ACADEMIC PROJECT SUBMISSION DETAILS:

<table>
<thead>
<tr>
<th>Supervisor/s:</th>
<th>Danielle Bertram and Michael Walmsley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Title:</td>
<td>Wave and Wind as a New Hybrid Renewable Energy Source for New Zealand</td>
</tr>
<tr>
<td>Field:</td>
<td>Renewable Energy/Environmental Engineering</td>
</tr>
<tr>
<td>Division/School:</td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering</td>
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EXPECTED OUTCOMES:

1. Verification of the hypothesis that Wave-Wind Hybrid systems increases base load electricity generation significantly
2. Poster
3. Research report
4. Journal publication

STUDENT TASKS:

1. Data extraction from MATLAB data files into excel files for specific time periods and site locations.
2. Macro level comparison of wave and wind resources for the four test sites using time series plot over one year.
3. Energy resource variability assessment across 2 week and 1 month periods, and sizing of hybrid energy system.
4. Write and test MATLAB code for determining the 3 hourly electricity output levels from the energy resource data for the individual wave and wind systems and for the hybrid system.
5. Apply MATLAB programme to each of the four locations, for at least four time periods.
6. Evaluate base load and variability benefits of the hybrid system.
7. Determine energy storage benefits to NZ electricity grid if scaled wave-wind hybrid system is adopted
8. Write up the results in a project report
9. Create a poster that summarizes the research findings

REQUIRED SKILLS:

1. MATLAB programming skills, or ability to learn
2. Understanding of energy science (thermodynamics) and renewable energy systems
3. Energy engineering analysis and modeling
4. Working with large Excel data files
5. Statistical analysis
6. System integration analysis
7. Graphical communication skills
8. Written communication skills
PROJECT ABSTRACT:

New Zealand is looking to permanently transition from fossil fuels to renewable energy sources to mitigate the effects of Climate change and to move New Zealand to a more sustainable future. A renewable energy source that has tremendous potential to assist New Zealand with this goal is energy from ocean waves. Electricity from the motion of waves has been achieved using a wide range of Wave Energy Convertor (WEC) technologies over the last 30 years, and over 200 different WEC devices have been developed during this time, including point absorbers, attenuators, oscillating wave surge converters and overtopping devices. WECs can produce electricity that is less variable and more predictable than other common renewables like wind and solar. Many WEC devices are still in the developmental stage and due to the challenging marine environment in which they operate; the levelized cost of the electricity from WEC technologies remains high. WEC developers are looking for ways to improve the financial payback of WEC systems and one possibility is to collocate wave energy systems with wind to create a hybrid renewable energy system that uses shared off-shore and on-shore infrastructure and takes advantage of the complementary nature of both renewable energy sources. A recent study for a site off the west coast of Ireland has demonstrated that combining wave and wind is synergistically beneficial and could more than double the baseload power available to the grid for a single ocean power facility. There are similar opportunities available in New Zealand.

In this project the synergistic value of using collocated wave and wind hybrid renewable energy systems with respect to electric power generation will be investigated within the New Zealand context. From Daniä’s PhD we already have 20 years of wind and wave energy resource data, at 3 hourly intervals, for 4 different locations on the west coast of New Zealand (two in the south island and two in the north island). At each location wind turbine and WEC energy resource-to-electricity conversion efficiencies will be applied to the data to estimate the three hourly levels of power generation across an entire year. A MATLAB programme will be prepared by the research scholar to enable efficient processing of the large amounts of data involved in the study. Our study will also assume both wind and wave provide equal amounts of energy to the grid during the time-periods being compared and extreme weather events will be excluded. The study will enable a preliminary assessment of the potential of the Wave-Wind hybrid renewable energy idea within a New Zealand context. If time permits the research scholar will also consider how the wave-wind hybrid concept also has the potential to reduce the amount of hydro pumped storage or battery energy storage that New Zealand’s electricity grid will need to make it possible to have a near 100% renewable electricity sector. A publications that has the potential to be well sited can result from this work.
ACADEMIC PROJECT SUBMISSION DETAILS:

