

IN ASSOCIATION WITH



Sligo Engineering & Technology 2021 Expo

Catalogue

Industry Folios
Final Year Student Projects

ITSligo50
An Institiúid Teicneolaíochta Sligeach



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Presidents Welcome

Engineering & Technology Expo 2021

As President of IT Sligo I would like to welcome you to the 2021 IT Sligo Engineering & Technology Expo!

For the second year in a row we are delivering the exhibition virtually due to the ongoing health restrictions. This year we welcome our sponsors Abbott Ireland to the Expo and thank them for their support not just in this exhibition but across many collaborations with IT Sligo over the years.

The team of the 2021 Engineering & Technology Expo have worked tirelessly to provide you an immersive virtual experience with many interesting "rooms" for you to explore online!



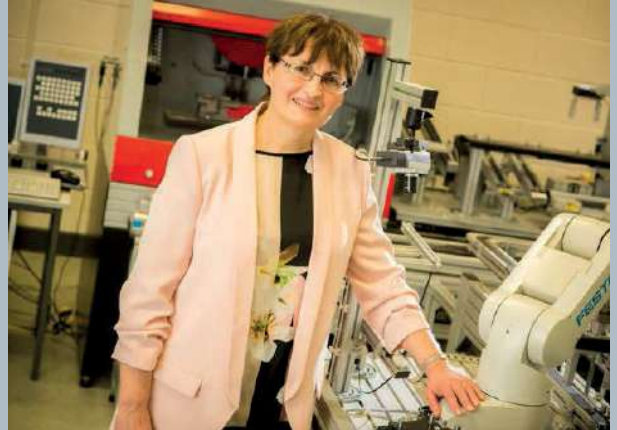
The northwest region is very active in the Engineering & Technology sector with some 40% of employers in the northwest involved in some way in Engineering technology and manufacturing. This sector is hugely important to the growth and development of the region and IT Sligo continues to work very closely with many companies to support their growth here in the North- West, maintaining a strong focus on engineering education and training. We remain the only provider of training for toolmakers in the country.

It gives me great pleasure to present this booklet to mark the strong collaboration between industry, educators and innovators, highlighting the work of some of the best talent and expertise across Ireland. The Expo reflects the close working relationship between IT Sligo and employers in all aspects of engineering and technology across the region and provides a real opportunity for forthcoming graduates to meet, discuss and engage with their future employers. I hope you enjoy this edition and we look forward to seeing you all back on campus in 2022.

Dr Brendan McCormack President IT Sligo

Introduction from the Head of the Faculty of Engineering And Design

Welcome to our virtual catalogue of the 7th Engineering & Technology Expo in IT Sligo. Sadly, due to continuation of the Covid-19 pandemic we will not be having the Expo on campus again this year. We are excited about the virtual experience we have created with the exhibition this year. Typically, at the Engineering & Technology Expo you see an extensive range of activities on show that include student projects, industry exhibits and




guest speakers – all aimed to inspire future engineers, showcase our graduates, promote engineering and technology in the Northwest and to open up engineering conversations and connections. We hope this booklet portrays the breadth of talent of our students and the industries that continue to support us and are keen to attract graduates to their businesses.

In this booklet, over one hundred and forty of our final year students showcase their projects that are the culmination of their education in IT Sligo. We are proud that we educate students that satisfy the needs of industry across a broad range of programmes including; civil engineering & construction, mechanical engineering, precision engineering & design, mechatronics, electronic & computer engineering and a broad variety of computing programmes. Many of our graduates have gone on to leadership positions in some of the top companies in Ireland and around the globe. The students contact details are on the posters for follow up for job opportunities etc. We have 17 companies showcasing the leading edge in engineering and technology on the industry promotional pages. Prospective job hunters and those interested about roles in engineering are invited to contact these companies. We hope that primary and secondary students along with the teachers and parents will be inspired about the potential of a career in engineering and technology. An event like this would not happen without a great team of people on board. I would like to thank everyone who contributed across many organisations and within IT Sligo. A special thank you to the industry steering group, our academic and technical staff who supported the student projects, our core IT Sligo organising team, our event manager Oli Melia and our key industry sponsor Abbott.

I hope you enjoy our virtual Sligo Engineering & Technology Expo 2021 and look forward to seeing you back on campus next year.

**Úna Parsons, Chartered Engineer, FIEI
Head of Faculty of Engineering & Design, IT Sligo**



2021 Sligo Engineering & Technology Expo...

Industry



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TOP EMPLOYER
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(Recent lunchtime Site Visit to the Sligo Western Distributor Road (Ph2))

Who We Are

Engineers Ireland is the voice of the engineering profession in Ireland. Our 25,000+ members make up a community of creative professionals delivering solutions for society.

The North West Region

Engineers Ireland North-West are a voluntary group that cover the counties of Sligo and Leitrim. We provide a focal point for engineers in the region and proactively encourage their continuous professional development (CPD) through delivery of a varied programme of lectures, site visits, and networking events. We typically provide upwards of 10 free CPD hours for our members per year.

Get Involved

We are always looking for volunteers and contact can be made via or [Facebook Page](#) or through the [Committee Portal](#)





FIRST POLYMER TRAINING SKILLNET

First Polymer Training (FPT) Skillnet operates as a training network for Irish Industry and is co-funded by [Skillnet Ireland](http://www.skillnetireland.com) and member companies. While they specialise in specific polymer programmes for the plastics and medtech industry, many programmes are aimed at the wider manufacturing sector, including a wide range of practical maintenance programmes.

Initiated and promoted by Polymer Technology Ireland (Ibec) since 1999; First Polymer Trainings objective is to provide subsidised technical training to industry, both at their technical training centre in Athlone or in-company as required. The centre in Athlone is a state of the art facility with 4 injection moulding machines, an extruder, a thermoformer and purpose built maintenance training boards.

FPT is a QQI validated provider for a number of technical programmes and has developed a series of polymer processing and design awards since 1999. A range of free e-learning programmes are also available, which are used to complement existing programmes.

FPT initiated a series of online polymer programmes with IT Sligo and is also involved in the delivery of a number of modules on these programmes. Skillnet Ireland funding is also available to subsidise the fees on this programmes.

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Please contact FPT or visit www.firstpolymerskillnet.com for more details on all programmes.



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Institute of Technology, Sligo

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The PEM Research Centre, provides Industry-focused research and development of precision engineering, manufacturing and materials technologies and innovation. We work with companies at all stages of their research and innovation journey and across the full spectrum of Technology Readiness Levels (TRLs)

Our aim at The **PEM Research Centre** is to:

- To service the needs of industry - working with companies to provide solutions to engineering, manufacturing, and technical problems across their value chain.
- To contribute to the technical and academic body of knowledge within the Precision Engineering & Manufacturing sector, and to transfer that knowledge to Industry.

The PEM Research, Development & Innovation capabilities provide industry with a unique RD&I support offering in precision engineering, manufacturing, and materials, which is underpinned by our experience and the expertise of our Principal Investigators, all who have individually achieved notable research achievements through engagement with industry.

The **PEM Research Centre** is focused on addressing specific manufacturing industry research needs in:

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- Sustainable Manufacturing.
- Additive Manufacturing.
- Enhancement, Optimisation & Control of Polymer Processes.
- Precision Engineering and Micro-Machining.
- Laser-based prototyping and Manufacturing technologies.
- Nanomaterials and Nanotechnologies.

Contact: Clíodhna Carroll, **Business Development Lead**

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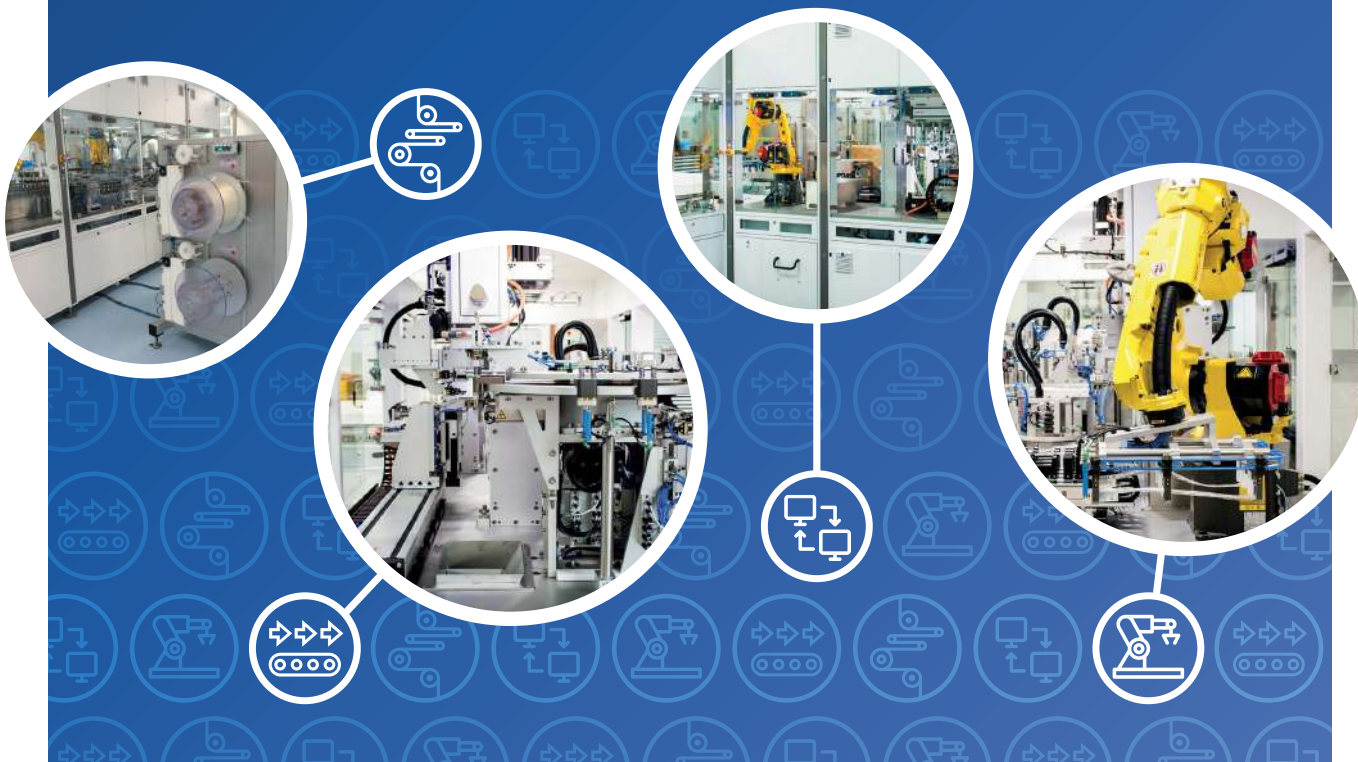
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About Hollister Incorporated

Hollister Incorporated is an independent, employee-owned company that develops, manufactures, and markets healthcare products worldwide. The company develops and manufactures products for ostomy care, continence care and critical care, and also develops educational support materials for patients and healthcare professionals. Headquartered in Libertyville, Illinois, it has manufacturing and distribution centers on three continents and sells in nearly 80 countries. Hollister is a wholly owned subsidiary of The Firm of John Dickinson Schneider Inc (JDS Inc.), a 100-year-old company. Hollister is guided by the shared Mission of JDS Inc., to make life more rewarding and dignified for people who use its products and services. www.Hollister.com.

Hollister Ballina

Hollister Incorporated opened its Ballina manufacturing facility in 1976 on a 40-acre campus in County Mayo. Almost 1000 Associates work at our Ballina facility.

The Ballina facility manufactures products for global distribution that support our ostomy care and continence care product lines. Over the years, we have expanded our operations beyond manufacturing to include **Research & Development, New Product Development, Corporate Engineering, Supply Chain Management and Finance Shared Services**. Global Research & Development for our Continence Care products is based exclusively in Hollister Ballina.

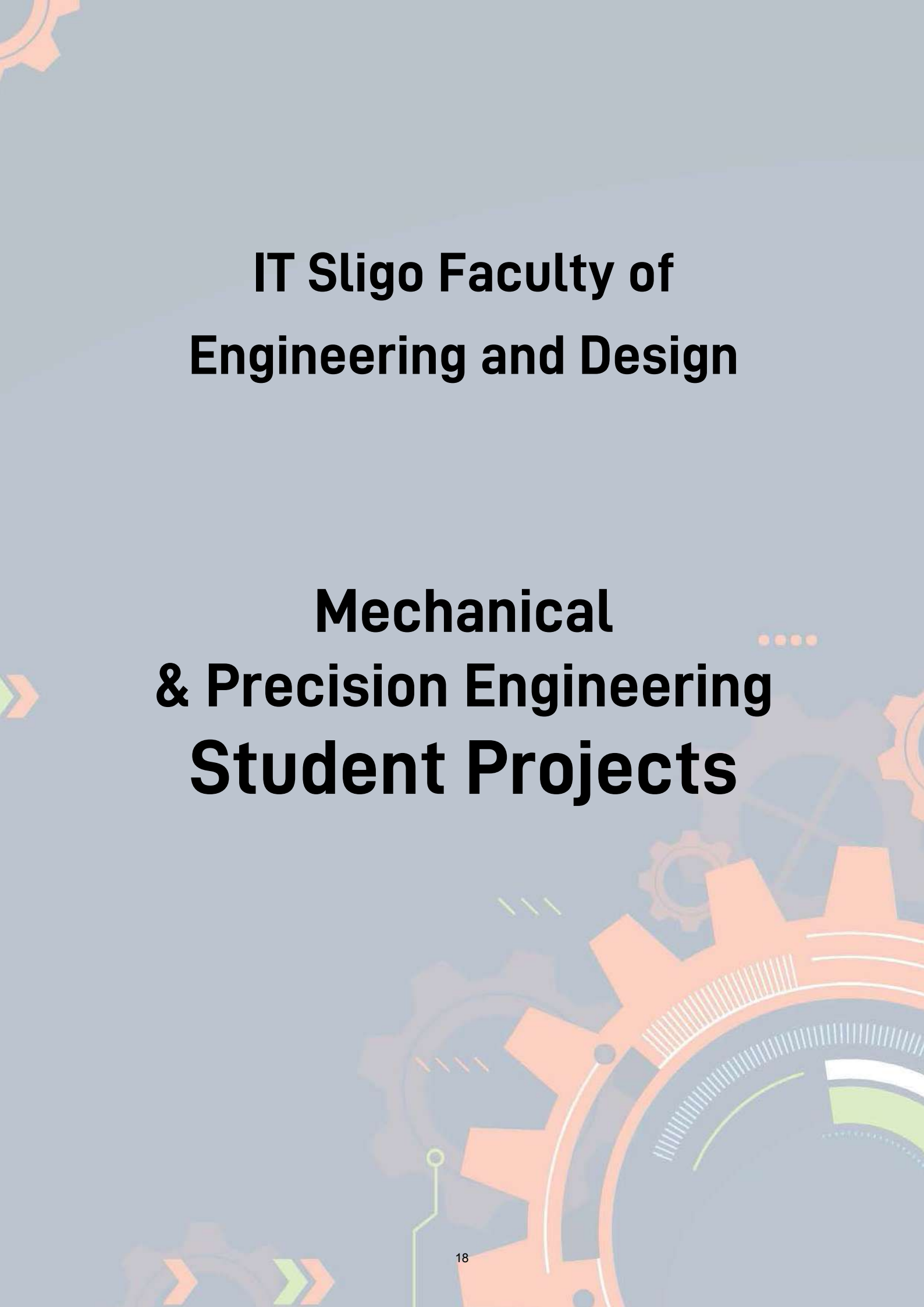
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Alternatively please scan the QR Code below to go directly to current vacancies in Hollister Ballina.





IT Sligo Faculty of Engineering and Design

Mechanical & Precision Engineering Student Projects

Leaf Lifter

Introduction

There are many reasons of making the mechanism, but the main reason is as we can see nowadays In some municipal areas, sweepers have many issues while cleaning roads, they have to swipe the dust and wastes together and then collect it in the swiping vehicle, This method is very time consuming, and much effort required for cleaning roads, also this continues a wasteful effort affects the working efficiency of sweepers, so it is necessary to develop a mechanism which will assist sweepers to collect wastes and dust effortlessly.

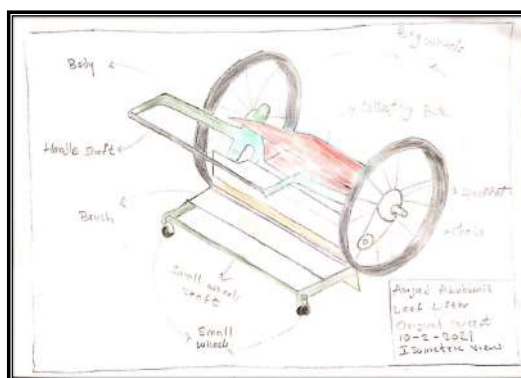
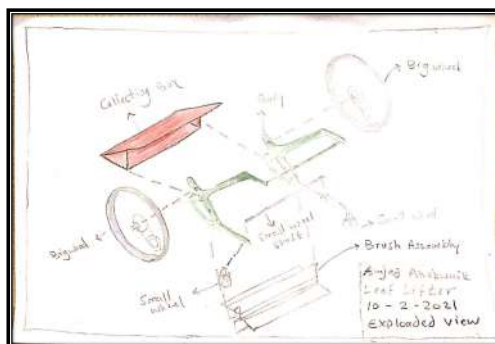
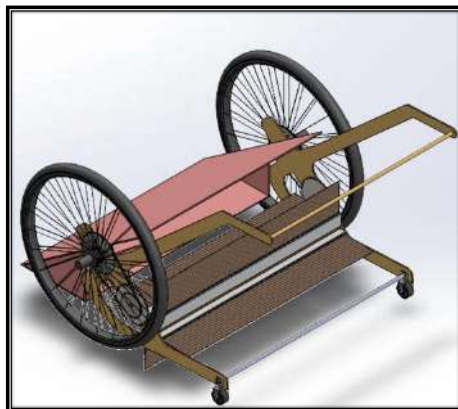
Project Description

Leaf lifter is a device that can clean all the road dust by a big brush placed in the middle of two wheels.

The two wheels are connecting together between the shaft, brush settled between the two wheels with help of chain sprocket.

The two gears are installed between the two sprockets in order of changing the direction of the brush.

Collecting box is placed in front of the brush to collect the wastes.



Running

When user pushes the leaf lifter, wheels start to rotate and chain drive.

Chain sprocket also start to rotate along with it.

Thus resulting the rotation of the brush which is attached to it. Brush will rotate in the direction opposite to the direction of the wheel.

waste will move forward in the collecting box where all dirt and waste are sorted.

After that we can easily remove the collecting box from the assembly to clean it and can easily return it back.

Main Components

Wheels
Shaft
Chain
Supporting Wheels
Handle
Gears
Bearing
Brush
Collecting Box

Contact

Name: Amjad Abukwaik
Student Number: S00183164
Phone Number: 00966544376225



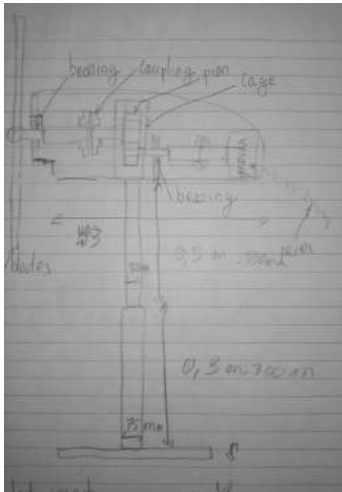


Introduction

Energy is the one of the key characteristic of development in the 21 century. The wind generator contributes to the expansion of businesses by supplying sufficient power to run an activities. Indeed, the need for the wind generator is felt mostly in farms, mountain houses or businesses requiring a independent source of energy not link to sector's. Technically talking, with generator has been designed to minimize use of unnecessary material while complying under the general health and safety standards in place.

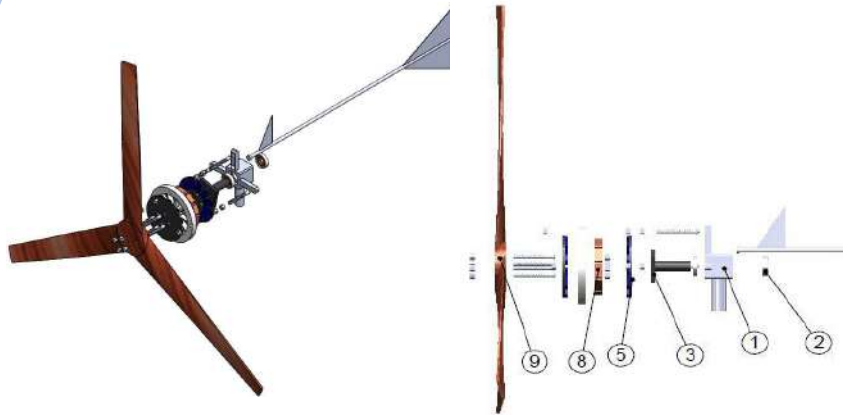
Free hand Sketches

The free hand sketches were supposed to be basic and advanced enough to show the progression of the unformed idea to a virtually formed image but still answering to engineering standards.



The free hand sketches shows incorporate a gearbox of a ratio 3:1, the idea was to maximize on each turn of the shaft. With SolidWorks a more advanced version In 3D has been developed.

Designs



9-the blades a play an important role to catcht air waves and give motion to the whole assembly;
5-The plate serve as a surface to have magnets organized; 8-the copper shape is obtained by making used of the winding handle, the assembly of element 5&8 produces the magnetic electro-magnetic field; 3-the hub serves to facilitate the rotational move in accordance with 2- the bearing; 1-The main support holds everything tight and together.

Methodology

Approach:

Growing an idea take some steps, the actual wind generator have to include details, that makes it reliable and durable:

- It should generate an electromagnetic field
- It should meet safety standards
- It should be able to produce power and stay in height

Design:

The design process is made out of:

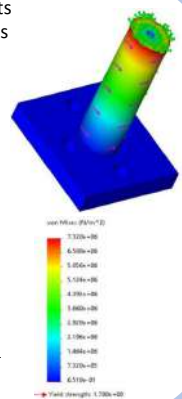
- * free hand sketches
- * Material cost
- * Operating procedures
- * Dimensioning
- * Schedule

Solidworks:

Coming up with a design that matches the above description.

Stress analysis

Stress Analysing parts of the assembly gives more insight on the safety of the machine. The hub rotating element in the wind generator gives an illustration on the nominal required stress to avoid fatigue.



$$\sigma = \frac{F}{A}$$

$$m=15\text{kg}$$

$$A=50\text{mm}$$

$$\sigma = (15 \times 9.81) / \frac{\pi \cdot 0.05^2}{4}$$

$$\sigma_{\text{nominal}} = 0.75\text{MPa}$$

Results & Conclusion

The design of the wind generator is now safe, all parts have been analysed and prescription have been done accordingly. Designing process includes diverse steps and procedures but the end results stays the same for each machine, respond to needs efficiently while complying under established standards. The wind generator is nothing but a safe machine that would help gaining in efficiency and promote engineering standards.





The Canoe Loader

Integrated project A

Institute Of Technology Sligo



INTRODUCTION

Canoes are great for getting out on the water and enjoying outdoors, but transporting them have been one of the biggest challenges for decades because of their weights and volumes. Therefore overcoming this challenge was highly important for economic, environmental and safety standpoints.

AIM OF STUDY

The aim of the project was then to design a prototype that allow people to safely and efficiently load a canoe or kayak on to the roof of their vehicles., demonstrates its safety, perform stress analysis and finally elaborate a project management and sustainability.

DESIGN AND METHODOLOGY

The process began by observing existing technologies and challenges faced by the public while trying to transport their canoe. The project was further broken down into 4 major steps:

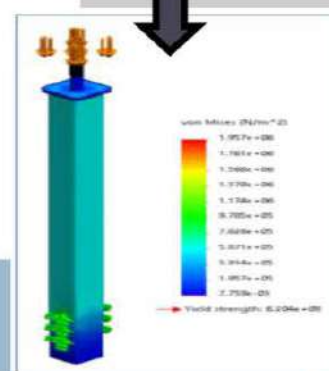
- Selecting technology
- Developing prototype
- Creating free hand sketch
- Generating 3D models

FEA SIMULATION AND RESULTS

The goal of the analysis was to develop a finite element based program in solidworks environment, which solves stress results of the structure. A stress analysis was performed to simulate the behaviour of the prototype to predict how the system could react to real world forces, vibrations, mechanical stress and other physical aspects. The picture above is one of the results of the analysis.

RESULTS (CONTINUED)

Von mises stress: von mises stress predict where yield will occur. In my design I made sure that the von mise stress stays under the material's tensile yield stress to prevent deformation and



CONCLUSION

The project consisted of generating conceptual drawings, conducting a safety process of the designed prototype to fit safety legislations and sustainability standards. The prototype is safe and can be manufactured with respect to the environmental sustainability



Introduction

The idea for this project stemmed from the authors personal interest for the environmental engineering sector. Due to the increasing amount of waste making its way into the Atlantic via coastline towns, it was clear that a solution for this problem is growing in demand. The aim of this project was to manufacture a waste collector which ran solely on renewable energy alone. The nature of this design is to be both simplistic and efficient in completing its task.

Project Aim

The project aim is to design, prototype and manufacture an environmentally friendly engineering project which obtains the capability to collect and clear a substantial amount of rubbish and waste from a medium sized river or estuary. For practical reasons, the design will have a multitude of corrosion resistant material incorporated.

Climate Considerations

The environment in any of the oceanic conditions presents many challenges, Project structure is comprised of pre-galvanised steel and aluminium so to continue to function despite changing currents, waves, and winds, avoiding wear and tear. Wave heights vary between 10 – 14ft. This perpetual wave motion will keep all components moving, therefore double support on either end of the drive shaft was designed to reduce strain on moving part.

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Background Research

- Studies have shown that there are more than eight million metric tons of plastic found in the ocean every year.
- By the year 2030, it is predicted that there will be *“More masks than jellyfish”* inhabiting the sea due to coronavirus waste.
- High chemical impacts also associated with plastic aquatic waste include the accumulation and transport of persistent, bio-accumulative, toxic contaminants, such as PCBs and pesticides.

Methodology

Design/Planning:

- Project schedule developed.
- Renewable energy types researched and selected.
- Create initial concepts.
- Review available resources.
- Component's selection.
- Model Solidworks design.

Water Wheel

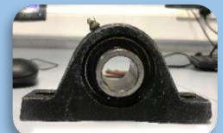
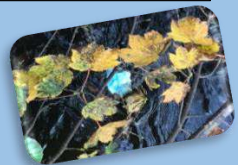
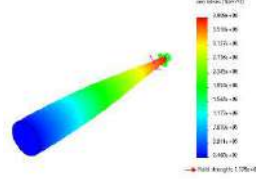
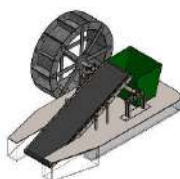
- Undershot Waterwheel – 60% Efficiency.
- Curved blades driving surfaces.

Fabrications

- Bicycle chain and cassette was used as a power transmitting system between drive shaft and conveyor.
- Steel components such as the base of the assembly and water wheel assembly were manufactured by means of the plasma cutter.

Safety

Pinch points, FOS, and max stress were identified for rotating components of the assembly.



Single Bale/Pallet Lift

Introduction:

The theme of the project came about when myself expressed and interest in keeping with tradition of the college and designing an agricultural themed project. The final decision of a Single bale Trailer was decided when the I discovered when small framers done have much for them on the market to move bales around the farm in the farming community both here and abroad

Design Brief

To design, build and test a working prototype for single bale trailer for a quad. The design prototy will be mounted to the rear of a farm quad or car/jeep via the towbar. This implement will have the ability to pick up one bale from the field and transport them safely to storage or the field for the animals to eat.

Methodology:

Research:

Research was conducted by visiting farms and speaking to farmers to get insight possible improvements that would aid there everyday lives and reduce the time it takes them to move bales around the farm and pallets completed on a day to day basis. A number of websites were also researched to get a better understanding of various issues facing small farmers.

Design/Planning:

The design process involved:

- Selecting the project.
- Develop project management/schedule.
- Carry out an objective tree analysis.
- Develop concepts and initial ideas.
- Analysis possible health and safety issues .
- Assign tasks among project members .
- Model design in Solidworks.



Fabrication:

Fabrication would have been completed on my project in the GEW in the Workshop on campus but due to covid this couldn't be completed

- Most of the parts were fabricated in the GEW.
- Materials and bending out sourced from local suppliers and Vendors.

Lifting Mechanism

- Purchased required Electric Winch was Purchased From local quad centre in my local town.
- Lifting mechanisms will also be using roller guides to maximise the weight ill be able to carry.

Methodology (Continued):

Quality check:

- Electric Winch was selected as it is compatible of lifting heavier with less stress then a hand winch and also make the lifting seamless so that the bale or pallet could be lifted and not leave stress on the linkag



Safety:

In order to ensure safety in this project,

- I added two axles on the trailer to relieve the stress on the hitch and this also help to keep the trailer with traction on the road or field.
- Trailer will also be fitted with Rear Lights the public road and also a spotlight on the mechanism to help when lifting in the night.

Results:



Design/Planning outcome:

Satisfied with the individual elements from the different concepts a final design was drafted with thought to:

- An adequate scale through mechanical analysis and lifting capacity agreed to satisfy the intended tasks.
- Inclusion of universal attachment joint that allows for the future designing of accompanying attachment elements.
- 0% of fabrication was completed in GEW.
- Industrial standard pins and materials were used throughout



Results (Continued):

Fabrication outcome:

Fabrication couldn't be completed in the workshop due to covid, So the fabrication of the project was a solidworks build to show the workings and design of our project,



Testing outcome:

- Electric Winch allowing full motion at all expected moving parts.
- Flotation tyres to allow greater grip in the wet and low traction fields.
- Detactable back Plate to allow for pallets and bales to lifted with just the removeable of a few standard bolts.



Conclusions:

- The project would have been a success in its entirety, But die to covid I couldn't completed the fabrication of the build, but with the research and design of the project both disciplines were equally utilised in the design and the Research process.
 - The objectives set in the brief where achieved with exception to the budget which was exceeded by €400.
 - The schedule set, experienced some set backs in it's infancy but completion arrived on the day set
- The main limiting factors of the project Included:**
- COVID
 - Understanding of linkage movement to carry out during the lifting process.

Improvements:

- Design method analysis Skills.
- Project/ Budget Management Skills.
- Quality Assurance skills.
- External Sourcing Skills.



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Daniel Cuffe

Introduction

The need for this project arose when a landscaper expressed the need for a sprayer with greater manoeuvrability. This was required due to operations in gardens with many obstacles and having to make tight turns. Comments were made that current sprayer models do not offer the degree of movement required for working in small areas with many obstacles.

Aims of Project

To design, build and test a simplified, improved version of a pedestrian sprayer. The key objective is to generate a quick, easy-to-use sprayer that provides great manoeuvrability.

Methodology

Research:

Research began by observing current products on the market. These products were viewed on their capabilities and considerations were made on where these designs could be improved. It was found that there could be three possible improvements made to enhance the operations of sprayers. These were:

1. Manoeuvring.
2. Independent spraying capabilities.
3. Folding boom.

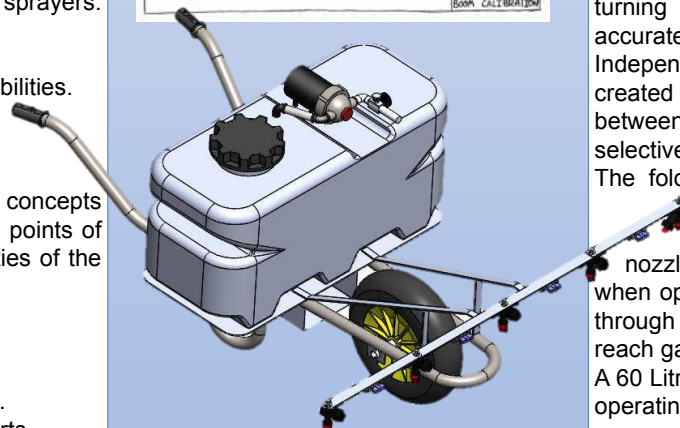
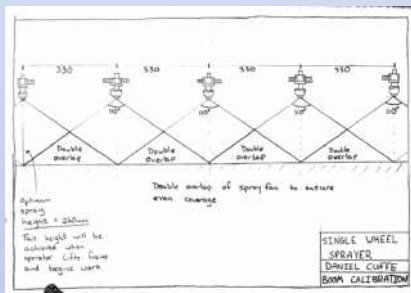
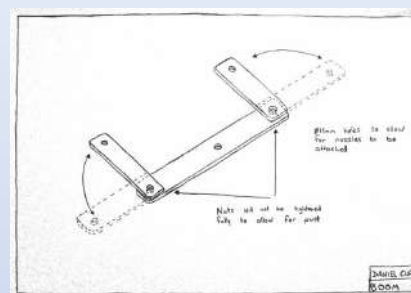
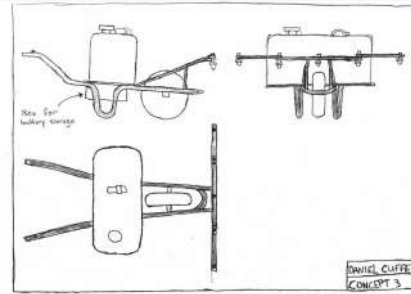
Design/ Planning:

Design began by sketching concepts that implement the three main points of improvement into the capabilities of the project. It involved:

- Sketching concepts.
- Integrate improvements.
- Enhance concepts.
- Review available resources.
- Source components and parts.

Analysis

To generate a better understanding of a complex matter, analysis is the process of breaking it down into smaller components.



Methodology (continued)

Analysis (cont.)

Analysis is to be performed on the sprayers boom measurements, taking overall width, nozzle spacing, valve spacing and nozzle fan angle into consideration. All of these considerations will have an effect on the boom height.

The fluid output rate is to be analysed based on nozzle selection. This will have an effect on the considerations of the tank size selection.

Fabrication:

- Parts will be fabricated in the GEW.
- All components will be assembled in the GEW.
- Most of the project components will be bought in.

Conclusion and Results

Unfortunately due to Covid-19 the project was cut short. In conclusion, a sprayer offering greater flexibility, manoeuvrability, spraying capabilities and folding was designed. Greater manoeuvrability is generated by having 1 wheel. This allows for on the spot turning and adjusting. This ensures accurate application of pesticide.

Independent spraying capabilities is created by having 4 cut-off valves, 1 in-between every nozzle. This allows for selective spray application.

The folding boom creates a narrower boom width of 670mm but still allows a maximum of 3 nozzles to operate. This is useful when operating on pathways and going through gateways to access hard to reach gardens.

A 60 Litre tank size was chosen for high operating time and sufficient fluid supply

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Sligo Engineering & Technology Expo 2021

Mechanical & Precision Engineering Award

For project titled

Hydrokinetic Water Turbine

to

Pearse Healy

Presented by:

Anna Parsons - Head of Faculty of Engineering & Design, IT Sligo

Chris O'Malley - Vice President, Research, Innovation & Engagement

Judged by:

Tommy Kennedy - Abbott Nutrition

29th April 2021

12345

Introduction:

The idea of this was project was to design a small and compact, functional water Turbine for use in streams and rivers. The design uses a propeller connected through a drive shaft to an alternator which converts the energy from the Waters Flow (Kinetic) into electrical energy capable of charging a 12V battery. The target base was primarily campers who wanted to use a renewable source of energy for light etc., Or Farmers who could use the battery to charge an electric fence at the river bank.

Aim and Objective:

The aim of this project is to allow both young and old people to make use of a continuous source of renewable and harness its often under utilized potential. The aim is to make the propeller and housing design sufficient so that the turbine will operate effectively, even in slow water speeds. The next aim is to have a turbine that is of high quality to deal with the harsh environment.

This will be accomplished by:

- Using Aluminium as the primary material.
- Using pegs and rope to mount the turbine on each of the rivers bank to maintain the best position.
- O-rings and Rotary seal to protect the vital internal components within the housing

Methodology:

Research:

- Research began by looking at the various different designs, and which were commercially available and affordable, as well as efficient. The most common commercial Water turbines are worm wheel and propeller based. Having researched the multitude of Water Turbines there wasn't one which was of a propeller design but was made of sufficiently high-grade material to last in harsher environments. The 3 main takeaways from the research that was done
- To produce a high quality but cost-effective Turbine.
- To Produce a device that is highly efficient and capable of operating at low speeds
- To make it easy to setup and secure for use in wider rivers
- To generate 12V of electrical Voltage.
- To have a continuous source of energy for campers/farmers with riverside land.



Design:

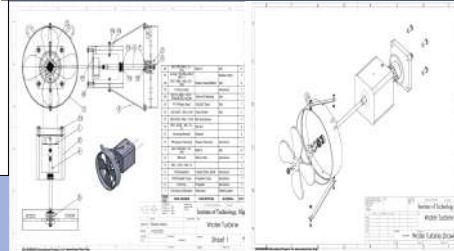
The design chosen for my turbine was a propeller design as it was better suited for an aluminium small-scale construction.

The advantages of this design is:

- The Blades can be cut more easily and there is only 4 propeller blades in total.
- Propeller housing can hold hinges used for the peg mount attachment for wider river sections.
- Housing for the alternator was an important design consideration as water could damage the alternator, a rotary seal was used where the driveshaft enter the housing chamber and O-rings were used for the exit of the positive and negative cable.

Methodology (Continued):

After many considerations trying to figure out what was the most efficient way to make this Turbine into a successful device it was to create a simple housing with a back plate where the alternator is mounted using a strong adhesive.



Safety:

Safe organizational practices are to be outlined in a user manual which will come with this project. This is to ensure that the risk of an accident or injury can be kept very low. There was a variety of safety factors taken into account when coming up with the design of this project which includes,

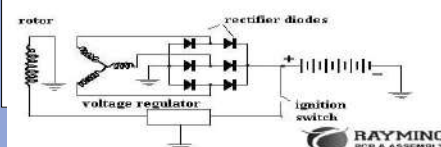
- Hazards with water at high tide, do not attempt to setup device in excessively fast current.
- Safe Way of lifting the device without causing injury (Notice for Propeller Blades).
- Electrical Discharge warning on rectifier and battery units.

Other Health & Safety factors

While this device can be used by children 10+ initial setup should be done under adult supervision and not at high tide. While only small, electrical shock can occur from loose wiring and from fences.

- For setting up the peg and rope mount for wider sections a second person is preferred but not essential.
- Commission for Regulation of Utilities (CRU) should be consulted about low-voltage applications and water safety regarding electrical equipment.
- E-stop is not required so only ground is necessary as it is a low-voltage Turbine
- Always read the safety label instructions before connecting any wires and ensure that all controls recommended by the manufacturer in the Safety Data Sheet (SDS) are followed.

Basic electrical circuit of an alternator



Analysis

The analysis aspect is going to determine the Torsion on the driveshaft to determine that no deflection will occur, the main aim of this is to be able to clarify that the grade of Aluminium will withstand the stress it will be subjected to. The shear stress of the bearing will also be calculated in the analysis, this is to ensure that the max RPM the bearing is subjected to does not result in the shear Stress exceeding the manufactures stated limit (95MN/m²). By doing this a factor of safety could then be determined.

Analysis (Continued)

Legend

OD= Outside Diameter
T = Torque
J = Polar moment of Area
R = radius
 τ = Shear Stress
F.O.S = Factor of Safety
Rotation 40Kw@120rpm

Torsional Stress on Driveshaft

Calculations for Torsion

Diameter = 10mm
Diameter 6mm hole in 15mm length

These are calculations for torsional stress on the 160mm long shaft section.

$$P = \frac{2\pi Nt}{60}$$

$$T = \frac{60P}{2\pi N} = \frac{60 \times 40,000}{2\pi(120)}$$

Torque = 318.31 Nm

J Value (Polar Moment of Area).

$$J = \frac{\pi}{32} (0.01)^4$$

$$J = 9.8174 \times 10^{-10}$$

Shear Stress

$$\tau = \frac{Tr}{J}$$

R = radius

$$\tau = 162,115,224 \text{ N/m}$$

$$\tau = 162.115 \text{ MN/m}^2$$

Max Torque from Hollowed Section

$$T = \frac{\tau}{r}$$

$$\text{Torque} = \frac{162.115 \times 10^6}{0.005} \left(\frac{\pi}{32} (0.01)^4 - 0.0064 \right)$$

Stress on the Bearing

Calculations

I.D = 10mm

O.D = 22mm

Torque = 318.18 Nm from Driveshaft calculations (40kW & 120RPM).

J-value

$$J = \frac{\pi}{32} (0.022^4 - 0.01^4)$$

$$J = 2.201 \times 10^{-8}$$

Shear Stress of Bearing

$$\tau = \frac{Tr}{J}$$

$$\tau = \frac{318.31 \times 0.005}{2.201 \times 10^{-8}}$$

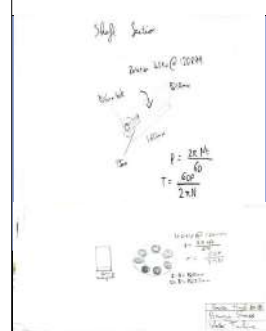
$$\tau = 72,310,313.5 \text{ N/m}^2$$

$$\tau = 72.31 \text{ MN/m}^2$$

Factor of Safety

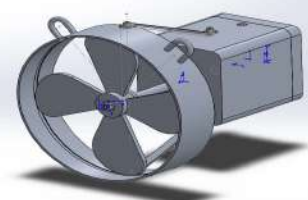
$$F.O.S = \frac{\text{Total Stress Recommended}}{\text{Stress Calculated}}$$

$$F.O.S = \frac{95}{73} = 1.3 \text{ Factor of Safety}$$



Conclusions:

The Turbine is built to suit both large scale rivers and narrow streams which ensures it has versatility. It is ideal for campers and is competitive on price so it can be used to charge batteries and power applications, at a low cost to farmers who no longer need to change batteries on a electric fence to protect there herd as this will continuously recharge the electric fence. This propeller-type design has some disadvantages but these were designed out when the propeller housing was formulated to both protect the propeller blades and allow for the hinges for stability in deep water/wide river sections. This device allows a cleaner source of energy from an unconventional source and is both cost effective and of high quality to have along life cycle.



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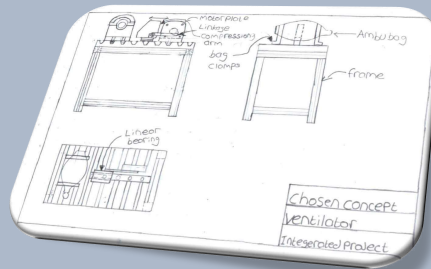
Emergency Support Ventilator

Introduction:

The need for this project came about when the world was facing a new never before seen virus that was first identified in December 2019 in Wuhan China. It was deemed a global health emergency in January 2020 and with the ever growing numbers of people experiencing respiratory issues it was elevated to a global pandemic in March of 2020

The aim of this project is design and build a working prototype support ventilator to meet a market demand.

With confirmed covid-19 cases reaching 116,874,912 as of 4:53 am of the 9th of March 2021 this has become an essential piece of equipment in intensive care units. Due to the high number of cases there has been a shortage of ventilators in hospital's across the world many people have died. The task is to design a ventilator that can operate in any environment across world and be more simplistic while retaining all the functionality of a mechanical ventilator in (ICU)s across the world.



Safety:

Safety is an important aspect of an project especially for this projects as this project is used in the medical sector. This project incorporates an EN:418 safety stop switch which will allow the operate to isolate the power to the machine in case of injury to the operator or patient. And will have all necessary guarding and will adhere to all relevant standards.

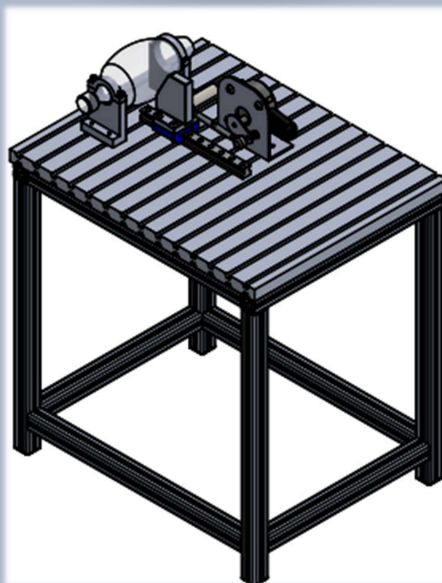
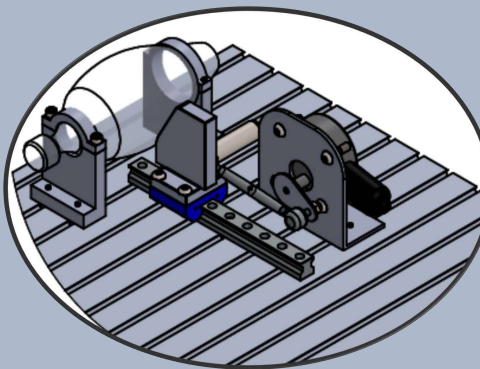


Results:

Design/Planning:

After narrowing down all concepts. Concept 3 was chosen as it was portable, compact and had the ability to run off a portable power supply.

- An ambulatory bag was used to mimic the air supply from a mechanical ventilator.
- All item profile was sourced from (MBS) machine building services. It allows quick assembly of the frame and came in many different sizes and configurations which accommodated any changes necessary.
- A Festo profile plate table was used to fix all components down to as it allows quick and simple solutions to fixing items to the plate.



Methodology:

Research was carried out into how a mechanical ventilator operates and how I could simplify this process down to make it small and compact and keep all moving components linear along its axis. Other areas of research were on components such as :

- Motors
- Methods of providing oxygen
- Power supply

Components Selected

- Ambulatory bag
- Linear guide rail bearing
- Festo profile plate
- Item profile 40x40mm

All other components will be sourced from the GEW



Results continued:

Design/Planning:

After researching all available methods of obtaining motor feedback. A slotted optical sensor was selected to determine the motors speed. So manual adjustments can be made.



Fabrication:

- Standard components were used throughout the design stage of the project.
- Due to the use of item profile for the frame it allowed quick assembly.
- Various manufacturing process were used throughout the project these include milling, lathe work and cnc milling.
- Other tools will be used such as a horizontal bandsaw, taps etc.

Conclusions:

The project gave me the opportunity to develop and new and existing skills and showcase them in this project. Overall the project was successful and allowed me to learn about an area that was outside my area of expertise. The design was the most critical part for me as I wanted to design a prototype support ventilator that was portable and could run of a 12V batter. The project schedule went according to target and the Gannt chart helped be stay of track and achieve milestones on time

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Introduction:

The theme of the project came along because of interest in an innovating way we recycle our waste, so the theme of the project was based all this idea. The final decision of a Underground Waste System. On this project construct the aptitudes that I have learned through the Mechanical engineering course from years one to three will be put to utilize to construct the prototype.

Design Brief

To design, build and test a prototype for a working model for an Underground Waste System. The device/prototype will be planned to fit into the ground. This design will have the capacity to cover up waste underground.

Methodology:

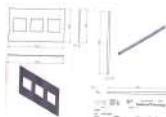
Research:

Research was conducted by visiting recycling companies and speaking to the owners to get insight on the possible improvements that would aid people's everyday lives. Several websites and medical journals were also researched and by talking to outside companies to get a better understanding of various issues with recycling.

Design/Planning:

The design process involved:

- Selecting the project.
- Develop project management/schedule.
- Carry out an objective tree analysis.
- Develop concepts and initial ideas.
- Analysis possible health and safety issues .
- Assign tasks among project members .
- Model design in Solidworks.



Fabrication:

- The fabrication would be done in the GEW, but due to covid-19 the project had to be completed off campus.
- The materials and bending outsourced from local suppliers and Vendors, if the college did not have the correct material
- Parts fabricated include cutting, drawing, punching and folding.



Hydraulics:

- Purchased required cylinder with hydraulic fluid or compressed air.
- Measured and purchased washer and spacers.
- Calculated amount of hydraulic fluid required to run the system.

Methodology (Continued):

Quality check:

- Yale YH Double-Acting Hydraulic Cylinders an extremely robust cylinders especially designed for universal heavy-duty lifting and positioning applications as well as for industrial production and assembly jobs.
- They can also be used as power source in frame presses, stamping fixtures and other industrial uses where high pushing and pulling forces are required.

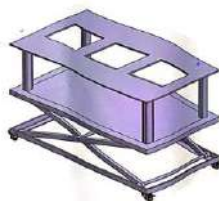


Safety:

To ensure the safety of myself and the others around the spacers and washer must be tighten, this will ensure that the scissor lift does not collide on itself.

I must be aware of control buttons to ensure the scissor lift moving up and down correctly.

Results:



Design/Planning outcome:

Satisfied with the individual elements from the different concepts a final design was drafted with thought to:

- Through mechanical analysis, an appropriate scale and lifting capacity were agreed upon to meet the expected tasks.
- Presence of a universal attachment joint, which provides for the future design of additional attachment parts.
- When the specifications of the hydraulic cylinders ordered differed from those received, there was a design oversight that was quickly corrected during the fabrication stage.

Results (Continued):

Fabrication outcome:

- Due the guidelines of Covid 19, the fabrication could not be completed, this was replaced with sketches, drawing and Solidworks design.



Testing outcome:

The final assembly and testing would have be on campus but due to covid guidelines everything was off campus.

Yale YH Double-Acting Hydraulic Cylinders to allow vertical movement.

Washers and spacers to secure the scissor lift and reduce the risk of the component loosening.



Conclusions:

- This project gives us an opportunity to use the skills we learned from first year to now. This helps use to use all practical skills and it's a learning experience.
- There was no exceeded amount because the project was funding by myself.
- The schedule set, experienced some setbacks in its infancy but completion arrived on the day set.

The main limiting factors of the project Included:

- Less communicating before the teams because of the off-campus guidelines..
- Availability of the hydraulic cylinder.
- Covid-19.

Improvements:

- Design method analysis Skills.
- Project/ Budget Management Skills.
- Quality Assurance skills.
- External Sourcing Skills.

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Introduction

The idea of making a **Tripod Lifting Device** came about by seeing that there was a market void in portable lifting mechanisms for heavy and awkward shaped loads. Also with one third of all workplace accidents occurring due to manual handling a mechanism was needed for lifting goods. The nature of the design was to keep it as **simple, efficient** and **safe** for the user as possible.

Aims of Study

To demonstrate the theoretical and practical skills gained over the course of Mechanical Engineering by showcasing a project.

Methodology

Research

Research began by looking at what the steps were when lifting and moving a load by a human. This considered weight, height being lifted and size of a load that would have to be handled by a mechanism operated by a human.

Design/Planning

The design and planning of this project involved several key processes:

- Develop a project schedule
- Create concept sketches and grading charts
- Review available budget and resources
- Create an analysis on chosen materials and design.
- Model design in Solidworks and create parts lists and drawings for fabrication.

Fabrication

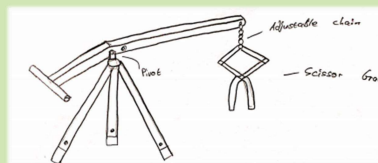
- Materials were ordered through suppliers and were also obtained from the GEW
- Fabrication would take place in the GEW
- A pillar drill, welder and lathe would be the main machines used in the fabrication of the prototype along with basic hand tools.
- The assembly of the mechanism would all be done by hand.

Safety

Safety was a key factor in the design and manufacture of this prototype. The device is designed not to let a load slam down or not allow it to be used without the correct training and can be locked for safety. There is also an overload sensor incorporated in the design to prevent lifting to heavy of a load.

Testing

After the completion of the prototype, testing would be required to see if all aspects of the design withstood the forces the device was lifting and also that it worked correctly. This would be done by lifting several loads of different weights and sizes numerous times. The main goal would be for the prototype to pass all the testing requirements successfully.



Results

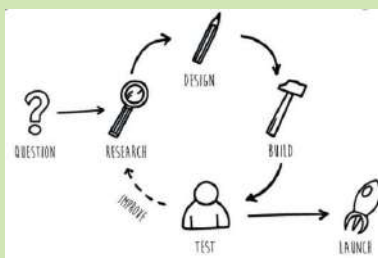
The end result of the Tripod Lifting Device would be to have a completed working prototype at the of the semester using skills gained throughout the full course of Mechanical Engineering.

