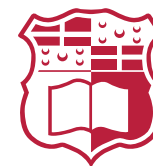




Faculty of Engineering Projects

2025



L-Università ta' Malta
Faculty of Engineering

Foreword

I am happy to introduce this year's final-year project booklet from the Faculty of Engineering. It brings together the work our students have done in their final stretch here, projects that show not just what they have learned, but how they have applied it.

These are not just classroom exercises. They are real attempts at solving problems, building things, testing ideas, and figuring things out along the way. You will see a mix of approaches and outcomes, and that is part of what makes it interesting. The work reflects effort, learning, and the kind of thinking that engineering demands.

This booklet gives a glimpse into the range of skills our students have developed, and it speaks to their commitment. It also reflects the support and guidance offered by the staff throughout the process.

Thanks to everyone who contributed, students, supervisors, and support teams. And to those reading, we hope you find something here that sparks your curiosity or inspires your own ideas.

Prof. Ing. Andrew Sammut

Dean, Faculty of Engineering



#EngineeringTheFuture
#ShineAtUM

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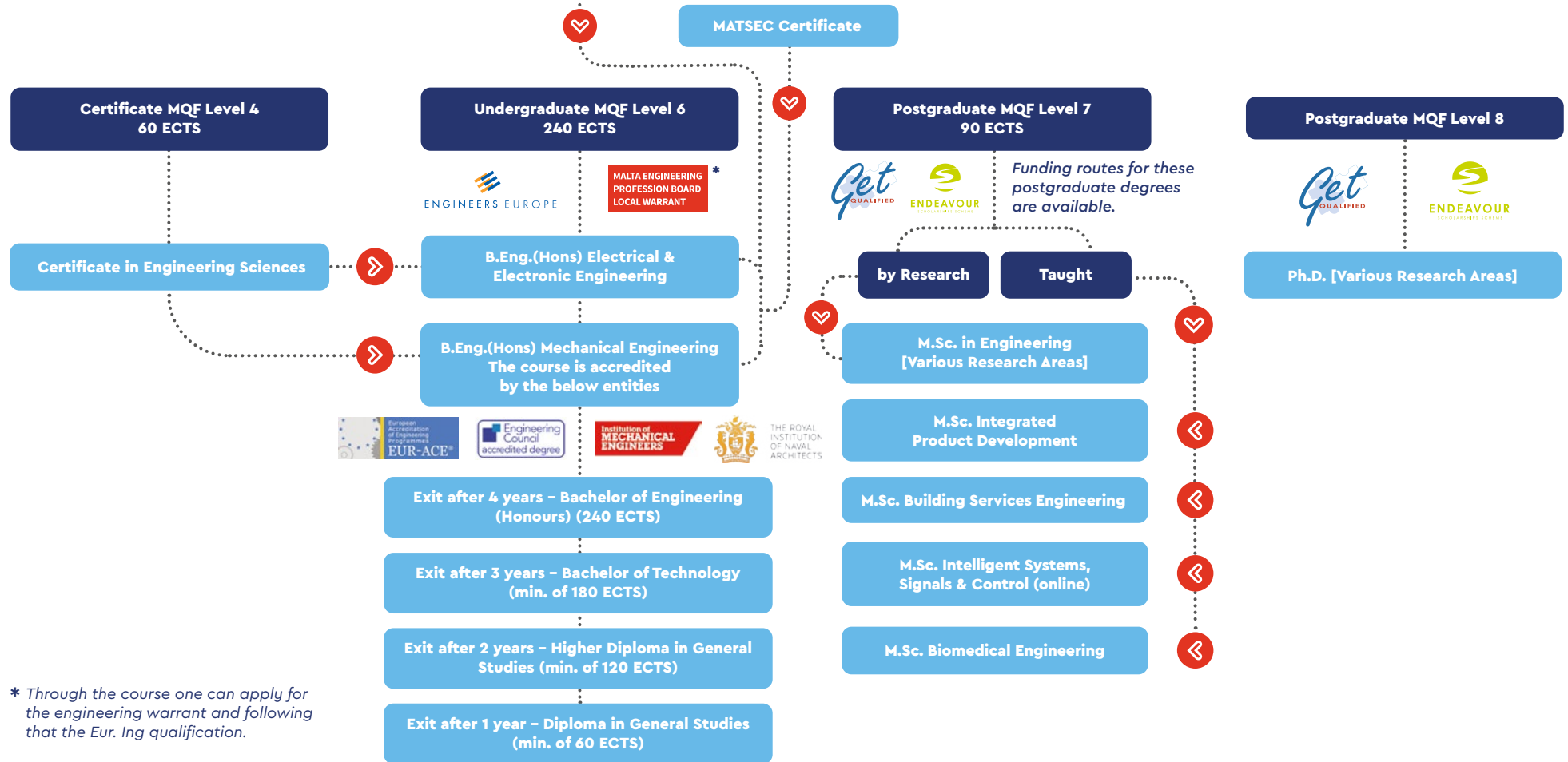
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Courses

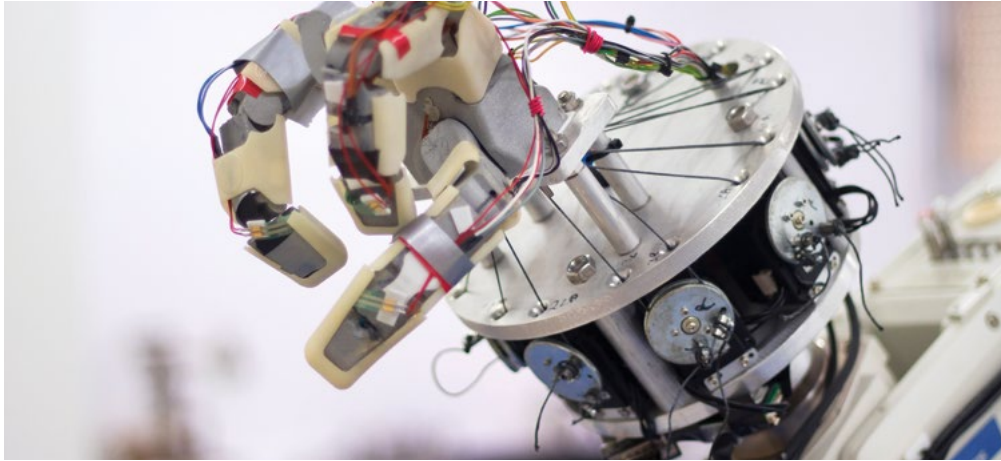
International School for Foundations Studies Course



Faculty of Engineering Courses



* Through the course one can apply for the engineering warrant and following that the Eur. Ing qualification.



Bachelor of Engineering (Honours)



UM STREAM
Science & Technology



MQF
Level 6



DURATION
**4 Years Full-time /
8 Years Part-time Day**



**COURSE
FINDER** →



AREAS OF STUDY

- Electrical and Electronic Engineering
- Mechanical Engineering

The Bachelor of Engineering (Honours) course develops the fundamental scientific and mathematical knowledge, engineering design, analysis and practice together with the interdisciplinary economic, ethical and social skills necessary for the different engineering-related job markets offered in various local and international industrial sectors such as the aerospace, biomedical, maritime, energy, telecommunications, electronics and manufacturing industries as well as that of building services. The course focuses on two main universal engineering areas of studies; Electrical and Electronic Engineering or Mechanical Engineering.

The Electrical and Electronic Engineering programme addresses the fundamental concepts in electrical engineering, electronics, signal processing and control systems. Students will be able to choose a variety of study-units geared towards the fields of energy generation,

conversion, storage and smart distribution, renewable energy, green transportation, electronic sensing, acquisition and measurement, electronic product development, automated systems, autonomous vehicles/robots and software algorithms for signal, image and video processing.

The Mechanical Engineering programme addresses the fundamental concepts in mechanical, manufacturing and materials engineering, and then focuses on one of three streams as selected by the student: Applied Materials in Engineering; or Applied Mechanics and Thermofluids Engineering; or Industrial and Manufacturing Engineering. Students will be able to choose a variety of study-units geared towards fields such as aerospace engineering, automotive engineering, biomaterials, biomechanics, building services, energy, maritime engineering, nanomaterials, polymer and composites manufacture, quality and reliability engineering, robotics and automation, structural integrity, surface engineering, tool design and manufacture.

This course is recognised by the local Engineering Profession Board as a prerequisite for the application of the Engineering Warrant (Ing.) and is also internationally recognised by the European Federation of National Engineering Associations (FEANI - Eur.Ing.).

Both areas of study are also accredited by the Engineering Council U.K. as, in part, satisfying the requirements of a Chartered Engineer (CEng - second cycle degree) and fully meeting the requirement of an Incorporated Engineer (IEng). The course is also recognised by the European Network for the Accreditation of Engineering Education (ENAAE) and labelled as a first cycle Engineering degree under the EUR-ACE programme.

ENTRY REQUIREMENTS

Either






- satisfy the General Entry Requirements together with **two** Advanced Level passes at Grade C or better in **Pure Mathematics and Physics**

or

- be in possession of the **Certificate in Engineering Sciences** from the University of Malta.

The Faculty Board may also consider applicants in possession of a qualification at MQF Level 5 in an engineering domain, together with passes in the Secondary Education Certificate Examination at Grade 5 or better in English Language, Maltese, Mathematics and Physics, to join the Course. Such applicants shall be required to present with the qualification they submit for entry, a detailed transcript showing their performance during their studies. They shall further be required to attend for an interview to assess whether they have the necessary aptitude to follow the Course with profit.

Certificate in Engineering Sciences

 UM STREAM Science & Technology	 MQF Level 4
 DURATION 1 Year Full-time / 2 Years Part-time Day	 COURSE FINDER 

The Certificate in Engineering Sciences is a one-year certificate course intended to prepare students with the knowledge, skills and competencies necessary to follow the B.Eng. (Hons) course. During the course, students will be studying mathematics and physics, bringing the student's knowledge and understanding of these two subjects to the level which meets the specific requirements of the B.Eng. (Hons) degree course. The programme also includes studies specific to the engineering profession. Through engineering workshops and laboratories, the programme will complement theoretical skills with practical skills in mechanical fitting, machining and manufacturing, electrical installations, electronics and control engineering. Moreover, a unit in computer systems and programming will help to prepare you to become a modern engineer.

ENTRY REQUIREMENTS

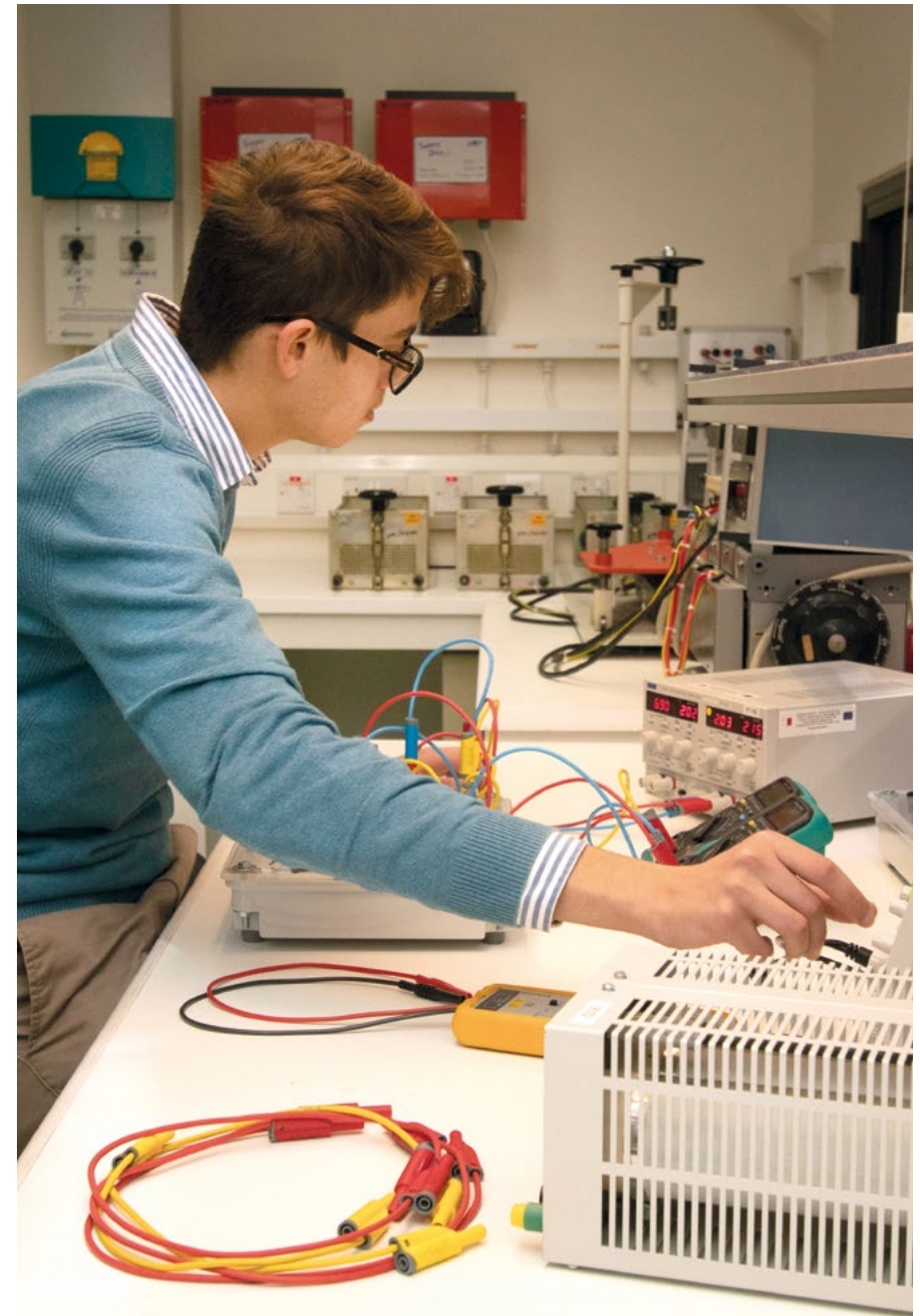
Either

have obtained a minimum of 36 points in examinations taken as part of the Matriculation Certificate and be in possession of passes in the Secondary Education Certificate Examination at Grade 5 or better in **English Language, Maltese** and **Mathematics** together with a pass at Advanced Matriculation Level in one of the following subjects: **Applied Mathematics, Chemistry, Computing, Engineering Drawing, Graphical Communication, Information Technology, Pure Mathematics, Physics** or other science/numeric subjects as approved by the Faculty Board;

or

be in possession of a diploma in an engineering domain which the Board deems as appropriate, classified at MQF Level 4, as well as passes in the Secondary Education Certificate Examination at Grade 5 or better in **English Language, Maltese** and **Mathematics**.