<table>
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<tr>
<th>Supervisor/s:</th>
<th>Leandro Bolzoni and Linda Peters</th>
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<tbody>
<tr>
<td>Project Title:</td>
<td>Characterisation of new metallic biomaterials with antibacterial activity</td>
</tr>
<tr>
<td>Field:</td>
<td>Biology and Materials Science and Engineering</td>
</tr>
<tr>
<td>Division/School:</td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering</td>
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</table>

EXPECTED OUTCOMES:

1. This research project is set to strengthen a recently established research partnership between the UoW School of Engineering and the School of Science around the development of new metallic biomaterials with antibacterial activity.
2. The data generated by the Summer Research Scholarship student will be complemented with other data about the behaviour of these new materials to be published in peer-reviewed scientifically recognised scientific journals.
3. The candidate will present their findings orally at the group’s lab meeting.
4. The realisation of this project has the potential to provide scientific understanding for future bidding of external funding.

STUDENT TASKS:

1. The student will lead and/or contribute to the following tasks:
2. Measuring the properties of the alloys which could include physical, microstructural and mechanical behaviour;
3. Media, inoculum and lawn preparation for the in vitro characterisation of the antibacterial activity while working in a physical containment laboratory level 1 in the Molecular Genetics Lab;
4. Prepare the materials for the quantification of the amount of ions released by the biomaterial once in contact with the antibacterial testing media in the Chemistry Lab;
5. Critically analyse the results to explain the behaviour of the alloy using scientific and engineering principles.

REQUIRED SKILLS:

1. Knowledge of biology principles and materials science and engineering related topics to understand the properties of the novel alloys.
2. Good practical abilities.
3. Understanding of basic interaction between organic and inorganic materials.
4. Ability to apply the scientific and engineering knowledge acquired to solve possible analytical problems derived by the experimental nature of the project.
5. Appropriate communication skills to discuss complex scientific issues.
The aim of this Summer Research Project is to consider the characterisation of innovative metallic Ti-based materials biomaterials with antibacterial activity in order to assess whether these novel materials with appropriate level of technological and mechanical performances can successfully be attained. Specifically, novel ternary Ti alloys made via powder metallurgy will be characterised in terms of physical, chemical, mechanical and biological behaviour. The student will join a recently established research partnership to contribute to the advancement of the characterisation of the biomaterials’ properties which aims to tackle the raising issue of the increasing number of prosthesis bacterial infection incidences occurring during total joint replacement surgeries. Antibacterial ability, cell response and understanding of the interaction of the newly developed metallic biomaterials with different microbial streams will be of interest. The student will also have the opportunity to participate in Priority One’s ‘Summer Open Lab’ (SOL) programme, which provides weekly workshops on the theme of innovation for students undertaking summer projects across the Western Bay of Plenty. This is designed to fit realistically within their workload, and will offer opportunity to network with local companies and other students, and build skills and capability relevant to their career development.
# ACADEMIC PROJECT SUBMISSION DETAILS:

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<tr>
<th><strong>Supervisor/s:</strong></th>
<th>Leandro Bolzoni</th>
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<tbody>
<tr>
<td><strong>Project Title:</strong></td>
<td>Demonstration of the potential of innovative powder metallurgy Ti-based alloys</td>
</tr>
<tr>
<td><strong>Field:</strong></td>
<td>Materials Science and Engineering</td>
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<tr>
<td><strong>Division/School:</strong></td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering</td>
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## EXPECTED OUTCOMES:

1. This research project aims to strengthen the creation of new low-cost beta-eutectic-stabilising-bearing Ti alloys.
2. The data about the final properties of these new alloys are expected to be of scientific interest and can constitute the preliminary information for a more extensive research work on biomedical materials.
3. Proper analysis of the results obtained via the work performed through this Summer Research Scholarship could potentially be presented at international conferences or published in a peer-reviewed article.
4. The project will expand the research portfolio of the Titanium Research Group and provide scientific understanding for future bidding of external funding.

