College of Design and Engineering

Summer Engineering Research Internship for US Students

SERIUS 2026

PROJECT CODE	TITLE	PROJECT SUPERVISOR
BIOMEDICAL ENGINEERING		
BME1	Fine-tuning and Evaluation of Large Language Model (LLM) for Protein Engineering	A/Prof Poh Chueh Loo
CIVIL AND ENVIRONMENTAL ENGINEERING		
CEE1	How do volatile organic compounds affect urban greenery and air quality?	A/Prof Yu Liya E.
CHEMICAL AND BIOMOLECULAR ENGINEERING		
ChBE1	Converting CO_2 to fuel using cyanobacteria	Prof Tong Yen Wah
ChBE2	Carbon capture and storage via clathrate hydrates	Prof Praveen Linga
ChBE3	Hydrogen storage via clathrate hydrates	Prof Praveen Linga
ChBE4	Converting CO_2 into methanol by hydrogenation	Prof Ning Yan
ELECTRICAL AND COMPUTER ENGINEERING		
ECE1	Dynamic and Control of Mechanical System in Offshore Engineering	Prof Sam Ge Shuzhi
ECE2	Develop digital twin of interacting systems in complex sea scenarios	Prof Sam Ge Shuzhi

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ECE3	Domain-specific Computing using Emerging Electronic Device Technologies	Dr Kelvin Fong Xuanyao
ECE4	Memory-centric Data Processing Hardware	Dr Kelvin Fong Xuanyao
ECE5	Non-volatile Ferroelectric Transistor Memory	Dr Kelvin Fong Xuanyao
ECE6	Non-volatile Mem-ristive Memories	Dr Kelvin Fong Xuanyao
ECE7	Energy Efficient Spintronics and Applications	Dr Kelvin Fong Xuanyao
ECE8	AI Chips that rewire themselves	Prof Aaron Thean
ENGINEERING DESIGN AND INNOVATION CENTRE		
EDIC1	Development of an Extended Reality System for a Comprehensive Eye Check-Up at the Hospital	Dr Tang Kok Zuea
EDIC2	Robotic Handler for Precise Parts	Dr Tang Kok Zuea
EDIC3	Using AI for Integrating IoT and Autonomous Mobile Robots	Dr Tang Kok Zuea
EDIC4	Using AI for Integrating IoT, Wearables and Outdoor Autonomous Mobile Robots	Dr Tang Kok Zuea
EDIC5	Health Assessment of Bone Structures using AI and Design Tools	Dr Tang Kok Zuea
MECHANICAL ENGINEERING		
ME1	Multiphase Flow in Pipelines and Multiphase Equipment Development	A/Prof Loh Wai Lam
ME2	3D Printing Enabled Urban Farming	Dr Sing Swee Leong
ME3	3D Food Printing for Sustainability	Dr Sing Swee Leong
ME4	Machine Learning for Additive Manufacturing	Dr Sing Swee Leong

ME5	Development of Ionically Conductive Bacterial Cellulose from Kombucha SCOBY	Dr Tan Yu Jun
ME6	From Kombucha Tea to Sustainable, Tough Hydrogel	Dr Tan Yu Jun
ME7	From Tea to Fiber: Developing Tough, Directional SCOBY-Based Fibers	Dr Tan Yu Jun
ME8	Control of a Quadruped Robot with a Robotic Arm	Dr Guillaume Sartoretti
ME9	Reinforcement Learning-Based Decentralized Multi-Agent Pathfinding	Dr Guillaume Sartoretti
ME10	MPPI-based Swerve Drive Robot	Dr Guillaume Sartoretti
ME11	4D metal printing	Dr Tan Xipeng
ME12	AM microstructure simulation	Dr Tan Xipeng
ME13	Developing antibacterial 3D-printed biomedical alloys	Dr Tan Xipeng
ME14	3D printing of high-performance alloys via direct ink writing	Dr Tan Xipeng

Project BME1

Supervisor **A/Prof Poh Chueh Loo**
https://engbio.syncti.org/

Fine-tuning and Evaluation of Large Language Model (LLM) for Protein Engineering

Large Language Models are revolutionizing protein engineering by enabling rapid prediction and optimization of complex sequence-function relationships, essential for applications in enzyme design, drug development, and biomanufacturing. Despite these advances, achieving accurate and reliable predictions with LLMs in protein engineering still requires specialized fine-tuning and rigorous performance evaluation, given the complexity of sequence-function features. This project focuses on systematically fine-tuning pretrained models using existing protein databases that provide rich annotations on protein sequences, structures, and functions, and rigorously evaluating the model predictive performance from structural and functional perspectives. Students involved will gain hands-on experience in protein data extraction and processing, model fine-tuning, and performance evaluation, equipping them with cutting-edge skills in protein engineering.

Maximum no. of participants: **1**

Project Learning Outcomes
Students will develop skills in fine-tuning LLMs specifically for protein engineering and learn to analyse and interpret results (sequences and functions) to ensure model reliability and accuracy.

Nature of Project
Model Development

Relevant Majors
Biomedical Engineering, Electrical Engineering, Computer Engineering, Computer Science, Chemical Engineering, System Engineering

Name and Address of Lab that participants will be attached to
Engineering Biology Lab
E6-04, 5 Engineering Drive 1, Singapore 117608

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
Programming skills (Python)

Project CEE1

Supervisor **A/Prof Yu Liya E.**
https://cde.nus.edu.sg/cee/staff/yu-liya-e/

How do volatile organic compounds affect urban greenery and air quality?

Volatile organic compounds (VOCs) (e.g., emitting from trees and household cleaning reagents) are known to be involved in photochemical smog generating compounds (such as O3) affecting public health. How do VOCs affect ambient air quality and the extent of urban greenery? This study aims to address the question through simulation of chemical reactions in a warm humid city in the equatorial Asia. Field measurements data are employed as inputs and validation of computational results. Specific focus can be given to investigate effects of selected VOC species originating from biogenic sources (e.g., isoprene) and anthropogenic processes (e.g., toluene). Students who are keen to integrate programming skills (Python and R) with atmospheric chemistry will enjoy the most.

Maximum no. of participants: **2**

Project Learning Outcomes
1. Atmospheric reaction mechanisms in warm humid urban environment.
2. Applications of Python to atmospheric environment.

Nature of Project
Computing and Analysis

Relevant Majors
Chemical Engineering, Chemistry, Atmospheric Science, Environmental Science Engineering

Name and Address of Lab that participants will be attached to
Air quality & aerosol science lab (AQASL)
E2-05-24, 9 Engineering Drive 1, Singapore 117575

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
1. Familiarity of Python will be most suitable.
2. Strong interests in data processing and chemical reactions.

Project ChBE1

Supervisor **Prof Tong Yen Wah**
https://cde.nus.edu.sg/chbe/staff/tong-yen-wah/

Converting CO_2 to fuel using cyanobacteria

Cyanobacteria have been successfully used to produce many value-added bioproducts directly from CO_2. These chemicals are high-value-added products and have been widely used in multiple fields. However, the production yields of such low molecular-weight chemicals by cyanobacteria are usually low, which is the most significant barrier against the commercialization of cyanobacterial cell factories. In this project, we are focusing on biomaterial production by engineered cyanobacterial cell factories and other CO/CO_2-utilising microorganisms. We will use a multi-physical field simulation model to help design the novel photobioreactor coupled with actual bioreactor fabrication to evaluate the most effective light absorbing photobioreactor. This is different from the traditional reactor development methods, and would help to accelerate the design and optimization processes by leveraging AI technology. Experiments in building photobioreactors and computer simulation will be coupled together in this joint project between NUS and SJTU, and the students will be able to work on bioreactor design, cell culture or product extraction.