Applicants may be required to attend for an interview to assess whether they have the necessary aptitude to follow the Course with profit.



The background is a monochromatic blue image. On the left, a hand is shown holding a pipette, with a small droplet of liquid being dispensed. On the right, a white DNA double helix structure is visible, partially overlapping the pipette's tip. The overall scene suggests a laboratory or research environment.

Section 1

Biomedical Engineering

Development and Characterisation of a Blood Perfusion System

Student: **Nicholas Conrad**

Supervisor: **Dr Ing. Evan Dimech** | Co-Supervisor: **Prof. Lourdes Farrugia**

What is your project about?

Microwave ablation is an alternative, minimally-invasive treatment for tumours that uses a microwave antenna to heat and destroy cells. Many studies surrounding ablation have been carried out on ex-vivo tissue without considering the effects of in-vivo blood perfusion on antenna performance.

This dissertation aimed to enhance the design, construction and characterisation of an automated perfusion system for ex-vivo porcine livers. Such a system could then be used to replicate parameters such as temperature, blood pressure and flow rate brought about by blood perfusion on ex-vivo porcine tissue, allowing for testing of microwave ablation equipment in conditions that more closely resemble the in-vivo physiological environment.

Why are you working on this project?

The motivation behind this project was the many ways that engineering can be used to understand the human body and provide new tools for better diagnosis and cures. The results of this project could potentially be used in the development of life-saving technologies to treat cancer and other medical conditions. Given the substantial contribution of cancers to the total death toll of many populations, including the Maltese population, this could open the possibility of more accurate testing of newer, potentially safer treatments which utilise electromagnetic radiation or other technologies.

This project has also helped me refine and expand on many aspects of engineering knowledge, since it involved different engineering facets during project design, development and validation. Moreover, it has given me an insight into the more interdisciplinary side of engineering, as through this project I have been introduced to areas such as fluid dynamics, human and animal physiology and the interactions between electromagnetic fields and biological tissue.



Developing a Multi-user SSVEP-based BCI

Student: **Kaya Saliba**

Supervisor: **Prof. Ing. Tracey Camilleri**

What is your project about?

This research explores how the brain's electrical signals responds to flickering visual stimuli that can control a computer system, in this case focusing on steady-state visually evoked potentials (SSVEPs). Participants in this test will wear caps with non-invasive electrodes to record brain activity while focusing on different flickering stimuli, both individually and in a competitive setting with another participant. The goal is to investigate whether a competitive environment improves brain signal clarity and response accuracy compared to when users perform the task alone. This research may enhance multi-user brain computer interface systems (BCIs) used in gaming, rehabilitation, and assistive technology.

Why are you working on this project?

The field of neural engineering and brain-computer interfaces represents a rapidly advancing frontier at the intersection of neuroscience, computing, and signal processing. This research was chosen in response to a growing interest in how human cognitive states—particularly attention and motivation—can be translated into functional control signals through non-invasive means such as electroencephalography (EEG). The inclusion of a competitive environment introduces a novel dimension, enabling the study of how social engagement and real-time feedback can influence neural signal strength and user focus.

From a broader perspective, this work holds relevance for both the public and industry. The applications of BCIs in assistive communication, rehabilitation, and immersive gaming are growing in demand. By improving the responsiveness and reliability of multi-user BCIs, this research has the potential to contribute to more inclusive technologies for individuals with motor impairments and to create richer, more engaging interactive systems. Personally, this research aligns with my academic interests in neurotechnology and my motivation to develop solutions that merge innovation with societal benefit.



A Novel Metered Dose Inhaler with Spacer for Effective Delivery of Drugs to treat COPD

Student: **Jake Bugeja**
Supervisor: **Prof. Inġ. Philip Farrugia** | Co-Supervisor: **Dr Cynthia Farrugia Jones**

What is your project about?

The project involves designing a smart attachment for a metered-dose inhaler spacer to enhance the delivery of respiratory drugs for patients suffering from Chronic Obstructive Pulmonary Disease (COPD). The attachment aims to monitor usage patterns, and provide real-time feedback to patients, particularly elderly individuals who may struggle with proper inhaler technique. By incorporating sensors and smart technology, this device helps improve drug efficacy and medication adherence, ultimately enhancing treatment outcomes for COPD patients.

Why are you working on this project?

Chronic Obstructive Pulmonary Disease (COPD) is a debilitating condition that affects millions worldwide, particularly the elderly. One of the greatest challenges in managing COPD is ensuring that patients use their inhalers correctly, as improper usage can lead to ineffective treatment. My motivation for working on this project is to improve the quality of life for COPD patients, especially older individuals who may struggle with correct inhaler technique. Through the development of a smart spacer attachment, my goal is to enhance medication adherence, ensure proper drug delivery, and ultimately help people manage their condition more effectively. By integrating technology into a simple healthcare device, I aim to create a practical solution that makes it easier for individuals to take control of their health and feel more confident in managing their COPD. This project is driven by my desire to contribute to the well-being of others and make a meaningful difference in the lives of patients.



Configuration Design of A Modular & Stable 'Above the Knee Prosthesis'

Student: **Tazio Spanò**
Supervisor: **Prof. Jonathan C. Borg**

What is your project about?

This project optimises a modular, low-cost, and user-friendly above the knee prosthesis (AKP) under the University of Malta's PREMIER initiative. This aims to enhance mobility and quality of life for amputees. By improving stability and aesthetics, the project enhances key components like the internal supports, gears, covers, and foot using improved materials and 3D printing. Innovations include an updated internal support geometry, durable polyamide (Nylon) helical bevel gears, and a carbon fibre foot for better stability. Additionally, a sleek protective cover ensures a natural look while improving ingress protection of the internal components.

Why are you working on this project?

By improving the PREMIER prosthesis, I aimed to address the challenges of limb loss, which profoundly impacts mobility and independence, often requiring costly prosthetics that lack stability or aesthetic appeal. As an engineering student, I aimed to make the PREMIER prosthesis affordable, stable, and user-centric, helping bring this project to fruition and better the lives of amputees in Malta and around the world. This project showcases Malta as a hub for innovative medical technology, which I am grateful to be a part of, while providing valuable experience in biomedical engineering. This aligns with my goal to create technology that not only fulfils its functions but betters the world as a whole. A goal I look forward to continuing in my career.



Comparative Analysis and Validation of Different Measurement Technologies for Vertical Jump Performance

Student: **Gianluca Falzon**
Supervisor: **Prof. Ing. Christopher Micallef**
Industrial Partner: **Malta Olympic Committee (MOC)**

What is your project about?

The Malta Olympic Committee (MOC) carry out various test in their Functional Diagnostic Laboratory (FDL) to analyse athlete health and performance. One of the tests is the multi-rebound jump which involves a number of consecutive jumps over a period of time. The current software used in the FDL fails to provide the individual flight times, contact times, and jump heights of the test. The main aim of this project is to provide the analyst with these metrics through a custom-built Excel software. Furthermore, the same metrics were found using an accelerometer on a mobile application. The results gathered from the accelerometer to the custom-built software were compared and validated with the use of a high-speed camera. This was done to analyse the accuracy of the different technologies and determine the most cost-effective technology.

Why are you working on this project?

My interest in Sports Science stemmed from a young age, particularly in how new technologies can be used to analyse and improve athletic performance. This project combines my passion for engineering and sports. Hence, I felt like it was the perfect opportunity to enhance my knowledge in the sports engineering field. By providing further metrics for the analyst at the Functional Diagnostic Lab (FDL) he will be able to better understand the athletes' physical condition. As a result, our national athletes will benefit from enhanced performance monitoring, early detection of potential injury risks, and more personalized training programs. Collectively, these improvements aim to support better preparation and, ultimately, stronger performances in competitive events.



Development of a Force Sensitive Prosthetic Finger

Student: **Luca Abela**
Supervisor: **Prof. Ing. Michael A. Saliba**

What is your project about?

This project involves designing a compact force sensor for integration into a prosthetic finger. The sensor measures the magnitude of an applied force and also identifies the position along the finger where the force is acting. Many current prosthetic hands lack this sensing capability, making it difficult for users to grip objects accurately and safely. By providing real-time feedback on both force and location, the sensor enhances control and precision, helping prevent issues like dropping or crushing objects. The goal is to improve the functionality and responsiveness of prosthetic hands, making them more intuitive and effective for everyday use.

Why are you working on this project?

I chose to work on this project because I am passionate about designing technology that directly improves people's lives. The field of prosthetics, especially upper-limb prosthetics, combines biomechanics, electronics, and mechanical design in a way that is both technically challenging and deeply meaningful. I am particularly interested in the problem of restoring a sense of touch and control to prosthetic users, as it represents a critical gap in current prosthetic functionality.

This project allows me to apply engineering principles to solve a real-world problem that affects many individuals, including those recovering from injury or living with limb differences. Developing a force sensor that can detect both the magnitude and location of contact can lead to smarter, more responsive prosthetic hands. Such advancements are not only relevant to individuals but also to the growing prosthetics industry, which continues to seek ways to create more lifelike and functional devices that enhance user independence and quality of life.



Biomechanical Analysis and Transtibial Prosthesis Design for Pedal Harpists

Student: **Michela Vella**
Supervisor: **Prof. Ing. Michael A. Saliba**

What is your project about?

Pedal harps, also known as concert harps, have seven foot pedals that are used to change the pitch of the strings and switch between musical keys while playing. Four pedals are operated by the right foot and three by the left. For professional harpists, losing one foot through amputation can make playing the instrument extremely challenging, if not impossible. This project explored how a harpist's legs and feet move during a performance, using motion capture technology to study the biomechanics of pedal use. These insights helped determine the range of motion and force that a prosthetic leg would need to replicate. The outcome was the design of a transtibial (below-the-knee) prosthetic leg aimed at enabling an amputee to play the pedal harp.

Why are you working on this project?

I chose this topic because it brings together two things I care deeply about: music and inclusive design. As a harpist myself, I have always been fascinated by the complexity of pedal technique, a crucial yet often overlooked aspect of concert harp performance. At the same time, I've developed a strong interest in biomechanics and how engineering can be used to improve people's lives. I was inspired by the innovation behind prosthetics developed for musicians, such as pianists and violinists, but realised that similar solutions have rarely been explored for harpists. This project gave me the opportunity to design something that supports accessibility in a highly specialised art form. While the target audience is niche, the broader relevance lies in showing how engineering can be applied creatively to empower individuals and restore access to their passions, a principle that resonates in both healthcare and industry.



A study on orthotic insoles using Finite Element Analysis

Student: **Matthew James Barbara**
Supervisor: **Prof. Ing. Pierluigi Mollicone**

What is your project about?

This project is focused on verifying the effectiveness of orthotic insoles for diabetic patients. Orthotic insoles are prescribed to diabetic patients on the basis that they may reduce the pressure underneath the foot, alleviating pain and any additional damage. Although this can also be investigated through experimental means, engineering analysis enables such an investigation to be conducted in a more repeatable, and flexible manner. Understanding how to accurately analyse the behaviour of a healthy, adult human foot as well as the material used in the orthotic insole was paramount for acquiring accurate results, synonymous with actual physical behaviour.

Why are you working on this project?

Coming from a sports background, biomechanics was always an interest of mine. The union of science, engineering and the human body is a field I find to be extremely fascinating, and this project presented me with an opportunity to use the engineering knowledge I have accumulated over the past four years to immerse myself in a biomechanics-related endeavour.

In addition to this, I also knew that my work would be contributing to a solution for a prevalent disease, affecting 11.1% of people aged 20-79 globally. Desensitisation of the nerves at the lower limbs is a common symptom of diabetes, which, if left untreated, can develop foot ulcers. The most pernicious consequences of foot ulceration are infection and/or amputation of the lower limbs, which can cause significant economic and emotional turmoil to the patient. This project perfectly aligns my interests with an opportunity to improve the well-being of a significant number of people.



