Southampton Solent University

School of Technology and Maritime Industries

# ENGINEERING PROJECT DAY 2026

**BEng (Hons) Electronic Engineering**
**BEng (Hons) Electronic Engineering Apprenticeship**
**BEng (Hons) Mechanical Engineering**
**BEng (Hons) Renewable Energy Engineering**

Southampton Solent University
Wednesday 20th May, 2026

# Contents



# 1. About the Engineering Project Day

The **Engineering Project Day** is the annual showcase of final-year project work by students in the School of Technology and Maritime Industries at Southampton Solent University. The event brings together students, academic supervisors, Industrial Advisory Board (IAB) members, and visiting employers to celebrate the breadth and quality of engineering innovation across Solent's Engineering undergraduate programmes.

The projects represent the culmination of a full academic year of independent research, design, and development. Each student has identified a problem, reviewed the relevant literature, and developed and evaluated a solution - demonstrating the professional competencies expected of a BEng graduate.

**Why the Engineering Project Day matters to employers:** visiting organisations have a unique opportunity to meet talented graduating engineers, discuss their projects directly, and follow up on any that spark interest. Students have indicated their openness to new opportunities using a colour-coded traffic-light system visible on their handbook entries and posters.

- **Actively looking** — seeking graduate roles or placements
- **Open to conversations** — currently employed, open to networking
- **Not currently looking** — happy to discuss project

**Programme of the Day**

| Time | Activity |
|---|---|
| 13:00 - 14:00 | Open to visitors: employers, IAB members, First and Second Year students |
| 14:00 - 14:30 | Closing ceremony & prize-giving — Lower Atrium |
| 14:30 - 15:00 | SMART Centre tour and refreshments for industrial guests |

# 2. Awards

## Automate-BEST Innovation Award

Sponsored by **Automate-BEST UK**, this award recognises the three most innovative final-year undergraduate projects presented on the Engineering Project Day. Judging is carried out by two Industrial Advisory Board (IAB) members, with prize money of **£300**, **£200**, and **£100** awarded to the first, second, and third placed projects respectively, along with certificates. All projects are eligible.

## Fortis IBA Group Prize for Best Engineering Dissertation with a Sustainability Theme

Sponsored by **Fortis IBA**, this prize is awarded to the student producing the best engineering dissertation with a sustainability theme within the BEng (Hons) Renewable Energy Engineering programme. The winner receives a **£50 Amazon voucher** and is announced at the graduation ceremony.

## IET Prize

Awarded annually by the **Institution of Engineering and Technology (IET)** to an outstanding student nominated by the department from an IET-accredited programme. The winner receives a certificate and two years of free IET membership - one year as a student member and one year of post-graduation membership and the award is announced at the graduation ceremony.

# 3. Industrial Advisory Board (IAB)

The following IAB members are attending the Engineering Project Day 2026. We are grateful for their time, expertise, and continued support of our students.

| # | Name | Organisation | Sector |
|---|---|---|---|
| 1 | Richard Savidge | Energy Systems Catapult | Renewable / Mechanical |
| 2 | Mark Newland | Abraham Associates | Design / Mechanical |
| 3 | Nige Ward | Lean / Six Sigma Expert | Lean, CI |
| 4 | Richard Little | Jenton Group | Electronics / Automation |
| 5 | Georgia Strickland | Doris Group | Offshore Wind |
| 6 | Martin Halford | DLM UK | Renewable Energy |
| 7 | Lauren Tuffin | Raymond Brown | Renewable Energy |
| 8 | Radoslaw Wojcieszek | CooperVision | Design / Manufacturing |
| 9 | Samantha Stott | Ultra Maritime Group | Electronics |
| 10 | Robert Hart | Altertek Ltd | Renewable / Battery Mgmt |
| 11 | Martin Thomas | AWE Nuclear Security | Mechanical / Electronic |

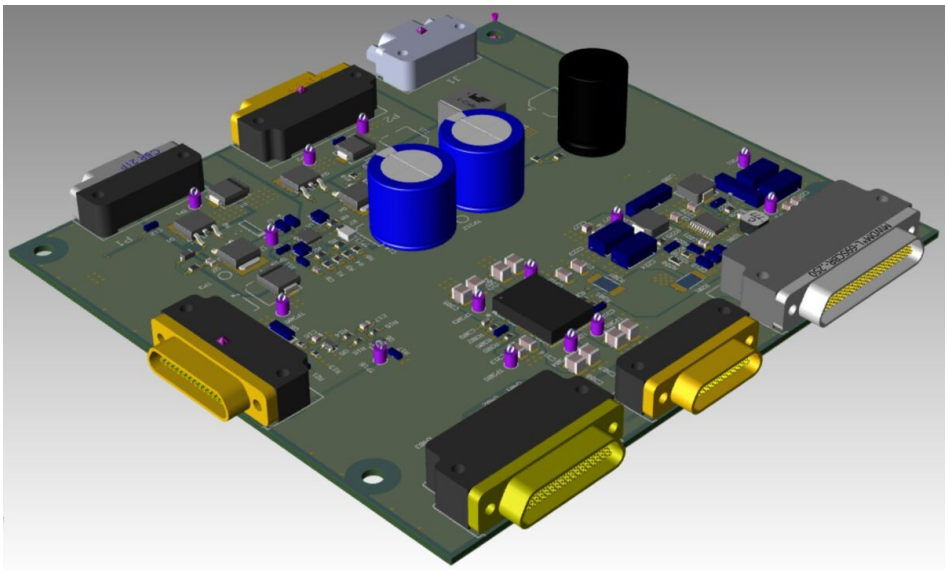
# 4. Student Projects

The majority of the Project Booklet is of course dedicated to our students — each page will provide background information to one of our fantastic projects that is being exhibited, including at least their name, course they studied, and a project description.

**Joshua Owen** BEng (Hons) Electronic Engineering Open to conversations

*Supervisor:* Dr Marc Molinari

## Development of a High-Efficiency Power Regulation System for a Sensor Acquisition Platform



This project focused on the design, development, and verification of a Power and Sensor Distribution Unit for use in a complex electronic system operating from a nominal 28 V DC supply. The PSDU was intended to distribute power safely and efficiently to multiple subsystems while providing regulated output rails, source switching capability, and protection features suitable for demanding applications. The work began with the creation and refinement of a System Requirements Specification, which defined the electrical, mechanical, environmental, and cost constraints for the unit. From this, a modular architecture was developed to provide regulated outputs at several voltage levels, support automatic switching between independent power sources, and incorporate filtering and protection features to improve reliability and electromagnetic compatibility. The project involved schematic capture, component selection, printed circuit board (PCB) layout, and prototype manufacture. A key aspect of the work was balancing performance requirements with real-world design constraints such as component availability, manufacturing limitations, interface changes, and budget restrictions. This required an iterative design approach, with early testing used to inform subsequent design decisions. Verification testing was carried out to compare the realised hardware against the original specification. This included electrical testing of voltage regulation, source switching behaviour, ripple performance, efficiency, current capability, and thermal performance under representative operating conditions. While some requirements were only partially verified due to prototype and resource constraints, the project successfully demonstrated the viability of the overall architecture and identified clear next steps for future development. Overall, the project provided practical experience in power electronics, PCB design, systems engineering, verification testing, and technical risk management, resulting in a credible prototype design and a strong foundation for further refinement and qualification.

**Adrian Poschina** BEng (Hons) Electronic Engineering Open to conversations

*Supervisor:* Dr Puja Mishra

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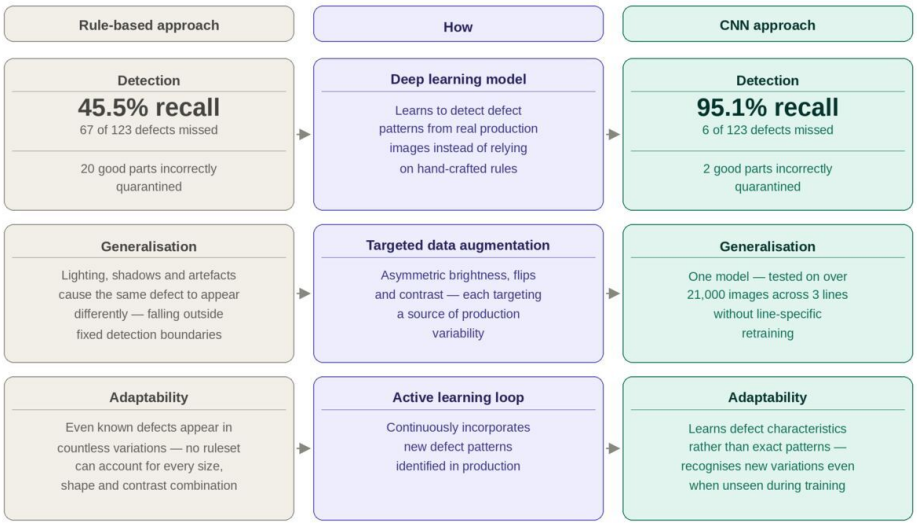
## Image based defect detection using Convolutional Neural Network (CNN)




This project explored, designed and implemented a CNN-based defect detection system as an alternative to rule-based approaches for industrial manufacturing inspection. The system classifies component images as Good or Bad based on the presence of surface defects, validated on real production data across three independent manufacturing lines. Development followed a structured iterative methodology across nine model versions, progressing from a handcrafted classical preprocessing pipeline — which was abandoned as its rigid parameter-based approach could not generalise across different production line conditions — in favour of a self-improving deep learning model trained directly on real production images. Cross-line robustness was achieved through a targeted augmentation strategy, with an asymmetric brightness layer specifically designed to address lighting variation between production lines. The training dataset grew from 1,679 to 11,452 images through an active learning loop that continuously surfaced and incorporated new defect patterns from production data. The final model achieved 95.1% combined defect recall against the rule-based system baseline of 45.5% — more than double the detection rate — while reducing false rejections by a factor of ten across 21,488 production images. All project objectives were met or exceeded. A standalone prototype inspection tool was developed and deployed for live production use, with the active learning loop ensuring the system is designed for continuous improvement as new defect patterns emerge.

