

Title: Unit Project

Group: Individual:

Graded out of: 100

Weight: 50%

Due date (Project report):	Week 11	Sunday, 17th of September 2023, 8:00 p.m. (AEST)
Due date (Project poster + presentation)	Week 12	Friday, 22nd of September 2023, 8:00 p.m. (AEST)

Submission: Online: Hardcopy:

Instructions: Submit using the submission dropbox located under the Assessments section of Moodle.

Summary: The Project in this unit tasks students with combining the knowledge and skills gained throughout the unit to analyse and solve a problem that relates to some form of Smart Home application.

Key Criteria – Report (approximately 1500-2000 words)

- Report contains a description of the problem being investigated,
- Report describes the method chosen to investigate the problem (both hardware and software),
- Report contains at least one photo of the hardware circuit that has been built,
- Report explains what data is being collected, how it is collected, as well as how the data has been cleaned,
- Report presents results of an analysis of the captured data,
- Report visualises part of the analysis to make understanding the results easier,
- Report considers the ethical issues and current limitations of the built system,
- Report recommends how the project could be extended into a larger smart home application,
- Arduino code created in project is submitted and documented,
- All relevant data files (including any analysis, diagrams, and “working out”) are submitted,
- Report discusses the design, application, and outcomes from potential Project Focus Areas.

Key Criteria – Poster + Presentation (approximately 500 words)

- Poster contains a title that states the problem being investigated,
- Poster summarises the method chosen to investigate the problem (both hardware and software),
- Poster includes at least one photo of the hardware circuit that has been built,
- Poster considers the possible ethical problems with the chosen data capture method,
- Poster presents results of an analysis of the captured data,
- Poster visualises part of the analysis to make understanding the results easier,
- Poster recommends how the project could be extended into a smart home application,
- Poster design is suitable for a scientific poster,
- Presentation is clear and discusses all parts of the poster.

Relevant Content Weeks & ULOs

Week 1 Week 2 Week 3 Week 4 Week 5 Week 6
 Week 7 Week 8 Week 9 Week 10 Week 11 Week 12

ULO1

Acquire, process, visualize, and interpret data using existing devices and technologies.

ULO2

Apply professional and ethical standards to data collection practices.

ULO3

Design data capture protocols and methodologies to meet user and functional requirements.

Please read the full assignment details that follow.

SIT123 Unit Project

Assessment Task Objective and Topic Areas

Your project should solve a problem within the area of 'smart home'. Within smart homes, you must select from the following categories as your main research area:

- Wearable/Portable Assistant
- Healthy Living/Exercise
- Electricity/Energy Use

Your smart home system should allow you to do the following:

1. Identify a problem area/topic to investigate,
2. Use sensors and actuators to collect some data as relevant to the problem,
3. Using your collected data, perform an analysis to gain insight into the problem,
4. Visualise the collected data,
5. Provide a recommendation/conclusion based on the analysis.

The data you collect from your system should allow you to reach a conclusion for the original problem area/topic.

Project Implementation

Once you have selected a topic area from the options above, you must design and build a prototype of a Sense-Think-Act system that can be used to investigate the topic.

Your system must meet the following **minimum requirements**:

- Uses an Arduino and breadboard.
- Should contain at **least one sensor** and at **least one actuator**. You must use at least **three different sensors/actuators in combination** (e.g. one sensor and two different actuators, three sensors and one actuator, etc.).
 - Note that separate LEDs count as one actuator; the RGB LED can count as a separate actuator to the regular LEDs only if it is used to blend colors together (i.e. an action that separate colored LEDs cannot easily do).
 - Note that the temperature and humidity sensor only count as one sensor.
- Can format and save the data into a csv-compatible file format. The data collected must include any sensors you use in the system, plus some form of additional time information, such as milliseconds.

Note that while this project is an individual assessment, if you require additional people to get involved with your data collection (e.g. to hold the system, to collect different user's data for comparison, etc), you are allowed additional people for this step. Make sure to document who was involved and for what purpose in your report.

