

Coursework 1

Sensor Selection & Measurement

Deadline: November 10, 2022, 4 pm (no extension will be given)

1 Objectives

The aim of this coursework is to provide the student the opportunity to work experimentally with a selected sensor and measurements. At the end of this project, the student should

- have knowledge of the different types/versions of a sensor of their choice.
- have hands-on skills in measurement with a selected sensor.
- be able to apply basic statistics on measurements.
- be able to write a report and work in a team.

2 Group Allocation

Each student should have been assigned to a specific group of 3-5 students (not less than 3, and not more than 5 students). Each group can be composed of students from level 6 and level 7.

3 Submission and Marking

Submissions will be done in the designated area for Coursework 1 on Keats. Weight for each assessment component, namely, group report, group presentation, and individual report, is indicated in the titles of their corresponding subsections.

3.1 Group technical report – 40%

Each group has to submit a group report by the end of the deadline, which is November 10, 2022, 4 pm. In the group report, the following should be taken into account:

- Abstract: This should include an objective definition, introduction to the topic, methodology and results summary, conclusion.
- Introduction and background: This section provides the setting of the scene and reflects the wider context (e.g. technology development, policy, industrial sectors) and project background. Especially, motivating for the selection of the sensor with relative applications.
- Literature review: This section will discuss the previous work and reflect state-of-the-art in the field.

- Objectives and questions to be addressed in this project: This section should include the overall project objectives, aims or any hypothetical questions to be addressed. You may like to give an overview of your report structure.
- Methodology: The methods section should be sufficiently detailed so that an external reader can reproduce your results. Specifically, the description of the sensor, both from the technology design point of view and a Table providing the key performance specifications/rating parameters. Furthermore, this section should contain the experimental design and protocol.
- Results and discussion: The results section should be concise and in general will not include a discussion of the results, but rather a presentation and enumeration of results. It is useful to consider consolidating the results in tables and figures. Figures should all have self-explanatory captions, and most importantly, they must tell a story. Please think about the figures you wish to place, why are they important and how they can save your time describing phenomena. Tables may also be appropriate to report the results. In particular, your result section should contain the probability distributions of your measurements and a statistical test on whether they can be assumed to be normally distributed. The evaluation should include scatter plots, curve fitting (for individual data and all), within/between mean and variances. Discussion section provides for the critical analysis of the results and the evidence that you have thought about the problem and have enough maturity and criteria to make informed statements.
- Conclusion and future work: The conclusion section allows you to be creative and innovative, suggesting new pathways to project. You may like to discuss your approach and results, providing a short overview of different versions of the same sensor and a discussion on how selecting another version could have affect the result.

The group report should be maximum 4 pages, including the references. Please use the templates from the IEEE. Either MS Word or L^AT_EX is acceptable, please see <https://www.ieee.org/conferences/publishing/templates.html>. Please note that we will not mark the reports that exceed the page limit and are not written using the IEEE templates; therefore, a mark of 0 will be returned.

3.2 Group presentation – 40%

Each group is expected to present their work during the lecture that will take place on th 11th of November, 2022, between 1 and 3 pm. Every group member should contribute to the presentatoin presentation. The project demonstration will be evaluated based on communication skills, demonstration and project visualisation, context and impacts. Each presentation will be followed by a Q&A session.

Please note that each presentation should be 5 minutes maximum. After 5 minutes, the session chair reserves the right to interrupt the presentation and move onto the next presentation.

The presentation contents are dependent on the nature of the project but should include the following sections:

- Project background and context
- Project objectives

- Project team and collaboration
- Project results, analyses
- Project conclusion and project impacts
- Project limitations and recommendations

3.3 Individual report– 20%

In addition, each member of the group has to submit an individual report summarising the following:

- Reflection: Critical analyses and description on how the overall project went and project management; Reflect your own time management and planning to support the overall project; Reflection on the lessons learned, what could be further improved; Reflect the new knowledge and skillsets developed throughout the project as an Engineer
- Contribution and development as an Engineer: Evidence and record of your technical contribution to the project; Highlight your development as an Engineer in the project
- Analyses: Your understanding of the project objectives, methodology, and results. Analyses of project limitation and future directions. If you were given an opportunity to take this project forward, what you would like to do?

The individual report should be maximum 1 page, including the references. Please use the templates from the IEEE. Either MS Word or L^AT_EX is acceptable, please see <https://www.ieee.org/conferences/publishing/templates.html>. Please note that we will not mark the reports that exceed the page limit and are not written using the IEEE templates; therefore, a mark of 0 will be returned.

4 Project Description

1) Each group should select a sensor (e.g., accelerometer) that the group has access to. This could be either from your smart device or if you can purchase a low cost device (each member needs the same device) or use a sensor available in the labs. If you choose your smartphone, it is possible to capture data from different sensors using dedicated Apps such “Sensorstream IMU+ GPS”. You can find other applications as well.

2) Design an experiment setup and take measurements. The measurements should be expressed as input-output (for example, if you choose to measure distance using IR sensors, you also need to use a ruler as reference so that it is possible to represent ruler vs. IR). The number of repetitions should be chosen so that the measurement variance is minimized as much as possible. Using the agreed protocol, each group member has to take measurements.

3) Bring the data together and evaluate your sensor/application.

4) Write a scientific report as described above and prepare a presentation.

Acknowledgement

The module leaders would like to thank Dr Ernest Kamavuako and Dr Miao Guo. This coursework builds upon their teaching materials on Sensors and group projects, respectively.