Fatigue Life Analysis on the Shell of the MaltaHip using Finite Element Analysis

Student: **Jasmina Sanjic**
Supervisor: **Prof. Ing. Pierluigi Mollicone**
Industrial Partner: **Garland Surgical Ltd**

What is your project about?

The MaltaHip is a novel polymer-on-metal hip joint prosthesis design that makes use of three cylindrical orthogonally-aligned articulations to replicate the three degrees of freedom of the hip. This unconventional design minimizes the wear on the prosthesis, increasing the lifespan of the prosthesis and reducing the necessity of revision surgery.

The aim of this project is to determine the fatigue life of the shell of the prosthesis by replicating the 'Standard Test Method for Fatigue Testing of Acetabular Devices for Total Hip Replacement' using finite element analysis (FEA) to help improve the current design.

Why are you working on this project?

From the onset of my engineering education, I have always been drawn to the field of biomechanical engineering. I was drawn to it because of its ability to integrate principles of mechanics with biological systems to improve human health. I am particularly interested in how biomechanical engineering contributes to the development of innovative implants that are not only structurally sound but also biocompatible and responsive to the body's needs. This area of study aligns closely with my academic interests in applying engineering concepts to solve complex challenges in medicine and rehabilitation.

This project has given me the opportunity to work on a real medical product with the potential to improve surgical outcomes of many total hip replacement patients in the future. The idea of working on something that can benefit people in the future adds a sense of fulfilment and achievement.



Section 2

Computer Vision & Artificial Intelligence

Identifying Optimal Investment Strategies with Deep Reinforcement Learning

Student: **Mia Gauci**
Supervisor: **Dr Kenneth Scerri** | Co-Supervisor: **Dr Liam Butler**

What is your project about?

My project explores how Artificial Intelligence (AI) can be used to make smarter financial decisions in the stock market thus mimicking robo-advisors or algorithmic traders' work. It focuses on a specific type of AI called deep reinforcement learning, which learns by doing, much like how humans learn from experience. The project looks at how this approach can help a computer recognise patterns in market data and decide when to buy or sell stocks to make a profit. The goal is to see whether these AI systems can make better investment decisions in unpredictable markets, without relying on fixed rules or constant human input.

Why are you working on this project?

Financial markets are constantly changing and designing systems that can respond intelligently to those changes is both a practical and challenging task. Through this project, I wanted to deepen my understanding of how markets function and how automated strategies can be built to make trading decisions without relying on fixed rules. Deep reinforcement learning stood out as a compelling method because it learns through experience, adjusting its decisions based on what leads to better outcomes over time. What interested me the most was the complexity of the method and its resemblance to real-world decision-making, where outcomes are rarely certain. This project explores whether such methods can be applied effectively to financial trading, and has clear relevance beyond academia, particularly in areas like algorithmic trading, hedge funds, and fintech, where adaptive and autonomous systems are becoming increasingly valuable.



Augmented Storytelling: Bringing Drawings to AR

Student: **Vanya Gelfo**
Supervisor: **Prof. Alexandra Bonnici**

What is your project about?

Humans can naturally interpret 3D shapes from simple 2D sketches, even when lacking depth or perspective—a skill that's especially noticeable in children's drawings. This project aims to replicate that intuition by transforming children's 2D sketches into interactive, textured 3D models within an Augmented Reality (AR) environment. Specifically, focusing on interpreting character drawings which can then be edited in the AR environment to create a live interactive story.

Unlike existing methods that ignore color and texture, this system retains the full visual identity of the original sketch. A custom PaintApp captures both the image and stroke data. Using an inflation method, the 2D silhouette is "puffed up" into a 3D mesh that reflects the original intent.

The final model is imported into Unity and displayed via HoloLens 2, where users can interact with and modify it using Constructive Solid Geometry (CSG) tools for real-time editing.

Why are you working on this project?

The motivation for this project stems from an interest in both creativity and technology. Focusing on interpreting children's drawings, this project has the ability to create a playful and educational tool that fosters creativity and engagement, especially among younger users. Providing a unique opportunity to contribute to both research and real-world applications by developing a system which is able to transform imaginative drawings into an interactive 3D experience within a Mixed Reality environment.



Stock Price Predictions using Ensemble Learning Methods

Student: **Luca Trapani**
Supervisor: **Dr Kenneth Scerri**

What is your project about?

My project aims to leverage data analysis and artificial intelligence to predict stock price movements. By analysing historical stock prices, trading volumes, and sentiment from news sources, the goal is to provide investors with insights into when to buy, sell, or hold stocks. The focus is on identifying hidden trends and patterns that traditional analysis might overlook, which could indicate potential future price changes. Ultimately, it seeks to enhance financial decision-making, making it more informed, efficient, and accessible to both experienced investors and those new to the market.

Why are you working on this project?

I chose this project because it brings together technology and finance. I've always been fascinated by how data and algorithms can be used to uncover patterns and make better decisions. The stock market, with its complexity and dynamic nature, presents a compelling challenge where small improvements in prediction can lead to significant results. Personally, I'm interested in how artificial intelligence can be applied to solve practical problems, and this project allows me to explore that in a meaningful way.



This work is highly relevant to both the general public and industry. With more people participating in financial markets, tools that can support smarter, data-driven investing are increasingly valuable. For the finance industry, such technology can improve risk management, strategy development, and operational efficiency. By exploring this field, I hope to contribute to the growing movement of making financial systems more intelligent, accessible, and transparent.

Augmented Training: AR Onboarding Solution for ERIL's DIME Labs

Student: **Usama Hamed Abdullah Al-Maskari**
Supervisor: **Dr Ing. Joseph Zammit**

What is your project about?

This project introduces an augmented reality (AR) solution to improve onboarding and safety training at the ERIL laboratories within the University of Malta. Using the Microsoft HoloLens 2, the system enables new students and researchers to explore lab spaces interactively. By scanning physical markers outside each lab, users access holographic panels that display equipment data, safety protocols, and lab-specific instructions. The application was developed using Unity and the Mixed Reality Toolkit (MRTK3), aiming to modernize the onboarding process and enhance user engagement, comprehension, and retention.

Why are you working on this project?

The onboarding process in educational and industrial environments often lacks interactivity and efficiency. As a mechanical engineering student passionate about digital manufacturing and immersive technologies, I wanted to explore how augmented reality could bridge this gap. This project reflects my personal interest in merging engineering with modern human-computer interfaces to solve practical problems. AR offers a powerful means to visualize and deliver complex information intuitively. By using it for lab onboarding, we aim to improve user understanding and safety awareness, especially for those unfamiliar with technical environments. This work is highly relevant to educational institutions and industries facing challenges in knowledge transfer, training consistency, and user engagement. With increasing adoption of AR in manufacturing and engineering, this project highlights a scalable and effective training method that could eventually be extended to maintenance, remote support, and process documentation.





Section 3

Electronics Engineering

Solid State Gamma Spectrometer

Student: **Mohamed Alouzi**
Supervisor: **Prof. Ing. Marc Anthony Azzopardi**

What is your project about?

This project focuses on the development of a compact gamma-ray spectrometer, a device capable of detecting and identifying radioactive materials by measuring the energy of emitted gamma rays. Traditional spectrometers rely on bulky, high-voltage components such as photomultiplier tubes. In contrast, this work explores a modern, low-voltage semiconductor alternative using the silicon photomultiplier (SiPM). This substitution enables a significant reduction in size and cost, making the spectrometer more accessible and suitable for portable applications. The project covers the process of designing and testing the gamma-ray spectrometer and evaluating its performance using natural radioactive sources.

Why are you working on this project?

This project combines my interests in physics and electronics. Gamma-ray spectrometry relies on the principles of radiation-matter interaction, while its implementation demands practical skills in analogue and digital circuit design. It's a project that bridges theoretical knowledge with hands-on engineering, offering both theoretical depth and practical application.

Radiation detection plays a critical role in fields such as environmental monitoring, nuclear safety, and healthcare. By using modern components like SiPMs, this project aims to create a spectrometer that is smaller, more affordable, and suitable for integration into systems such as drones or handheld tools. This could enable faster response times in nuclear incidents or improve accessibility to radiation monitoring in remote areas.



Software Radio for a UHF Phased Array Ground Station

Student: **Jarno De Jonckheere**
Supervisor: **Prof. Ing. Marc Anthony Azzopardi**

What is your project about?

The ASTREA project at the University of Malta aims to develop a low cost solution to allow end users and electronics manufacturers to test electronic devices, systems and materials directly in space. As part of this project a low-cost icosahedral geodesic dome antenna using a phased-array architecture and a Transmit/Receive module to interface with, and drive the geodesic dome antenna were designed.

This project aims to design a software-defined radio solution to drive a Transmit/Receive module with a similar signal processing chain, which deviates from the original Transmit/Receive module towards a Frequency-Multiplexed Phased Array architecture.

During this project a Commercial Off-The-Shelf (COTS) low-cost SDR was used. The focus of this project was mainly on digital signal processing architecture design and performance optimization without heavy reliance on FPGA acceleration which would require more high-end SDR hardware.

Why are you working on this project?

The subject of this project was particularly appealing to me as it exists in the same sphere as space, satellites and other related topics, which is for any aspiring engineer a rather interesting topic.

As a student whose experience and previous experiences and education was also primarily focused on electronics, telecommunications and software development this project seemed to fit perfectly not only within my field of interest but also my academic background, but also, my further aspirations.

As a Belgian Erasmus student, all of the above, combined with the fact that I had the opportunity to complete this project in a foreign country, at a new university, and within a completely new environment, made this experience both unique and rewarding. Additionally, the shorter timeframe of my project added an extra layer of challenge, pushing me to adapt quickly and manage my time effectively. Overall, this project has strengthened my skills, broadened my perspective, and enhanced my passion for engineering.



Comparative Analysis of Pre-Compliance EM Conducted Emissions in Automotive Products

Student: **Gary Lee Vella**

Supervisor: **Dr Ing. Evan Dimech** | Co-Supervisor: **Prof. Lourdes Farrugia**

Industrial Partner: **Methode Electronics Malta Ltd.**

What is your project about?

The project focuses on evaluating electromagnetic (EM) noise that automotive products emit into their wiring systems, known as conducted emissions. It involves the setting up of multiple CISPR 25 test environments with the aim of comparing results from pre-compliance setups which involve equipment which abides close conformity to the standard and a more cost-effective alternative, finally comparing the results with those obtained from a certified laboratory. The aim is to determine how reliable pre-compliance tests are, offering a cost-saving and iterative test procedure especially during the design stage. Additionally, this work studies the effects of common-mode and differential-mode conducted emission noise, to understand their role during the design stage.

Why are you working on this project?

Electromagnetic compatibility (EMC) is a fascinating and increasingly important area of study, especially as modern vehicles become more reliant on complex electronic systems. I was drawn to this project because EMC remains a somewhat ambiguous field, with ongoing research and development both globally and at the University of Malta, where this area is still relatively new. This presented an exciting opportunity to contribute to a growing body of knowledge.

The motivation behind this work lies in improving the accessibility of EMC testing. Certified lab tests are expensive, which hinders electronic manufactures to test early especially during the design stage. Hence reliable pre-compliance testing can help developers save time and resources. Through this project, I am not only expanding my knowledge in EMC but also engaging with practical engineering challenges that are highly relevant to industry.





Section 4

Engineering Mechanics & Structural Integrity

Analysis of 3D Printed Honeycomb Cores

Student: **Josef Xerri**

Supervisor: **Prof. Inğ. Claire De Marco** | Co-Supervisor: **Prof. Inğ. Duncan Camilleri**

What is your project about?

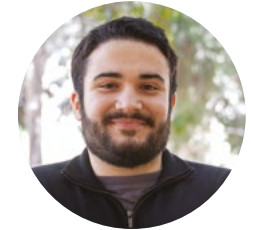
This dissertation explores how 3D printing can be used to create honeycomb cores. These structures are strong yet lightweight, commonly found in applications where saving weight without sacrificing strength is essential, such as aircraft wings and car panels. The aim of this study is to understand how these 3D-printed structures behave during tension and compression and to compare their response to theoretical and experimental results. This work includes mechanical testing of printed samples and computer simulations to predict and validate the experimental findings.

Why are you working on this project?

I chose this project due to my interest in the relationship between advanced manufacturing and structural design. 3D printing offers versatility when producing complex geometries with minimal material waste, and honeycomb cores are an ideal case study due to their high structure-to-weight ratio.

The project appealed to me as it combines theoretical analysis, finite element analysis, and experimental validation. The work is highly relevant to the aerospace and automotive industries, where reducing weight without compromising performance is a key design aspect.

Understanding how 3D-printed materials behave under mechanical loads can contribute to more sustainable and efficient engineering solutions. I find it rewarding to tackle problems where innovative design and materials can result in performance improvements in real-world applications.



Structural Integrity of Spur Gear Systems using Analytical and Finite Element Analysis Techniques

Student: **Alessandro Baldoni**
Supervisor: **Prof. Inğ. Martin Muscat**

What is your project about?

This project focuses on understanding how and why gear teeth fail, especially due to pitting and bending. Pitting is when small cracks form on the surface and grow over time, while bending failure happens when a tooth breaks at its base from repeated stress. These failures can affect many types of vehicles and machines, such as cars, turbines, and aircraft. The project aims to study the stresses on gear teeth using both traditional analytical calculations and modern computer modelling and analyses. This helps in providing more insight into the design reliability and performance of gears in real-world applications.