## STUDENT TASKS:

1. The student will participate to the steps needed to create new alloys either leading the task or contributing to its proper achievement as specific training might be required.
2. The student will collaborate on:
   - Measuring the physical properties of the alloys through applying basic physics law such as Archimedes’ principle;
   - Prepare the materials for the quantification of the microstructure which will involve optical and/or electronic microscopy;
   - Perform mechanical testing including determine the tensile behaviour and hardness response of the newly made alloys;
   - Critically analyse the results to explain the behaviour of the alloy using scientific and engineering principles.

## REQUIRED SKILLS:

1. Understanding of materials science’ basic concepts such as phase diagrams and how they can be used to develop new alloys.
2. Good practical skill and previous experience on materials’ preparation is a must.
3. Knowledge on manufacturing processes, especially powder metallurgy is desirable.
4. Ability to use fundamental engineering knowledge to solve technical issues related to applied experimental research.
5. Good communication and writing skills combined with a solid materials science background to be able comment, discuss and interpret experimental results on the basis of scientific principles.
Titanium and titanium alloy are regarded as very promising materials for a great variety of engineering applications because of their excellent combination of properties such as lightweight, strength and excellent corrosion resistance. The aim of this Summer Research Project is to consider the manufacture and characterisation of novel Ti-based materials aiming to advance the field and promote the uptake of Ti alloys in industry by demonstrating the technological and mechanical performance of materials bearing cheap beta eutectoid stabilisers alloying. The production of the selected compositions via powder metallurgy limits the manufacturing costs where the investigation is based on changing the ratio and amount of different alloying elements to tailor the physical microstructural, mechanical and biological response. The project aims to demonstrate the feasibility of manufacturing smartly designed functionalised Ti alloys.
### ACADEMIC PROJECT SUBMISSION DETAILS:

<table>
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<tr>
<th>Supervisor/s:</th>
<th>Mark Dyer and Ray Hudd</th>
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<tr>
<td>Project Title:</td>
<td>Restoration of Tokomaru Historic Wharf</td>
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<tr>
<td>Field:</td>
<td>Civil Engineering</td>
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<tr>
<td>Division/School:</td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering</td>
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<td>School of Engineering</td>
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### EXPECTED OUTCOMES:

1. Proof of concept for repair of historic reinforced concrete pile from early twentieth century
2. Successful field pilot study for an initial set of four piles nearshore
3. Conference or possibly journal paper
4. Invitation for ongoing involvement in the restoration project for both wharf and associated historic buildings

### STUDENT TASKS:

1. Devise mix design for self compacting concrete in terms of strength and workability
2. Identify suitable polymer reinforcement in place of conventional steel reinforcement
3. Devise a suitable delivery system for placing self compacting concrete into temporary formwork
4. Conduct field trials on a set of four piles
5. Prepare a poster, video and report of the research project
6. Present the results to the Tokomaru Bay Heritage Trust and Iwi

### REQUIRED SKILLS:

1. Ability to devise a mix design for self compacting concrete
2. Ability to identify suitable polymer concrete for reinforcing concrete pile
3. Ability to design and build temporary formwork along with placement of self compacting concrete
4. Report and presentation skills
PROJECT ABSTRACT:

Following decades of neglect, restoration plans are underway for the historic wharf at Tokomaru Bay in East Cape. In the initial phase, the restoration works will involve devising an innovative process to strengthen the damaged reinforced concrete piles supporting the decking. This entails researching mixed design for self compacting concrete together with polymer reinforcement to replace the spalling concrete in the splash zone. Having identified a suitable mixed design using laboratory and field work, the project will need to design a feasible method for delivering the concrete into temporary formwork that replicates the existing profile of the upright piles. These activities will be conducted in collaboration with the Tokomaru Bay Heritage Trust and appointed civil engineering contractor during late spring and summer when sea conditions are suitable for the repair work.
### ACADEMIC PROJECT SUBMISSION DETAILS:

