Project (E) 448 Responsibilities & Student's GA Achievement Plan Ver2.1

This form must be filled out by the student, signed and handed in to the module administrator early in the semester. Both the student and the supervisor must sign the agreement on main details and mutual responsibilities. The student should discuss their GA achievement plan with the supervisor, before completing this form. Only the student signs their GA achievement plan, as it is their own responsibility. ***This plan is NOT a guaranteed recipe for passing Project (E) 448.*** *Rather, it serves as a record of the student having considered these important aspects at an appropriately early stage. GA achievement plans should be revised as needed and in consultation with the supervisor, during the course of the project.*

Main details

Student	Initials and surname	G.V.C. Allen	SU number	23905093
Supervisor	Initials and surname	A Barnard		
Project title	The Design of a PocketQube Satellite Communication System			
Project description, including the aim, scope and envisioned approach *(max. 150 words)*	This project aims to design and implement a wireless communication system for a miniaturised satellite called a PocketQube (PQ). This will involve both a tracking Ground Station (GS), as well as a PQ 'unit', which should fit into the satellite's housing. The GS should mechanically track the satellite using a combination of open and closed-loop control. The closed-loop control could make use of either GPS or signal strength tracking. The integration of a directional antenna, motors, and digital electronics onto an existing antenna mount will be done. The GS's electronics will be placed onto a newly-designed PCB. The satellite module will consist of an antenna, a communication interface, and a PCB, which should integrate into the PocketQube standard. Lastly, an existing Isosonde should be modified to integrate into the PocketQube system, and the GS should be capable of receiving its data.			

Mutual responsibilities

1. It is the responsibility of the student to clarify aspects such as the definition and scope of the project, the place of study, research methodology, reporting opportunities and -methods (e.g. progress reports, internal presentations and conferences) with the supervisor.
2. It is the responsibility of the supervisor to give regular guidance and feedback with regard to the literature, methodology and progress.
3. The rules regarding submission and evaluation of the project is outlined in the module framework and SUNLearn page and will be strictly adhered to.
4. The supervisor conveyed the departmental view on plagiarism to the student, and the student acknowledges the seriousness of such an offence.
5. The supervisor certifies that the project as described above has sufficient scope to achieve, in principle, the required GAs.
6. It is the responsibility of the student to initiate a discussion with the supervisor on GA achievement prior to filling out and handing in this form.

Signatures for agreement on main details and mutual responsibilities

Role	Signature	Date
Student		31/07/2023
Supervisor		04/08/2023

Student's graduate attribute (GA) achievement plan

How will GA 1 **(problem solving)** be achieved? *(<=100 words)*
The initial project description consists of three high-level components. The various sub-problems involved will be investigated, such as the type of antenna to use, the closed-loop tracking method, and the various sub-components involved in the digital electronics design. Further, the PQ standard is relatively new, and the design of systems involving this standard are unfamiliar. The solutions involved might require the creation of new custom protocols. Further, there are various limitations imposed, such as the PCB form factor, the PQ's power requirements, and ISM antenna regulations. This may conflict with optimal range or throughput requirements, requiring design trade-offs.
How will GA 2 **(application of scientific and engineering knowledge)** be achieved? *(<=100 words)*
The knowledge acquired from an under-graduate EE Engineering course will be applied. System design and engineering will be applied in the design of both PCBs and the selection and layout of the components involved. Software design will be tested in the communication protocol and ground station control. Specific knowledge from Control Systems may be used for the ground station. Further, knowledge from Electronics and Computer Systems courses, such as amplifier design, microcontroller programming, and the use of integrated circuits and components, will be used. Electromagnetics knowledge, including antenna and RF design, and link budget calculations, may also be needed.
How will GA 3 **(engineering design)** be achieved? *(<=100 words)*
Various sub-systems will be designed, involving circuit layout, PCB design, system integration, and embedded digital design and software development. This includes integrating three complex systems which have relatively high-level descriptions (a ground station, PQ unit, and an Isosonde). Specifications of the complex systems should be listed. This will include the investigation of the multiple possible solutions, such as choosing components, investigating when to use existing modules (e.g. with the antenna or software design) etc. Design choices should be documented, and testing procedures should allow results to be critiqued, such as data thoughput and communication reliability.
How will GA 4 **(investigations, experiments and data analysis)** be achieved? *(<=100 words)*
Investigation of existing solutions and components will be done to aid in the design process. Existing protocols and standards will be studied (e.g. the PQ60 standard). Lastly, literature will be consulted when various solution methods are available, such as GPS vs. antenna strength tracking. Continuous testing and analysis of the proposed tracking system will be done in an iterative manner in order to ensure the best design is reached. Measurements should be conducted to test the data throughput and connection reliability of the system, and this should be analysed to draw conclusions on the system's success.
How will GA 5 **(engineering methods, skills and tools, including IT)** be achieved? *(<=100 words)*
A software development environment and software tools will be used. The digital design will likely require the use of compiler tools and programming. Further, CAD tools such as PCB design software and circuit schematic software will be needed for hardware design. Further, if a dedicated antenna is to be designed, Electromagnetic analysis software may be needed if the design is too complex.
How will GA 6 **(professional and technical communication)** be achieved? *(<=100 words)*
The project includes a written report and an oral presentation. These demonstrate competence to communicate effectively, both orally and in writing.
How will GA 8 **(individual work)** be achieved? *(<=100 words)*
The student will take primary responsibility for successful completion of all aspects of the project.
How will GA 9 **(independent learning ability)** be achieved? *(<=100 words)*
For successful completion of the project, the student is required to acquire knowledge independently (from the literature or the internet, for example) and without the context of this required knowledge being fully specified in the project definition.

Signature acknowledging own responsibility to achieve GAs

	Signature	Date
Student		31/07/2023