Why are you working on this project?

I've always been fascinated by how things work and, more importantly, why they sometimes don't. This curiosity led me to explore mechanical engineering, where understanding failures is just as crucial as designing new systems. While gears are the focus of my current project, they serve as a practical example to delve into broader concepts like stress analysis, material behaviour, mechanical design principles and structural integrity assessments. This project offers a hands-on opportunity to apply theoretical knowledge to real-world scenarios, enhancing my problem-solving skills and engineering judgment. The insights gained here are applicable across various industries, from automotive to aerospace, where reliability and efficiency are paramount. Ultimately, this work aligns with my goal of contributing to the development of durable and efficient mechanical systems that stand up to the demands of everyday use.



Design by Analysis Applicable to Mechanical Engineering Components within a Nuclear Fusion Reactor

Student: **Edward Rossi**
Supervisor: **Prof. Ing. Martin Muscat**

What is your project about?

This project investigates the design of components inside a nuclear fusion reactor and how they behave under extreme conditions. Using computer simulations, it models how parts of the reactor—specifically the divertor, which handles intense heat and neutron irradiation—respond to high temperatures, pressure, and mechanical loads. An elastic design by analysis approach is used. The aim is to ensure that these parts remain safe and fit for their purpose during reactor operation. By performing structural integrity assessments of these in vessel components the project supports the broader European goal of making fusion energy a viable and sustainable source of power for the future.

Why are you working on this project?

Fusion energy has the potential to provide clean, abundant energy with minimal environmental impact. I chose this project because I'm fascinated by the challenge of designing components that can survive in such an extreme environment. It combines my interest in mechanical engineering, materials science, and advanced simulation techniques. From a personal perspective, the opportunity to contribute—even in a small way—to the development of sustainable energy solutions is very rewarding. This work is highly relevant to industry and society: fusion energy could transform the global energy landscape, but only if we first solve the engineering challenges. The results of this project could help guide the design of future reactor components, contributing to safer and more efficient fusion reactor systems.



Design and Optimization of a Solid Rocket Motor

Student: **Francesco Cini**
Supervisor: **Prof. Ing. Martin Muscat**

What is your project about?

The final year project consists of finding the optimal design of a solid rocket motor which is capable of propelling a rocket up to a final altitude of 9 kilometres. Minimizing the mass of rocket components is crucial, as a lighter vehicle allows for a larger payload. Due to the iterative nature of solid rocket motor design, traditional design approaches tend to be time-consuming and prone to human error. In this project I developed computer software which combines modern optimization techniques and rocket propulsion design principles to determine a design configuration which results in minimum mass for a given performance requirement.

Why are you working on this project?

I've always been interested in the field of Aerospace Engineering. Two years ago, I set up the student organisation 'UM Rocketry', which focuses on designing, testing, and launching amateur-scale rockets. As president and former leader of the propulsion team, as of writing, two solid rocket motors have already been designed over the course of two years, with one currently being manufactured. Having such experience in this line of research, it was clear that the current design phase was rather inefficient, taking up lots of time, as well as difficulties having designs that can be easily manufactured with currently existing material suppliers. This issue drove me to develop a more streamlined approach, resulting in speeding up the design process, saving time, increasing the rate of prototyping, and decreasing manufacturing complexity. All of these improvements will contribute to accelerating progress in amateur rocketry research within our student organisation and beyond.



Structural Integrity of Pod-Mounted Pico-Satellites during Launch Conditions

Student: **Ryan Grech**

Supervisor: **Prof. Inġ. Pierluigi Mollicone** | Co-Supervisor: **Prof. Inġ. Marc Anthony Azzopardi**

What is your project about?

My project is centred on ensuring that a pico-satellite weighing less than 250 g, is strong enough to survive the conditions it will face during its ascent into orbit. Using numerical analysis I was able to investigate whether the satellite structure is likely to survive intense vibrations, shocks and accelerations typical of rocket launches. This analysis helps build confidence on the safety of the satellite during launch, contributing towards its eventual certification for space missions. Ultimately this work contributes to research aimed at reliable and affordable access to space exploration.

Why are you working on this project?

My interest in space technology, aeronautical engineering and the significance of miniaturising satellites in facilitating access to space led me to pursue this field. I'm motivated by the prospect of directly contributing to satellite technology, particularly since pico-satellites have the potential to drastically lower the complexity and cost of space missions. My interests in space vehicle dynamics, computer-aided engineering and mechanics are all combined in this project, which gives me hands-on experience with state-of-the-art engineering analysis tools. Furthermore, by supporting essential services like communications, scientific research, environmental monitoring, and emergency management, structurally safe satellites serve society as a whole. The work has a direct impact on the future of space exploration and the provision of services delivered via space assets. This is extremely relevant to enterprises searching for dependable, effective methods to launch technologies into orbit.



Vertical Dynamics Characterisation of Formula Student Suspension

Student: **Bernard Vella**

Supervisor: **Prof. Inġ. Duncan Camilleri**

What is your project about?

Suspension systems in motorsport play a fundamental part in how well the vehicle handles and how comfortable it feels for the driver. But with so many parts and settings that can be adjusted, figuring out what is important for optimal performance can be incredibly challenging and time-consuming. The goal of the project is to develop a software simulation package for the University of Malta Racing team to allow testing of thousands of different suspension setups—virtually—without needing to test them all on a real track. This saves time, money, and effort while still helping the team find the best possible settings. To make sure the computer simulations are accurate, an experimental test rig was built to physically replicate the suspension system. By comparing real-life test results to simulations, we can better understand any differences and make the simulations even more reliable.

Why are you working on this project?

Being part of the University of Malta Racing team over the past four years has been one of the most rewarding experiences of my academic journey. It has sparked a deep passion for motorsport engineering, particularly when improving the performance of the race car through the understanding of vehicle dynamics and suspension design. The project was a natural extension of that interest, providing the opportunity to stay involved with the Formula Student race car while gaining valuable hands-on experience in suspension tuning, experimental testing, and sensor calibration. The skills and knowledge I've developed through the project will be an important step toward my goal of building a career in the motorsport industry within Formula One, where cutting-edge performance and engineering innovation are pushed to the limit.



Damping Characteristics of Natural Fibre-Reinforced Composites

Student: **Neil Bezzina**
Supervisor: **Prof. Inġ. Duncan Camilleri** | Co-Supervisor: **Prof. Inġ. Claire De Marco**

What is your project about?

The purpose of this dissertation is to test 4 different variants of natural fibre-reinforced composites made from woven Sisal and/or Flax fibres combined with a bio-based epoxy resin to determine the damping characteristics of these materials. The damping characteristics determine the composite's ability to absorb energy and disturbances, hence the importance of this dissertation is to further justify the use of these natural, eco-friendly alternatives in industrial and commercial applications as opposed to the standard materials used nowadays. These materials have proven to be a low-cost alternative for common applications, and this project will also further the research in the ever-growing technology of bio-composites and their properties.

Why are you working on this project?

I have chosen to conduct my research on vibrations analysis related to bio-composites as I wanted to explore the potential of these new materials while also challenging myself by analysing their damping characteristics. I am always looking for a new challenge, so this project was a clear opportunity to test myself.

The field of mechanics always interested me, especially those related to vibrations as the study of moving parts has always intrigued me. My curiosity to work out the movement and behaviour of any components in motion was discovered when I first learned physics in secondary school.

Currently, natural composites are scarcely seen being used in large-scale, industrial applications. However, they are expected to become the new alternative material for common components which will provide substantial growth and advancements to the automotive, marine, aviation, construction and even fashion and textile industries. These new materials can become a low-cost alternative which will benefit these industries without minimising quality while also contributing to sustainable development.



Damage Resistance of Hybrid Natural Fibre Composites Subject to a Quasi-Static Indentation Force

Student: **Matthew Jake Zammit**
Supervisor: **Prof. Inġ. Duncan Camilleri** | Co-Supervisor: **Prof. Inġ. Claire De Marco**

What is your project about?

This project explores the toughness of plant-based materials, specifically flax and sisal. These natural fibres are hand-woven into mats and combined with a resin to form solid plates. Some are made entirely of flax or sisal, while others combine both, creating hybrid composites. A metal indenter is used to slowly press into each plate until failure, allowing the energy absorbed to be calculated from the force and displacement. The results will help compare the performance of these natural composites to synthetic ones like fibreglass and carbon fibre. The goal is to support sustainability by encouraging natural alternatives in engineering applications.

Why are you working on this project?

My interest in this project was inspired by the potential that natural hybrid composites have in future industries. Combining different fibres in a single material can lead to noticeable changes in how it behaves, and it is interesting to observe the relationship between these parameters and the resulting performance. This variability is part of what makes composite materials so engaging to study. Flax and sisal stood out as materials since they are natural, biodegradable, and still relatively unexplored in structural applications. Working with them offered the chance to learn more about their potential and to see whether they could perform well enough to serve as alternatives to synthetic materials. These natural fibres are especially intriguing for use in products with a short lifespan such as sports equipment. The project brought together my interest in composite behaviour with the broader goal of supporting more sustainable engineering solutions.





Section 5

Fluid Dynamics & Thermodynamics

Examining the Effects of Different Winglet Designs on Aerodynamic Forces using Computational Fluid Dynamics

Student: **Rachel Mizzi**
Supervisor: **Prof. Ing. Christopher Micallef**

What is your project about?

Most aircrafts use specially designed wingtip geometries called winglets to improve aerodynamic efficiency. This project analyses several winglet types to examine how their shapes influence lift and drag forces. By increasing the lift-to-drag ratio, winglets help make the aircraft more efficient. While flying, aircraft generate turbulence, leading to the formation of wake vortices at the wingtips. These vortices contribute to drag and instability. This study investigates how winglets affect the formation of these vortices to reduce their intensity. All analyses are carried out using computational fluid dynamics (CFD), a simulation tool that models airflow around different objects to assess different aerodynamic properties.

Why are you working on this project?

I have always had a strong interest in the aviation and aerospace industry. Air travel has become one of the most widely used modes of transport, and over the years, various modifications have been made to aircrafts to improve their design, performance, and efficiency. Through this study, I was able to deepen my understanding of aerodynamics and how airflow interacts with different components through computational simulations.

Winglets play a significant role in improving aerodynamic efficiency by reducing drag and increasing lift, ultimately lowering fuel consumption. This has a direct environmental benefit by reducing emissions, making aviation more sustainable. The study focuses on the winglet designs most commonly found on commercial aircraft and investigates how their geometry contributes to better performance. By analysing current winglet designs used in aircrafts, future research could focus on developing alternative geometries that offer improved aerodynamic efficiency.



CFD modelling of the indoor unit of an air conditioner

Student: **Nichole Spiteri**
Supervisor: **Prof. Ing. Christopher Micallef**

What is your project about?

This project investigates how air flows within a split-type indoor air conditioning (SAC) unit to improve its performance and efficiency. Using computer simulations and experimental testing, the airflow patterns at different fan speeds were analysed. The main objective is to understand the complex flow behaviour, including turbulence, recirculation, and energy transfer, that affects how efficiently the AC unit delivers conditioned air. The findings aim to optimize AC system design to ensure better energy efficiency, lower operational costs, and improved indoor comfort.

Why are you working on this project?

Air conditioning systems are essential for maintaining indoor comfort, especially as global temperatures rise, and cooling demands increase. However, the efficiency of AC units often varies, and inefficiencies in airflow can lead to higher energy consumption and increased costs. This project aims to tackle these inefficiencies by understanding the airflow inside a SAC unit. By investigating how the fan speed and internal components influence air distribution, areas where design improvements can make AC systems more energy efficient can be identified. The motivation of this project comes from a desire to help reduce energy consumption in everyday appliances and make a meaningful contribution to sustainability. This work is relevant not only to improving the performance of AC units but also to the wider HVAC industry, as it provides valuable insights into airflow dynamics. Optimizing AC systems can lead to significant reductions in both energy usage and carbon emissions, benefiting consumers and industries alike.



Characterizing the Aerodynamic Performance of Carved Bamboo Micro-wind turbine blades using CFD

Student: **Martina Zammit**
Supervisor: **Prof. Inğ. Tonio Sant** | Co-Supervisor: **Mr Luke Aquilina**

What is your project about?

Wind turbine technology has today reach high levels of technological maturity. There is now a drive to produce turbines from sustainable materials with reduced carbon emissions associated with their production. The aim of the project was to analyse the performance of carved bamboo micro-wind turbine blades. Computational Fluid Dynamics (CFD) was used to determine the performance and efficiency of the micro-wind turbine. The carved bamboo wind turbine was compared to other commercially available wind turbines of similar sizes to determine the feasibility of using a natural composite such as bamboo in micro wind turbines.

Why are you working on this project?

This project addresses the energy poverty crisis, where millions of people around the world are still deprived of adequate sources of energy, especially in remote locations in many Asian and African countries. However, many of these locations have an abundance of bamboo. With the use of bamboo to build wind turbine structures, electricity and energy can be provided to remote communities where transportation of metal structures and connection of electricity supply would otherwise be almost impossible. Bamboo, being a light weight, fast-growing green material possessing high strength and carbon sequestration properties makes it a great environmentally friendly material that can be used in many different applications. Bamboo holds remarkable potential as a sustainable engineering material in the fight against climate change. The possibility of analysing the use of such materials and analysing how wind energy can be harvested in ways that go beyond the conventional use of large-scale wind turbines is what interested me most in this project.