Conclusions

This project gave an opportunity to demonstrate the theoretical and practical skills gained over the course of Mechanical Engineering.

Throughout the 2020/21 academic year a prototype of a Tripod Lifting Device was designed to be fit for manufacturing and testing.

The objective of the project was reached by designing a functional prototype successfully. The project schedule ran according to plan.



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Helical Wave Energy Generator



Aim

The concept was to create a helical wave energy generator that utilizes the motions of the waves to produce rotational motion.

Introduction

Wave energy generation has been attempted many times around the globe with various amounts of success.

Development of this project intended to highlight a potential new design that could be utilised in harvesting wave energy, a resource which Ireland is rich in.

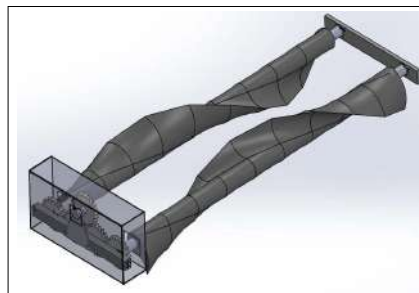
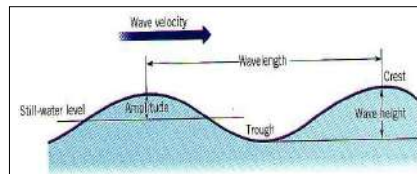
Research

This involved exploring renewable energy in Ireland and the wider world. Including previous wave energy devices.

Design/Planning

The design was process involved:

- Background research into past wave generators.
- Research into the motions of the waves/sea.
- Design discussion and optimisation.
- Concept design and modelling/ sketching.
- Prototyping and testing.
- Project scheduling.
- Material exploration.
- Further development and design alteration.



Construction

A working prototype was constructed composed of PVC pipe and plastic gears. The PVC was shaped into a helix and a frame was manufactured that allowed the prototype to demonstrate the movement of the device.

Results

Apparatus required further alterations from the prototype, including limiting some stress points and an alteration in design.

Conclusion

Wave energy generation is a major area for potential development in Ireland. The main limiting factors for this project were; time, man power, access to resources, budget and timescale.

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AIR TO AIR HEAT EXCHANGER

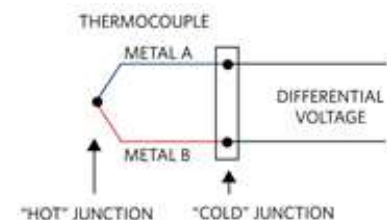
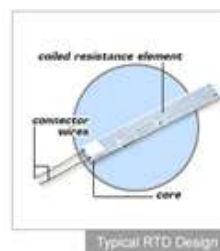


STUDENT NAME:
PATRICK MILLS
STUDENT NUMBER:
S00189287

INTRODUCTION

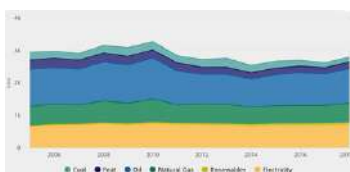
The project aims to design, build and test a working prototype of an air to air heat exchanger. The device will heat cold outside air using solar energy and will release the heated air into the space chosen to heat. The device must be affordable, sustainable and non-polluting. It will help lower the amount of money spent on heating and also help lower the amount of fossil fuels used to provide space heating.

Sensors were needed to measure the temperature of the air going in and the air coming out make sure the device was working as a space heater not a air conditioner. There are two main types of temperature measurement sensors, PT100'S and thermocouples



METHODOLOGY

Research: Research began by looking into the impacts fossil fuels have on the environment, and also what methods were being used for space heating at the moment.

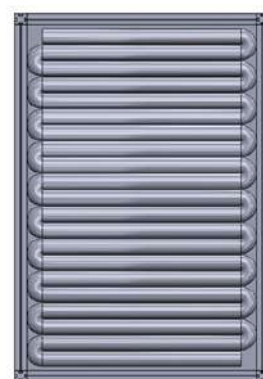


As you can see from the above graph fossil fuels are the main source of space heating.

Design: the design process involved applying the research done and picking the final concept. When the concept was picked it was designed in solidworks

Aim of this study

To demonstrate the theoretical knowledge gained over the course of our study in a practical, real world application.



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Eco-friendly Wheelie bin washer



Introduction

As a part of the mechanical engineering course at I.T Sligo, it is a requirement that 3rd years students must design and build a project using the knowledge and different experiences provided over the last 3 years. The project must be built with the input of technical, practical analytic and communicative skills to design, build and test a prototype machine.

Methodology Research

The idea for the prototype was established after numerous concepts. It was important that the prototype had a successful outcome and achieved the end goal whilst being efficient and eco-friendly. The idea of an all-electric powered machine became probable after hours of research

Project Management

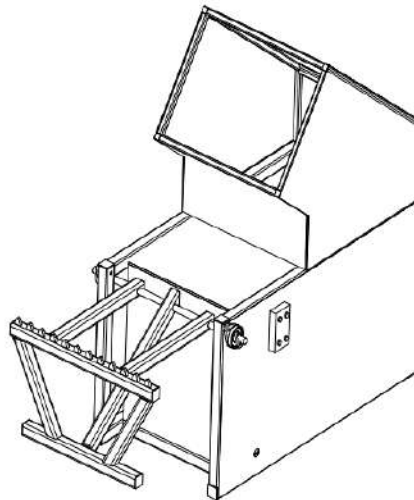
With heavy emphasis on the importance of planning, it was essential that project management was not overlooked in any aspect. The involvement of the module this year proofed very beneficial to me. It thought me the importance of milestones and keeping on top of each given deadline.

Design

An initial importance of freehand sketches helped to establish an accurate solid works drawing.

Methodology Continued

After many hours of designing and prototyping a solid works assembly was created.



Safety

Safety for the project was the main objective to achieve above all else. The project was designed to incorporate safety instead of trying to overcome potential risks that were created along the way. Important measures were taken. All electrical components were designed to be completely separated from outside exposure and inner water flow. The use of alarms and emergency stops played a big role in the design phase and encouraged a detailed system which would suit each sequence of operation whilst maintaining safety. Such features include a 2 hand operating control panel and clamps to ensure stability of the bin and also an E-Stop and function stop. The prototype was designed to ensure splash hazards were eliminated.

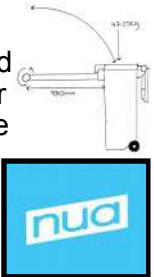
Analysis

One of the main areas of concern was finding a motor with enough torque to lift the bin into the wash chamber.

$$\begin{aligned} \text{Weight of bin} &= 47.25\text{kg} \\ \text{Torque} &= \text{Force} \times \text{Radius} \\ \text{So Force}_{\text{total}} &= 47.25\text{kg} \times 9.81 = 463.5\text{N} \\ \text{Radius} &= 980\text{mm} \\ \Rightarrow \text{Torque} &= (463.5) \cdot (0.98) \\ \text{Torque Needed} &= 454.23\text{Nm} \end{aligned}$$

A brief explanation is as shown.

This showed which motor was suitable and limited selection options drastically.



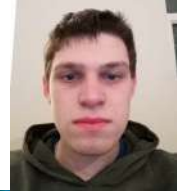
Conclusion

I achieved an extraordinary amount of experience as well as valuable skills to prepare me for working in industry. Through hard work and dedication I got the job done and I really enjoyed the process along the way.

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QR Code**





Introduction:

The idea for this Weed Mower was formed due to a personal need to combat excessive growth of aquatic weeds. These have become an issue in the past 4/5 years due to the lack of traffic on the river and in and around the marina.

Excessive growth of weeds can cause numerous problems from blocking up water cooling in boats, getting tangled in prop shafts and causing damage and making canals and streams with low water flow impassable and completely overgrown.



Aims of Study:

To apply the knowledge gained from personal issues and that obtained from collage to apply it in a real world scenario over come a complex issue.

Methodology:

Research:

Research began by looking at methods that are in use in both present day and past to see how weeds, both land and water variants were handled and dealt with. There are 3 main methods;

1. Use of herbicides
2. Extraction
3. Mowing/trimming

Due a process of previous testing mowing/trimming is the best method to deal with the issue.

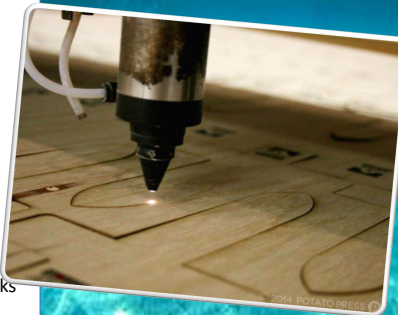
Design/Planning:

The design process involved:

- Researching other mowers in use
- Creating a timescale/project management
- Creating various concept mowers
- Selecting the best prototype
- Setting target dates for different aspects
- Overcoming and ironing out any potential flaws + adding in final details
- Creating and modelling the prototype on solidworks

Fabrication:

- Creating various dxf files of the parts
- Cutting out mock ups of the parts at a 1:5 scale.
- Going back and re designing some parts on solidworks
- Cutting out final 1:5 scale prototype.
- Assembly of the prototype and adding in some 'off the shelf parts' like finger bar blades and bolts.



Methodology (Continued):

Propulsion Unit:

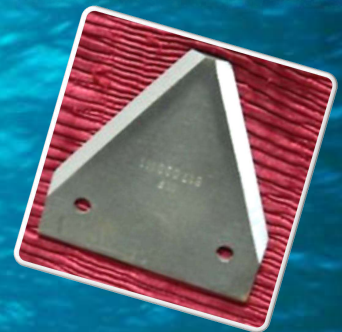
For the propulsion of the mower, a pto shaft would be connected to a 90° gear box, which was connected to a single cylinder diesel engine. The pto and engine setup was chosen for 3 reasons;

1. It was the most environmentally friendly that could be used
2. There is high torque from these 1 cylinder engine and also have very good speed variation.
3. It was a very cheap and cost effective method. This is because it made us of 'off the shelf parts'. This also meant it was cheap to run and repair.



Safety:

Safety is very important aspect of every mechanical product and beyond. This mower contained numerous safety aspects incorporated into the design. These includes sheer bolts, emergency stop buttons and guards on some moving parts.



Testing & Results

The results from testing the prototype seemed positive. Firstly, tests were carried out on soft material such as paper and card board as these would closely resemble what a reed would be like to cut. There were a few minor changes made to the cutter at this stage. These were mainly to do with tolerances of the blades and the revolving driving mechanism.

Once these changes were made on the solidworks parts, new dxf files of these changes were made and these were sent down to be cut on the laser cutter. The cutter was then disassembled and these new components were fitted. This proved to be very beneficial and made the cutter more tighter and sturdy with less chance of jamming or becoming stuck.



Conclusion

Due to the current pandemic the on campus aspect of this module was unfortunately cut short. This meant that all learning and further progress was to be made online. The main aspect of this module then became report writing and not further construction of the project.

However I do intend to someday use these drawing that were created to construct and build a 1:1 scale weed cutter for use on the river Shannon. This will most likely commence when this collage semester is complete and I have the available resources gathered.



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Introduction

The Purpose of this project was to simplify manual work for to included efficiency, performance and longevity. It was also important that the design was easily used by the customer and also incorporate all necessary safety features to prevent and cautions from the tool. Over my time studying Mechanical engineering I learned many skills and practices and this design was a perfect opportunity to individually apply as many skills as possible and as a result improve my experience in this area. ol users and make the actions of bolt cutting & shearing easier by automating the tools required to complete multiple tasks that are quite labour intensive. The aim for the design was to incorporate a hydraulic system to power a set of linkages to carry out various motions. Important requirements for this project

Methodology/Approach Research

To develop a design for this project it was important to understand what requirements and outcomes I wanted to achieve from this design. The performance of the tool was the main factor and to achieve a high performance it was essential that the force applied by the source was transferred efficiently to the end attachment. Hydraulic cylinder
Power sources were researched and compared before the hydraulic cylinder was chosen based off its characteristics and ability to co-operate with the design.

Hydraulic cylinder specification
Research was carried out on what force, pressure & power ranges were required for the tool to be effective in its actions. The characteristic were determined from research and based off this the specification for the cylinder was drawn up and ordered. The option to control the system manually or automatically was research and decided that the option to include both in the design was chosen as both had their own advantages. Automated control through use of an electronic pump allowed for speed control and a consistency, Manual control allowed for greater control over the output and also was more efficient technique.



Design Process

It was important to take the research and specification and effectively incorporate it into the design process. The steps in doing this to satisfy the brief included:

- Highlighting essential features of design
- Prototyping
- Sketching and comparing concept ideas
- Selecting the chosen design
- Dimension, scaling and developing final design.
- Solid works design process
- Part drawings.
- Assembly drawings.

Linkages

The linkage system was designed and proportioned based off the cylinder sizes. It was important that the linkage design transfer both motion and force efficiently to the end attachment. This part of the design also requires high strength, durability and can be quickly changed for both attachments to be used.

End attachment

Designing the end attachment the important factors were that the part would be able to withstand a lot of force and would simultaneously comply with the movement of the cylinder arm.

Safety
Safety was a well researched important factor in this project and the design has complied with all relevant directives. This can be seen with the incorporated emergency stop & safety guard features.

Sourcing/ Production

- The standard parts such as the hydraulic cylinder were sourced online when the correct specification was found.
- All parts to be machined and turned were sourced in the GEW and production of these components began in the GEW.
- Fabricated parts included the linkages which were to be laser machined & the cylinder bracket which began milling and turning process in the workshop.



Conclusions/Results

What will make the project successful?

The specification of the design has various steps in order to determine the project successful and this will be decided in the testing phase of the project.

Key aspects include:

- The output force of the tool.
- The efficiency of the power output.
- The aesthetic of the design
- The safety features addition.
- Can it cut through bolts of relevant size.
- Can it separate listed forces.

Testing

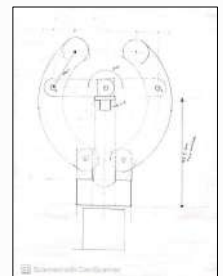
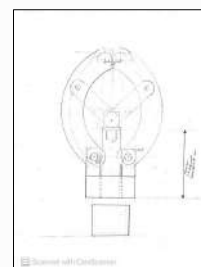
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Results

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Conclusions

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Introduction:

The idea behind the design of this device was to Give small to medium farmers an alternative cost effective and efficient way of spraying agricultural crops. Small to medium farmers generally use the knapsack back sprayer to spray their agricultural crops which is time consuming, costly and human fatigue is a major concern. The aim was to keep the design as simple and functional as possible while also eliminating the various issues associated with the traditional backpack sprayer



Aim and Objective:

The aim of this project is for the farmer to be able to pull the mechanism mounted on the trolley to run the pump and spray the pests instead of carrying the whole pesticide sprayer pump on his back. This makes the farmer feel comfortable, relaxed and less tiresome.

The next aim is to minimize human effort by minimizing the fatigue load acting on the body due to the continuous pumping action for generating pressure within the pesticide sprayer.

- To increase efficiency of the sprayer
- To save human effort in pumping
- To reduce cost by advancing the spraying method
- To provide a comfortable spraying experien for the farmer

Methodology:

Research:

- Research began by looking at the various agricultural sprayers that is was on the market that was affordable as well as efficient. The most common sprayer that was used by small to medium farmers was the knapsack back sprayer. Having researched the multitude of sprayers there wasn't a sprayer on the market that was cheap and that was highly efficient with a multiple nozzles. The 3 main takeaways from the research that was done
- To produce a cost effective agricultural spraying device
- To Produce a device that is highly efficient for the price of the device
- To make spraying less tiresome for the operator
- To eliminate back strain on the user
- To make agricultural spraying more comfortable for small to medium farmers.



Design:

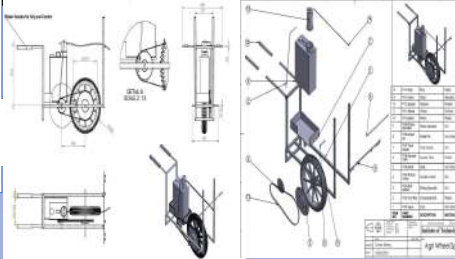
The idea behind the design was to for the connecting rod to engage with the connecting rod on the knapsack which in turns creates pressure inside the pump which after a certain amount of pressure sprays out onto the sprayer line.

The advantages of this design is

- The handlebars is made out of rubber so it gives the user a relatively comfortable experience while operating the device
- Human effort in pumping is saved
- increases the spraying capacity with the multiple nozzles
- As the tank is borne on a trolley frame, it is less tiresome compared to the traditional sprayer.

Methodology (Continued):

After many hours trying to figure out what was the most efficient way to make this device a success it was to create a simple trolley like frame for the base of the sprayer, as it is relatively easy to manufacture and easy to assemble.



Safety:

Safe organizational practices are adequately enforced to ensure that the risk of an accident or injury can be kept very low. There was a variety of safety factors taken into account when coming up with the design of this project which includes,

- Hazards when dealing with dangerous chemicals such as pesticide, herbicides etc.
- Safe Way of lifting the device without causing injury
- Correct use of PPE

Training

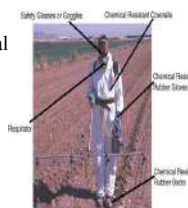
When dealing with dangerous chemicals such as pesticide the operator to handling the spray must have a certificate to verify that he is qualified to handle such equipment. There is standards put in place when someone has control of spraying pesticide such as

- Only a trained professional can apply pesticides authorised.
- Compulsory Certificate of Competency Training courses in pesticide operation are available from many accredited training providers in compliance with the Standards and Qualifications Ireland (QQI) standard.
- Always read the safety label instructions before spraying any chemical and ensure that all controls recommended by the manufacturer in the Safety Data Sheet (SDS) are followed.

PPE

The Appropriate PPE to wear while using the device would be

- disposable rubber gloves
- Face Shield
- Safety Glasses
- Disposable chemical overal
- Rubber Wellies/Boots



Analysis

The analysis aspect is going to determine the efficiency of the device under a set off conditions, the main aim of this device is to be more efficient than the typical knapsack sprayer so we are now going to indulge on an analysis to see how efficient this device is. We are going to determine how much of land we can cover in a given amount of time, flowrate of pump, distance covered per stroke etc.

Analysis (Continued)

Gear Selection

OD= Outside Diameter
N= Number of Teeth
 D_r = Root Circle Diameter
M= Module
D= Pitch Diameter
 D_p = Diametrical Pitch

Driven Gear

Module= $\frac{PCD}{N} = \frac{162}{31} = 5.23$

$N = \frac{PCD}{M} = \frac{162}{5.23} = 30.98 \text{ teeth}$

31 teeth on driven side

$PCD = N \times Mod = 31 \times 5.23 = 162.13mm = 162mm$

$OD = (N + 2)(Mod) = (31 + 2)(5.23) = 172mm$

Flowrate

There isn't sufficient space in this poster to demonstrate the calculations to determine the flowrate, the flowrate we got from the pump was 0.0556 litres per minute. The time taken to spray lets say 1.5 acres of land was estimated to be 270 minutes. We also determined the amount of fluid necessary to spray the entire land which is around 160 Litres, so this means that the operator will have to refill the tank 10 times during the spraying process to spray their land.

Drivers Gear

Module= $\frac{PCD}{N} = \frac{324}{62} = 5.23$

Number of Teeth= $\frac{PCD}{M} = \frac{324}{5.23} = 61.95 = 62$

62 Teeth on Drivers side

$PCD = N \times Mod = 62 \times 5.23 = 324mm$

$OD = (N + 2)(Mod) = (62 + 2)(5.23) = 334.72mm$

334.72mm

Gear Ratio/Velocity Ratio

$\frac{N1}{N2} = \frac{62}{31} = 2:1$

Distance Covered

Wd= Wheel

Diameter=600mm

Circumference= $\pi \times wd = \pi \times 600 = 600\pi = 1884.95mm$

$\frac{N1}{N2} = \frac{62}{31} = 2:1 \text{ gear ratio}$

Distance Covered per one

cycle= $\frac{\text{Circumference}}{\text{Gear Ratio}} = \frac{1884.95}{2} = 942.475mm$

942.5mm covered per one cycle

Distance Per Stroke=

$\frac{\text{Distance per cycle}}{\text{Gear Ratio}} = \frac{942.5}{2.0} = 471.25mm \text{ per Stroke}$



Conclusions:

The equipment is built for small-scale farmers with 2 to 8 acres of land. It is ideal for spraying any form of liquid, such as fertilizers, chemicals, pesticides, herbicides, and so on, at a low cost to farmers. This wheel-driven pull-type sprayer is both low-cost and easy to travel around in the fields, and it increases pesticide spraying efficiency. Back discomfort is no longer an issue because the tank (pesticide stank) is no longer carried on the back. The designed equipment has a greater number of nozzles, allowing it to cover a larger area in less time and at a faster pace. This mechanism is primarily a manual-operated device that does not depend on external forces such as electric motors, electric pumps, or fuels.



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Investigation into the Advantage of using Profiled Tubing vs Round Tubing in Racing Bikes

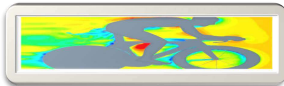
By: Seán Dever

Introduction

- This study looked at how the performance of a racing bike is affected by altering the shape, size and overall geometry of the tubing in a racing bike and which tubing is superior for performance.
- The study focused on the aerodynamic efficiency of the tubing with the testing consisting of a wind tunnel test, simulation using solidworks flow simulation and manual calculations.

Background

- Aerodynamics is the study of the properties of moving air and the interaction between the air and solid bodies moving through it.



Objectives

- Obtain a section of round cycle frame tubing and profiled tubing.
- Design a fixture for the wind tunnel to hold the tubing and measure the drag force.
- Test the tubing specimens at different speeds.
- Analyse setup with basic fluid dynamics theory.
- Model using flow analysis.
- Compare results.

Methodology

Research:

- This section of the report discussed the literature and theory that had been reviewed to gain an understanding of aerodynamics in racing bikes. The section reviewed the introduction of aerodynamic efficiency in racing bikes including, materials and geometries.

Testing:

- This section covered a number of the testing aspects including using solidworks flow simulation, wind tunnel testing including rapid prototyping, & analysis using some manual calculations.



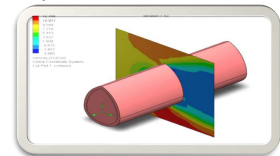
- Solidworks flow simulation tested the performance and aerodynamic efficiency of both profiled tubing and round tubing. The simulation analysed the velocity but also analysed the drag force, drag coefficient and the drag power.



- Due to the Covid-19 pandemic restrictions physical testing in the college was not possible for this study, therefore the section covered how the physical testing would be carried and a support fixture was designed for the test pieces
- A number of manual calculations were then carried out, testing Bernoulli's equation and Reynolds number.

Results

The results produced from this study seemed to emulate results from the few previous studies that were available, proving the profiled tubing to be superior than the round tubing for performance and aerodynamic efficiency.



The finished study fulfilled most of the objectives including:

- Designed a fixture for the wind tunnel to hold the tubing and measure the drag force.
- Test the tubing specimens at different speeds.
- Analysed setup with basic fluid dynamics theory.
- Model using flow analysis.

Conclusions

- This project provided an opportunity to put into practice and improve the analytical, communicational and design knowledge learned throughout the course.
- Overall the project was a success and was an excellent learning experience.
- It was quite disappointing however, not too be in a position to carry out the physical wind tunnel testing in the college.

Mountain Bike Suspension Analysis for Total Hip Arthroplasty

Aim: To conduct an analysis of mountain bicycle suspension with the objective of incorporating compliance into a hardtail suspension mountain bicycle, for specific use by people with total hip arthroplasty.

Compliance: this is the ability of a bike frame to be comfortable and responsive to the weight of the user and the inputs of the road surface, while not requiring suspension components such as shock absorbers or air springs [1]

Hardtail: This has been used to describe bicycles that have no suspension at all for most of the history of bicycles. In the past 3 decades it has been refined to refer to bicycles with front fork suspension but not rear suspension



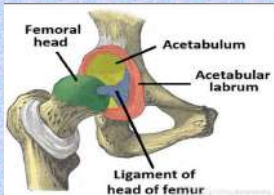
[3]

Softail: This is a bicycle that has both front fork suspension and some combination of a shock absorber and sway bar. The shock absorber is either a metal coil spring or an air spring compression cylinder. Both have oil damping cylinders with them.



[4]

Total Hip Arthroplasty (THA): This is a minimal invasive surgery that replaces the hip socket, cartilage and femoral bone with prosthetics. In the US alone, almost 450,000 THA are performed, according to the Agency for Healthcare Quality and Research[2]. While this procedure has become more advanced and has a high success rate, there are limitations placed upon the patient after their operation. One limitation by most surgeons is a prohibition on Mountain Biking. This is due to the intensive nature of the sport on the hip joints.



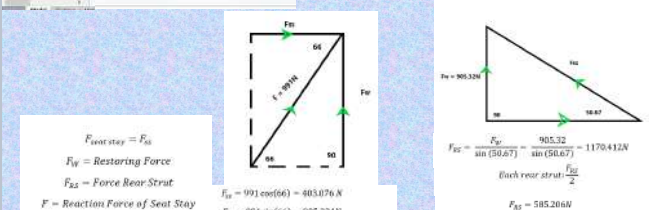
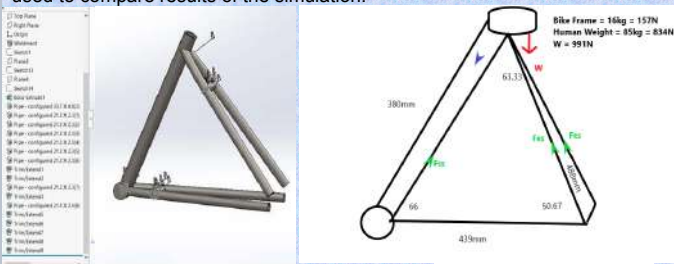
[5]



[6]

Methods:

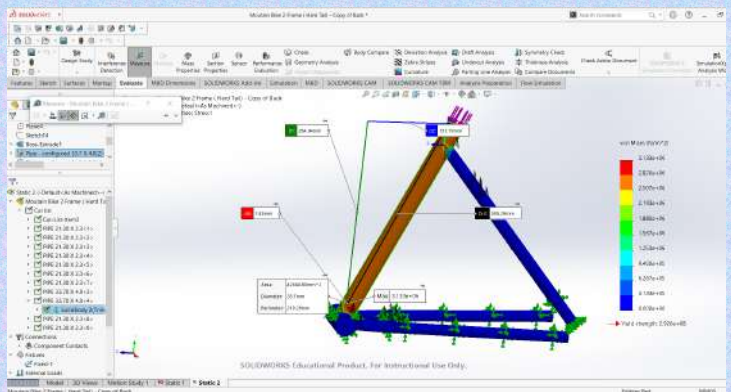
Using Finite element Analysis and Solidworks Static simulations, a model was built and tested. Using the weldments feature in Solidworks, the rear triangle section of a hardtail mountain bike was modelled. The dimensions of the model triangle were noted and a manual calculation was conducted which would be used to compare results of the simulation.



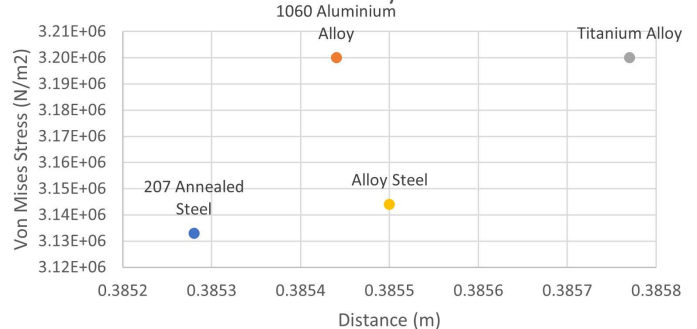
Results:

1. Can compliance be built into a bike frame to dissipate impact force throughout a frame?

As seen in the plot below the material choice makes a marginal difference to the dissipation of the force. Selecting Titanium over Annealed Steel result in the force absorbed being greater and is absorbed lower on the frame. Titanium has superior tensile and compressive strength to compliment its high modulus of elasticity. When compared with either Aluminium alloy or Steel Alloy, these mechanical properties allow it to be elastic enough to dissipate force further down the seat stay tube and allow it to be strong enough to absorb more of the impact stress. This is an example of how compliance can be built into a frame even without adjusting design, while also giving improved performance characteristics in terms of comfort for persons with THA.



Graph of Von Mises Stress vs Distance travelled down Seat Stay Tube



2. What alterations to the frame structure lead to the greatest dissipation of force?

Still Under Investigation.

The following adjustments are being tested –

- Changes to the position where the rear struts join the seat stay tube
- Joining together of the two individual struts into one before attaching to the seat stay tube
- Addition of curvature to the seat stay tube and rear struts

3. Are the improvements only marginal or does it offer a significant benefit to a person who has undergone Total Hip Arthroplasty?

Currently insufficient data sets to draw any final conclusions.

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Bladeless Wind Power Generator Introducing New Technology in Ireland



“SIMPLY DESIGNED & SIMULATED VORTEX BLADELESS WIND POWER GENERATOR PRODUCES EFFECTIVE RESULTS & PROVED TO BE EFFECTIVE ALTERNATIVE OF BLADE WIND TURBINES”



Drag coefficient is one of the most important parameter and its value affects directly the power generated by the turbine and it is concluded that its value remain horizontal which means the result is converged.

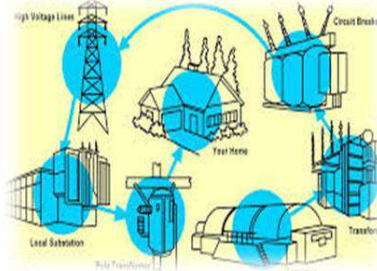
Introduction

Wind energy is the most common power generation method in Ireland with 85-87% contribution of renewable energy generation and 23% of total generation of energy making Ireland one of the leading country in wind power generation.

Aim

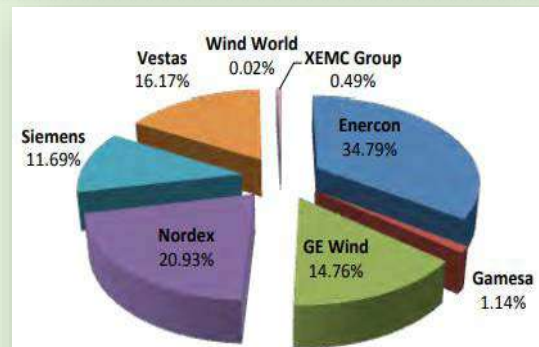
This study aims to improve the affectivity of bladeless wind power generator along with its designing, simulation and testing that can produce power on small scale in different areas of Ireland. Specifically, prototype is tested and simulated with corresponding determined parameters.

Design includes a flexible mast structure which resonates with the vortices produced due to wind. Magnets and coils assembly vibrates which produces electrical induction energy is stored in batteries for future use. Ireland has the capacity to produce surplus energy through wind potential by 2030. Generation of wind in 2015 accounted for 22.8% of generates electricity which was the second largest source of generation of electricity natural gas being the first. The design is proved to be feasible and analyzed.



Guides are published by SEAI for coupling large and small scale wind turbines to electricity distribution system. Wind industry is expected to hit a peak annual investment of between €6 billion and €12 billion by 2040,

Wind turbine manufacturer total market share demonstrates the contribution of manufacturers in fulfilling excessive demand of wind turbine installation projects all around Ireland. According to annual report of IEA, Vestas wind turbine manufacturing company drops its market share and other innovative companies like 'Enercon' & 'Nordex' are adopting new techniques according to location and demand. Enercon becomes the leading manufacturer of wind turbines because it develops only small scale projects and to overcome demand, balance of market is shared with Siemens, Nordex, GE Wind and XEMC Group.



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INVESTIGATION OF CAM BOUNCE

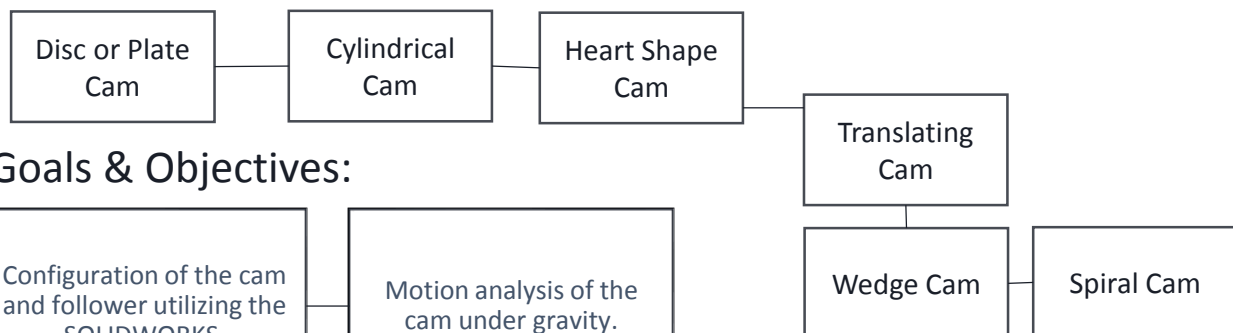
Submitted By:
Salim Al-Saadi

Bachelor of Engineering (Honors) in
Mechanical Engineering
Institute of Technology, Sligo April 2021

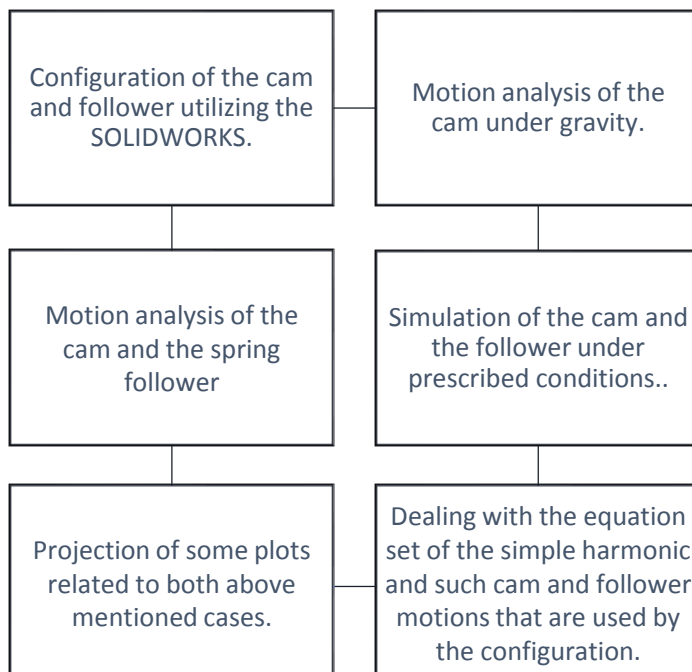
Introduction/Project Brief:

Cam and the follower mechanisms are the widely utilized technology in modern age. This mechanism is also used for the controlled motion of the objects utilized in numerous applications. The common illustration of this mechanism is the engine in which the valves are operated by the cam. Machines these days have numerous cam-driven linkages that give movement to tooling. Cams are additionally originating in a wide assortment of uses from an overhead camshaft in engine to cam worked specials reason machines, etc. Cams have an assortment of standard profiles or movement, for example, basic consonant movement and steady speed increase and impediment and so on these are marginally unique as far as development strategy and perfection of activity.

Types of CAMs



Goals & Objectives:



References:

- Cam Design Handbook by **Harold A. Rothbart**
- Shigley's Mechanical Engineering Design by **J. Keith Nisbeth** and **Richard G. Budynas**
- Cam Design and Manufacturing Handbook by **Robert L. Norton** and **Robert Norton**

Aerodynamic analysis of the stalling characteristics of a Van's RV-7 aircraft.

By: Colm Duddy

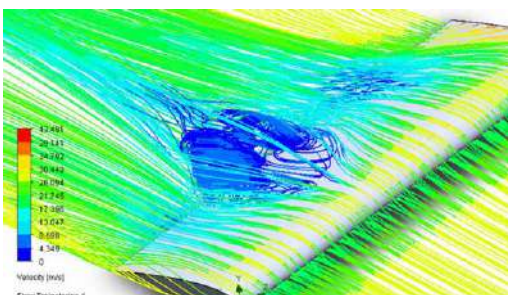
Introduction

The stalling characteristics of an aircraft is when the angle of attack is too great for the trust causing the airflow over the wing to turn turbulent and generate insufficient lift as a result. This document outlines the factors that causes stall on a Van's RV-7 aeroplane. This document outlines research into solutions for reduced stall speeds on this aircraft by reviewing different wing configurations.



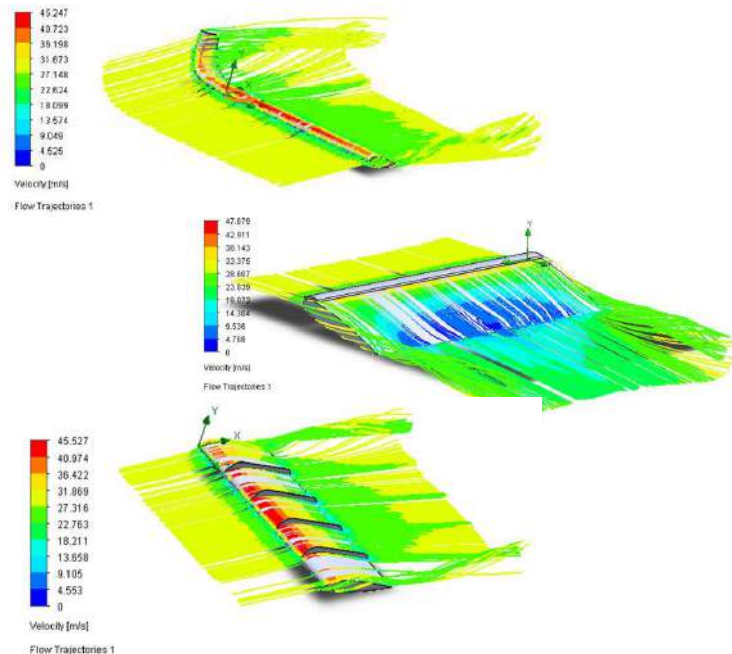
Objective

The objective of this project is to design wing attachments that will increase the planes stall factor. This has many benefits to the performance of a plane. The plane will have the capabilities of flying at slower speeds, will have a greater angle off attach and will be able to take off and land in shorter runways. The first task involves carrying out an experiment to assess the stall speed on the plane. Calculations would need to match the CFD simulation to prove the findings. After this high lift devices can be added to the wing to see how they influence the lift and stall factors.



High lift Devices Developments

High lift components attach to an aircraft's wing to increase its overall efficiency. Devices can vary from fixed components to moving mechanical parts. The attachments modelled on the RV-7 simulation were wing tips, slats and wing fences.



Conclusion

Below are the results obtained by the simulations. The standard wing is the same wing as the RV-7 aerofoil with no attachments. These results correspond with the calculations and with the test carried out in the RV-7. The next simulation carried out was with the wing tips. The wing tips brought the stall speed of the airplane from 29.1m/s to 18.48m/s which was a 36.5% improvement. The wing tips had the greatest effect out of the 3 variations. The next designed reviewed was the aerofoil fences. These also had a large impact on the stall speed reducing it from 29.1m/s to 22.4m/s. The last design was the slaps, these did not have as much of an impact on the RV-7 airplane as the wing tips or the Fences. They reduced the stall speed by 0.9m/s. The wing high lift developments would work very well on the RV-7 Airplane and could be implemented to improve lift stall speed and fuel reduction.

	Standard wing	Wing Tips	Fences	Slaps
Coefficient of lift	1.4	3.67	2.39	1.5
Force Y- Lift force	7646(N)	19959(N)	12985(N)	7951(N)
Stall speed	29.1m/s	18.48m/s	22.4m/s	28.2m/s

Wind Turbines

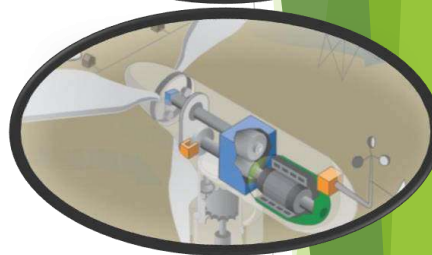
Direct-Drive Vs Gearbox



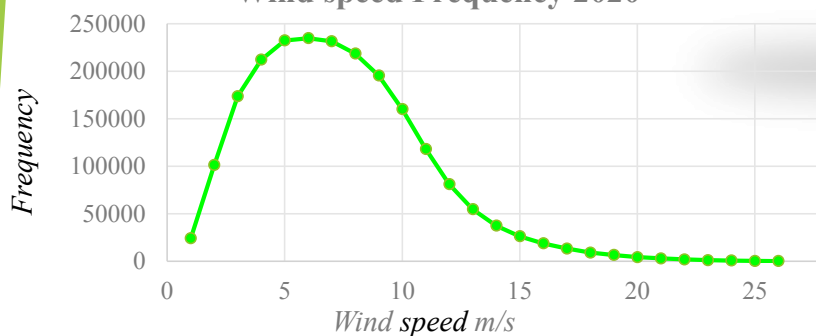
An in-depth analysis on wind turbine powertrains

This report looks at wind turbines in the Meenadreen site Co. Donegal, and answers the question which is the better power train Direct-Drive or Gearbox.

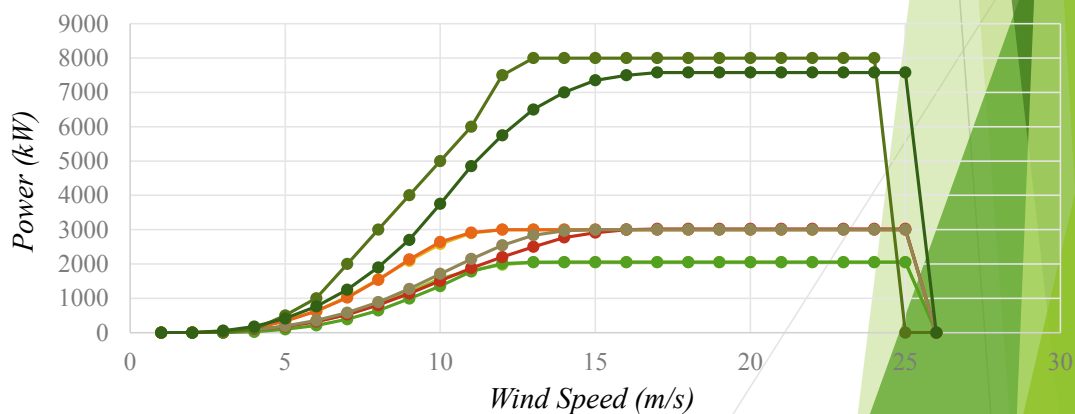
Shown above is the wind farm in Meenadreen this report will analyse power trains by using Met-Mast data (wind Speed) from this wind farm, and comparing power curves of various turbines to determine which power train is most suitable for this site.



Wind speed Frequency 2020



Power Curves



—●— Enercon E2 —●— Senvion MM92 —●— Enercon E-115 —●— Nordex N117
 —●— Enercon E-82 —●— Vestas V90 —●— Aerodyn SCD-168 —●— Enercon E-126

By Matthew Doherty

S00172788

Introduction

Heat exchanger are most used in process industries, they are used to transfer heat involving two process streams. It should be noted that any process which involves cooling, heating, boiling, condensation, etc. will require heat exchanger for these purposes. Process fluid like water or oil usually are cooled or heated before the process undergo change of phase. The design of heat exchanger includes many operating and geometric parameter in order to fulfill the thermal energy demand and system effiteness with the given conditions. This heat exchanger is built with a bundle of tubes housed in a large cylindrical shell with it axis parallel to the shell



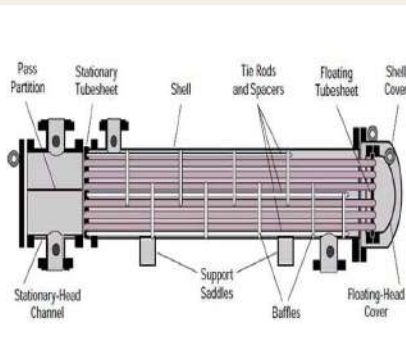
Project Description

The shell and tube heat exchanger of the most popular types of exchanger owing to the flexibility the design has to guarantee for a wide range pressure and temperature. The project consist heating cold water flowing at the rate of 0.5kg/s into the tube by a hot engine oil. The engine oil at the flow rate of 0.8kg/s. the outlet temperatures pf the tube side are obtained using a special thermometer by varying the inlet and outlet temperature

Block Diagram

Inlet temperature 40°C	→	Double tube pass heat exchanger	→	Outlet temperature 49.8°C
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Block diagram of heat exchanger

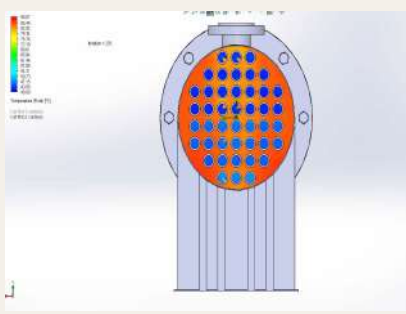
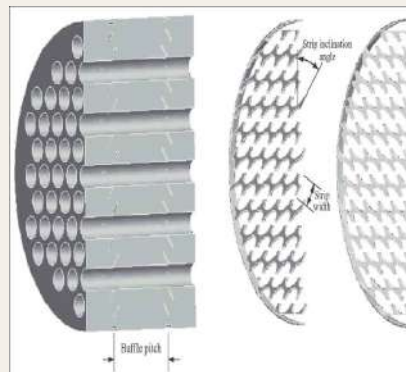
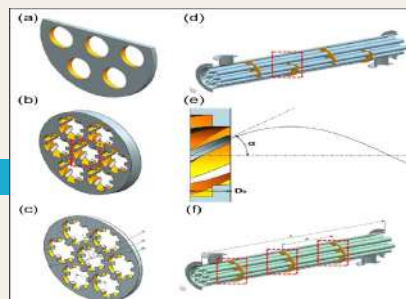
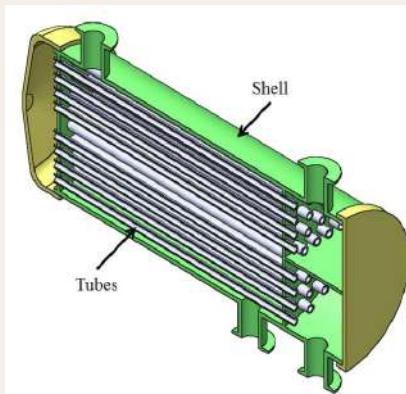


Float head heat exchanger

Components of Heat Exchanger

A typical heat exchanger consist of the following components

1. Tube
2. Shell
3. Tube sheets
4. Baffles



Expected Results

For the result and outcome of the project, there are different temperature inlet through the tube that is going to generate series of water outlet temperature. In order to sufficiently see the value, a thermometer is installed/attached to the output nozzle of the header



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Heat Exchanger (Tube In Shell)

Jeremy Price

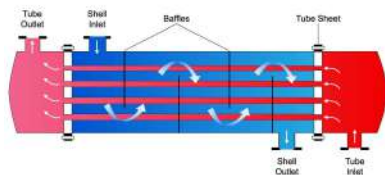
Supervisor: Dr Gerard Mc Granaghan

IT Sligo



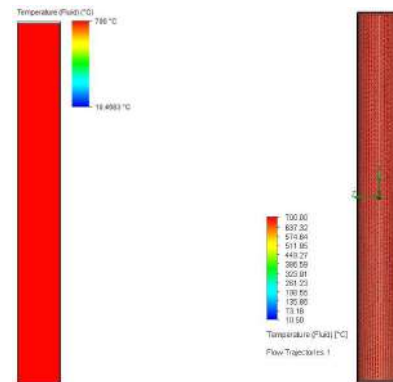
Introduction

A tube in shell heat exchanger is one of the most common types of heat exchanger that would be found in large chemical processes, oil refining, home fire burning stoves and many more applications. Shell in tube heat exchangers consists of a cylinder carrying one fluid with some smaller cylinders inside it carrying another fluid. The two fluids both of which have different starting temperatures that are flowing through the heat exchanger. One of these flows goes through the tube side and the other fluid flows through the shell side. The heat is passed from one fluid to the other fluid through the tube walls. This can work in both directions, hot to cold and cold to hot. The fluids in the heat exchanger and either be in gas or liquid form. For efficient transfer of heat a large area should be used for the heat transfer using many tubes as this will help with heat being wasted.

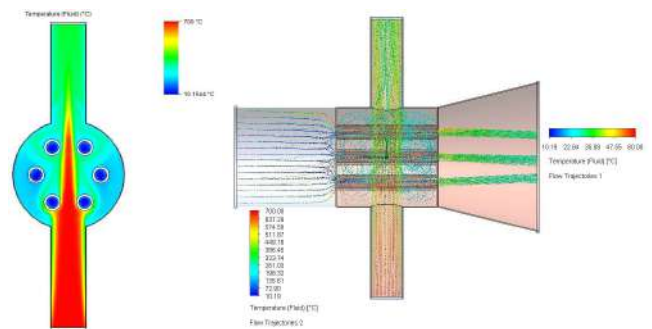


Compare Solidworks result with real-world results

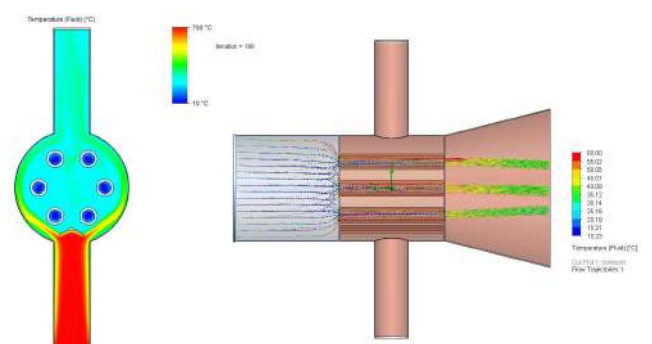
A rig was built to retrieve results from the real-world test, using anemometers and temperature sensors to get the results. This rig was then modelled up on Solidworks and had flow simulation set up to the same boundary conditions which the real-world test was ran at. exchanger to see if the results from the real-world test would match up. And from there make improvements to the heat exchanger.



Flue with no heat exchanger (Heat being wasted)
(Solidworks model)



Flue with original with heat exchanger attached showing temperature increase from the cold air to hot. Heat being reclaimed (Solidworks model) Air temperature 30°C



Heat exchanger with modification of a diffuser at entry to the heat exchanger showing more heat than the original being reclaimed due to the diffuser.
(Solidworks model) Air Temperature 40°C

Conclusion

By adding a diffuser to dissipate the hot air at the entry of the heat exchanger the efficiency rose by increasing the temperatures, when compared to the temperature that was being recorded from the original heat exchanger there is a difference in temperature of 10°C.

Thermal management of a CPU

Introduction

All electronic equipment will have a flow of electricity through it, this in turn generates heat. This heat generation will be the focus in the design of the cooling system. As Heat is an irreversible process it must be removed for continued operation of the system. Today's electronic devices cannot solely rely on pure conduction, natural convection or radiation. CPU's need a more powerful system to cope with the heat that is generated.

objective

The primary goal of this study and of thermal management is to keep components at or below their maximum junction temperature T_j when operating at the Thermal Design Power (TDP). The maximum power consumption of a component is known as its TDP. A typical user would rarely encounter a scenario where they would be using max TDP but this still has to be accounted for.

Research

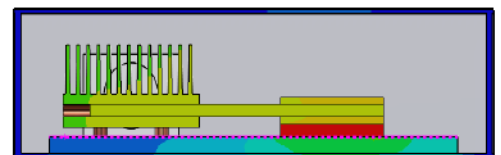
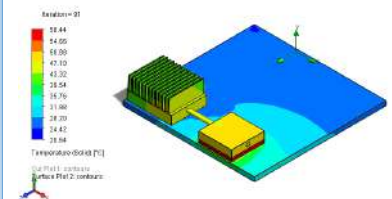
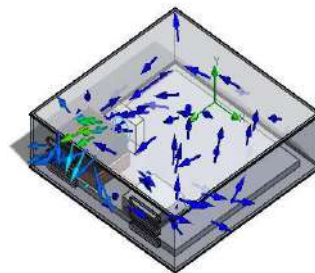
The overall design of the thermal management system requires research to optimise cooling. The CPU, PCB, heat sink, Aluminum block, fan and heat pipe are the components that are researched due to their influence on flow regime and overall CPU temperature. Small specifics such as transistors, capacitors and wires are ignored.

