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S2 2023 Individual Project Registration (study contract) - ENGN4200

Note: this form must be completed with a text editor by the student and signed by the student **and** supervisor. The naming of a second examiner (also known as *reviewer*) is highly desirable but not strictly required for initial registration, except for *externally supervised projects*, where a CECC-affiliated co-supervisor or reviewer must be included in this agreement (please refer to guidance document for external projects).

STUDENT

UniID: u5841150

FAMILY NAME: Bradbury PERSONAL NAME(S): Neil

SUPERVISORS AND EXAMINERS

PRIMARY SUPERVISOR (may be external i.e., non-CECC)

FAMILY NAME: Ernst PERSONAL NAME(S): Marco

University ID or 'External': u5457130 AFFILIATION: ANU

Will the primary supervisor act as an examiner for this project (Yes/No)? Yes

INTERNAL CO-SUPERVISOR if applicable/required (CECC)

FAMILY NAME: PERSONAL NAME(S):

University ID: AFFILIATION:

Will the co-supervisor act as an examiner for this project (Yes/No)?

SECOND EXAMINER (REVIEWER) if known/required (CECC)

FAMILY NAME: Nguyen PERSONAL NAME(S): Hieu

University ID: u5247402 AFFILIATION: ANU

The reviewer *will* act as an examiner in this project

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PROJECT DETAILS (double click checkboxes to edit)

COMMENCEMENT SEMESTER: ☐ S1 ☒ S2 STUDY LOAD ☒ STANDARD ☐ DOUBLE

PROJECT TITLE:

Development of a Portable Electroluminescence Measurement System for Photovoltaic Modules

PROJECT DESCRIPTION:

Solar panels or photovoltaic (PV) modules provide solar energy which is a renewable and clean source of energy. Electroluminescence (EL) imaging techniques are used to identify defective areas of PV modules. The motivation for developing a portable Electroluminescence (EL) measurement system for PV modules is to reduce the infrastructure costs associated with production and maintenance.

EL imaging works due to the reciprocity principle being applied to PV modules. PV cells in a PV module absorb light and produce a DC current (electricity) and the opposite is possible due to the reciprocity principle where a DC current injected into a PV cell will produce light (electroluminescence). The light produced is in the infrared range and can be captured by infrared-sensitive cameras to produce EL images of the PV module. Defective regions within a PV module will produce no light and can be detected in these images.

This project will continue the development work of a portable EL measurement system previously completed by the ENGN8170 students Team Solar in 2023. The team developed a system that could image one PV module at a time and produce EL images within 5 minutes. The team documentation for the system recommended five areas of future work which were:

- increase image capture from 8-bit low-resolution to 12-bit resolution to improve image detail,
- develop a more portable and reliable enclosure, this will be an enclosure that houses components securely and prevents dust and water ingress,
- implement power management to optimise power consumption,
- create a PCB board to for circuitry currently seated on a prototyping board, and
- increase the current rating above 10 A to allow the device to scale to work with larger PV modules.

The deliverables for this project will extend the current prototype design to meet the recommendations as follows:

- develop the python code to handle 12-bit resolution images and redevelop/update the GUI,
- design and construction of an improved enclosure,
- modification to the electrical circuitry to optimise the power,
- construction of the PCB for the electrical circuit to replace the prototyping board, and
- recalculation of the component values of the electric circuit to handle loads above 10 A

The final deliverable will be to generate performance metrics of the device by testing the device under a range of different conditions such as:

- background light intensity,
- exposure parameters, and
- filter types.

The purpose being to enable the device to be benchmarked against other commercial/industry devices.

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DETAILS OF ENGINEERING FOCUS:

This engineering project will apply knowledge from my engineering degree to produce an advanced technical artefact i.e., the updated EL measurement system through the application of various engineering skills taught in my engineering studies.

The modification of the python code to handle 12-bit images and to update the GUI will require knowledge of programming and computer vision for the image manipulation relating to knowledge drawn from ENGN2219 Computing for Engineering and ENGN4528 Computer Vision.

The modification to the electrical circuitry to optimise the power and recalculation of the component values of the electric circuit to handle loads above 10 A will require knowledge drawn from ENGN4625 Power Systems and circuit principles taught in ENGN2218 Electronic Systems & Design.

The construction of the PCB for the electrical circuit to replace the prototyping board, and design and construction of an improved enclosure will require knowledge that I have not been formally taught but are electronics industry related skills that I will take this opportunity to learn in a project environment.

INTELLECTUAL PROPERTY ARRANGEMENTS:

The default ANU arrangement for Intellectual Property (IP) is that ***students have complete ownership of any IP generated in their honours projects****. If special restrictions apply for this project, and/or non-disclosure agreements (NDAs) are required, please describe these here. IP arrangements must be endorsed by the Program Convenor and any NDAs signed prior to project commencement.*

The ENGN8170 students *Team Solar* in 2023 that produced the initial prototype had previously completed an IP Agreement in the document: *ST07 Internal Student Project Deed.doc*.

In Part A: Details under Item 6 Special Conditions the documented IP arrangement is:

"The parties have agreed that ANU will place any resulting Intellectual Property from the Project into the public domain under a suitable open-source agreement, similar to the CC BY-SA 4.0 licence.
This special condition applies only if the project material is of the quality required for publication and has been deemed suitable for publication by the academic supervisor."