A Computational Study on the Airflow and Dispersion of Airborne Particles in Hospital Wards

Student: **Tijana Srbinovska**
Supervisor: **Dr Jean Paul Mollicone**

What is your project about?

This project investigates the impact of different room layouts on airflow patterns and the dispersion of aerosol particles through the use of computational fluid dynamics. The objective is to model the airflow patterns and the trajectories aerosol particles generated during events such as coughing or sneezing. By comparing various ventilation configurations, the project provides insights into how room design impacts the airflow and the transport of aerosol particles. This project contributes to more efficient ventilation strategies and airflow optimisation, thereby mitigating the risk of airborne disease transmission.

Why are you working on this project?

I chose to work on this project because I wanted to focus on a technical topic that is widely applicable, more specifically the application of fluid mechanics to real-world indoor environments. Fluid mechanics has always been an appealing area of engineering to me because it governs the movement of fluids, including the air that humans breathe. This project allows me to deepen my understanding of the airflow behaviour and aerosol transport through the use of computational fluid dynamics (CFD). Indoor air quality has been increasingly critical, especially since the COVID-19 pandemic, where airborne transmission of diseases raised serious concerns. Therefore, by modelling airflow and aerosol particles in CFD, I was able to investigate the impact of spatial design on the airflow and particle transport. This project bridges engineering with human well-being, thereby making it highly relevant to public health, indoor safety and building design practices.



Numerical Analysis of Aerodynamic Behaviour of the EV24 Formula Student Vehicle

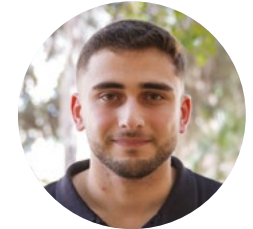
Student: **Nathaniel Scerri**
Supervisor: **Dr Jean Paul Mollicone**

What is your project about?

This project investigates the aerodynamic behaviour of the EV24, UM Racing's first electric Formula Student race car. Using computer-based numerical analysis, specifically computational fluid dynamics, the aerodynamic forces acting on the vehicle were quantified. After establishing a baseline for performance, simple modifications such as smoothing the underfloor and optimising the rear diffuser by systematically varying both diffuser and ride angles were introduced. These changes were selected due to their relative simplicity and ease of implementation by the team. Increased downforce leads to improved tyre grip, enabling higher cornering speeds and consequently reducing lap times. The resulting data were analysed and compared, offering a robust benchmark for the design and development of future UM Racing vehicles.

Why are you working on this project?

This project was chosen due to its strong alignment with my academic interests and my responsibilities within UM Racing. I currently serve as Secretary General for the team and was also a member of the design technical team responsible for the development of the EV24 electric race car. This experience provided me with valuable exposure to both the organisational and engineering aspects of the team, while also offering insight into the technical improvements necessary for enhanced vehicle performance. I am interested in the air dynamics over vehicles, such as understanding how geometric variations influence air flow and ultimately vehicle handling. This project allows me to explore this in a focused and applied manner. I am particularly motivated by the potential of small aerodynamic refinements to deliver significant improvements in performance, a principle that is highly relevant not only to motorsport but also to the wider automotive industry.



Investigation of a Multi-temporal Discretisation Approach for Ice Formation on Aerofoils

Student: **Christopher Alexander Hili**
Supervisor: **Dr Ing. Simon Mizzi**

What is your project about?

My project involves investigating a method which can more accurately simulate the aerodynamic performance of an aircraft wing exposed to ice formation. This was done by manipulating the ice shape around the front of the wing by dividing the ice into finer discrete layers. The purpose of the discretisation was to compare the resultant ice profiles and their respective effects on the aerodynamic characteristics of the wing. This was modelled for a case when a wing is exposed to airflow at ground level and when a wing flows through thinner air at higher altitudes of approximately 4,000 metres.

Why are you working on this project?

I have always had a profound interest in the aviation sector from a very young age. This enabled me to be more attentive around various issues related to the aviation industry such as the problem of aircraft icing. Therefore, with this project I wanted to analyse the effects of icing on critical aircraft components, in particular the wings. The idea that a thin layer of ice can completely alter an aircraft's performance is both alarming and intellectually engaging. Therefore, understanding how to mitigate this risk is crucial.

Flight safety is of relevance to this project since icing on aerofoil elements, such as wings and propellers, can lead to reduced lift, increased drag and potential loss of control, all of which increase the risk of accidents. Moreover, ice accumulation can introduce reductions in aircraft performance and fuel efficiency which point towards higher operational costs for airlines. Consequently, the understanding of the aerodynamic performance degradation of crucial aircraft components due to icing helps improve measures on safety and fuel economy.



Numerical Modelling of Wave Energy Converters in Coastal Defending Structures

Student: **Martina Muscat**
Supervisor: **Dr Ing. Simon Mizzi**

What is your project about?

This project focuses on the analysis and performance of the Wells turbine integrated into an Oscillating Water Column (OWC) wave energy system. An OWC, which is often incorporated into coastal structures such as breakwaters and jetties, converts the oscillatory motion of waves into usable energy by driving an air turbine. The Wells turbine is specifically designed to operate efficiently under bi-directional flow, offering an elegant and efficient solution to a complex engineering problem. Computational Fluid Dynamics (CFD) is used to simulate the flow conditions and aerodynamic behaviour of this turbine, with the aim of identifying performance limitations and exploring design optimisations that could enhance efficiency and increase the total energy yield from wave energy systems.

Why are you working on this project?

The global shift towards sustainable and renewable energy sources has increased interest in wave energy in recent years. Wave energy is an abundant, high energy density, renewable source that remains largely untapped across the globe. For countries with vast, unsheltered coastlines or island nations such as Malta, wave energy could offer a constant and predictable source of power. The structural simplicity of the Wells turbine in an OWC system has led to its implementation in coastal infrastructures in countries including Portugal, the UK and Japan. By using CFD, an increased understanding of the aerodynamics and internal flow physics involved in turbomachinery design is obtained. The significance of this research extends beyond academic interest and has practical implications for improving the design and of future wave energy systems. By understanding the performance of the Wells turbine in greater depth, this project contributes to advancements in future coastal infrastructures for wave energy harvesting worldwide.



Characterising the Steady-State Behaviour of a Single Scroll Turbocharger

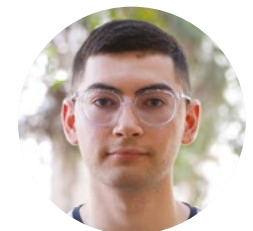
Student: **Matthew Azzopardi**
Supervisor: **Dr Ing. Simon Mizzi**

What is your project about?

A turbocharger is a forced induction device which utilises the flow of exhaust gases to compress air from the intake of an internal combustion engine (ICE) to generate more horsepower. This project is about designing the turbine section of a turbocharger and analysing its performance. To carry out this analysis, Ansys Fluent was used to simulate a turbine being rotated at different rotational speeds (RPM). The main challenges of this project were modelling the turbocharger's complex geometry - the turbine wheel and housing and running highly demanding simulations.

Why are you working on this project?

In today's world, where regulating emissions has become the main priority for most countries, the vehicle manufacturing industry has been moving to electrifying their vehicles. Apart from the many drawbacks electrical vehicles have, the raw feeling of automotive sport will eventually start dying out. This project is beneficial to those who would like a general understanding of how turbochargers work and having the knowledge on the different types of turbochargers available in the market thus far. The simulation results presented in this project should give the reader an understanding of how varying the inlet conditions of a turbine, for different sets of rotational speeds, affects the adiabatic efficiency of a turbocharger.



Investigating Induced Drag on Wings Exposed to Detached Flow and Application of Suction Control

Student: **Francanne Mercieca**
Supervisor: **Dr Ing. Simon Mizzi**

What is your project about?

This project explores the use of suction as a method to control airflow over constant chord wings and improve aerodynamic performance. The study focuses on conditions where wings approach stall, a situation in which airflow separates from the surface and lift is significantly reduced. To understand and address this, airflow is simulated over both two-dimensional aerofoils and three-dimensional wings. While 2D simulations help study basic stall behaviour, they do not capture effects like induced drag, which are present in real 3D wings. Suction is applied along the surface of the aerofoil in 2D to maintain attached flow, and at the wingtips in 3D to mitigate induced drag.

Why are you working on this project?

I chose this project because I have a strong interest in flow dynamics, especially how aerofoils achieve optimal aerodynamic efficiency. As the demand for improved aerodynamic performance continues to grow, techniques like boundary layer control have become increasingly important. This growing relevance motivated an investigation into how effective such methods are at enhancing performance.

What drew me to this topic was the opportunity to explore a powerful tool—Computational Fluid Dynamics (CFD). Over the course of the year, working on this project has helped me develop a deeper understanding of how real-world flow behaviour can be simulated using numerical models. It demonstrated how complex aerodynamic problems, which are often too difficult to solve analytically, can be tackled effectively through computational approaches.

Techniques like boundary layer control can reduce drag and delay stall, leading to better fuel efficiency, which in turn helps lower operational costs and environmental impact. I found the project rewarding because it allowed me to apply methods I learned throughout the degree in a practical and meaningful way.





Section 6

Industrial & Process Engineering

3D Printing of Metal Components through Fused Filament Fabrication (FFF) – A Feasibility Study

Student: **Joelant Aquilina**

Supervisor: **Dr Ing. Pierre Vella** | Co-Supervisor: **Prof. Arif Rochman**

What is your project about?

This project aims to investigate the feasibility of using the Fused Filament Fabrication (FFF) process for successfully producing copper components with the Ultimaker S5 3D printer equipped with a Metal Expansion Kit. The study focuses on print quality, dimensional accuracy, and material characteristics following the debinding and sintering processes. FFF is a widely adopted additive manufacturing technique, known for its ease of use, low cost, and broad material compatibility. Recent advancements have enabled FFF to incorporate metal filaments, such as copper, thereby expanding its applications to functional metal components. By designing and testing the printed geometries, the project identifies both the strengths and limitations of metal FFF. The results offer valuable insights about the practical capabilities of this technology and material, highlighting their potential role in current and future manufacturing industries.

Why are you working on this project?

The technology of Additive Manufacturing, especially the Fused Filament Fabrication (FFF) process which is commonly known as 3D printing, has always been an aspect which interested me and kept me eager to expand my knowledge. The recent advancements enabling metal 3D printing, combined with the lack of extensive studies, sparked a long interest in me to conduct this feasibility study. This project combines hands-on experimentation with advanced engineering concepts, allowing me to explore the technical challenges of printing, debinding, and sintering of metal parts. My motivation stems from a desire to contribute to the evolution of digital manufacturing, where the general public and even small-scale users can produce functional metal parts without the need for costly powder-bed systems. This project is also relevant to the industry as it provides a cost-effective alternative to existing metal fabrication methods, with applications for rapid prototyping and small-batch production of specialised components ranging from electronics and automotive to healthcare and tooling in prototyping, repair, and development.



Rapid Fabrication of Microfluidic Devices Using AM Technologies

Student: **Andrew Brincat**

Supervisor: **Dr Ing. Pierre Vella** | Co-Supervisor: **Prof. Arif Rochman**

What is your project about?

A microfluidic device is a tool that transfers small amounts of liquid through narrow channels, about the width of a hair. Microfluidic devices are used in places like hospitals, laboratories, and environmental testing facilities. They help with things like quick disease testing, checking water quality, and other biological studies. They're usually made using a process called soft lithography which is a very expensive and time-consuming process, but newer methods like 3D printing are being tested. 3D printing also makes the process cheaper and shorter which in a production industry are two very important aspects. My project is about the feasibility of two major 3D printing processes, FFF and DLP, to create these microfluidic devices.

Why are you working on this project?

I chose this topic because microfluidic devices are used in many important areas like healthcare, and I found it interesting how such small devices can have a big impact on our lives. Another aspect that got me interested in this project is that currently additive manufacturing processes like 3D printing are becoming increasingly popular due to their vast number of benefits such as efficiency and costs. Creating and designing of products is why I chose to pursue this project and engineering as a whole, while improving a process to make it useful for my application. This project is relevant to the engineering industry because the fabrication of these devices is made easier and in a shorter period of time which in turn will increase production and maximum of devices produced per day or shift.



Characterization and 3D Printability of Novel Bio-based and Biodegradable Polymers

Student: **Racquel Marie Cachia**
Supervisor: **Prof. Arif Rochman**

What is your project about?

This project investigates the properties and 3D printability of polybutylene succinate (PBS), a bio-based and biodegradable polymer derived from organic waste through biological processes. This material is being evaluated as a potential alternative to conventional petroleum-based polymers, particularly for single-use applications. The research focuses on two main areas: (1) analysing the material's thermal, mechanical, and flow behaviour, and (2) evaluating its suitability for additive manufacturing using fused filament fabrication (FFF) and fused granular fabrication (FGF) techniques. The aim is to understand how well the material performs during the 3D printing processes and to assess the mechanical quality of the printed parts.

Why are you working on this project?

My interest in this project stems from a fascination with how emerging sustainable materials can transform modern manufacturing. The concept of converting biogenic waste into functional, printable polymers presents both a technical challenge and a chance to work with materials that are still relatively underexplored in additive manufacturing. This work integrates several fields that strongly align with my interests, namely materials science, mechanical testing, and process engineering. The project also offers the opportunity to work with both fused filament and fused granular fabrication systems, allowing for a deeper understanding of material behaviour under different processing conditions. This work is not only relevant to my own academic and professional goals, but also to industries that are actively seeking innovative material solutions. Through this research, I aim to generate meaningful insights into the practicality of bio-based PBS in additive manufacturing and develop a strong foundation in material characterisation and process integration.