Design

Components with a high impact on CPU performance where modelled and designed on solidworks. A number of configurations for these models where done to optimise performance. A 13 finned heat sink configuration with flow trajectory is shown below along with the path of heat transfer.

Conclusion

As a result of the research and analysis involved in this project, it can be concluded that a optimal temperature can be got for a CPU. Fan speed and the number of fins on the heat sink proved to be most important. In one scenario that was tested, an increase from a 8 finned heat sink to a 23 finned heat sink, a -8°C change to CPU temperature was found.

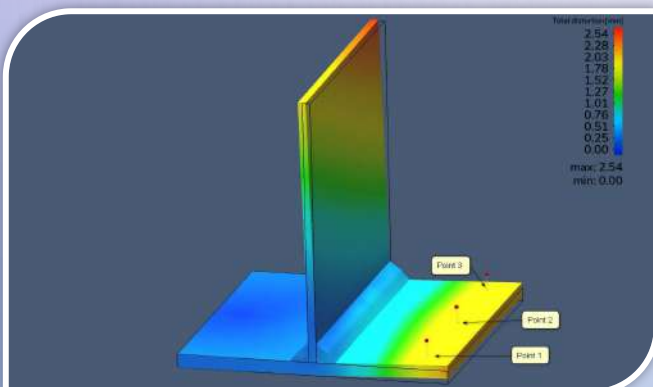


A STUDY OF WELDING DISTORTION WITH (REMOTE TESTING VS NUMERICAL SIMULATION)

By: Adam Mc Laughlin

Introduction

Welding is one of the most commonly used procedures for the joining of various structural components in a wide variety of applications within the world of engineering. The reason for this is the low price and simplicity of the application itself. The subsequent rapid cooling of the various metals after they are melted causes non uniform expansion and contraction. This phenomenon leads to the occurrence of permanent plastic deformations and residual stresses to the weld structure which in turn had a very negative effect on the overall durability and structural integrity of the component. Through the use of thermal and mechanical procedures these dimensional inaccuracies can be prevented and this then has a positive knock on effect on time and labour saved and an end goal of overall financial gain. As a prime interest determining the magnitude of the residual stresses and the deformation in advance is essential so that the appropriate measures can be put in place to reduce them. T-joint web and flange fillet joints have a prominent place due to their frequent applications in industry's such as shipbuilding and infrastructure where accuracy is a key motive.

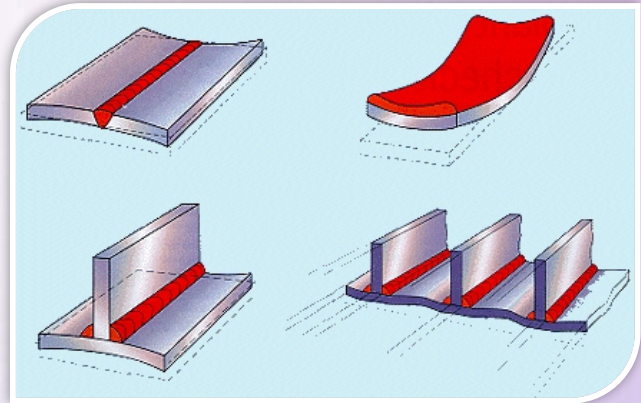


Conclusion

As a result of the research and analysis involved in this project, It can be concluded that the numerical simulation and the remote testing results where all within the international welding tolerance of 0.5mm which shows that these simulations and experimental testing where in agreement with each other and mean they are a very effective way of predicting residual stresses and dimensional inaccuracies.

With the price of industrial steel continually rising it is essential that companies have the capacity to predict these problems well in advance of manufacturing which will keep overall production costs at a minimum.

In order to further research the internal effects of these tests, x-ray reports would be required to determine the degree of residual stresses within in T-joints. Due to covid-19 these facilities where not available.



Objective

The objective of this project is to investigate the extent of welding deformation in a web and flange t-joint. The influence of the flange thickness will be investigated by remote home testing and a numerical simulation

To undertake this process an extremely precise welding programme was used know as "Simufact Welding" which would observe how the web and flange joint with three different flange increments of 3mm, 4mm and 5mm reacts to the heat input and residual stresses.

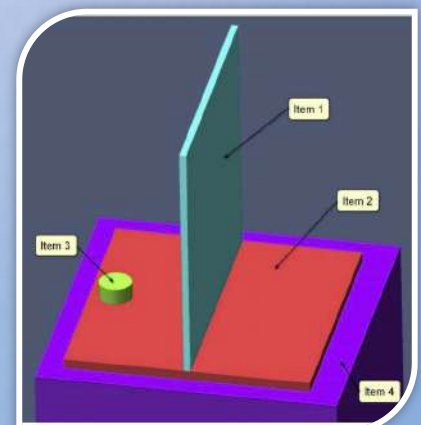
The simulation results will then be compared to the remote testing which will be carried out in a local workshop due to the Covid-19 restrictions. These tests will be an exact comparison which will allow for a fair test which can be thoroughly discussed

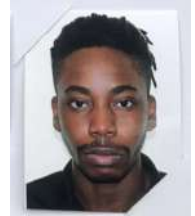
Research

The design of the web and flange joint had to insure that the simulation was able to cope with the capacity of the weld. 100mm weld was agreed. A standard steel was chosen better known as s275JR+AR which is widely used in the industry.

With welding being a relatively complex process numerous parameters had to be taken into consideration when comparing both types of test some of these include:

- Welding current
- Welding speed
- Electrode diameter
- Gas composition
- Electrode polarity
- Weld orientation



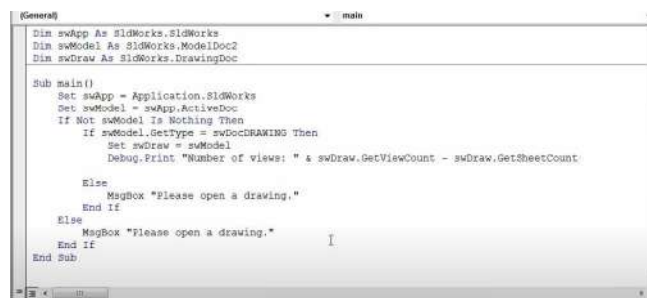
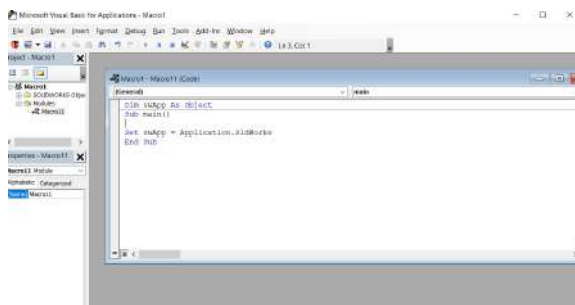


Development of Cam modelling Utility for Automation of Modelling of Cams

Introduction

The objective of this exercise is to develop a cam modelling utility for automating the modelling of cams. Due to the limitations of the Solid Works CAM modelling utility, the purpose of the project is to develop a utility for modelling cams to replace the existing cam modelling tool in Solidworks. These tools with the help of VBA within Solid Works will be used to automate the modelling process.

Macros in SOLIDWORKS are a useful way in aiding to save time from having to perform repetitive tasks. A single macro can range anywhere from performing a few simple tasks to complex programs that will change depending on user input. Macros simplify the day-to-day tasks of CAM programmers. Manufacturing knowledge can be standardized and automatically applied to machining features. This translates into NC programs at the push of a button.



$$\text{Cutting Speed } V_c = \frac{\pi \times D \times n}{1,000}$$

$$\text{Spindle Speed } n = V_c \div \pi \div D \times 1,000$$

$$\text{Feed } V_f = n \times f_z \times Z$$

$$\text{Feed per Tooth } f_z = \frac{V_f}{n \times Z}$$

V_c = Cutting Speed (m/min)

π = 3.14 (The Circular Constant)

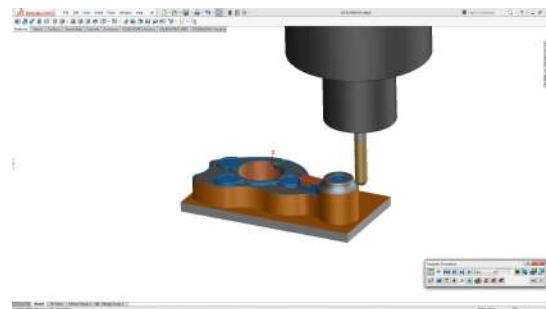
D = Diameter (mm)

n = Spindle Speed (min^{-1})

V_f = Feed (mm/min)

f_z = Feed per Tooth (mm/tooth)

Z = Number of Flutes



Conclusion

CNC (Computerized Numerical Control) manufacturing technologies such as milling, turning and drilling are used to transform a digital model into a machined component. A CNC machine tool created the component from a stock model, cutters, and NC programs.

Important business objectives are to produce components economically, accurately and on time. Today's design components have increasing complexity and sophistication, and as such, manufacturing companies need a powerful CAM (computer-aided manufacturing) system in order to be able to meet these requirements. By using CAM software, NC programmers make a key contribution to return on investment for CAM software and the CNC machine tools companies invest in to meet their objectives.

Engineers working with SOLIDWORKS are often faced with tedious, repetitive work that can consume a lot of time, but it doesn't have to be this way. Custom macros do take a bit of time initially to create. However, once a well-written macro is created, it can save hours of programming and program proving time. The use of a well-written custom macro can also help many CNC users avoid the cost of expensive CAM programming.

Examining the Impact of a Shroud on a Wind Turbine



Introduction

This project concept looks at the current development of wind energy world wide and how this renewable clean energy can be further enhanced and modernised in this ever changing world and climate.

Wind energy is a renewable source of energy, but the expense of windfarms and damage to our environment that's been created by as a result of wind turbines and windfarms is colossal. Finally the investment that goes into windfarms and turbines is that of high risk and breaking the profit barrier form these investments is both challenging and time consuming.

Aims of Study

Firstly, to design a shroud and a wind turbine on 3D-CAD. The main aim of this study is to improve the energy production in wind turbines by increasing the velocity outputs and generating higher pressures through the design and addition of a shroud attachment onto the wind turbine..

Research

Background:

Firstly, looking at the current debate around wind energy, wind power is encountering many problems about ecology and economies of scale. With the world needing more sustainable, renewable energy many look at wind as the solution.

The average lifespan of a wind turbine is 20-25 years which is quite short and minimises the profit barrier for wind energy.

16% of the worlds population are without access to electricity today which approximates to 1.2 billion people.

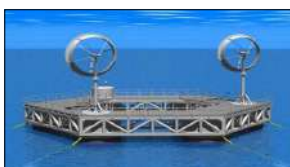


Objectives:

The main objective of this project looks to examine the impact the addition of a shroud may have on a wind turbine.

Other objectives include,

- Investigate the current issues and complications wind turbines currently cause.
- Test the shroud by means of simulation using a CFD software package and also by mathematical analysis.
- Produce a set of results by both flow simulation and mathematical analysis for both the wind turbine and the shrouded wind turbine.
- Observe, compare and conclude on the results form both methods of testing.
- Spur an interest and enthusiasm amongst the wider public that they can have a positive impact on both the future energy of their planet and the environment of their own communities.



Methodology

Design:

Once the Research was completed on the various impacts on wind energy and the different types of wind turbines a concept of the desired project then began to be developed.

Shroud Design Considerations:

There are a variety of different shroud types that can be selected to use on a wind turbine. Each shroud type has different pros and cons. These shrouds can be designed in all different shapes and sizes but its important the chosen design does not cause too much hindrance to the local landscape and also effect the aesthetics of the wind turbine.



Wind Turbine Design:

The chosen wind turbine design is a three blade horizontal axis wind turbine. The turbine selected is a standard effective design with components including a Base, Upper and lower mast, a Hub, Three Blades, Nacelle left and right, a Shaft, and two washers.

The chosen shroud concept consisted of a cylindrical shaped shroud inlet and a cone shaped shroud diffuser which is attached to the inlet.



Shrouded wind Turbine:

One turbine was designed overall and in order to test the component, the turbine would be first tested on its own then retested again with the addition of the shroud to the model.



Testing (Mathematical Analysis)

The mathematical analysis in this project is derived by means of manual calculation. In order to calculate the output average velocity and pressure drop of both the turbines this is calculated from the rearranging of Bernoulli's equation.

$$p_1 + \frac{1}{2} \rho v_1^2 = p_2 + \frac{1}{2} \rho v_2^2$$

Where Average Velocity is calculated by,

$$v_2 = v_1 \frac{a_1}{a_2}$$

The Pressure Drop is calculated by,

$$\Delta p = \frac{1}{2} \rho v_1^2 - \frac{1}{2} \rho v_2^2$$

Testing (Flow Simulation)

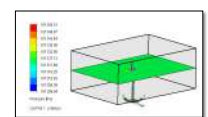
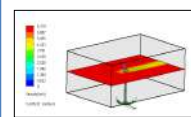
The other method of testing is carried out by means of flow simulation using 3D-CAD where the flow simulation is built into the software.

The simulation enables the flow of a substance over or through a component.

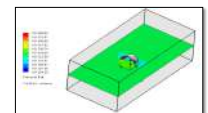
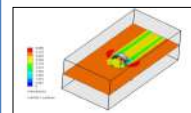
In this case the substance used in the flow was air and an input velocity in the X-axis direction of 6m/s.

Due to the complexities of running the flow simulation with rotating parts, the components on the turbine were static during the course of the flow simulation testing.

Wind Turbine:

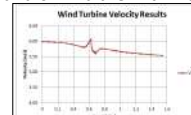


Shrouded Wind Turbine:

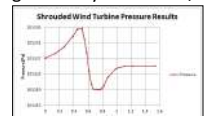
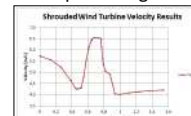


Results

The results of both methods of testing had similar outcomes in the testing of the wind turbine. The average velocity results of 5.77m/s and 6m/s satisfy each other and the pressure drop values of 2.61Pa and 0.44Pa are within a close range.



However, both testing methods have altered outcomes in the testing of the shrouded wind turbine. Although the values are altered, they are with range of each other, both methods calculated an increase in pressure drop of 15.7Pa and 5.04Pa. The mathematical analysis suggest that the average velocity almost doubles with the addition of the shroud producing an average velocity of 10.43m/s.



Conclusions

The addition of the shroud benefited the turbine as higher maximum velocities and pressure outputs were generated from both the flow simulation and mathematical analysis testing.

Concluding the shroud has made a positive impact on the wind turbine.

Negative factors of the project Included:

- Lack of knowledge on flow simulation which limited outcome of the simulation.
- The Impact Of COVID-19.
- Unable to access certain apparatus and software in the college due to Level 5 lockdown restrictions.

Sean Carrabine.
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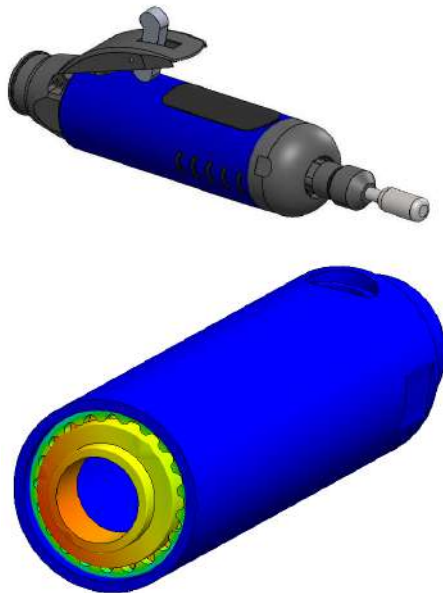
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Vibration Reduction in ATA Air Tools

By: Darren Walls

Introduction

A particular model of pneumatic die grinder from ATA's range is producing undesirable levels of vibration when the tool is being operated. This can affect the fatigue life of the bearings in the tool and can also have negative health effects for the operator of the tool. There is a high risk that continual use of vibrating hand-held power tools may lead to diseases affecting blood vessels, nerves, bones, joints muscles and tissues of the hand and forearm. Such diseases are known as Hand-Arm Vibration Syndrome and Reynaud's disease. There is no cure for these diseases so prevention is essential.



Conclusion

- Frequency simulations carried out using FEA.
- Damper/Bushing re-designed
- Comparative analysis carried out to validate optimal bushing
- New prototype bushing designed, 3D printed and tested in tool.
- Results show 22% reduction in vibration levels



New Prototype Vibration Damper



Objective

The ultimate objective of this project is to reduce the vibration being produced by the tool to improve customer satisfaction and provide a safer, more user-friendly tool for the operator. Having a lower vibration level than competitors tools would be an attractive selling point and should boost sales for the company.

Research

The effectiveness of the current vibration damper/bushing in the tool was analysed using Finite Element Analysis (FEA) and practical vibration testing using a tri-axial accelerometer. ISO Standard 5439-1 sets out the Vibration Total Value (VTV) limit that operators must not be exposed above on a daily basis. This value must be less than 2.5 m/s^2 for hand held equipment.

In order to improve the bushings isolation properties, bushing design and technologies were researched. The theory behind mechanical vibration was also researched under relevant headings including:

- Frequency
- Resonance
- Amplitude

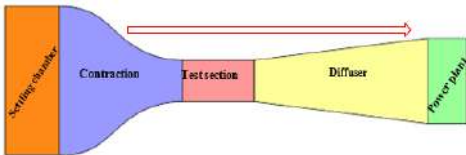
Elastomeric materials used in bushing for vibration isolation were also researched to find the best material suitable for this application.

Optomisation of IT Sligo Wind Tunnel Contraction Cone

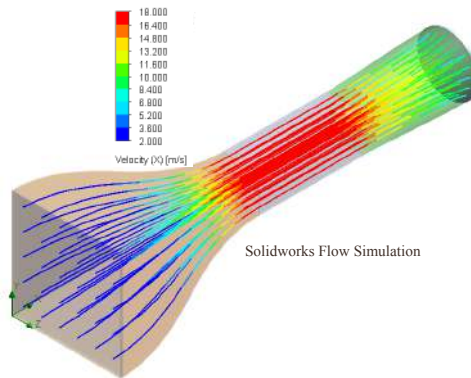
Leslie Jones

Supervisor: Dr Gerard Mc Granaghan

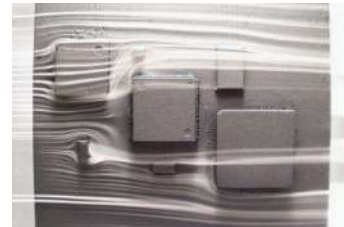
IT Sligo



Commercially available open loop wind tunnel, VDAS AFI450W



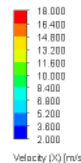
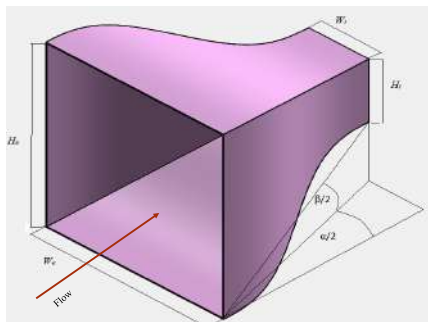
Solidworks Flow Simulation



Multi component PCB cooling study at the GMIT sub-sonic wind tunnel. Smoke streamlines aid in flow visualization.

Introduction

A wind tunnel is essentially a tube through which fluid is made to flow in a controlled manner, allowing the observation of interactions between bodies and such a flow. Well known for their aeronautical provenance, wind tunnels are increasingly employed in other areas such as architecture, sports performance, automotive testing, climatic studies and heat transfer, particularly in relation to electronic circuit cooling. The fluid is blown or drawn through the system, accelerating through the inlet contraction and becoming more uniform before passage through the test section.



Aerofoil section under test in a wind tunnel

Objectives

To design a contraction that will produce high uniformity, low turbulence flow suitable for aerodynamic studies.

The wind tunnel at IT Sligo is suitable for many applications but its contraction component not optimal for producing high uniformity, low turbulence flow. To allow rudimentary aerodynamic studies to be conducted, the contraction must be addressed.

Optimisation

3 new contractions are designed, where the contour is derived from cubic and 5th order polynomials. The experimental contractions are assessed by simulation, and the most effective contraction is developed.

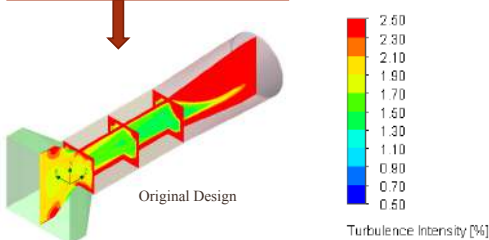
Conclusion

The Morel Cubic contraction out-performed all others in terms of flow uniformity and turbulence reduction. The length was then optimised iteratively

Contraction Cones

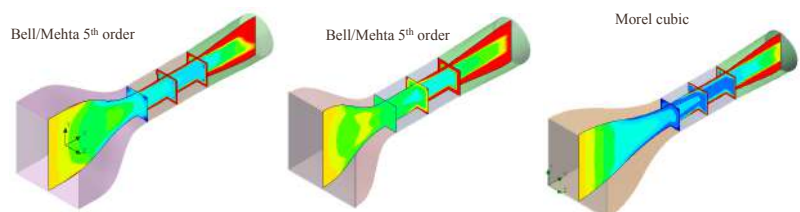
A crucial component common to most wind tunnels is the contraction cone, which, in agreement with conservation of mass, must accelerate the velocity of flow as the cross-sectional area decreases. Other beneficial effects are an increase in flow uniformity and reduction of relative flow turbulence intensity, of critical importance for accurate data from measurement devices. Contraction geometry in large part dictates the quality of flow. The identification of suitable geometry to maximise these effects and minimize losses forms the basis of contraction design.

From This



Original Design

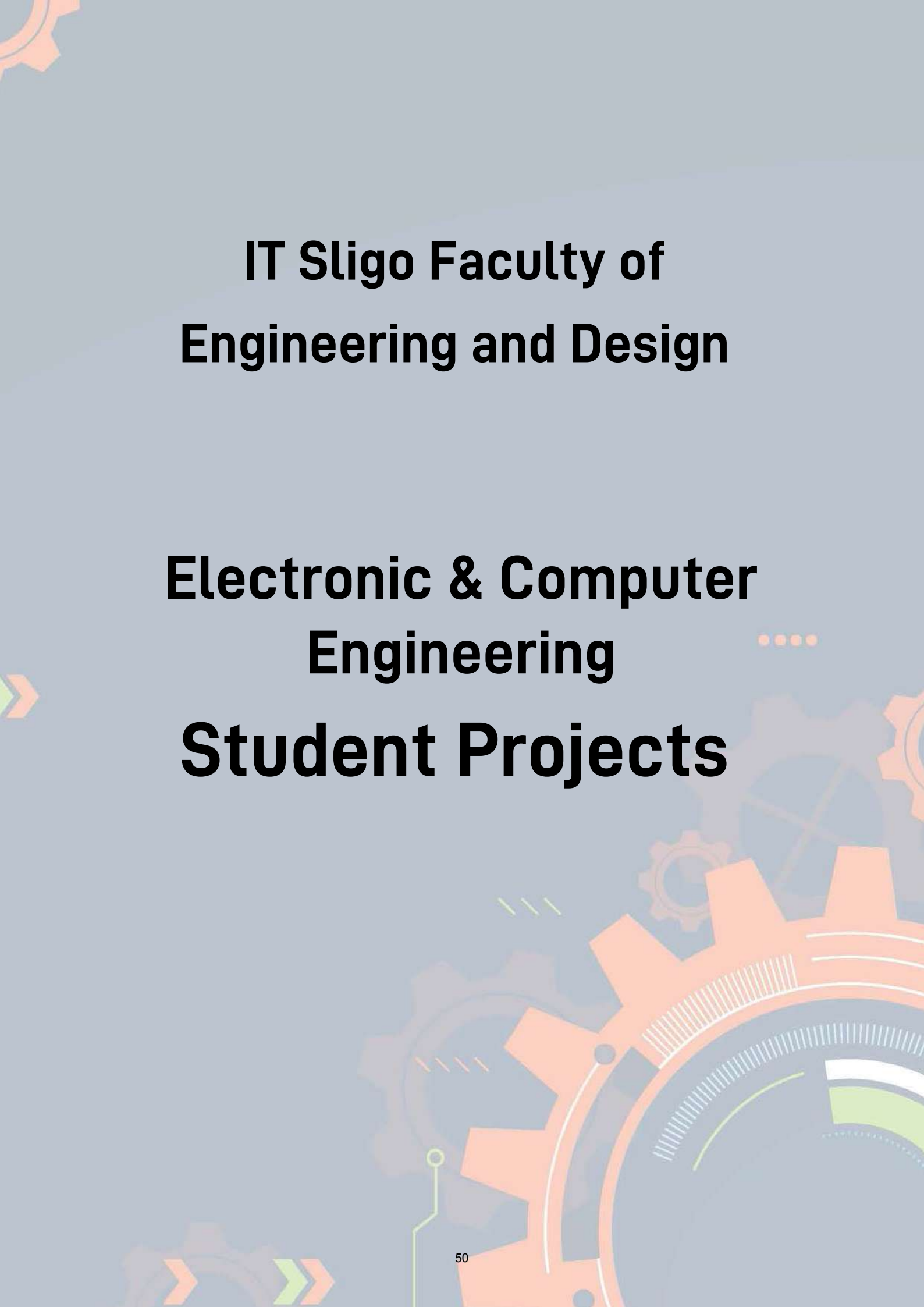
To This



Bell/Mehta 5th order

Bell/Mehta 5th order

Morel cubic



IT Sligo Faculty of Engineering and Design

Electronic & Computer Engineering Student Projects



Introduction

Covid-19 caused a huge increase in online shopping but as it was essential for people to social distance this created a problem for delivery drivers and people receiving deliveries. This project aims to create a safe working environment for delivery drivers while also providing a safe space for deliveries to be temporarily stored. It will also provide an added layer of protection for vulnerable people or the elderly who need to receive deliveries. The device will minimize the spread of the virus by reducing close contacts of delivery drivers who could potentially spread Covid-19 to many households.

Aim of Study

To create a safe temporary storage container that is electronically controlled. This container will be accessible by the delivery driver and the homeowner. I hope to demonstrate the knowledge I have gained during this course in this practical project

Methodology

Research

This project began by researching similar products and examining their features. During this phase any potential improvements on previous designs were documented. Potential electronic components for this device were also researched.

Planning

In this phase, the specific electronic components were selected. The initial concept was developed along with block diagrams. The software that would be used for this project was also decided upon.

Software

This project uses an Arduino to process the inputs and control the outputs. To create the program for the Arduino to function as required, the Arduino IDE software was used. This device can be controllable by a mobile phone application. The software used to create this application was Android Studio.



android studio



Methodology continued

Components



- Arduino Uno
- HC-06 Bluetooth Module
- BYJ28-48 Stepper Motor
- ULN2003 Motor Driver Circuit
- ZFM-708 Fingerprint Sensor
- MB102 Breadboard Power Supply
- 2x Pushbuttons
- IR Sensor
- Buzzer



The App

- The App uses Bluetooth to send signals to the Arduino via the HC06.
- Pressing the OPEN button on the app sends a '1' to the Arduino.
- Pressing the CLOSE button on the app sends a '2' to the Arduino.
- The Arduino can then determine which signal was received and rotate the motor to the appropriate position.
- Pressing the NOTIFY HOMEOWNER button will send a text message from the mobile phone to the homeowners phone number.



Methodology continued

How it works

- The delivery driver has access to the box using the mobile phone application.
- Once the driver arrives, he will connect to the HC06 using Bluetooth.
- The app will allow him to open and close the box and notify the homeowner that a package has arrived.
- ❖ The homeowner will access the box using the fingerprint sensor.
- ❖ Provided the blue pushbutton is pressed and an enrolled fingerprint is placed on the fingerprint sensor the box will open.
- ❖ The homeowner will close the box using the red pushbutton.
- ❑ There is a locking sensor on the box to ensure the box is correctly locked.
- ❑ If the sensor detects the box is secure the buzzer will sound two short beeps to notify the user, the box is secure.
- ❑ If this locking sensor detects that the box is not secure the buzzer will sound a long beep to notify the user, the box is not secure.
- A beam of infrared light is used as the locking sensor.
- If the beam is broken by the latch that means the box is secure.
- If the beam is not broken the box is not secure.

Results and Conclusions

- Overall the project was a success.
- The device works as intended and can provide a safe space for deliveries to be temporarily stored.
- It also isolates the delivery driver from the people receiving deliveries reducing the spread of Covid-19.
- The device minimises the possibility of spreading Covid-19 by utilising two methods of gaining access to the box.
- This project provided an opportunity to showcase the practical skills and knowledge I have gained from my studies at IT Sligo.

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Legionella Management System

Introduction

Water is not a sterile environment. The motivation behind this project is a bacteria that existed for quite a while without been detected, and to this day human diseases are not always associated with it, although it is responsible for them. The existence of legionellosis or legionnaires' disease bacteria was not discovered until 1976. The bacteria become extremely dangerous when it starts to grow in facilities around the country especially those services where the water is being used by humans. Legionella grows best at 20–50 ° C.



Project overview

To prevent the growth and spread of Legionella bacteria, the finished product is designed to monitor, check conditions and communicate so that the user can remotely prevent stagnation. It will detect favorable conditions for legionella. By using an IoT system, the device owner can check the temperatures, access the history, and allow the system to be flushed. This project would be an upgrade to evolving anyone's system, to facility management.



safety design



product that monitors the correct water temperature in plumbing installations



self-powered, long live without maintenance



small design and easy to install



remote reading and control



coverage with minimal fees

Building and testing



The project was challenging yet extremely rewarding. It gave me the opportunity to solve issues and adapt my course skills to a real-world problem. I had to check and search for programming errors, possibilities not previously taken into account. Select and combine electronic and mechanical components in a real environment.

AUTOMATIC H₂O LEVEL CONTROLLER

Introduction:



An important element in the world of aquarium hobby is water change. However, it is a tedious job and as we know, water and electricity do not go hand in hand.

Aim of the study:

The aim of this study is to show the acquired skills during the years of study to create a fully automated system that does not require the input of third parties.

Methodology:

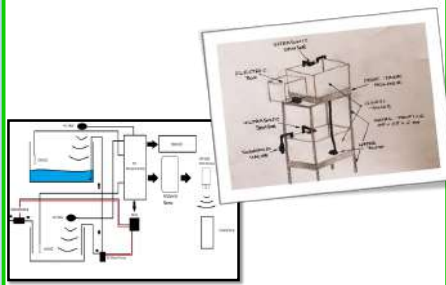
The research began by observing a large freshwater aquarium. How tiring and dangerous a weekly water change can be when the water can spill out, potentially posing an electric shock hazard.

The idea was developed and then divided into three stages:

1. Design stage

Raw design sketch of project including the basic elements:

- metal frame
- glass water tanks
- wooden bases
- Electric box



Methodology(Continued):

2. Fabrication stage

- Welding and painting of metal profiles
- Gluing aquariums
- gluing mdf boards for the bases
- Electric box installation and PCB board soldering



3. Programming stage

with the use of MPLAB X IDE. Distance measured by Ultrasonic sensor converted to a water percentage in tank and adc value converted to temperature displayed on 20x4 LCD.



Results:

Prior testing of this project the biggest concern was the PIC's software design to allow device multitasking and also project hardware for user monitoring.

Results(Continued):

After software and hardware testing **Automatic water level controller** is monitoring level as well as temperature in both tanks and display results on LCD.

The device does not need third parties to change the water, because it is independent and will replace it if the water level drops.

In addition, the user has the option of automatic water change with a press of a button.

Conclusion:

The main goal of this project was to automate the process of changing the water in the aquarium to make it safer and more convenient for the user by displaying the level and temperature of the water in the tanks.

The concept of **Automatic water level controller** can be used not only in aquariums, because it has a wide range of applications in monitoring the level and temperature of liquids in all kinds of tanks.

The goal of the project has been achieved and can therefore be considered successful..

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Smart Warehousing Incorporating a Digital Twin

INTRODUCTION

Technology is advancing at record rates allowing ever-expanding areas of application. Warehousing is an industry where the potential for advancement and improvement through the implementation of technology is immense. Smart warehousing involves the use of autonomous robots, cloud computing, augmented reality, simulation, big data and analytics, industrial internet of things, system integration and additive manufacturing.

OBJECTIVES

To design an inventory management system

To design an automated warehouse using an automated guide vehicle to pick and deliver boxes

To develop and utilise a digital twin to assist in system integration

METHODS

Research:

Researched traditional and smart warehouses to identify key components. Determined essential elements would be

- Automated Guide Vehicle with robotic arm
- Line Follower
- Barcode Recognition
- Cloud based Inventory Management System
- Digital Twin

Design/Planning:

The design process involved:

- Identifying best components
- Developed timeline
- Identified key milestone
- Acquired appropriate materials
- Model design in solid works

Programming:

Programmed the following:

- Line Detector to follow appropriate path
- Ultrasonic sensor to detect obstacles
- Servo motors to pick and hold boxes
- Direct current motors to propel the AGV
- Digital twin to follow line



Fabrication:

Used an Annet A8 3D printer to fabricate boxes, shelving and cylinders to replicate warehouse products.

Safety:

Safety was paramount in the design of the project. If the AGV encounters an obstacle in its' path it comes to an emergency stop.

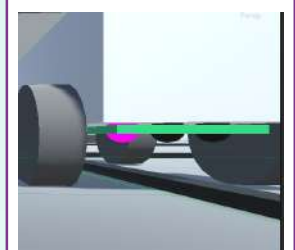
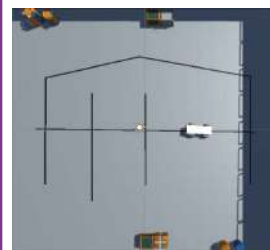
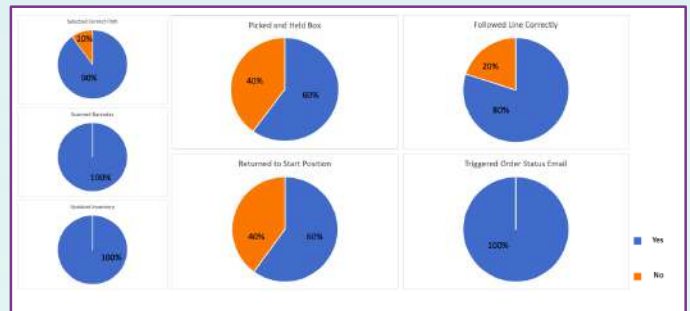
Evaluation:

Warehouse product picking and drop-off was simulated 10 times to evaluate performance at each key step in process.

RESULTS

AGV successfully:

- Follows line
- Detects obstacles
- Recognizes barcodes
- Routes to the appropriate location for each specific product
- Picks and holds product
- Transports product to drop-off point and drops product
- Updates inventory
- Triggers order status email



Digital Twin

- Full simulation of warehouse layout and design
- Replicates warehouse environment
- Maps out possible AGV paths
- AGV successfully follows line

CONCLUSION & FUTURE STUDIES

- ❑ AGV successfully navigates environment in modelled warehouse. It is capable of picking, transporting and dropping product at appropriate locations.
- ❑ AGV interfaces with the cloud in order to update inventory and trigger order update emails.
- ❑ Digital twin models warehouse environment and AGV successfully follows the line to navigate the simulated warehouse.
- ❑ Future studies would continue to develop the digital twin to allow for advanced modelling of all smart warehouse components. This would facilitate greater reliance upon the digital twin in warehouse procedure development.

ACKNOWLEDGEMENTS

I would like to thank my project supervisor Eva Murphy for all her time, advise and support over the duration of this project.



Introduction:

Noise cancellation is a big field in signal processing. Nowadays the average user can experience noise cancellation through active noise cancelling headphones and earbuds. However the entry price to this technology is too high for a lot of people.

The project being presented is an android application that gives the user a similar experience to what mainstream noise cancelling headphones offer. The app software will cancel background noise just like a conventional noise cancelling headphone.

Aim of project:

The project aims to offer the user a similar experience to what mainstream noise cancelling headphones offer. The user would only need a pair of wired headphones/headsets.

Methodology:

Research:

My initial research began in google scholar. I needed to understand how noise cancellation is performed and what would be the requirements to do so. Using google scholar meant that all of the information I would find would be published documents. However, when I reached the development stage of my project which is mostly programming due to the nature of my project, I started researching in google. The app set up instructions were found in the android studio website.

Design/Planning:

The design process involved:

- Selecting a noise cancelling algorithm.
- Testing the noise cancelling algorithm using a premade noise signal in python
- Develop a schedule to code the application.

Application development and noise cancellation:

The noise cancellation process is:

- Taking a noise input from the microphone.
- Process the signal using adaptive filters and a noise cancelling algorithm.
- Output the noise cancelling signal to the connected headphones/headsets.
- Display the input, output, and error values to the user.

Testing:

- Test the noise cancelling performance by plugging in headphones and having an air conditioner working in the background.
- Display the signal values to the screen and see how the application behaves.
- Test the compatibility of the application by installing it in different android phones. The phones tested are:
A phone running the latest version of android at the time (android 11).
A midrange old Samsung phone running android 8.0.

Results:

Application development and noise cancellation:

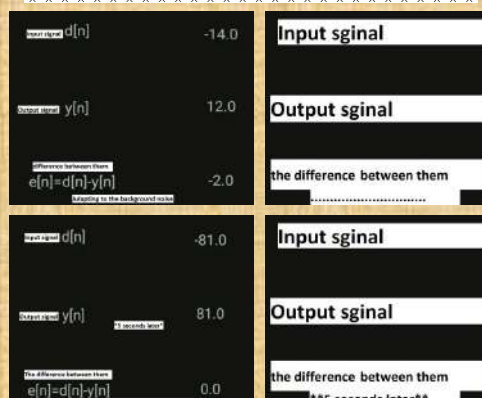
- The application takes a noise input from the microphone and processes the signal using adaptive filters and a noise cancelling algorithm. Then it outputs the anti-noise signal to the connected headphones/headsets. The app displays the input, output, and error values to user.

Testing:

- Unfortunately, the noise cancelling performance is not good. The user would not have an experience similar to what is offered in mainstream ANC headphones. This is mainly due to only having one microphone which is placed far from the user's ears.
- As for the values displayed to the user, the numbers confirm that the noise cancelling algorithm is working, and the adaptive filter works well. The app takes about 5 seconds to reduce the error signal to almost zero.
- The application works well in both of the phones which were tested.

Conclusion:

In conclusion, the app does work in the sense that it picks up noise from the microphone, processes the noise signal using adaptive filters and a noise cancelling algorithm, and outputs the anti-noise signal to the headphones/headsets. The values displayed to the user show the adaptive filter working and noise reducing over time. However, the app does not give the user the experience promised due to only being limited to one microphone which is far from the user's ears resulting in an error in the input frequency.



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Introduction:

The Purpose of the Seated Posture Aid is to mediate back pain caused by prolonged sitting in incorrect posture.

Posture is the position in which we hold our body.

We as humans tend to adapt a hunched back when working at a computer and we rarely sit in an up right position, even with the best intentions.

The Seated Posture Aid will inform the user when they leave a straight-back position to allow the user to rectify a damaging posture. With many people working from home due to the current pandemic, without their usual ergonomic chairs, the importance of practicing good posture is even more essential.

Effects of **Poor** Posture:

- Soreness & Pain.
- Poor Circulation.
- Stress.
- Digestive Issues.

Effects of **Good** Posture:

- Reduces abnormal wearing of joints.
- Protects muscular & skeletal systems
- Decreased stress on spine
- Prevents fatigue



Aim:



Methodology:

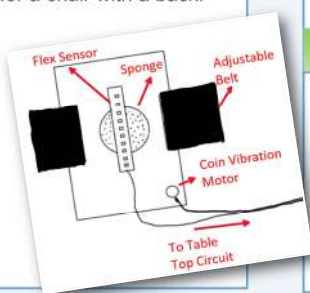
Research:

There are several ergonomic aid projects for posture monitoring and/or correction. However there is a gap for a portable low cost device that can be used by multiple users. Devices currently in market must be worn by the user.

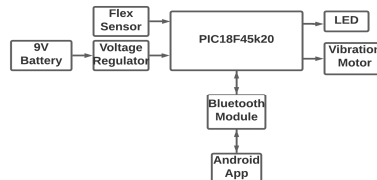
Design/Planning:

The design was influenced by the gap found in the research study. The Posture Aid is an attachable device for a chair with a back.

- Adjustable Belt (Different chairs)
- Flex Sensor (Position change)
- Sponge (Compression)
- Vibration Motor (Tactile Alert)



Methodology:



Inputs:

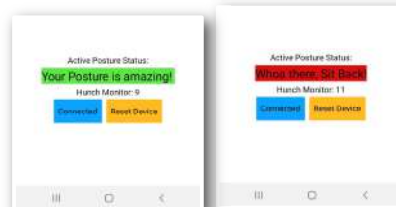
- The Flex Sensor is used to read the change of resistance from back compression.
- The 9V battery is inputted to the voltage regulator to stepdown the voltage to 3.3V to power the PIC18F45k20.

Outputs:

- LEDs are a visual representation. One LED shows if you are no longer compressing the flex sensor. "OFF" - flex sensor is compressed, "ON" - flex sensor is not compressed. Second LED shows if Bluetooth is connected.
- Vibration Motor is used to alert the user by small vibration that they are no longer compressing the flex sensor.

Bi-directional:

- Bluetooth Module is used to communicate between the PIC18F45k20 and an Android App. This allows the user to reset their configured upright position and receive notifications when they are no longer in the upright position.



Control:

- The Seated Posture Aid is controlled with the PIC18F45k20 MCU.
- The ADC module reads in the change of voltage caused by the flex sensor.
- The PWM module controls the speed of which the vibration motor operates at.
- The EUSART module controls the transmit and receive between the Android App and the Seated Posture Aid.
- The General I/O module will control the turning on and off of the LEDs.

Results:

The Seated Posture Aid resulted in the following:

- Accurately determine when the upper back left the back of the chair.
- The vibration motor alerted the user when the back was no longer in an upright position.

Results:

- The Mobile App was notified when the flex sensor was no longer compressed.
- The Mobile App successfully allowed user to reconfigure their straight-back position.
- The adjustable belt allowed for the device to be used on different chairs.



Conclusions:

This project was a great opportunity to explore many aspects within research, project design, development and quality assurance testing.

- The Seated Posture Aid alerts the user through the App that they are no longer sitting with their back to the backrest of the chair through tactile and visual aids.
- It also uses an already accessible device most of us have and use regularly, a smartphone.
- The Seated Posture Aid can be adjusted to any chair with a backrest. This versatility will help introduce ergonomic safety at a low cost.

Future Work:

For future development of the Seated Posture Aid I would like to explore the following:

- Creating PCB to integrate the circuitry into the belt itself, making it a fully wireless device.
- Use Firebase in conjunction with the App to retain statistics for the user to analyse.
- Research a more sustainable backing for the flex sensor.



Seated Posture Aid
Keeping your back safe!

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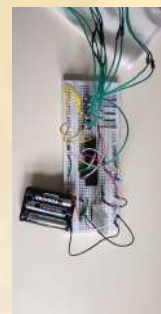


INTRODUCTION

- Given the current climate with the COVID-19 pandemic, I chose this project to help reduce the amount of healthcare workers that catch COVID. I wanted to design a robotic hand so that the healthcare worker can perform the test from a safer distance of two metres from the patient.
- The user wears a glove containing flex sensors that is connected to a PIC. The PIC then processes and sends the information through a Bluetooth communication to the Arduino to bend the corresponding finger(s) of the robotic hand, mimicking the movements of the user's hand.

METHODOLOGY:

- Flex Sensors:**
 - Five flex sensors are used in a glove to measure the bend of each of the users fingers in order for the robotic hand to mimic it
- PIC Microcontroller:**
 - A PIC18F45K20 is used to take in the change of resistance from the flex sensors, perform an Analog-to-Digital conversion and convert it to a character to be sent via Bluetooth.
- Bluetooth Modules:**
 - There are two Bluetooth modules used, a HC05 to transmit data from the glove (PIC); and a HC06 to receive the data to the robotic hand (Arduino).
- Arduino UNO:**
 - An Arduino is used to take in the data from the glove and use it to control the servos in the robotic hand.



ROBOT MIMICKING
HAND MOVEMENT

RESULTS & CONCLUSIONS:

- The robotic hand cannot perform a COVID test as it does not have the required wrist movement that is necessary in gripping and manoeuvring a cotton swab.
- The flex sensors give an accurate representation of how the fingers move and bend and work. The flex sensors are a great size to fit the average sized finger and are sensitive enough to pick up on even a slight bend.
- Bluetooth communication is ideal for an application such as this. Bluetooth is designed for communicating in shorter distances of less than 10 metres which is more than enough as the user will need to see what they are doing.



Home Security System



Introduction

In a world of uncertainty and distrust, people are going to feel uncomfortable leaving their homes unprotected. This project was selected because I sometimes find myself not at ease in late nights, where anybody can walk through the door that you wouldn't recognise.

Aims of Study

To demonstrate the theoretical knowledge gained over the course of our study in a practical, real world application.

This project is dedicated to demonstrating the functionality of a password-protected home alarm system that can alert you on your own phone.

Hardware

The entire system itself will be controlled by an Arduino Uno microcontroller board.



The alarm of the system will be triggered by a passive infrared motion sensor, or PIR sensor for short.



The alarm will be password protected, so you'll need a keypad to input the code. We will be using a 3x4 membrane keypad.



A 16x4 LCD Monitor with a I2C interface will be used to show the status of the system in your own home and see the inputs you make.



To further ensure the sensor's functionality, you may be required to check the sensor via Bluetooth on your phone. Hence, why I included a HC-06 Bluetooth module.

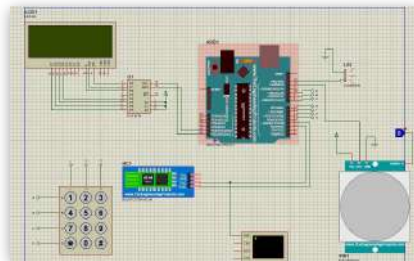


When necessary, after a period of time while the sensor is detecting movement, it will trigger a buzzer sound, solidifying that there is an intruder in your home. A Piezo buzzer is used.



Methodology (cont.)

A schematic for the entire project can be seen below.



Imagine the component PCF8574 in the place of the I2C interface, since Proteus didn't have that exact component in library. The I2C simplifies the LCD connections from several small ports to four. (VCC, GND, SDA & SCL).

Software

Arduino Uno:

I had to rely on using Arduino software to write up the program used for the system. It involved downloading a few libraries that some of the components needed to operate.

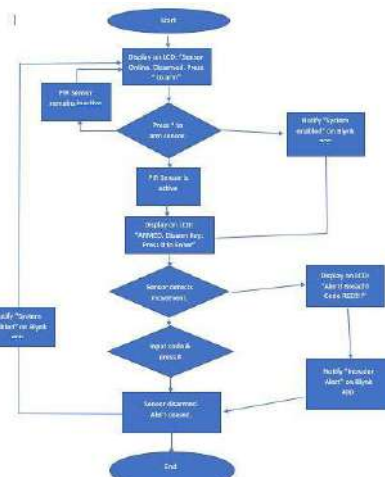
Arduino Bluetooth Terminal (ArduTooth):

An app that connects to the HC-06 via Bluetooth and reads what the serial monitor is transmitting and see if the sensor is still detecting anything.

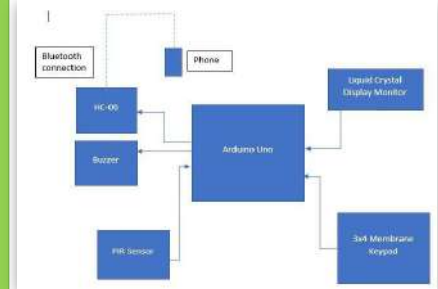
Blynk:

An app that can allow you to simulate Arduino systems and link them to your phone. I used it to as a way to receive notifications that my system was either armed or disarmed or if my sensor detected movement.

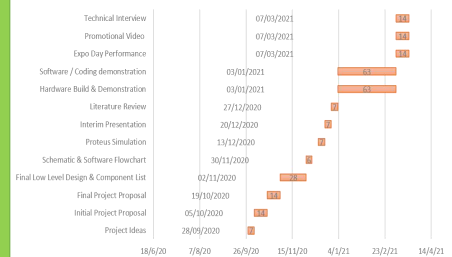
This software flowchart was made to demonstrate the order of programming.



Design / Planning



Block Diagram of the Security System.



Gantt Chart of Project Planning and Construction.

Results

The project was a remarkable success.



However there were some slight complications.

- The system had a harder time deactivating after the alarm was triggered.
- The sensor's range being too far, making it mistake surfaces for threats.
- The connection between the Blynk app and the system requires a Windows batch file being run on the laptop/PC it is connected to.

Conclusions

This project was an opportunity to test my focus and planning skills.

It was difficult keeping on task with it, mostly because I was anxious and bored, I couldn't bring myself to do it until later. This, in turn, tested my skills of time management. Trying to plan out what I was going to do next. I was also tested on my problem solving skills when getting around issues. I face a variety of problems but eventually solved them.

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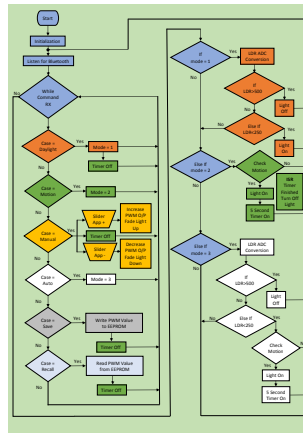


Introduction

AmbiLight is an Intelligent Lighting Controller, this is a device that receives control information from a number of inputs and then adjusts light levels based on the information received.

The project will allow an Android device interface with the lighting controller using Bluetooth. A number of modes of operation will be available for selection from the device, each utilising a different energy saving control strategy.

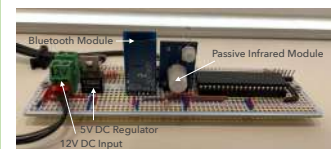
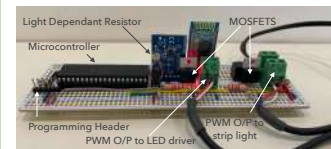
The ability to control the quantity and quality of light within a space can conserve energy, enhance the visual appearance, and facilitate specific tasks. Wireless control may also be beneficial to people with mobility issues.



Software Flowchart



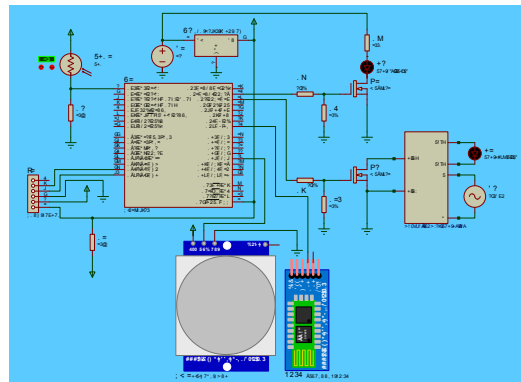
LED Strip Light



Lighting Controller PCB



Android Application



Circuit Diagram

Methodology

Research: Investigate efficient lighting control methods that would effectively optimise energy utilisation.

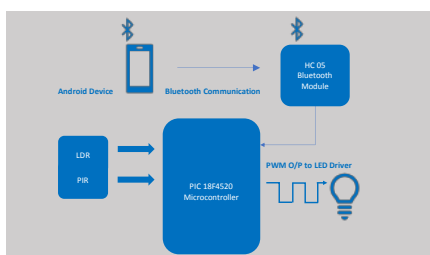
Design/Build:

1. Develop C code for a PIC microcontroller utilising MPLABX IDE.
2. Simulate operation of hardware and software utilising Proteus 8.
3. Develop Android mobile application utilising MIT App Inventor.
4. Build prototype and debug hardware and software.

Results/Conclusions

1. Microcontroller based lighting controller with Android App interface. Several modes of operation available from the user interface - light level dimming, occupancy detection, and light level dependant switching available.
2. Software simulation confirmed circuitry operated as intended and allowed initial testing and development of C code.
3. Hardware Testing included operation of sensors, PWM dimming and communication with an Android device using EUSART communication.
4. Development of additional features including second dimming channel and the ability to save preset levels to EEPROM from the user interface.

