Department of Electronic and Computer Engineering

UNIVERSITY OF LIMERICK
OLLSCOIL LUIMNIGH

In order for the project documentation to be processed by the Department of Electronic and Computer Engineering, each student is asked to complete and submit this *Abstract Submission form* as part of the project requirements under GDPR (General Data Protection Regulation). The form is to be completed and uploaded in the Spring semester along with all required final project documentation.

All documents you produce within the project should be considered as being publicly available unless otherwise identified. This does not mean that the documents produced will be published, rather that the information cannot be automatically considered as confidential unless specifically identified as such. It should be noted that one of the key departmental uses to which your project reports (final and/or interim) may be applied is as a source of information or inspiration for future student projects. For example, your project may have included suggestions for future work which other students may pursue; in this case, your project report would serve as a reference.

Whilst the documents are created for the purposes below and not published elsewhere without the agreement of all involved, if there is any company confidential information relevant to the report, this information should be kept out of the report and referred to only in general terms after consultation with your department supervisor and, if relevant, company supervisor.

Any questions relating to the report/poster/abstract should be directed to your project supervisor.

Project Title:	General purpose data acquisition system using the STM32 microcontroller and FreeRTOS
Student Name:	Qinyuan Liu
Supervisor:	Ian Grout
Programme of study:	B.E. Electronic & Computer Engineering
Abstract:	The rapid advancement of embedded systems has significantly increased the demand for efficient, scalable, and real-time data acquisition solutions, particularly in industrial automation, robotics, and control systems. This project focuses on developing a general-purpose data acquisition system using the STM32 microcontroller and FreeRTOS, integrating 16×16 analog I/O and 16×16 digital I/O with synchronized data transfer. The hardware design includes PCB layout, component selection, and power optimization, featuring MCP3008 ADCs, MCP4822 DACs, and digital I/O expansion via 74HC165/74HC595 shift registers, all communicating through SPI and GPIO multiplexing techniques. On the software side, the system is designed with RTOS-based task scheduling, synchronized communication, and real-time data acquisition. Future work will concentrate on firmware implementation and system optimization, addressing key challenges such as reducing ADC sampling jitter, optimizing task prioritization, and refining serial data transfer protocols. The final system aims to deliver real-time monitoring and control capabilities, applicable to battery management, industrial vibration analysis, and automation systems.

Please indicate below **Yes** (**Y**) or **No** (**N**) for the following questions:

Interim Report	Yes (Y):	Y	No (N):	

The *Interim Report* is primarily an internal document within the department and its primary use is for the project assessment. You are at liberty to disseminate your report (and all documentation developed in the project) as you wish once the project has completed.

Yes
The department may use the report for additional department purposes outside the scope of the project.

No
The report remains an internal department document for use in the project only.

Final Report	Yes (Y):	Y	No (N):	

The *Final Report* is primarily an internal document within the department and its primary use is for the project assessment. You are at liberty to disseminate your report (and all documentation developed in the project) as you wish once the project has completed.

Yes
The department may use the report for additional department purposes outside the scope of the project.

No
The report remains an internal department document for use in the project only.

Abstract	Yes (Y):	Y	No (N):	

The *Abstract* will be publicly available and may be disseminated outside the department within the *Book of Abstracts*. Therefore, the content and wording are important in this case. The Abstract would be open for public viewing.

The Abstract text provided in this document will automatically be included in the Book of Abstracts.

Yes
The Abstract text will be included in the Book of Abstracts and your name **will** be included along with the Abstract text.

No
The Abstract text will be included in the Book of Abstracts but your name **will not** be included along with the Abstract text.

Poster	Yes (Y):	Y	No (N):	

The *Poster* will be publicly available and may be disseminated outside the department. As the poster will be on public display during the project day in week 9, the poster will be open for public viewing.

In addition, a copy of the poster will be included within the Book of Abstracts.

Yes
Your name and photograph **will** be included within the Poster.

No
Your name and photograph **will not** be included within the Poster.