5-Axis CNC Machining Process of a Vehicle Upright

Student: **Sean Gauci**
Supervisor: **Prof. Inğ. Emmanuel Francalanza** | Co-Supervisor: **Dr Inğ. Pierre Vella**

What is your project about?

My project focuses on making a complex part for the Formula SAE race car known as an upright, using a 5-axis CNC milling machine. This part connects the car's suspension and wheel, so it must be strong, precise, and accurately machined. The challenge lies in using a new machine, working with complex geometry, and meeting tight tolerances for the bearing housings. I also explore how different machining parameters and workholding techniques affect the final result. The goal is to successfully machine this part and use the findings to adapt future designs to better suit the faculty's workshop machine capabilities to be manufactured in-house.

Why are you working on this project?

I chose this project because it combines my interest in motorsport with the practical application of advanced manufacturing methods. The upright stood out to me as a challenging part. Small in size, but critical in function, requiring both strength and high precision while using new advanced technology in CNC machining. The upright was a great fit for this because of its complexity and importance in a vehicle. It's not just about making a part; it's about understanding every stage of the process, from design choices and material behaviour to the practical limits of the machine and setup. It's also a way to contribute something useful: helping the workshop move towards more self-sufficient, in-house manufacturing.

This project gave me the opportunity to bridge the gap between theory and practice, a skill that's not only personally fulfilling but also highly relevant in today's manufacturing and engineering industries.



What is your project about?

During the course of this project, I collaborated closely with Domestica Ltd. to identify production inefficiencies and enhance the productivity of their furniture manufacturing facility. I developed a digital twin of the facility utilising AnyLogic simulation software, after collecting qualitative and quantitative data from the shop floor. This model was rigorously verified and validated to ensure its accuracy. Based on the simulation results, I identified critical internal logistics bottlenecks, allowing me to propose specific improvements. This project exemplifies how operational enhancements in manufacturing can be realised through the application of simulation tools and data-driven decision-making processes.

Why are you working on this project?

My passion for engineering began at an early age when I watched How It's Made with my father. I was captivated by the precision and elegance of the machines and processes that transformed raw materials into finished products. What fascinated me most was the seamless synchronisation of systems and the craftsmanship of artisans who mastered these complex processes over decades. As I progressed through my bachelor's degree, this appreciation deepened. I began to understand not only the intricacy of manufacturing systems but also the critical role that engineering plays in enabling innovation, efficiency, and sustainability. This project aligns perfectly with my interests, as it brings together digital tools and real-world production challenges. With the emergence of Industry 4.0, technologies such as simulation, automation, and data analytics are becoming increasingly relevant. The skills and insights I've gained through this thesis will be instrumental as I contribute to the future of smart manufacturing.



Section 7

Maritime Engineering



Preliminary Design of a Wooden Luzzilla Fishing/Pleasure Vessel

Student: **Mario Cauchi**
Supervisor: **Prof. Inġ. Claire De Marco**

What is your project about?

Starting with the design of the overall vessel, this project aims to finish building a modified form of a traditional Maltese boat. The aim of this work is to modernise the general design of the vessel while maintaining its historic relevance. Apart from its conventional use, the boat is suitable since it has been rebuilt to serve as a pleasure vessel as well. The boat is therefore ideal for usage. This idea strives to achieve its objective by merging historical significance and modern practicality in a way that appeals to a wide audience due to their combined relevance.

Why are you working on this project?

I chose to concentrate on this specific topic because I have always been fascinated by classic boats, especially their distinctive appeal and cultural significance. The personal enthusiasm I have demonstrated in this topic has motivated me to study it as part of my engineering degree. Working on a project of this nature not only allows me to contribute to the preservation of a vital component of the local heritage but also provides me with the opportunity to gain a deeper understanding of traditional maritime design. By re-examining and altering them for modern purposes, particularly recreational ones, this project has the potential to revive public interest in traditional wooden boats. It also reminds us of the principles of design and craftsmanship that were crucial for the evolution of early boatbuilding. Even now, these ideals inspire and instruct marine engineers. Ultimately, by fusing historical significance with modern practicality in a way that is both significant and interesting, this work can close the distance between invention and legacy.



Design of a High-Speed Hydrofoil Boat

Student: **Nathan John Portelli**
Supervisor: **Prof. Inġ. Claire De Marco** | Co-Supervisor: **Prof. Inġ. Tonio Sant**

What is your project about?

Hydrofoil boats are currently experiencing rapid growth in popularity due to their ability to maintain high speeds while remaining level in waves. Their significantly reduced drag also leads to improved fuel efficiency compared to traditional boat designs. This thesis focuses on the preliminary design of a high-speed hydrofoil vessel, specifically tailored for operation in Maltese waters. The design process was aligned with international rules and regulations, with detailed calculations performed to determine the appropriate powertrain and to size the hydrofoil system accordingly. The design of the vessels was verified to ensure safety and stability for the target range of operating conditions.

Why are you working on this project?

Having grown up with my father working in the maritime industry, I was consistently surrounded by large vessels from a young age. This early exposure nurtured a strong appreciation for the maritime world and eventually sparked a deep interest in Naval Architecture. My involvement with the University of Malta Rowing Club further strengthened this passion, as I gained firsthand experience with small boats and their behaviour at sea. My familiarity with coastal rowing boats, especially their response to waves, led me to become especially interested in high speed vessels, in particular hydrofoils, which offer the unique advantage of significantly reducing hydrodynamic drag by lifting the hull above the water. This not only improves speed and stability but also drastically lowers energy consumption, enabling cleaner and more sustainable marine transport. Designing a high speed hydrofoil vessel allowed me to explore the full potential of this innovative technology in challenging, performance-driven scenarios.



Preliminary Design of a Wind Turbine Service Vessel

Student: **Sean Murphy**
Supervisor: **Prof. Inğ. Claire De Marco**

What is your project about?

Wind Turbine Service Vessels (WTSVs) play a critical role in the operation and maintenance of offshore wind farms, which are essential to meet global renewable energy targets. My final year project involves the preliminary design of a high-speed WTSV, designed and engineered to support offshore wind farm operations. The vessel is intended to transport personnel and equipment safely and efficiently in various sea conditions. Through the integration of analytical methods and computational tools, the design addresses the growing need for reliable offshore service in the expanding renewable energy sector.

Why are you working on this project?

Developing vessels that can meet the demands of offshore environments is becoming increasingly important as offshore industries continue to grow. The design of specialised vessels offers a unique opportunity to apply the principles of naval architecture in a practical context. Naval architecture has always been an area of personal interest, and this project allowed me to explore it in depth. Working on the vessel design allowed deeper understanding of how engineering solutions can improve offshore operations while meeting regulatory demands. The project's focus on current applications, namely supporting renewable energy infrastructure, adds further value and purpose to the work. This area of engineering stands out for its ability to merge innovation with sustainability, making it an exciting and meaningful field to contribute to.





Section 8

Materials Engineering

Avoiding Martensite Formation in Shot Peened AISI 304 Intended for Biomedical Applications

Student: **Matthias Cauchi**

Supervisor: **Prof. Ing. Maurice Grech** | Co-Supervisor: **Prof. Ing. Stephen Abela**

What is your project about?

This project explores the use of the surface engineering technique known as shot peening on AISI 321, an austenitic stainless steel characterized by its excellent corrosion resistance, high ductility, and good biocompatibility, but limited by poor wear resistance and low hardness. The objective of this dissertation is to apply shot peening to AISI 321 in order to induce residual compressive stresses at the surface, thereby enhancing wear and fatigue resistance while avoiding martensite transformation. This study investigates the effects of stand-off distance and peening temperature on martensite formation, induced residual stresses, surface topography, hardness profile, depth of hardening, and induced magnetism—which could pose challenges in biomedical applications.

Why are you working on this project?

I am intrigued by this project because it allows me to explore my interest in the field of materials and biomedical engineering, which I developed throughout my engineering course. What drew me to this topic was the challenge of balancing the improvement of surface properties in AISI 321 through a treatment like shot peening, while avoiding the formation of martensite. This also presented an opportunity to gain deeper insight into a widely used and impactful surface engineering technique. My motivation stems from a strong interest in surface engineering techniques as a means of enhancing material performance, along with a desire to contribute to advancements in the biomedical field. Furthermore, the significance of this research extends beyond academia, with important implications for both industry and the general public. This project could pave the way for further studies exploring the effects of shot peening on materials intended for use in biomedical implants.



Surface engineering of a WE43 magnesium alloy for orthopaedic scaffold applications

Student: **Naomi Sammut**

Supervisor: **Prof. Ing. Joseph Buhagiar** | Co-Supervisor: **Prof. Ing. Bertram Mallia**

What is your project about?

This project focuses on developing a protective surface coating for a WE43 magnesium alloy, a biodegradable metal being explored for orthopaedic scaffold applications. Magnesium alloys are promising because they have mechanical properties similar to bone and naturally degrade within the body, eliminating the need for a secondary surgery. However, their rapid corrosion and hydrogen gas release limit their use. This research aims to reduce that corrosion by applying a chemical conversion coating to the alloy's surface. The effectiveness of this treatment is assessed through material characterisation techniques and corrosion testing, comparing the alloy's performance before and after the coating process.

Why are you working on this project?

The motivation for this project stems from a strong interest in biomaterials and their role in advancing orthopaedic implants. This field appeals to me as it combines materials engineering with healthcare, offering the chance to develop solutions that directly benefit patients. This project allows me to contribute to solving that problem by developing a surface coating that improves the corrosion resistance of WE43 magnesium alloy while also serving as an interlayer for an additional polymer coating. What interests me most about this project is its focus on innovative surface engineering techniques with direct medical applications. The outcomes of this research could enhance the performance of orthopaedic scaffolds, making it relevant to both the medical industry and the wider public.



Liquid Nitrogen-Assisted Freeze Drying of Reduced Graphene Oxide Aerogels

Student: **Rhea Xuereb**

Supervisor: **Dr Ing. Anthea Agius Anastasi** | Co-Supervisor: **Dr Daniel A. Vella**

What is your project about?

My final year project focuses on the development and optimisation of reduced graphene oxide (rGO) aerogels using a novel liquid nitrogen-assisted freeze-drying method. The study investigates how changes in the freezing rate can be used to control the internal pore structure of rGO aerogels, which are lightweight, highly porous materials with potential in thermal insulation, filtration, and environmental applications. As part of the study, I also explored how well this method could be scaled up to produce larger samples without compromising structural integrity.

Why are you working on this project?

I was always interested in nanomaterials and how they can be used to create efficient, purposeful solutions to real-world problems. This project gave me the chance to explore how manipulating something as simple as the freezing rate influence pore size, a key factor in the performance of porous materials like aerogels. These materials have great potential for real-life applications such as insulation, water filtration, and environmental clean-up. What excited me most was the ability to create a new type of material using liquid nitrogen, which happens to be available freely on demand at our laboratory. Being able to design and produce something that didn't exist before, and to tailor its properties for a specific purpose, is what I found most rewarding. It's an area of active science that combines creativity, sustainability, and engineering in a practical and exciting way.



A close-up photograph of a microscope's objective lens and stage, overlaid with a semi-transparent blue filter. The image shows the intricate mechanical parts of the microscope, including the lens housing and the stage where a slide would be placed.

Section 9

Product Development

Design of a 3D Printed ExoSkeleton for Human-Centred Industrial Operations

Student: **Samuel Jordan Cachia**
Supervisor: **Prof. Inġ. Jonathan Borg**

What is your project about?

This project focuses on designing a wearable mechanical support system, commonly known as an exoskeleton, to assist industrial workers in physically demanding tasks. Many workers experience strain and fatigue from repetitive or awkward movements, such as lifting, drilling, or working overhead. The goal is to reduce the risk of injury and long-term health issues by creating a comfortable, lightweight support system that enhances physical performance. By combining ergonomics with engineering design, the project aims to improve working conditions and safety in industries where automation cannot fully replace human effort.

Why are you working on this project?

I chose this project because it combines mechanical design with solving a real-world issue I've seen firsthand. Having worked in industrial environment, I've experienced the physical demands of industrial tasks and witnessed how repetitive strain and poor ergonomics can affect workers over time. These challenges aren't always visible, but they have a major impact on safety, productivity, and long-term health. This project gives me the opportunity to address those issues through engineering by designing a support system that reduces strain, improves posture, enhances comfort and improves productivity during demanding tasks. I was especially drawn to the human-focused aspect of this work. It's not just about building something that functions well on paper it's about improving the day-to-day experience of people in real industrial settings. As wearable robotics continue to evolve, this project represents a step toward practical, real-world exoskeleton solutions that can redefine how we approach industrial labour.



A Modular Test Jig for Smart Packaging Solutions

Student: **Mark Mifsud**
Supervisor: **Prof. Inġ. Philip Farrugia**

What is your project about?

SMARTSPACK is an ongoing university project in collaboration with Xjenza Malta and funded by FUSION R&I that aims to develop a novel smart packaging solution, which prioritises user requirements and sustainability aspects within the food and pharmaceutical industry.