<table>
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<tr>
<th>Supervisor/s:</th>
<th>Christian Gauss and Kim Pickering</th>
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<tbody>
<tr>
<td>Project Title:</td>
<td>The influence of 3D printing parameters on the mechanical properties of harakeke/hemp reinforced PLA composites</td>
</tr>
<tr>
<td>Field:</td>
<td>Materials Engineering</td>
</tr>
<tr>
<td>Division/School:</td>
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</tbody>
</table>

### EXPECTED OUTCOMES:

1. Protocol for tensile testing of 3D printed objects
2. The printing parameters affecting the mechanical properties
3. Mechanical behaviour of 3D printed fibre-reinforced PLA

### STUDENT TASKS:

1. Literature review
2. Identify important 3D printing parameters to be optimised
3. Create a design of experiments
4. Perform 3D printing tests with natural fibre-reinforced filaments
5. Mechanical testing and data analysis
6. Writing the report

### REQUIRED SKILLS:

1. Good knowledge on the mechanical properties of materials
2. Programming knowledge is a plus
3. Familiar with 3D printing and solid works
4. Laboratory skills is an advantage

### PROJECT ABSTRACT:

Additive manufacturing technologies are at the forefront of the next industrial revolution. Polymeric, composite, ceramic, and metallic materials are already being utilised for the production of complex shapes through different 3D printing methods. Fused deposition modelling (FDM) is the most used method for polymers and composites, from homemade to industrial applications. However, the development of bio-based materials alternatives for this method is limited if compared with other non-renewable and traditional polymers. Polylactic acid (PLA), a bio-based and biodegradable polymer, is already well consolidated in the market for its balanced combination of printability, mechanical properties, and cost.
Nevertheless, the improvement of its mechanical performance by reinforcing fibres, such as harakeke and hemp, is still not optimised in terms of composition and printing parameters. Therefore, this project will investigate the influence of different printing parameters, e.g., nozzle size, printing patterns, layer height, and width, on the final mechanical behaviour of natural fibre-reinforced PLA filaments. The obtained results will be used to optimise the tensile performance of bio-based 3D printing objects and to create a tensile testing protocol for future natural fibre-reinforced filaments.
ACADEMIC PROJECT SUBMISSION DETAILS:

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<tr>
<th>Supervisor/s:</th>
<th>Chanelle Gavin and Mark Lay</th>
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<tbody>
<tr>
<td>Project Title:</td>
<td>Bio-based materials for packaging applications</td>
</tr>
<tr>
<td>Field:</td>
<td>Materials Engineering/Materials Science</td>
</tr>
<tr>
<td>Division/School:</td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering</td>
</tr>
</tbody>
</table>

PROJECT #: 29

EXPECTED OUTCOMES:

1. A literature review of existing research
2. Foamed products from proteins and blends
3. Testing, data collection and analysis of the resulting materials
4. A research poster

STUDENT TASKS:

1. A literature review of protein-carbohydrate blends used in both foams and films
2. Foam a range of proteins-additive and protein-carbohydrate blends
3. Produce films from a range of proteins-additive and protein-carbohydrate blends
4. Use mechanical analysis techniques to assess these materials
5. Investigate protein secondary structure (desirable)
6. Produce a research poster

REQUIRED SKILLS:

1. Ability to collate and analyse existing research
2. Willingness to try multiple different formulations
3. A good understanding of materials and/or proteins
4. Able to follow procedures for testing
5. Independence and adaptability
6. Most suited to a MAPE or CABE student, other disciplines can apply
Efforts to replace fossil based plastics packaging (both foams and films) has resulted in the use of bio-derived versions of these materials. However, this approach only addresses the source and does not guarantee these materials will also be biodegradable.

Protein plastic foams are a renewable, and in most cases biodegradable. Work by a previous summer scholarship project demonstrated that a stable protein foam could be produced using a less common and inexpensive foaming technique (freeze drying) and established appropriate analysis methods. While the gelatine foam produced had a suitable cell structure, and good recovery when compressed, the strength was insufficient despite attempts at reinforcement.