**Ryan Howell**

BEng (Hons) Electronic Engineering

*Supervisor:* David Hawkins

## Volleyball Court Detection

When playing a game of volleyball, a recurring challenge is determining whether the ball landed inside or outside the court lines. A reliable automated system to make this call in real time would remove the chance of human error and could also be used to automatically determine the score.

The aim of this project is to create a system to determine if the ball landed inside or outside the court lines, giving a real-time decision. The work involves a literature review of existing ball detection systems, followed by the design and construction of a prototype that determines ball position relative to the court boundaries. The solution will be evaluated for suitability, and all circuit design and calculations will be completed in full.

**Vivienne Clark** BEng (Hons) Electronic Engineering (Apprenticeship) Open to conversations

*Supervisor:* Dr Nils Bausch

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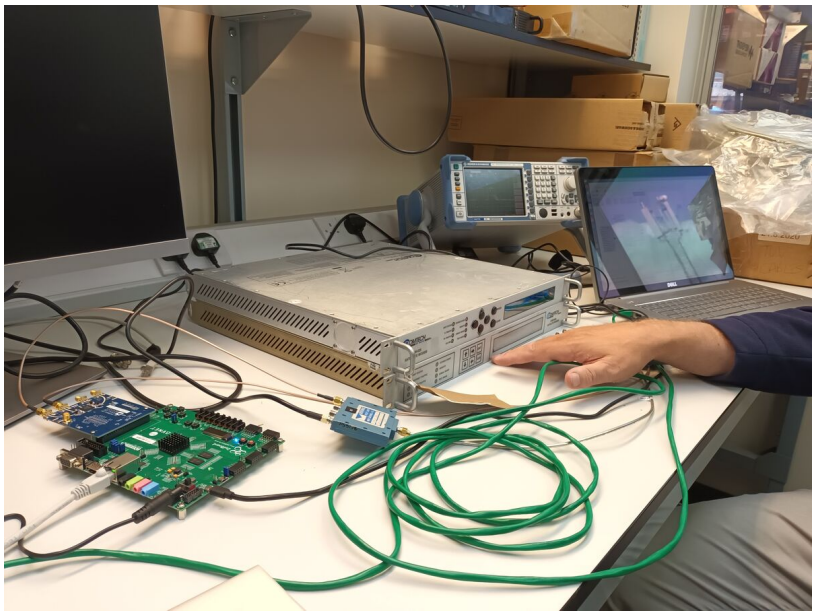
## A Satellite Communications Software-Defined Radio Transmitter Implemented on a Field Programmable Gate Array



This project addresses the challenge of developing flexible and affordable satellite communication systems. Many existing systems are either highly expensive and non-configurable, or low-cost but limited in capability. This creates a gap for a platform that is both configurable, user-friendly and practical for research and education.

To address this, a software-defined radio transmitter was developed using the Digilent ZedBoard Zynq-7000 FPGA and the Analog Devices AD9361 RF transceiver. The FPGA was programmed in VHDL using the Vivado development environment. A modular design approach was adopted, where key parts of the transmit chain—including the data source, framing, encoding, modulation and filtering—were implemented as individual custom IP blocks integrated into the AD9361 reference design.

AXI4-Lite was used to provide a simple interface between the hardware and software, allowing the user to configure and monitor the system. KuiperLinux was used to control the transmitter through a command line interface. Using straightforward and user-friendly commands, the user can start, stop and restart transmission, mute the output, view system status, and switch between waveform configurations in real time.

Four waveforms were successfully implemented. These include a basic uncoded BPSK waveform and an OQPSK waveform with frequency hopping, as well as a telecommand (ground-to-spacecraft) and a telemetry (spacecraft-to-ground) signal. The telecommand and telemetry waveforms were inspired by the CCSDS space communication standards. These standards are widely adopted by the global space communications industry.

Overall, the project demonstrates a flexible, low-cost SDR transmitter capable of simulating realistic satellite communication scenarios, bridging the gap between academic platforms and practical systems.

**Miroslaw Gabrys** BEng (Hons) Electronic Engineering (Apprenticeship) Open to conversations

*Supervisor:* Dr Marc Molinari

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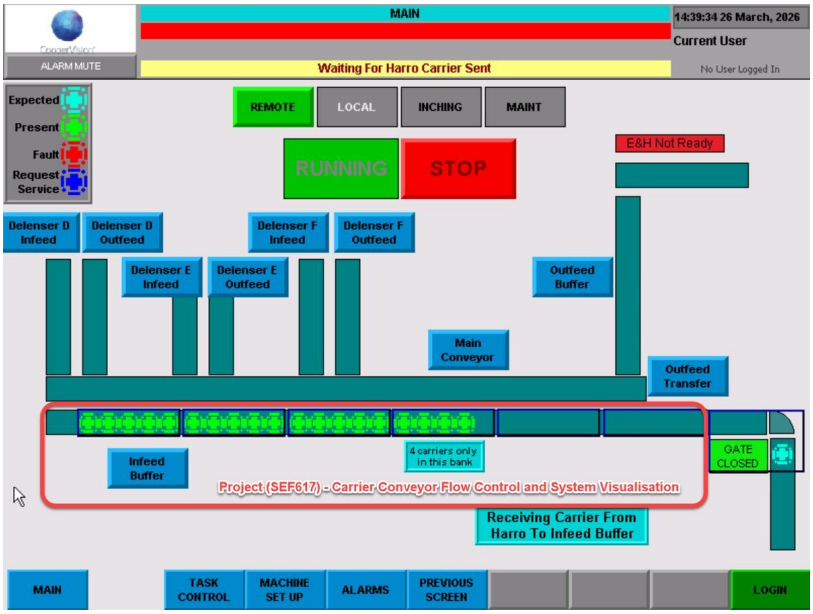
## Carrier Conveyor Flow Control and System Visualisation




This project focused on improving the reliability and performance of a conveyor system used in high-volume contact lens manufacturing. The existing system experienced issues during peak operation, where excessive accumulation of carriers led to mechanical stress, equipment faults, and unplanned downtime. In addition, limited system visibility made it difficult for operators to quickly identify and resolve problems.

To address these challenges, a new flow-control solution was designed and implemented within a live production environment. The approach combined mechanical buffering with an upgraded control system, including programmable logic controller (PLC) modifications, real-time tracking of carriers, and enhanced visualisation through Human-Machine Interface (HMI) and SCADA systems.

The solution introduced controlled accumulation zones along the conveyor, supported by intelligent sequencing and fault detection logic. This allowed the system to regulate carrier movement more effectively, reduce line pressure, and provide operators with clear, real-time information about system status and faults.

Testing and validation confirmed improved flow stability, more reliable fault detection, and enhanced operator awareness. The final system provides a scalable and maintainable solution that supports future expansion while minimising disruption to ongoing production.

**Sinead Lines** | BEng (Hons) Electronic Engineering (Apprenticeship) | Not currently looking

*Supervisor:* Dr Sinan Khwandah

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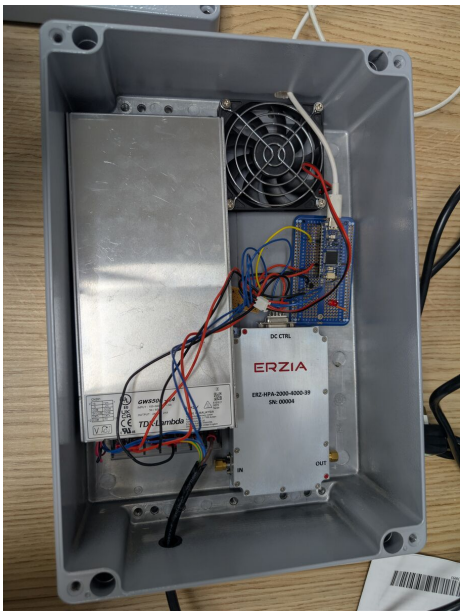
## High Power Amplifier Temperature Regulation and Warning System




A proof of concept prototype to be used as a mitigation to prevent a high power amplifier from overheating / reaching maximum operational temperature.

**Dylan Packham** BEng (Hons) Electronic Engineering (Apprenticeship) Actively looking

*Supervisor:* Dr Nils Bausch

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**LinkedIn Profile**

## Development of a Dual-Axis, SDR Based Radio Telescope from Domestic Satellite Components

The project I'm showcasing explores how radio astronomy can be made more accessible by building a low-cost radio telescope from widely available and reused hardware. Traditional radio telescopes are large, expensive, and far beyond the reach of most students or hobbyists. The aim of this project was to show that the basic principles of radio observation can be demonstrated using affordable consumer components, and a practical engineering approach!

The system is centred around a domestic UK Zone 1 satellite dish, a quad Low-Noise Block (LNB), a software-defined radio (SDR), and a custom-built motorised dual-axis mount. This mount allows for the dish to be rotated horizontally and vertically (Az/EL), maintaining its position when stationary and providing accurate targeting. The overall system implements mechanical design, electronics, motor control and signal handling, whilst prioritising low-cost, accessible, and recognisable components and mechanisms.

The final outcome is a working proof-of-concept that combines mechanical, electronic, and RF engineering into a larger system. As well as demonstrating how radio signals can be received and analysed, the system highlights the value of sustainable engineering through repurposing everyday satellite hardware, perfect for educational STEM applications.

Overall, the project shows that radio telescopes aren't out of reach for amateurs, and that they can be approached in a practical and affordable way!