The aim of this project is to design, develop and manufacture a modular test jig that can house various samples of different shape and size and determine the physical force needed to use the packaging solutions developed in the SMARTSPACK project. The results obtained from the produced test-jig will then be used to optime the design of the packaging solutions being developed.

Why are you working on this project?

I was intrigued to work on this project as during the engineering course I was always inclined towards the product design area of engineering. By working on this project, I was allowed to express my passion for engineering design and apply the knowledge gained during the course as well as through research conducted during this project to design a functioning test-jig within the boundaries of the project. Using fundamental engineering design principles to develop a working design while also dealing with real-world situations to procure and develop the parts and materials needed to manufacture the product proved to be a challenging process, however a satisfying one when the project was complete. Overall working on this project provided me with a deeper insight into the world of engineering design and an opportunity to improve my knowledge regarding this field.





Section 10

Robotics, Automation & Control

AI Driven Inverted Pendulum: An investigation into Machine Learning's Application within Robotics

Student: **Nicholas Bajada**
Supervisor: **Prof. Ing. Simon Fabri** | Co-Supervisor: **Prof. Joseph Cilia**

What is your project about?

With the ever-advancing relevance of Artificial Intelligence (AI), model free Reinforcement Learning (RL) is finding an expanding set of use cases for the control of physical systems. By taking the challenging control problem of balancing a Reaction Wheel Inverted Pendulum (RWIP), which is an inverted pendulum with a reaction wheel attached to its body, and using three different RL techniques, one can study whether AI could learn how to control dynamic nonlinear mechanical systems. The three selected RL algorithms considered are Q-Learning, Deep Q-Networks (DQN) and Deep Deterministic Policy Gradient (DDPG). All three provide their own benefits and downsides. The use of Q-Learning and DDPG to the problem of balancing a RWIP is a novel contribution of this project.

Why are you working on this project?

The fields of control theory, robotics and AI are state-of-the-art engineering topics which are increasingly proving useful in today's world. The concept of controlling the physical world via the use of intelligent systems presents an intriguing solution to many problems that would otherwise require great effort or manpower to solve. One cannot underestimate the importance of being able to program and control a remote system in situations where human error and the risk to life far outweighs the effort involved in designing a system. Good examples of this can be found in space exploration, fire control and even the management and control of radioactive or chemical materials. Hence by proving that AI can control a nonlinear system such as a RWIP, one can lay down the groundwork for AI to be implemented in more complex systems, without the need for the complex modelling required in more traditional control design methods.



Stable Self-levelling Control of a Stewart Platform

Student: **Kyle Muscat**
Supervisor: **Prof. Ing. Simon Fabri**

What is your project about?

As the need for stability in motion continues to grow across various industries, there has been a keen interest in self-levelling platforms. These are mechatronic systems designed to automatically maintain a stable and level orientation, even when the surface they rest on is tilted or disturbed. The project focuses on a specific type of robot known as a Stewart Platform which uses six links that can adjust their length to control the movement of its top plate.

The main objective of this dissertation is to design and implement a controller that can reliably keep the top plate level, even when the system is affected by unpredictable forces or disturbances — all while managing the complex, highly non-linear behaviour that characterises the platform's dynamics.

Why are you working on this project?

Motivation behind this project stems from its strong interdisciplinary nature and its wide-ranging industrial relevance. Self-levelling platforms have numerous practical applications, such as ensuring safe UAV take-offs and landings on ship decks, stabilising stretchers in mobile surgical units and ambulances, and enhancing comfort through self-levelling beds on luxury marine vessels.

This project provides the opportunity to apply and deepen the understanding of multiple engineering disciplines—particularly robotics, electronics, control systems engineering, and instrumentation. It tackles a real-world challenge by developing a practical and novel self-levelling controller solution for a Stewart Platform. Beyond the technical aspects, this work holds real value for public safety, robotics innovation, and automation across various sectors, making it personally fulfilling and aligning closely with the goal of contributing to impactful engineering solutions that improve real-world systems.



Designing Safe and Collaborative Robotic Experiences in Manufacturing Environment

Student: **Isaac Cutajar**
Supervisor: **Prof. Inġ. Emmanuel Francalanza**

What is your project about?

This project presents a collaborative robotic workstation designed for safe human-robot interaction in manufacturing environments. Traditional industrial robots increase efficiency but must operate behind fences to avoid injuring people. Although collaborative robots, or “cobots,” include built-in safety features, these often react after contact occurs. My project goes beyond current approaches by enabling the system to sense its environment in real time and respond intelligently to reduce the likelihood of collisions and other safety risks. The goal is to build a workplace where safety and efficiency go hand in hand without needing a physical barrier between humans and machines.

Why are you working on this project?

I have always been drawn to solving problems and finding ways to do things more efficiently. Robotics offers the precision, repeatability, and speed that can transform how tasks are performed. I find it fascinating how robots can carry out tasks autonomously and bring meaningful improvements to the way we live and work. What makes this project meaningful is the opportunity to enhance safety in human-robot collaboration—an area that is still evolving across many industries. My personal motivation comes from the belief that technology can be a force for positive change, and I want to contribute to that progress. I enjoy the process of turning an abstract design into a working system, as it’s incredibly rewarding to see an idea come to life. By focusing on safety, this project aims to take a step toward workplaces that are both more productive and more human-centred, where the strengths of both people and robots can be fully realised.



Development of a Robotic Gripper Inspired by the Tentacles of Cuttlefish

Student: **Daniel Attard**
Supervisor: **Prof. Inġ. Michael A. Saliba** | Co-Supervisor: **Prof. Inġ. Pierluigi Mollicone**
Advisor: **Prof. Arif Rochman**

What is your project about?

This project focuses on the design and development of a soft robotic gripper, inspired by a cuttlefish’s tentacles intended for grasping objects. The gripper is cable actuated and utilises compliant materials to conform to targets and make it suitable for delicate handling tasks. Key components within this system include the gripper, housing unit, actuators, control system and force transmission mechanisms. The process of developing a system such as this involved familiarisation with actuation methods, deformation concepts and the behaviour of soft material under load. It also required iterative design, simulation and testing to ensure effective control and reliability.

Why are you working on this project?

I have been fascinated by robots and robotics from a young age. With soft robotics being a relatively new and rapidly evolving field within robotics, I was immediately drawn to the idea of this project. The main motive was to explore biomimicry as a tool within robotics, taking inspiration from nature and implementing it to solve complex engineering problems. This project allowed for an opportunity to explore such a concept in depth. What excites me most about soft robotics is its potential for innovative motion, versatility and safe interaction with human beings and anything of delicate nature. Real-world applications such as prosthetics indicated a promising future within this area. As automation continues to develop, soft robotics has the potential to be a critical component in its evolution. I highly believe that taking inspiration from nature around us will have a big impact on the efficacy at which this technology develops and integrates into our day to day lives. This makes this project not only personally fulfilling but also highly relevant to both society and industry.



Development of Demonstration Projects for the Robotic Systems Laboratory

Student: **Martina Caruana**
Supervisor: **Prof. Ing. Michael A. Saliba**

What is your project about?

This project aims to explore various engaging and practical laboratory outreach demonstrations designed to spark the interest of people of all ages, from primary students to visiting researchers. It also displays complex robotic systems such as smart cameras and the collaborative robot, showing how robots see, move and make decisions. Every demonstration, from cocktail-making to inspecting bottle caps, is thoughtfully designed to meet the expectations of its target audience. The project boosts curiosity, learning and meaningful interactions across different educational backgrounds by translating technical content into understandable demonstrations.

Why are you working on this project?

My passion for robotics originates from a deep interest in how different robotic machines can replicate human actions and ease daily life. I chose to study this field because it integrates hands-on work with critical thinking. By developing robotic demonstrations, complex engineering concepts can be translated into engaging and understandable experiences for different audiences. What drives me most is the opportunity to spark curiosity in future generations, especially by using interactive and educational resources that make advanced technologies more approachable and inclusive. My end goal is to show the audience how robotics can be incorporated into real-world applications to improve accuracy and efficiency. Ultimately, this project provides a way of communicating the importance of robotics by addressing practical problems and encouraging a deeper appreciation for engineering among different audiences.



A large field of wind turbines under a blue sky with a blue overlay. The turbines are arranged in rows, and the sky is a deep blue with some light clouds. The foreground is a green field.

Section 11

Smart and Sustainable Energy Systems

Design and Development of a Single-phase Voltage Regulator

Student: **Leon Cachia**
Supervisor: **Prof. Inġ. John Licari** | Co-Supervisor: **Prof. Inġ. Cyril Spiteri Staines**

What is your project about?

Traditionally, electricity has been generated in a centralised manner, that is, power is generated by power stations and then sent to consumers over long distances through the electrical network. However, nowadays, traditional power grids are transitioning into a distributed generation scenario with multi-directional power flows. Due to large photovoltaic generation during the day, the power flow can reverse direction, that is from consumer to substation. However the network still experiences high loads during the evening. This change in power flow direction causes the voltage levels to increase and decrease beyond the acceptable tolerance limits set by the EN 50160 standard, which defines the voltage characteristics for public distribution systems. This project aims to tackle this issue by designing and developing a single-phase voltage regulator that is capable of real-time voltage correction, ensuring it remains within the permissible range.

Why are you working on this project?

The power electronics field is the backbone of modern energy systems, from powering of everyday electronics to enabling clean energy solutions. This project gave me the opportunity to apply what I learned to build something which will be crucial in the transition to renewable energy sources as a major source of energy. My motivation comes from observing how voltage fluctuations can damage appliances and disrupt daily life, especially in areas with unstable power grids. I find it fascinating to be able to design a device that can automatically correct such issues. This project also aligns with my long-term interest in sustainable and resilient power systems. The use of single-phase low voltage regulators is expected to become more widespread as voltage violations increase with the transition from a conventional grid to a distributed grid. The voltage regulator offers a fast and effective solution to voltage issues, especially when upgrading or reinforcing the distribution network is costly and time-consuming.



Grid Based Adaptive Control of Domestic Electrical Loads

Student: **Thomas Cutajar**
Supervisor: **Prof. Inġ Cyril Spiteri Staines** | Co-Supervisor: **Prof. Inġ. John Licari**
Industrial Partner: **Enemalta Plc**

What is your project about?

One of the daily challenges engineers face is maintaining a balance between energy supply and demand on the electrical grid. Typically, several demand side management (DSM) strategies are employed by utility companies to encourage consumers to modify their energy consumption routines to reduce load during peak hours and reschedule deferrable loads to off peak hours. Renewable sources can be unpredictable, causing sudden changes in energy supply. To compensate for such sudden changes one DSM technique used is Direct Load Control (DLC), whereby the utility company remotely controls some of the consumer's loads. This project primarily explores the possibility of developing a communication gateway to interface smart appliances and IoT devices with a smart grid automating DSM via DLC.

Why are you working on this project?

Having spent a number of years working in a technical role prior to enrolling in Electrical and Electronic Engineering undergraduate course, I have always had an avid interest in the process of interfacing discrete systems with the aim of automating processes. One of the main roles of engineers and technical people is that of simplifying and automating processes for nontechnical users. Hence my interest in this project stems from the fact that in essence it involves automating the process of energy management for consumers by utilizing information sent over the electrical grid to control domestic loads and energy storage devices. Furthermore, the automation of energy management at the consumer's end will allow deferring certain electrical loads to hours during which generation from renewable sources is at its peak, increasing the immediate consumption of energy produced by such sources, thereby reducing the undesirable effects of excess energy generation by renewable sources.



A MPPT Controller for Small Wind Turbines

Student: **Darren Sultana**

Supervisor: **Prof. Ing. Reiko Raute** | Co-Supervisor: **Prof. Cedric Caruana**

What is your project about?

As the European Union pushes for a greater share of energy to come from renewable sources, efficient small-scale wind power solutions are in high demand. Small wind turbines face the challenge of very dynamic changing wind speeds. This project focuses on developing a Maximum Power Point Tracking (MPPT) controller tailored for small wind turbines, ensuring they extract the most energy possible from varying wind conditions. By improving efficiency, this technology can make small wind systems more viable for homes, farms, and remote areas, contributing to cleaner energy adoption and supporting the EU's renewable energy goals.

Why are you working on this project?

I chose to work in this field because electric energy is the foundation of modern life, and contributing to innovative ways of generating it is both exciting and impactful. Renewable energy, in particular, fascinates me because it harvests power that already exists in nature—wind, sun, and water—transforming it into clean, sustainable electricity. Small wind turbines have great potential for decentralized energy production, especially in rural or off-grid areas, but their efficiency is often limited by fluctuating wind speeds. By developing an MPPT controller tailored for these systems, this project aims to maximize their energy output, making small-scale wind power more practical and accessible. Beyond the technical challenge, I'm motivated by the broader goal of advancing renewable energy solutions that reduce reliance on fossil fuels and support a greener future. This work is relevant to both industry and the public because improving small wind turbine efficiency can lower energy costs, increase its adoption, and contribute meaningfully to global sustainability efforts—helping communities and the planet alike.



Hybrid energy storage system for green energy transportation

Student: **Justin Xerri**

Supervisor: **Prof. Ing. John Licari** | Co-Supervisor: **Prof. Ing. Cyril Spiteri Staines**

What is your project about?