Maximum no. of participants: **2**

Project Learning Outcomes
1. Design and operation of bioreactors.
2. Culture and growth of microorganisms.
3. Analysis and testing of products.

Nature of Project
Laboratory Investigation

Relevant Majors
Chemical Engineering, Environmental Engineering

Name and Address of Lab that participants will be attached to
E8-06-16/17, 1 Engineering Drive 3, Singapore 117580

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
NA

Project ChBE2

Supervisor **Prof Praveen Linga**
https://blog.nus.edu.sg/lingalab/

Carbon capture and storage via clathrate hydrates

Global CO_2 emissions are currently estimated to be around 30.6 gigatons [2020] by the International Energy Agency [IEA]. To prevent the catastrophic repercussions of global warming, such as rising sea levels, melting glaciers, and rising global temperatures, the CO_2 worldwide emissions must be drastically decreased. The IEA has set a target of achieving a zero-carbon economy by 2050 and limiting global warming to 1.5 °C. Carbon capture and storage [CCS] has the potential to significantly reduce CO_2 emissions in the atmosphere. The ocean can serve as a huge pool for carbon capture and storage. However, the carbon dioxide cannot be disposed of directly into the ocean due to environmental restrictions such as ocean acidification and threat to aquatic life. The storage of CO_2 as gas hydrates in deep ocean sediments is an alternative approach. Through experimental tests and computational models, this research will conduct a fundamental morphological study on CO_2 hydrate formation kinetics in aqueous media and porous media. The successful applicant will be responsible to help with lab experiments and computational modelling.

Maximum no. of participants: **2**

Project Learning Outcomes
1. Experimental skills.
2. Technical writing and presentation skills.
3. Data analysis skills.

Nature of Project
Hybrid (eg. mixture of experiment & theoretical, or experimental and numerical/software)

Relevant Majors
Chemical Engineering, Mechanical Engineering, Chemistry, Oceanic Engineering

Name and Address of Lab that participants will be attached to
Biomolecular Engineering
E8-04-06, 1 Engineering Drive 3, Singapore 117580

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
1. Background reading on CO_2 hydrates recommended.
2. Skills in using Microsoft Excel and Matlab programming preferred.
3. Good communication and writing skills preferred.

Project ChBE3

Supervisor **Prof Praveen Linga**
https://blog.nus.edu.sg/lingalab/

Hydrogen storage via clathrate hydrates

Hydrogen (H_2) with zero-emission upon combustion is projected to play a leading role in the clean energy portfolio. Establishing the hydrogen economy necessitates the development of innovative hydrogen storage technology for both onboard and stationary applications. Hydrate based hydrogen storage enabling safe, long-term, and energy-dense storage of hydrogen molecules under moderate temperature and pressure conditions is promising for stationary storage applications in the foreseeable hydrogen economy.

This project consists of the following objectives: a) to identify thermodynamic promotors to improve the temperature and pressure conditions required for hydrogen storage by gas hydrates; b) to identify kinetic promotors to enhance the hydrogen storage speed by gas hydrates; c) Optimization of the parameters for enhanced hydrate formation kinetics.

Outcomes:
On successful completion of this project, students will be able to: a) understand the fundamental properties of gas hydrates; b) master the basic and necessary experimental skills to conducted gas hydrate-related experiments; c) understand and estimate hydrogen storage capacity and efficiency of various hydrate systems using fundamental thermodynamics concepts (Equation of state et al); d) be familiar with various chemical engineering equipment, e) understand the process design and optimization.

Maximum no. of participants: **1**

Nature of Project
Laboratory Investigation, Computing and Analysis

Relevant Majors
Chemical Engineering, Mechanical Engineering, Material Engineering

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
No

Any other information/requirements
Candidates with prerequisite knowledge in heat and mass transfer, thermodynamics, and material characterization are favorable.

Project Learning Outcomes
1. To master the basic and necessary experimental skills on gas hydrate research in the state-of-the-art gas hydrate laboratory.
2. To obtain a complete understanding of the hydrate based hydrogen storage and transport process.
3. Possibly achieve a breakthrough in the research area with potential collaboration on a scientific research paper.

Name and Address of Lab that participants will be attached to
Linga Lab
E8-04-04, 1 Engineering Drive 3, Singapore 117580

Project ChBE4

Supervisor **Prof Ning Yan**
https://www.yan-group-nus.com/

Converting CO_2 into methanol by hydrogenation

The escalating concerns about global climate change necessitate the development of technologies that can address the excessive CO_2 levels in our atmosphere. The project "Converting CO_2 into Methanol by Hydrogenation" offers a viable solution to this challenge by converting carbon dioxide, a major greenhouse gas, into valuable methanol through hydrogenation.

Maximum no. of participants: **2**

Nature of Project
Laboratory Investigation

Relevant Majors
Chemical Engineering, Chemistry

CO_2 Hydrogenation Reactor

Name and Address of Lab that participants will be attached to
Green Catalysis Lab
E8 level 5, 1 Engineering Drive 3, Singapore 117580

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
No

Any other information/requirements
NA

Project Learning Outcomes

1. Students will develop basic understanding of the principles and mechanisms behind the hydrogenation of CO_2 to produce methanol, encompassing both thermodynamic and kinetic aspects.

2. Through hands-on experience with the synthetic robot, students will acquire skills in designing, synthesizing, and characterizing various catalysts tailored for CO_2 conversion.

3. Students will become adept in setting up, operating, and troubleshooting the advanced multi-channel reactor, ensuring safety and optimal performance throughout the process.

4. By collecting and analyzing experimental data, students will gain the ability to derive meaningful insights, understand catalyst behavior under different conditions, and optimize reaction parameters for maximum methanol yield.

5. Students will be challenged to innovate and optimize the process continuously, fostering their analytical and problem solving skills.

Synthesis Robot

Project ECE1

Supervisor **Prof Sam Ge Shuzhi**
https://cde.nus.edu.sg/ece/staff/ge-shuzhi-sam/

Dynamic and Control of Mechanical System in Offshore Engineering

Offshore engineering is concerned with the design and operation of systems in harsh environment conditions. It is one of the most challenging tasks in offshore engineering. The modeling and control of such system have received increasing attention in recent years with growing energy demands extending oil and gas explorations. Offshore applications are characterized by the timevarying environmental disturbances and the sea conditions. For riser systems, vibration and deformation of the flexible structures due to the ocean current disturbances and the tension exerted at the top can produce premature fatigue problems and failures that require costly repairs. Proper control techniques are desirable for preventing damage and improving the lifespan of the structure. The problems and the proposed solutions will be of interest to the offshore engineering community, to the academic control community, and to who may be able to make even further contributions in wide range of industrial and control area.

Maximum no. of participants: **2**

Nature of Project
Hybrid (e.g., mixture of experiment & theoretical, or experimental and numerical/software)

Relevant Majors
Engineering, Computing

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
Python, Matlab, Control Science

Project Learning Outcomes
1. Theoretical exploration on dynamics of marine mechanical system.
2. Developing advance strategies for control design of systems with guaranteed stability.
3. The control design are coupled with numerical simulations to illustrate the effectiveness.

