CC3501 Assignment 2 Task Sheet

James Cook University, 2024

Overview

You are to **design and build an embedded system** to produce a useful product. You are responsible for:

1. Identifying a problem that you wish to address and considering the broad context of how an engineering solution can contribute towards addressing this problem;
2. Designing the embedded system hardware and/or software, considering all important technical and non-technical constraints; and
3. Presenting your system to the class and evaluating its success.

In most cases, your final product will be based upon the dev board that you created in Assignment 1. For example, you might add a different kind of sensor, a motor control circuit, a radio interface, etc. However, some products will use the Raspberry Pi single board computer instead of a microcontroller, in which case you will be required to implement more sophisticated software. In general, the technical requirements are deliberately open-ended to give you realistic scope to implement an embedded system to address a particular need.

Several suggested projects are provided. You may adopt one of those or you may develop your own. Projects for a customer outside the CC3501 class will be highly regarded.

Proposing a custom project

You are free to propose your own project (or a variation of one of the suggested ones). Your proposal must be accepted by your lecturer as being of sufficient complexity for a third-year class. The suggested projects will give you some ideas of how complex your system should be. Typically, your product would be expected to demonstrate:

- The acquisition of data from sensors or communication interfaces, and/or
- The communication and cooperation of multiple devices, and/or
- Communication with an Internet-based service; and/or
- The use of persistent memory on board your device(s).

These requirements may be relaxed if there is a corresponding increase in complexity elsewhere in your design. If you have a project idea then please discuss it with your lecturer, because there is almost always a way to adapt your goal to the requirements of the class.

To propose a project, write an email to your lecturer that describes:

1. The problem you seek to address and/or the system you propose to build;
2. Who is the intended end user of your system; and
3. How that user would benefit and why your approach is suitable to address the problem.

Custom projects must be submitted on or before Friday of Week 4, with project allocations being released the following Monday at the latest. If you have not self-selected a project by this date then your task will be randomly allocated.

Agile project management

You are responsible for planning your work, monitoring progress, and updating the plan over time as the development process proceeds. Every design team is required to produce a project management plan where weekly tasks are identified and assigned to specific team members. It is completely

normal for the plan to change as the work proceeds. The goal is to be adaptable to new information that comes to light as you carry out the detailed design. The purpose of the plan is to quickly review your progress, identify whether you are on track to deliver the product on time, and assign responsibilities to specific team members for engineering work and peer review.

You are required to report on your progress on a weekly basis by sending an email to laurance.papale@jcu.edu.au by the close of business on Friday each week. There is a project management template provided for your use.

Technical design constraints

- If your project requires a microcontroller, you must use the RP2040.
- If your project requires a Linux single board computer, you must use the Raspberry Pi.
- Your hardware must be manufacturable at JLCPCB using the same process as Assignment 1. Typically, you will receive 5 fully manufactured copies of your design.
    - Exception: If justified by your specific project, you may order larger quantities of bare PCBs and solder the parts yourself. An example may be if you need many simple boards to string together a distributed wired sensor network. Talk to your lecturer about your options if you are considering this.

Conditions

You are to treat this as a genuine engineering project. You are responsible for the entire process from ideation to design to delivery of the prototype.

Your budget for PCB fabrication, BOM, and assembly is $USD 80. This is priced in USD because that the currency that JLCPCB uses for their orders. This budget covers the manufacturing of at least 5 boards, which is the minimum order quantity at JLCPCB. A larger order quantity is possible if required for your project, provided you stay within the budget. You are responsible for managing the cost of your design. You can control the cost by selecting “Basic Parts” from the JLCPCB catalogue, by minimising the number of components that you use, and by carefully evaluating alternative parts to choose the most cost-effective parts.

Through-hole components that we already have in stock in the workshop are not counted towards your budget. If JLCPCB do not have a suitable part for your design, and you have received permission from the lecturer, then you may ask your workshop technician to order parts from other suppliers. For example, you may need to source radio modules from elsewhere because the JLCPCB catalogue is quite limited. In that case you must solder those parts yourself.

Policy regarding the use of generative AI

You are allowed to use generative AI (such as Github Copilot, ChatGPT, etc). However, you take responsibility for the quality of the work that you submit. It is your responsibility to critically assess all parts of your design, and this is true regardless of whether you wrote a piece of code by hand, received AI assistance, and/or adapted code samples from elsewhere. Writing small snippets of code is not the key outcome of a third-year design project. You need to move up the scale of responsibility and consider how the overall design fits together, whether the architecture is appropriate given all the constraints and objectives of the project, and whether it even solves the right problem. Anyone can drive an AI tool, but a professional engineer is someone who can exercise genuine technical judgement. Use any and all tools but be careful about the limits of the technology and take professional responsibility for the entire system. Ultimately, what matters of the overall quality of the product you are building.