**Alec Parkin** | BEng (Hons) Electronic Engineering (Apprenticeship) | Actively looking

*Supervisor:* Dr Puja Mishra

*Connect*

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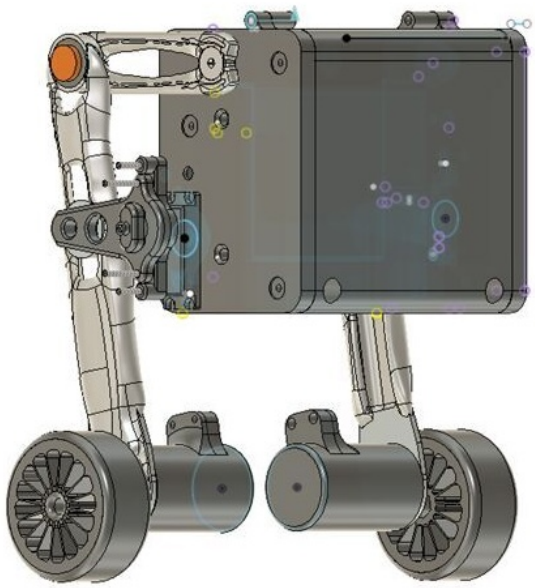
## Use of Inverted Pendulum Robots to Develop Self-Tuning Control Systems



This study explores the critical role of Inverted Pendulum (IP) robots as a benchmark for advancing adaptive control strategies in smart embedded systems. Due to their inherent instability and non-linear dynamics where the centre of mass resides above the pivot point, IP robots serve as an ideal "stress test" for developing robust Self-Tuning Control (STC) algorithms. Unlike traditional fixed-gain controllers, STC systems utilize a parameter estimator, such as a genetic algorithm or a Covariance matrix adaptation evolution strategy, to identify the system's "plant" model in real-time and automatically synthesize optimal control parameters.

The study highlights how these smart embedded frameworks adapt to physical changes, such as shifts in mass or environmental disturbances, which are common in real-world applications like satellite orbital control and humanoid balancing. Experimental results demonstrate that while standard PID controllers may struggle with varying dynamics, self-tuning systems maintain stability by dynamically recalculating gains. By integrating these algorithms into embedded hardware, the research provides a scalable blueprint for automation and control, bridging the gap between theoretical mathematical modelling and practical, high-precision engineering applications.

**Oscar Smith** | BEng (Hons) Electronic Engineering (Apprenticeship) | Not currently looking

*Supervisor:* Dr Puja Mishra

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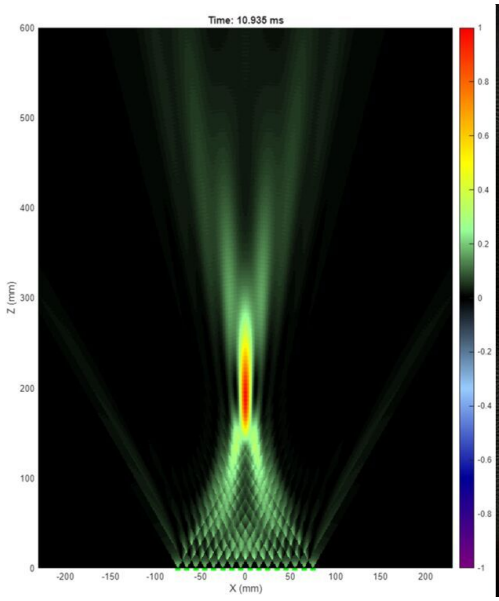
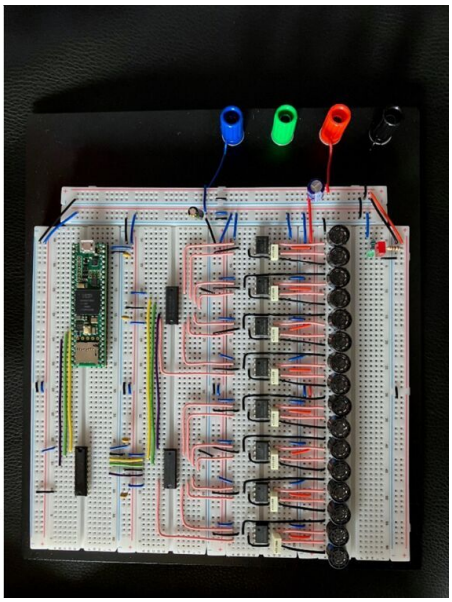
## Contactless Haptics Using Ultrasonic Phased Arrays



Current Human-Computer Interaction systems, such as touchscreens, are limited by the lack of haptic responses. This flaw necessitates constant visual confirmation of actions, leading to operational errors and genuine safety risks in attention-critical environments such as driving. In addition, the ongoing transition to spatial computing, including AR/VR and 3D displays, presents a critical challenge: users can view digital 3D objects but cannot physically feel or interact with them, breaking immersion and restricting functionality.

This project explores an experimental solution: contactless haptic feedback using acoustics. The system employs an Ultrasonic Phased Array to precisely focus acoustic waves into three-dimensional free space. This process generates localised focal nodes, vibrating at low frequencies to selectively activate the cutaneous mechanoreceptors within human skin, simulating the physical sensation of touch without requiring contact or the user to wear any equipment.

By re-engineering this technology from first principles, this project has yielded two primary research artifacts:

- **Simulation:** A custom, real-time linear phased array simulation developed in MATLAB to forecast array behaviour, predict acoustic grating lobes, and refine focal point resolution across a 2D coordinate system.
- **Prototype:** A physical array prototype engineered on a breadboard to validate the electronic driver logic, with potential for expansion into a PCB with perceivable haptics. The system utilises a Teensy microcontroller and cascaded shift registers to dictate nanosecond phase-delays for precise acoustic beamforming.

The long-term vision for this technology is to integrate seamlessly with 3D displays and spatial computing, using AI hand-tracking to establish the groundwork for an era where users can physically feel, grasp, and interact with holograms and digital interfaces in mid-air.

**Daniel Smees** | BEng (Hons) Electronic Engineering (Apprenticeship) | Open to conversations

*Supervisor:* Dr Marc Molinari

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**LinkedIn Profile**

## Machine Learning Based PID Parameter Optimisation Under Uncertainty in Biotech Systems

Biotechnology processes are highly complex, nonlinear, and influenced by uncertainty from biological variation, changing reaction conditions, and noisy measurements. Because of this, effective control is essential to maintain stability and product quality. Although PID controllers are widely used for their simplicity and robustness, traditional tuning assumes fixed system dynamics. When biological behaviour shifts, PID performance often degrades, reducing efficiency and consistency. Machine Learning offers a data-driven alternative by modelling changing system relationships and enabling adaptive optimisation of PID parameters. Combining ML with PID control can improve robustness, enhance reliability under uncertain conditions, boost equipment performance, and reduce reliance on specialist expertise for tuning. Might ML-enhanced PID control change the way future bioprocesses are managed?

**Aaron Christon-Greet** BEng (Hons) Electronic Engineering (Apprenticeship) Open to conversations

*Supervisor:* Dr Puja Mishra

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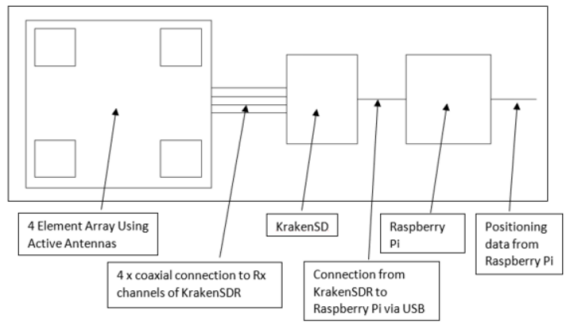
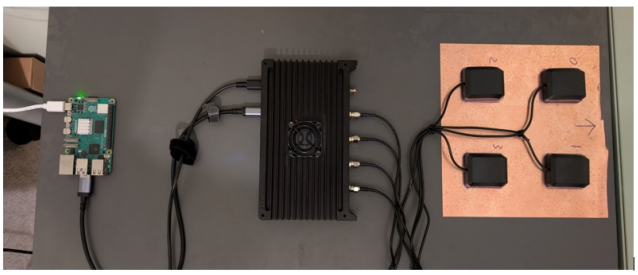
## Investigation of Controlled Reception Pattern Antennas Using Only Commercial Off-The-Shelf Components



My project investigates the feasibility of developing a low-cost anti-jamming system to protect small autonomous vehicles, such as delivery drones, from GPS interference. Currently, GPS signals are weak and easily disrupted by intentional jamming or everyday electronic noise. While specialist hardware exists that can filter out this interference by creating blind spots toward the source, it is typically too expensive and heavily regulated for civilian use.

To address this problem, the project adopted a commercial-off-the-shelf approach, with the goal of building a functional, miniaturised system for a fraction of the cost of existing solutions. The physical design used a small custom antenna array connected to affordable, widely available computing hardware. Instead of relying on expensive dedicated equipment, the system used custom code and digital signal processing algorithms to identify and mathematically cancel interference.

The project achieved several key outcomes, successfully running complex signal-cancelling algorithms in real time on low-cost hardware. This demonstrates that building affordable, accessible anti-jamming technology for commercial use is feasible, as modern low-cost computing components are now powerful enough to handle the complex mathematics required.

## Lucas Amery

BEng (Hons) Electronic Engineering (Apprenticeship)

*Supervisor:* Dr Sinan Khwandah

### Reactionary Environmental Control Unit

Hawk-Eye Innovations uses hardware that travels and operates out of compact flight cases and cabinet-type housings. A consequence of PDUs, servers, switches, and various control units being tightly confined together when in use is a persistent risk of overheating. Current mitigation measures — fans and de-humidifier units — run permanently at maximum power regardless of the local environment, wasting energy and generating unnecessary noise. These parts also burn out more quickly as a result. This project has been commissioned by Hawk-Eye to design and build a reactionary environmental control unit that measures temperature, humidity, and sound, and uses that information to better control and power the existing environmental mitigation systems to match the actual requirements of the local environment. The aim is to save power and reduce excess sound pollution while also extending the lifespan of the cooling and dehumidification equipment.

**Matthew Hope**

BEng (Hons) Electronic Engineering (Apprenticeship)

*Supervisor:* Dr Sinan Khwandah

## Affordable and Durable 121.5 MHz Homing Beacon Transmitter

Homing beacons used during search and rescue (SAR) operations come in various forms depending on whether they are used in aircraft, watercraft, or carried by individuals. Personal Locator Beacons (PLBs) typically transmit two signals: a high-powered burst around 406 MHz, which sends GNSS data to a network of satellites known as COSPAS-SARSAT, and a low-powered 121.5 MHz signal that acts as a homing beacon for tracking the device in the field.