Name and Address of Lab that participants will be attached to
Control and Simulation Lab
E4A-03-04, 3 Engineering Drive 3, Singapore 117582

Project ECE2

Supervisor **Prof Sam Ge Shuzhi**
https://cde.nus.edu.sg/ece/staff/ge-shuzhi-sam/

Develop digital twin of interacting systems in complex sea scenarios

In offshore operations such as FLNG offloading or rig installation, the environment envelopes are very conservative due to the high risks of explosions and environmental pollution. Operators are interested to enhance the productivity of the offshore assets through better understanding and predictability of the global performance of the coupled systems, predictability of operations and active control strategies.

In this project, students are expected to design and develop digital-twin for Offshore operations to achieve its controllability and predictability by working together with our group. During the project, students are expected to strengthen the abilities of self-motivated study, project planning , algorithm development, system integration, and academic writing.

Maximum no. of participants: **3**

Nature of Project
Hybrid (e.g., mixture of experiment & theoretical, or experimental and numerical/software)

Relevant Majors
Engineering, Computing, Mathematics, Physics

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
1. Enjoy programming and familiar with unity, python.
2. Enjoy design and development of software or hardware.
3. Good at Math, Physics and writing and teamwork.
4. Excellent learning and take challenges.

Project Learning Outcomes
1. Describe the aspects of offshore robotics and technological solutions.
2. Understand digital twin and apply to offshore engineering.
3. Understand digital representation and marine robot motion.

Name and Address of Lab that participants will be attached to
Control and Simulation Lab
E4A-03-04, 3 Engineering Drive 3, Singapore 117582

Project ECE3

Supervisor **Dr Kelvin Fong Xuanyao**
https://blog.nus.edu.sg/seeder

Domain-specific Computing using Emerging Electronic Device Technologies

Future computing systems will require unprecedented levels of energy-efficiencies and can solve much more challenging problems that are beyond the capabilities of existing electronics. In this project, students will explore the mapping of challenging problems (e.g., MAX-CUT) to electronic devices that may be able to better model the atomic operations needed in algorithms to solve those problems. Students will attempt to prove their ideas using simulations and evaluate the designs.

Maximum no. of participants: **4**

Project Learning Outcomes
1. Map a computational problem to an electronic device technology.
2. Demonstrate and evaluate their proof-of-concept using simulations.

Nature of Project
Computing and Analysis, Design

Relevant Majors
Applied Mathematics, Applied Physics, Electrical Engineering, Computer Engineering, Electronics Engineering

Name and Address of Lab that participants will be attached to
Computational Nanoelectronics & Nanodevices Lab
E4-07-12, 4 Engineering Drive 3, Singapore 117583

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
1. Familiarity with Python and MATLAB.
2. Good to know the Finite Element Method and COMSOL but not required.

Project ECE4

Supervisor **Dr Kelvin Fong Xuanyao**
https://blog.nus.edu.sg/seeder

Memory-centric Data Processing Hardware

Future Cognitive Internet of Things will deploy data-intensive machine learning and artificial intelligence algorithms on edge devices for various applications. However, the hardware architecture needs to be designed to drastically reduce the energy consumption and meet the unique energy requirements for edge devices. Memory-centric microarchitectures have emerged as a promising solution. In this project, students will be involved in the design of a memory-centric microarchitecture based on non-volatile memory devices (e.g. ferroelectric RAM, ReRAM, STT MRAM and SOT MRAM).

Maximum no. of participants: **4**

Project Learning Outcomes
1. Be able to simulate a memory-centric microarchitecture.
2. Identify key design problems in the microarchitecture.

Nature of Project
Computing and Analysis, Design

Relevant Majors
Electrical Engineering, Computer Engineering, Electronics Engineering

Name and Address of Lab that participants will be attached to
Computational Nanoelectronics & Nanodevices Lab
E4-07-12, 4 Engineering Drive 3, Singapore 117583

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
1. Knowledge of Python and MATLAB.
2. Familiarity with concepts of memory subsystems.

Project ECE5

Supervisor **Dr Kelvin Fong Xuanyao**
https://blog.nus.edu.sg/seeder

Non-volatile Ferroelectric Transistor Memory

Non-volatile ferroelectric memory is a promising technology for future non-volatile memories. In this project, we will be exploring the design of the non-volatile ferroelectric transistor using simulations. Students will work with Python libraries and COMSOL to work with the simulation tools, benchmarks and test suites. The simulation tools will also be calibrated to experimental measurements from collaborators or in the literature.

Maximum no. of participants: **2**

Nature of Project
Computing and Analysis, Software Development

Relevant Majors
Applied Mathematics, Applied Physics, Electrical Engineering, Computer Engineering, Electronics Engineering, Materials Science

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
1. Familiarity with Python.
2. Good to know the Finite Element Method and COMSOL but not required.

Project Learning Outcomes
1. Create a test suite to test their simulation programs.
2. Calibrate the simulation programs to experimentally measured device characterization data.
3. Perform an analysis of the non-volatile ferroelectric transistor.

Name and Address of Lab that participants will be attached to
Computational Nanoelectronics & Nanodevices Lab
E4-07-12, 4 Engineering Drive 3, Singapore 117583

Project ECE6

Supervisor **Dr Kelvin Fong Xuanyao**
https://blog.nus.edu.sg/seeder

Non-volatile Mem-ristive Memories

Non-volatile mem-ristive memory devices exhibit stochastic behavior that increases the complexity of models and analysis methodologies that are needed for design. In this project, we will be exploring the Fokker-Planck based simulation framework to study emerging mem-resistive memories. Students will work with Python libraries and COMSOL to work with the simulation tools, benchmarks and test suites. The simulation tools will also be calibrated to experimental measurements from collaborators or in the literature.

Maximum no. of participants: **3**

Nature of Project
Computing and Analysis, Software Development

Relevant Majors
Applied Mathematics, Applied Physics, Electrical Engineering, Computer Engineering, Electronics Engineering, Materials Science

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
1. Familiarity with Python.
2. Good to know the Finite Element Method and COMSOL but not required.

Project Learning Outcomes
1. Create a test suite to test their simulation programs.
2. Calibrate the simulation programs to experimentally measured device characterization data.
3. Analyse one novel device concept using the developed simulation framework.

Name and Address of Lab that participants will be attached to
Computational Nanoelectronics & Nanodevices Lab
E4-07-12, 4 Engineering Drive 3, Singapore 117583

Project ECE7

Supervisor **Dr Kelvin Fong Xuanyao**
https://blog.nus.edu.sg/seeder

Energy Efficient Spintronics and Applications

Spintronics technology is promising for non-volatile memories and domain-specific computational circuits. In this project, we will be exploring applications of spintronics using a simulations approach. Students will work with relevant simulation tools like COMSOL, Object-oriented MicroMagnetic Framework or MuMax3.

Maximum no. of participants: **2**

Project Learning Outcomes
1. Perform analysis of spintronic devices.
2. Develop simulation models at different levels of design abstraction.
3. Perform analysis of systems that use spintronic devices.

Nature of Project
Design, Computing and Analysis, Feasibility/Case Studies, Software Development

Relevant Majors
Applied Mathematics, Applied Physics, Electrical Engineering, Computer Engineering, Electronics Engineering, Materials Science

Name and Address of Lab that participants will be attached to
Computational Nanoelectronics & Nanodevices Lab
E4-07-12, 4 Engineering Drive 3, Singapore 117583

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
Good to know the Finite Element or Finite Difference Methods and COMSOL but not required.