This project focuses on developing a direct current (DC) microgrid that integrates a solar PV array and a Battery Energy Storage System (BESS) together with a DC load. The system manages power flow automatically by storing excess solar energy in the BESS whilst utilizing the BESS to aid the PV array in supplying the required power to the load, when PV generation is in deficit. A control system maintains a stable DC bus voltage whilst monitoring the battery's State-of-Charge (SOC). This project explores the design and operation of the power converters utilized in the proposed microgrid together with their control loops, the energy storage technologies available, as well as various control strategies for microgrids. Furthermore, the complete microgrid model is simulated to assess its performance under various operating conditions, ensuring stable and reliable energy management.

Why are you working on this project?

Throughout the past years there has been a global shift towards reducing carbon emissions by enabling the integration of renewable energy sources like solar arrays, wind turbines and fuel cells. This has led to a growing interest in DC microgrids which offer an efficient and reliable way to manage renewable energy, especially in areas where AC grid access is limited or for green transportation applications such as electric vehicle charging. Their growing importance is driven by advances in power electronics and the need for cleaner, more resilient energy systems in both public and industrial applications. As a result, from the beginning, this project grabbed my attention as sustainable development in the energy sector is one of the key areas for achieving a greener future. Furthermore, I believe that this research allows me to contribute to the ongoing transition toward cleaner, more efficient energy systems.



Auxiliary Power Unit for Drones

Student: **Liam Zammit**

Supervisor: **Prof. Ing. Reiko Raute** | Co-Supervisor: **Prof. Robert Camilleri**

What is your project about?

The aim of this project was to design and construct a prototype auxiliary power unit for drones which is able to convert gasoline fuel into a clean and stable direct current (DC) voltage output, even under dynamic load conditions, which can be used to power drones. This will serve as an alternative power supply instead of standard lithium-ion batteries. A small RC aeroplane engine coupled to an electrical generator will provide the electrical power required by the drone. This electrical power is then passed through a power electronics converter which is able to stabilise, filter and regulate the voltage to satisfy the drones electrical specifications.

Why are you working on this project?

Electrical power engineering, specifically how it unionises the mechanical and electrical realms, has always been one of my personal favourite areas to study in my four-year venture. Seeing physical mechanisms rotate and move because of electricity, and conversely seeing electricity being generated due to physical mechanisms has always been fascinating to me.

Whilst multi-copters have been around for more than a century, unmanned multi-copter drones are a relatively recent engineering development, starting in the 1990s. As such there are still many interesting applications and advancements which have yet to be developed. This project specifically seeks to increase the flight time, and naturally the travel distance, that drones can achieve. This is usually limited due to the heavy weight of batteries. Fuel however, has a much higher energy/ weight density and thus longer flying times and distances can be achieved.



Recycling of PET and thermoset waste for composite materials

Student: **Katryna Grech**

Supervisor: **Prof. Ing. Paul Refalo** | Co-Supervisor: **Prof. Arif Rochman**

What is your project about?

Plastic waste continues to be a growing environmental concern, with large quantities of post-consumer and industrial plastic materials being discarded every year. This project addresses the issue by investigating the potential of two major waste streams: plastic beverage bottles collected through the Beverage Container Refund Scheme (BCRS) and thermoset scraps from a local manufacturing company, to be repurposed into new composite materials. This project aims to combine these two materials through a process of melt compounding and extrusion to form a composite material which can be reused in industrial applications, such as injection moulding. The aim is to support more sustainable use of resources by developing a practical method for recovering and reintroducing these materials into the manufacturing cycle.

Why are you working on this project?

I chose to undertake this project out of a strong interest in sustainable engineering and a drive to address the environmental challenges posed by plastic waste. With increasing concern over the environmental impact of plastic disposal, there is a clear need to reconsider how we deal with materials that are traditionally considered unrecyclable, such as thermosets, which can only be reused in limited ways. This project provided an opportunity to investigate how different waste streams can be combined to create new, usable materials, rather than being discarded. It also enabled me to explore how locally generated industrial waste, specifically thermoset by-products, could be reintroduced into productive use. By focusing on waste generated within the local context, this project demonstrates the potential for practical and scalable approaches that can reduce environmental burden and promote more circular practices within industry.



Development of a Sustainable Pneumatic Monitoring and Control System

Student: **Matteo Stivala**

Supervisor: **Prof. Ing. Paul Refalo** | Co-Supervisor: **Prof. Ing. Emmanuel Francalanza**

What is your project about?

This project, focuses on the development of a smart Pneumatic Monitoring and Control System (PMCS) that reduces compressed air consumption by up to 30%. While the system offers clear energy-saving benefits, it also introduces environmental and financial impacts that need to be assessed. The aim of this work is to evaluate and improve the environmental and financial sustainability of the PMCS, whilst introducing design modifications that specifically improve the financial payback period, making the system more economically feasible and attractive for industrial use.

Why are you working on this project?

I chose to work on this project because I strongly believe that sustainability is the way forward. In today's world, where industries and governments are under pressure to adopt greener practices, industrial technologies such as the AIR SAVE system are essential. This project resonates with me personally, as it aligns with my interest in environmentally conscious engineering solutions. With my work on this project, I am contributing to a technology that has the potential to reduce energy waste, lower operational costs, and minimize environmental impact across various industries. My work aims to make this innovative system more financially viable, encouraging wider adoption. I find it incredibly motivating to know that the outcomes of this research could help companies operate more sustainably while remaining competitive, which is ultimately an essential step toward a greener future.



Exploring the Efficiency of Bifacial Photovoltaic Systems

Student: **Elena Curmi**

Supervisor: **Prof. Cedric Caruana**

What is your project about?

This project looks at a recent kind of solar module called bifacial photovoltaic (PV) technology, which can collect sunlight from both the front and rear sides. This helps the module produce more energy. In this project, the tilt angle, height and albedo of these modules are simulated to see the affect on energy generation. The project uses PVlib Python which is an open source, community developed toolbox for simulating the performance of photovoltaic energy systems. The PVLib simulations are first validated against actual measured data and then used to examine the performance under different system configurations. The project intends to generate detailed insights on the overall performance of bifacial modules. The knowledge can then be used to improve the utilisation of the technology and facilitate reaching more ambitious renewable energy targets.

Why are you working on this project?

I selected this area of engineering because I am passionate about renewable energy and how innovative technologies can improve energy efficiency and sustainability. Bifacial PV technology represents a major step forward in solar energy systems, and exploring how to optimise their performance combines both technical challenges and real-world impact; two aspects of engineering I find especially exciting.

What personally motivated me about this project is the opportunity to apply both programming and engineering principles. Using tools like PVLib allows me to simulate and test different system configurations, which feels both creative and purposeful. Also, using PVLib, which is an open source software, opens up great possibilities for sharing knowledge across the world. I enjoy working with data, modelling, and applying engineering knowledge to improve how systems perform in the real world.

This work is highly relevant to both the public and the industry. As the world transitions away from fossil fuels, optimising technologies like bifacial PV systems can help make solar power more affordable, efficient, and widely adopted. For industry, this research provides practical insights that can guide installation practices, improve return on investment, and lower the overall cost of renewable energy projects thus making clean energy solutions more accessible on a global scale.



An aerial, long-exposure photograph of a highway interchange at night. The image is dominated by a deep blue color palette. Multiple curved light trails, primarily in shades of white and light blue, sweep across the frame, representing the movement of vehicles. The trails are most prominent on the right side, curving downwards and then back up. On the left, more horizontal and slightly curved trails are visible. The background shows the dark silhouettes of trees and the structural elements of the interchange, including overpasses and support pillars. Several bright, starburst-like light sources are scattered throughout, likely from streetlights or building lights. The overall composition is dynamic and conveys a sense of constant motion and connectivity.

Section 12

Transportation

AI-driven Trajectory Prediction for Aviation

Student: **Neville Azzopardi**

Supervisor: **Dr Ing. Brian Zammit** | Co-Supervisor: **Dr Ing. Jason Gauci**

What is your project about?

My project focuses on using Artificial Intelligence (AI) to predict an aircraft's future location during flight. While traditional trajectory prediction relies on mathematical models, this project uses an AI tool developed and trained on historical aircraft data from over 700 flights recorded in January 2025. The model now has the capability to forecast key aircraft parameters such as altitude, longitude and latitude for new flights.

Why are you working on this project?

I've chosen to work on this project because of my lifelong fascination with aircrafts and aerospace technology, sparked since I was young. The opportunity to combine this passion with AI has always been a dream, driving me to pursue this field of engineering. My personal motivation goes beyond passion; I aim to leverage the skills and knowledge gained to fuel future business ideas, potentially revolutionizing the industry. This work is highly relevant as it enhances the aviation sector by offering a more accurate way to predict flight positions, improving safety and reducing costs. With air travel being a vital part of global connectivity, these advancements could prevent accidents, optimize fuel usage, and enhance passenger trust, benefiting both the public and the industry on a large scale.



Prediction of Traffic Accident Severity

Student: **Diana Cassara**

Supervisor: **Dr Ing. Luana Chetcuti Zammit** | Co-Supervisor: **Dr Therese Bajada**

What is your project about?

Road accident severity is a serious global concern. Major crashes can lead to life-threatening injuries or even fatalities, and they also cause traffic congestion, delays, and productivity losses. Research suggests that many such incidents follow identifiable patterns and are preventable. This project analyses historical traffic accident data from Malta to predict how severe future accidents might be. It applies machine learning classification techniques to learn patterns associated with different levels of accident severity. After learning these patterns, the model can relatively accurately predict the severity of future traffic accidents.

Why are you working on this project?

Machine learning is a fast-growing field that has always fascinated me due to its ability to derive meaningful insights from data. I was motivated to apply this technology to road safety because predicting accident severity can help create safer roads. Targeted safety measures can be introduced by proactively identifying high-risk situations and areas prone to accidents, which may help prevent serious crashes. I am also driven by the real-world impact this project can offer. In a small and busy road network like Malta's, even a single crash can cause widespread disruption, so the prospect of making a tangible improvement in road safety is especially motivating. I chose this project to combine my passion for machine learning with a chance to contribute towards safer roads benefiting the general public.



Towards a Secure Urban Traffic Network

Student: **Luca Galea**
Supervisor: **Dr Inġ. Luana Chetcuti Zammit**

What is your project about?

This project investigates the integration of blockchain technology within Intelligent Transportation Systems (ITS) to address critical challenges related to data security, trust, and system decentralization. Traditional ITS architectures often rely on centralized platforms, which are susceptible to cyberattacks, performance bottlenecks, and operational errors. Blockchain, with its decentralized structure and consensus-driven data validation, presents a promising alternative. By interfacing Aimsun traffic simulation software with blockchain frameworks, the project aims to develop a secure, trusted, and distributed model for managing interconnected, signalized traffic junctions. This research contributes to the foundational infrastructure required for resilient and intelligent future transportation networks.

Why are you working on this project?

I chose to work in the field of transportation because it is a vital part of everyday life, impacting nearly everyone on a daily basis. In Malta, where private cars are the dominant mode of transport, traffic congestion has become a persistent and growing issue. The opportunity to contribute to solutions that could ease this burden and improve the quality of daily commuting for the general public is both exciting and fulfilling. Beyond my interest in transport efficiency, I was also drawn to this project by the integration of blockchain technology, a field I've long been curious about. Blockchain's potential to introduce greater transparency, security, and decentralization into data systems aligns well with the current challenges faced by Intelligent Transportation Systems. This project allows me to merge two areas of interest while contributing to work that has clear relevance to both industry and society, especially as urban mobility continues to evolve globally.



Design of an Accumulator Management System for an FSAE vehicle

Student: **Jacques Vella Borg**
Supervisor: **Prof. Inġ. Reiko Raute** | Co-Supervisor: **Dr Inġ. Evan Joe Dimech**

What is your project about?

This project involves the design and development of an Accumulator Management System (AMS) for a Formula Student electric vehicle. The accumulator is the vehicle's battery pack, made up of multiple lithium-ion cells connected in series to produce a high-voltage DC source. This powers the electric drivetrain. Monitoring such a system is a must due to the risks associated with lithium-ion chemistry, such as overheating and electrical faults. A prototype semi-distributed AMS was developed, with monitoring boards connected to a segment of the accumulator to collect data such as voltage and temperature, communicating with an external master board to detect and handle any faults.

Why are you working on this project?

This project brings together my interest in electric vehicles and my commitment to sustainable transport. Formula Student provides a platform to test and apply energy storage systems under real conditions. The technical challenges involved offer practical experience in system design, safety, and testing.

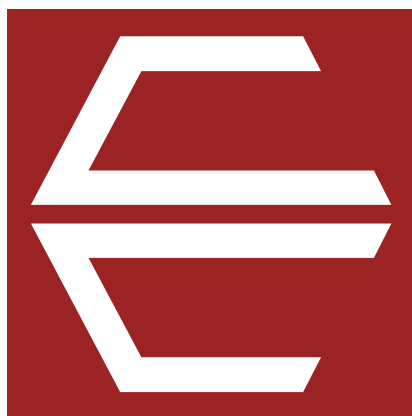
There is also a growing need in Malta for battery storage capable of storing excess renewable energy. As more solar and wind power is added to the grid, reliable energy storage becomes more important. The skills and knowledge developed through this project are relevant to this shift. I chose this area because it aligns with current industry needs and supports long-term goals in transport and energy. Working on this system allows me to contribute to the development of safer and more robust energy systems while gaining experience in a field that is growing both locally and globally.











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