On-campus students: Where possible, you should simulate your system in TinkerCad to confirm the system works as intended, before borrowing any hardware for the real data analysis.

Project Data Analysis

After you have built your system and have collected data, you will need to conduct an exploratory analysis and visualisation of the data to obtain some form of insight into the environment you sensed for your chosen Topic Area.

Note that how much data you collect is up to you to decide, but you will need to be able to reason why the data you collect is enough to reach a conclusion in your written report.

Your choice of analysis and visualisation is also up to you, using the strategies introduced and practiced from the unit activities. Again, you should reason why you have chosen these methods in your report.

As a pre-analysis step, you need to clean your data to ensure it is ready for analysis. You should document your process for cleaning the data: what did you look for, what was found, and how did you clean the dirty data?

Note that while the goal of your analysis is to be able to gain insight into your research area, this does not mean that you must necessarily prove something. Your project is limited to collecting data for a short period of time, so definitive answers to a research question may not be possible. However, your prototype system might be able to provide an early indication of the system's ability to get an answer in the future.

In your submission, you should include any working out files, such as any Excel files that you used for your analysis and visualisation. You will document your analysis in your written report.

Project Report Details (45 marks)

Your submission needs to be in the form of a written report (Word or PDF document), approximately 2000-2500 words in length. Your report must contain the following sections, using appropriate headings to indicate each section. In addition, all **code** and **data files** must be included with the report in a single zip file and uploaded to Moodle.

The report must have **all** the following sections:

1. **Introduction:** A description of the project and the problem it is attempting to solve in sufficient detail. This includes:
 - a) A problem statement – which Topic Area have you chosen and what information are you trying to discover? Include in this section a research question that you hope your system will be able to produce an answer to.
 - b) Which Focus Areas have you selected to customise your system?
2. **System design:** This includes a detailed description of the system you have chosen to build. You should explain why you have built the system in the way you have and include several photos of the system when you are using it to collect data.
3. **Data capture and cleaning process:** You must explain how much data was recorded and why this amount was needed. You also must describe your method to prepare the data file for analysis, including:
 - a) A description of your data cleaning process, including whether any dirty data was found and how you fixed it.
 - b) Potential sources of dirty data that could appear when using this system, and your recommendations for how to clean such dirty data.
 - Note: these examples may not have occurred when you were collecting your data, but they are examples of what could occur with your system.
4. **Analysis and conclusion:** Your results after analysing your data and a discussion on:
 - a) How you have analysed the data, including a summary of any interesting findings. Your choice of how to analyse this data is up to you to decide, but you should consider trying to analyse as much of the data as possible to gain as much insight into your problem area as possible.
 - b) A visualisation of your data. Your discussion in this section should be based on the data you have visualised here. Your choice of data visualisation is up to you to decide, which will depend on the data being collected. You should justify the form of visualisation you have decided to create, relating it to our understanding of visual variables.
 - c) A conclusion as to whether you can answer the research question presented in your introduction section of the report and what the answer is.
 - Note: it's possible you may not be able to answer your research question. Provided you suitably explain why, you will not lose marks.

5. **Smart home limitations/ethical issues:** Describe any limitations or ethical issues of the project. Remember that the project is about a system that has been installed into a real environment, so you should consider any ethical issues surrounding the data being collected. Other limitations should also be discussed here, such as limitations due to the sensor placement or number/type of sensors.
6. **Project Extension Proposal:** Using your experience designing/building/analysing this system and your selected smart home category, you must propose an improved and extended design for this smart home system. How you improve and extend this system is up to you, but you must ensure that your system includes appropriate Sensing, Thinking, and Acting subsystems.
- a) Include an illustration, diagram, or TinkerCad image of your proposed system extension. You don't need to write the sketch code for this, but you should be able to provide a draft diagram of the circuit.
- Note: consider improving the system to address any documented limitations or issues that you have identified in section 5.