Project ECE8

Supervisor **Prof Aaron Thean**
https://sites.google.com/atresearchgroup.net/at-research-group/about-us

AI Chips that rewire themselves

We are working on new semiconductor device technologies that may allow chips to learn and reconfigure themselves. The devices are oxide-based semiconductors with ferroelectric memory that can be integrated into the interconnect wirings of advanced chips. Here, in this project, we would like to explore the design and integration of circuit components for novel neural network on 3D chip applications. Interested students will have a choice to work on the system design, circuit design, or material development/integration.

Maximum no. of participants: **2**

Nature of Project
Laboratory Investigation

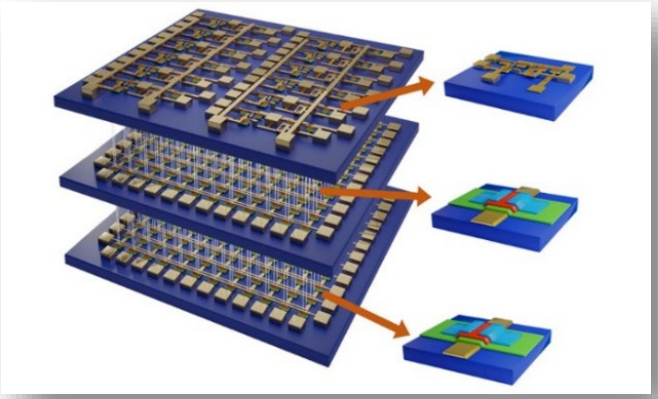
Relevant Majors
Electrical Engineering, Materials Science

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
No

Any other information/requirements
1. Basic semiconductor device theory and processing.
2. Basic electronic circuit concept.

Project Learning Outcomes
1. Student to learn basics of semiconductor processes.
2. Student to learn the basics of AI chip architecture.
3. Student to learn about memory device material.

Name and Address of Lab that participants will be attached to
E6-06-07, 5 Engineering Drive 1, Singapore 117608



Last Updated: 12 November 2025

Project EDIC1

Supervisor **Dr Tang Kok Zuea**
https://cde.nus.edu.sg/edic/staff/tang-kok-zuea/

Development of an Extended Reality System for a Comprehensive Eye Check-Up at the Hospital

This project aims to develop an extended reality (XR) system for health eye check-ups at the hospital. The system should include an agentic AI enabled component to guide the userto complete the health assessment. The current method of a comprehensive health check-up at the hospital employs more than 6 medical staff members. This tests is also time-consuming, frequently performed unreliably, lacks real time feedback to the patient on test performance, and occupies too much space on precious hospital real-estate. The developed XR system will be relatively inexpensive, easier to perform, produce more reliable results (in part through provision of real-time feedback on test performance) as compared to current methods. Patients will also be able to perform these tests at their own time in the comfort in a dedicated booth, reducing unnecessary waiting times in the hospital, and freeing up precious space within hospital grounds for other patient care activities. Ultimately, it is envisaged that this project will translate into a more accurate and efficient health assessment, reducing the need for medical staff members. This project also involves software development.

Maximum no. of participants: **4**

Nature of Project
Software Development, Design, Product Development

Relevant Majors
Electrical and Computer Engineering, Mechanical and Product Development Engineering

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
NA

Project Learning Outcomes
1. Understand and appreciate the selection of suitable components in an XR system.
2. Develop skills and experience related to using Unity for App development.
3. Develop skills and experience related to developing an edge computing board with relevant sensors.
4. Proof-of-concept development for the integrating the various components in the proposed approach.

Name and Address of Lab that participants will be attached to
Engineering Design and Innovation Centre (EDIC)
E2A, #04-05, 5 Engineering Drive 2, Singapore 117579

Project EDIC2

Supervisor **Dr Tang Kok Zuea**
https://cde.nus.edu.sg/edic/staff/tang-kok-zuea/

Robotic Handler for Precise Parts

Current procedures to handle small and precise parts for the purpose to check on the working condition and cleanliness of the parts involve using human hands. The process is slow and may risk injury to the staff if proper and safe procedures are not adhered to. The smart robotic handler is to be developed to transfer the small parts in an efficient manner from one tray to the other.

With this innovation, it will benefit a large group of people such as the instrument processing department, surgeons and patients. Packaging staffs will be able to work in a less stressful environment and more efficiently without the use of count sheets. With the reduction of human errors, it will reduce the time wastage of the surgeons and the patients. Overall, the efficiency in every aspect will be improved with the success of this innovation.

Maximum no. of participants: **4**

Nature of Project
Software Development, Design

Relevant Majors
Electrical and Computer Engineering, Mechanical and Product Development Engineering

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
NA

Project Learning Outcomes
1. Understand and appreciate the various components in an Vision based AI system.
2. Develop skills and experience related to developing a method to control the multi-axial robotic handler.
3. Proof-of-concept development for the integrating the various components in the proposed approach.

Name and Address of Lab that participants will be attached to
Engineering Design and Innovation Centre (EDIC)
E2A, #04-05, 5 Engineering Drive 2, Singapore 117579

Project EDIC3

Supervisor **Dr Tang Kok Zuea**
https://cde.nus.edu.sg/edic/staff/tang-kok-zuea/

Using AI for Integrating IoT and Autonomous Mobile Robots

The integration of autonomous mobile robots (AMRs) into industrial and logistical operations offers significant potential to streamline processes and boost efficiency. However, effective integration requires advanced artificial intelligence (AI) techniques to address challenges such as dynamic environments, complex tasks, and real-time decision-making. This project explores the application of AI in AMR integration using internet-of-things (IoT) technology for reliable wireless communication, focusing on areas like perception, navigation, and human-robot interaction. By leveraging AI and IoT, AMRs can become more adaptable, collaborative, and intelligent, revolutionizing the future of automation. This project is focused on software-development aspects of the project, related to robots' navigation.

Maximum no. of participants: **4**

Nature of Project
Software Development, Design

Relevant Majors
Electrical and Computer Engineering, Mechanical and Product Development Engineering

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
NA

Project Learning Outcomes
1. Understand and appreciate the various components in an Edge-AI electro-mechnical system.
2. Develop skills and experience related to communicating with AMRs.
3. Develop skills and experience related to developing an edge computing board.
4. Proof-of-concept development for the integrating the various components in the proposed approach.

Name and Address of Lab that participants will be attached to
Engineering Design and Innovation Centre (EDIC)
E2A, #04-05, 5 Engineering Drive 2, Singapore 117579

Last Updated: 12 November 2025

Project EDIC4

Supervisor **Dr Tang Kok Zuea**
https://cde.nus.edu.sg/edic/staff/tang-kok-zuea/

Using AI for Integrating IoT, Wearables and Outdoor Autonomous Mobile Robots

The integration of outdoor autonomous mobile robots (AMRs) with personnel in outdoor environment offers significant potential to streamline security processes and boost efficiency. However, effective integration requires advanced artificial intelligence (AI) techniques to address challenges such as dynamic environments, complex tasks, and real-time decision-making. This project explores the application of AI in AMR integration using internet-of-things (IOT) technology for reliable wireless communication, focusing on areas like perception, navigation, and human-robot interaction. By leveraging AI and IOT, outdoor AMRs can become more adaptable, collaborative, and intelligent, revolutionizing the future of automation. This project is focused on software-development aspects of the project, related to robots' navigation and wearables.

Maximum no. of participants: **4**

Nature of Project
Software Development, Design

Relevant Majors
Electrical and Computer Engineering, Mechanical and Product Development Engineering

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
NA

Project Learning Outcomes
1. Understand and appreciate the various components in an Edge-AI electro-mechnical system.
2. Develop skills and experience related to communicating with AMRs.
3. Develop skills and experience related to developing an edge computing board.
4. Proof-of-concept development for the integrating the various components in the proposed approach.