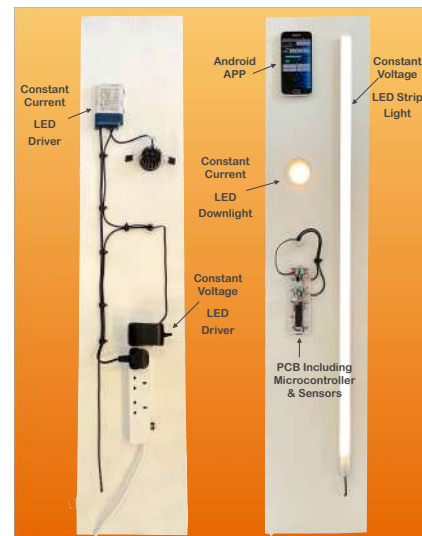
The project allowed the knowledge gained on the course to be applied in a practical application. I found the project was an excellent way to further develop my skills and I believe the objective to build a lighting controller was successful.



High Level Design



Hardware Build in Progress



Final Hardware Build

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Introduction

Covid-19 caused a huge increase in online shopping but as it was essential for people to social distance this created a problem for delivery drivers and people receiving deliveries. This project aims to create a safe working environment for delivery drivers while also providing a safe space for deliveries to be temporarily stored. It will also provide an added layer of protection for vulnerable people or the elderly who need to receive deliveries. The device will minimize the spread of the virus by reducing close contacts of delivery drivers who could potentially spread Covid-19 to many households.

Aim of Study

To create a safe temporary storage container that is electronically controlled. This container will be accessible by the delivery driver and the homeowner. I hope to demonstrate the knowledge I have gained during this course in this practical project

Methodology

Research

This project began by researching similar products and examining their features. During this phase any potential improvements on previous designs were documented. Potential electronic components for this device were also researched.

Planning

In this phase, the specific electronic components were selected. The initial concept was developed along with block diagrams. The software that would be used for this project was also decided upon.

Software

This project uses an Arduino to process the inputs and control the outputs. To create the program for the Arduino to function as required, the Arduino IDE software was used. This device can be controllable by a mobile phone application. The software used to create this application was Android Studio.



android studio



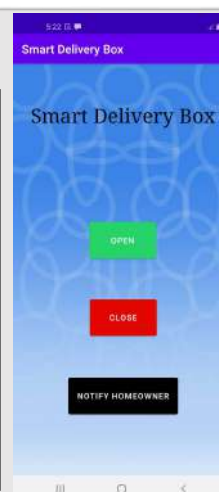
Methodology continued

Components



The App

- The App uses Bluetooth to send signals to the Arduino via the HC06.
- Pressing the OPEN button on the app sends a '1' to the Arduino.
- Pressing the CLOSE button on the app sends a '2' to the Arduino.
- The Arduino can then determine which signal was received and rotate the motor to the appropriate position.
- Pressing the NOTIFY HOMEOWNER button will send a text message from the mobile phone to the homeowners phone number.



Methodology continued

How it works

- The delivery driver has access to the box using the mobile phone application.
- Once the driver arrives, he will connect to the HC06 using Bluetooth.
- The app will allow him to open and close the box and notify the homeowner that a package has arrived.
- ❖ The homeowner will access the box using the fingerprint sensor.
- ❖ Provided the blue pushbutton is pressed and an enrolled fingerprint is placed on the fingerprint sensor the box will open.
- ❖ The homeowner will close the box using the red pushbutton.
- ❑ There is a locking sensor on the box to ensure the box is correctly locked.
- ❑ If the sensor detects the box is secure the buzzer will sound two short beeps to notify the user, the box is secure.
- ❑ If this locking sensor detects that the box is not secure the buzzer will sound a long beep to notify the user, the box is not secure.
- A beam of infrared light is used as the locking sensor.
- If the beam is broken by the latch that means the box is secure.
- If the beam is not broken the box is not secure.

Results and Conclusions

- Overall the project was a success.
- The device works as intended and can provide a safe space for deliveries to be temporarily stored.
- It also isolates the delivery driver from the people receiving deliveries reducing the spread of Covid-19.
- The device minimises the possibility of spreading Covid-19 by utilising two methods of gaining access to the box.
- This project provided an opportunity to showcase the practical skills and knowledge I have gained from my studies at IT Sligo.

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SMART DELIVERY BOX

Verilog HDL of Kangaroo by Atari

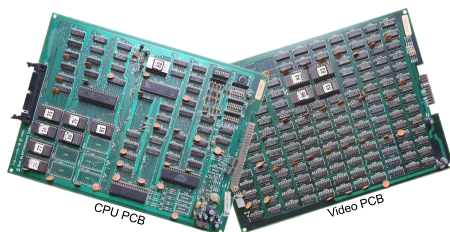


Jonathon McEllin

Introduction

Pre-2000s arcade gaming cabinets now range from 20 to 50 years old and as is the case with any hardware, there will come a point in time where they will inevitably fail. With some manufacturers having ceased operations and others having progressed their product portfolios, a natural and expected drop in support for obsolete hardware has occurred. This has created the very real risk of these games and their technological historical significance being lost forever.

This project aimed to take an original arcade game, in this case, "Kangaroo" by Atari, Inc., and research potential techniques that utilise today's technology which will best document and represent the game system hardware while maintaining the highest possible level of original system functionality.



Research

In the course of researching this project, several methods of preservation were explored, each resulting in varying degrees of representation and compromise.

They included;

- Schematic Capture and SPICE Modelling
- Software Emulation methods
- Hardware Emulation utilising a Field Programmable Gate Array

Hardware Emulation

Hardware emulation utilising an FPGA was selected for this project, for the following two reasons;

1. The use of a structural implemented Hardware Descriptor Language offered self-documentation of the system at its gate level while presenting the opportunity to capture any potential quirks/bugs in the original hardware.
2. Synthesising the resultant HDL and placing it on to an FPGA offered the opportunity of User playability.

Methodology

Hardware being Represented

The arcade system for Atari's Kangaroo comprises of two Printed Circuit Boards, the CPU PCB and the Video PCB. It totals 192 individual Integrated Circuit components from 29 different IC families.

Verilog Representation

In order to leverage the self-documenting nature of the HDL and support future works, the Verilog was implemented using a four-level hierarchy that comprised of the Top Level (Overall Hardware), Level 1 (PCBs), Level 2 (as per the schematic documentation i.e., sheet 5A, etc.) and Level 3 (Components).

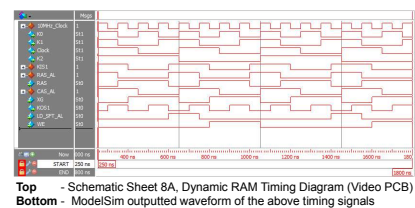
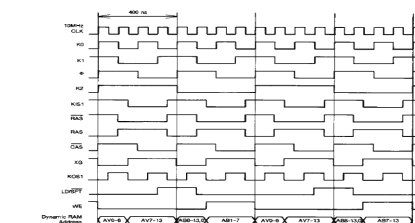
While the majority of the components were implemented using structural Verilog, in order to reduce development time, some modules utilised Intel specific primitives i.e. D-Type Flip Flops, T-Type Flip Flops, etc. Also, for components like the Z-80 Microprocessor, cores were sourced.

Simulation

For each component module implemented, a test bench was written to verify compliance with the appropriate datasheets defined functionality.

Results

Simulation



FPGA Implementation

When preparing to synthesise the HDL for use on an FPGA, a couple of issues became apparent.

These issues revolved around the representing of this particular system for use on an FPGA and comprised of; the difficulty of ensuring timing closure when attempting to implement Asynchronous Memory and the inability of FPGAs to internally implement

Results (continued)

Tri-State Signals. As a result, it was not viable to proceed with the FPGA implementation.

Comparing with MAME

With an accurate HDL representation of the system, the opportunity to compare with a known emulated version, namely MAME's emulation of Kangaroo, arose.



MAME's Emulation



ModelSim's signal output converted with Python

When comparing the two outputs above, a number of observations can be made. The most obvious are, MAME's introduction of horizontal blank lines into the playfield and its incorrect colouring of the monkey. MAME also renders the image at 512x240 deviating from the original hardware's 256x240.

Conclusions

This project set out to accurately preserve a piece of arcade history while offering the opportunity for a user to experience the game.

Yielding an accurate representation of the system hardware, the project unexpectedly demonstrated that while FPGAs are highly flexible, they still have their limitations.

Comparing the HDL output to that of MAME, it reinforced the reasoning for not originally selecting a software emulation. Although, utilising the HDL representation, the opportunity now exists to correct deviations identified in the emulated version.

Contact Information

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Additional Information

Project GIT Repository:

https://github.com/mcellin/kangaroo_hdl

Verilog HDL vs MAME Comparison Video:

https://www.youtube.com/watch?v=xckg_KCCJVI



Helpful Hint!

How to use a QR code:

1. Open your device's Camera App.
2. Hold your device so that the camera can see the QR code.
3. Click on the notification that appears.

If viewing this through digital media, each address contains the appropriate hyperlink.



Introduction

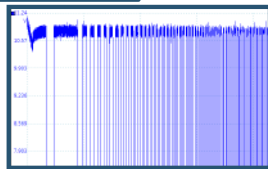
New temperature control systems in the transport sector incorporate high efficiency fan motors as a solution towards fuel consumption and maintenance costs.

This design is an upgrade of an existing fan motor test rig fixture which will provide more accurate data, resulting in better problem diagnosis and improved product development.

Methodology & Approach

Problem Statement

The initial idea was driven by the need to improve the existing fan motor test fixture. While the motor was supplied with 48V DC, the speed of the fan was regulated using external 12V power supply. However, the fan's actual speed was never monitored nor measured.



Original design issues

Research

Initially, various signals of the existing fixture were scoped and analysed to understand the level of susceptibility to external interferences. The outcome of these provided guidance to research and study the precision instrumentation, analogue/digital information processing, the Fourier analysis and communication protocol implementation techniques and designs.

Requirements

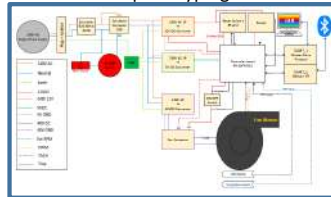
An understanding of the complex fan motor systems, completion of the research required and the compilation of a list of requirements for the final design. In addition:

- the ability to read TACH provided by the motors instrumentation
- the ability to compare TACH with external RPM sensor readings
- the ability to request speeds using precisely defined impulses
- the monitoring of temperatures on inlet/outlet of the fan and within the control's module
- manual test and calibration
- professional user interface
- the design of robust communication protocols and attributes
- recording data traces for post analysis and post processing.

Methodology & Approach continued...

Hardware Design

The design began with the high-level map identifying safety measures and the bulk components required. Then the design focused on selection of electronic components and prototyping based on a block-by-block basis, both in Proteus program and on the first version of hand-soldered prototyping board.



Hardware high-level map



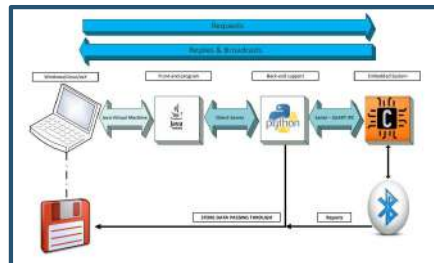
Prototype board – rev_1

Software Design

Similarly, the design began with a high level map assessing the required programming languages, defining each of the control flows and design and standardization of the communication protocols. The complex code included debug mode, comprehensive test cases and the platform independent ability of its execution (Linux, Pinux, osX and Windows). The software was revision controlled and documented for traceability purposes. Programming languages decided on were Java, JavaFx, Python, C and Maven.



Inter-Process communication protocol across platforms



Data processing and communication flow

Health and Safety Requirements:

The plan, concept and high level maps were shared with an external company for review. Additional list of safety requirements were implemented following which the fixture went through CE marking process. With external safety measures in place, the fixture qualifies and complies with EN13849 requirements.

Results

Planning and Design

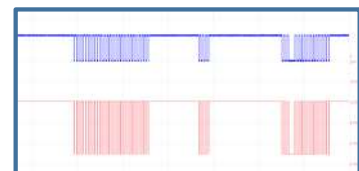
The final design was reviewed against the project needs and was shown to fulfil the requirements for the fixture.



Final design

The microcontroller accurately responds to the external signal impulses, communication requests and reports back to the front end application.

The undesirable frequency components disharmonizing the integrity of the intended signal are removed, leaving razor-clean signals for analysis.



Signal intended for analysis

The comprehensive user interface provides information of the current state and stores data for post processing.



HMI user interface



ICD 3 – Program loading compatibility

Conclusions

The design was validated with external measuring equipment and proven to work as per requirements. The fixture now provides a comprehensive set of readings which is a very valuable edition to previous fan design. This will prove to be an invaluable resource for rapid fan testing and fault diagnosis, which will lead to better product at lower cost.

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Object Detection for Road Safety



INTRODUCTION

Over 140 people lose their lives on the Irish roads every year. Constantly increasing number of vehicles on the roads results in higher number fatalities. The most common problem when it comes to road safety and the single biggest factor contributing to deaths on the roads is speeding. Over 40% of fatal collisions are caused by excessive speed. One of the preventive measures to that problem are Speed Cameras deployed on the most dangerous sections of the roads where the highest number of collisions are reported.

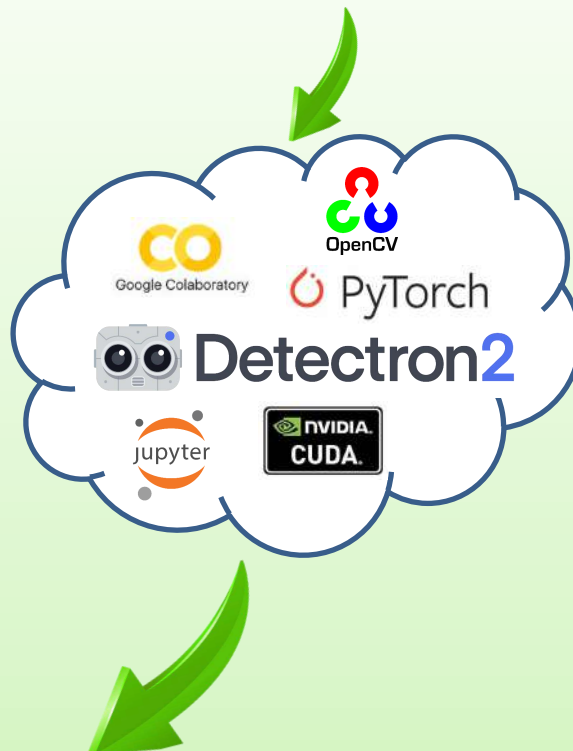


DATASET

- First step was to create custom dataset.
- For this project 86 images of Speed Camera Signs were collected with 103 different instances.
- Each instance was annotated and new detection class was created.
- Augmentation techniques were used to double the size of the set.
- Annotated images were converted to COCO format dataset.

METHODOLOGY

In this project, I will try to implement a Convolutional Neural Network based on Detectron2 framework to detect warning signs and warn the driver about the danger. Custom training COCO dataset was prepared. Using transferred learning method, new model was trained to detect Speed Camera Signs. Model was trained and verified using Detectron2 running on Google Colaboratory. Once Speed Camera Sign or Speed Camera Van are detected, warning message appears on the screen with warning signal to inform the driver about the danger.



TRAINING

- Model was trained on Detectron2 run on the Google Colaboratory.
- Faster R-CNN was used initialized from backbone Model Zoo.
- Colaboratory provided access to fast Nvidia chip GPU's which together with custom configuration settings enabled quick and efficient training with satisfying detection results.

CONCLUSION

Object detection is a technology commonly used nowadays in automotive industry. Project proved that this method can be used to detect and warn the driver about the most dangerous sections of the road by detecting Speed Cameras.

CONTACT

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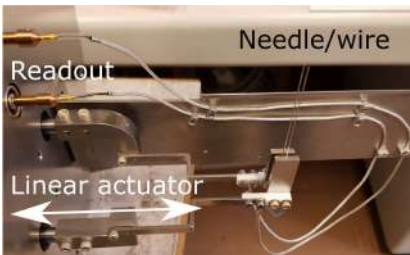


Beam Scanner Expert Tool



INTRODUCTION

The Beam Instrumentation group at the European Organization for Nuclear Research (CERN) is in charge of measuring key parameters of the multiple particle beams in its accelerator complex. One family of instruments developed and maintained is the beam wire scanners, which read out the electrical charge deposited on a wire when it intersects the beam.



Example of a dual-needle scanner

To build and maintain these scanners, it is necessary to move their linear actuators (driven by stepper motors) in the workshops and laboratories. Currently, this needs special equipment and dedicated expert software. With this tool, anybody can operate the scanners, saving time and resources.

AIMS OF STUDY

- To design and build a portable device that can drive the stepper motors linked to the linear actuators of the scanners.
- An Android application to set parameters using a mobile phone.

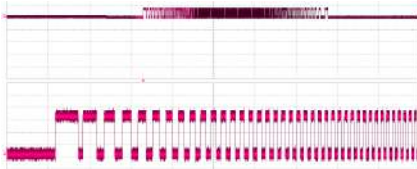
METHODOLOGY

Research:

The first stage was investigating commercial integrated circuits for stepper motor drivers and battery management. These are the basis for the project:

- Common stepper motor driver on standard PCB modules.
- Battery charger with power path selection.
- Voltage boost converter for high-current 24V supply.
- Bluetooth to serial adapter for easy interface.

The next stage was researching published works for methods of calculating smooth acceleration of stepper motors. An algorithm was found and adapted to work with the available resources on the PIC microcontroller.



Pulse timing generation for smooth acceleration

METHODOLOGY

Design and planning:

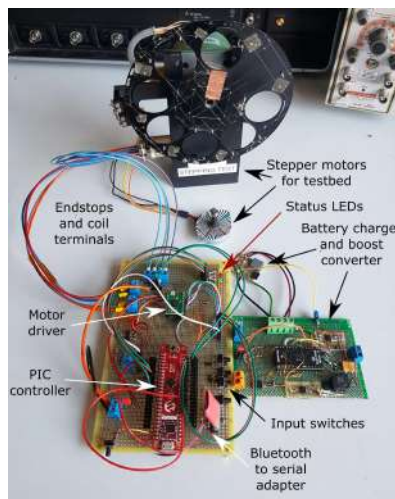
The project was split into three main parts: hardware, microcontroller firmware and Android application. These parts were developed in parallel as changes to one usually impact the rest.

Build/Fabrication:

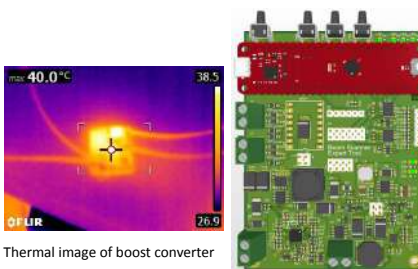
A hand-made prototype was built to test different parts of the project:

- A battery/power path board.
- A boost converted board.
- A microcontroller and stepper motor driver board.

After the first prototype was validated, a printed circuit board was designed that incorporates the previous boards. Both the board and its schematics were designed in Altium.

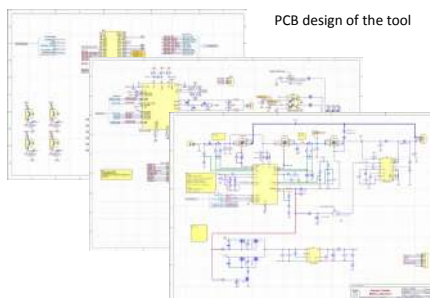


Annotated development set-up



Thermal image of boost converter

PCB design of the tool



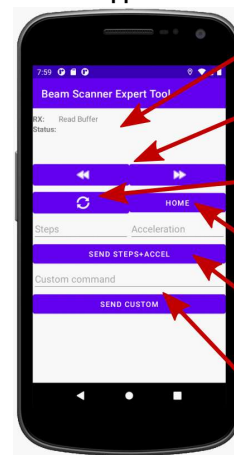
Schematics

METHODOLOGY

Testing:

Verification of the design was accomplished with the use of electronic laboratory tools: oscilloscope, multimeter, logic analyser, debugging software, thermal camera, etc.

Android application:



- BT connection status
- Simple movement
- In+out movement
- Find home
- Parameter input
- Advanced commands

Android application

RESULTS

The developed tool performs the task successfully. It is able to drive the scanners so that their movement can be studied and the development .

The savings in time due to the flexibility of a portable, handheld tool permit a faster development time and quicker in-the-field troubleshooting of these specialised pieces of equipment.

CONCLUSIONS

- The PIC microcontroller has limited resources, but it can be used for complex tasks when leveraging peripherals.
- Simple Android applications can be developed quickly using the SDK.
- Developing single-job tools that save a few minutes every day will save a great deal of time in the mid-term.



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Introduction

This project is a coming together of the worlds of Artificial Intelligence and Augmented Reality in the fast developing Fourth Industrial Revolution or 'Industry 4.0'.

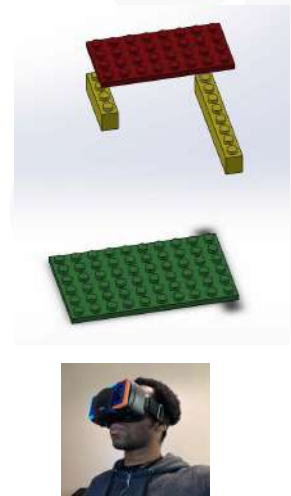
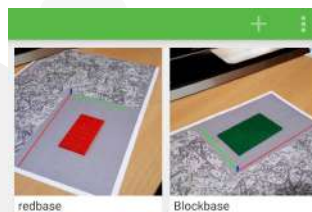
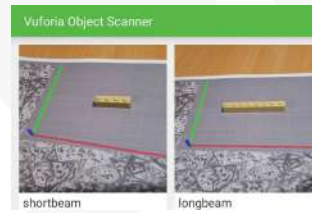
The Intelligent Parts Assembly Trainer is a technology that will train new employees in manufacturing factories and guide, in real time, how to assemble parts based on what has been taught to the system by an expert.

Aim

This is aimed at reducing the amount of routine in-person training sessions that would have been conducted if a human was charged with the task of training every new employee in a manufacturing company.

Methodology

- The approach taken makes use of a Lego set with easily distinguishable individual parts.
- These parts are scanned to generate a 3D marker in Vuforia.
- The scanning is done using Vuforia's object scanner for Android.
- Using Solidworks, direct 3D images of these parts are constructed to use in the guide animations.
- The 3D constructed images and exploded view animations are imported into Unity 3D.
- The Unity Editor is used to develop the app to first detect the parts through the device's camera using the Vuforia plugin for the scanned markers.
- Once detected, the app proceeds to show a looped animation for the assembly of the first two parts as defined by the developer.
- After the user completes the first assembly, the app scans the assembly to detect if the part was fitted properly or not.
- If the assembly is made correctly, the app indicates it to the user and moves on to animate the next part to be assembled.
- This process is repeated for the remaining pieces of the set until all parts are assembled correctly.
- The success criteria for this method is in how accurately the image detection system works when parts are assembled at each step.



Results

The development of the application was done for android only but equally compatible with PC and other platforms as well using Unity 3D's cross platform builder.

The app was developed as planned out in the methodology and live tests were carried out to determine the system's responsiveness.

The android device used was a Samsung Note 8 which has separate proximity sensors beside its rear camera which helped the process.

- The image detection worked well for the larger pieces but was a slight challenge for the smaller pieces.
- The 3D animations served well to give clear instructions to the user as to where to place each next piece.
- The assembly confirmation was able to detect the assembled image 90% of the time.

Conclusion

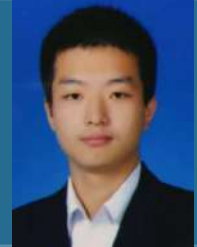
This project was a success and gave the opportunity to explore an evolving technology while providing a platform to showcase knowledge which can be developed into a large-scale solution for industries.

The major challenge faced was in finding a way to automate the learning process to make the assembly instructions dynamic.

Project Designer

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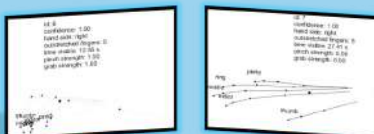


introduction

With the advent of the Industry 4.0 era, the Internet of Things technology is developing rapidly. As an important part of the practice of the Internet of Things technology, smart homes have also attracted more and more attention. Gesture control is a brand-new interactive method developed in recent years. Unlike the general button, voice and other interactive methods, gesture control is easier to master and apply. The user can directly interact with the computer or cell phone through different gestures. This project is based on using the leap motion for gesture control of a smart home.

Aim

Recognize different gestures using a leap motion and transfer the information to the Arduino. To realize the control of each subsystem of the smart home namely: lighting control system, fan ventilation system, security alarm system, and real-time display of temperature and humidity system.



Leap motion and it recognizes the opening and pinching of the hand



Arduino use relay to control smart home



Smart home based on gesture control

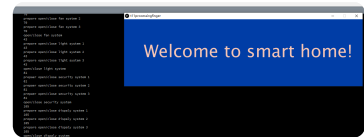
Methodology

1. Leap motion is a gesture recognition machine. It can recognize that there is a virtual ball in a human hand through an algorithm. People can change the radius of the ball by pinching and placing the hand, and leap motion can read the radius of the virtual ball in real time



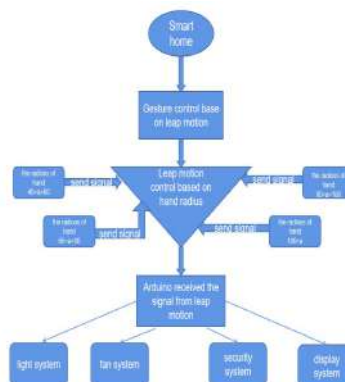
2. Write a program in 'processing' to read data from leap motion and establish a connection with Arduino. Classify the hand radius data read from leap motion and send different signals to Arduino.

The program of Arduino IDE and Processing



Processing In running state

3. Write a program in the Arduino IDE to enable the Arduino Mega2560 to close the related relays when receiving the relevant hand signals from the leap motion, and to supply power to the different smart home subsystems to initially start the work of the different smart home subsystems. In addition, code was written to control the detailed working status of specific sensors. For example, in the display system, the temperature and humidity sensor (DHT22) is combined with the LCD display (I2C2004) to realize the function of real-time display of temperature and humidity.



Results

The radius of the virtual sphere recognized by leap motion is divided into five sections, one of which is the waiting command area, in which no signal is sent to the Arduino. When the data of the radius of the virtual sphere is in the other four sections, the signals corresponding to the sections are sent to the Arduino respectively. When the Arduino receives the corresponding signals, the corresponding smart home subsystem is enabled or disabled.

Contact

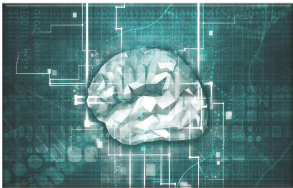
phone number: (+353)0830242018
(+86)18631292998
e-mail: 1337345184@qq.com

Conclusion

The gesture control and smart home system based on leap motion is now complete. When the light condition is good, the user can control the opening and closing of the corresponding smart home subsystem only by the degree of closing of the hand (the subsystems are the lighting system, fan system, security system, and real-time display of temperature and humidity System. This covers most of the functions of the smart home).

Although the gesture control method based on leap motion is very novel and very convenient in the interactive process, it has higher requirements for the light of the environment in which it is used. If it is not satisfied, the recognition will be unstable and inaccurate.

Home Surveillance At The Edge



Introduction:

The last number of years have seen big advancements in home security systems with moves now away from traditional monitoring system to cloud-based services. These cloud-based services have some constraints and drawbacks due to the processing happening in the cloud, so a more ideal solution is to do the bulk of the processing locally or at the 'Edge'. With advances in AI and with Vision chips this is now possible even on low powered low memory embedded devices.



Methodology:

- Cameras are placed around various locations around the home
- Multiple ESP32 cameras are used for face detection
- The Raspberry Pie and camera is used for face detection and recognition with the help of Intel Neural Stick
- Both embedded devices will send detections and images back to a monitoring server for viewing
- The ESP32 cams will send notifications to a telegram messaging bot when a face is detected
- The Raspberry Pie will send images of any unknown person back to the telegram messaging bot

The ESP32 Cams use the MTMN model for face detection. It is a lightweight model which was built on a mobile architecture called MobileNetV2 and Multi-task Cascaded Convolutional Network which is specially designed for embedded devices.

The Raspberry Pie will use 3 models to build a pipeline able to detect faces on videos, their key points (aka "landmarks"), and recognize persons using the provided faces database (the gallery). Inference is executed using the Intel Neural compute stick 2



Results

- Frames are captured from the multiple camera sources around the perimeter of the home.
- On the raspberry pie the frames are sent through an optimised neural network for face detection, face re-identification and landmark regression
- Face recognition occurs when the minimum distance classifier is used to compare faces captured with known faces from its inbuilt face database



- On the ESP32 cams face detection is achievable using the MTMN model
- All detections and recognitions are sent from the cameras by a message passing library called ZeroMQ to the monitoring terminal where users can view each camera.
- The Telegram messaging bot receives notifications and images from each of the devices if there is a detection made

Conclusion:

The main objective of the project was to create an edge application on embedded devices independent of the use of a cloud-based detection system. All image processing, facial recognition and alert notifications has been implemented successfully using the various devices on a local network in near real time.





Introduction:

This project is to simulate the automatic driving of a car on the road. The road surface information is received through the sensor, processed using Raspberry Pi, and then, and then automatic driving is realized.

Aim:

To demonstrate the use of programs in practical applications to deep learning and control the driving of the car.

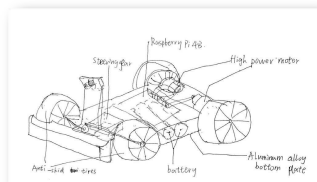
Methodology:

Research:

Research the autonomous driving technology of vehicles. Create a car that can realize automatic driving. Divided into two parts: hardware and software.

Design/Planning:

The main body is to design a four-wheeled trolley, two front wheels are used for steering, and two rear wheels are powered by two motors.



Methodology (Continued):

Fabrication:

Use screws and nuts to assemble the trolley. It is difficult to assemble the steering gear of the front wheel. It is necessary to use a transmission rod for connection, and screws are used for other parts.

Motor:

The motor uses two 37-520 motors with a reduction ratio of 1:10 and a voltage of 12v.



Steering gear: MG996R



Camera: 5 million pixels, 160 degree viewing angle.



Raspberry pi 4B:



Expanding board:



Control handle:



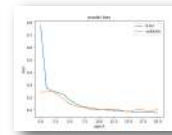
Methodology (Continued):

Train:

- Use the handle to control the forward and steering of the car, drive on a small road with obvious boundaries, and take a series of photos (collecting data).



- Transfer the collected data to the computer, and then train.



Results:

After the training is completed, open the Raspberry Pi terminal and use the web control. I choose to use the control handle to control. Use the handle to turn on the autopilot mode. Put the car on your training road and observe the car for autonomous driving.

Conclusions:

This project provided an opportunity for me to learn how to use the Raspberry Pi and how to use deep learning to train a car. The final result was successful.

- Realize the use of Raspberry Pi to control the driving of the car
- Realize the automatic driving of the car controlled by the camera

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Trajectory Prediction System



Introduction

Machine vision system with the ability to predict the trajectory of an object in motion.

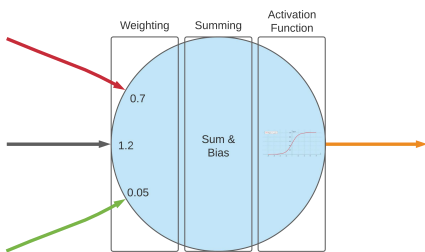
Research

Machine Vision Systems

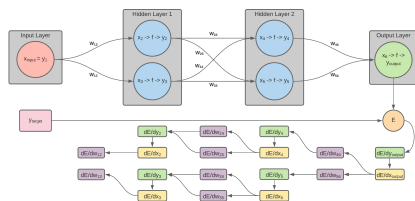
- How computers see the world

Deep Learning

- How computers can interpret complex data
- Processing Unit



- Backpropagation in Artificial Neural Network



Background Subtraction

- Highlight object in motion from rest of frame

Object Detection

- Find object in motion within frame

Trajectory Prediction

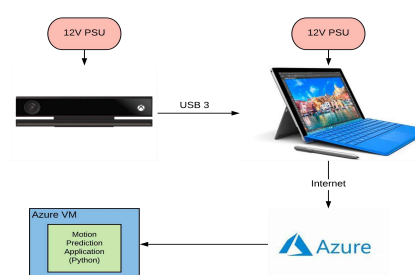
- Predict object in motion future location

Cloud Computing

- Performing data processing nonlocally

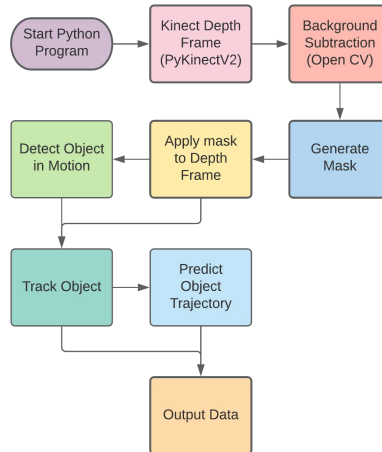
Design and Planning

Component Diagram



Design and Planning cont.

Software Flowchart



Develop Schedule

Generate Test Plan

Build

Programming Language

- Python 3.9

Cloud Computing

- Azure Virtual Machine

Generate Depth Image

- Kinect V2



- PyKinect2

- PyGame

Background Subtraction

- Open CV

- Numpy

Object Detection

- Open CV

Object Trajectory Tracking/Prediction

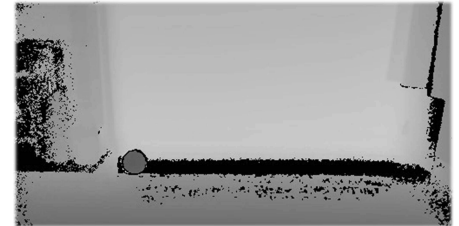
- Kalman Filter

Testin

Kinect Studio

- Allows for recording and playback virtualisation of Kinect V2

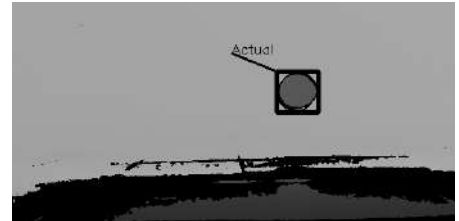
Depth Image



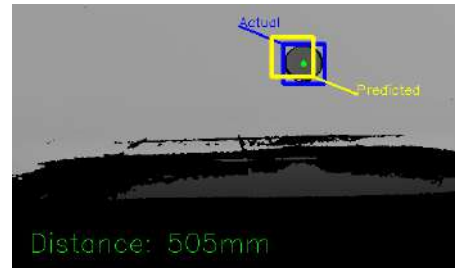
Background Subtraction



Object Detection



Object Trajectory Tracking/Prediction



Results & Conclusion

Python Program

- Depth Image Generated
- Background Subtraction Mask Generated
- Mask Applied to Depth Image
- Object Detected

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Project Report



Github





Paul Lanigan, QR Code
Celbridge,
Kildare



Paul.lanigan@live.com

Introduction

The idea for Time My Run came from my personal interest in health and fitness. Also, I coach teams and have a keen interest in data analysis that can improve an individual's performance.

Safety:

Health and Safety is a key objective and has determined the design and build of this project.

Aims & Research

To design and build a training aid that Local teams or Individuals at any fitness level can benefit from. Data can be used to motivate and set goals. Technology allows us to track data at the click of a button. Three highly qualified coaches were interviewed to get feedback on the concept & idea.

- C Mitchell: UEFA A licence coach
- S Corbett: Intercounty Selector
- J Daniels: GPO Kildare

Concept

An android app will be built using M.I.T. App inventor. The app will control the gates and save the data to a database.

A microcontroller is integrated with two IR sensors that will start and stop a timer. A traffic light system is used to operate the gates with LEDs.

Design/Planning:

Develop schematics, PCB layout and software flowchart. Develop test code on each individual part.

Approach

C programming language is used to write the program in MPLAB-X. Proteus was used to simulate the code and test the programs.

A HC-05 Bluetooth module is used to communicate the app to the PIC microcontroller.

The sensors are programmed as inputs and the LEDs & buzzer are outputs.

Results

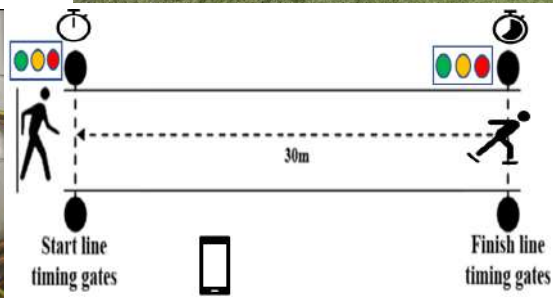
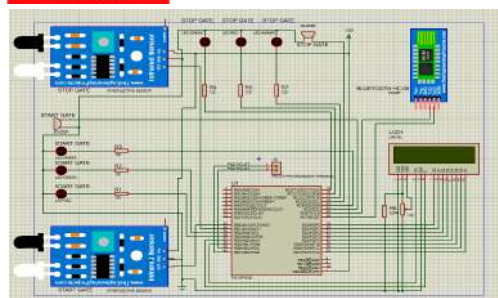
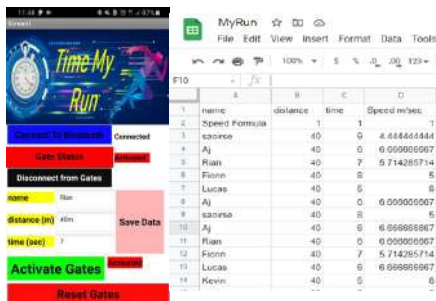
The app activates and resets the gates. A traffic light sequence is used to control movement through the gates. When start sensor activated the timer starts and when Stop sensor is activated the timer stops. The Time is displayed on a 16x2 LCD. The app resets the gates after run.

The name, distance and time is entered into the app and then saved to a database.

Conclusions

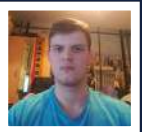
Overall the project was a success and my aim of creating a training data aid was achieved.

The project provided an opportunity to display skills & knowledge gained from my experience on the course. It also thought me new communication skills through promotional video & poster advertisement.



IT Sligo Self Driving Car Object Detection and Lane Detection

Paulius Bričkus



Introduction

I chose this project as I am interested in self-driving cars and the technology involved.

This project looks at the vision systems and how effective they are at allowing a car to drive without human intervention.

Aims

The project aimed to see how effective a self-driving car can be using only vision systems by achieving these aims.

- Object detection
- Lane line detection
- A system driving with only video input.

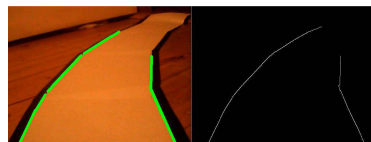
Method

The first objective was to get the individual aspects working object Detection, Lane Detection and a system to drive the car. Once they worked, the goal was to get them working together.

1, Lane Line detection

The lines on the road were detected using canny edge detection, a region of interest marked out based on the road setup and hough Lines add and draw the high-lighted lines on the road.

Result



2, Object detection

It's where an algorithm is trained to detect objects within an image or a video

Then a bounding box is drawn on the image or video using OpenCV, it's set up to make the smallest bounding box it can where the object is still able to be detected with a high result.



3, Driving

Creating a system to drive the car, programming a system to be able to drive on a road using only the camera and no other sensors.



Conclusion

The three objectives were effective and worked individually, they now need to be tested together. From working on this project, I've gained a better understanding of vision systems, by researching and using many different methods of manipulating a video.

Detecting edges by manipulating the video using canny edge detect and HSV to detect colour.

HSV is used to detect the solid white road so as working with only black and white is easier.

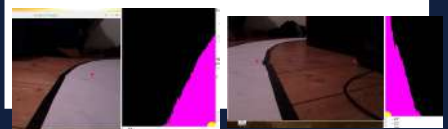


Warping images to a more useful perspective.

In this case to get a birds eye view of the road. The warped image next to original.



Using a histogram to find the curve of the road, and how to make use of them. The images below showing the histogram looking at the right and left of the road the values below indicating curvature.



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LinkedIn QR Code



Fire & Smoke Alarm System



Introduction:

This project is a fire and smoke alarm system using a buzzer, LEDs and also three sensors - smoke, flame and temperature.

In the event of a fire in a building it is important that people are safe and equipment is not damaged. An immediate alert to the fire is imperative.

Aims of Study:

To design and build a fire and smoke alarm system that will activate when the sensors detect flame, smoke or heat. The use of all three sensors makes this design more efficient.

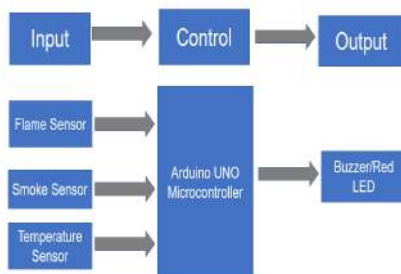
Methodology:

Hardware:

If the flame sensor detects a nearby flame or if the smoke sensor detects smoke or if the temperature sensor detects a temperature over 21 degrees celsius then the buzzer and red LED turn on - otherwise the green LED turns on and the buzzer turns off.

- The **flame sensor** used in this project is the Uxcell IR Flame Sensor. It has four pins – one for an analogue output and another for a digital output. The other two pins are used for ground and power.
- The **smoke sensor** used here is the MQ2 gas sensor. It has one output pin which is connected to A0 of the Arduino UNO.
- The **temperature sensor** used is the LM35 which is a linear temperature sensor where the voltage rises or falls based on the measured temperature then outputs this in degrees celsius to the Arduino IDE serial monitor.

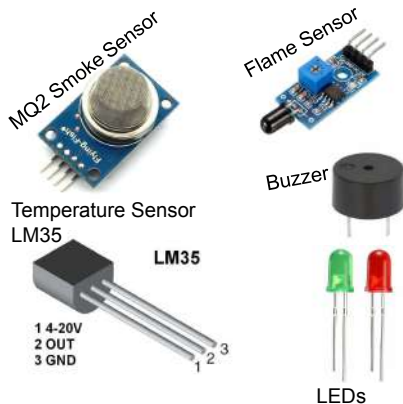
Hardware block diagram



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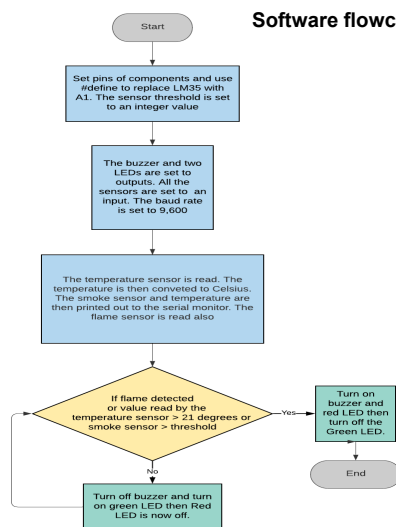
Methodology (Continued):



Software:

- The code was written in **Arduino IDE** for Windows 10. This code is written in the C language. The code sets up the pins used by each hardware component.
- In the **setup** part of the code the baud rate is set as well as components being set as inputs or outputs.
- In the **loop** part of the code there is an if statement used to check the value of the sensors in order to detect if there is flame nearby the flame sensor, smoke nearby the smoke sensor or a temperature rise over 21 degrees celsius. If any of these occur the buzzer and red LED turn on otherwise, they turn off. Software flowchart shown below.

Software flowchart



Testing:

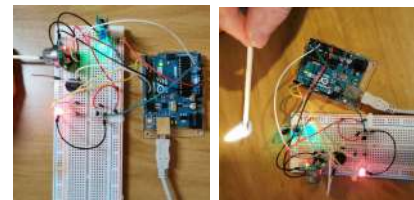
- While testing the flame sensor and smoke sensor it was realised that the smoke sensor needed an external component, and the flame sensor was not setting off the buzzer and LED. After some research a new flame sensor was ordered and tested. This one turned on the buzzer and red LED when a flame is detected.
- A smoke sensor and temperature sensor were then added to the project. The temperature sensor had to turn on the buzzer and red LED when the temperature is over 21 degrees celsius. All sensors were tested with flame, smoke and heat of household matches and an electric radiator.
- All three sensors were tested with separate programs on an Arduino UNO microcontroller. Once it was confirmed that all three sensors work using three separate programs, these three programs were then combined into one in order to combine the use of all three sensors.

Results:

- The hardware is interfaced together in order to detect if a flame, smoke or a temperature rise occurs. If any of these occur the buzzer and red LED turn on otherwise the green LED turns on and the buzzer turns off.
- The code is the backbone behind this. Using the Arduino UNO, an if statement is used to check if any of these sensors detect anything. If so, the buzzer and red LED turn on, otherwise the green LED turns on and the buzzer turns off. The circuit works in this way as intended.



Testing the temperature sensor with an electric radiator



Testing the smoke and flame sensor with household matches

Conclusion:

- While designing and building this project knowledge of sensors was gained in order to make them work with the buzzer and LEDs.
- Multiple roles were associated with the project such as programmer and designer.
- Overall, the project was a success as all sensors work independently to detect fire, smoke or a temperature rise. The use of three sensors made the design more efficient.

Safety:

- A fire and smoke alarm is an essential safety measure to detect a hazardous fire. All stages of this project were carried out with the utmost safety in mind. Safety goggles were worn throughout.
- All components of the circuit were connected correctly on the breadboard in order to ensure the circuit was safe to use.



Automated Visual Inspection with Conveyor Belt and Ejecting Arm.



Introduction:

During the project development modern and complex aspects of automation systems have been investigated including implementation of PIC microcontrollers and Vision Systems. Today automation is present everywhere, in theory all process can be automated. Production processes are getting more efficient and safe due to automation usage. Repetitive tasks are more often conducted by customized machines.

Aim of study:

Analysis of image processing system based on Jetson Nano B01 integrated with PIC18F45K20 microcontroller and Bluetooth HC-06 module.

Automation of repetitive task in production process.

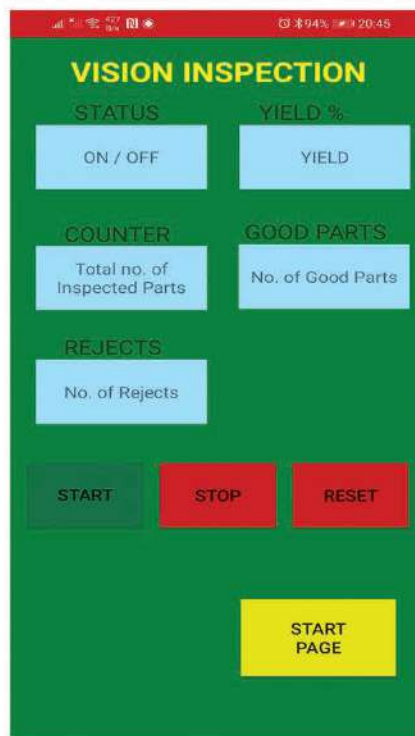
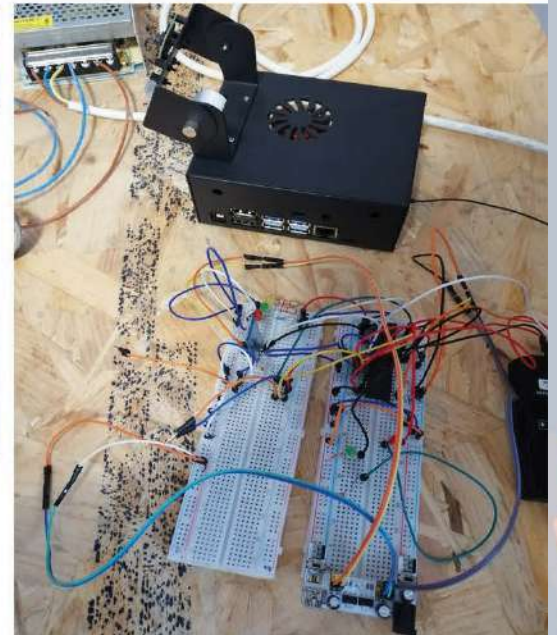
Methodology :

Research:

Initially different platforms where investigated for Vision System Implementation. The Jetson Nano B01 platform was chosen due to higher potential and not common implementation. This platform can be implemented in commercial project due to obtained certifications.

Design/Planning:

- Identifying activities required to complete project
- Project schedule development
 - Circuitry development
 - Coding PIC18F45K20 microcontroller
 - Coding Android application
 - Coding Vision Software with use prebuild libs
 - Building Haar Cascade
- Setting up Linux on Jetson Nano environment and Vision Software
 - Setting up Linux on Virtual Machine with Vision Software
- Construction of physical model



Results(up to date):

- Vision System set up
- Jetson Nano interfaced with PIC18F45K20 with use of C++ and C
- Bluetooth module interfaced with android application and PIC microcontroller
- Android application for remote control developed in Android Studio with use of Java
- PIC18F45K20 programmed
- Code in C++ for Vision system partially developed
- All components obtained for project
- Haar Cascade Optimized for project needs
- Code on PIC18F45K20 optimized for simulation needs

To Do:

- Assemble hardware -motors,belt,arm and sensors
- Test whole system construction including physical model (it is not going to happen due to delays)
- Switches will be added for simulation purpose

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Introduction:

This Project is beneficial to a user that could make use of a task reminder. The aim of this project is to design a wireless connection between an android phone and an Arduino Controlled Screen displaying users daily tasks.

In this modern era, wireless telecommunications have become an integral part of each other to provide wireless communication to an ordinary person who helps people in every part of the world to communicate efficiently. Wireless communication technologies transmit information over the air using electromagnetic waves such as IR (infrared), RF (Radio Frequency), satellite. For example: GPS, 3G and 4G networks, and Bluetooth.

Methodology:

Research:

Research began with a pic microcontroller that would communicate with an android phone. In order to achieve this the components needed are a Bluetooth module, (HC-06) pic microcontroller keypad, the Arduino IDE software, an android phone and finally the MIT App inventor.

Design/Planning:

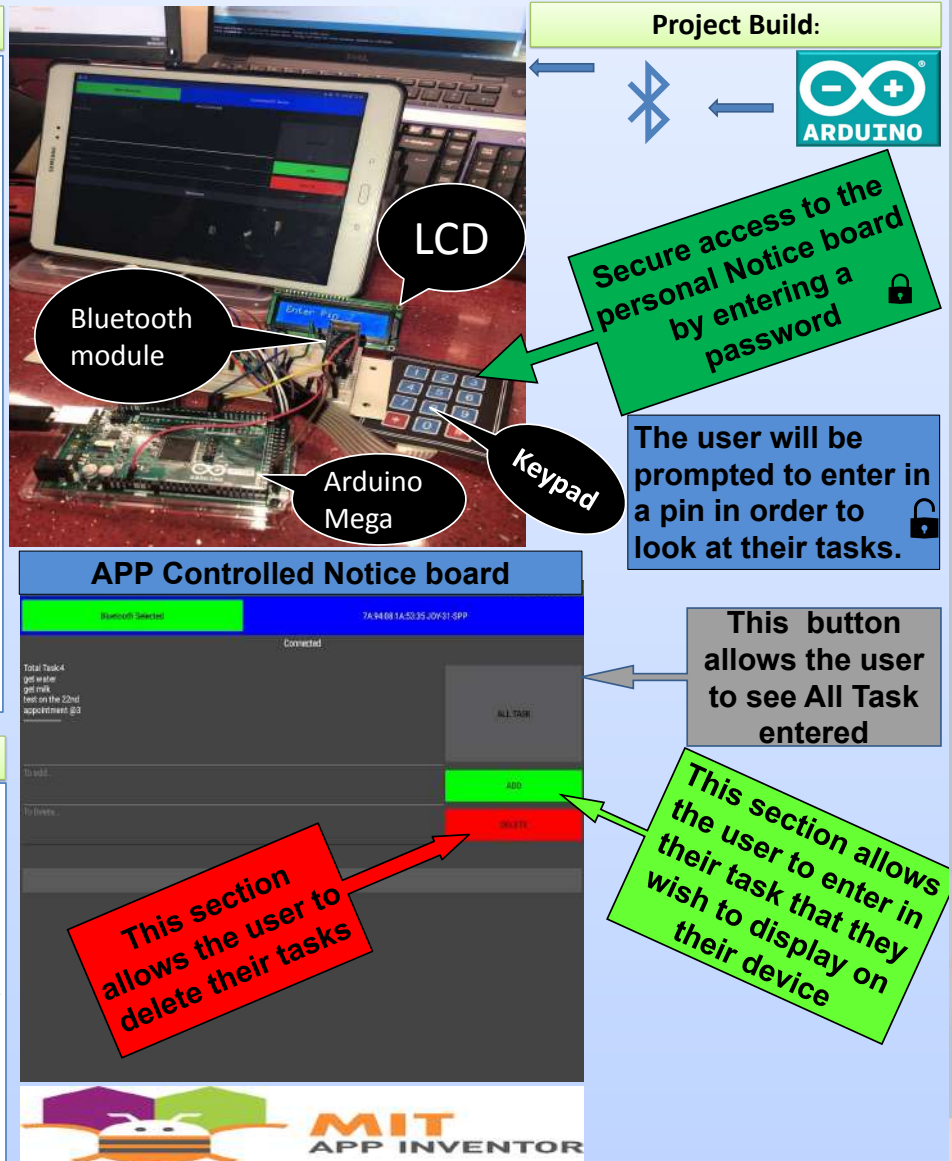
The design process involved:

- Selecting technology
- Order of hardware
- Planned each section of the build by the aid of a Gantt chart.
- Finding a good source of programs to suit my project and editing it to suit how my should project to run.