Report – Referencing Sources

Any external information used that does not come from the SIT123 Moodle site should be cited and referenced in your report. The correct referencing format used in this unit is **Australian Harvard** format.

More information about this referencing format and a guide on how to follow it can be found on the Deakin University website: <https://www.deakin.edu.au/students/study-support/study-resources/referencing>

Note: The Deakin Guide to Australian Harvard linked above includes information about appropriately citing the use of **Generative AI** in assessment works (select the Harvard format, then check the tab labelled "Other Sources"). Any use of generative AI should be discussed with your teacher before being used.

Project Arduino Sketch (10 marks)

Include your final Arduino sketch code in your submission to the Moodle dropbox. Your code should include appropriate code commenting.

Excel File Submission (5 marks)

Include your Excel file that shows any data collected as well as any analysis/visualisation created in Excel.

Project Focus Areas (20 marks, 10 marks each)

As part of your project, you have the choice of customising your system on a selection of Focus Areas. There are six Focus Areas described below, of which you should **choose two** and add them to your project. If a student chooses to add more than two, the two highest graded Focus Areas will contribute to your Project final grade.

Note that some Focus Areas may not be suitable for certain projects, so consider selecting Focus Areas early in your system design.

Focus Area 1: Enclosure Design

Using basic physical materials (e.g. cardboard, markers), design an enclosure for your physical prototype. Your enclosure should incorporate the Arduino and all connected parts, not including any computer used to provide power. The enclosure must make use of a moving object, either as a method for sensing something, or for an actuator (e.g. using a servo motor to manipulate part of the enclosure). Labels on the enclosure should be documented. In your report, describe how the enclosure improves your prototype system in a meaningful way.

Focus Area 2: JSON Data Formatting

Using at least **three sensors** in your system design, collect data and format it into a JSON format, instead of csv. You would need to update your Arduino sketch so that the data written to the Serial Monitor follows the JSON formatting standard. Note you can still import data in JSON into Excel for your analysis. In your report, document the difficulties of this approach compared to csv and describe how the JSON format could be useful in a larger system.

Note: if choosing this Focus Area, your data does not need to be formatted into csv for the minimum requirements. You only need to format as JSON.

Focus Area 3: Data Validation

Data validation requires checking whether data is correct and in the expected format during the data capture process. This is different to data cleaning, which occurs after data has been collected. To validate your data, you would need to update your Arduino sketch code so that as you read from a sensor, you determine that the values are appropriate for what you are sensing. To confirm your validation works as expected, you will need to document how you tested your validation.

As part of this system, you should make use of at least **three sources of data** that require validation. In your report, document how your validation is designed and how you have tested its capabilities.

Focus Area 4: Creative Data Visualisation

Extend your data visualisation by using at least **two sensors** in your system and practice using less traditional forms of data visualisation. Design two additional creative visualisations of your data – these visuals however **cannot** be any of the following:

- Line chart
- Scatterplot
- Bar Chart/Column Chart/Histogram
- Pie/Donut Chart
- Area Chart

Other forms of visualisation are acceptable but need to be appropriate for the data types you have collected. In your report, describe these visuals and what insight they give you into the environment sensed.

Focus Area 5: Additional Hardware

Extend your system by adding additional hardware to your Arduino. You need to add at least **three additional forms of hardware components** not introduced in the unit. The hardware added must not be trivial, instead they must add something new to the system (e.g. new form of sensing, or new acting, etc).

Parts not included in the SIT123 Hardware Parts List (found in the unit information section) count towards this Focus Area, even if used in a practice activity (e.g. the Piezo Buzzer used in lab report 8 would count as an additional form of acting in this Focus Area).

In your report, include a description of these additional parts and the purpose they give in your system design.

Note: students may need to purchase this additional equipment. Consider choosing a different Focus Area if this is not possible for you.