The aim of this project is to design, build, and evaluate an affordable and durable 121.5 MHz homing beacon transmitter that complies with Ofcom standards and is robust enough to survive in rugged mountain terrain where it may realistically be used. An anechoic chamber will be used to test the design and validate performance and durability.

## Charlie Bailey

BEng (Hons) Electronic Engineering (Apprenticeship)

*Supervisor:* Dr Puja Mishra

### Analog Direction Finding System Using Beamforming

Direction finding is applied across many industries including wireless communication, radar, navigation, and search and rescue. Traditional direction finding techniques such as Adcock/Watt and pseudo-Doppler systems can be complex and require significant digital processing. An analogue beamforming system offers a low-cost and transparent alternative.

The project aims to design and build an analogue direction finding system using beamforming, capable of estimating the angle of arrival of an RF signal within $\pm 60^{\circ}$. The system will be demonstrable in an indoor environment and will rely on four main RF building blocks: antenna array, beamforming network, RF front-end, and power detection. Using an ISM radio band allows for low-power and legal testing without large hardware. Key objectives include designing and simulating a 4-element antenna array with a $4 \times 4$ Butler matrix, implementing fixed beam patterns, applying low-noise amplification and filtering, and developing a simple angle estimator based on beam power comparison.

**James Jenks** BEng (Hons) Electronic Engineering (Apprenticeship)

*Supervisor:* David Hawkins

## Smart Controller Upgrade for Old Amusement Games

Many amusement games are old and simple — a crane grabber, for example, consists of a few motors, a solenoid, some buttons, switches, and sensors, paired with a 'dumb' controller. Many of these games date back beyond the 1990s and large numbers are still in use today, but are often unreliable and frequently replaced as a full unit due to the age of the electronics inside. This represents a huge waste, with no scope for customisation or any smart features that would be expected from modern devices. The project aims to create a modernised system with a web interface that can be retrofitted to old games, bringing them back to a smarter operational life at lower cost and with less environmental waste. It will provide live diagnostics, financial performance statistics, remote configuration and control, and infinite customisability through configurable object-oriented software. The deliverables include a working PCB prototype and a real-life crane demo rig.

**Tommy Rowe**

BEng (Hons) Electronic Engineering (Apprenticeship)

*Supervisor:* Dr Puja Mishra

## Self Stabilising Model Rocket

This project aims to design and build a self-stabilising model rocket using a PID feedback control system to manage flight stability via thrust vector control (TVC) on a two-dimensional axis — that is, moving the entire solid-state motor rather than merely directing thrust. A Teensy 4.1 microcontroller serves as the flight computer, with an Inertial Measurement Unit (IMU) monitoring real-time orientation data. Based on IMU feedback, the PID controller dynamically adjusts the rocket motor's gimbal position to correct for deviations in pitch and yaw during ascent.

The rocket's structural frame and TVC mount are custom-designed using Fusion 360 and fabricated from 3D printed materials. The overall objective is to achieve stable, vertical flight with autonomous correction for disturbances caused by wind or imbalanced thrust. For legal and safety reasons, flight will be simulated using a custom-built test mount. The project integrates embedded systems, control theory, sensor fusion, and mechanical design.

**George Eason** BEng (Hons) Mechanical Engineering ● Not currently looking

*Supervisor:* Dr Fayyaz Rehman

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## The redesign and development of an obsolete Rocker Arm using reverse engineering techniques

The ability to reverse engineer and remanufacture obsolete components is becoming increasingly important. The requirement to effectively repair aging systems within a timely manner is driving the development of 3D Scanning, CAD practices and Additive Manufacturing processes. This is an issue seen across a wide variety of industries, in particularly the remanufacture of obsolete classic car and motorcycle components is frequently complicated and expensive. This is often due to the limited production runs required and the cost involved using traditional manufacturing methods. Classic car and motorcycle components often contain complex geometry or features that require heat treatment or machining processes causing them to be costly to reproduce. A 1929 Blackburne Engine Rocker Arm contains complex geometry in addition to both heat treated and ground surfaces. The aim of the project was therefore to replicate an obsolete 1929 Blackburne Engine Rocker Arm using 3D Scanning and Computer Aided Engineering practices. This was to be completed by researching the available processes, down selecting the most suitable and finally validating the findings through the replication of the component. The project demonstrates the process of component replication and optimisation using 3D Scanning, CAD practices and Additive Manufacturing processes. The project shows that this methodology could be applied across many applications within several industries.

**Abdelrahman Mahdy** BEng (Hons) Mechanical Engineering ● Actively looking

*Supervisor:* Dr Nils Bausch

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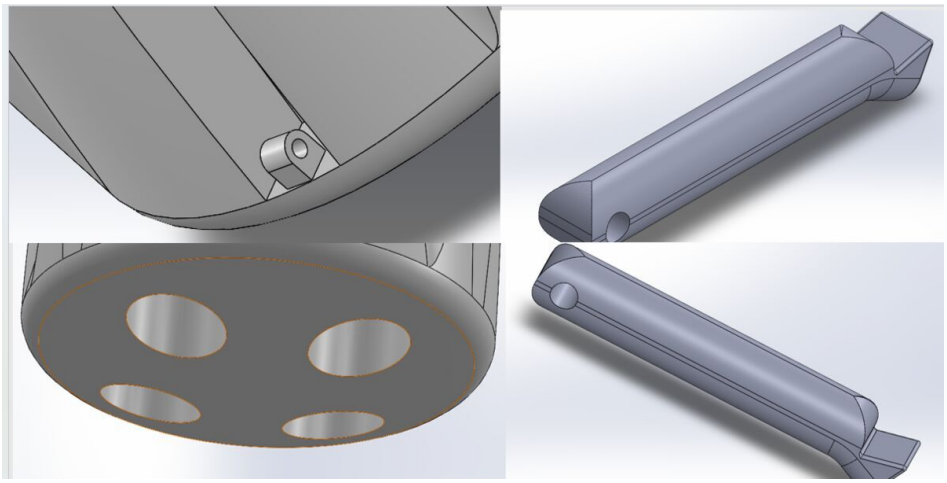
**LinkedIn Profile**

## Impact absorbing Landing System for Space Capsules (Design, Simulation, and evaluation)



Space capsule recovery is usually done through an ocean splashdown. This method is chosen for how simple and safe it is, since the ocean provides a large, accessible landing surface and acts as a natural shock absorber. While landing on land is possible and has been done and proven in similar applications, it's still considered a less preferred way to land back on Earth, since it requires precise targeting and terrain analysis, and it produces higher impact forces that demand robust energy absorption systems. Nonetheless, land-based capsule recovery can be easier, faster, and safer in many situations.

This project works on the design and simulation of an impact absorbing landing system tailored for space capsules intended to land on terrestrial surfaces.

The project will examine multiple energy dissipation mechanisms and evaluates their performance through a series of simulations, FEA analysis, and dynamic modelling.

*Project Aim:* This project aims to contribute to the development of safer, more efficient terrestrial recovery systems for future space missions. The goal is to develop, design, and simulate a system that shows good mechanical efficiency, mass constraints, and reliability.

*Objectives:* To research and compare impact mitigation systems and shock absorption methods; to design an impact-absorbing landing system that enables space capsules to safely touch down on land; to simulate and analyse various mechanisms to reach the best results using FEA under realistic impact conditions; and to optimise the design for minimal mass and maximum reliability, considering manufacturability and scalability.

**Bradley Roberts** | BEng (Hons) Mechanical Engineering | Actively looking

*Supervisor:* Dr Fayyaz Rehman

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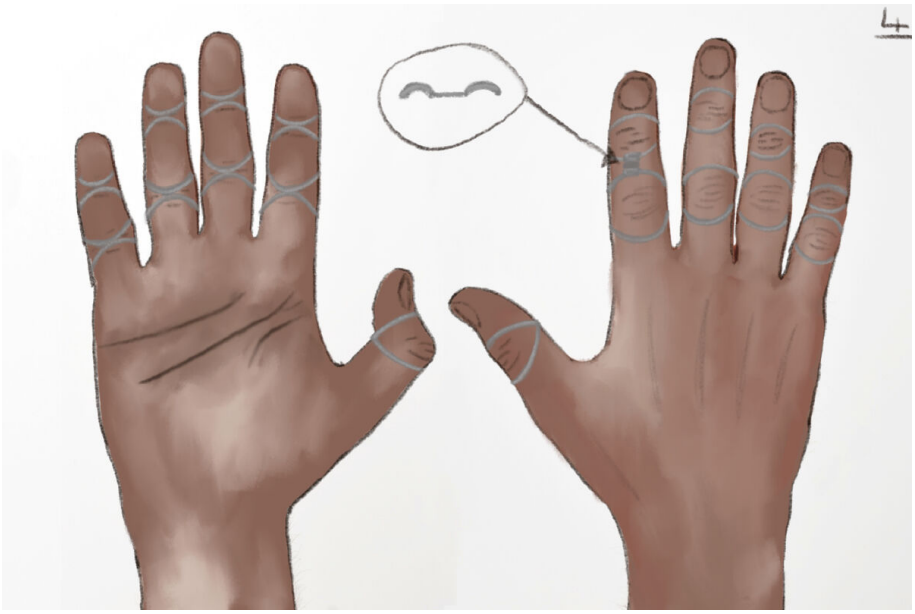
## Design and Development of a device to reduce pain for people with Ehlers-Danlos Syndrome



This project focuses on addressing the challenges faced by individuals with joint conditions such as Ehlers-Danlos Syndrome (EDS) and arthritis. These conditions often cause joint pain, instability, and hyperextension, particularly in the fingers, which can make everyday tasks difficult. Current solutions, such as splints, are often bulky, restrictive, or expensive, highlighting a gap in the market for a more practical and accessible device.