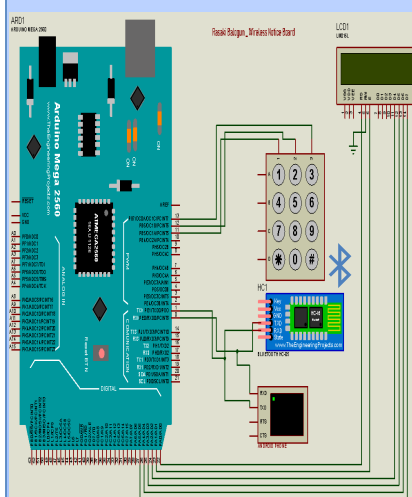
Hardware & software

- The parts obtained for this project are a combination of online orders and the college store of components. Software used for this project is the Arduino IDE & MIT App inventor to create my app

Project Build:



Proteus Schematic



Conclusion & Results

Result: After building this project, the operation of the software and hardware worked accordingly with what I wanted to implement in this project. The user is able to enter tasks and see their results immediately and securely. Although an extra feature that I had planned to add was a fingerprint sensor but due to some technical issues this could not be implemented to the project

Conclusions: The project gave me confidence and a opportunity to show some of the skills that I have gained from the course. The project also ran according to plan.

Bidirectional Visitor Counter

Introduction

Due to the current COVID 19 pandemic there has been an increased need to monitor the volume of people visiting establishments in recent times. This project aims to aid in the prevention of the spreading of COVID 19 and future novel viruses. The need for this type of project was evident in my local shop, and every shop like it.

Method

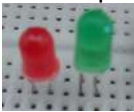
- The Project utilizes the PIC18F45K20 microcontroller, which will keep count of the number of people entering and exiting the premises.



- Two Infrared Obstacle Avoidance sensors will detect the presence of a person standing at the door.



- A green and red LED traffic light system will indicate to the customer if they are able to enter the premises.



- The LCD display will keep a visible count of the number of people currently in the shop.



- A motor will open the door when someone approaches and then close the door after they have entered.

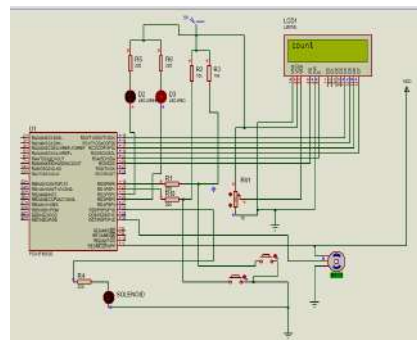


- A solenoid will lock the door when capacity is reached and release when not at capacity.

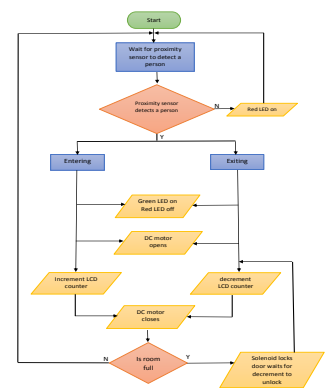


- The capacity is based on user input entered from a mobile phone app.

Proteus



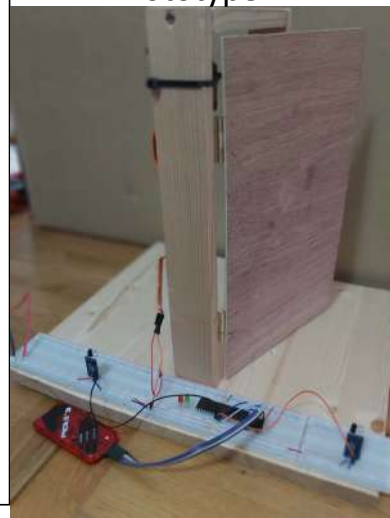
Software Flowchart



Results

- The Project utilizes the PIC18F45K20 microcontroller, which will keep count of the number of people entering and exiting the premises.
- Two Infrared Obstacle Avoidance sensors will detect the presence of a person standing at the door.
- A green and red LED traffic light system will indicate to the customer if they are able to enter the premises.
- The LCD display will keep a visible count of the number of people currently in the shop.
- A motor will open the door when someone approaches and then close the door after they have entered.
- A solenoid will lock the door when capacity is reached and release when not at capacity.

Prototype



Conclusion

- This project is relevant with the times due to the current COVID 19 pandemic.
- There are many upgradable components for different applications, such as an ultrasonic or infrared sensor. A larger motor or linear actuator for larger applications.

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Sligo Engineering & Technology Expo 2021

Electronic & Computer Engineering Award

For project titled

Facial Emotion Recognition

to

Shuo Li

Presented by:

Una Parsons - Head of Faculty of Engineering & Design, IT Sligo

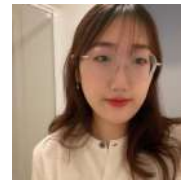
Chris O'Malley - Vice President, Research, Innovation & Engagement

Judged by:

Dr Michael Barrett - Head of Faculty of Business & Social Sciences in IT Sligo

29th April 2021

123 Q



Introduction:

The goal of the project is to create a prototype of a facial emotion recognition APP called Y-Hope. It can use face recognition to determine the emotions of users. Then different content is pushed to users according to different emotional classification, such as sentences, movies, pictures, songs, etc. In this way, people are encouraged and can relax.

Methodology:

Basic knowledge:

- Python
- OpenCV
- Convolution Neural Network (CNN)
- numpy

IDE:

- PyCharm

Model creation:

First, it need to practice a face data model to improve the accuracy of recognition. This part is divided into five tasks.

Task 1:

To import the modules needed in this project, it needs to define some variables to save the program time running.

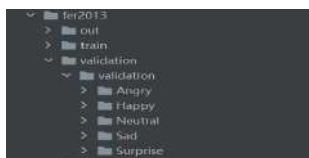
Such as:

NUM_CLASSES = 5: This variable defines the number of classes or emotions we will be working with when training the model.

Task 2:

Loading the data set, and the deep learning model is determined by the data set. There are used five types in the FER2013 dataset, including anger, happiness, sadness, surprise and neutrality.

So I used a total of 24,256 images as training data and 3006 images as validation data.



Task 3:

Using a dataset of image enhancement techniques. The Keras Deep Learning Neural Network library provides the ability to use image data enhancement to fit the model through the ImageDataGenerator class.

Task 4:

Make a model of the brain, namely the CNN network. A sequential model is used, which defines that all layers in the network will be stored sequentially, one after the other, in a variable model. The seven types of layers that exist in Keras. layers are used here.

Methodology (Continued):

Task 5:

Creating 3 things using keras.callbacks class: Checkpoint(Function — ModelCheckpoint()) Early Stopping (Function — EarlyStopping()) Reduce Learning Rate (Function — ReduceLROnPlateau()) Finally compile the model and fit or train the model on the dataset. The model generation is completed, which can use this model to create the emotion detector.

Driver code and Use camera:

Loading the model and the haarcascade_frontalface_default classifier. The haarcascade_frontalface_default classifier detects the front face of a person in an image or a continuous video feed. Define a variable class_labels to store the name of the classes or the types of emotions going to predict and also a variable cap to store the value returned by the cv2.VideoCapture method. class_labels=['Angry','Happy','Neutral','Sad','Surprise'] Some functions of OpenCV are called to compile and detect the model that has been trained before.

Results:

Cv2. The putText method is used to display the detected emotion on the screen next to the frame and CV2. ImShow method displays the result.



Accuracy:

Everyone is different and most people want to be thought of as different and unique. The app requires people to make real expressions in order to recognize facial expressions. At this point, people have the consciousness to express their true feelings. Therefore, this method of dynamic and psychological interaction will improve the accuracy of recognition.

Web Design:

A widely used APP must have aesthetic page design.

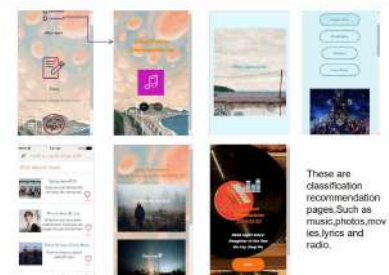
Login and user centre pages:

The user needs to register in the personal center and log into his/her account every time he/she uses it in the future to store data and record personal information.



Recommendation Pages:

After logging in, users could click the icon in the recommendation Pages to choose what they want to look through, or write the diary and identify their emotion to gain the recommendation through the recognition result.



Conclusion:

This project combines facial emotion recognition technology with real social problems. Although it has only provided a basic sample of an APP so far, it is of great significance.

In modern social life, the mental health problem deserves great attention. People are facing more and more pressure, they need to use the fragmented time to decompress. The development of the field of artificial intelligence needs to create empathy and understand the real needs of human beings in the context of real life. To sum up the concept of the app and my hopes in one sentence: "Hope it can be your hope."

Shuo Li

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Introduction:

The reason I have chosen to create this project is that I believe everyone should have access to some form of electricity in emergencies, also in areas that are disadvantaged and may not have constant access to electricity. This project is a small-scale wind and solar panel project that charges a battery from renewables sources letting the user charge or use small electronic devices

Also, this project could be useful in emergency situations to contact emergency services or even have a form of power to use for lighting and or starting up vehicles etc.

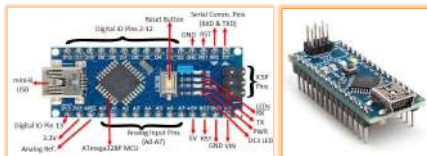
Aims of Study:

To demonstrate the theoretical knowledge gained over the course of our study in a practical, real world application.

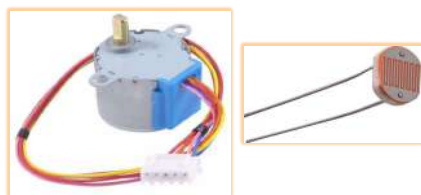
The main aim of study is to have a constant supply of renewable energy which can be used at any time that is harvested with accuracy.

Methodology:

- The design of this project is using two Arduino Nanos, one for Solar the other for Wind.



- A Stepper motor, driver and LDRs will be used to turn the wind turbines direction to oncoming wind.



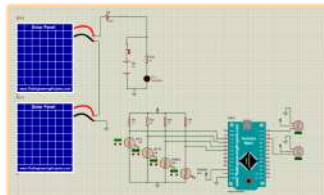
- The base of the project is constructed from 3mm PVC board. The frame of the project is constructed from 20mm PVC pipe.
- The solar panels are mounted to frames and move in XY planes by SG90 servo motors. By taking input from LDRs it will signal the servos to track the sun constantly throughout the day.



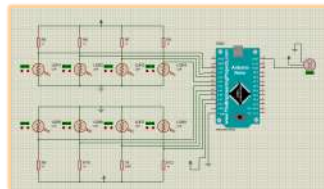
- When energy is harvested from both sources, it is then sent to a 12V battery for later use. I have also used a car charger which will allow for USB charging.

Methodology (Continued):

- I used resistors to create a voltage divider for the LDRs on the solar part of the project which gave the LDRs a high voltage when bright and a low voltage in darkness.



- For the wind part of the project I used eight LDRs around a wind vane. I used a 20mm bearing to allow it to rotate, this will then create a high low voltage on a LDR signalling the stepper motor to turn in the direction with the low voltage.



Design Phase/Testing:

At the beginning of the design phase a number of deliverables were to be produced for the project these included.

- Gantt Chart
- List of components that are going to be used for the project

When I was deciding what material to use for the frame I was going to try wood but it was difficult to source. Instead I opted for PVC board which was easy to get in my desired thickness allowing me to mount all components easily.

Results:

While testing the project it is not functioning as expected, I will keep continuing on getting the project working correctly. The project is harvesting power. The servos are not functioning correctly and the wind generator is too heavy and becomes unstable.

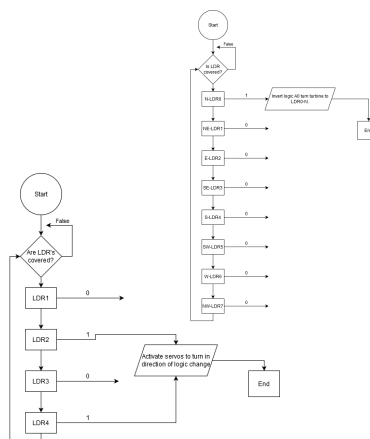
I will be adjusting the turbine to allow for it to hold more weight and not become unstable.

I will be adjusting the sensor wiring as the wires are too short and may be interfering with a servo.



Software:

- I used C code for this project to programme both the servos and the stepper motor for the project.
- During the design phase of the project software block diagram charts were produced.



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Smart Warehousing Incorporating a Digital Twin

INTRODUCTION

Technology is advancing at record rates allowing ever-expanding areas of application. Warehousing is an industry where the potential for advancement and improvement through the implementation of technology is immense. Smart warehousing involves the use of autonomous robots, cloud computing, augmented reality, simulation, big data and analytics, industrial internet of things, system integration and additive manufacturing.

OBJECTIVES

To design an inventory management system

To design an automated warehouse using an automated guide vehicle to pick and deliver boxes

To develop and utilise a digital twin to assist in system integration

METHODS

Research:

Researched traditional and smart warehouses to identify key components. Determined essential elements would be

- Automated Guide Vehicle with robotic arm
- Line Follower
- Barcode Recognition
- Cloud based Inventory Management System
- Digital Twin

Design/Planning:

The design process involved:

- Identifying best components
- Developed timeline
- Identified key milestone
- Acquired appropriate materials
- Model design in solid works

Programming:

Programmed the following:

- Line Detector to follow appropriate path
- Ultrasonic sensor to detect obstacles
- Servo motors to pick and hold boxes
- Direct current motors to propel the AGV
- Digital twin to follow line



Fabrication:

Used an Annet A8 3D printer to fabricate boxes, shelving and cylinders to replicate warehouse products.

Safety:

Safety was paramount in the design of the project. If the AGV encounters an obstacle in its' path it comes to an emergency stop.

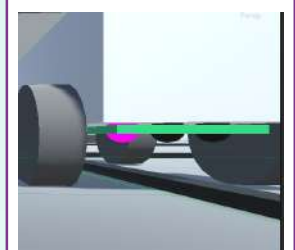
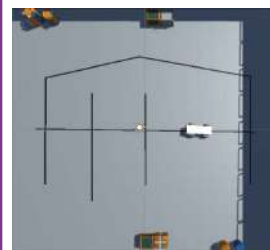
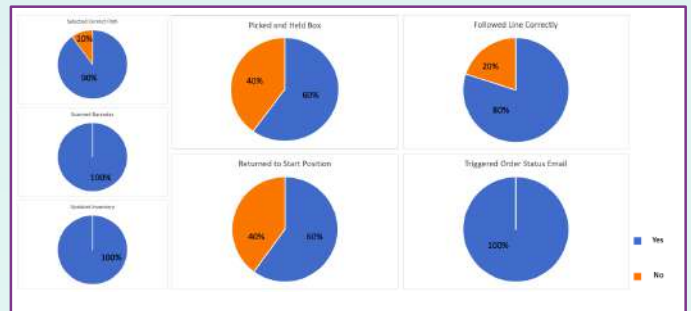
Evaluation:

Warehouse product picking and drop-off was simulated 10 times to evaluate performance at each key step in process.

RESULTS

AGV successfully:

- Follows line
- Detects obstacles
- Recognizes barcodes
- Routes to the appropriate location for each specific product
- Picks and holds product
- Transports product to drop-off point and drops product
- Updates inventory
- Triggers order status email



Digital Twin

- Full simulation of warehouse layout and design
- Replicates warehouse environment
- Maps out possible AGV paths
- AGV successfully follows line

CONCLUSION & FUTURE STUDIES

- ❑ AGV successfully navigates environment in modelled warehouse. It is capable of picking, transporting and dropping product at appropriate locations.
- ❑ AGV interfaces with the cloud in order to update inventory and trigger order update emails.
- ❑ Digital twin models warehouse environment and AGV successfully follows the line to navigate the simulated warehouse.
- ❑ Future studies would continue to develop the digital twin to allow for advanced modelling of all smart warehouse components. This would facilitate greater reliance upon the digital twin in warehouse procedure development.

ACKNOWLEDGEMENTS

I would like to thank my project supervisor Eva Murphy for all her time, advise and support over the duration of this project.

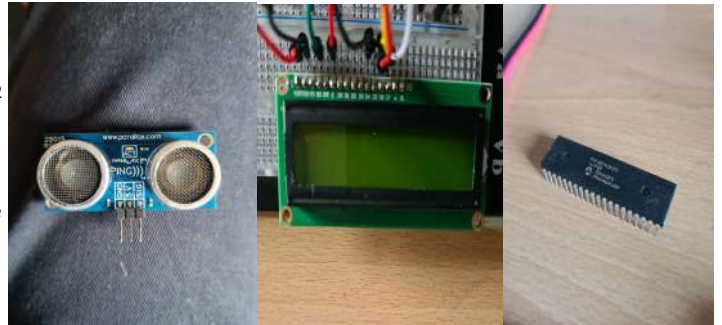
Covid-19 Distance sensor alarm

Stephen Morrison

L7 B.Eng Electronic.

Introduction

The purpose of this device is to provide a system of alerting someone to remain 2 metres away from the nearest person in a queue or when using a service desk such as a bank. The idea for this device came to me during the Covid19 global pandemic, after spending many long periods of time queueing up outside supermarkets or inside public building such as a bank, in which sometimes people would inadvertently stand too close to someone else or to the cashier behind the desk. The aim is to implement a system which will alert a person, which will help to maintain compliance to the 2 metre distance rule.



Aim of Study

The Aim of this project is to demonstrate the knowledge and experience I have gained whilst studying Level 7. Electronics engineering, such as C programming, Embedded architecture and interfacing a microcontroller with other electronic components to support an application.

Methodology

Research

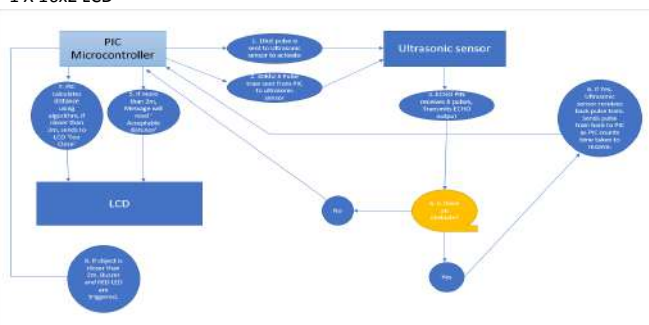
The project idea progressed to a project following some research in to similar proximity sensor projects which used a buzzer and proximity sensors to detect objects and sound an alarm. Research also took place to understand projects which used ultrasonic sensors to detect the actual distance of an object in real-time and provide a reading to an LCD.

It was decided to follow along the lines of a similar project which uses an ultrasonic sensor to measure distance, and to use this reading to trigger an alarm depending on the proximity of the object – this will allow the object to come within 4metres but no closer than 2metres before triggering a Red LED and buzzer.

Design

Key components were outlined as requirements for his circuit –

- 1 x Ultrasonic sensor –
- 1 x Pic Microcontroller
- 1 x Buzzer
- 1 x LED
- 1x Crystal
- 1 x 5v Power supply
- 1 X 16x2 LCD



PIC18F45K22 Microcontroller programming

The microcontroller of this circuit provides the commands to the LCD and the ultrasonic sensor. Therefore, this component must be programmed to do so. The methods of programming a PIC18F series microcontroller is by using software called MPLAB X IDE. This software allows users to write code in C which is programmed to the PIC18F as an executable set of commands. The PIC then requires power to continue to command the circuit once it has been programmed using the 5v power supply.

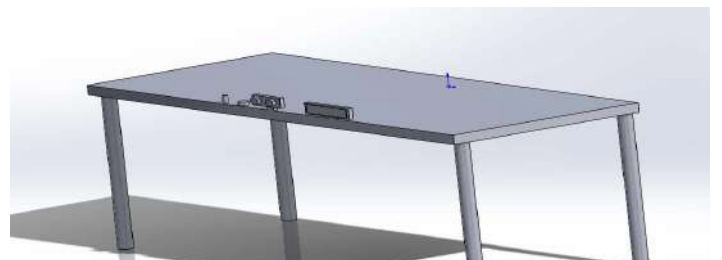
Results

The circuit designed will be mounted to the front of the desk as outlined below. The Ultrasonic sensor uses a 'while loop' which continuous awaits an object to trigger the echo pin.

Upon this trigger, the PIC18F45K22 commands the ultrasonic sensor to emit an ultrasonic vibration which will bounce off the object, the receiving sensor awaits the vibration to return, which once it is received back, the Ultrasonic sensor returns to the PIC18F45K22.

The PIC18F45K22 has used the internal Timer module to count the length of time it has taken for the ultrasonic burst to come back and the algorithm which was programmed into the PIC now calculates the distance of the object using the Distance = Speed/Time maths algorithm.

The PIC is then programmed to send commands to the buzzer, LED and LCD to alert the object that they are too close.



Conclusion

This project provided me with the opportunity to showcase what I have studied in this Level 7. From using C programming skills to programming the Microcontroller, and understanding the components of a circuit and how they work together.

I found this project to be difficult and sometimes trying to build an electronic circuit can offer a lot of small issues which I bumped into such as powering the breadboard during prototyping, and trying to limit the amount of current which was reaching certain components.

Certain elements of this circuit I would change would be to try and include several ultrasonic sensors which could detect several objects and also work in a longer queue situation in which several people could maintain distance which would be controlled by the one circuit.

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Ball Picking Robot Car

Electronics Level 8 Project Year 4



Introduction

With the progress and development of society, people live happier lives. More people are involved in sports. Tennis is a famous sport, and more and more people pay attention to and participate in this sport, and picking up the ball is a tedious process.

Therefore, a trolley capable of automatically picking up balls is needed. The purpose of this project is to design a car that automatically catches the ball. It can automatically locate the position of the ball and pick up the ball on the ground.

Aims

The purpose of this project is that the camera of the car captures and recognizes the tennis ball, and automatically drives to the ball and then picks it up.

Find the ball



Catch the ball

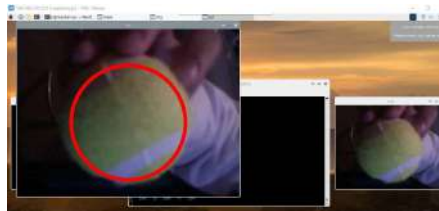


Put the ball



Methods

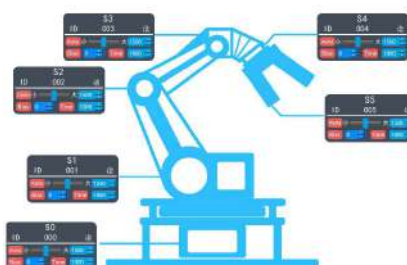
Detection: Use Python to detect tennis balls. The key factor in finding tennis balls is color recognition. It is estimated that the color range of the tennis ball is probably yellow-green, and then find the HSV value of this color range, and then circle it according to the shape of the ball. The virtual machine can check whether the ball is detected.



Automatic drive: The STM32 series of single-chip microcomputers control the movement of the trolley. By burning the program into the car to realize the automatic driving of the car.



Catch the ball: Since the robot arm of the trolley is controlled by the steering gear, it is necessary to change the parameter value of the steering gear to design the action of catching the ball.



Result

Under the simple conditions of the surrounding environment, the camera captures the ball, the car automatically drives to the ball and picks it up, completing the action of picking up and then putting it down.

Conclusion

- The robot car is completed step by step according to the assembly instructions.

- This project uses python and Keil programming environment.

- The camera recognizes the ball and detects the ball relies on the Raspberry Pi, and the recognized and framed tennis ball can be seen on the VNC virtual machine; the movement of the trolley relies on the STM32 single-chip microcomputer.

- Tennis can be used in simple surroundings. If the surrounding environment is too complex and there are many colors, it will interfere with the camera's recognition of tennis.

- The size of the tennis ball matches the maximum opening angle of the gripper of the robotic arm. The mechanical grabber grabs the tennis ball according to the command, but due to the continuity of the grabbing action, it will continue to complete the subsequent movement when it does not grab the ball. This will cause the ball to not be caught. This will be a problem that needs to be solved later.

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Introduction

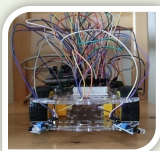
- Intelligent appliances is gradually entering people's lives, and their emergence provides a new way of life, a more convenient and more efficient way.
- As one of the most common intelligent appliances, vacuum cleaner robot is playing the role of cleaner in more and more families. Users just need to start it, and it will automatically clean at home.
- It can liberate your hands and save you time in cleaning. Let you spend more time with your family and enjoy life.

Aims

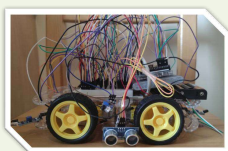
- The purpose of this project is to learn to understand, design and assemble a prototype.
- The most important part of the vacuum cleaner robot is whether it can cover the whole house.
- This project focuses on how to control the movement of the prototype to achieve as full coverage as possible, and the cleaning part is not designed.

Design

- Hardware design:** the car body uses 4-wheel drive kit, which can install sensors in different positions of the car body to meet the needs of the characteristics. The sensor chooses ultrasonic sensor and infrared sensor, and the control microchip chooses arduino Mega2560.



Front



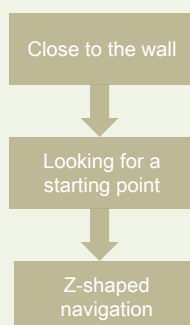
Side

- Software design:** programming with IDE officially provided by arduino



Partial code

Motion flow chart



- I. Close to the wall: the car will first approach one side of the wall, and when the distance is close enough, step back along the wall.
- II. Looking for a starting point: When go back to the end of the corner of the wall, use this position as the starting point for departure.
- III. Z-shaped navigation: the car performs a Z-shaped motion mode from the starting point to ensure full coverage of the specified area.

Methodology

- The movement of the car is achieved by controlling four wheels. If you give four wheels different speeds, you can realize the steering function through the speed difference. Setting different speeds requires the knowledge of PWM waveforms. Forward and backward can be achieved by controlling whether the wheel rotates counterclockwise or clockwise.
- A motor drive chip is also needed to control the motor of the wheel. The L293D motor driver chip can drive two independent wheels. The use of two of this motor drive chip can achieve the purpose of controlling all wheel motors.
- In addition, ultrasonic sensors and infrared sensors are also used. The former can measure distance data more accurately. The latter can be used to detect whether there is an object approaching.

Result

The success of the automatic sweeping robot project depends on whether it can completely cover the whole ground. Before the test, a closed area was built with cardboard as the test site. Put the prototype into it and observe its performance. The deficiency is that there is no specific indicator of how much of the area is covered. But the test has been carried out many times, from the visual point of view, it can better cover most of the area.



Test record excerpt

Conclusion

When the final test is completed, the goal of the project is achieved. During the period of conception, design, manufacturing and assembly of the project, the knowledge of many disciplines was comprehensively applied. Such as programming, circuit analysis and design, electrical principle analysis, electrical knowledge, component welding and project management.

Contact

Xulu Cui

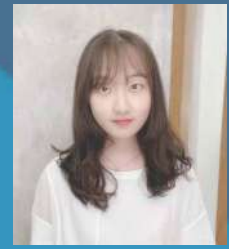
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Simulated Food Delivery Robot

Electronics Level 8 Project

Zhenzhen Yu



Introduction

With the rapid development of science and technology, artificial intelligence is becoming more and more developed. The gradual development of food delivery robots can attract customers and reduce the labor intensity of waiters in restaurants. The food delivery robot has a motor function. It can walk in a designated area, reach the location specified by the user, and avoid obstacles based on surrounding information.

Aims of study

The Raspberry Pi car was used to simulate the food delivery robot. The camera recognized the color of the food, followed the tracking route, and completed the autonomous navigation to send the food to the designated place.

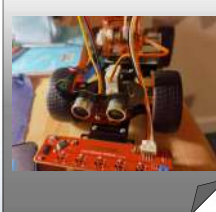
Methodology

- Raspberry Pi VNC Viewer remote desktop configuration

- Line Following

The line follower detects lines in the surrounding environment, and transfers the data to the processor. The processor analyzes the data, and sends a command to control the movement of front wheels and rear wheels.

It used a large of paper, a roll of black lines, a hard card board to make a track for line following.



- Obstacle Avoidance

The ultrasonic obstacle avoidance module detects and transfers the collected data to Raspberry Pi that can calculate the distance from the obstacle. The Pi will send a command to adjust the front wheels and rear wheels direction and

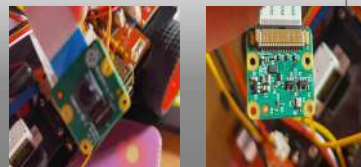
Methodology

rotation to control the PiCar-S walk away from the obstacle if there is one.



- Camera

- Wiring (the blue side of the cable faces the USB port and the inner side of the camera).
- Set camera enable.
- To check whether the camera has been successfully connected, type in the terminal (ls-o /dev/).
- Using MJPG-Streamer to implement network monitoring.



Results

- Line Following

The car is set the turning angle of the servo in different levels according to the detection results of the probes.

When the car moves forward originally, the servo is in 90 degrees. To drive the car to turn left, the servo should be in 90+step degrees; to turn right, the servo should be in 90-step degrees.

- Obstacle Avoidance

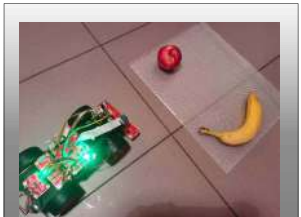
When the car starts, it will detect obstacles and measure the distance in cycle, make judgement, and take actions. Here are three cases: when the distance to the obstacle is equals to the threshold, the car will turn directions; when the distance is less than the threshold, the car will move backwards before turning direction; when the distance is more than the threshold, it

Results

will keep moving forwards.

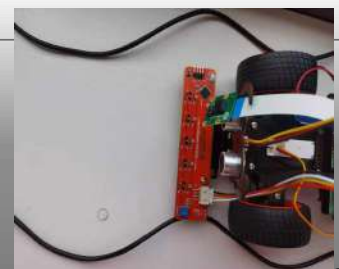
- Camera

The car uses the camera to identify the color of the food.



Conclusions

In this project, Raspberry Pi car is used to simulate a simple food delivery robot. From hardware assembly to software debugging, finally the completion of the test car. This project is very meaningful. According to my professional knowledge and the principle of Raspberry Pi, basically completed this project smoothly.



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INTRODUCTION

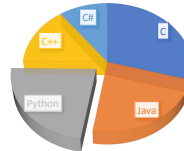
For the elderly in today's society, most of them live alone. In such a situation, their safety and mental health will not be guaranteed. For example, most home invasions happen to elderly people who live alone. Such elderly people are also more likely to experience feelings of loneliness. So now humans have the ability to use artificial intelligence technology to design a robot to ensure the physical and mental health of the elderly. Therefore, I designed an intelligent car (a car to act as robot) which can be controlled by users.

It has facial recognition and voice capabilities to ensure the safety of the elderly.

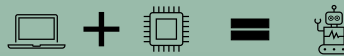
AIM OF STUDY

In the fourth year, I developed a strong interest in Python, so I plan to use the Python knowledge I have learned to design a product that can improve the quality of life of the elderly.

USAGE OF VARIOUS PROGRAMMING LANGUAGES



Methodology



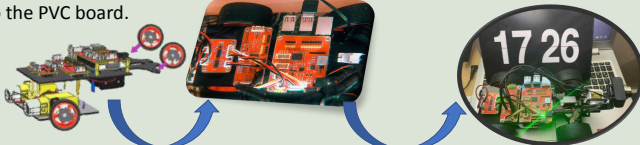
The whole project is divided into software and hardware parts in nature.

At the beginning of the project, the two parts were implemented independently. The second half of the project performs the integration of software and hardware. It can be roughly divided into two steps:

1. Hardware (PICAR-V assembly and sensor selection)
2. Software (Face recognition program debugging and alarm function to add)
3. The debugged program under Windows system was imported into Raspberry Pi 3B and ran successfully under Linux system.

Hardware assembly and debugging :

- Connect the battery base and Robot Hats, Motor Driver, PCA9685 PWM Driver to the PVC board.



- The camera steering gear module and tire steering gear module were tested respectively



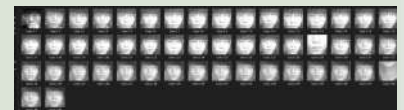
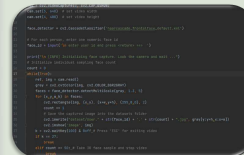
- Test whether the wireless network module and Bluetooth module of Raspberry Pi version can be used normally

设备名称	IP 地址	物理地址(MAC)
raspberrypi	192.168.1.17.99	b8:27:db:61:54:40

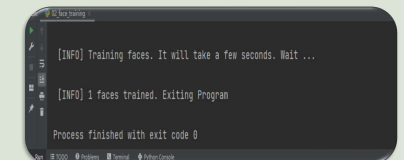
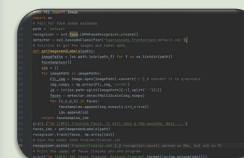
Software and debugging :

(1). Life safety for the elderly (Face recognition alarm system)

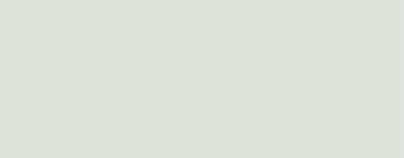
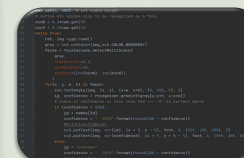
- Face data is inputted into the database, and face numbers are inputted. Each user takes 50 images.



- The data entered into the database were trained using the known training model.

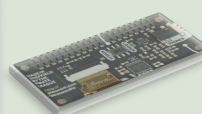


- According to the system that has been trained, the faces appearing in front of the camera are recognized. If there is a stranger, the screenshot of the stranger's face will be sent to the designated mailbox.



(2). Speech module implementation

- Connect the voice module to the 40 pins of the Raspberry Pi to test whether the electronic display works properly



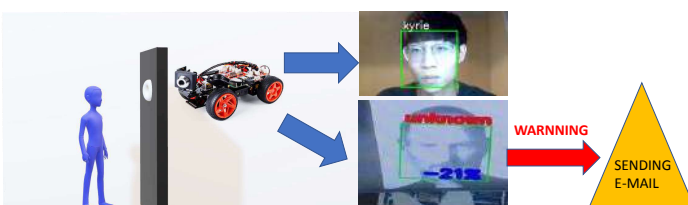
Download the module driver in Linux system and add auto - play the specified voice function.

To help the elderly reduce loneliness, the robot (car) is designed with facial recognition and voice functions. In order to ensure the safety of the elderly, if the visitor is not recognized, the robot can contact the nursing staff

RESULTS

The robot could play many roles in practical use.

1. Accompany the old man for a walk as a companion (to relieve the old man's loneliness to some extent);
2. As a security officer, I can identify anyone approaching the door and automatically send emails to the designated mailbox when I meet strangers;
3. Act as a player, playing specified music or even reading materials.





CHLORINE DISINFECTION SYSTEM USING DATA ANALYSIS AND MACHINE LEARNING CONTROL

BY JONATHAN LOGUE

INTRODUCTION

The aim of this project was to build a prototype system to aid in the operation & decision making in the chlorine disinfection process used in water treatment facilities in Ireland, by leveraging Industrial Internet of Things (IIoT) principles, Data harvesting & Analytics, Cloud technology, Machine learning (ML) to provide suggested control set-point values, an android application to view process conditions & SMS warning system. With the hope of creating more connected, transparent & efficient processes.

TECH AIMS

- Provide a small, cost effective, minimally invasive device to connect via Ethernet to existing control system infrastructure i.e. Programmable Logic Controller (PLC)
- Develop code to harvest real-time process data from the control system & route the data to a cloud database to hold the real-time data.
- Build & Train a ML model using site specific historical data, that is capable of producing (outputting) a suggested (predicted) control set-point based on process variables provided to the model as inputs.
- Develop an android application with user login/register functionality to pull the data from the real-time database on the cloud & display this to the user.
- Provide a small cost effective SMS system that monitors both process & device health status via the cloud & trigger appropriate SMS warnings i.e. process alarms, device loss of heartbeat (LOHB) etc.

METHODOLOGY

Research - My research in the project began with searching if systems like this exist in water treatment facilities around the globe, the concept exists but in practical terms seems to be in its infancy. I then concluded to have 5 main blocks to focus on, data harvesting, data migration to the cloud, ML model, Android app, SMS system. once I had these main building blocks, I began to work on each section.

Design / Planning - The design section of this project falls into two categories, hardware & software.

- **Hardware** - component selection, 2x Raspberry Pi 4's, 1 Arduino Nano, 1 SIM800c GSM chip.
- **Software** - Language selection, The Arduino controlling the GSM module is programmed with a c/c++ hybrid language, the android app was developed in Java & all other coding was completed in python.

Testing - Testing was an ongoing event throughout this project and was approached with the main blocks as mentioned above, with some functionality not being able to be tested until other functions were tested. Testing was broken into 3 parts.

- **Verification** - Physical testing of the hardware circuitry & software blocks as individual functions.
- **Functional testing** - Assessing that the project functionality as a whole (i.e. hardware & software combined /communicating/ML model testing) is operating as intended in the design considerations.
- **Principle Testing** - Ensuring that the project has achieved what is set out to achieve in a timely & efficient manner.

RESULTS

The research & planning carried out initially in this project really helped to keep tasks on track & on schedule. The Models I attempted to apply to this project were as follows:

- Supervised Linear Regression Model
- Neural Network MLP Regression Model

This was important to attempt more than one model to allow for comparing & contrasting of model performance to allow for proper model selection.

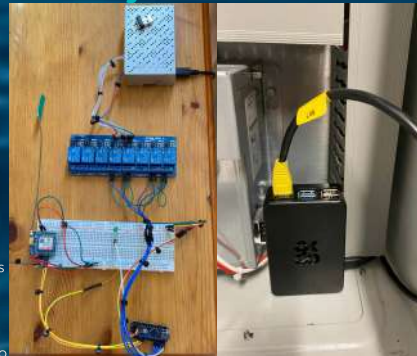
As can be seen in the comparison diagrams, the linear regression model outperformed the neural network in every department which we can see visually in the chart. The reasons why, are beyond the scope of this project & will be answered in future studies.

I feel overall the project has been a success as all of the technical goals I wanted to achieve in this endeavour have been met & the projects satisfies the overall aim of the project set from the outset.

Android App



Project Hardware

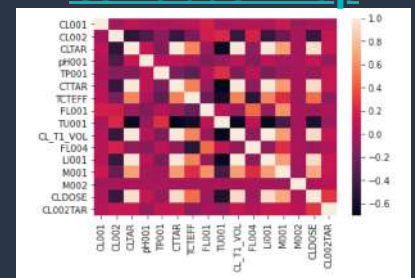


RECOMMENDATIONS

The concept has the potential to provide very accurate control set-point predictions, this accuracy would vastly be improved with a larger amount of high quality historical data from which the model would be trained. i.e. a year round data set as water conditions fluctuate throughout different seasons.

Also I would like to further analyse & adjust the model inputs, in a bid to optimize the models efficiency by eliminating parameters that have minimal/no correlation with the model output

Model Input Correlation Map



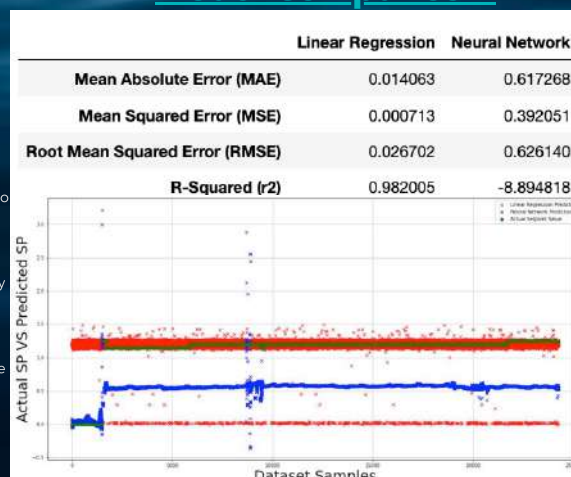
CONCLUSIONS

I thoroughly enjoyed the experience taking part in this project & have gained a great deal of technical knowledge & confidence in my abilities as an Engineer.

I have mostly enjoyed having the chance to experiment & work with such cutting edge technologies such as ML modelling & cloud computing. It is an amazing concept how devices which previously would be considered "dumb" devices can now, with the addition of a few sensors & access to WIFI can become vital nodes on a network contributing to process decisions & actions & also become visible to anyone on the planet. Thanks to IIoT principles.

After the success of this project I believe that this concept could be easily scaled up & further developed to allow the project to become a commercially viable concept for use on many different processes in water treatment facilities.

Model Comparison

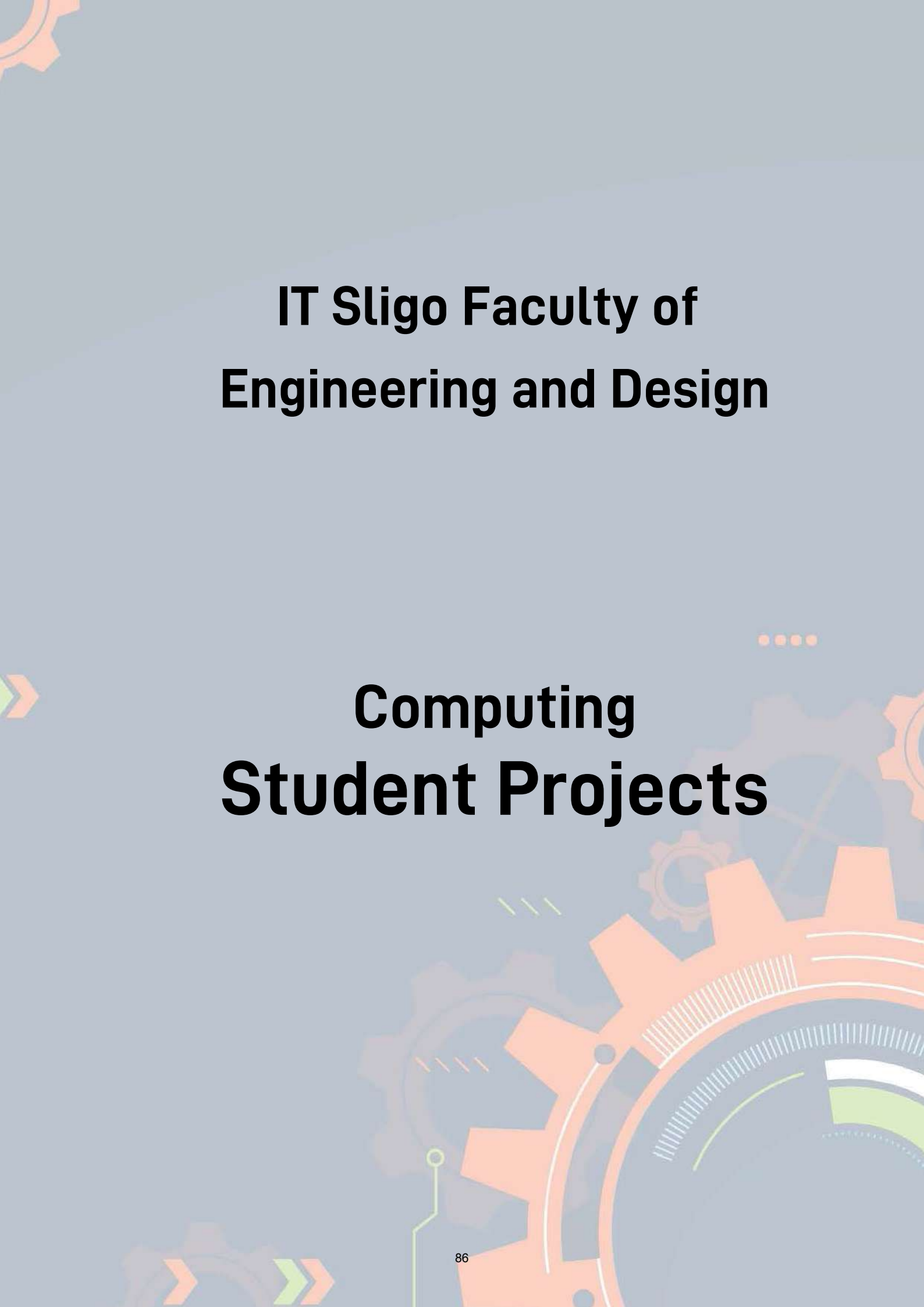


Project Designer

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IT Sligo Faculty of Engineering and Design

Computing Student Projects

BOOKING 300

TABLE-BOOKING APPLICATION

TEAM MEMBERS

- AARON DOLLARD
- ALAN REGAN
- JOHNATHON CRAWFORD
- MATTHEW MC GIRL

PROJECT OVERVIEW

- We developed an application that could be used by a restaurant to improve the flow of their booking process.
- Using our application, all bookings for a restaurant would be centralised within the application whether a booking is created online by a customer or by a staff member of the restaurant.
- Users must register and log in to the application to access functionality.
- We implemented different types of users:

ARCHITECTURE



FRONT END

We used Angular and Typescript to build the web app

DESIGN

We used both Angular Material Design and Bootstrap to design the app

BACK END / API

We created a Node.js server using the Express framework. This handled our authentication, authorisation and booking data

DATABASE

We chose MongoDB as it is very easy / fast to query because of the lack of relations

Also, it is easy to integrate with Node.js and Express

We used an S3 bucket to host our Angular application

We hosted our API on an Amazon EC2 Instance which we deployed using Elastic Beanstalk

We chose MongoDB Atlas to host our Database

LEARNING OUTCOMES



Authentication:

Learned about the two main types of username/password authentication methods in web apps and how to implement them.

Authorisation: how to restrict access to content on both the front and the back end



NoSQL Databases:

Gained experience working with data in MongoDB, data modelling, enforcing relations in a non-relational database and working with multiple collections



Development Experience

Knowledge furthered with Front-End Design, using Cloud Infrastructure, the M.E.A.N stack, Software Project Management and working as Part of a team.

TOOLS & TECHNOLOGY

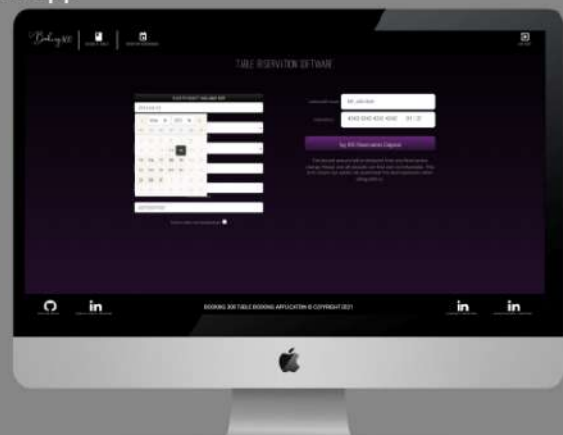


FUTURE WORK

- Visual representation of available/unavailable restaurant tables
- More of a responsive design
- Mobile app version
- User Personalisation (loyalty rewards)
- Customization to suit an individual restaurant

DESCRIPTION OF WORK

- Weekly meetings with project supervisor to track progress and stay motivated
- Used Pivotal Tracker to assign tasks and ensure each member had clear goals
- Pair programming sessions
- Implemented the MEAN stack to create a functional web app



the **Git Club**

<http://project300.s3-website-eu-west-1.amazonaws.com/>



@TheGitClub
/booking-300

Project Supervisor: Vivian Kinsella

Elizabeth



Technologies

- Unity
- Maya



- Blender
- Discord



- Photoshop
- Trello



Meet The Team

The Sunbros:

- Shane Butler
- Piotr Galkowski
- Oluwatoroti Elegbede

About Us:

A three man team of video games enthusiasts who are fascinated by the horror genre. We set out to design and develop a horror game that would keep you on the edge of your seat while immersing you into the story.

Conclusion

This project has highlighted to us the importance of good communication and teamwork in achieving project goals and creating a good end product. Through frequent meetings and agile development, we achieved a lot of the goals we set out at the beginning of the project but we weren't able to implement a lot of other features due to time constraints.

Overall, we have improved our technical skills such as games programming and 3D modelling and interpersonal skills like project management and communication.

Project Overview

The aim of this project was to create a horror escape the room video game. We tried to make the game less linear compared to other games of the same genre by adding elements of randomness that would make the player want to do multiple playthroughs.

Research:

For the development of Elizabeth we looked into other horror games. Some features that we researched included:

- Environment exploration
- Enemy AI
- Storytelling
- Interactable environment
- Input System
- Methods to scare the player

Design:

After looking at already existing popular horror games, we created a design plan for the features and mechanics that our game would include. We explored multiple map layouts that would both be interesting and balanced in terms of difficulty for the player.

Development process:

This process included continuous improvement of existing features, which was made easier because we continually learned and improved our skills. We continued to do research during the development process on possible new features for the project.

Proof of Concept

We created Elizabeth with the Unity game engine and developed features that helped to create a memorable experience for the player. These features include:

- Responsive enemy AI
- Inventory system
- Randomised key item spawns
- Stealth System
- User Interface
- Various Interactable Objects

Current Implementation:

The player can explore the first floor of a building which contains lots of rooms - many of which are behind locked doors. The player has to use stealth to avoid detection and collect items which are needed to escape.

Future Plans

There are a number of different elements of the game we would like to expand on in the future with more development time -

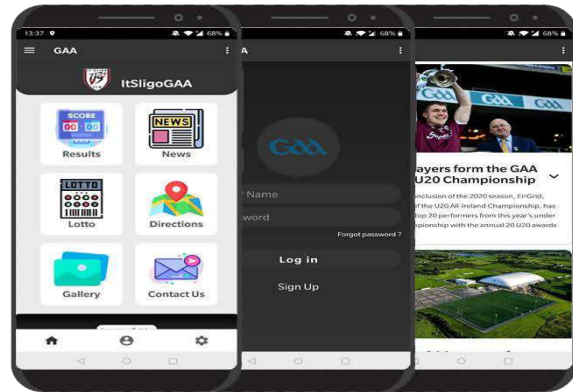
- Creating more unique interactable items.
- Expanding the building so that there is more to explore for the player.
- Making a more advanced AI for the enemy.
- Improving the visuals of the game.

GAA Team App

Oisín Lynch(S00189006), Kyle Gilmartin(S00188438), Ronan Finnegan Duffy(S00187127)

Agile Methodology

- > Our aim for project 300 was to create an easy-to-use mobile application for any GAA club around the country.
- > Our goal was to create an app that had many admin features that were not accessible to normal users, but also to create an app that provides a seamless experience for the user.



App Screenshots

Agile Methodology

- > Agile development was vital to the success of this project.
- > We used testing throughout the project to make sure each feature was of high quality.
- > We held weekly meetings to review the work that had been carried out during the previous week.
- > We produced a list of priorities for our key features and each week members were delegated a task from the priorities list.
- > Minutes were kept during these meetings and posted to the team group afterwards, so everyone knew each others' tasks for the week.