This project will therefore focus on improving the foam rigidity through blending with chemical additives and/or carbohydrates. It will also explore the properties of naturally occurring protein-carbohydrate mixtures such as aquafaba. A simultaneous investigation of the film forming ability of these blends will be conducted using the same technique.

Successful foams will be analysed for expansion ratio, compressive strength, elasticity and foam structure. Any successful films produced will be analysed in tension. The material properties of these products will also be examined using FT-IR for protein structure and thermogravimetric analysis may be used to determine moisture content and thermal transitions.

While the intention is to work towards an alternative packaging material it is expected that the results of this study will be of interest to people from both a food science and materials background.

This project may require the student to work across both the Hamilton and Tauranga campuses.
# Summer Research 2020/21

## Project Abstract

### ACADEMIC PROJECT SUBMISSION DETAILS:

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<th>PROJECT #: 30</th>
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<tbody>
<tr>
<td><strong>Supervisor/s:</strong> Mark Lay and Brendan Hicks</td>
</tr>
<tr>
<td><strong>Project Title:</strong> Develop mitigation measures for native fish migration at Kaimai Hydroelectric Power Scheme</td>
</tr>
<tr>
<td><strong>Field:</strong> Engineering/Biological Sciences</td>
</tr>
<tr>
<td><strong>Division/School:</strong> HECS - Division of Health, Science, Computing &amp; Engineering</td>
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</table>

### EXPECTED OUTCOMES:

1. Assessment of the Kaimai Scheme and surrounding waterways to identify barriers to native fish passage
2. Define environmental and cultural triggers for downstream migrating eels
3. Develop possible solutions and recommend one
4. Provide a plan for Trustpower

### STUDENT TASKS:

1. Conduct an assessment of the Kaimai Scheme and surrounding waterways to identify barriers to native fish passage
2. Define environmental and cultural triggers for downstream migrating eels
3. Research solutions, which may include potential structural modifications, to enable downstream native fish passage
4. Provide recommendations to Trustpower in the form of a plan

### REQUIRED SKILLS:

1. Be able to conduct fieldwork responsibly and safely
2. Have a full driver’s licence
3. Be able to create some assessment criteria for investigating waterways and surrounding structures
4. Be able to investigate, develop, and construct potential solutions
5. Be able to use Solidworks
6. Have practical design and fabrication skills
7. Be able to communicate with iwi, locals and engineers
8. Self motivated, enthusiastic, independent learner and thinker
Trustpower operates 38 hydro power stations across 19 hydroelectric power schemes throughout New Zealand. Trustpower has a strong focus on sustainable renewable electricity generation and is continually seeking to minimise operational impacts. Trustpower has a proven and respected reputation for responsibly managing their generation facilities. They always seek to deliver energy at a reasonable costs, with minimal cost to the environment.

In keeping with Trustpower’s Environmental Policy, this project aims to promote the continual improvement of environmental performance and environmental awareness, specifically at the Kaimai Hydroelectric Power Scheme.

The Scheme is in Kaimai catchment and collects water from a catchment area of approx. 425km² which eventually discharges to Wairoa River near Tauranga. There are various structures within the catchment that divert water towards four power stations, which provide power to approximately 26,500 households.

The scheme and surrounding lands, waters and fauna hold a special significance for both Trustpower and local iwi.

This is an opportunity for a student from the Science and Engineering Faculty with a minimum of 2 years study completed, ideally with an Environmental Engineering major, to participate in the understanding and improvement of current environmental and engineering matters at an operational hydroelectric power scheme.

With support from Trustpower’s Generation Team and the University of Waikato, the student will:

- conduct an assessment of the Kaimai Scheme and surrounding waterways to identify barriers to native fish passage; and
- define environmental and cultural triggers for downstream migrating eels; and
- research options, which may include potential structural modifications, to enable downstream native fish passage; and
- provide their recommendation to Trustpower in the form of a plan.
## ACADEMIC PROJECT SUBMISSION DETAILS:

<table>
<thead>
<tr>
<th>Field:</th>
<th>Robotics/Engineering</th>
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<tr>
<td>Division/School:</td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering</td>
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</tbody>
</table>

### EXPECTED OUTCOMES:

1. Quantifying force required to cut apple fruitlet stalks.
2. Recommendations on a suitable hardware design for the robot.
3. Damage thresholds for apple fruitlet bruising.