To address this, the project involves the design and development of a finger support device that fits over the knuckles. The aim is to reduce hyperextension and provide joint stability while still allowing natural hand movement. A user-centred approach was taken, beginning with a questionnaire to gather feedback from potential users. This helped identify key requirements such as comfort, adjustability, appearance, and affordability.

Based on these findings, several concept designs were created using both hand sketches and digital methods. A final design was selected and developed using SolidWorks, where the device was modelled and tested through simulation. Material selection was carried out using Granta EduPack to ensure the chosen materials met requirements for strength, durability, corrosion resistance, and user comfort.

The key outcome of this project is a functional and adaptable finger support design that improves upon existing products by balancing performance, usability, and cost. The final design demonstrates the potential to provide a more accessible solution for individuals experiencing joint instability in the hands.

**Jonathan Hutchins** BEng (Hons) Mechanical Engineering Open to conversations

*Supervisor:* Dr Abdulla Tahhan

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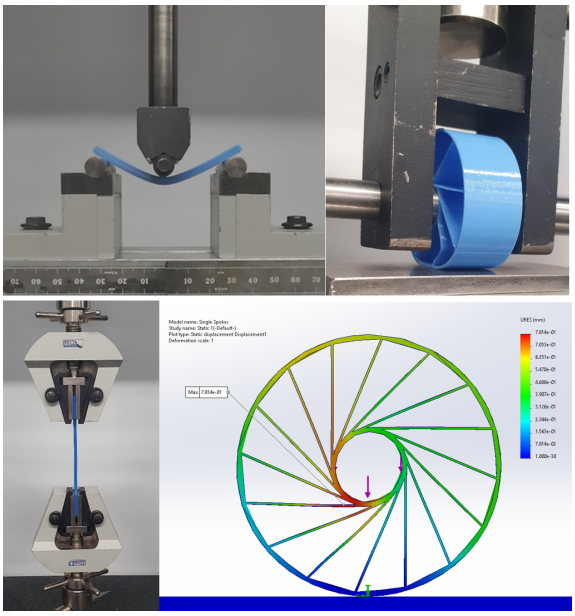
## Materials Testing and Simulation of FDM 3D Printed Non-Pneumatic Tyres Applied to a Pipe-Climbing Robot



Traditional pneumatic tyres represent a significant liability in many robotic applications due to their dependency on air pressure, making them prone to punctures and explosive blowouts. For specialised systems like pipe-climbing robots, which must securely scale copper pipes for inspection missions, reliable traction and constant compressive force are critical. This project investigates the design and experimental validation of Fused Deposition Modelling (FDM) 3D-printed non-pneumatic tyres (NPTs) as a safer, more durable, and recyclable alternative. The research focuses on the mechanical behaviour of Thermoplastic Polyurethane (TPU), a material ideal for creating complex airless structures. A key challenge addressed is material anisotropy, where the strength and stiffness of 3D-printed parts vary significantly based on the raster orientation. Comprehensive tensile, flexural, and hardness testing revealed that aligning printed lines with the loading axis produced a tensile modulus of 573.22 MPa, more than double the stiffness of the worst-case perpendicular orientation. These findings highlight the necessity of in-house testing to verify manufacturer data, which was found to overestimate real-world printed stiffness by over 50%.

Using the experimental data, Finite Element Analysis (FEA) was utilised to optimise six candidate geometries, including auxetic and hexagonal lattices. A dual direction tangent-spoke design emerged as the optimal geometry, achieving the required 100 N load capacity and a Factor of Safety of 3.65 while minimising weight to just 6.70 g. When integrated into the pipe-climbing robot, the engineered compliance of the NPT allowed it to conform to pipe irregularities and welds, significantly increasing the contact area and friction required for safe, accurate climbing.

**Iain Charlton-Brown** | BEng (Hons) Mechanical Engineering | Open to conversations

*Supervisor:* Dr Abdulla Tahhan

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## Investigating Confined Space Shunt Cooling Within Portable Equipment


This research project investigates the thermal management of a high-current shunt within a confined space where Ingress Penetration is minimised, with emphasis on application to the DMO200 Mk2. The primary engineering challenge is dissipating heat during a 200 A high-load duty cycle while maintaining temperatures below 75 °C, ensuring system reliability without compromising Ingress Protection (IP) ratings.
The study evaluated five configurations: a sealed Control, Passive Ambient venting, active airflow through Positive and Negative Static Pressure, and a Vapour Chamber. Each was subjected to a 30-minute thermal cycle comprising a 15-minute 200 A load phase and a 15-minute cooling phase. Success was defined by maintaining an operational peak below 75 °C and achieving a post-test dissipation temperature below 50 °C. To validate the methodology, the Control baseline was verified through SolidWorks transient thermal simulation and infrared thermal imaging, showing a high degree of correlation between numerical and practical results.
Findings demonstrate that passive strategies are insufficient for high-flux loads. The Passive Ambient and Vapour Chamber configurations both failed to prevent thermal runaway, confirming that in restricted volumes, heat accumulation outpaces passive rejection. In contrast, forced convection proved viable, with both PSP and NSP achieving stabilised temperatures well below the threshold. However, engineering analysis revealed that NSP is highly sensitive to internal geometry and air bypass. This study concludes that Positive Static Pressure (PSP) is the optimal solution. By reliably disrupting the stagnant air boundary layer and utilising the enclosure walls as a functional heat exchanger, PSP ensures thermal stability and repeatability.

**Diana Babii** | BEng (Hons) Mechanical Engineering | Actively looking

*Supervisor:* Dr Fayyaz Rehman

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## Design and Development of an Aircraft Safety Belt Enhancer for Improved Accessibility and Usability

Air travel is often described as one of the safest and most accessible forms of transport, yet a simple task such as fastening a seatbelt can still present a genuine challenge for many passengers. Individuals with reduced mobility, tremors, visual impairments or limited grip strength frequently experience difficulty aligning and securing the belt, sometimes relying on cabin crew for assistance. This project addresses that over-looked gap by focusing on improving the usability of an existing, highly standardised system without compromising its certified safety performance.

The proposed solution is a simple, two part attachment designed to work alongside a standard aircraft seatbelt. Rather than replacing the current mechanism, it enhances usability by guiding the metal tongue into position and helping it align naturally with the buckle. The design avoids unnecessary complexity, relying on intuitive use while ensuring no interference with normal operation. This ensures that the product remains suitable for all passengers, including those who do not require assistance.

The final outcome is a compact and lightweight design that supports faster, more confident fastening while maintaining compatibility with existing seatbelt systems. By focusing on ease of use and inclusivity, the project demonstrates how small but meaningful design changes can significantly improve the travel experience of reduced mobility passengers. It highlights the importance of considering accessibility at all stages, turning a moment of difficulty into one of independence.

## Zheng Yang Ang

BEng (Hons) Mechanical Engineering

*Supervisor:* Dr Fayyaz Rehman

### Design and Development of a Self Stabilising Spoon for Parkinson's Patients

Roughly 150,000 people in the UK have Parkinson's disease, which causes tremors, muscle stiffness, and slowness, restricting what patients can do independently. One problem that this project attempts to address is the difficulty patients face when feeding themselves. During the early stages of Parkinson's, patients are not yet accustomed to the loss of control in their body, and very few devices exist as temporary solutions.

This project focuses on designing a self-stabilising spoon to help patients eat without spilling food or worrying about tremors. The aim is to research, design, develop, prototype, test, and evaluate the device. Objectives include researching existing aids on the market, creating a design specification, generating and selecting a concept, detailing the design using CAD, evaluating it using Finite Element Analysis, and creating a physical prototype.

**Nana Kwadwo Sefa Asiedu** BEng (Hons) Mechanical Engineering

*Supervisor:* Dr Nils Bausch

## Joint Loading in Common Football Actions: Implications for ACL and Ankle Sprain Risk

Football has one of the highest injury rates in sport, particularly to the knee (ACL, MCL, and meniscus tears) and the ankle. These injuries typically stem from high-risk movements that generate large ground reaction forces and torques transmitted through the joints. Rapid changes of direction (cutting) and powerful instep shots are the primary examples.

Whilst research into sports biomechanics has identified some risk factors, most work has been conducted at the elite level using complex motion capture setups. This project takes a mechanical engineering approach, using motion simulation software, accessible motion capture tools, force measurement, and inverse dynamics modelling to quantify joint loading under different footwear and surface conditions.

The aim is to investigate ankle and knee joint mechanics during cutting and shooting motions, and assess how boot stud patterns and turf conditions may influence joint loading and injury risk.

## Hayden Blankson

BEng (Hons) Mechanical Engineering

*Supervisor:* Dr Fayyaz Rehman

### Design and Development of an Improved Posture Correction Device

According to UK government data, over 20 million people suffer from back-related issues, and 2.9 million of them from posture-related issues. This problem is likely to increase, particularly among younger people who spend long periods on electronic devices. The most popular posture correcting products target either the back or the neck, but not both.

This project aims to improve on this by designing and developing a posture correction device that targets both neck and back issues simultaneously. The device features an adjustable neck brace to improve neck position, together with a section that runs down along the spine and straps around the waist. It will be designed to be personalised to each user for maximum comfort and effectiveness. The project will research, design, develop, and prototype the device, evaluating it for comfort, effectiveness, and durability.

## Wade Cave

BEng (Hons) Mechanical Engineering

*Supervisor:* Jonathan Ridley

### Using Additive Manufacturing and Topology Optimisation to Optimise a Motorsport Component

Engineers in motorsport are consistently searching for ways to make their vehicles more efficient, lighter, and thus faster. Topology optimisation is a shape optimisation method that uses algorithmic models to optimise material layout. Using additive manufacturing such as 3D printing, it has become more accessible than ever to produce these designs in the real world.

The aim of this project is to develop skills in CAD software using a variety of simulations to test designs, alongside FEA, material selection, and additive manufacturing, finally producing a scaled 3D printed model to demonstrate a potential final product. As proprietary data is not available, well-reasoned estimations will be used to define load cases using vehicle dynamics and aerodynamics. Deliverables include a detailed technical report, CAD models, FEA results for each design iteration, and a 3D scaled prototype.