January 11 2021

Attendance: Oisín, Stephen, Ronan, Kyle

Priorities: UI and Navigation for app
Fixtures/Results print out
Lotto?
News page
Contact Page
Web interface
More details on home page
Maybe a gallery?
Maybe admin can contact a user?
About us page?

Working on: Oisín: Fixtures database print out
Ronan: Web Interface
Kyle: Profiles
Stephen: Contact page

Weekly Minutes

KEY FEATURES

- > Ability to create an account either as an admin or a user
- > Admins have extra features available and the ability to edit the app
- > An admin can schedule training for the team and send a notification
- > Users can see the upcoming fixtures, results and the league table
- > Lottery feature where users enter their details and will be given a random set of numbers
- > Users can see grounds on Google maps for directions
- > Users can contact an admin through the app
- > Gallery page showing selected images accompanied by a title
- > Workout page where registered users can select from several workouts and follow along with a timer

Implementation

There were many different software solutions available to create our app

- > We used android studio and Java for the front-end development
- > Firebase Storage and the Realtime Database was used for the back-end
- > We decided to use Java/Firebase as we were familiar with them though our previous modules over the past 2 years
- > Storing the data on Firebase also allows for the implementation of a web interface but with the same data that the mobile application uses, such as users who have registered on the app

Conclusion

- > The application provides clubs around the country with the ability to manage their club on a mobile device
- > The application is easy to use providing the users with all the relevant information on their club in one place



Architecture Diagram



Sligo Engineering & Technology Expo 2021

Computing Award

For project titled

Ethereal Soul

to

Bartomiej Bialowas David Coleman,

Evan Keith Jordan McGrath

Presented by:

Una Parsons - Head of Faculty of Engineering & Design, IT Sligo

Chris O'Malley - Vice President, Research, Innovation & Engagement

Judged by: Jarrett Gillen - Innovation Centre, IT Sligo

29th April 2021

23 certificates

Ethereal Soul

**SPACE
MONKEY
GAMES**

Bartłomiej Białowas
David Coleman
Evan Keith
Jordan McGrath



FEATURES SO FAR

- Custom Character Model
- Animations and Visual Effects
- Melee Combat and Dodge
- Enemy AI and Patrol Routes
- Life-Steal mechanic
- Soundtrack and Sound Effects
- Inventory system and Pick-Ups
- End-of-Level Boss Fight
- UI, Main menu, Pause menu
- Playable Level
- Health and Stamina



PROJECT OVERVIEW

Ethereal Soul is an action game built around life-stealing attacks. Players must 'fight for their life' in a very literal sense. Each hit - by player or by enemy - would increase the attacker's health by the damage dealt. This creates a far more intense and engaging experience.

The project continued to develop around this core mechanic. Every change was designed to fit seamlessly and improve upon the overall experience. Research went into the mechanics that other games of this genre employed, and it was decided whether to incorporate them into our game.



FUTURE PLANS

- Weapon Parts and Crafting system
- Perks and Player Progression
- Multiple levels
- NPCs, Vendors, and Side Quests
- Story and Lore
- Challenges and Skill Rewards

ARCHITECTURE

- Unreal Engine 4
- Blueprints
- C++

Unreal Engine 4 was chosen over other software, such as Unity, as it has a lot of built-in and ready-to-use features.

These features allowed us to quickly and efficiently develop a working prototype, letting us put a lot more thought and care into the game's design. Also, Unreal's blueprint system allowed us to make quick changes on the fly, without having to worry about rewriting lines and lines code.



CONCLUSION

This project has proven to be very challenging, testing many different skills; designing, programming, and creative abilities, among many others, have all improved significantly.

Working together as a team has also been tremendously beneficial. Communicating effectively was crucial throughout the project, along with our time management and task assignments. Everyone played their part, and the work flow was extremely productive and efficient as a result.

Unreal Engine, along with many other programs, were unfamiliar technology. In-depth research and testing were required for a satisfactory result.



OTHER PROGRAMS



MOVIEDECK

INTRODUCTION

Virtual Movie Nights with friends are a growing trend in today's society. On average, 700 movies are released a year, so it is often difficult to decide on a movie that suits everyone.

With MovieDeck, we aim to take away this tiresome task of finding a movie that you and all your friends want to watch, all with a quick swipe of hand!

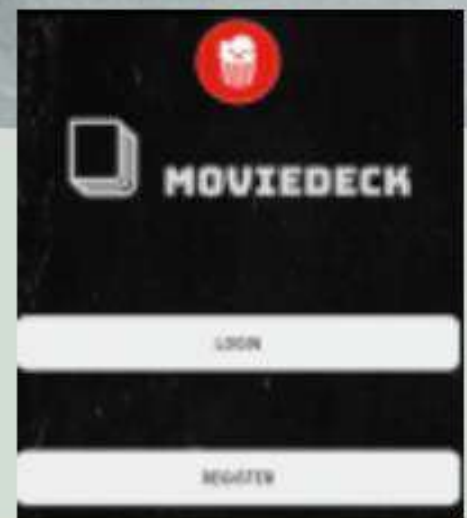


PROJECT AIM

Our goal is to provide a service that takes the task of deciding what to watch and let the app do the work for you, providing movie recommendations.

FEATURES

- Browse movies
- User profile
- Match with friend
- Watchlist



TECHNOLOGY



Software: Android Studio
Programming language: JAVA
DATABASE: Firebase
API: TMDB API
Blog: HTML, CSS, Bootstrap

PROJECT MANAGEMENT



- Conducted a survey to get feedback
- Using Trello to track ideas and progress.
- Shared code on GitHub.
- Blog to document

WORK COMPLETED



- Signin/Signup
- Add to watchlist
- Right and left swipe ability to like or dislike films
- connect and display matches
- Filter by category
- Browse/search films

FUTURE WORK



- Host on google play store
- Log in with facebook/google
- Match with specific users at the same time



CONCLUSION

MovieDeck is easy to use, adding a fun twist on choosing a movie to watch with your friends!

MovieDeck challenged our team greatly, but allowed us to utilize our skills, and create an amazing application together!

Zahra Al Bulushi / Hannah Byrne / Carla Mulligan / Kian Waters

RAGNARÖK

Meet The Team

Team Ragnarok:

- Jason Jordan - Game Development (Year 3)
- Jonathan O'Donnell - Game Development (Year 3)
- Emmett Nolan - Game Development (Year 3)
- Domas Ruginis - Game Development (Year 3)

About us:

We are a group of gamers who love stories on greek mythology so we decided to make a game of the Goddess Demeter. We are ambitious, sometimes even more than we can handle. As a team we hope this game will give you many memories playing and we also want to make it as fun as possible for this story based game.

Project Overview

After looking at already existing open world role playing games, we planned out all the features and mechanics we wanted in our game. This ranged to many different abilities to choose from to many different weapons to pick up and use.

Development Process:

The development process was essentially making all the features we wanted in the game to work. This was an extremely hard task and not every feature we wanted was put into the game for this reason. The development time took a lot longer than what we anticipated. We had to do a lot of research while using unreal engine 4 as we never used this technology or coding language before. We only ever used Unity and C#.



Initial Features

- HUD
- 4 Abilities
- Quests
- Traps
- 2 Enemies
- Boss
- Shopkeepers
- Saving/Loading
- Main Menu
- Dialogue
- Trails
- Achievements
- Loot Drops
- Sound System

Design:

As a team we designed many assets on our own using maya and blender. Such 3d models include our player character Achaues, an ancient Greek temple of Hades and a cabin that's the home of our character Achaues. We all had previous experience with Maya and Blender but still had lots to learn.



Current Implementation:

Our current implementation of the project opens with a main menu, you have the option to play the game, look at the controls or exit the game. If you play the game you enter our game world with control of Achaues our main character. You are dumped outside your home, the same home that Demeter cursed you in and your task is to find the temple of Hades to get him to help you get revenge on Demeter and undo the curse she bestowed upon you. You can go wherever you want in the level. It's fully open with no barriers. You can use 4 abilities, blood orb, change, teleport and consume potion. These abilities among the weapons you find will help you defeat the enemies in your way.

Features Included

- HUD
- 4 Abilities
- UI
- Inventory
- Main Menu
- 1 Enemy

Learning Outcomes

To be Proficient in blueprints in Unreal Engine 4

As a team we now have great proficiency in unreal engine 4 as that was our main coding methodology. We accomplished many things using blueprints such as creating a main menu, HUD, UI and various abilities.

To have a better understanding of C++

We did not learn as much C++ as we would have liked. Many tutorials and information online were directed at blueprints instead of C++ coding. This is because many gaming studios have adopted blueprints over C++ because blueprints is a lot more manageable and it attracts new people learning how to make a game.

To be able to design and model effectively using Maya and Blender

We learned many things with our time in Maya and Blender. We learned how to properly texture a model, how to import and export files and how to animate the objects.

To collaborate efficiently as a group.

As a team we worked very well together. There was some miscommunication at the start but that was quickly resolved. It was a learning curve learning how to work most efficiently with each other but after a year we got more efficient as time went on.

To manage our time appropriately

It was hard to manage our time especially with all the other projects and modules we had to do. Nevertheless, we overcame this and completed all our deliverables in the given time.



Software used throughout project

- Unreal Engine 4 *v4.25)
- Maya
- Blender
- Visual Studio
- Paint
- Adobe Photoshop 2019
- Adobe Illustrator 2019

Technologies



Software used throughout project

- Github
- Mixamo
- Microsoft Teams
- Discord
- Trello
- Epic Games Store

Future

If we were to continue developing our game Ragnarök, there are a few things we would like to implement.

These things are:

- Cut scene of Demeter cursing you
- Sides quest with Hades.
- Main quest of hunting down Demeter.
- Level up system, getting experience from fallen enemies.
- Different enemy types.
- Final Boss as Demeter.
- Different weapons such as spear and mace.
- Abilities are unlocked from Hades not automatically.
- Model of Demeter and Hades

Once we complete these things above, we believe our game would be a final product worthy to be published on steam. Many small teams publish their games on steam, and some find amazing success and we believe there is a big market for a game like this. Seeing how our game was developed using Unreal Engine 4 it shouldn't be a problem compiling for steam as the two are very compatible. If we do decide to future develop this game, we could be potentially looking at a 2022 release date.

Conclusion

A very important part of every project including this one was teamwork and how efficient our team members work with each other. A huge part of a team working well together is communication and common interests. That is why we think we worked well together as a team. Our game relies on many systems working together efficiently. Such as the ability system working with the weapon system. You can't have one being overpowered, if you do why would a player bother with the other one.

Our project tested each member individually skills. We all had to model, code and design as well as manage the project and our time. I think using the agile methodology help us with this aspect. We made sure to meet up weekly and get something done. This bumped up our efficiency in working together as a team.

Considering the fact, the we chose to work on a new technology such as unreal engine 4, something we never touched on before, we still managed to make a final product to be proud of. Something we think is unique as of right now and in the future will only grow to gain respect of others in the gaming community.

SIMPLY BUDGET

Team Members

Anna Gwizdz - Software Dev - Testing & Code
Shannon Viney - Software Dev - UI Design & Graphics
Robert Donoghue - Software Dev - Project Lead & Code

Background

Simply budget android app allows the user to manage their money using an easy envelope-based system.

We found multiple applications on the market that have the same simple budget system.

The complexity of other applications can be too high for users new to budgeting and they wish for a more user-friendly solution.
This is the demographic of our target audience

Methodology

We used Agile techniques as we were working remotely with a new language and IDE.

CD was used along with Trunk-Based coding workflow for our team size.

Trello helped organise a 2-week long backlog.

Manual logging was done on Office 365 via Teams.

Weekly meetings were scheduled with the team and our supervisor. This helped us prioritise what needed to be done and discuss immediate or ongoing issues.



Tools/Technologies



Architecture



Conclusion

Remote work at the time was mandatory- we as a team had to adapt to the new ways of development

It was difficult yet rewarding to get to the point where we are. Some issues along the way tripped us up with GitHub and Andoid Studio but eventually we resolved them.

This project put our skills, communication and time management to the test: SQLite datanase design, graphics design, UX design, writing new java script and working with more than two pages applications.

With the limited time we had and using new software that we learned in three months.

We are happy with the outcome of the budgeting app. We are pooud to demonstrate the skills we have learned over the years and work on a big project with a team.

UNOWN

Meet The Team

Team Unown:

Simran Dhillon
Mohamed Shiha

Mattie Bowen
Adil Rouibet

About Us:

A team of developers with a passion for games development who decided to create an exciting sci-fi game with unique mechanics designed to challenge the player and keep them engaged.

All team members are year 3 Games Development Students

Project Overview

The aim of the project is to create a fun and interesting sci-fi game that allows players to control their environment and the objects within it using telekenises, teleportation, thermal vision and blink.

Research:

Having researched various Sci-Fi games we found several mechanics and aspects that we would like to implement such as:

- Portals
- Teleporting
- Time Dilation
- Telekinetic Abilities
- Thermal Vision
- AI Behaviours
- Particle Systems
- VRT
- Level Streaming
- Scene Transitions
- Material Design
- Lighting



Portal



Thermal Vision / Invisibility

Project Design:

After researching different aspects within the Sci-Fi genre we decided to combine several mechanics to develop a unique experience for the player such as thermal vision and invisibility.

Development Process:

We decided to use agile approach throughout the development process of project Unown. Using Github and Trello we were able to track and manage the development process. Each member was assigned tasks to complete before a weekly meeting where we would recap and address problems to maintain quality assurance.

Technologies

Software used throughout the project:

- Unreal Engine
- Maya
- Trello
- Github
- Audacity
- PhotoShop
- Substance Designer
- Discord
- Teams
- Visual Studio
- Substance Painter
- Paint 3D



Future

With our architecture design choice, we have made it possible to implement additional levels and features to make future development more efficient.



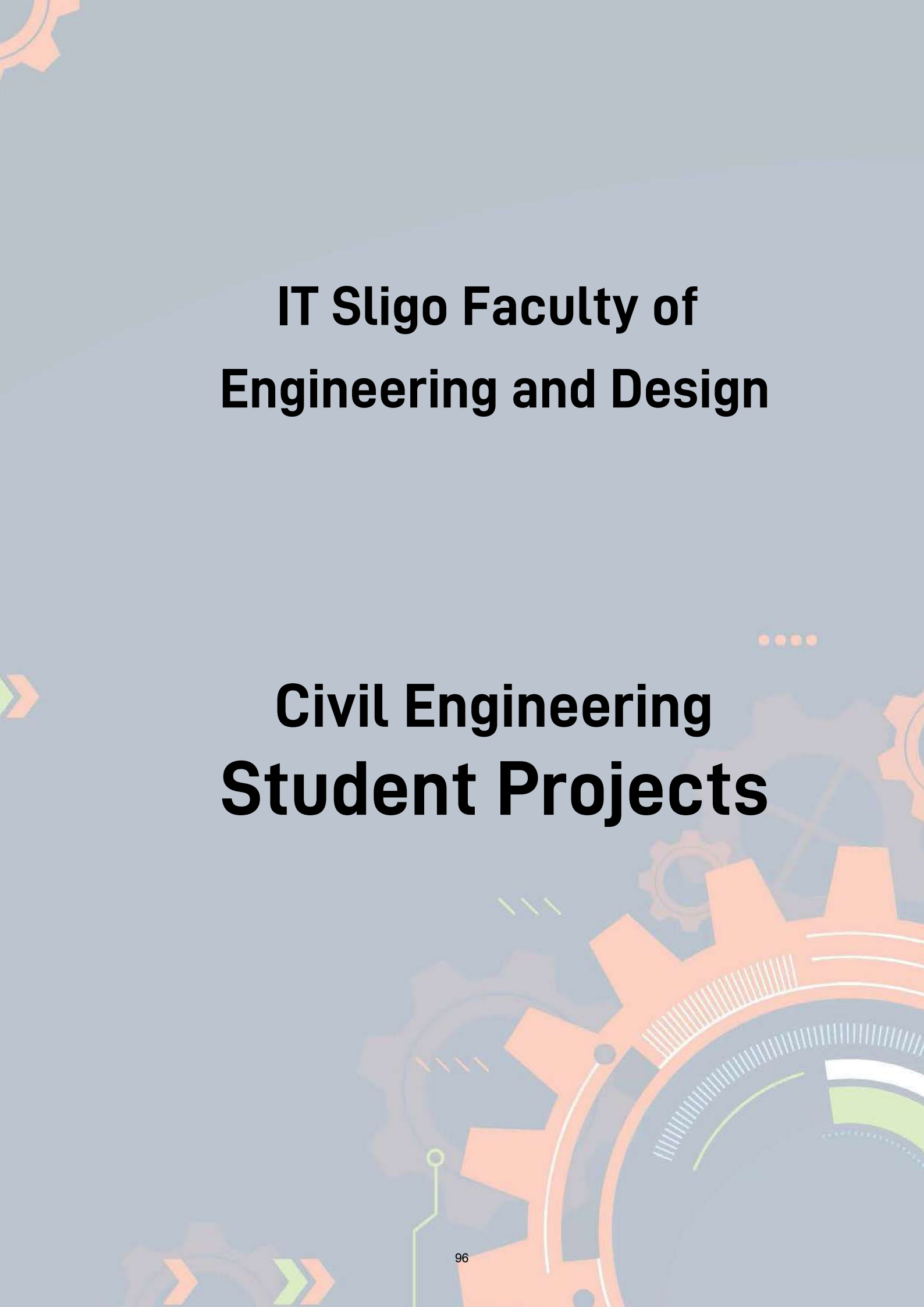
Level Concept

Ideas for future implementation:

- AOE Abilities
- Destructible Environments
- Mind Control
- Story Elements
- Companion
- Progression Tree
- Boss Enemies
- Vehicles
- Weapons
- Inventory System
- Quest system
- Cosmetics

Conclusion

Having good communication within the team was the key to consistent progression. The team and the game both progressed together throughout the project life cycle. To attempt to reach our desired goal, we had to rely heavily on teamwork and testing our individual skills. The outcome of this resulted in a playable prototype with core mechanics implemented and functioning which is a step closer to our desired result.



IT Sligo Faculty of Engineering and Design

Civil Engineering Student Projects

INTRODUCTION

Aluminum alloys are considered as economical and as a result competitive in structural applications. Although, the high costs of production and high deformability, they have many advantages such as lightness where aluminum alloys have a low specific weight which equals one third that of steel, as well as corrosion resistance and toughness at low temperatures.

AIMS

The Aims and Objectives of this report:

- To describe aluminum and its alloys
- To review their application in structural engineering
- Compare the physical properties of aluminum to steel
- To assess the merits of aluminium as a structural material compared to steel
- To design structural aluminum beams (restrained and unrestrained) and compare them with steel beams

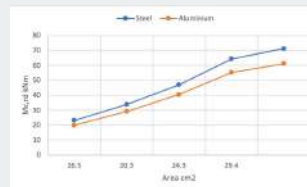
METHODOLOGY

The project focused on designing Aluminum beams as well as Steel beams. The first part was to design Laterally Restrained Beams and in the second, Laterally Unrestrained Beams.

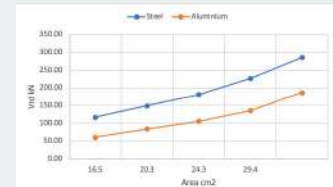
- Aluminum beams were designed in accordance with EN 1999-1-1 using Excel sheet
- Steel beams were designed in accordance with EN 1993-1-1 using Excel sheet
- Comparison between aluminum beams and steel beams was made using graphs.

RESULTS

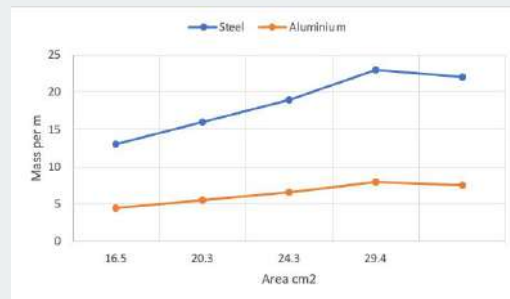
Aluminum and Steel beams design results



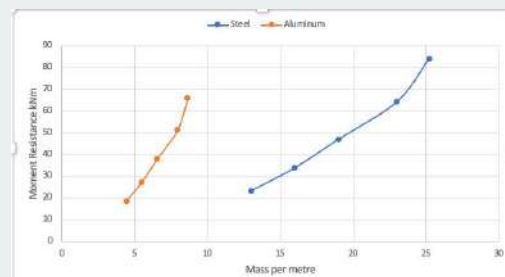
Area versus Bending moment resistance



Area versus Shear



Area versus Mass per meter



Bending Moment resistance and Mass per metre

CONCLUSION

The summary conclusion of this study was:

For the same beam sections, Steel beams provide larger shear and bending moment resistance than aluminum beams. However, Aluminum beams are lighter, and provide acceptable shear and bending resistance. For example, a steel beam of 13kg/m provides 23.15 kNm moment resistance, whereas a 4.45 kg/m aluminum beam provides 18.5kNm.

Aluminum beams are applicable to use for long-span roof systems when live loads are less compared to dead loads and for structures in corrosive environment.

INTRODUCTION

This research project focused on the analysis and assessment of masonry arch bridges. It is vital to preserve these structures as part of our transport infrastructure, both economically and as our heritage. Figure 1 presents a masonry arch bridge built in the 2nd century and stands to this day. Masonry arch bridges are a durable form of construction due to their funicular shape and materials. The arch behaviour is similar to an inverted chain acting in compression rather than tension, as shown in Figure 2 (a) and (b).



Figure 1 – Masonry arch bridge (Wanders, 2019)

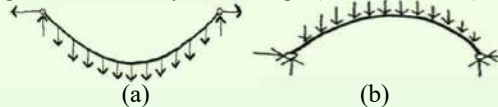


Figure 2 – (a) Cable acting in pure tension and (b) Arch acting in pure compression (Millais, 2017)

AIMS OF THE RESEARCH

- Identify how various masonry arch bridges respond to changes in geometry and defects that may during their lifetime
- Perform a parametric study using two methods of masonry arch bridge assessment and compare the results obtained.
- Determine the accuracy of these methods in assessing masonry arch bridges.

METHODOLOGY

A parametric study was conducted using the MEXE method and LimitState:Ring analysis on various arch bridges. The study was carried out to verify if both methods provided similar load assessments as reported in the literature and to identify the cause of discrepancies that might exist. The study involved varying geometric and material properties using both methods. The assessment approach and all the variables assessed in the parametric study are shown in Figure 4 and 5.

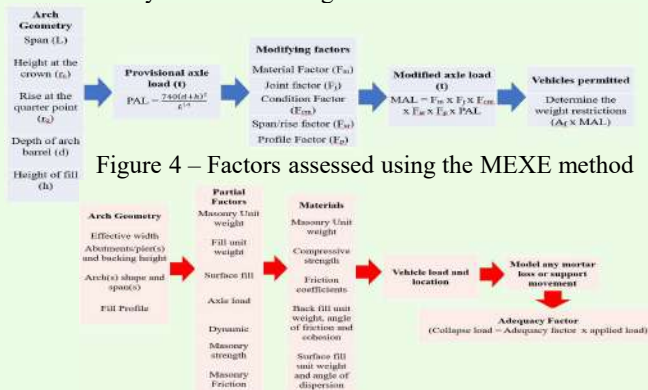


Figure 4 – Factors assessed using the MEXE method

Figure 5 – Factors assessed using the LimitState:Ring analysis

RESULTS

- Figure 6 (a) and (b) presents output graphs from the MEXE methods excel parametric sheet. The plots are created using a semi-empirical formula contained in the MEXE method.
- Figure 7 presents the line of thrust in blue which indicates how forces will travel in the arch, the red dots represent hinge locations where cracks will likely occur.
- Figure 8 presents how the results vary in both assessment methods.

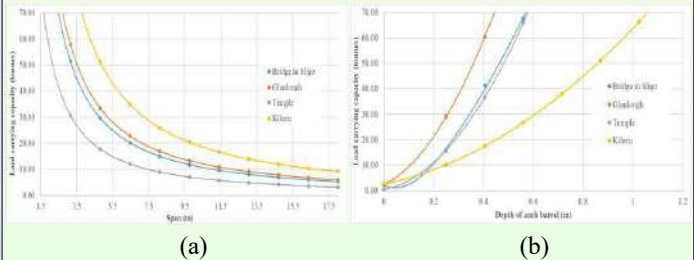


Figure 6 – (a) Span versus load carrying capacity and (b) depth of the arch versus load carrying capacity

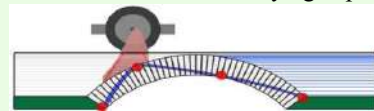


Figure 7 – Bridge model output from LimitState:Ring

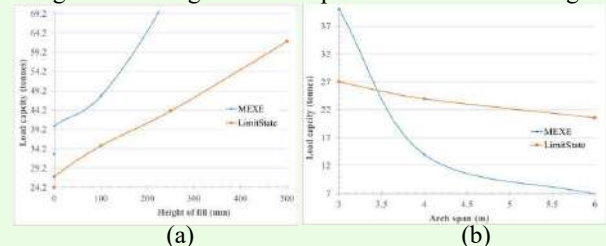


Figure 8 – (a) Effect of height of fill on the arch load capacity and (b) Effect of arch span on the arch load capacity

CONCLUSIONS

- A higher depth of fill allows for higher load carrying capacities as it provides a pre-stressing force on the arch and also restrains the arch against lateral movement. Figure 8 (a) demonstrates this effect and indicates that the MEXE method is overestimating the load capacity of the arch.
- Longer spanning arches produce lower load capacities as the arch geometry moves away from the more efficient funicular shape, preventing the arch from acting in pure compression as shown in Figure 8 (b). The MEXE method appears to be conservative in its load carrying predictions, producing lower load carrying capacities as compared to LimitState:Ring.
- The MEXE method can be conservative in its load capacity predictions but can also overpredict, whereas LimitState provides more consistent results due to its detailed analysis capabilities.

The Design and Assessment of Embodied Energy and Carbon in Different Concrete Mixes

Máirín Dolan – Bachelor of Engineering (Honours) Civil Engineering

Dr. Tomás O'Flaherty – Supervisor

INTRODUCTION

Every manufactured product requires varying quantities of energy to produce it. Cement is the most widely used manufactured material in existence, while concrete is the most consumed commodity in the world, second only to water. Unfortunately, concrete production has a very heavy carbon footprint. Every tonne of normal Portland cement produced generates 1.25 tonnes of carbon emissions into the environment. Carbon emissions cause climate change resulting in global warming, rising sea levels, the destruction of natural habitats, extreme weather events and many other deleterious effects.

Carbon emissions from cement production account for almost 8% of all global CO₂ emissions (IPCC Report, 2020). The 2015 Paris Climate Agreement has a target to limit global warming to below 2 degrees Celsius for the remainder of the 21st century. The cement industry must reduce its CO₂ emissions by a minimum of 16% by 2030 to comply with this target, and to net zero by 2050.

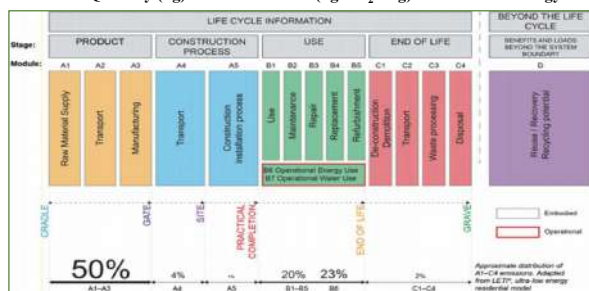
AIMS

- Carry out a literature review to gain knowledge and awareness of how concrete production can become a more sustainable industry.
- Determine what concrete constituents contribute the most embodied CO₂ and identify lower carbon alternatives such as secondary cementitious materials.
- Apply environmental assessment methods such as BREEAM, environmental product declarations (EPD) and life-cycle analysis (LCA) as benchmarks to assess different concrete mixes.
- Present a parametric study of the embodied carbon in 6 different mix designs, as specified for structural elements of a concrete frame building.

METHODOLOGY

- Assessed the embodied carbon in different concrete mixes by applying the following formula:

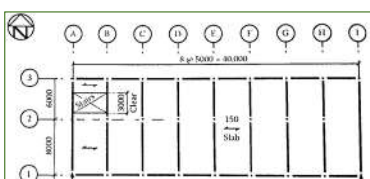
$$\text{Material Quantity (kg)} \times \text{Carbon Factor (kg CO}_2\text{ / kg)} = \text{Embodied Energy}$$



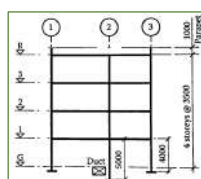
Life Cycle Stages and Modules (BS EN 19578, 2011)

The life cycle stages and modules set out in BS EN 19578, 2011 were used for environmental impact assessment. 50% of the embodied carbon of a product is produced at the A1 – A3, cradle to gate stage.

The Structural Carbon Tool from The Institution of Structural Engineers was utilized to calculate the embodied carbon in structural elements for the building, shown below. Various concrete mixes were explored to find the most sustainable mix with the lowest amount of embodied carbon.



Floor Plan



Elevation

RESULTS

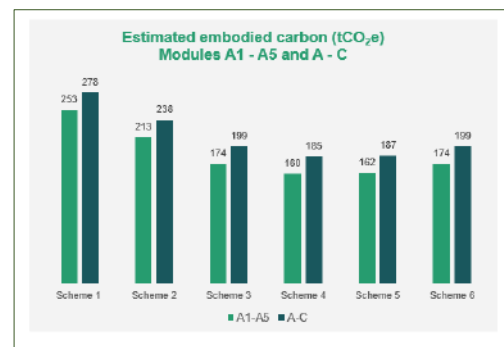
The embodied carbon was estimated for a reinforced concrete frame structure.

Reinforced Concrete Structural Elements

Elements	Dimensions (m)	Concrete (mm ³)	Steel (kg/m ³)
Beams	0.3 x 0.3	59	220
Edge Beams	0.3 x 0.35	34	220
Columns	0.3 x 0.3	36	350
Slabs	0.15	420	110

Concrete Mix Specifications

Scheme	Concrete Strength	GGBS (%)
1	C25/30	0
2	C25/30	25
3	C25/30	50
4	C25/30	75
5	C32/40	75
6	C40/50	75



- Considering modules A – C, the life span of construction materials from the cradle to the grave, Scheme 4 has the least embodied carbon, 35% less than Scheme 1.
- Carbon assessment tools optimise the most sustainable concrete mix and expedite the design process.

CONCLUSIONS

- Normal Portland cement is the concrete constituent that contributes the most embodied carbon to a concrete mix.
- Replacing Portland cement with secondary cementitious materials such as GGBS, fly ash, silica fume and other natural pozzolanic materials can significantly reduce the amount of embodied carbon in a concrete mix design.
- Reinforced concrete (RC25/30) produced using 75% GGBS concrete contains 35% less embodied carbon per meter cubed compared to the same strength of concrete made with CEM 1 concrete.
- CEM 111/B contains 66-80% GGBS and has the lowest amount of embodied CO₂ per tonne.
- Smaller structural elements can be produced using higher strengths of concrete that contain GGBS, fly ash and silica fume (industrial by-products) to replace CEM 1.
- In addition to using secondary cementitious materials in lieu of normal cement, concrete manufacturers should utilise more renewable energy such as wind, solar and hydro power. This will further reduce the amount of embodied energy and carbon in concrete mixes
- Concrete mixes containing GGBS have slower initial strength gain and lower heat of hydration compared to concrete produced using CEM 1. For this reason, these mixes are less suitable for emergency repair works carried out during cooler weather.
- BREEAM recognises the increased resilience and durability of concrete containing GGBS and can award a significant number of credits to a project where it is specified.

USING THE KORE INSULATED FOUNDATION SYSTEM TO PREVENT THERMAL BRIDGING IN DOOR AND WINDOW THRESHOLDS

Project Author - Donncha Gilligan

IT Sligo

INTRODUCTION

This study analyses the viability of using the Kore Insulated Foundation System as load bearing insulation in door and window thresholds.

RATIONALE STATEMENT

In today's world, energy production techniques, and methods of reducing energy consumption are constantly being updated and researched in the fight against climate change in order to reduce the amount of carbon released into the atmosphere. In order to achieve this goal new insulating technologies are constantly being developed and improved upon for use in housing sector or industry. In most modern building door and window manufacturers require their product to be supported from beneath. In order to provide this a stable platform must be provided, this platform often becomes a thermal bridge, making the building less efficient. The goal of this paper to determine if the KORE INSULATED FOUNDATION SYSTEM has the required properties to solve this problem. As part of the current manufacturing and insulation process insulation blocks are cut to size and the off cuts of this process are recycled. This paper intends to provide a use case for this waste product.

AIMS AND OBJECTIVES

Review published literature relating to expanded polystyrene and its mechanical and insulating properties.

- Determine the suitable systems and technologies currently used to prevent thermal bridging in doors and window thresholds to meet current building standards.

- Use case studies to demonstrate how effective various processes, systems and technologies are at preventing thermal bridging in doors and window thresholds

- Investigate experimentally in the laboratory the efficiency of Kore Insulated Foundation System at supporting the dead and live loads imposed on it by the doors and windows, and analyse how the material will react to the loads over an extended period of time.

EPS

Expanded Polystyrene (EPS) is a form of plastic which is made from crude oil. It has a variety of uses but the one which is explored in this paper is its use as a thermal insulator, particularly its use as insulation in buildings.



KORE INSULATED FOUNDATION SYSTEM

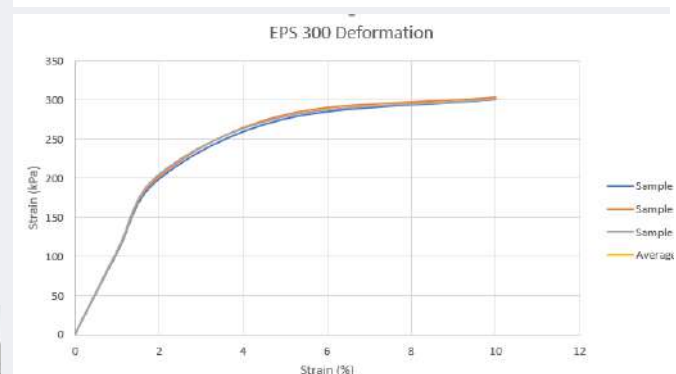
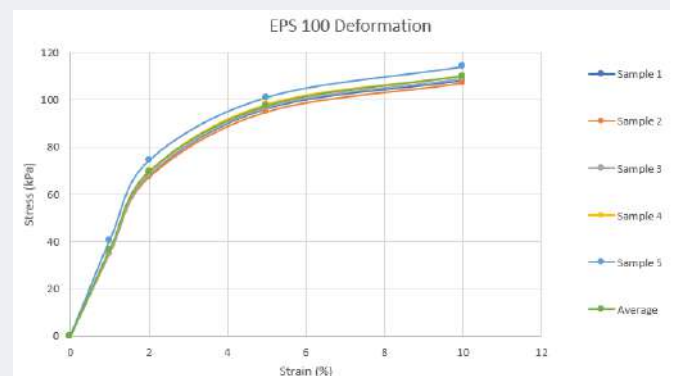
The Kore Insulated Foundation system consists of ridged pieces of EPS which prevent thermal bridging from concrete floors. A typical installation would consist of three Kore products, they are Kore Floor EPS100 White, Kore Floor EPS200 White, and Kore Floor EPS300 White. The system works by providing an insulating layer between concrete floors and the soil below.



METHODOLOGY

The compressive strength and the U-value of the EPS 100 and EPS 300 grades of the insulation were analysed. The compressive strength of the materials was determined according to EN 826, the compressive behaviour of thermal insulating products and the U-value was determined according to EN12667, Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Products of high and medium thermal resistance.

RESULTS



EPS 100 U Value = 0.034218 W/mK

EPS 300 U Value = 0.031998 W/mK

CONCLUSION

The Kore Insulated Foundation System not only has excellent insulating properties but also has the required compressive strength to support doors and windows. Currently the only rival product on the market is Compacfoam, however, this material is designed to much higher compressive strengths and as a result is very expensive making it uneconomical for commercial housing projects.

The effects of pH on the formation of trihalomethanes (THM) in wastewater treatment

Darragh Drury – Bachelor of Engineering (Honours) in Civil Engineering

Supervisor – Salem Gharbia

Introduction

The formation of THMs in drinking water is a worldwide problem. It is a major engineering challenge to reduce and control the level of THMs in water to create a safe drinking water environment. THMs are formed when chlorine which is present during the chlorination process in a wastewater treatment plant (WWTP) mixes with organic matter found in raw water. There are many factors that impact on the concentration of THMs formed. This project focuses on how pH effects the concentration of THMs formed. Controlling and reducing the level of THMs in drinking water is important as THMs are carcinogenic.

Aims

The aims and objectives of this project were to:

- Carry out a Literature Review on THMs and how pH effects the level of formation.
- Carry out experiments on raw water samples and tap water (chlorinated in a WWTP) samples at different pH levels to find the effect pH has on the formation of THMs.
- Form an experimental database from the experimental results so a statistical analysis can be completed.
- Determine the optimum pH conditions for the disinfection process to reduce the formation of THMs.
- Form recommendations that will help the engineering challenge of reducing and controlling the level of THMs in drinking water.

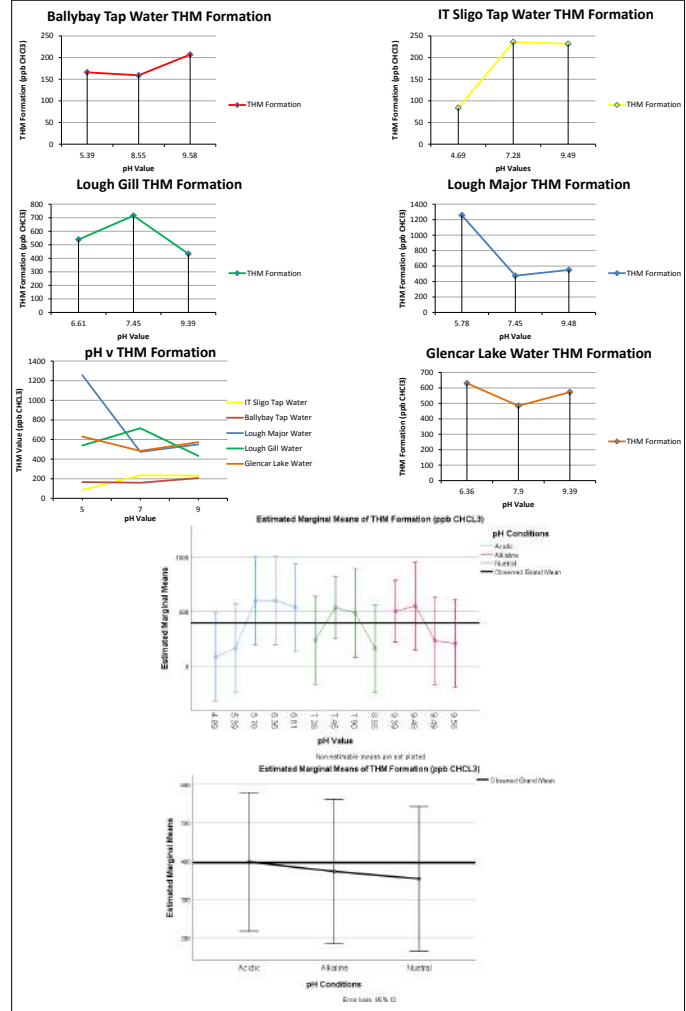
Methodology

This project involved conducting experiments in the water lab to determine the effects of pH on the formation of THMs:

- The experiment procedure used to determine the level of THMs was the water bath and THM PLUS method.
- 5 water sources were examined which included 3 raw water sources and 2 tap water sources.
- Chlorine granules at a chlorination dose of 1mg/L was used in conjunction with a 3-4hrs contact time to chlorinate the raw water samples.
- 3 samples were examined from each water source; this included a water sample at an acidic, neutral and alkaline pH level. The acidic and alkaline pH water samples were created by adding pH buffer to the water samples.
- A precise 30 step method was then conducted on all of the water samples.
- The DR2800 spectrophotometer was the instrument used to determine the water samples THMs formation after the experiment was completed.
- Below shows five images taken during different stages of the experiment procedure.



Results



Conclusion

The following conclusions were made after this study was completed:

- It is difficult to recommend an optimum pH condition that will reduce THM formation as THM formation was reduced at neutral pH conditions for 3 of the water sources, while THM formation was also reduced at acidic and alkaline pH conditions for the remaining 2 water sources.
- This study only analysed the formation of THMs in relation to pH conditions. There are many other factors that can cause a formation of THMs, which could have impacted on the results of some of the water sources. This is seen where the graph lines do not all have a common shape, with reductions and increases in THMs occurring at different pH levels for some water source's. This leaves it difficult to draw a strong correlation between THM formation and pH.
- However the statistical analysis of the experimental results indicated that pH did have a significance on THM formation. Ultimately, the analysis slightly indicated that a neutral pH condition is the optimum pH condition to reduce and control the formation of THMs.
- Therefore to help the engineering challenge of reducing and controlling THMs, I recommend wastewater treatment plants to control and balance the pH of raw water to a neutral pH condition prior to the chlorination stage to reduce the formation of THMs.



Sligo Engineering & Technology Expo 2021

Civil Engineering Award

The Influence of Layer Thickness and Material Stiffness on the Modelling of Flexible Pavements for Input into the Pavement Structural Design Process

to

Michael McNasser

Presented by:

Una Parsons - Head of Faculty of Engineering & Design, IT Sligo

Chris O'Malley - Vice President, Research, Innovation & Engagement

29th April 2021

Judged by:

Paul Hardiman, Chartered Engineer, Resident Engineer, Sligo County Council; Committee member of Engineers Ireland North West Region

The Influence of Layer Thickness and Material Stiffness on the Modelling of Flexible Pavements for Input into the Pavement Structural Design Process



Project Author Michael Mc Nasser

Project Supervisor Bill O'Kelly Lynch

Date 12/04/2021

Award Bachelor of Engineering in Civil Engineering (Honors)

Introduction

This study will examine the influence of layer thickness and material stiffness on the modelling of flexible pavements. A sensitivity analysis is performed using the Kenpave programme with the aim of gaining insight into how individual pavement layer's properties effect the overall structure.

Aims and Objectives

- To describe the typical components and characteristics of flexible pavements.
- To explain how multi-layer systems with linear elastic flexible pavements may be modelled to enable the stresses/strains to be computed.
- To carry out a sensitive analysis on the effect of various parameters on the strain in flexible pavements and compare the findings of the analysis to published literature.

Flexible Pavement Composition

Surface Course
Binder Course
Base Course
Subbase Course
Compacted Subgrade



A flexible pavement is comprised of 5 main layers, however for simplicity the pavements may be modelled as a three layer system comprised of surface course, subbase and subgrade

Sensitivity Analysis Methodology

The aim of the sensitivity analysis is to gain an further insight into how each layer's properties contribute to the overall structure. To examine this, the layers thicknesses and stiffness moduli were varied incrementally in a variety of scenarios.

The asphalt layer was varied in two subbase scenarios, thin and thick subbase layers, while the subbase was varied with thin and thick asphalt layers.

For the modulus tests, three asphalt layers specified in TII flexible pavement design manual (DN-PAV-03021-05) were examined.

- AC 32 dense base 70/100 rec 3,100 MPa
- AC 32 dense base 40/60 rec 4,700 MPa
- EME2 8,000 MPa

The purpose of varying both thickness and stiffness scenarios is to provide clearer insight into the relationship between layers. The theoretical pavements used for the analysis were designed according to recommendations by Transport Infrastructure Ireland (TII).

References

TII, 2010. Pavement & foundation Design: DN-PAV-03021. Dublin: National Roads Authority.

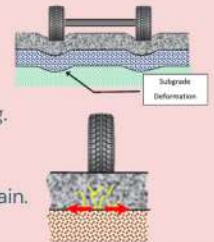
Critical Strains

Rutting

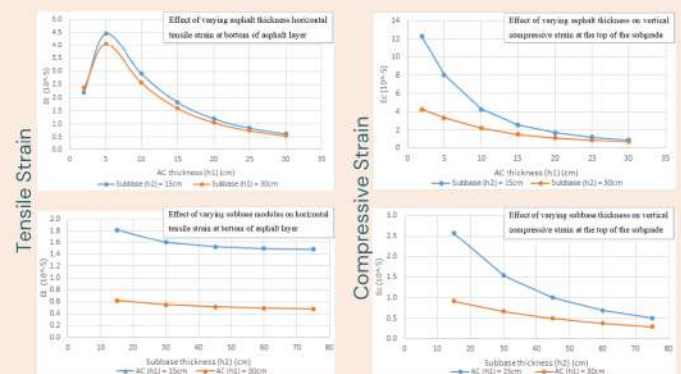
The vertical compressive strain at top of subgrade is used to control permanent deformation in the pavement known as rutting.

Fatigue cracking

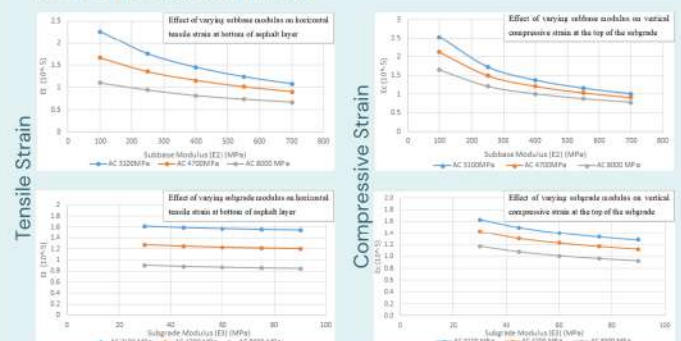
Fatigue cracking relates to the number of allowable loading repetitions to the tensile strain. Examined at bottom of asphalt layer.



Effect of Varying the Layer Thickness on the Critical Strains

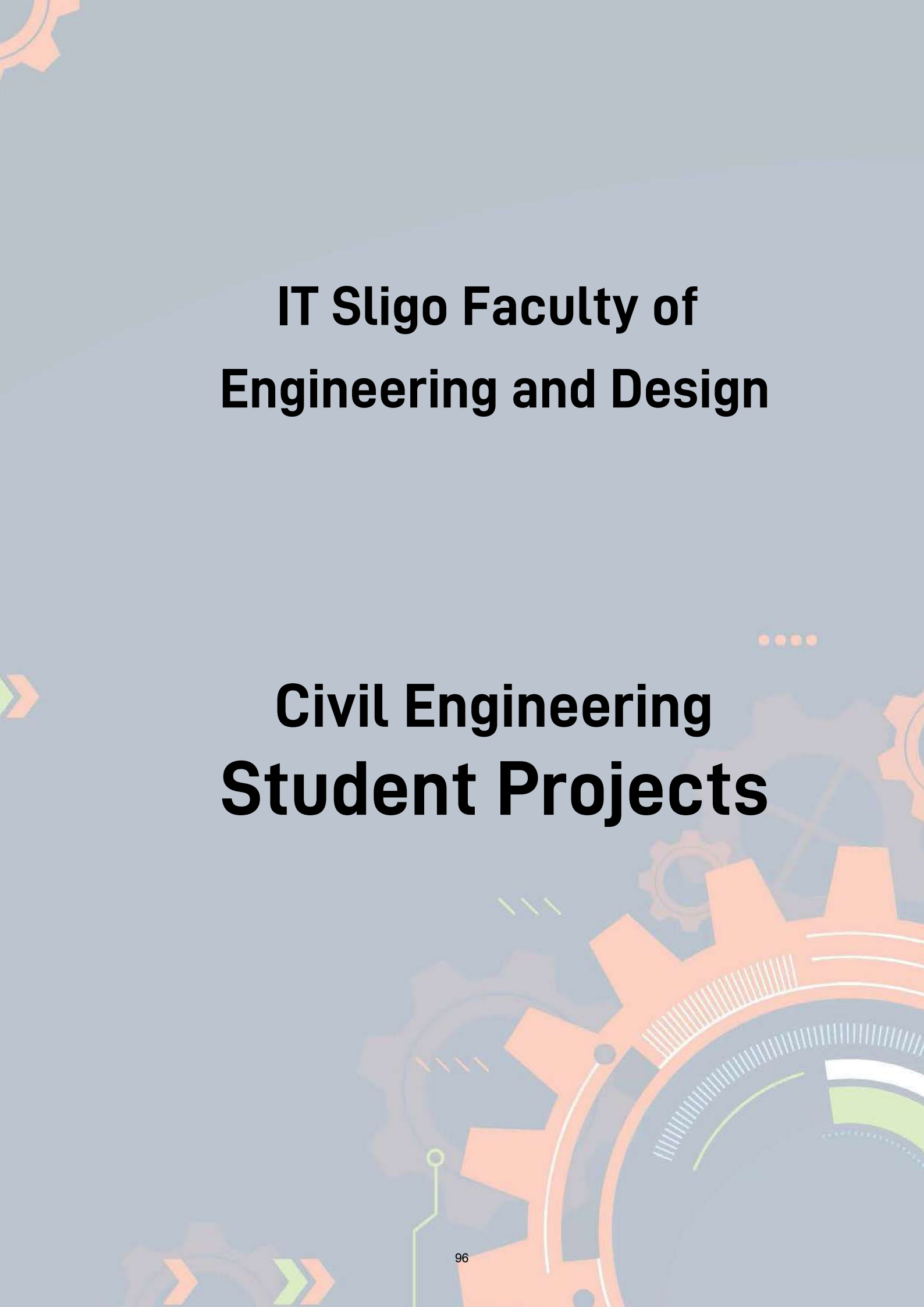


Effect of Varying the Layer Modulus on the Critical Strains



Conclusions

- The asphalt layer is the crucial layer in the control of both fatigue cracking and rutting.
- An increase to either the thickness or modulus of the asphalt layer results in a significant reduction in strain for most scenarios.
- The subbase's thickness and modulus have a less pronounced effect on the control of strain while the subbase was observed to have little effect on strain.
- In each layer, the effectiveness of the thickness and modulus in reducing strain becomes less pronounced as their values increase.



IT Sligo Faculty of Engineering and Design

Construction Project... Management Student Projects

The Role of Public Consultation During the Planning and Design Phases of a Major Infrastructure Project

Alan Coleman S00202222

BSc Construction Project Management

Introduction

The role of public consultation during the planning and design phases of a major infrastructure project is a crucial process in helping a project progress through the design phases. The aim of the dissertation research is to determine if there are changes that could improve the process, with the end result of projects not been delayed. The project focuses on the TII Project Management Guidelines for Major Infrastructure projects. The projects must follow the phases outlined in the Figure 1.



Figure 1 The Phases of a major infrastructure Project. Reference: TII Publications (2019).

Methods

Following on from the Literature review, this research adopted two methods to collect the data. (Mixed methods approach).

Firstly, a series of interviews for qualitative analysis were carried out. The questions were based on the M28 Motorway project case study. Three engineers were selected for the interviews to determine if there was an opportunity to improve or speed up the process of planning and design phases of a major infrastructure project

The second method involved collecting quantitative data in the form of a questionnaire. To determine how the participants felt about projects being delayed and determine why and where the projects are mostly delayed.

A total of 54 questionnaires were circulated, with 33 valid returns. This resulted in a 61% return rate. The use of Google Forms was used to collect the information. All the results collected were pre analysed into charts as can be seen in Figure 2.

The questionnaire was distributed to engineers, project managers and within the local authorities.

Results

Results from the qualitative analysis show that the public consultation is a critical step in identifying and resolving potential issues that may arise during the design phases. The M28 motorway project was typical project of that nature that had public involvement and a vast amount of effort went into resolving the difficulties within the project.

It is noted that the timing in which the public consultations are held can have an impact on the results, such as before an election - this brought additional political and media attention to the project proposals.

The idea of the public consultation process as been as open and transparent as possible got an interesting response; one of the engineers interviewed believed that this enabled the public to form an alliance of objectors that opposed the project for issues that would not directly affect them.

As can be seen from the Figure 2 below the results from the Questionnaire is that almost two-thirds of participants (65.6%) were of the opinion that delays occur in the pre-construction stage.

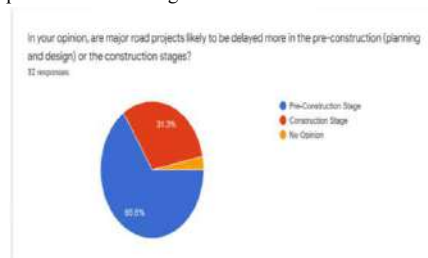


Figure 2 Question 12

Conclusion

It is noted that the chosen route should be influenced by the views of those who will use it and those who will be impacted by its construction. Public consultation gives the public a chance to air their views on what would serve the community best. Many people had the opinion that the consultations will reduce conflict.