Focus Area 6: Distributed Data Collection System

Add to your data collection a different data source. Using a personal device (e.g. smart phone, smart watch, etc.) that will let you collect data into an appropriate data file, design your system to use both the data from your personal device and the data collected by the Arduino system. Both parts of this system need to complement each other so that together they are representing a larger distributed system.

The data you collect from your personal device must be included in your analysis/visualisation, to show that they can be combined to gain insight into the environment sensed. Include a description of this and your findings in your report.

Moodle submission – additional files

When preparing to submit your project report to Moodle, double check that all of the following is submitted together:

Report file (Word document or pdf format)	All data collected and analysis working out (e.g. Excel files)	The Arduino sketch code created for the project
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Poster (10 marks) + Week 12 Presentation (10 marks)

Your project poster needs to be in the form of a digital A3 size poster (created in Word, PowerPoint, an image editing program, or similar software). All sections from your written report must be summarised into this poster, approximately 500 words in length. You can reuse text from your report but summarise it to be suitable for a poster format. As you put your poster together you should start to consider preparing for your presentation. Aim for your presentation to be approximately 3-5 minutes in length. During the presentation you will need to summarise the details of your project, presenting your poster to the class. Be prepared for the possibility of needing to answer questions based on your project at the end of the presentation.

Poster – Additional advice

Your poster is intended to be a **summary** of your project and report, so not all information is required. You should consider as you write your report what information might be most important to include in the poster as well.

You can use a template when creating your poster, but like any assessment, you should consider modifying the template you use to create something that is unique to you.

Some resources on creating posters:

- <https://guides.nyu.edu/posters>
- <https://colinpurrington.com/wp-content/uploads/2011/09/scientific-poster-advice-purrington.pdf>
- <https://www.posternerd.com/tutorials>

Some software resources to help create your poster include:

- Microsoft Office 365 (in case you don't have your own office installation):
<https://www.deakin.edu.au/office365>
- Canva.com (easy to use online software that comes with a number of templates):
<https://www.canva.com/>

Presentation – Week 12

You must present your project poster in class during week 12. You are allowed to prepare a script that you can read from during the presentation, or you can just use your poster. The purpose of the presentation is for you to explain to the class how you have attempted the project. If you use a script or written notes, submit these with your project on Moodle.

If you are unable to attend class during week 12, you must contact your teacher before the final due date of the project report (Sunday week 11) and arrange an alternative day/time.

Deakin College on-campus students: after conducting your presentation in either week 12 class, your attendance will be noted and you are free to leave class, or you can stay to watch the remaining presentations.

Deakin College Online students: project presentations will be conducted during the final week 12 online session. If you normally cannot attend during this time, please discuss with your teacher before week 12.