### STUDENT TASKS:

1. Data collection of apple fruitlets.
2. Required lab tests on the samples.

### REQUIRED SKILLS:

1. MS Word, Excel
2. Solidworks
3. Communication
4. Willingness to learn new things.
5. Full drivers license

### PROJECT ABSTRACT:

Apple growing sector in New Zealand has been consistently facing labour shortages for the past few years. Experts are calling for a viable alternative solution to prevent further straining of the situation. Robots have shown potential in various other fruit picking operation from around the globe, and this is now being applied to thin apple fruitless.

The literature review has shown no previous recorded attempts at robotic fruitlet thinning, and therefore, the data from characteristics of the apple fruitlet will have to be obtained and established from the ground up. This data will enable the researchers to develop suitable hardware and decision making algorithms for the robot.

The summer research project involves field trips to Hawkes bay apple orchards to collect weekly samples of apple fruitlets. Lab tests on the samples will include compression tests, apple fruitlet stalk-cutting force etc.
### ACADEMIC PROJECT SUBMISSION DETAILS:

<table>
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<tr>
<th>Supervisors:</th>
<th>Melanie Ooi and Kuang Ye Chow</th>
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<tbody>
<tr>
<td>Project Title:</td>
<td>Smart pasture monitoring robot</td>
</tr>
<tr>
<td>Field:</td>
<td>Engineering</td>
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<tr>
<td>Division/School:</td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering</td>
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</table>

### EXPECTED OUTCOMES:

1. Research Poster to communicate the results
2. Field data which will be the basis to support industry sponsorship of the future project
3. Developed Embedded system for the smart pasture monitoring robot

### STUDENT TASKS:

1. Test the transmitter-receiver for edge communication and global positioning
2. Integrate the developed electronics subsystem using a Raspberry Pi as a controller
3. Field test to validate the system

### REQUIRED SKILLS:

1. Python Programming
2. Able to implement digital communication protocols
3. Basic electronics workshop skills such as soldering etc.

### PROJECT ABSTRACT:

The WaiRAS research group has built a new pasture monitoring robot, whereby the mechanical, electronics and communication sub-systems have been developed and tested separately. The main task of this project is to integrate the sensor systems responsible for geo-positioning and pasture monitoring into the mechanical and communication sub-systems of the robot. The controller is a Raspberry Pi, and there are 4 sub-systems, including (1) vision and ultrasonic sensors for local positioning, (2) transmitter-receiver for edge communication and global positioning, (3) optical system for telemetric data collection and (4) the power system. The project requires the development of the sub-system (2), and the integration of all 4 sub-systems. Field tests will be performed to validate the final result.
ACADEMIC PROJECT SUBMISSION DETAILS:  

<table>
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<tr>
<th>Supervisor/s:</th>
<th>Rachael Tighe</th>
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<tbody>
<tr>
<td>Project Title:</td>
<td>Towards Non-Destructive Examination of Subsea Power Cables</td>
</tr>
<tr>
<td>Field:</td>
<td>Non-destructive testing - renewable energy</td>
</tr>
<tr>
<td>Division/School:</td>
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EXPECTED OUTCOMES:

1. A thorough review of existing technologies will be completed
2. Promising inspection technologies will be highlighted
3. A plan for small scale development of feasible inspection approaches will be developed
4. Preliminary small-scale testing will be carried out at the University of Waikato
5. Findings will be reported back to stakeholders
6. A research poster will be produced

STUDENT TASKS:

1. Using literature and to talking to Engineers across a range of industries, assessment of current NDE techniques with potential will be made
2. Representative small-scale samples will be identified
3. Promising techniques will be identified, and small-scale testing feasibility assessed
4. Preliminary testing will be undertaken
5. Create an award-winning research poster

REQUIRED SKILLS:

1. The project is based on sensing and measurement - A third year ME, Mechatronic or Electronics student would be desirable however other committed and interested students would also be considered.
2. Some experience of signal processing in Matlab and/or Python would be beneficial.