**Luke Dower** BEng (Hons) Mechanical Engineering

*Supervisor:* Dr Fayyaz Rehman

## Design and Development of a Deployable CubeSat Mechanism for Solar Arrays

CubeSats are widely used in low Earth orbit missions due to their cost-effectiveness and modularity. However, their compact stowed volume places strong constraints on deployable subsystems such as solar arrays and booms, which are essential for power generation and payload operation. Current mechanisms often face challenges in reliability, weight optimisation, and deployment stability. A compact, lightweight, and fail-safe deployable mechanism would directly address this engineering challenge and demonstrate relevance to aerospace applications.

The project aims to design, simulate, and prototype a lightweight deployable mechanism suitable for CubeSat solar arrays or booms. The work will analyse the structural and dynamic performance of the mechanism under simulated launch and space conditions, evaluate deployment reliability, and propose improvements for future CubeSat missions.

## Ethan Drew

BEng (Hons) Mechanical Engineering

*Supervisor:* Dr Abdulla Tahhan

### The Feasibility of CFRP Additive Manufacturing of Automotive Aerodynamic Components

In the automotive industry, reducing component mass while maintaining mechanical performance is a continuing challenge, particularly for aerodynamic components such as spoilers and diffusers. Traditionally manufactured from fibreglass or aluminium alloys, these components offer high strength but at the cost of increased weight. Additive manufacturing (AM) using continuous fibre reinforcement offers high specific stiffness and tensile strength alongside potential weight savings, though material performance is strongly dependent on printing parameters including fibre orientation, fibre volume fraction, and layer height.

The overall aim of this project is to demonstrate that additive manufacturing of carbon fibre reinforced polymers (CFRPs) can produce aerodynamic components with improved strength-to-weight ratios compared with simulated fibreglass and aluminium equivalents. The project includes material-level sample testing across varied print parameters, CAD design and FEA of the component, and manufacture of 1/5 scale prototypes on the Markforged Mark Two for mechanical testing and comparison against simulation baselines.

**Jeremiah Kamanda** BEng (Hons) Mechanical Engineering

*Supervisor:* Dr Abdulla Tahhan

## Design and Finite Element Analysis of a Cooling Plate for a Proton Exchange Membrane Fuel Cell (PEMFC)

Proton Exchange Membrane Fuel Cells (PEMFCs) are increasingly being adopted in automotive and portable power applications due to their high efficiency and zero-emission operation. However, their performance and lifetime are highly dependent on effective thermal management. During operation, approximately 40–60% of the fuel's energy is converted into heat, which must be removed to maintain the optimal operating temperature range of 60–80 °C. If this heat is not efficiently dissipated, non-uniform temperature distribution can cause membrane dehydration and eventual degradation of cell components.

The project aims to design and perform Finite Element Analysis on a cooling plate for a PEMFC that ensures uniform temperature distribution, structural integrity, and efficient heat removal. The work involves designing flow-channel configurations (serpentine, parallel, or pin-fin) in SolidWorks, performing FEA to evaluate thermal and structural performance, and optimising the design to achieve a temperature uniformity of $\Delta T \leq 5$ °C with a factor of safety of at least 1.5.

## Moses Lawanson

BEng (Hons) Mechanical Engineering

*Supervisor:* Dr Nils Bausch

### Evaluating the Efficiency of a Collaborative Robot (the Baxter Robot) in Gearbox Assembly Compared to a Human Operator

Automation and collaborative robotics are transforming modern manufacturing. Robots like the Baxter robot are designed to work safely alongside humans, performing assembly and handling tasks that are normally carried out by skilled operators. This project investigates whether a collaborative robot can match or even exceed human efficiency in assembling a simple mechanical gearbox.

The project aims to program the Baxter robot to assemble a simple gearbox and compare its efficiency and accuracy to that of a human performing the same task. Objectives include specifying the assembly task and creating a safe, repeatable workstation; developing control software for Baxter; conducting parallel human assembly trials; collecting data on assembly times, error rates, and repeatability; and analysing results to assess Baxter's effectiveness and identify variables affecting performance.

**Bruno Liistro** BEng (Hons) Mechanical Engineering

*Supervisor:* Dr Abdulla Tahhan

## Influence of Build Orientation and Environmental Factors on the Mechanical Behaviour of FDM-Printed PLA

Fused Deposition Modelling (FDM) has emerged as one of the most accessible and widely used 3D printing technologies, enabling rapid prototyping across many industries. The mechanical performance of FDM-printed polymer is highly dependent on printing parameters such as temperature, speed, and orientation, which influence layer adhesion and internal stress distribution. Polylactic Acid (PLA) is commonly used due to its availability and diverse mechanical profiles. However, its behaviour under long-term mechanical stress — including tensile loading, creep deformation, and fatigue cycles — remains a critical area of study for applications requiring durability and reliability.

This project aims to evaluate the tensile, creep, and fatigue behaviour of FDM-printed PLA under varying conditions. By investigating the influence of printing parameters and environmental factors, the study seeks to identify performance trends, develop predictive insights, and improve reliability for engineering applications of 3D-printed components.

**Mateusz J Rolinski** BEng (Hons) Mechanical Engineering

*Supervisor:* Dr Abdulla Tahhan

## Topology Optimisation and FEA of a Modular Prosthetic Elbow Joint: A 3D Printing Approach for Lightweight Fabrication

Current high-end prosthetic elbow joints offer incredible function but come with staggering price tags, making them inaccessible to most people who need them. On the flip side, affordable options frequently fail prematurely or lack the necessary function and personalised comfort.

This project aims to harness the power of Additive Manufacturing and topology optimisation to design a lightweight, modular prosthetic elbow joint at a fraction of traditional costs. Using SolidWorks for design and Finite Element Analysis (FEA) to validate structural integrity, the project targets a significant mass reduction (over 30%) while maintaining or exceeding a predetermined safety factor. The work progresses from baseline CAD modelling and FEA, through topology optimisation and refined modelling, to the physical fabrication and assembly of a functional prototype, demonstrating its modularity and lightweight geometry.

## Teddy Woolhouse

BEng (Hons) Mechanical Engineering

*Supervisor:* Dr Shehu Yusha'u

### Development and Applications of Additive Manufacturing for Construction

The UK is currently experiencing a housing crisis where the supply of homes cannot keep up with rising demand and cost. The UK government currently estimates that 300,000 homes need to be built per year to meet current demand; however, during 2022-23 only 234,000 were delivered.

This project investigates whether additive manufacturing is the key to meeting the rising demand for housing. The research covers developing additive manufacturing technologies, their real-world applications, and whether they can be used on a larger industrial scale for construction. The aim is to evaluate whether additive manufacturing could be a viable option for speeding up construction times and providing the supply needed for the current demand.

**Rawad Alawneh** | BEng (Hons) Renewable Energy Engineering | Not currently looking

*Supervisor:* Dr Tony Morris

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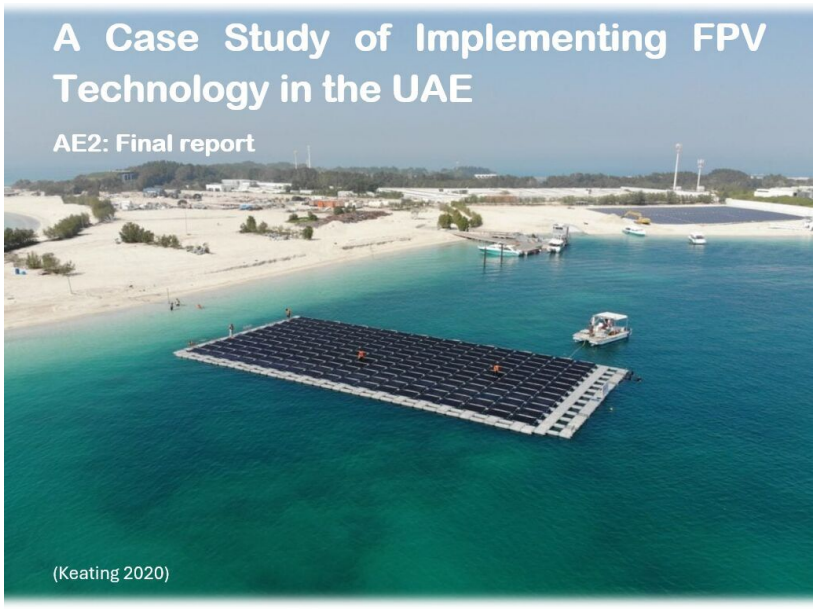
## A Case Study of Implementing FPV Technology in the UAE




This case study takes a holistic approach at assessing the viability of implementing floating solar farm technology in the United Arab Emirates. The project starts with a literature review to give needed context and then moves onto tackling specific questions such as picking a location for the solar farm, assessing energy output required, assessing economic and environmental factors, and specific technology requirements. That all leads to the use of PVSOL premium solar simulation software to provide data to test the project's actual viability. Finally, using the results a discussion will be had and then a conclusion.