It was noted that early engagement with landowners and residents is the best way to progress the project, therefore showing the importance of the public consultation.

It was also noted that the threshold level for objectors proceeding through to the court system should be higher and more stringent for each level of court. It is far too easy for the objectors to significantly delay a project through the courts process.

The importance of Lean Construction in relation to Construction Project Management

Author: Benin Mac Donnacha Supervisor: Paul Hamilton

Dissertation (QUSU08023) - B.Sc. (Hons) in Construction Project Management - Institute of Technology Sligo

INTRODUCTION

- For construction project management to be deemed successful, the project needs to meet the client's requirements, by complying with time, cost, quality, health & safety, environmental considerations, etc.
- For a construction project manager to achieve these aspects, they must be extremely organized, highly experienced, set out a detailed plan that is efficient and must stick to this plan as much as reasonably practicable.
- Lean construction would majorly contribute to construction project management to achieve these aspects. The term Lean Construction is a concept which aims to reduce waste, improve efficiency, and so on.
- There has been some research already done on the philosophy of lean construction, but there needs to be more done, especially now as it will be used much more in the future, especially in construction project management

AIM & OBJECTIVES

The aim of this research is, to explain that it is vitally important for construction managers to use the concept of lean construction in their projects. The research objectives to achieve this aim are as follows:

- Evaluate previous research made on lean construction.
- Explain the advantages involved with using the philosophy of lean construction.
- Investigate how projects suffer when construction managers do not adhere to the concept of lean construction.
- Discuss the positive effects of lean construction on construction project management.
- Explain why lean construction is important to the future of construction.

LITERATURE REVIEW

- Womack & Jones (1996) describe lean as "the endless transformation of waste into value from the customer's perspective".
- "The Toyota Way was historically the first domain, where the practices and principles of lean production or lean construction were formulated and developed" Gao & Low (2014).
- Ballard & Howell (2003) states that on the week-by-week work plan, only around 50% of the tasks are finished before the end of the planned week.
- A journal article by Ansah, Sorooshian, & Mustafa (2016), agrees with the fact that the principles of lean construction is beneficial to construction project management.
- Ballard & Howell (1993) states that lean project management is different from traditional management, not only in the desired standards and goals but also in its structure of phases, the relationship between those phases and the participants in each phase.
- Based on research conducted by Zhang & Chen (2016), lean tools positively effect knowledge creation, as well as promoting lean performance. This helps to understand how lean techniques function, which will increase the knowledge management of lean construction.
- According to Aziz & Hafez (2013), compared to other industries like, manufacturing, pharmaceutical, etc, the construction industry produces waste on a much larger scale. Can be seen below in (Figure 1).

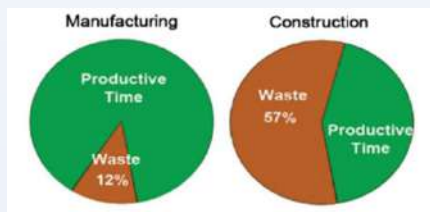


Figure 1 – Percentages of Waste in Manufacturing and Construction: Aziz & Hafez (2013)

METHODOLOGY

- Mixed method approach was used, which included both qualitative and quantitative data.
- Also, both primary and secondary research was gathered from literature reviews, interviews, and questionnaires.
- All data gathered, was reliable and from relevant sources.
- The literature review data was gathered from journal papers, books, etc. These were retrieved from Google Scholar, etc.
- The interviews were carried out in a Guided – 'semi – structured' form. The results were obtained from cognitive mapping, themes, notes, verbal and body language, etc.

METHODOLOGY CONT.

- The questionnaires were created on Google Docs and required answers from a 5-point Likert scale. Google Docs automatically analysed the results, through means, averages, bar charts, histograms, scatter charts, etc.
- Overall, the chosen methodology had to achieve the research aim and objectives, which in this project it did.

RESULTS & FINDINGS

A breakdown of the main findings are as follows:

- Importance of efficiency
- Importance of communication.
- Importance of waste.
- Positive opinions on LC.
- Design, quality, health & safety, etc, as advantages of LC.
- Further training required to properly implement LC.
- Mindset a major part of LC.
- Feasibility of lean management over traditional management.
- Concept of LC may be developed even further.
- Overall themes of positivity, seriousness, optimism, obtained from data.

Traditionally, a Construction Project Manager has been used effectively on the majority of construction projects.



Figure 2 – Scatter Chart of CPM's effective use on a project

Lean Construction is important in relation to Construction Project Management.

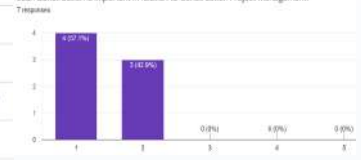


Figure 3 – Lean construction is important in relation to construction project management

DISCUSSION & CONCLUSIONS

- Overall, this research contributes to the construction industry by strongly highlighting and emphasising the urgency and importance in using the concept of lean construction, especially by construction project managers. (Figure 3)
- It mostly agrees and builds upon previous research and doesn't majorly contradict with existing research or theories.
- The biggest limitation was not being able to get the large sample size and number of respondents desired, due to the impacts of Covid-19.
- Further recommendations include, conducting research when Covid-19 restrictions aren't in place, investigating the potential of lean construction and its development in the future, as well as discover what's the best way the construction project managers could utilise lean construction.

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ACKNOWLEDGEMENTS/CONTACTS

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How the Use of AI Influences the Efficiency and Management of a Construction Project.

Christopher O'Neill S00167995

Introduction

The construction industry is currently going through change and this change comes in the form of digitalisation and artificial intelligence (AI). These programmes can be used in areas such as scheduling and design when used in the construction sector along with a variety of other tasks. This could greatly reduce the time and costs of construction projects. The ability of AI to work in conjunction with present construction management methods such as BIM, lean construction and the PMBoK method is something that could greatly improve efficiency and as a result reduce costs, waste produced and the time it takes to complete a project. Methods used when managing a project will be examined and how they could be used in conjunction with AI. Research will then be undertaken in the form of a questionnaire which will be sent to relevant industry professionals through LinkedIn.

Literature Review

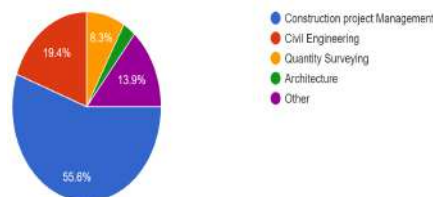
The literature review investigated the current implementation of AI in construction and how different AI technology could be used to supplement methods already in use in the construction industry. It was discovered that construction lacked investment into the area of AI when compared to other sectors. The different elements of AI were investigated to find out how they could be beneficial to construction.

- Expert Systems: Useful for scheduling and monitoring progress.
 - Heuristic Search: Useful for problem solving and site planning.
 - Natural Language Processing: Most software use this to translate commands from us into a language computers understand.
 - Vision: Could be used to prevent defects, monitor progress, enhance safety and improve efficiency.
 - Fuzzy Logic: Useful for tasks where uncertainty is a factor such as scheduling.
 - Artificial Neural Networks: Could be used for cost estimation, estimating the productivity of machinery and labour and risk analysis.
- Some of the methods used in the construction industry were investigated next to find out where AI could be used to enhance these methods and improve the management and efficiency of projects.
- Lean Construction: Focused on maximising value and minimising waste. Computer vision could be applied to this technique to monitor progress and artificial neural networks could be used to assess quality and efficiency. AI scheduling software such as ALICE could also be used to enhance this method.
 - PMBoK Method: This method defines a project as having some limited resources and a defined beginning and end. Artificial neural networks used for risk analysis and computer vision for quality control and progress monitoring.
 - BIM: Several software have been developed to work in conjunction with BIM such as Construction IQ which is used for risk management and productivity and Astralink which automatically links construction to BIM models through a computer tablet.

Research Method

The research undertaken for this project consisted of a questionnaire which was sent out to the relevant industry professional's to try and find out how widely AI software is used and what are peoples opinions on AI and its possible implementation. Data was also collected on the usage of the methods used to manage projects to find out which method is used the most. The questionnaire consisted of 16 questions. The data collected from the questionnaire was all quantitative. The questionnaire got 36 responses which formulated the data collected.

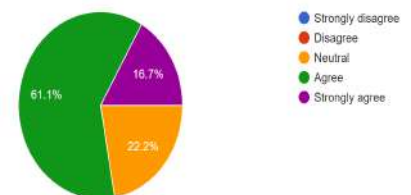
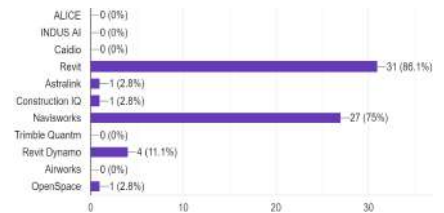
Results



The demographic of the participants was first analysed followed by the methods of construction management. The participants experience with AI was then examined with the final section comprising of a couple of questions about the organisation that employs them. Of the participants, 75% had worked on a project that was scheduled inefficiently and 83.3% had worked on a project that had gone over budget. Only 63.9% of those surveyed had even heard of the term AI in relation to construction.



Results Continued



Participants response to if they thought the development of AI in construction is slow.

Conclusions

The applications of AI in relation to construction were highlighted with each AI elements benefits explored.

- Each element of AI has at least one use that could be applied to construction.
- Despite this the uptake of the technology has been slow.
- Over 35% of those surveyed had never even heard of the term AI in relation to construction.
- The implementation of these methods in conjunction with techniques already in use would be very beneficial.
- Technology already developed to work with BIM.
- BIM and Lean Construction were used much more than the PMBoK method.
- Virtually no use of AI software among the participants surveyed.
- People working in the industry agree the development of AI in construction has been slow.
- Large majority of those surveyed worked on projects that were scheduled inefficiently or had gone over budget.
- AI could potentially solve these issues if developed correctly.

The Effects of The Digitalisation of The Construction industry on Project Management



Cormac Shaw S00175149

Institute of Technology Sligo

Module Code: QUSU08023

BSc (Hons) Construction Project Management



Introduction

The research was carried out to look at how digitalisation of the construction industry has affected the role of project management, it looked at how and why there has been a slow take up of digitalisation within some sectors of the industry? It looked at what advantages and or disadvantages there was in using these technologies, it examined digital technologies collaboration with Building Information Model, Modelling or Management (BIM) It highlighted the advancements in and the importance of data management in the industry and how it all affects the project management profession..

Aims & Objectives

The aim of the study was to use relevant literature, Interviews and questionnaires to analyse how this digitalisation of the industry affected project management. With the Objectives being, establishing the background of digital technologies, the apparent advantages and disadvantages to project management, to compare, contrast and evaluate the adoption of these technologies within the industry, to highlight whether the digitalisation of the industry affects overall project performance in comparison to that of more traditional methods and to explore why all the various stakeholders have not yet embraced digitalisation.

Methodology

There are three approaches to research Qualitative, Quantitative or Mixed methods. Given the complexity of the construction industry a single research approach would make it difficult to achieve the aims and objectives set out above, so a Mixed Method approach was chosen.

Mixed Methods

As per Greene, (2007). a Mixed methods approach is a combination of both Qualitative and Quantitative methods. With this approach the weaknesses of one method, are compensated by the strengths of the other, and they offset the inevitable method biases.

Qualitative

Qualitative research places emphasis upon exploring and understanding “the meaning individuals or groups ascribe to a social or human problem” (Creswell 2014; Holliday 2007). The Qualitative research started with a review of relevant literature. The review was carried out under the five headings listed below and these headings followed through the study.

1. Digitalisation now and the future
2. The Advantages of Digital Technologies
3. Building Information Modelling (BIM)
4. Information and Data Management systems and their advantages
5. Effects on Project Management

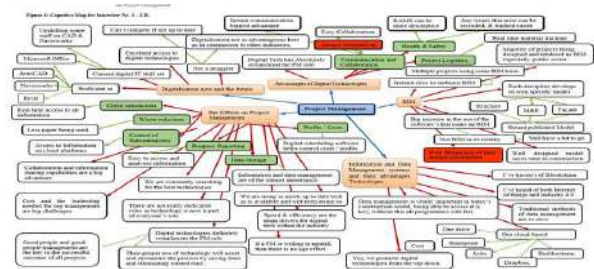
Three semi structured interviews were carried out for the second stage of the qualitative approach using questions formulated from the research in the Literature review. Due to the Covid -19 pandemic it was extremely difficult to get participants however three people agreed to a short interview.

Quantitative

In the most basic terms, quantitative research methods are concerned with collecting and analysing data that is structured and can be represented numerically (Goertzen, 2017). As part of the Quantitative research a questionnaire was constructed using Google forms, it consisted of closed ended research statements formulated from the qualitative research under the five headings. There were sixty three respondents with nine found to be invalid due to a number of reasons and these responses were removed from the survey.

Results

Cognitive mapping was used to summarise each interview transcripts

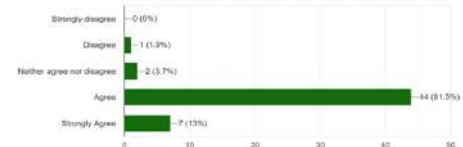


Then tables separating the interview results as per the five headings was formed. The results of the interviews supplement data collected by the literature review and questionnaires. Questionnaire results returned in a graph format and were then placed into a tabular form.

Q.38

Digital technologies complement the traditional project management role?

54 responses



Conclusions

Digitalisation now and the future

Following the study, the access and use of technologies appears to be good, the same can be said for digital capabilities within the industry. It appears uptake maybe slow dependent on the size of the organisation. However, everyone seems committed to its future.

The Advantages of Digital Technologies

The results of the study show that Digital Technologies have streamlined the project management process and had great efficiencies in regards to Communication & Collaboration, Health and Safety & Project logistics, among others.

Building Information Modelling (BIM)

Through the study it became apparent that although companies are using a lot of the individual tools needed to carry out a fully implemented BIM project, that in a large portion of the industry this type of project is not happening on the ground.

Information and Data Management systems and their advantages

The secure storage and easy fingertip access of information came out as being extremely important to the industry within the study, and that the digital systems are vitally important, this is why all participants are using these systems.

Effects on Project Management

94% of the participants agreed that digital technologies complement the Project management role in a number of ways and that these technologies will not make the Project management role obsolete.

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Introduction

Throughout the entire world safe, habitable and affordable housing is failing to supply the demand (Madden and Marcuse, 2016). In Canada, affordable housing is defined as a residential dwelling which costs less than 30% of the occupants pre tax income by the Canadian Mortgage and Housing Company. In 2016, approximately 1.7 million Canadian households were in core housing need (Baqutayan et al., 2015; Canada Mortgage and Housing Corporation, 2019; Statistics Canada, 2018). The core housing need assessment is a two-step examination process which assists in identifying housing needs throughout the country (Canada Mortgage and Housing Corporation, 2019; Waterston et al., 2015).

NANOS POLL: CANADIANS SUPPORT URGENT END TO HOMELESSNESS



<https://nanos.co/>

Methodology

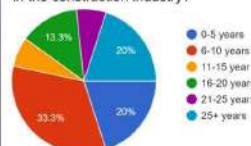
Both qualitative and quantitative methods were used in conducting the research for this dissertation. 3 semi-structured interviews and a questionnaire were the chosen methods to collect the data. The researcher considered conducting a case study by comparing the time and cost of constructing the same house with both onsite and off-site methods. The researcher determined that the fluctuating timber prices would depict an inaccurate comparison. A pragmatic approach was taken for this research as it relies on the real world practical experiences of industry professionals. The analysis of both the semi-structured interviews and the questionnaire were completed manually. A manual analysis was chosen because of the small interview sample size and a low response rate on the questionnaire.

Results Experience

The experience of the participants who took part in interviews and questionnaire was broad in both methods. The Interview participants possessed 60+ combined years of experience in positions such as Safety Advisor, Carpenter and Architect.

Questionnaire Participant Experience

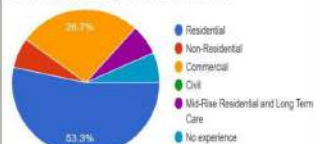
How many years of experience do you have in the construction industry?



Experience of the questionnaire participants varied from under 5 years to over 25 years with the most prominent range being 6-10 years of experience.

Questionnaire Experience Continued

What construction sector does your Offsite Construction Experience relate to?



Benefits Noted

Benefit Provided	Times Mentioned (x=individual mention)
Cost Reduction	xx
Timeline Reduction	xxxxxxx
Limit Material Waste	xxx
Increased Quality	x
Constructability	xx
Increased Productivity	xxx
Climate Control	xx
Better Material Scheduling	xx
Reduced Time On-Site	xx

Participants of the interviews noted benefits of timeline reduction, limiting material waste, an increase in build quality, climate control and reduced time on site (30-40%). A cost benefit was not identifiable but cost competitiveness was evident. Further safety and material control were heavily emphasized by 2 of the 3 interview participants.

Limitations Experienced

Limitation Provided	Times Mentioned (x=individual mention)
Design Limitations	xxx
Access to Site	x
Space for Storage	x
Unit / Module Size	x
Transportation	xxx
Required "Buy In" from all Stakeholders	xx
Design Commitment	x
Trade Worker Issues	xx

Interview Participants noted several similar limitations including unit / module size, transportation limits and commitment to the agreed design. Additionally, interview participants added careful consideration / planning when installing components to be limiting.

Conclusion

Based off of the research conducted for this dissertation, the researcher believes that off-site construction methods are viable in producing and supplementing affordable housing in its current state. This conclusion was reached based off of the interviews and questionnaires conducted highlighting the current state of technology, projects completed using the methods and support given to off-site construction by large affordable housing producers and contractors in Canada. Further the questionnaire highlighted the quality of management, safety/security, and positive outcomes attributed to using off-site construction methods. The researcher believes that these methods can help supplement the affordable housing market alongside conventional methods leading to the creation of more housing for all.



Sligo Engineering & Technology Expo 2021

Construction Project Management Award

For project titled

Use of Modular Construction Methods to Build Multi-Storey Buildings in Ireland

to

Declan Keegan

Presented by:

Una Parsons - Head of Faculty of Engineering & Design, IT Sligo

Chris O'Malley - Vice President, Research, Innovation & Engagement

Judged by:

Paul Handinan, Chartered Engineer; Resident Engineer, Sligo County Council; Committee member of Engineers Ireland North West Region

29th April 2021

IT Sligo

Use of Modular Construction Methods to Build Multi-Storey Buildings in Ireland
by Declan Keegan – S00182114



Introduction

- This chapter will give a broad outline of all matters relating to the construction of modular buildings in Ireland
- Nationwide Homes describes a modular home as 'a home constructed in a factory, away from your property, in a controlled environment and then delivered to your job site' (NationwideHomes, 2018).
- The paper strives to develop an understanding of the multi storey modular construction and the science underpinning it



Modular buildings (modularhomemanufacturing, 2017)



Puukuokka apartment building (Oopea, 2021)



101 George Street Croydon (HTA, 2020)

Aims and Objectives

- Understand the differences between traditional construction methods and modular construction methods
- Compare the cost of traditional builds to modular construction.
- Compare the build times of traditional builds and modular builds
- Understand how a multi storey modular building is constructed
- Are modular buildings constructed as well as traditional buildings
- Understand why is this type of construction method not used regularly in Ireland?

Methodology

- Research method chosen was qualitative with an in dept questionnaire being the research tool chosen
- 'Qualitative Research is primarily exploratory research. It is used to gain an understanding of underlying reasons, opinions, and motivations' (DeFranzo, 2011).
- Creswell (2014) states that qualitative methods should be used to address a research problem when there are no known variables and when research objectives need to be explored.
- Other tools considered included an interview but this was deemed unsuitable due to time constraints of the research project and also the current closure of all construction in Ireland due to the Covid 19 pandemic which made contacting construction companies very difficult. Below is the process of collecting the data.

Contact relevant Companies/ prepare questionnaire



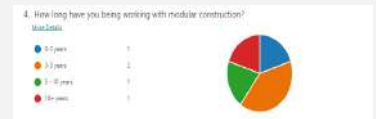
Email questionnaire to appropriate people



Responses were analysed using Microsoft Forms/Excel

Results and Findings

- The respondents to the questionnaire are very experienced in modular construction with 80% of the respondents having over 3 years experience and 20% having over 10 years experience



- 100% agreement from respondents that modular construction is quicker than traditional construction but only for houses with the same design
- 100% agreement from respondents that modular construction costs less than traditional methods
- 100% agreement from respondents that multi storey modular buildings are suitable for the Irish climate
- Confined sites, sites with poor access and poor soil quality may deem a site unsuitable for modular construction
- It was found that there are no design limitations using modular construction with the right design team in place

Analysis/Discussion

- The participants mention how all these modular buildings are A rated and are accredited by IGBC and IIBN which means they are insurable and mortgageable, thus making modular homes a very sustainable way of constructing buildings.
- All respondents were in agreement that waste material and labour is considerably less than traditional builds which means that the build cost is less, this is due to being built in a factory setting
- It was found that the reason that so few multi storey modular buildings exist in Ireland is the misconceptions that modular buildings are only temporary and cheaply built
- (Leiker, 2018) suggests that today's modular homes 'have surpassed traditional, site-built homes in terms of quality as well as energy efficiency' and thus making them a better option in comparison to traditional builds.

Conclusions

- Modular construction methods are better suited to social housing projects or multi storey modular buildings which use the same design and materials all through the project.
- For modular homes to become the future of building developments in Ireland there needs to be a substantial amount of research carried out and published for the public to move away from the lingering misconceptions around the process.
- In regards to research, there is still a huge amount of unanswered questions regarding multi storey modular construction in Ireland and abroad which is something that needs to be explored in great detail

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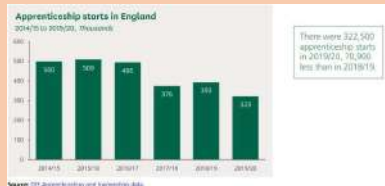
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The Efficiencies and inefficiencies of offsite construction with a focus on precast concrete construction

Derek Curran S00175968

Introduction

This paper studies the onsite/offsite dynamic. Onsite construction and offsite construction both have their pros and cons. The burning question in this paper is what does the future hold for the traditional style of the construction industry in the age of today and moving forward into the future. Therefore, this paper contributes to our understanding of the construction industry as a whole and in what direction it may lead in the future. This study looks at and questions all areas of construction. Certain sections of the industry became apparent that were in need of change mainly being the interest in the school leaver to enter the construction industry. The numbers leaving school and entering the skilled labour force is dropping and this will affect the industry and the construction sector grows. This paper studies off site construction as a possible cure all for the construction industry.



The construction industry is pivotal to the economy. "As outlined in the Build 2020 report prepared by the department of public expenditure and reform, the total investment in building and construction grew by an estimated 11% in 2019 to €27 Billion (Linesight, 2020). There is also around 129,000 persons employed in the construction industry in Ireland according to the same article. The offsite construction sector can reduce the number of labour needed on site significantly, it can also decrease project construction time on site by up to 50%.

Aims and Objectives

- Is off-site construction cost effective?
- Is off-site construction any more effective for time constraints and can it maintain a time certainty?
- Is off-site construction more or less efficient for waste on site?
- How predictable is off-site construction?
- How sustainable is off-site construction?
- How does off-site construction affect on-site labor?
- If there is a shortage in skilled labor, is off-site construction the long-term solution?
- How does off-site construction effect health and safety on site (Positive or negative)?
- What percentage of construction is currently being executed as off-site construction?
- What are the environmental impacts of off-site construction?

The main reason for this study was to understand the concept of off-site construction, what it is, and is it being utilized properly or is the construction industry afraid to move on from its traditional values. In the modern era of BIM level 2 the concept of knowing each aspect of a project before breaking ground is very much a reality. In this concept the design teams will know where every switch, socket, hinge, duct, and all other parts of a building are situated. Therefore, if these can be panelized and made off site and erected onsite at a fraction of the time, why is this not being done?

Methodology

The research for this paper is set to look at the construction industry as a whole and where it is heading with the potential of off-site construction and its efficiencies and inefficiencies. There might be gaps in the market that need to be addressed which led to the research in this paper.

Primary and secondary sources

- A questionnaire was undertaken to establish what personnel within the construction industry taught of the issues outlined in aims and objectives.
- A visit to a precast concrete manufacturing facility was undertaken to understand how the precast market works and its advantages and disadvantages.
- Informal interviews were held with this facilities operation's manager along with a construction project manager.

Quantitative and qualitative

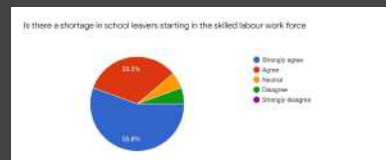
- A literature review was undertaken to establish what literature was already published on the matters pertaining to this research.
- Time constraints, cost constraints, skilled labour shortages, Environmental issues and

health and safety were all issues studied within the literature review.

Research and results

"The global penetration of off-site construction is difficult to quantify, but despite an upward trend, no major market yet exceeds 20% penetration. In the US offsite barely registers at all with Germany and Japan up in the high teens to 20%". (de Laubier, et al., 2019). Sutrisna states "that offsite construction has been hailed as a potential solution for alleviating the housing imbalance. This is mainly because of the perceived superiority offsite construction compared to conventional construction"(Sutrisna, et al., 2019).

With the research for this paper, it was found that offsite construction can have several benefits to the construction industry. Firstly, on the question of the skilled work force depleting and the industry growing offsite construction may be the solution as the requirements for labour on site is reduced significantly.



Another finding was that offsite construction can significantly reduce costs and time on site resulting in projects being completed on time more often and within budget. The results of this study found that with offsite construction project programmes are improved due to the certainty of time to manufacture the materials and budget overruns are far less likely due to the certainty of the product manufacture and pricing.



Conclusions and Discussions

In 2016 an article was released in the Irish building magazine called constructing Ireland 2027 it stated "By 2027, the CIF believes that the Irish construction industry in partnership with government can create over 100,000 additional jobs, increase construction related exports by €2 billion and increase output to €20 billion up to 2020 and over €25 billion by 2027. Furthermore, it aims to contribute on average 10 – 12 % to Irish GDP over the next decade and achieve 50 percent reduction in the overall time from inception to completion for building and refurbishment" (Downey, 2016).

As this clipping suggests the Irish government intend to grow employment in the construction industry while shortening project times and growing the industry on an international scale. However, while looking through the research for this paper, these figures don't seem achievable in the current market.

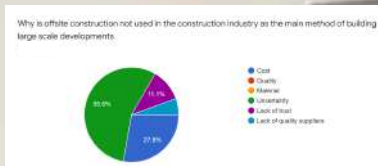
If employment in the construction sector is to increase by 100,000, reform needs to be taught out and implemented to attract school leavers to the skilled labour force or the numbers will keep dropping rather than improving. Furthermore, to reduce project programme times the industry needs to look at a fresh approach to construction.

According to research offsite construction has a twenty percent penetration into the construction industry. For projects to be completed 50% quicker, something needs to change.

With the research done for this paper, offsite construction could solve these issues. With a greater guarantee for programme times, Costings, and a significant reduction in labour needs.

The Main reasons for construction not using offsite construction according to the survey was uncertainty, with 55% using this as the reason construction continues to build traditionally.

The paper should go some way to disproving that common misconception.



H

Modular Construction

Students, Dermot Gildea S00202520

Course, BSc(Hons) Construction Project Management . Department of Civil Engineering and Construction . Institute of Technology Sligo.



Introduction

The research was carried out to look at Modular Construction, the history of modular known in a historical term as prefabrication or prefab. The different types, the advantages and disadvantage, the future of modular construction and automation in modular construction. An in-depth look at how light gauge steel modular construction can fulfil educational accommodation requirements



Picture 1 Crystal Palace designed by Joseph Paxton 1851



Picture 2 Prefab House England 1950s

Aims & Objectives

The aim of the study was to research relevant information from literature review , carry out interviews with professional in the industry and to send out questionnaires to a wider sample of people that work in the construction industry regarding modular construction.. With the objective to find out the history of modular construction , the systems being used , the advantages and disadvantages , automations , and how the use of light gauge steel framing can help to fulfill the education accommodation shortage. The interviewing of professionals and sending of questionnaire to people in the construction industry to get their view and knowledge about modular construction.

Methodology

The different methods of research methodology for this study was Qualitative and Quantities or Mixed methods.

Literature review was carried out to find current knowledge and information about Modular Construction, on the headings of the study.

Qualitative information was gained by carrying out semi-structured interviews with construction professionals who worked and had experiences in modular construction. A pre-produced list of questions were used to gather the information of the key issues and perceptions on modular construction. With Covid -19, it wasn't easy to get professionals with the knowledge of modular construction to sit down for interviews but three interviewees agreed, and the interviews were carried out at their place of work.

Quantitative information gathered from a questionnaire prepared and using Google Forms was distributed to various people working or studying in the construction industry. This questionnaire was formulated with multiple choice questions to gain background information on the respondents and questions on their knowledge and attitude of modular construction using the Likert scale. 55 questionnaires were issued 37 responses were returned



Picture 3 Light gauge steel frame modules for Temporary Classroom as shown in picture 5



Picture 4 Modules in the production line .



Picture 5 Temporary Modular Classroom

Results

The results from the information research methodology were analysed in a review of each question from the interviews to find trends in the data from the different interviewees similar to the trends in the literature review. The questionnaires results that was returned on the Google forms portal were in a graph and spreadsheet format, which allowed them to be analysed from the different respondents, which backs up the findings of the data from the qualitative research.



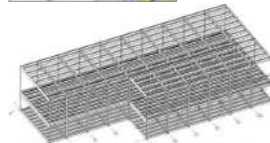
Picture 6 George Street, Croydon (Residential) Programme: 24 Months Design : A 44-storey and 38-storey tower scaling 135 meters No of Units : 546 One of the worlds tallest modular buildings



Picture 7 Timber frame Housing & Section of Wall panel



Picture 8 Precast Concrete Modular Process ,



Picture 9 Light gauge steel framing for modular Permanent school building

Conclusions

The following is the conclusions after studying and researching Modular Construction.

- The history of modular that had a stigma of poor construction is fading with the new standards.
- Modular construction is a faster way for completing buildings.
- The acceptances that modular will form a big part of construction methods for the future.
- Skill shortage in construction will be improved by the use of modular construction and automation.
- Architects and Engineers will have to invest in training staff to work with modular systems.
- Modular contractors will have to train their staff in modular systems.
- With the requirements for high insulation and environmental values modular construction suits best to meet these targets.
- The lifespan of modular building is equal to traditional buildings.
- Investment in technology and production methods will reduce the cost of modular production.
- Timber frame modular construction suits housing and low rise construction.
- Precast concrete and Light gauge steel 3D modules suits both low rise and high rise construction.
- Light gauge steel modules is suitable for educational buildings and will allow school buildings to be completed in a shorter time frame for both Permanent and Temporary buildings
- As a final conclusions a large percentage of buildings in the future will be constructed using Modular methods.



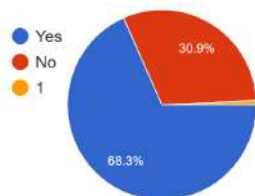
References of Pictures:
1, 2, 4 Google image, 3 & 9 BW Industries
5 MBIC Modular's 6 Vison Modular 8 F P McCann 10 Questionnaire Chart

Remote Working in the Construction Sector During Covid-19

Gearóid Murray (S00064125)

Introduction

Prior to last year (2020) over 50% of companies did not allow remote working, however over a year into a global pandemic where governments enforced restrictions and social distancing are now standard practice, things have changed; around half of those currently working are estimated to be doing so remotely. Is this something the construction sector has adopted and is it a possible benefit?



Since Covid-19, do you work remotely?

Aim of Research

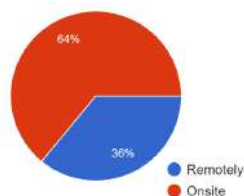
This study aims to discuss remote working in the Construction Sector; with a view to proving it's benefits and importance. It will look at the difficulties faced with implementing remote working and how advancements in software can help bridge this gap. It will look at the pro's and con's remote working provides, as well as how it measures up in productivity compared to onsite working.



Results and Conclusion

Whilst the first-hand data collected does show a slight preference with onsite working (64% of construction sector professionals who completed the questionnaire) and 50% of the Project Managers interviewed. Ultimately remote working as been proven to be invaluable to the construction sector, as without it many projects would have been completely shut down due to the government enforced restrictions and 'stay at home' orders in response to the current global pandemic (Covid-19).

Many professionals also noted they felt personal benefits of remote working and now realise the importance and positive impact it has on their lifestyle, health and well-being.



If you could choose, would you work Remotely or on site?

Methodology

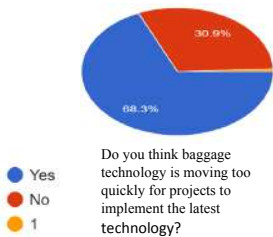
The research includes case studies and reviews of previous literary works in this and similar fields, as well as first hand opinions and experience; including interviews with construction Project Managers, as well as 138 questionnaire responses from current professionals working across many areas in the construction sector, throughout Europe and further afield.

"Technology has really changed the way we work, BIM has become more prevalent, we use virtual and augmented reality for remote site visits, and we have recently purchased a drone camera to gain more site footage...technology and remote working go hand in hand"

- Anon. questionnaire response, Remote Working in the Construction Sector During Covid-19.

Introduction

Aviation Construction and particularly the baggage systems within the aviation construction Industry are an integral part to the Life Cycle of an Airport. Baggage Systems within the aviation construction are frequently upgraded or replaced to meet current or future legislation and technical requirements to improve the safety and operational aspects of the Airport.

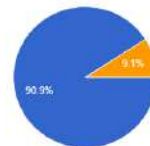


Aim of Research.

This study aims to discuss Aviation Construction and in particular the construction of baggage systems within the Aviation Construction Industry. Baggage Systems within Airports have constantly been upgraded and with technology improving at a rate that installation and Aviation cannot keep up with. Coupled with this is EU directives requiring upgrades of systems for security purposes. The aim of the research is to find out is it feasible to continue with the construction and upgrades works and such cost to the aviation industry, clients, and the disruption this causes.

Results and Conclusion

The results of the data collected from the survey and interviews indicates that Aviation professionals feel that works on baggage systems within the industry are too frequent. While the upgrades of the systems are valued, and security measurements are improved, the frequency of these projects remains critical. With legislation constantly changing within the sector and the accelerating rate in the advancement of technology. Operations also suffer with all the disruption during the ongoing projects. With all of this it was also observed that during the pandemic of Covid -19 that works on projects could flourish as the disruption to operations were avoidable as the downturn in the aviation industry with Covid was a perfect time to upgrade the Airports.



Do you feel that the EU directives are too frequent for airports to keep up with?

Methodology

The research includes case studies and reviews of previous literary works in this and similar fields, as well as first-hand opinions and experience, including interviews with Aviation and Construction Project Professionals, as well as a questionnaire and survey responses from current professionals working across many areas in the Aviation Construction sector, throughout Ireland, UK, and Europe.

How Modern Methods of Construction can be used to off-set risks that would be traditionally evident in Construction Projects

Author: Jason Torris S00195235

Introduction

Modern Methods of Construction (MMC) are innovative techniques offering solutions to an underperforming construction industry. The fundamental aim of this paper was to thoroughly investigate if MMC could off-set time risks that are present on traditional construction projects. It is hoped that this paper will offer an insight to those both in the world of academia and the industry, in gaining an understanding of the time benefits MMC can offer.

Research aims, objectives and questions

Understanding if Modern Methods of Construction (MMC) techniques could be used to off-set the time associated risks that would be traditionally evident in construction is the fundamental aim of this research.

1. To explore the traditional risks associated with construction projects.
2. To investigate Modern Methods of Construction and explore the programme management techniques used.
3. To examine if MMC, using standardised construction approaches, can help enable more accurate time estimation, at the planning stage.
4. To establish how MMC can assist the management of projects and minimise the risk associated with construction programming.

Methodology

Primary and Secondary Data Research

Primary data research is contained first-hand and collected by the researcher (Nasom, 2007). The below-mentioned surveys are an example of the primary data research collected in this dissertation. Secondary data is collected and obtained from other sources (Nasom, 2007). The data collected in the Literature Review chapter represents secondary data collected for this dissertation.

Qualitative Research

Qualitative research can be described as subjective. It places importance on people's experiences and meanings (Nasom, 2007).

Semi-structured interviews were conducted as part of qualitative research. This utilised open and closed-ended questioning. It allowed the interviewee to uncover as much from the interview as possible.

Quantitative Research

Online survey questionnaires were conducted as part of the quantitative research method. The surveys asked a series of questions to be answered using a five-point Likert scale.

The online survey questionnaires was completed by 63 people, it allowed research to be gathered from a large base of the population with a relatively non-time-consuming task. The questionnaires were formulated to further examine the information collected from the literature and semi-structured interviews, while also testing out one's hypothesis for accuracy.

Mixed-Method Approach

This dissertation was developed through a mixed-method approach utilising both qualitative and quantitative methods.

Creswell et al. (2003) explained that adopting a mixed-method approach has benefits. It allows for a deeper interpretation and triangulation of the research.

A mixed-method approach was selected as the advantages of both methods can be extracted and offset against the disadvantages of the other.

Ethical Considerations

While conducting the research certain ethical considerations were accounted for.

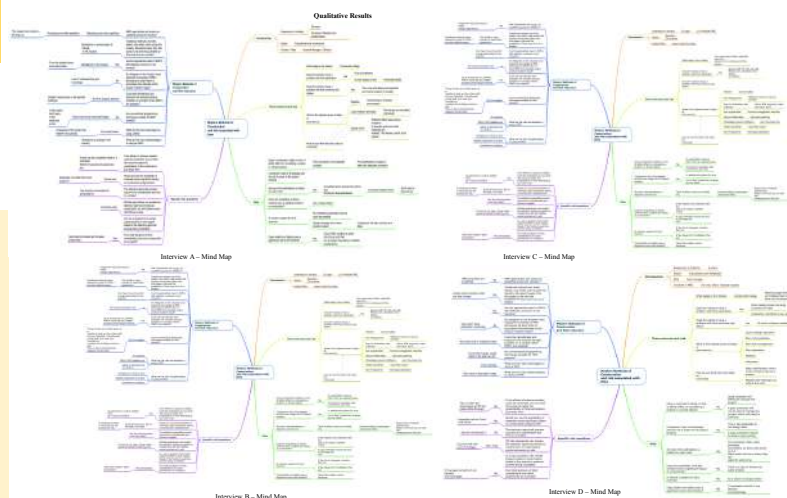
During the write-up stage, all attempts were made to avoid bias. No falsification or invention of findings took place to meet the audience needs. All results published are fully and honestly reported.

Methodological Limitations

A core limitation of this research was the Covid-19 pandemic.

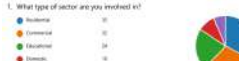
Time restrictions and correspondingly the word count imposed further limitations on this study.

The authors first time conducting academic research of this kind.



Quantitative Results (63 responses)

1. What type of sector are you involved in?



2. How long have you been involved in the Construction industry?



4. Are you involved with Modern Methods of Construction?



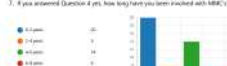
5. If you answered Question 4 yes, what type of MMC are you involved with?



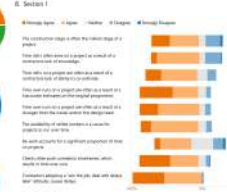
6. If you answered Question 4 no, do you envisage your company using an MMC approach in the future?



7. If you answered Question 4 yes, how long have you been involved with MMC?



8. Section 1



8. Section 2



10. Section 3

Strongly agree Agree Neither Disagree Strongly disagree



11. Section 4

Strongly agree Agree Neither Disagree Strongly disagree



Conclusions

One could conclude from the research conducted that, the innovative techniques used in Modern Methods of Construction could be used to off-set risks that would be traditionally evident in Construction Projects. This can be done through standardizing the procedures. Adopting off-site, simplified, and repetitive processes which shield the construction development from traditional risks, could provide the platform for less risk in construction programming.

Recommendations for future research

Regarding further investigation and research of this topic it would be beneficial to investigate if Early Contractor Involvement would further reduce risks. As Modern Methods of Construction (MMC) have their own constraints, it would be advantageous to discover if the contractor, at an early stage, could lessen these risks, making the timeline on the project more efficient.

Implications of the study

Relative to the research undertaken it could be argued that Modern Methods of Construction (MMC) can be used to off-set risks that would be traditionally evident in Construction Projects. MMC techniques could be adopted on time restricted projects where time assurances are of a high priority. The practices used in MMC could the traditional risks that were outlined throughout the document. This has the potential to create shorter more productive timeframes on projects, thus improving the overall performance of the industry.

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Discussion and key findings

Through the research, the construction stage was deemed the riskiest on a project. A Contractor's lack of knowledge and ability also gives rise to time associated risk. Inaccurate time estimations and changes from the design team also were found to cause delays on a project.

The availability of skilled workers also proved to be a reason for delays. The findings on rework suggest that it is a reason for the delay, but it is not a dominant reason.

The client's attitude of pushing a demanding schedule was almost unanimously found to be a reason for delays. A contractor agreeing to an unrealistic approach with a "win the job first, deal with the consequences later" was universally found through both research methods to be a reason for time overruns on projects.

The research approach found that if the adverse effects of weather could be minimised, time-related risks would be reduced. Through the Quantitative findings the use of repetitive tasks allowed for work crews to gain efficiency. The results for work crews to change tasks regularly was found to be neither for nor against.

The Quantitative findings found that if the overall amount of labour could be reduced the overall schedule would be reduced.

The availability of materials was found to be a key cause of time risks across both research methods.

Both Quantitative and Qualitative methods found that Health and Safety was a considerable risk to time on a project. It was also found across both methods that good systems of work can promote productivity on site.

The Qualitative findings found that the statutory approvals process was not a reason for delay. This was not universally found in the Quantitative findings.

The results of the study found that the use of Modern Methods of Construction (MMC) would neither require nor would not require upskilling across the industry.

It was neither found nor not found that greater risk would be incurred if the industry moved away from the use of traditional methods towards MMC methods.

Both the Quantitative findings and the Qualitative findings discovered that MMC techniques are relatively unknown in the industry.

Through the Qualitative results, it was revealed that designers were not well versed to effectively plan for the use of an MMC on a project. These results were not completely mirrored in the Quantitative findings, as answers were more evenly distributed.

The findings showed that site remoteness would not have an adverse effect on an MMC project.

Qualitative and Quantitative findings revealed that conventional programming techniques may not be best suited to an MMC project.

Introduction

- The title of this research paper is Common Factors That Affect the Success or Failure of Oil and Gas Construction Projects Globally
- The global oil and gas EPC market was valued at \$43.66 billion in 2019 and is predicted to rise at a CAGR of 7.0 percent to \$75.01 billion by 2027
- The construction industry is an essential and integral part of a country's economy, the more efficient the construction industry is, the better economic results will be.
- This paper will identify specific factors that affect the success and or failure of projects in the oil and gas industry on the international stage.
- During the research it became apparent that to identify the factors, it was a critical step to identify what is deemed as a successful project in this industry.

Aims

- What constitutes success in this industry.
- To analyze the literature available, for construction projects, in the oil and gas industry, and ascertain the correlation, between factors affecting their success and or failure, if they exist.

Study Design

The study consisted of 3 components:

- (i) Literature review (ii) Interviews (iii) Survey

Methods

Literature Review

- A comprehensive literature review was carried out. This review is based on the relevant academic material available. Looking at successful projects and unsuccessful projects and try to establish a link between causation.
- The literature search was confined to construction projects in the oil and gas sector. The search criteria will include "oil and gas" "construction" "management" "factors" "success" "failure".
- This secondary data collected from a cross section of the literature was qualitatively compiled.

Interviews

- Seven interviews were arranged with industry professionals, due to the current restrictions in regard to the pandemic these interviews were conducted over a combination of Microsoft teams and skype.
- The information was then compiled, transcribed, and thematically analysed.

Survey

- Using the data from the literature review and the interviews a survey with 20 questions was developed
- This questionnaire was sent to 63 people, 31 people responded. This represents a 49% response rate.

Results

- Results from the literature review, were divided into two categories, internal factors, these are factors internal to the project and in theory, under the control of the project team and external factors. Factors external to the project and project teams control.

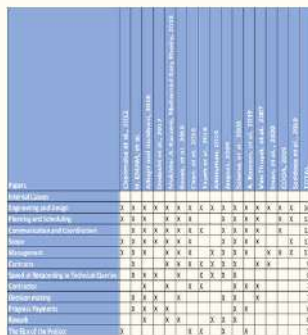


Figure 1: Internal Factors

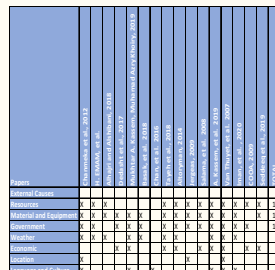


Figure 2: External Factors

Results

- During the literature review it became apparent to be able to assess factors having an affect on success or failure it was vital to identify the criteria for measuring this.
- The Iron Triangle, also known as the Triple Constraint or the Project Management Triangle, is a central feature of how we think of project performance

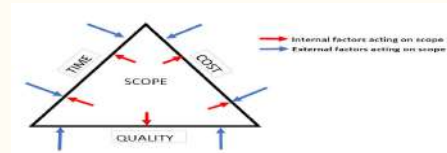


Figure 3: Iron Triangle

- Figure 3 shows a conventional Iron Triangle, with cost, time, quality being at each tip of the triangle.
- The triangle represents the scope of work. The red arrows added represent the internal factors discussed in figure 1. The blue arrows added, represent the external factors that have been identified Figure 2.
- The interviewees were asked if they would like to add anything to these three, they were not given any options, and six out of seven respondents immediately said safety. The respondents to the survey were given the four factors as an option and asked to rank them in order of most important to success. 51.6% ranked safety as the most important.

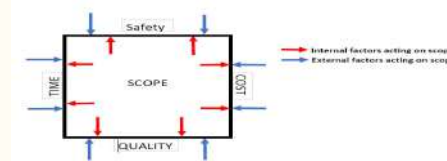


Figure 4: Iron Square

Survey V Literature Review Results Rankings

- Figure 4 shows the results of the literature reviews versus the results from the survey. The data in this table was compiled using the information from the literature review, this data was then used to develop the interview questions and finally, the data from the interview was used to develop the survey and below are the results from this research

Factors	Ranking from Literature review	Ranking from survey	Difference between Results
Engineering and Design	1	2	1
Resources	2	6	4
Material and Equipment	3	8	5
Planning and Scheduling	4	4	0
Communication and Coordination	5	9	4
Risks	6	12	6
Equipment	7	18	11
Management	8	3	5
Contracts	9	10	1
Weather	10	18	8
Environment	11	20	9
Speed of Response to Technical Queries	12	7	5
Site Conditions	13	14	1
Contractor	14	1	13
Contract Funding	15	5	10
Progress Payments	16	15	1
Research	17	11	6
The Size of the Project	18	17	2
Leadership and Culture	19	12	7
Logistics	20	13	7

Figure 5: Survey V Literature Review Results Rankings

Conclusions and Recommendations

- The Literature was analyzed, the primary and secondary data was compiled the research points towards a correlation between certain factors affecting the success and or failure of oil and gas construction projects.
- The following definition has been developed from the research. The definition of success in the oil and gas construction industry can be defined as: A project that finishes, with no safety events, on time, within budget, and to the desired quality. This definition stems from the metrics used to determine success, safety, cost, time, and quality
- See figure 5 for the list of factors common to oil and gas construction projects.
- This is a list of common factors. It is not an exhaustive list, there are other factors. These factors also vary in degrees of impact between country to country and between project to project.
- Further Research is required to develop this list

To investigate the effects of Covid-19 in the Construction Industry

Keith Coleman S00202255



Institute of Technology Sligo
B.Sc (Hons) in Construction Project Management 2021
School of Engineering

INTRODUCTION

The Covid-19 pandemic has impacted the entire world and everything that we do. The World Health Organisation declared the Covid-19 outbreak a Public Health Emergency on 30 January 2020 and upgraded to a pandemic on 11 March 2020. As of the 19th April, the total number of cases reported is over 142 million and over 3 million deaths globally since the start of the pandemic.

From an industry viewpoint meetings and general human interactions have switched to online activities as a means of keeping social distancing to a minimum.

The role of construction however is one sector that cannot be achieved online. As a result, the construction industry has been highly disrupted causing delays and terminating projects before they commence. The effects of Covid-19 on the construction industry brought all construction activities to a standstill. Many new guidelines and standard operating procedures were introduced into the working site to ensure safety.

OBJECTIVES

This research aims to examine the challenges encountered within the construction industry by looking at a number of objectives.

1. Accessing the impacts on the Construction Industry
2. Claims and additional costs resulting from Covid-19
3. The impact on the construction industry compared to other sectors
4. Productivity before and after lockdown
5. Supply chain Issues
6. A review of the CIF guidelines and the proactive approach on the construction industry

RESULTS

Impact on the Construction Industry

Figures released in early September by the Central Statistics Office (Sept 2020), indicate a 6.1% contraction in the Irish economy during Q2 2020, constituting the largest quarterly decline on record. The economic impact over Europe shows the average contraction is closer to 12%.

Claims and additional costs resulting from Covid-19

One key element in this is that the economic impact is in full effect however the full damage is yet to be assessed. Companies must carefully weigh the considerations for a project on a case-by-case basis based on the contract language and type of contract they are working under. Covid-19 is not making projects impossible to complete, rather slowing them down causing delay and disruption.

Impact on the construction industry compared to other sectors

Employment decreased in 7 of the 14 economic sectors, with the Accommodation and Food storage activities showing the largest rate of decline (-29.6%).

Productivity

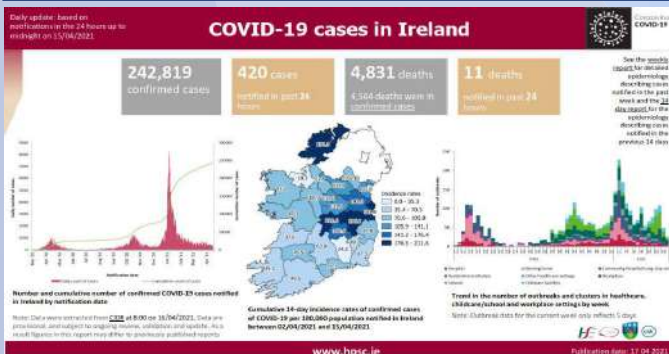
A survey carried out by (Turner and Townsend, August 2020) indicates that the latest results for the Irish construction industry indicate that the market is only weakening in the short to medium term. However, based on the Qualitative and quantitative analysis, the results show that productivity is down by as much as 20-30%.

Supply Chain issues

The research shows that the supply chain had already systemic weaknesses before Covid-19. Supply chain disruptions, further exacerbated by trade restrictions, have caused a majority of suppliers to halt production and several logistic partners to postpone the transport of goods.

CIF Guidelines

The Construction Industry Federation introduced a series of return-to-work protocols to anyone operating in the construction industry. 129,000 people employed in the construction industry in the second quarter of 2020 were affected with the construction closures. The handbook outlines the key control measures that construction sites are required to put in place before re-opening during the pandemic. This is currently on Version 7 and updated based on current conditions and Government policies.



METHODS

Following on from the Literature review, this research adopted a mixed method approach to collect the data.

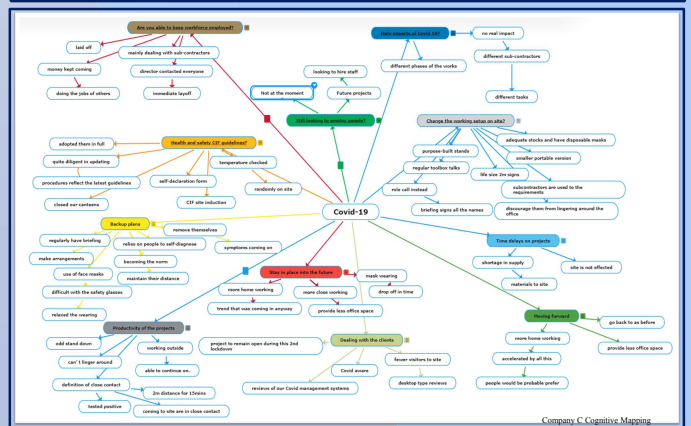
Firstly, a series of interviews for qualitative analysis were carried out. The questions were based on the review of key literature and are modified for this research. A semi structured interview process was conducted using 13 questions for discussion.