Name and Address of Lab that participants will be attached to
Engineering Design and Innovation Centre (EDIC)
E2A, #04-05, 5 Engineering Drive 2, Singapore 117579

Project EDIC5

Supervisor **Dr Tang Kok Zuea**
https://cde.nus.edu.sg/edic/staff/tang-kok-zuea/

Health Assessment of Bone Structures using AI and Design Tools

In collaboration with the Health Promotion Board (HPB), this project brings together students from different disciplines to develop an AI-powered tool to assist in the mass health assessment in schools for bone structure growth. Highlighted assessment includes scoliosis and other adverse bone growth conditions. Traditional screening methods are often manual, subjective, or reliant on doctor's subjective assessment. The goal is to design and prototype an accessible, accurate, and user-friendly health assessment tool using AI and computer vision technologies.

Maximum no. of participants: **4**

Nature of Project
Software Development, Design, Product Development

Relevant Majors
Electrical and Computer Engineering, Mechanical and Product Development Engineering

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
NA

Project Learning Outcomes
1. Understand and appreciate the selection of suitable components in a vision based system.
2. Develop skills and experience related to App development.
3. Develop skills and experience related to developing a standalone controller with relevant sensors.
4. Proof-of-concept development for the integrating the various components in the proposed approach.

Name and Address of Lab that participants will be attached to
Engineering Design and Innovation Centre (EDIC)
E2A, #04-05, 5 Engineering Drive 2, Singapore 117579

Project ME1

Supervisor **A/Prof Loh Wai Lam**
https://cde.nus.edu.sg/me/staff/loh-wai-lam/

Multiphase Flow in Pipelines and Multiphase Equipment Development

Multiphase Flow occurs in various industries, including the nuclear industry with nuclear reactions and also in the oil & gas industry during oil & gas production. In oil & gas production, a multiphase mixture of oil, water and gas flows through a pipeline for very long distances. Due to differences in densities, viscosities, and other physical properties, various flow regimes, i.e. stratified, wavy, bubbly, slug, annular and dispersed flows, can develop as a result, depending on the superficial velocities of the fluids. Different flow regimes have different effects on the pressure drop, flow pattern, etc., and ultimately on the stability of the flow. Pipeline integrity can also potentially be compromised due to force loadings from some of the flow regimes. This project looks into multiphase flow and also into the development of equipment for the oil & gas industry.

Maximum no. of participants: **2**

Nature of Project
Laboratory Investigation, Computing and Analysis, Hybrid (e.g., mixture of experiment & theoretical, or experimental and numerical/software)

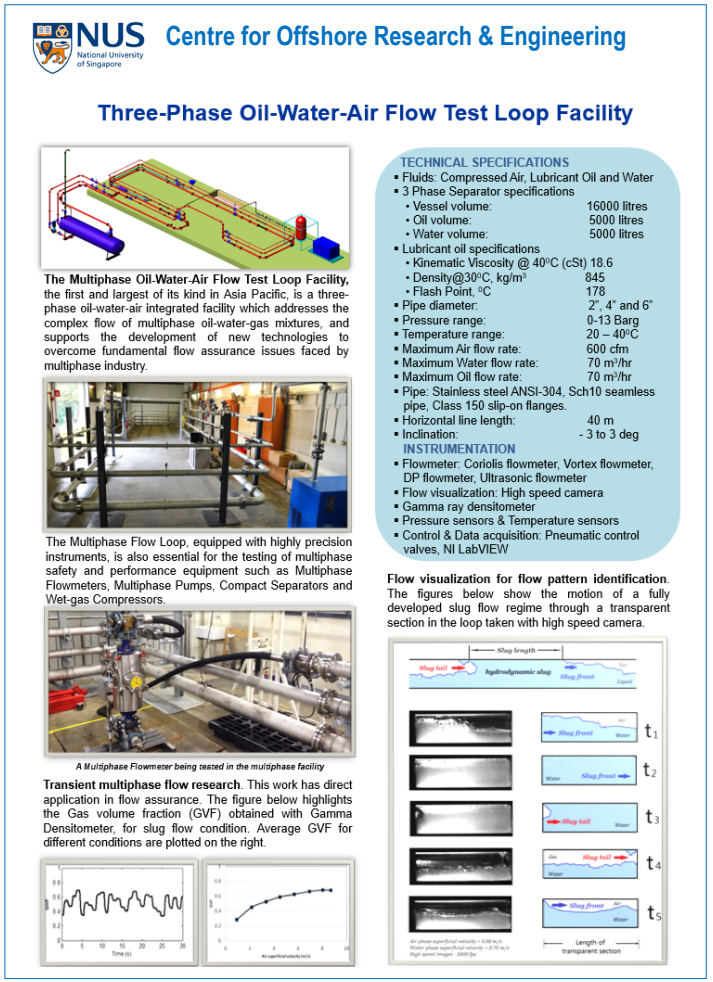
Relevant Majors
Chemical Engineering, Mechanical Engineering, Process Engineering, Nuclear Engineering

Project Learning Outcomes
Through experiments and numerical simulations, students will get to understand the occurrence of multiphase flows, i.e., how they are generated and the effects the have on pipelines and flow stability. Student can also gain useful knowledge of how multiphase equipment developed for the oil & gas industry works.

Name and Address of Lab that participants will be attached to
Multiphase Oil-Water-Air Flowloop Test Facility
EW1, Engineering Drive 2, Singapore 117579

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
NA



Last Updated: 12 November 2025

Project ME2

Supervisor **Dr Sing Swee Leong**
https://cde.nus.edu.sg/me/staff/sing-swee-leong/

3D Printing Enabled Urban Farming

Urban farming has gained traction in recent years, especially for developed regions to attain self-sustainability. In this project, the feasibility of using 3D printing for design and fabrication of efficient structures for urban farming will be explored. The project aims to achieve high efficiency in urban farming via space saving and higher nutrient/water transport effectiveness.

Maximum no. of participants: **2**

Nature of Project
Laboratory Investigation, Product Development, Feasibility/Case Studies, Hybrid (e.g., mixture of experiment & theoretical, or experimental and numerical/software), Design, Computing and Analysis

Relevant Majors
Mechanical Engineering, Civil Engineering, Materials Science, Biological Science, Bioengineering

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes. The designing of components can be done using open source or commonly used computer aided design (CAD) software. Analysis of performance of the designed components can also be done using numerical methods.

Any other information/requirements
Experience with computer aided design, flow analysis will be advantageous

Project Learning Outcomes
1. Evaluate current methods in urban farming and study the design features.
2. Design suitable structures for urban farming and their feasibility to be manufactured by additive manufacturing.
3. Evaluate the efficiency of 3D printed structures for urban farming.

Name and Address of Lab that participants will be attached to
NUS Centre for Additive Manufacturing (AM.NUS)

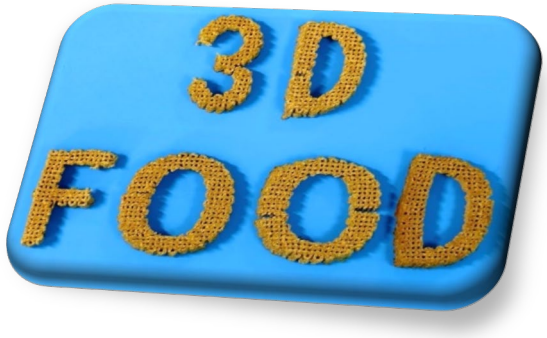
Last Updated: 12 November 2025

Project ME3

Supervisor **Dr Sing Swee Leong**
https://cde.nus.edu.sg/me/staff/sing-swee-leong/

3D Food Printing for Sustainability

3D food printing provides the opportunity to create alternative food source using correct material combinations and print patterns that can mimic the texture of commeical food product. In this project, the material combination chosen will be used to evaluation the feasibility of such technology in sustainable causes in terms of benchmarking the texture and appearance to conventional food products.