**Omar Benajem** BEng (Hons) Renewable Energy Engineering Actively looking

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## Wind turbine fault detection using AI and vibration data

| | |
|---|---|
| **Input data** | High-frequency vibration data collected from wind turbine drivetrain components using vibration sensors. |
| **Data characteristics** | Expected frequency in the range of 10–25 kHz, which is suitable for capturing bearing and gearbox fault signatures (Teng et al. 2021). The data will include both normal operating conditions and known fault conditions to allow supervised learning. |
| **Data pre-processing requirements** | Segmentation of raw vibration signals into fixed length samples suitable for model input. |
| **Feature extraction** | Time-domain features (RMS, kurtosis, skewness, crest factor), Frequency-domain features (FFT, amplitude spectra and dominant frequency components). |
| **Artificial intelligence models** | Models will be implemented using Python-based libraries such as Scikit-learn and TensorFlow or PvTorch. |
| **System output** | Classification of turbine condition (normal operation or fault condition). |
| **Performance requirements** | The evaluation will use accuracy, precision, recall, F1-score, and confusion matrices. |
| **Project limitations** | The project is limited by the availability and quality of vibration datasets. |

Wind turbines operate under continuously changing environmental and mechanical conditions, which can lead to faults in critical drivetrain components such as gearboxes and rolling element bearings. These components are among the most failure-prone parts of a wind turbine, and their malfunction can result in significant downtime, high maintenance costs, and reduced energy production. Early detection of such faults is therefore essential to improve turbine reliability and support predictive maintenance strategies. This project investigates the use of vibration-based condition monitoring combined with AI techniques for detecting drivetrain faults in wind turbines. Vibration signals are widely used in rotating machinery diagnostics because mechanical defects often produce characteristic vibration patterns that can be detected and analyzed. Due to the limited availability of publicly accessible wind turbine vibration datasets, this study generates synthetic vibration signals to simulate three operating conditions: healthy operation, bearing faults, and gear faults. These signals are designed to represent typical vibration behaviors associated with each condition while including random noise to reflect realistic operating environments. The generated signals are processed using signal analysis techniques such as the Fast Fourier Transform (FFT) to examine their frequency characteristics. Key statistical features, including Root Mean Square (RMS), kurtosis, and peak frequency, are extracted from each signal to describe its vibration behavior. These features are then used to train a Support Vector Machine (SVM) model to classify the turbine operating condition. The results demonstrate how combining signal processing and machine learning can support automated fault detection in wind turbine drivetrain systems, highlighting the potential of AI-based monitoring methods to improve maintenance planning and reduce operational risks.

**William Copleston** | BEng (Hons) Renewable Energy Engineering | Actively looking

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## Feasibility and Design of Solar-Tidal Hybrid Energy System

My project investigates whether floating solar panels could be combined with the proposed Swansea Bay Tidal Lagoon to create a more reliable and space-efficient renewable energy system. The problem it addresses is the need for cleaner electricity while avoiding some of the limitations of single renewable technologies. Tidal power is predictable but does not generate constantly, while solar power depends on daylight and weather. By combining the two, the system could help smooth energy supply and make better use of an existing marine site rather than taking up valuable land.

The approach involved reviewing existing research on tidal lagoons, floating solar systems, marine conditions, and hybrid renewable energy schemes. I then developed a model of the proposed system using PVsol Premium for the floating solar array and MATLAB for the tidal lagoon and combined energy output. The solar system was first modelled at a smaller scale, then scaled up to estimate performance over the lagoon area. Different design choices were considered, including panel type, layout, tilt angle, losses, and long-term degradation.

The results suggest that the concept has strong potential. Covering 10% of the lagoon surface with floating solar could generate about 173.1 GWh per year. When combined with tidal generation, this could cover around 78.3% of Swansea's local electricity demand. Further scaling showed that about 22.9% surface coverage would be needed to meet 2022 demand over the panels' lifetime. The project also found major potential carbon savings, although further work is needed on cost, environmental impact, maintenance, and structural durability.

**Abigail Dowell** BEng (Hons) Renewable Energy Engineering Actively looking

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## Self-Planting, Biodegradable Solar Lantern with Integrated Seeds for Soil Regeneration in Disaster Zones

Natural disasters often damage environments and strip soils of necessary minerals for plant growth. This causes vegetation to struggle to recover and reduces biodiversity within environments. These areas often need lighting solutions without being connect to the power grid, that produces waste which accumulates over time and pollutes the area. This project addresses both of these issues through designing, developing and prototyping a biodegradable, self-planting solar lantern which provides light and supports soil rejuvenation.

This project followed multiple stages including research, concept generation, testing and prototyping. The initial concepts were explored and tested while comparing results to ensure the best final product. This lantern consists of a biodegradable structure containing a paper based casing and embedded seeds, and transplantable electronic components which can be removed and changed to other lanterns. After its useful life, the lantern can be disassembled and the casing planted into soil, where the seeds can grow, helping to restore soil nutrients.

The outcomes of this project include producing a product which combines renewable energy engineering, biodegradable materials, environmental regeneration and sustainable design concepts. While limitations were identified during this project, a strong potential was found for creating a low-cost, sustainable solution that reduces waste while having a net positive interaction with the environment.

**Benjamin Folling** | BEng (Hons) Renewable Energy Engineering | Actively looking

*Supervisor:* Dr Shehu Yusha'u

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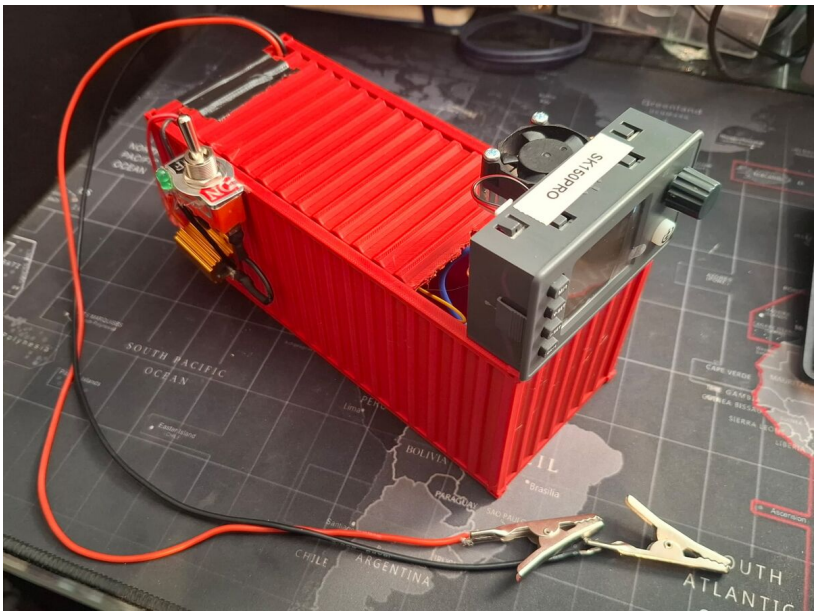
## Design and Feasibility Assessment of a Containerised Wind Energy Microgrid




This study considered a design and feasibility analysis of a containerised wind energy microgrid suitable for rapid off-grid deployment. The background to the study is that there is an ongoing reliance on diesel generators as the main source of electricity generation in temporary and remote locations. Although they are efficient, they pose various issues concerning fuel delivery, emissions, noise pollution, and maintenance. This research thus sought to investigate the feasibility of replacing this technology with a portable wind energy generator with integrated energy storage.

Instead of designing a commercial product, this research conducted an engineering feasibility study. It involved the literature review process, specification of requirements, conceptualisation, modelling of wind turbine performance, design, and development of a 1:30 scale proof of concept prototype. The wind turbine performance analysis was carried out using MATLAB, using the Bergey Excel 6 power curve combined with ERA5 wind data for two locations, namely Stornoway and Longyearbyen. The conclusion of this study shows that the concept is feasible at this stage of its conception. The outcome of this study reveals that the concept has much more potential in exposed, windy sites. However, it equally indicates that its feasibility depends highly on its location and would require further development before implementation.

**George Hammerton** | BEng (Hons) Renewable Energy Engineering | Actively looking

*Supervisor:* Dr Sinan Khwandah

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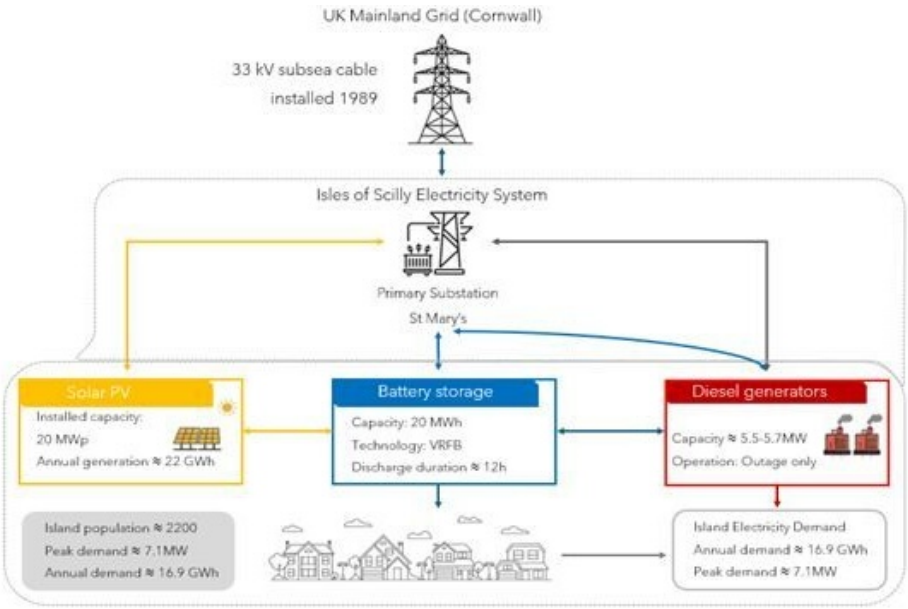
## Feasibility Study for Replacing Fossil Fuel Reliance on the Isles of Scilly: A Consultancy Analysis of Solar PV, Energy Storage, and Circular Design Strategies




This project investigates whether diesel contingency generation on the Isles of Scilly can be eliminated through large-scale photovoltaic deployment combined with energy storage.

A simulation framework was developed using PVsyst and MATLAB to model hourly solar generation, battery behaviour, and grid operation under real outage conditions. The system was tested against a defined outage envelope representing interconnector failures, where diesel currently provides backup power.

The results show that annual renewable energy generation alone is insufficient to eliminate diesel use. Instead, system resilience is governed by storage discharge duration relative to the longest outage event. A threshold of approximately 12 hours of usable storage was identified as necessary to maintain uninterrupted supply without diesel generation.

The study demonstrates that island decarbonisation is fundamentally a resilience-sizing problem rather than a generation-capacity problem. This provides a transferable design principle for other islanded or grid-constrained energy systems transitioning to net zero.