Three groups of target respondents were selected for the study. They included Tier 1 and Tier 2 civil engineering and building contractors, and construction related service contributors. Cognitive Mapping provides a visual representation to summarise the findings of the qualitative analysis.

The second method involved collecting quantitative data in the form of a questionnaire. In order to consider the current impact Covid-19 is having on the construction industry, a questionnaire was distributed to construction professionals within the industry. A total of 103 surveys were circulated, with 41 valid returns. This resulted in a 39.8% return rate. The survey remained open for three weeks to allow as many respondents as possible.

The questionnaire survey was distributed to a number of Tier 1 and Tier 2 civil and building construction contractors, a number of private sector construction company's and to local authorities within the public sector.

The use of Google Forms was used to create, distribute and collect the information from the survey. All the results collected were pre analysed into charts.



CONCLUSIONS

According to the research carried out and comparing Covid-19 to the SARS outbreak in 2003, the safety measures put in place by the CIF show that all correct and appropriate steps were taken.

The literature review shows that Ireland is in fact in a period of recession. This impact has not yet been seen on current projects, however over the next number of months/ years, projects that are currently scheduled to commence may be delayed due to finance issues.

What is apparent is that the full effects of Covid-19 are not yet seen on the construction industry.

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An Analysis of Project Controls in Irish Construction

1. Introduction

The Irish construction industry is fragmented in nature and at times can be a volatile place to make a profit. Construction projects are high risk ventures that are carried out under strict contracts that define their length and cost.

What is a successful project?, the answer to this question will vary depending on the stakeholder asked. Three major factors that define a project's success-

- Schedule
- Cost
- Quality

Project Controls are used to measure these key performance indicators. Analysis of the monthly budgets and costs aid the QS to determine the end cost, analysis of the schedule determines the variance of the job compared to the baseline and the amount of snags and reworks at the end determines the quality of the final product.

Risk plays a very important role on all 3 KPI's and must be factored in when estimating the cost of the project and the duration of the project.

2. Aim of Research

The aim of the study is to undertake research to determine what project controls are utilised in the Irish construction market and how risk identification is used in the estimation stage of the project to mitigate project overrun.

3. Methodology

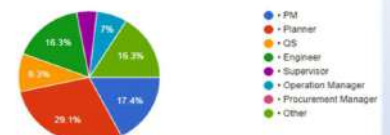
1. Qualitative - Interviews with construction professionals were undertaken over Microsoft teams
2. Quantitative – A Google docs questionnaire was distributed to major construction companies in Ireland which yielded a return of 86 completed.

4. Results

1. The interviews conducted were with senior construction project personnel including a director in a well established Irish engineering company.
2. The 27 question, questionnaire had responses from over 8 different construction personnel disciplines, of which just under 30% were planners.

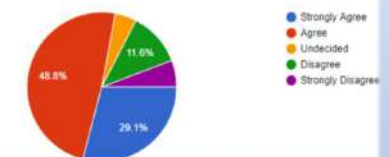
Which option best describes your current role?

86 responses



Project cost and project schedule are interdependent

86 responses



5. Conclusion

The research shows that the bigger Irish construction companies have mature project controls that include risk when estimating durations. The smaller companies rely on far simpler project controls that don't incorporate the risk factor into their schedules and costs. 72 % respondents chose delays to the CSA as the highest risk to project overrun. Further research is warranted to see if the varying levels of project controls by the different on site contractors factors in project overrun.

The Benefits of BIM In The Construction Industry For Construction Contractors

Luke Cawley

S00179997

BSc Hons Construction Project Management

1. Introduction:

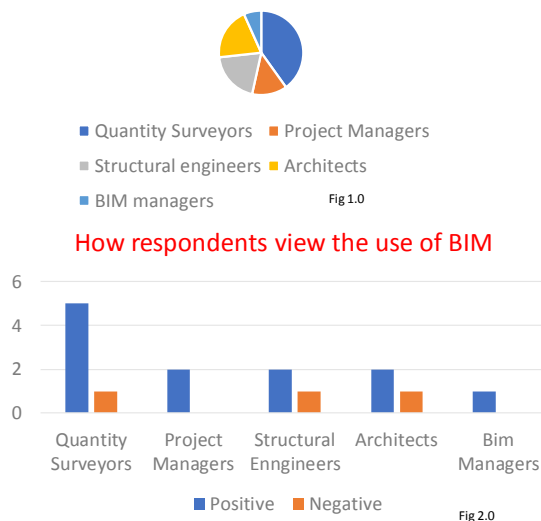
In recent years the use of the process of Building Information modelling has become more and more widely used.

This project will discuss why this is and especially why this process is becoming more popular for contractors within the industry.

2. Aims/Objectives of the research:

- This project aims to discuss what the BIM process is and what it is used for.
- It also aims to discuss advantages that there are for contractors who adopt this process and any disadvantages there may also be.
- Gather knowledge from a wide variety of sources.

Responses from questionnaire



3. Methodology:

In this research project there was extensive research carried out to determine if there are indeed benefits for construction contractors to adopting BIM.

To complete this task there were different tasks undertaken in order to obtain a broad range of knowledge on the use of BIM.

- A literature review was carried out which examined credible sources of literature to back up all points which were made.
- Mixed method research was carried out consisting of:
 - Qualitative research: This involved interviews which were carried out over Microsoft Teams and Zoom.
 - Semi structured interviews were carried out.
 - Quantitative research: This involved sending out questionnaires to professionals within the construction industry.
- Questionnaires determined what profession and other info about who was answering the questions.
- Their personal or companies experiences with BIM.
- 38 questionnaires were sent out and 15 responses were received.
- These questionnaires consisted of 20 questions.

4. Results and Conclusions:

The results of this research found that the research questions were answered by carrying out the methods of literature review and mixed method research.

From the qualitative and quantitative research in most cases the professionals who seen more benefits to BIM generally had less than fifteen years of experience.

The conclusion that can be drawn from this is that there are many benefits for contractors who adopt the BIM process as shown from each of the research methods carried out.



Introduction

The Irish construction industry is unpredictable. Global pandemics, economic recessions and changing client requirements mean levels of success for companies can differ from year to year. A big reason for fluctuating levels of success is the traditional project management methods that the Irish industry has mainly adopted. Traditional project management methods make it difficult to improve productivity and reduce waste. Lean project management is a system that, if properly implemented, can equip companies with the tools to navigate future turmoil.

Lean

Lean is defined by the National Institute of Standards and Technology (NIST) (2000) as "A systematic approach to identifying and eliminating waste through continuous improvement, flowing the product at the pull of the customer in pursuit of perfection"¹.

Research Aim

The aim of this study is to, through quantitative and qualitative research,

- Identify the main existing barriers that could possibly impede the smooth transition from traditional project management to lean project management.
- As a result, recommend measures to be taken in order to successfully adapt to lean management.

Methodology

This study was undertaken using a mixed method approach, with primary and secondary qualitative research analysis being used as well as quantitative.

1. Secondary qualitative research was used in the form of an exhaustive literature review of existing research papers in the area of lean management and previous cases of implementation within the construction industry.
2. Primary qualitative research was undertaken through a series of three interviews with industry professionals, undertaken via Zoom.
3. The information collected from the interviews and the literature review was used as the basis of the quantitative research by constructing a questionnaire in which 82 professionals from the Irish construction industry were invited to take part, with 27 being returned complete. The questionnaire was created using Google Forms, with the results being compiled into graphs and charts. This questionnaire was distributed to the top 50 Irish construction companies in 2020 as well as members of Lean Construction Ireland.

1. National Institute of Standards and Technology (NIST) (2000). Lean, ISO, and Six Sigma. MD, USA; US Department of Commerce.

THE FEASIBILITY OF IMPLEMENTING LEAN IN THE IRISH CONSTRUCTION MARKET AND THE PREVENTING BARRIERS THAT EXIST

MICHAEL REID
S00114538

BSc Hons Construction Project Management

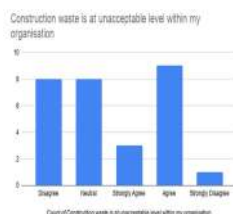


Figure 1

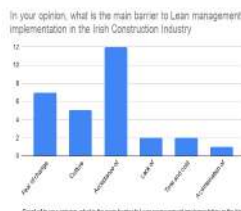


Figure 2

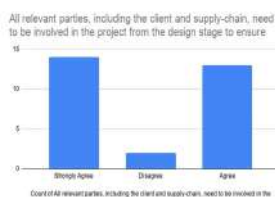


Figure 3

Results

Main Barriers Identified

Cultural reluctance, Individuals being un-willing to accept responsibility, Lack of supply-chain involvement, Half hearted effort from upper management to fully change the company structure, Negative stigma surrounding the word 'lean', with many of the research participants using an alternative name for the system. Fear of failure.

An interesting finding was that, although the literature review showed that waste reduction was a prime reason for lean implementation, none of the interviewees mentioned this to be true, with the questionnaire participants being split on the subject, as shown in figure 1. It was found through the interviews that external drivers, mainly client requirements were the main catalyst for adapting to lean management.

A positive finding was the existence of the Lean Construction Ireland Book of Cases promoting success stories of Irish implementation, although publicity of the book is mainly contained within circles that are already knowledgeable on the subject, limiting its spread.

Discussion

- Lean management can be implemented with great success in the Irish construction industry.
- The main barriers are numerous and objective, with the interviewees noting cultural problems as the main barrier while the questionnaire results note acceptance of change as the most difficult roadblock to overcome, as seen in figure 2.
- An adjustment to the company culture may be needed.
- Staff must be open to change
- Full support and involvement needed from both top-down and bottom-up within the company
- Supply-chain must be involved, informed and motivated to join the lean vision at the earliest possible stage, confirming this is questionnaire result shown in figure 3.
- Knowledge levels of staff and management must be improved, with training being offered and skill improvement being promoted within the company.

Conclusion

Lean is a management system that will undoubtedly continue to grow in the Irish construction sector, with adaptation levels becoming higher as knowledge on the system grows.

The pitfalls and barriers that exist are numerous, but also navigable, but to do so successfully full support from the team is necessary. Management must promote the change and the workforce must accept the change, otherwise it is destined to fail.

Drafting in external consultants is seen as necessary in order to see a clear picture of the company's current situation and what changes need to be made for a change to lean to be a success.

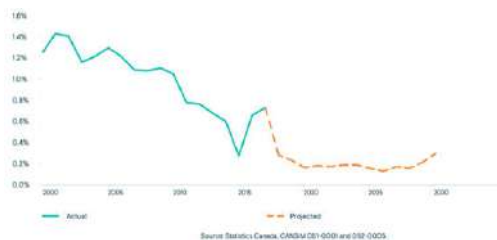
Finally, it is paramount total commitment to the implementation of Lean project management exists company wide, positive results may not be obvious at first which has led to a high failure rate. Sustainability will only be possible through continuous education and implementation, which will lead to prosperous results.

Curbing Skilled Labour Shortages: Critical Analysis of Governmental Efforts and Technological Solutions

Nelson Trzecak S00190305
B.Sc. (Hons) in Construction Project Management

1.0 Introduction

Within Ontario's construction industry, skilled labour is regarded as the backbone for developing projects across various categories, including residential, commercial, institutional, and infrastructure. Through these individuals' projects are completed to meet social demands and expand fiscal gains throughout the region. However, in most recent decades, these work positions have seen a drastic decline in employment, affecting project completions throughout the province. In a bid against it, government and private sector institutions regularly implement social initiatives and investment programs to promote trade careers. These efforts have proven to alleviate some concerns; however, they fall short in meeting long-term demands as population growth increases exponentially year over year.



As labour concerns continue to compound, alternative efforts outside of current programs could provide other means to a solution. Through the advent of digital and technological advances, some solutions may include expanded use of building information modelling (BIM), information and communication technologies (ICTs), and On-site automation within the construction sector. Unfortunately, this may not prove easy, as technology often requires sizeable financial capital

2.0 Aim(s) and Objective(s)

Aim(s): To determine the best solutions for alleviating skilled labour shortages based on and beyond current efforts.

Objective(s):

- Elaborate on current strategic solutions and provide realized outcome of effort
- Identify, compare and contrast DSTs related to the current and emerging concerns.
- Determine appropriate DSTs for SME and Large scale organizations

3.0 Methodology

The research was done using qualitative and quantitative processes, known as a mixed-method approach. Through this process, interviews and surveys were conducted, gathering data from industry specialists. Twenty-six questions (26) were asked in both cases, broken down into one (1) of the following five (5) categories, introductions, construction trends, skilled labour shortages, government initiatives, and technology adoption.

REQUIREMENTS

- Collect data on industry perspectives towards the effectiveness of current initiatives.

DESIGN

- Semi-Structured Interviews
- Semi-Structured Surveys

Both are containing a similar breakdown of questions.

EXECUTION

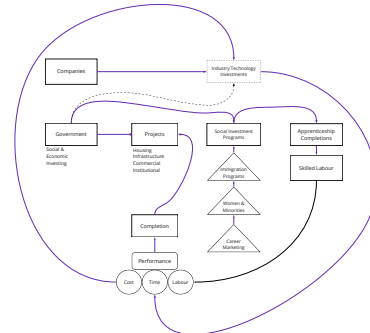
- Interviews were carried out through MS Teams averaging 1 hour in length.

Surveys distributed among industry professionals through LinkedIn.

DATA ANALYSIS

- Formulate and review data collected to identify consistencies and inconsistencies

Provide feedback on steps that could help future research analyses

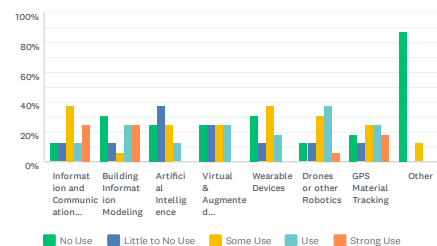


4.0 Results/Findings

- Participating members itemized difficulty in retaining current employees, elaborating on an inability to expand current organizational operations.
- Labour losses less hinder those organizations of considerable stature.
- In-situ construction is favourable among most based on familiarity.
- 70% are unaware of skilled labour subsidies, helping to access and involve women and minority groups within construction.
- Supply shortages and increased competition added additional costs through wages and construction lead time.
- Organizations without financial capital to invest in tech are less able to expand into other areas and provide much-needed services.

5.0 Analysis/Discussion

- Past Ontario Investments - \$20.8 per/yr from 2005 to 2016
- Current Ontario Investments - \$75.5m per/yr 2016 to 2020
- The federal government of Canada has also provided mass national investments ranging into the billions.
- An increase in investment towards programs and projects has alleviated some concerns around labour shortages, and they have not addressed them entirely. As many companies differ in utilizing more technological resources to advance production, investment efforts need to follow suit.



6.0 Conclusion

Though government bodies' investment initiatives and programs are needed, they have only proven to alleviate supply burdens and not address them entirely. As the situation continues, a more complex and alternative solution is required. The approach may entail further investment into these programs; however, this would prove insufficient as it provides a similar outcome of results. To fully address such issues, a collaboration of current efforts with monetary subsidies may prove more effective. These subsidies would allow SME operations to ascertain technological equipment and software that increases operational efficiencies; alternatively, as adv tech is commonplace, these tech types will entice a young generation born into computerization.

A study into of the impact of COVID-19 on construction project management.

Pauric Martin (S00173786)

IT Sligo School of Engineering

Methodology



Abstract

The aim of this dissertation is to develop an understanding of the impact of the COVID-19 pandemic on construction projects and evaluate the implications on construction project management in the delivery of construction projects. The COVID-19 pandemic presents extreme difficulties to project teams due to its complex, uncertain nature. Many construction projects were forced to close at some point in the last 12 months due to the COVID-19 pandemic. As a result, project managers and their teams faced significant challenges in meeting contractual obligations by completing projects on time and within budget.

Due to the novel nature of the COVID-19 pandemic, only a few studies have been conducted to date that assess the impact on the construction industry and project management. The intention of this study was to expand on previous research by investigating its findings in the context of the impact caused on construction project management in the construction industry. As a result of an extensive literature review this research defined and assessed the impact that the COVID-19 pandemic is having on construction project management, as well as the areas identified and deemed the most severely impacted in the delivery of construction projects during the research period.

Based on previous studies, the various analysis methods and engagement methods were identified and analysed. As a result, the researcher made assumptions about which methods are deemed most effective in the context of this research. In the discussion section of this dissertation, these assumptions were then compared to the findings of the primary research.

The primary research revealed that project managers observed the impact of the COVID-19 pandemic in a number of areas. The findings identified communication, risk sharing, and adaption to new ways of working as the most impacted areas, as well as the additional costs associated with compliance and lockdowns. Respondents identified digital technology as a key factor in keeping construction projects and the construction sector open and afloat during the COVID-19 pandemic. Respondents also emphasized the importance of construction contracts now as a means of achieving fairness, as well as the role they will play in the future as a vehicle for dealing with unforeseeable events and associated risks, such as future pandemics.

Introduction

The COVID-19 pandemic is an unprecedented event that has caused widespread turmoil not only on the island of Ireland but worldwide. Governments around the world have implemented contingency plans and rolled out aid packages to sustain and support their economies. Due to the severity and complications associated with COVID-19 many countries made the difficult decision to declare a complete national lockdown in the first half of 2020 then again in the latter part of 2020 and into early 2021. Construction was deemed essential in some countries, such as the United Kingdom (UK), while in others, such as Ireland, only certain types of construction were deemed essential, such as public works, social housing, and the pharmaceutical sectors. The construction industry relies heavily on the movement of people and materials, as well as involving people working in close proximity, to achieve success. These are the very things that governments and health organizations across the globe are attempting to restrict in order to slow the spread of the COVID-19 virus. This is where a balance must be struck, which is proving to be difficult given there is no blueprint or caveats for an event in the magnitude of the COVID-19 pandemic. The researcher became interested in this topic after witnessing firsthand the uncertainty and impact of the pandemic on construction projects as a student engineer.

This dissertation aim is to look at the following areas through the lens of project management, with the following objectives.

- To investigate the main areas impacted on construction projects as a result of COVID-19.
- To evaluate the countermeasures put in place to ensure that sites can reopen, and continue to work safely.
- To determine the key learnings for the industry and identify potential long-term benefits for the sector.

Key central questions asked in this dissertation:

- What areas of construction project management have been most significantly impacted by mandatory regulations and guidelines resulting from the COVID-19 pandemic?
- How has the industry adapted to such an unprecedented event and what implications will this have going forward?

Literature Review

There is no template in the industry for dealing with this unprecedented type of event. The changing nature of the virus left companies in limbo with full lockdown implemented mid-project in some instances. Adjustment and adaptation were key for the successful management of projects to help deal with the challenges of the pandemic.

The way we work has changed drastically and the adoption of new technologies accelerated practically overnight.

Government regulations around social distancing limit the number of bodies on site at any one time. Staggered work times increase overall task completion times and pull labour cost. Protective measures such as personal protective equipment and sanitizing stations along with increased welfare and office facilities on site also increase costs. These factors all impact on the overall project management process and successful completion of projects.

Ensuring that the contractual requirements are complied with is a key area in project management. It is vitally important to investigate the contract thoroughly follow the stipulated or express terms of the contract and ensure effective coordination and cooperation between the contractual parties is maintained. This is paramount to contractual performance and project success.

The pandemic evolves many companies may reviewed existing construction contracts. Many will look to negotiate and add bespoke COVID-19 or pandemic clauses from a view to mitigate, manage, share or shift risk for associated project delays and cost increases brought about by the COVID-19 pandemic or similar unforeseen events. Project managers should review their work practices and consider if adjustments or amendments are needed to manage the risk of the spreading of the virus in all work fronts.

The conclusions drawn from the literature review served as the foundation for the development of the primary research, which tested the external validity of these findings conducting semi-structured interviews and circulating a questionnaire to project managers in the construction industry.

The primary research seeks to determine whether the findings of the literature review are representative of what is happening on the ground. The primary research used a Likert styled 1-5 scale self-completed questionnaire to evaluate respondents' perceptions of the impact of COVID-19. The questionnaire was created largely as a quantitative method of research with two number qualitative questions added, using a mixed method approach to capture as much information as possible while staying true to the research question and objectives.

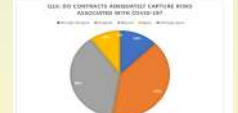
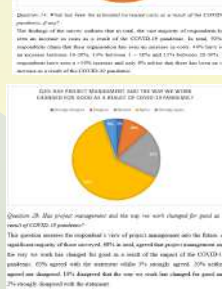
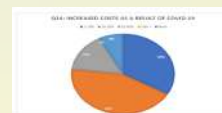
The criterion that used for selecting the target population of the questionnaire was:

- Persons who work for companies involved in the construction industry.
- Individuals who work on construction projects and are involved in project management.

The researcher used the internet to distribute the questionnaire and collect the results. Google Documents, an online platform for producing and circulating data and information in the one place, was the adopted for constructing and conducting the questionnaire.

A semi-structured interview with three individuals involved in construction management was also used to support the research using a qualitative approach. The semi-structured interview process was deemed the most appropriate method to support the research question and findings from the literature review. Since COVID-19 is a novel and unprecedented event, a semi-structured interview gives the interviewee the freedom to probe various areas and ask specific questions during the interview to fill any gaps in the research.

Results



Discussion

Digital Technology: The survey results show that 95% of the respondents had an increase in digital technologies as a result of COVID-19 restrictions. On-site meetings, remote working and online training are all now common place in many companies.

Construction Contracts: A common theme among interviewees and respondents is that future contracts will need to be adjusted to account for the treatment of COVID-19-like events and to ensure that risks are shared equally and fairly between contract parties.

Based on survey results, a significant percentage of respondents have processed claims for both extensions of time (51%) and / or costs (39%). With 79% of respondents detailing an impact on time and 54% detailed an impact on cost.

Conclusions

- An increase in terms of cost and budget as a result of implementing additional health and safety measures, guidelines and SOPs estimated at 20% cost increase and 1-10 man hours per employee per week.
- All contract parties should share the pandemic risk equally, and construction contracts should be adjusted and clarified to reflect this. Events that are considered compensation events, as well as those that are considered extensions of time only in relation to unforeseen events such as pandemics, should be included and clarified.
- Digital technology was a critical tool in helping the construction industry stay open and keep projects running. Adaptation, as well as open and transparent communication, are essential for it to work effectively. As the transition to the digital era accelerates, this could become the new normal for communication in the construction industry.
- Adaptability and flexibility will be critical tools for construction project managers now and in the future, whether that is in terms of communication, adjusting to new work systems, or new working environments.

“How risk is managed in the Construction Industry with a focus on strategy towards recession”

Introduction



Williams (1995) said; “Success in a construction project has been regarded as achieving project objectives, which traditionally have been provided on time, on budget and of a required performance or achievement”. Further to this, in a study by Sir Michael Latham, (1994) he mentioned that “No construction project is risk free. Risk can be managed, minimised, shared, transferred, or accepted, but it **cannot** be ignored”.

The construction industry is plagued by various, ever changing risks. This often results in poor project performance. Regardless of risk management techniques being applied, the lack of a standard approach has produced varied results.

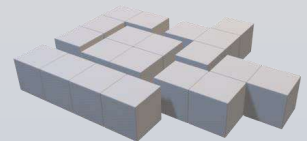
Aim of this Research



The aim of this dissertation is to discuss the tools and methods used to determine and manage risk, within the construction industry.

To analyse the literature available relating to risk in construction projects and ascertain whether strategy can improve the risk management process when it comes to tough economic times.

Methodology



Literature Review

An in depth literature review was carried out based on the relevant academic material available. A full breakdown of risk in the construction industry was detailed to make the readers aware of the extent.

The literature search was subject to a broad range of construction projects. This secondary data collected from a cross section of the literature was be qualitatively compiled.

Interviews

Using the data from the literature review, interview questions were formed. Through seven requests for interviews, only four came back. Due to the current climate, these were all conducted over MS Teams. The interviews were then transcribed so they could be appendicised in the dissertation and, and then quantitatively analysed.

Questionnaire

Using the data from the literature review and the interviews, a questionnaire with just over twenty questions was formed. This was then sent out to many industry professionals, having worked with a broad range, as well as being posted on LinkedIn. LinkedIn massively improved feedback and broadened the spectrum of findings.



Results

Throughout the quantitative research, there was a broad range of participants. The questionnaire showed the greatest range of mixed review, as this was not solely focussed on the personnel who make strategic decisions. This topic may have been over the participants heads to a certain extent.

The Interviews were more focussed on the personnel in the know when it comes to forming risk strategy and offered a better direction to whether the topic of the dissertation was accurate. This mostly confirmed that not all forms are best prepared for a downturn.

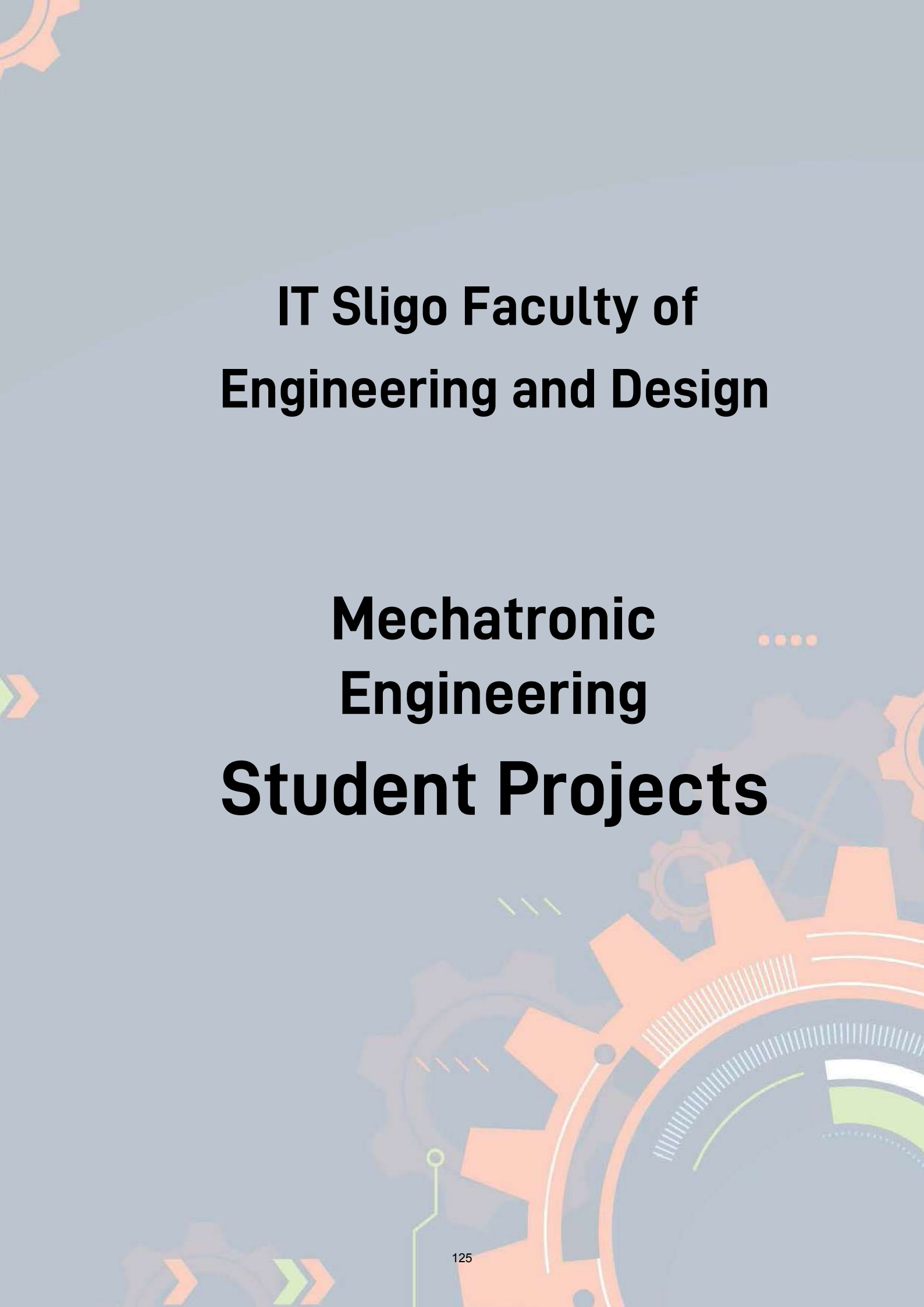
Conclusion and Recommendations

The literature was extensively analysed and summarised. The primary and secondary data collected added perspective as to how strategies relating to risk in construction can help the company forming the strategy continue trading at a high level, when economic hardship arrives. This is effectively preparation for the worst.

It is recommended that any firm prospering during good economic times, remembers that this, if not before, is the time to start making strategic moves for when a downturn comes.

If firms wait until the downturn, it is too late and may struggle with procuring new works during this period.

Ronan Judge – S00134756



IT Sligo Faculty of Engineering and Design

Mechatronic Engineering Student Projects



Sligo Engineering & Technology Expo 2021

Mechatronic Engineering Award

For project titled

Automated Robotic Sorting System

to

James Boland

Presented by:

Una Parsons - Head of Faculty of Engineering & Design, IT Sligo

Chris O'Malley - Vice President, Research, Innovation & Engagement

Judged by:

Carmel Cullen - Nikon Medical

29th April 2021

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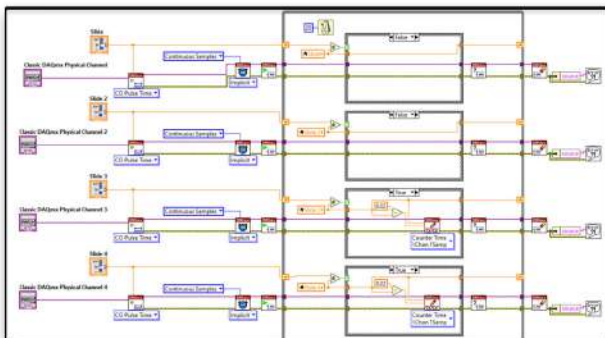
Automated Robotic Sorting System

James Boland S00186030

INTRODUCTION

The use of robotic arms and vision systems in industry has grown and is still growing vastly throughout the world. Automation and vision in industry have become very popular because it cuts down on human intervention, error and therefore cost.

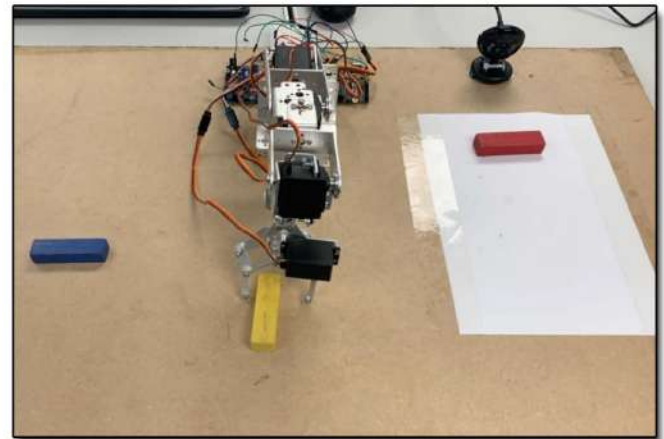
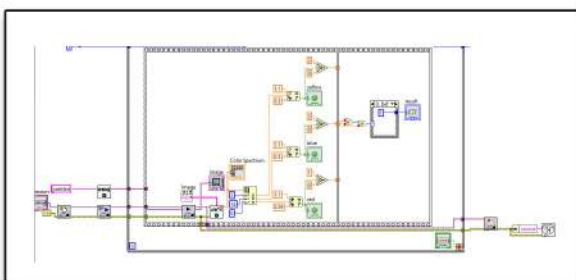
This project looks at the control of a robotic arm to sort coloured blocks. The aim of this project is to place coloured blocks in front of a camera which then detects the colour and tells the arm to place it in its according section. The main components used are servo motors to control the movement of the arm Arduino boards as an interface between the computer and the arm and the LabView software to program and control the actions and decisions of the robotic arm.



RESULTS

The results were successful as the vision system clearly identified the coloured blocks and communicated that information to the programmed software.

The robotic arm performed as predicted, successfully picking and placing coloured blocks into their appropriate sections. All the blue, yellow and red blocks in there own sections respectively.



METHOD/APPROACH

The method and approach I used:

The 1st step was carrying out research and development. Due to Covid restrictions I was limited in the availability of resources. The biggest challenge was moving online and sourcing available resources locally.

This Automated Robotic Sorting System is easily controlled and programmed with Arduino, however, as Arduino is rarely used in the engineering industry LabView was a better option when used with a DAQ.

After sourcing a web camera for the vision system; a system which is designed and programmed to identify the colour of a block which would then tell the Automated Robotic Sorting System where it needs to be placed.

Lastly, the system is finalised and the physical part of the build is completed.

Also included is a report which informs the reader about the project and the design process.

CONCLUSION

The Automated Robotic Sorting System is a simple and diverse way of sorting and stacking products on a production line.

With further investigation and research this project can be developed into a more sophisticated system that would learn and perform independently.



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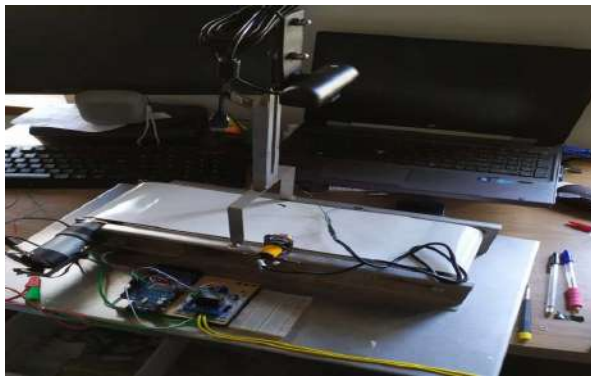
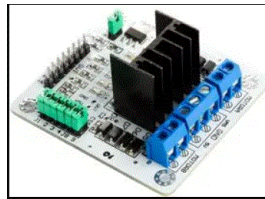


Vision Inspection System



INTRODUCTION

Industrial automation is a broad discipline, companies are becoming more reliant on vision systems to work in tangent with other systems such as conveyors. Human error caused by repetitive cumbersome tasks can lead to costly downtime in industry. This project aims to demonstrate how a vision system integrated with a conveyor can minimise these problems and increase reliability.

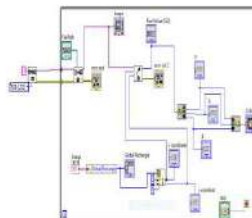
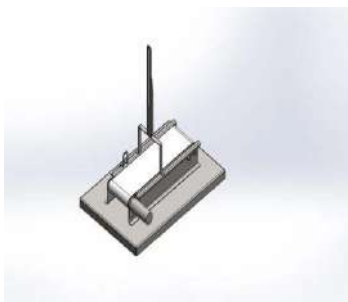


SOLUTION

The goal intended was to build a prototype automated conveyor system, that could operate by itself and with minimal human input needed. The project would be reliant on labVIEW to do this.



Acer QHD 5 MP Webcam | Black



RESULTS

- The project was a success overall
- The code designed for the gradual ramp up of the belt speed worked.
- The algorithm was successful in distinguishing a black and white lid
- The motor chosen was more than capable of driving the belt with a load

METHODOLOGY

Research:

The project began by researching the hardware, designing/planning the conveyor system and consideration given to the fabrication direction.

Design/Planning:

This phase involved finalising the final hardware parts for the system. The conveyor was modelled in Solidworks at this stage. The software to be used was also decided upon.

Software And Components:

The project is been controlled by LabVIEW. An Arduino Mega is used as interface between LabVIEW and the hardware. A motor driver is used to power a 24volt motor. An Acer hd webcam takes the images. When the motor is started. the speed of belt will ramp up gradually to a set point.

Operation of system:

- A tablet bottle is placed on conveyor
- It will be stopped at camera by proximity sensor and image will be taken.
- If the bottle cap is white it passes quality check, if it is black it is a reject.

CONCLUSIONS

The project was very rewarding, it forced the student to combine the material learned over the 3 year period together. An industrial camera would of been more sufficient in the vision part so as to grab an image without stopping the product.

ACKNOWLEDGEMENTS

<https://www.rs-online.com/>
<http://www.pharmastainless.ie/>
<https://cpc.farnell.com/>

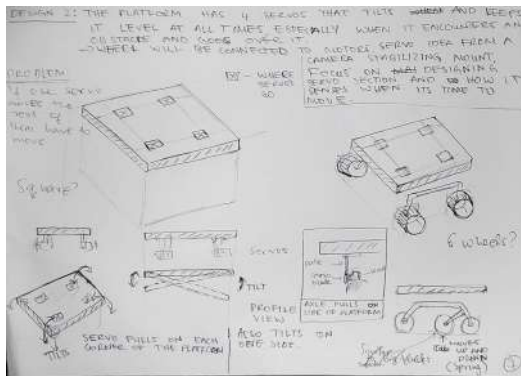
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Introduction

PID control can be used to balance a ball, for instance, on a platform or control its position. Many projects are trying to balance something on a stationary platform. The project is trying to take this to the next level. This project investigates placing a self-balancing platform on an off-road car.

Cars can be very bumpy and shaky when they are speeding on rough terrains. What if the passengers or load are not affected by the suspension of the car compressing and expanding? The aim of this project is to create a car model that can do that.

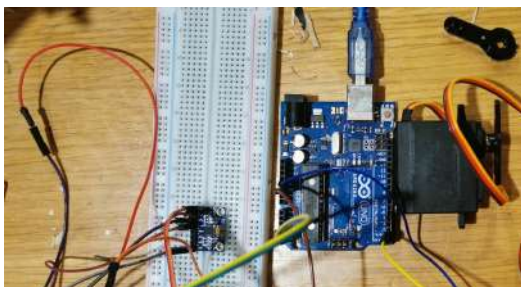


Aim of Study

The theory is that, using an Arduino and a gyroscope, we can use the initial reading of the gyroscope as the baseline of how the platform should be positioned throughout the car journey. The Arduino, with the use of servos will use PID calculations to keep the position and angle of the platform unchanged.

With the use of strategically placed servo motors, the platform's position can be controlled with a higher level of accuracy and precision.

The Arduino is programmed using Arduino software and the data collected will be analyzed and visualized using Processing software

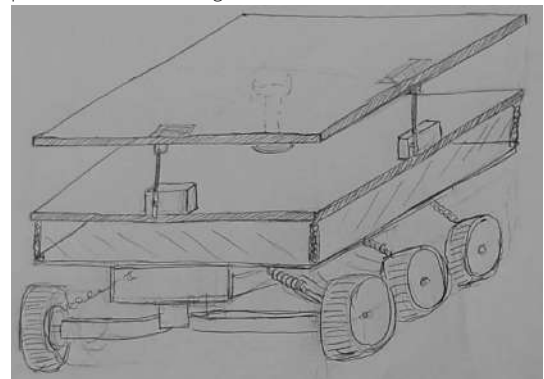


Technical Difficulties and Solutions

Design

While "ball on plate" is a popular project design, which uses servo motors and a touch screen to control the position of a ball on a platform, and is very similar to our project. We were trying to approach this from a different angle and have attempted to produce different designs from scratch or influenced by other projects.

Moreover, the ball on plate project relies on using a touch screen to monitor the ball's position and act according to the collected data. Our project uses a gyroscope mounted on the platform itself which will assist in determining the angle of the platform relative to the ground.



Power

Due to the limitations of Arduino's design for power delivery and distribution, the Arduino cannot power more than a couple of motors.

Earlier concepts relied on using more than eight motors on the platform alone and were deemed excessive, expensive, and more complicated. Motor drivers were necessary to operate the final design.

Conclusion

The project was exciting to work on. It was challenging and expensive due to the number of ideas we were trying to combine in one project. The project has taught us both about research and time management.

Additionally, We have learned that most of the time we may have to acquire new skills along the way to carry out the project the way we want to.

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INTRODUCTION

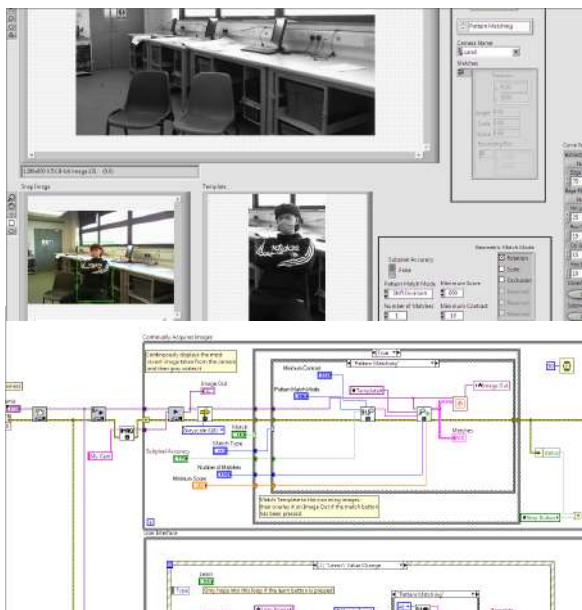
Essentially, this project was designed for buses. One of the most significant mass transportation vehicles are the buses. Buses, public or private, are essential in modern day. This project focuses on monitoring the occupancy and availability of seats using LabView software which is a product of National Instruments.

AIM

The aim of the project is to design a system with the focus of monitoring the availability of seats in a bus or any vehicle using electrical indicators and vision acquisition. That said, even though initially this project was designed for buses, it can operate in any environment with a designated number of seats to monitor. It is fair to mention that due to Covid-19, this project was put to limitations. Thus, the images present shows a class environment where this project is still applicable.

EQUIPMENT

- LabView National Instruments
- LabView Add-ons
- HD Camera (USB)
- Breadboard
- Wires
- Arduino or DAQ
- Colored LEDs
- 7 Sigma Display
- Visual Development Module (LabView Add-on)
- Vision Builder for Automated Inspection



METHOD

- **Research the procedure**
 - Understand how the add-on operate in LabView
- **Accumulate the equipment**
 - Online/store/IT workshop
- **Download LabView and the required add-on software**
 - From the National Instruments website
- **Wire the indicators**
 - Connect the indicators to the desired acquisition device (Arduino or DAQ)
- **Program the procedure**
 - Program the block diagram of the Virtual Instrument (VI)
- **Set the testing environment**
 - Securing the camera in a specified position and orientation
- **Final testing and modifications**
 - Run VI
 - Machine learning using snaps taken by the camera
 - Troubleshooting

Results

As is shown in the figure, the results were satisfying; data can be acquired from the camera and then modified via LabView using machine learning (image processing) in order to detect any changes in any further image data accumulated. However, as of the time creating this poster, the software requires modification with regard to software errors and the indications section of the project.

Conclusion

By and large, it fair to say that such projects are essential for statistical purposes like counting the average number of passengers, especially the young and the elderly, in a transport facility of any sort. The data accumulated can be then used to improve in that facility, wither public or private, in like the number of seats to be implemented, for example. It is not unreasonable to mention that the position of the visual sensor- camera- is crucial for maintaining a controlled result.

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- **Vision Builder for Automated Inspection**- <https://www.ni.com/en-ie/shop/software/products/vision-builder-for-automated-inspection.html>

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Golf ball Tolerance check using image processing and vision systems

INTRODUCTION

The R&A is the Governing body for golf. They set the rules and regulations within the sport. One regulation within the sport is the size of the golf ball. The diameter of the golf ball can be no smaller than 1.680 inches. To date, there is no full-size regulation for the golf ball as long as it conforms to all other standards. The official test protocol uses a metal ring gauge suspended in Perspex.

In my project, I will use a camera to measure the golf ball as it passes down a moving conveyor. If it is under the Requirements set by the governing body at 1.680 inches, then the golf ball will be rejected from the conveyor system.



METHOD/Approach

- Research of components and desire operation procedure.
- Design and build a conveyor system that can transport golf balls to a testing area.
- Attach an ultrasonic sensor, webcam and a deflector mechanism to the conveyor system.
- Embed an Arduino mega into LabView and use it to control my system.
- Labview will be the primary Programming language

RESULTS

CONCLUSIONS and RECOMMENDATIONS

If I had spent more time educating myself on Labview programming, I think I could have made a more sophisticated program where I could have checked the size and colour of the golf ball and sorted them into designated areas accordingly.

ACKNOWLEDGEMENTS

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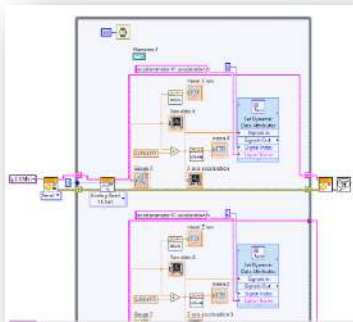
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Introduction

For my project I wanted to work on something that I would be passionate about and coming from a farming background I decided to design a collar with a series of sensors in them that livestock could wear to show me if they are healthy or not.

In farming technology is starting to play a bigger role and many farmers are now no longer full-time farmers and have less time to look at their stock. My idea is that the farmer will be able to fly out a drone and pick up the data that will be stored in the collar for 24hrs that will let you know how the livestock has been doing.



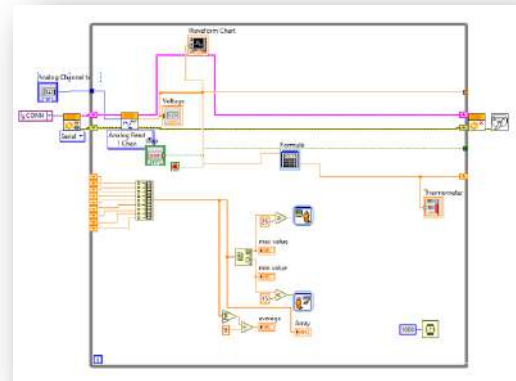
Research

The research I undertook was what sensors to use and why these would be the most effective sensors in spotting ailments in stock.

The three I picked were the three that would be the most fatal if the livestock were not meeting the criteria for that sensor e.g., if the cow isn't visiting the drinking trough it is a sure sign of sickness as cows need from 10 – 110 litres of water per day depending on age.

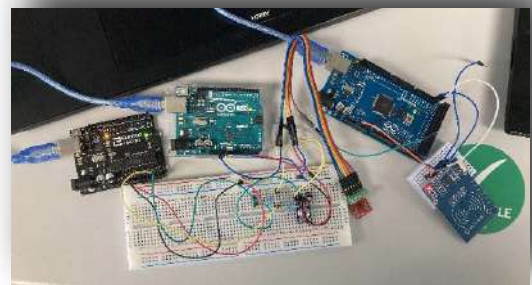
The temperature in a cow is important because it can tell us many things like if the cow is in heat which means they are ready to go back in calf or it could also be a sign of ailment.

Livestock well-being tracker



Sensors

The sensors I decided to use inside the collar are, an infrared temperature sensor, an accelerometer, and an RFID tag sensor. The reason I picked an infrared sensor is because this sensor does not actually have to be in contact with the object to detect the temperature. The accelerometer will be able to tell me how fast they have been moving and the RFID tag sensor is to have the tag on the water trough so it will let me know how many times they drink water a day.



Results

As expected, the project had its problems and the corona virus pandemic did not help the process, it was hard getting the sensors to work together and all work in unison and give feedback without causing errors for each other.

Transferring the data to the drone was tough as well and with the pandemic I had to end up simulation this process using TCP in LabView.



PICK AND PLACE ROBOT WITH A VISION SYSTEM

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INTRODUCTION

Industrial automation is a vast specialty, and businesses are increasingly relying on vision systems to operate in conjunction with other systems such as robotics. Human error caused by routine, time-consuming activities can result in costly downtime in the workplace. The aim of this project is to show how a vision system integrated with a robot can reduce these issues and improve reliability..

SOLUTION

The intended vision was to develop a sample pick and place for a vision device that could function autonomously and with limited human intervention. To accomplish this, the project will depend on labVIEW..

RESULTS

- Overall, the project was a success.
- There were no errors when running the software.
- The algorithm was able to tell the difference between a black and white lid.
- The robot chosen was just right for the job, making it easy to work with.

METHODOLOGY

Research:

The project started with studying the electronics, designing and programming the robot system, and thinking about the fabrication path.

Design/Planning:

This process involved finalizing the system's hardware. The robot was obtained from the IT lab. The program to be used was also chosen.

Software And Components:

The project is been controlled by LabVIEW. The Arduino serves as a bridge between LabVIEW and the hardware. A high-definition webcam captures the images, identifies a single entity, and tracks it.

Operation of system:

- A camera takes a look at a collection of things.
- It finds a certain entity that it has been designed to find..
- It is picked up by the robot arm.

CONCLUSIONS

The assignment was very rewarding because it required the student to combine information gained over a three-year cycle. In the vision section, an inbuilt camera would have been more than adequate to make the job more clean..

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INSTITUTE OF TECHNOLOGY SLIGO.

Introduction

Because of their versatility of control stepper motors are used in a wide range of applications, it's control provides high holding torque at low speeds.

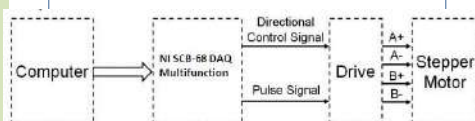
Nowadays, stepper motors are used for positioning because they have precise position control due to their integrated phase movement and can be easily operated using open loop, they are used in robotics applications such as Industrial robots, Space robots & Medical robots.

Objectives

- The ability to monitor the hysteresis of a stepper motor system operating as an open-loop system with minimal error, having a magnetic memory and ability to read data, and accurately positioning heads are the primary advantages of this project.
- Also achieving Micro-stepping which increases system Performance, lessens noise and resonance, and increasing step accuracy and resolution

Methods and Materials

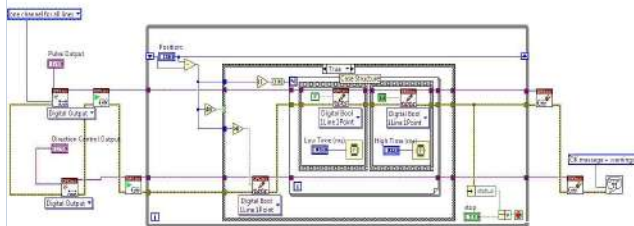
- Stepper motor control system scheme:** the overall design is separated into 4 parts



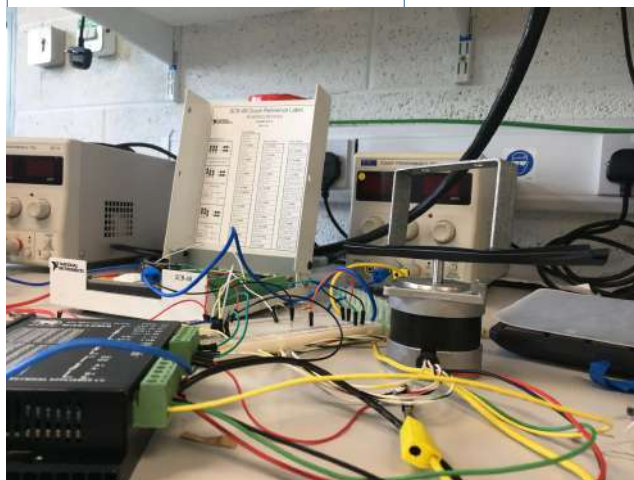
- Stepper motor fundamental:** The main purpose of a stepping motor is to send an electric signal to the corresponding windings, causing the motor to run in a specific direction.
- Steering Control Principle:** Step motor rotation direction control is the control of the stepper motor's forward and backward rotation, which can be changed by adjusting the power sequence.

Methods and Materials

- LabVIEW coding and simulation:**



- Stepping motor adopts RS440-442 two-phase four-wire stepping motor
- WANTAI Micro-step driver DQ542MA:** This driver is designed to drive the stepper motor with forward and reverse control.



Results

The stepper motor was controlled and manipulated as anticipated, resulting in accurate readings and hysteresis understandings, giving me a complete interpretation of a stepper motor driven by the combination of LabVIEW and DAQmx.

Conclusions

It's important to note that stepper motors are intended for unique applications requiring low-cost, high-accuracy positioning and variable speed. The project's usefulness can be put to good use in any area that does not require or exclude human intervention, such as hazardous environments, mining, and a variety of other industrial and medical fields.

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Acknowledgments:

John Hession

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https://www.researchgate.net/publication/276062605_Stepper_Motor_Control_using_LabVIEW_and_NI-myRIO