Maximum no. of participants: **2**

Nature of Project
Feasibility/Case Studies, Laboratory Investigation, Hybrid (e.g., mixture of experiment & theoretical, or experimental and numerical/software)

Project Learning Outcomes
1. Evaluate current development in 3D food printing.
2. Study of suitable materials for 3D food printing using material extrusion technology.
3. Evaluate the 3D food printing as alternative method of food production technology.

Relevant Majors
Materials Science, Mechanical Engineering, Chemistry, Applied Physics

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Name and Address of Lab that participants will be attached to
NUS Centre for Additive Manufacturing (AM.NUS)

Any other information/requirements
NA

Last Updated: 12 November 2025

Project ME4

Supervisor **Dr Sing Swee Leong**
https://cde.nus.edu.sg/me/staff/sing-swee-leong/

Machine Learning for Additive Manufacturing

Additive manufacturing (AM), also known as 3D printing, starts with data from a digital model file. The process chain of AM is well suited to be integrated with machine learning due to its digital nature. In this project, the feasiblity of using machine learning in additive manufacturing will be explored, focusing on the data analytics of various aspects across the whole process chain.

Maximum no. of participants: **2**

Nature of Project
Feasibility/Case Studies, Laboratory Investigation, Hybrid (e.g., mixture of experiment & theoretical, or experimental and numerical/software)

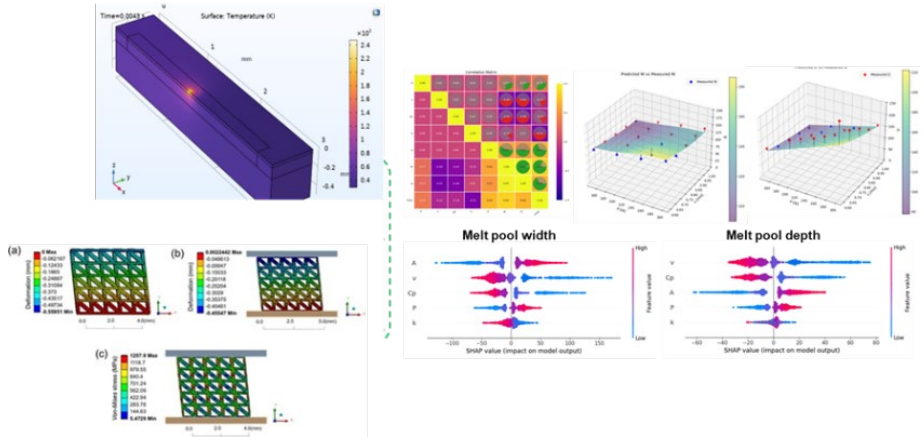
Relevant Majors
Computer Science, Mechanical Engineering, Applied Physics

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
NA

Project Learning Outcomes
1. Evaluate current development in machine learning for additive manufacturing.
2. Study the use of different machine learning models in additive manufacturing.
3. Evaluate the efficiency of machine learning approaches in additive manufacturing.

Name and Address of Lab that participants will be attached to
NUS Centre for Additive Manufacturing (AM.NUS)



Project ME5

Supervisor **Dr Tan Yu Jun**
https://yujuntan.com/

Development of Ionically Conductive Bacterial Cellulose from Kombucha SCOBY

This project aims to explore ways to enhance the functional properties of Kombucha SCOBY (Symbiotic Culture of Bacteria and Yeast) by making it ionically conductive. SCOBY is a naturally produced bacterial cellulose material that is tough, flexible, and biodegradable, but it lacks electrical or ionic conductivity, limiting its potential in advanced applications. In this project, students will investigate methods to introduce ionic conductivity into SCOBY through approaches such as ion doping, polymer blending, or salt incorporation while maintaining its mechanical strength and sustainability. The goal is to develop a biocompatible, flexible, and conductive SCOBY-based material that can be used in emerging technologies like biosensors, flexible electronics, or soft actuators. This project combines concepts of materials chemistry, biofabrication, and green technology, offering students hands-on experience in sustainable material innovation.

Maximum no. of participants: **2**

Nature of Project
Laboratory Investigation

Relevant Majors
Materials Science, Mechanical Engineering

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
No

Any other information/requirements
1. Feels strongly for a more sustainable future.
2. Prior undergraduate research experience.
3. Strong interest in flexible eletcronics and material science.

Project Learning Outcomes
1. Understand the fundamentals of ionic conduction and how it can be integrated into natural polymer systems like bacterial cellulose.
2. Develop laboratory and analytical skills in material modification and conductivity testing.
3. Apply principles of sustainable materials science to design eco-friendly, functional biomaterials for electronic or sensing applications.

Name and Address of Lab that participants will be attached to
Materials Lab
E3-04-01/02, 2 Engineering Drive 3, Singapore 117581

Project ME6

Supervisor **Dr Tan Yu Jun**
https://yujuntan.com/

From Kombucha Tea to Sustainable, Tough Hydrogel

This project aims to transform waste materials from Kombucha tea production into a sustainable and high-performance material. The by-product of Kombucha fermentation, known as SCOBY (Symbiotic Culture of Bacteria and Yeast), is naturally tough but unstable—it dries out easily, grows mold, and contains living microorganisms, which limit its long-term use. This project seeks to innovate by using SCOBY as a starting material and modifying it to create a tough, transparent, and stable hydrogel. The goal is to develop an abiotic (non-living), stretchable, and durable material that maintains the desirable strength of natural SCOBY while overcoming its weaknesses. By converting Kombucha waste into a functional hydrogel, this project promotes sustainable material innovation and explores the potential of bio-derived resources for future applications in soft materials and green technologies.

Maximum no. of participants: **1**

Nature of Project
Laboratory Investigation

Relevant Majors
Materials Science, Mechanical Engineering

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
No

Any other information/requirements
1. Feels strongly for a more sustainable future.
2. Prior undergraduate research experience.
3. Strong interest in material science.

Project Learning Outcomes
1. Understand the structure, properties, and limitations of bio-derived materials such as Kombucha SCOBY and how they can be modified for improved performance.
2. Develop practical skills in material preparation, chemical modification, and characterization techniques to create and test sustainable hydrogels.
3. Apply principles of sustainability and materials science to transform biological waste into functional, stable, and eco-friendly materials.

Name and Address of Lab that participants will be attached to
Materials Lab
E3-04-01/02, 2 Engineering Drive 3, Singapore 117581

Project ME7

Supervisor **Dr Tan Yu Jun**
https://yujuntan.com/

From Tea to Fiber: Developing Tough, Directional SCOBY-Based Fibers

This project aims to explore the fabrication of fibrous, anisotropic materials derived from Kombucha SCOBY (Symbiotic Culture of Bacteria and Yeast). SCOBY, a bacterial cellulose biopolymer produced during Kombucha fermentation, naturally forms as a soft, tough film but lacks directional structure. By modifying the SCOBY formation or processing it into long, aligned gel fibers, this project seeks to create a material with anisotropic mechanical properties: stronger and tougher along one direction. Students will experiment with techniques such as controlled stretching, extrusion, or templated growth to align the cellulose nanofibers. The goal is to develop tough, flexible, and sustainable SCOBY-based fibers that could serve as a foundation for bio-textiles, artificial muscles, or soft structural materials. This project combines creativity with materials science, allowing students to explore structure–property relationships in naturally derived polymers.