The IP arrangements will be the same and specific Student Project Deed has been updated for this project.

ADDITIONAL PROJECT REQUIREMENTS:

Ethics clearance: _____N/A

Funding: _____N/A

Use of departmental facilities: _____N/A

Others (specify): _____ N/A

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RESPONSIBILITIES

STUDENT

- Must adhere to the deliverable deadlines set out in this agreement
- Must comply with the University's policies and procedures in terms of applying for assessment item/deliverable extensions and/or deferred assessments.
- Must attend all scheduled meetings with the Primary and/or Co-Supervisor, and provide (where practicable) prior notice of their unavailability if unable to attend.
- Must understand and exercise the Academic Integrity requirements of the ANU.
- Must provide regular feedback on progress to the Primary Supervisor and/or Co-Supervisor, and report any challenges which could impact their ability to successfully complete the project (e.g., Health concerns).
- Must report any concerns which could be considered significant (e.g. harassment/bullying, Primary Supervisor becomes unresponsive) directly to the Course Convener.

PRIMARY SUPERVISOR

- Has a duty of care to the student and must ensure projects are scoped appropriately.
- Must establish regular (weekly or fortnightly) progress meetings with the student, which are agreed in writing (email is sufficient).
- Must maintain regular contact with the student. If a student is unresponsive and/or does not attend 2 scheduled meetings in a row without prior explanation, the Supervisor must:
    - Notify the student in writing that they are at risk of breaching their obligations under the project agreement and provide a deadline for response; and
    - Contact the Course Convener so a record can be made.
- Must provide regular feedback, assistance and guidance to students and ensure that the student has access to resources required to complete their project.
- Must advise the student, the Co-Supervisor (if applicable) and the Course Convener immediately should circumstances arise requiring the supervision to be discontinued or suspended for a period longer than 2 weeks.
- Must communicate any known issues or concerns relating to the student's progress or welfare to the Course Convener.
- If acting as one of the examiners for the project:
    - Must hold an appropriate qualification level (Master's or higher degree) in Engineering or appropriate affine discipline relevant to the project
    - Must attend the project oral presentation and assess the final project report in accordance with the required deadlines.
    - Provides recommendations for project reviewer – can be in discussion with student.

INTERNAL CO-SUPERVISOR (where applicable)

- Has a duty of care to the student and must ensure that a project conducted with an external supervisor complies with the requirements of the ANU School of Engineering (e.g., adequate scoping, appropriate workload, regular supervision, fair assessment)
- Must monitor the project progress through periodic meetings (every 4-6 weeks) with both the student and the primary supervisor.
- Must report any concerns which could be considered significant (e.g. harassment/bullying, primary supervisor becomes unresponsive) in relation to the student and/or their supervision directly to the course convener.
- Provides recommendations for project reviewer – can be in discussion with student.
- Must attend the project oral presentation and assess the final project report in accordance with the required deadlines.

SECOND EXAMINER (REVIEWER)

- Must advise the primary/co-supervisor and the course convener as soon as practical should they become unable to act as a reviewer for the project.
- In the absence of a co-supervisor, must be prepared to engage in project progress monitoring and interim student support upon request from the course convenor.
- Must attend the project oral presentation and assess the final project report in accordance with the required deadlines.

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DECLARATIONS

STUDENT

1. I certify that the information I have given in this contract is complete, accurate and truthful.
2. I have read and understood the obligations that apply to me as the student, as well as the requirements of my supervisors and the course convener.
3. I agree to fulfil the obligations of this contract.

Mil Bradbury ..... 3/8/2023 | 11:35 AM AEST .....

Signature Date

PRIMARY SUPERVISOR

1. I certify that the information I have given in this contract is complete, accurate and truthful.
2. I have read and understood the obligations that apply to me as the primary supervisor, as well as the requirements of the student, the secondary supervisor/ examiner and the course convener.
3. I have reviewed the aforementioned student's academic transcript and assess this student to be suitable to complete the project detailed above.
4. I agree to provide supervision and support to the aforementioned student for the duration of the project.
5. I agree to fulfil the obligations of this contract.

Marco Ernst ..... 3/8/2023 | 11:33 AM AEST .....

Signature Date

INTERNAL CO-SUPERVISOR

1. I certify that the information I have given in this contract is complete, accurate and truthful.
2. I have read and understood the obligations that apply to me as co-supervisor, as well as the requirements of the student, the primary supervisor, the reviewer and the course convener.
3. I have reviewed the aforementioned student's academic transcript and assess this student to be suitable to complete the project detailed above.
4. I agree to provide supervision and support to the aforementioned student for the duration of the project.
5. I agree to fulfil the obligations of this contract.

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Signature Date

REVIEWER

1. I certify that the information I have given in this contract is complete, accurate and truthful.
2. I have read and understood the obligations that apply to me as reviewer, as well as the requirements of the student, the primary supervisor, the co-supervisor and the course convener.
3. I agree to provide interim supervision and support to the aforementioned student if requested by the course convenor.
4. I agree to fulfil the obligations of this contract.

Hieu Nguyen ..... 4/8/2023 | 10:19 AM AEST .....

Signature Date