Technical report (strict limit: 3000 words)

Your group must submit a report detailing your designs and justifying your choices. There is a strict limit of 3000 words, but a good report is probably shorter than that. It is not sufficient to simply describe what you have done; instead, you must critically assess your design choices and make recommendations for a future engineer who might revise your work. The critical review of engineering projects is a key competency that you need to practice. You're encouraged to discuss with your lecturer or tutor.

In an Appendix (which is not counted in the word limit), you must include circuit schematic(s) and a reference for your communication protocol(s) and data format(s). The level of detail must be sufficient for someone else to design a system that could interoperate with yours.

Due Dates

Milestone	**Due date**
Identify problem to address	Any time before Friday Week 4
Submit weekly progress report using the template provided on LearnJCU	Every Friday from Week 5 – Week 13 inclusive
Suggested date to submit draft schematic for feedback	Week 8
Design review in class (based on your draft schematics)	Week 9 Lecture
Final hardware design submitted for manufacturing	Friday Week 9
Approximate date from which PCBs will be available for collection	Week 10 – 11
Software and documentation due; demonstration of final product	Final lab session in Week 13

Assessment Criteria

The **individual contribution** will be assessed every week based upon the weekly report that your group submits. You must ensure that your contributions are apparent in the weekly report so that you can receive an accurate score. Your final grade for the individual components will be the average over all the weeks that were assessed. If you were not able to properly contribute during a particular week, for example because of sickness or another legitimate reason, then inform your lecturer by emailing laurance.papale@jcu.edu.au and that week will be excluded from your average.

The **expected volume of work** for this subject in 10 hours per week. Therefore, after considering the rest of the subject, you should be averaging approximately 4 hours per week on the assignment.

The **group contribution** will be assessed at the end of the project based upon the final product, your demonstration of it, and the report that your group submits.

Component (weighting)	**High distinction (100% - 85%)**	**Distinction (85% - 75%)**	**Credit (75% - 65%)**	**Pass (65% - 50%)**	**Unsatisfactory (0%)**
Individual contribution. Assessed weekly based on the weekly report. Overall grade is the average over all weeks.					
Technical work (20%)	There is clear evidence of strong technical achievement in the relevant tasks that were completed this week. The engineering work is of a very high standard and is highly likely to be correct and appropriately balance all the relevant trade-offs. The work is clearly done in a way that contributes to the effective functioning of the team. There is evidence of leadership (when appropriate) and allowing others to lead (when appropriate).	There is evidence of strong technical achievement in the relevant tasks that were completed this week. The engineering work is of a high standard and may have only occasional issues or may not consider every trade-off. The work is done in a way that contributes to the effective functioning of the team. There is evidence of leadership (when appropriate) and allowing others to lead (when appropriate).	There is evidence of good technical achievement in the relevant tasks that were completed this week. The engineering work is likely to substantially contribute to the overall project, although it may require some revisions. There is evidence of effective team membership.	The technical work this week will contribute towards the overall project.	The student was not adequately engaged in the project.
Peer review (20%)	The peer review of another student's work produced high quality feedback to improve the overall project. The feedback is highly technically correct, shows excellent engineering judgement, and is presented in a way that supports the team member.	The peer review of another student's work produced good quality feedback to improve the overall project. The feedback is technically correct, generally shows good engineering judgement, and is presented in a way that supports the team member.	The peer review of another student's work produced useful feedback to improve the overall project. The feedback shows good judgement and is presented in an appropriate way.	The peer review of another student's work produced useful feedback that will improve the overall project.	There was inadequate engagement with peer review.

Component (weighting)	High distinction (100% - 85%)	Distinction (85% - 75%)	Credit (75% - 65%)	Pass (65% - 50%)	Unsatisfactory (0%)
Group contribution. Assessed on the basis of the final product.					
Product (30%)	The overall system is of a highly professional standard. It competently achieves its objectives, implements advanced functionality where appropriate, works effectively and reliably, and is easy to use.	The overall system is of a professional standard. It achieves its objectives, works effectively, and is generally easy to use.	The overall system is mostly of a professional standard. Its objectives are generally met and the system is functional.	The overall system meets most of its requirements, but there are some issues with reliability, functionality, and/or ease of use.	The system is not functional or does not satisfy the requirements of the task.
Technical report (30%)	The documentation is clear and easy to read. The technical report justifies the design choices very well and shows an excellent level of technical judgement and critical thinking. The document is of a professional appearance and is written in correct Australian English.	The documentation is mostly clear and easy to read. The technical report gives appropriate justifications and shows reasonable judgement and critical thinking. The document is of a professional appearance and has only minor or occasional errors in spelling and grammar.	The report gives appropriate justifications but may be lacking in overall judgement and criticality. There are only minor errors in spelling and grammar.	The documentation is sufficient to explain the design and its operation. There are only minor errors in spelling and grammar.	The documentation fails to explain the design or is unprofessional in appearance or style.