Maximum no. of participants: **1**

Nature of Project
Laboratory Investigation

Relevant Majors
Materials Science, Mechanical Engineering

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
No

Any other information/requirements
1. Feels strongly for a more sustainable future.
2. Prior undergraduate research experience.
3. Strong interest in manufacturing and material science.

Project Learning Outcomes
1. Understand how microstructural alignment influences the mechanical and functional properties of biomaterials.
2. Develop hands-on experience in processing bacterial cellulose into fibers and characterizing anisotropic materials.
3. Apply sustainable design principles to create bio-derived fibers for potential use in soft materials and green engineering.

Name and Address of Lab that participants will be attached to
Materials Lab
E3-04-01/02, 2 Engineering Drive 3, Singapore 117581

Project ME8

Supervisor Dr Guillaume Sartoretti
http://marmotlab.org/

Control of a Quadruped Robot with a Robotic Arm

Articulated legged robots, such as quadrupeds with manipulator arms, combine agile locomotion with dexterous manipulation, enabling operation in complex and unstructured environments. This project focuses on developing a reinforcement learning–based control framework for such robots, where the student will first design and train end-to-end RL controllers in simulation to coordinate leg and arm movements for stable locomotion and manipulation. Building on this foundation, the project will extend to developing a vision-driven teleportation pipeline that converts human motion—captured from video or a VR headset—into corresponding robot commands for arm movement and grasping. The goal is to achieve natural, human-guided whole-body control that can later be validated in high-fidelity simulation or on a physical quadruped platform.

Maximum no. of participants: **3**

Nature of Project
Laboratory Investigation, Software Development, Computing and Analysis

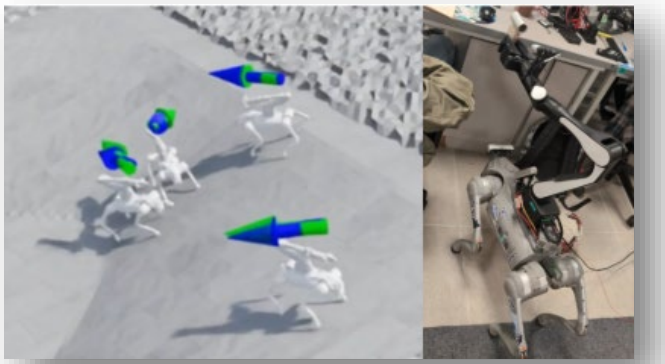
Relevant Majors
Computer Science, Robotics, Mechanical Engineering, Electrical Engineering

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Any other information/requirements
1. Python3 programming skills required.
2. ROS/other simulation experience preferred.
3. Strong mathematical background.
4. Enthusiasm and passion for (legged) robots.

Project Learning Outcomes
1. Demonstrate a reinforcement learning–based loco-manipulation controller for a quadruped robot in simulation.
2. Develop a vision-driven teleportation pipeline that maps human motion from video or VR input to robot arm and grasp commands.
3. If feasible, validate the learned controller and teleoperation pipeline on a physical quadruped platform.

Name and Address of Lab that participants will be attached to
Control and Mechatronics Lab
E2-01-05, 9 Engineering Drive 1, Singapore 117575



Last Updated: 12 November 2025

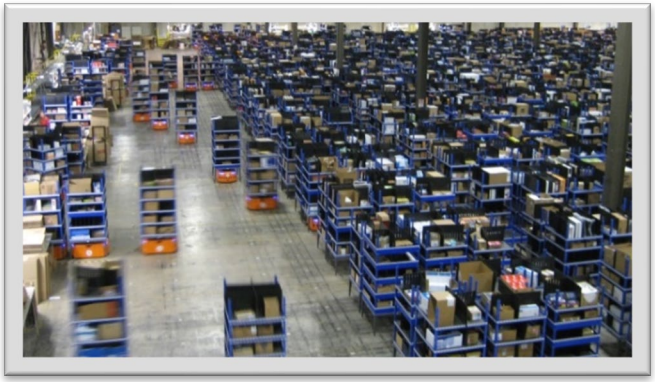
Project ME9

Supervisor **Dr Guillaume Sartoretti**
http://marmotlab.org/

Reinforcement Learning-Based Decentralized Multi-Agent Pathfinding

With affordable robots now coming equipped with built-in sensing and computing power, we are quickly reaching a point where factories and logistics centers could use hundreds, or even thousands, of robots at once. To make such large-scale systems possible, a great deal of research has focused on multi-agent path finding (MAPF), the problem of coordinating many robots so they can move efficiently without collisions. MAPF has applications in warehouse automation, video game NPC control, airport ground traffic, and even multi-robot search and rescue.

As the number of robots increases, however, coordinating them becomes much more complex. Current state-of-the-art optimal planners can handle a few hundred agents, but scaling further remains a major challenge. As a result, researchers are increasingly exploring suboptimal methods that trade some accuracy for speed and scalability. In this work, we aim to advance reinforcement learning–based MAPF methods (such as PRIMAL, SYLPH, and LNS2-RL) to achieve better performance and demonstrate these strategies on real robots.



Maximum no. of participants: **2**

Nature of Project
Computing and Analysis, Software Development

Relevant Majors
Computer Science, Electrical Engineering, Mechanical Engineering, Robotics

Project Learning Outcomes
1. Get familiar with existing RL-based MAPF techniques and code base.
2. Learn ROS and deployment of learning based policies on real robots.

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes

Name and Address of Lab that participants will be attached to
Control and Mechatronics Lab
E2-01-05, 9 Engineering Drive 1, Singapore 117575

Any other information/requirements
1. Python3 programming required, and experience with pytorch and ROS preferred.
2. Familiarity with GNU/Linux and command line interface.
3. Enthusiasm and passion for multi-robot systems and coordination.

Last Updated: 12 November 2025

Project ME10

Supervisor **Dr Guillaume Sartoretti**
http://marmotlab.org/

MPPI-based Swerve Drive Robot

A swerve drive robot is a type of mobile robot that uses independently steered and driven wheels, allowing it to move in any direction without changing its orientation. Each wheel module can rotate 360 degrees, enabling smooth omnidirectional motion and precise control over translation and rotation simultaneously. This design provides excellent maneuverability, agility, and stability, especially in dynamic environments. Compared to differential or mecanum drive systems, swerve drives offer better traction, higher speed, and more efficient power use. They are widely used in autonomous vehicles, robotics competitions, and research platforms requiring advanced motion control and path planning. This research will be carried out in simulation, but a hardware demo can be investigated if the student(s) progress(es) fast.

Maximum no. of participants: **1**

Nature of Project
Laboratory Investigation, Software Development, Computing and Analysis, Field Testing and Instrumentation

Relevant Majors
Computer Science, Electrical Engineering, Mechanical Engineering, Robotics

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
Yes. Note: Project can be conducted virtually as he experimental portion of this project can be removed in favor of more simulation work. The robot can be operated using a ROS-based simulator (e.g., Gazebo).

Any other information/requirements
C++ programming and experience with ROS required

Project Learning Outcomes
1. Get familiar with existing object tracking techniques.
2. Develop and demonstrate a localization and tracking controller in simulation (and then on real robot).