PROJECT ABSTRACT:

Installed floating offshore wind energy predicted to grow from 50MW to 30GW worldwide by 2030. New Zealand is reported to only be able to meet itâ’s 2050 sustainable energy goals if offshore wind resources are utilised. NZ has no continental shelf; hence offshore floating wind is the only option available. If floating offshore wind is to be reliable there is a drive to develop subsea power cables that can withstand the dynamic load regime inherent to floating platforms operating in the open ocean. Fatigue is a significant concern with such cables; however currently cables that have undergone physical testing can only be assessed visually through dissection - this is no trivial matter for a large, heavy cable.
**PROJECT ABSTRACT:**

This project aims to assess the potential for Non-Destructive Examination (NDE) of structures representative of the cables by exploring techniques currently used in other fields. Particular challenges include the multi-layered and multi-material composition of the cables. Promising techniques can then be assessed experimentally at small scale.

Dr Rachel Nicholls-Lee of the University of Exeter, UK will be supporting the project. Dr Nicholls-Lee is part of the UK Engineering and Physical Sciences Research Council's Supergen ORE Hub. For the summer project Dr Nicholls-Lee will provide information on the cable construction and loading as well as industry knowledge. The work will underpin the future goals of the larger project where the techniques identified can be implemented at the University of Exeter's Dynamic Marine Component Test Facility in the future.
### ACADEMIC PROJECT SUBMISSION DETAILS:

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<th><strong>PROJECT #: 34</strong></th>
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<tr>
<td><strong>Supervisor/s:</strong> Rachael Tighe and Chanelle Gavin</td>
</tr>
<tr>
<td><strong>Project Title:</strong> Lagrangian Sampling of lowland rivers</td>
</tr>
<tr>
<td><strong>Field:</strong> Environmental sensing and monitoring</td>
</tr>
<tr>
<td><strong>Division/School:</strong> HECS - Division of Health, Science, Computing &amp; Engineering</td>
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### EXPECTED OUTCOMES:

1. Define a sensing and sampling method capable of collecting, storing and transferring data
2. Build a robust device that meets criteria required for deployment
3. Desirable criteria: an alert system for identifying device location if stationary for over a designated time
4. Produce summer research scholarship poster

### STUDENT TASKS:

1. Based in the lab, develop the sensing system including user interface
2. Create a robust, light weight, buoyant waterproof housing for the system
3. Test and iterate the device design
4. Create an award-winning project poster

### REQUIRED SKILLS:

1. Prior Arduino coding experience (or similar) would be highly beneficial
2. Engineering student, most suited to EE, Mechatronics or ME, other disciplines can apply

### PROJECT ABSTRACT:

A current major issue in NZ is the quality of water in our rivers and lakes. Developing cost-effective interventions to improve water quality requires a good understanding of the mechanics of water pollution. In this project we are seeking a motivated student to develop a low-cost device for water quality monitoring in lowland rivers using the Lagrangian approach. Lagrangian sampling involves following a "packet" of water as it flows through a system and documenting where significant changes to that water occur.
The project will need to build a small floating device that contains a data logger, appropriate water quality sensors and a GPS tracker. The device will be deployed in a river, will float downstream, and will record as it goes. In addition, it will need a cellular connection to allow it to be located if it gets stuck on the way. To achieve this your project will be to develop an Arduino-based unit that can interface with temperature, conductivity and turbidity sensors, record the data at programmable time intervals, and connect to a cellular network to advise its current GPS location on demand. You will house system, including power supply, in a waterproof package that will float down a river. The project is run in collaboration with Professor Ian Hawes in School of Science who will later use the device in his research to help understand the water quality in our local river and lakes.