**James Paul O'Leary** BEng (Hons) Renewable Energy Engineering Actively looking

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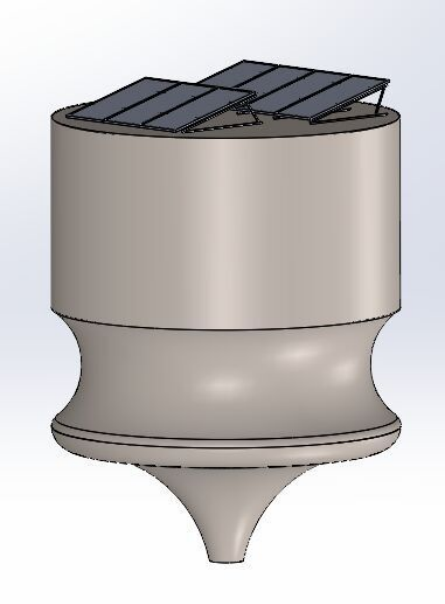
## Viability and Design of a Solar-Wave Hybrid Energy Conversion Device



Global energy demand is rising due to population growth and industrialisation, increasing the need for cleaner energy. Solar power has become a major solution, with significantly improved efficiency and reduced costs. However, large solar farms can take up agricultural land and affect biodiversity, leading to interest in floating solar systems placed on water.

These systems can perform better due to natural cooling, but there are limited lakes and reservoirs available, and offshore environments introduce challenges such as waves, wind, and salt, which can reduce lifespan. At the same time, wave energy remains underused despite being reliable and widely available, largely because it is still developing and can be costly.

Combining solar and wave energy in a single system allows both to generate power in the same space. As they perform better under different conditions, this can provide a more consistent energy supply throughout the year. The wave system can also act as a structural support for the solar panels, potentially improving overall durability.

**Jack Winchester** BEng (Hons) Renewable Energy Engineering Actively looking

*Supervisor:* Dr Nils Bausch

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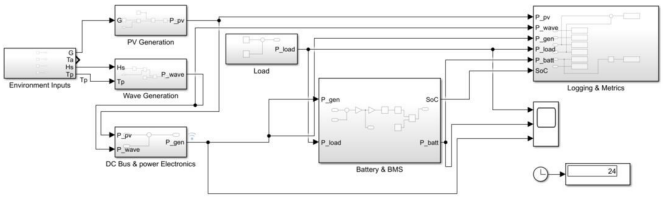
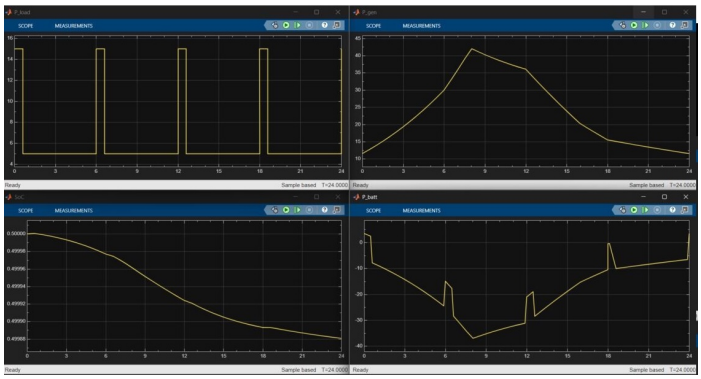
## Adaptive Battery Management System for Hybrid Solar-Wave Marine Buoys in UK Waters



Marine monitoring buoys and sensors are vital for gathering ocean data, but keeping them powered in harsh environments is a constant challenge. Most current designs rely on solar panels and basic battery systems. This often leads to power failures during dark winter months or reduced battery life due to the ”stop-start” nature of renewable energy. As the UK moves toward more autonomous maritime technology, there is a clear need for more reliable, ”intelligent” power management that can handle multiple energy sources at once.

This project focuses on designing an Adaptive Battery Management System (BMS) for a hybrid buoy that captures energy from both the sun and sea waves. Using the Solent strait as a real-world case study, I am integrating local environmental data such as specific wave heights and solar irradiance to create a realistic testing environment. The core of the work involves developing a digital simulation using MATLAB/Simulink. This allows me to design a ”smart” control algorithm that can automatically decide when to charge or discharge the battery based on real-time weather conditions and the buoy’s power needs.

The primary outcome is a functional simulation that proves whether a hybrid solar wave system can maintain a stable power supply in UK waters for at least seven consecutive days. Additionally, the project provides a conceptual 3D CAD model of the buoy’s internal layout to show how these electronic components can be protected and integrated into a physical marine-grade hull. Ultimately, this research aims to demonstrate a cost-effective and sustainable way to increase the lifespan and reliability of offshore technology.

**Rhianne Rose** | BEng (Hons) Renewable Energy Engineering | Actively looking

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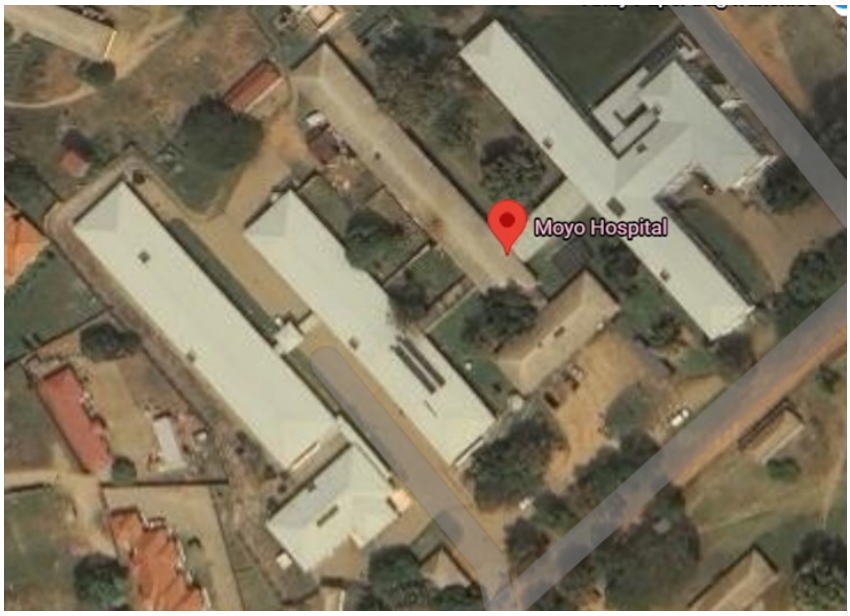
## The Design of Affordable Renewable Microgrids for Electrification in Remote Communities




My aim is to design and evaluate a reliable renewable energy microgrid for Moyo General Hospital. Energy demand modelling as well as system sizing and performance analysis will be used to evaluate the system, making sure it fits the requirements of Moyo General Hospital. The microgrid will be able to provide critical loads in remote conditions. As well as reliability, the microgrid will be built with cost, renewable contribution and suitability for a remote hospital in mind. The goals for this microgrid are to meet the energy demands of Moyo General Hospital, ensure reliability and support critical loads. My project will produce a complete system design which will be a validated solution for Moyo General Hospital.

The main challenge I encountered was that there was virtually no architectural information about Moyo General Hospital, so factors relating to energy demand, reliability and cost were estimated using a hospital with very similar characteristics - comparable bed count and site location in Uganda. My outcome for this research paper is that while supplying renewable off-grid energy to places like Moyo General Hospital is more than possible, every solution comes with its own challenges, and in some cases these challenges can cause the failure of a project.

**Thomas Hughes-Lewis** | BEng (Hons) Renewable Energy Engineering | Actively looking

*Supervisor:* Dr Shehu Yusha'u

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## Efficient wave energy module

The aim of the project is to make a wave energy device that can be efficient in both high and low wave speeds as this then can cover the demand from the high and low wave frequencies. Being able to cover both the contrasting wave frequencies is important to make sure that wave energy devices can become more useable within the UK energy mix so it can contribute to the 2030 plan to be 95% renewable energy. In this project, the aim is to improve the PTO of the device. By adding a 2nd motor, efficiency increases as it can focus on when the device is at a low in power due to low wave frequency and can change to a low frequency motor to increase the efficiency of the motor.

**Salvador Vilela Cogorno** BEng (Hons) Renewable Energy Engineering

*Supervisor:* Dr Shehu Yusha'u

## Design of a Wave Powered River Surface Cleaning System for Floating Waste Removal in Developing Countries

The rapid rise in population across many developing countries has led to a significant increase in waste entering rivers, including plastics, household waste, and organic debris. Inadequate waste management infrastructure intensifies this problem, causing severe risks to aquatic ecosystems, water quality, and human health. Traditional river cleaning methods are either labour intensive or depend on costly machinery powered by fossil fuels, which are difficult to operate and maintain in poorer regions. Many communities in developing regions are built around rivers and canals, where natural currents and river traffic create continuous surface disturbances. The project aims to harness the wave energy generated by these movements as a free and renewable power source for waste removal. The aim is to develop a sustainable, low-cost, and environmentally friendly system by converting the kinetic energy of surface disturbances through principles of hydrodynamics and oscillatory motion to power a debris collection mechanism.

# 5. Collaborate with Solent University Engineering

Solent University's Engineering Department works with employers to turn real business challenges into practical student projects and future talent opportunities. By sharing live technical briefs, companies can shape final-year projects that align directly with their innovation, product development, or skills needs.
This approach gives businesses early access to motivated, work-ready graduates while benefiting from fresh thinking, problem-solving, academic expertise and can provide a pipeline into funded R&D, consultancy or longer term partnerships, enabling the idea to be embedded within your organisation.
Employers may also access external funding such as Knowledge Transfer Partnerships (KTPs) to further develop successful concepts, often allowing you to support a students development post-graduation as they enter the employment market.
Collaboration provides a low-risk way to test ideas, engage future engineers, and build a sustainable graduate recruitment pipeline, supported by Solent's advanced engineering facilities and industry-focused academic team. Having a university collaborator is not just helpful, it opens additional funding opportunities and can help strengthens the proposals.
To continue the discussion please contact engagement@solent.ac.uk

# 6. The Engineering Team

The following academic staff supervised and supported the projects presented today. Visit their profile pages to learn more about their research interests and expertise.

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