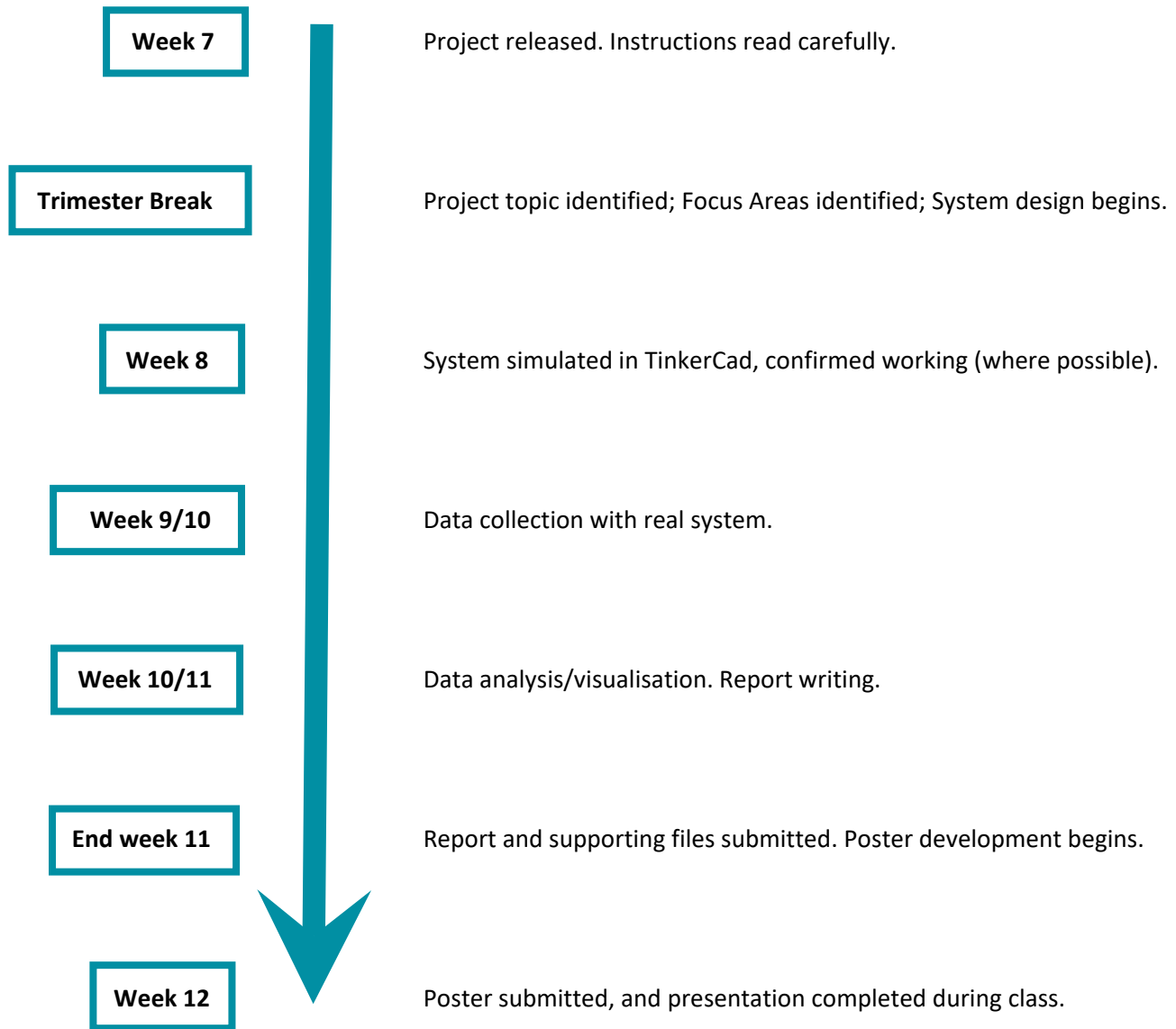
Important Note:

All students **must** respect the presenters during week 12. You're allowed to continue working on your project poster while others present theirs, but any disruptive or disrespectful behaviour to those presenting may result in losing marks in your final project grade.

Project Timeline Estimates

As the project is a large body of work, students are highly encouraged to plan out certain milestones to aim for with this workload. This is especially important for on-campus students that require borrowing the College supplied Arduino kits – kits are limited in number, and borrowing will be offered to students that have been in discussion and planning with their teacher over ad-hoc requests.

As a general guide, consider the following timeline as a rough guide for project milestones to aim for:



What if I submit late?

The details for late submission are summarised in our Unit Outline. Late submission of assessments will be accepted with a late penalty applied – you will lose 5% of the maximum mark for an assessment for each day late. After 5 days, you will automatically receive a zero for the assessment. More information can be found in the Unit Outline (check the Unit Information tile in the unit site).

Note that the presentations are to be completed during class time. If time runs out during week 12 for everyone to present in class, alternative times will be arranged – provided your poster is submitted before the Friday 12 due date, you will still be permitted to present. Presentations in week 13 may involve presenting to an audience of teaching staff as an alternative.