Name and Address of Lab that participants will be attached to
Control and Mechatronics Lab
E2-01-05, 9 Engineering Drive 1, Singapore 117575

Project ME11

Supervisor **Dr Tan Xipeng**
https://cde.nus.edu.sg/me/staff/tan-xipeng/

4D metal printing

Nickel-titanium has shown to be the most attractive shape memory alloy with many potential applications due to its outstanding capability of recovering the original shape upon heating or upon removal of the applied stress. Therefore, they can be used for biomedical, aerospace, and robotic components, such as coronary stents, artificial muscle, and actuators. This project aims to design and 3D print nickel-titanium parts with shape memory properties, namely the so-called "4D printing", for various applications.

Maximum no. of participants: **2**

Nature of Project
Design, Laboratory Investigation

Relevant Majors
Mechanical Engineering, Materials Science

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
No

Any other information/requirements
NA

Project Learning Outcomes
1. Learn about shape memory alloys and their properties.
2. Learn about metal 3D printing techniques.
3. Understand how to realise 4D metal printing.
4. Explore applications of 4D metal printing.

Name and Address of Lab that participants will be attached to
Materials Lab
E3-04-01/02/03, 2 Engineering Drive 3, Singapore 117581

4DP Benchmark Part

Project ME12

Supervisor **Dr Tan Xipeng**
https://cde.nus.edu.sg/me/staff/tan-xipeng/

AM microstructure simulation

This project establishes a multiphysics simulation framework to model microstructure evolution in metal additive manufacturing. By integrating thermal, fluid, and solidification phenomena, it predicts grain morphology and defect formation, enabling the design of process parameters for tailored microstructures and improved mechanical properties in 3D-printed metallic components.

Maximum no. of participants: **2**

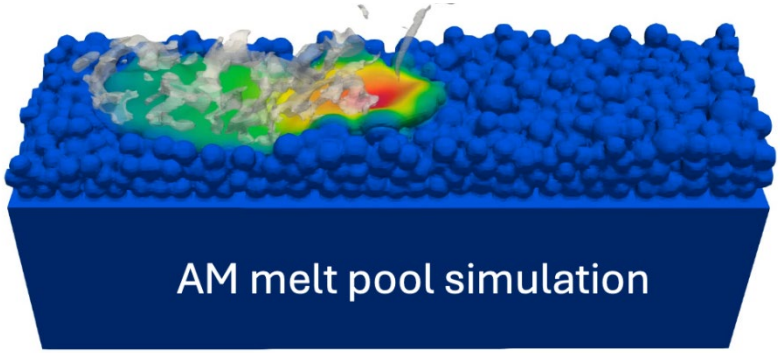
Nature of Project
Modelling and Simulation

Relevant Majors
Mechanical Engineering, Materials Science

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
No

Any other information/requirements
NA

Project Learning Outcomes
1. Understand importance of microstructure simulation in additive manufacturing.
2. Learn about CFD based AM simulation methods.
3. Build up process-microstructure-property correlations through simulations.



Name and Address of Lab that participants will be attached to
Materials Lab
E3-04-01/02/03, 2 Engineering Drive 3, Singapore 117581

Project ME13

Supervisor **Dr Tan Xipeng**
https://cde.nus.edu.sg/me/staff/tan-xipeng/

Developing antibacterial 3D-printed biomedical alloys

This project pioneers antibacterial 3D-printed biomedical alloys that combine strength, biocompatibility, and infection resistance. By integrating antibacterial elements and precise additive manufacturing, it tailors alloy microstructures to inhibit bacterial growth while supporting tissue integration. The outcome: next-generation high-performance metal implants that heal, protect, and endure.

Maximum no. of participants: **2**

Nature of Project
Laboratory Investigation

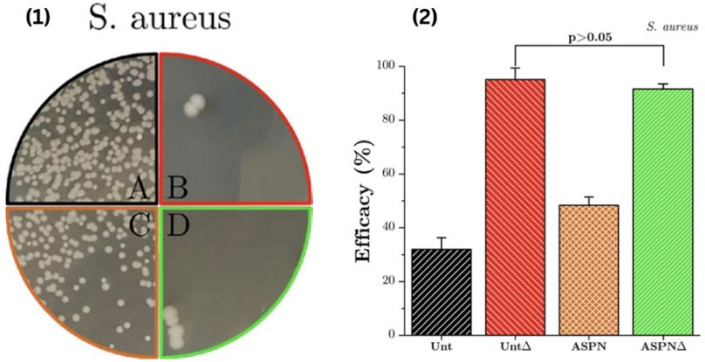
Relevant Majors
Biomedical Engineering, Mechanical Engineering

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
No

Any other information/requirements
NA

Project Learning Outcomes
1. Understand the importance of antibacterial function in biomedical engineering.
2. Gain hands-on experience of conducting antibacterial testing.
3. Learn about antibacterial alloy design and its 3D printing methods.

Name and Address of Lab that participants will be attached to
Materials Lab
E3-04-01/02/03, 2 Engineering Drive 3, Singapore 117581

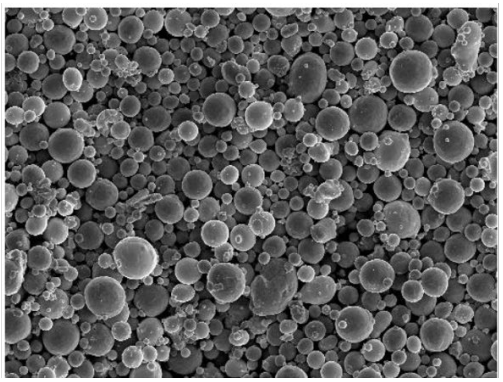


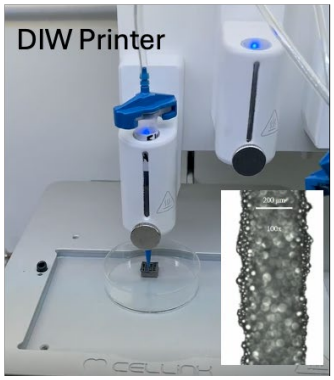
Project ME14

Supervisor **Dr Tan Xipeng**
https://cde.nus.edu.sg/me/staff/tan-xipeng/

3D printing of high-performance alloys via direct ink writing

Direct Ink Writing (DIW) of high-performance alloys is an additive manufacturing technique that uses a paste-like ink made of alloy powders mixed with a binder to create complex, customized structures. This technique allows for the precise deposition of material layer by layer through a nozzle, enabling intricate geometries and fine feature control. DIW is particularly advantageous for high-performance alloys, as it maintains the material's properties by reducing the need for high temperatures during fabrication. Once printed, the part undergoes sintering to enhance strength and density. DIW's flexibility and low material waste make it ideal for applications in aerospace, energy, and biomedical fields.





Maximum no. of participants: **2**

Nature of Project
Design, Laboratory Investigation

Project Learning Outcomes
1. Understand the advantages of direct ink writing in meta alloy fabrication.
2. Hands-on experience in DIW 3D printing and post processing.
3. Apply DIW for printing high-performance alloys.

Relevant Majors
Biomedical Engineering, Materials Science, Process Engineering

If the summer program needs to be suspended physically (e.g., due to COVID 19), can the project be offered and conducted virtually?
No

Name and Address of Lab that participants will be attached to
Materials Lab
E3-04-01/02/03, 2 Engineering Drive 3, Singapore 117581

Any other information/requirements
NA

Last Updated: 12 November 2025