Learn-Design-Implement (LDI) Project [5 weeks]

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Project Objectives and ILOs

This project has multiple objectives as listed below. Although you will (in most cases) work as a team*, your work will be evaluated individually using rubrics that are based on these broad objectives and intended learning outcomes*. Therefore, you must understand the objectives and ILOs below.

Objectives

1. **Learn:** The first goal of this project is to teach you a deeper understanding of modern communication networks within the scope of. In this project, you will explore connections between these topics, their theoretical background, and how they are applied to practical problems.

2. **Design:** The second goal of the project is to teach you how to design engineering solutions using the methods you have learned, measure success, iterate designs, and explain your design choices.

3. **Implement:** The third goal of the project is to make you take initiative in your learning. Specifically, acquiring necessary tools (data, software), scoping a feasible plan, and productively managing the time to implement your engineering solutions to realise your designs.

4. **Present**: The fourth goal of the project is to let you practice communicating what you have done and why using various methods such as answering questions about the project and writing a proper project report.

Intended Learning Outcomes

- Learning theoretical topics, abstraction, architectures, and algorithms relevant to modern communication networks.
- Learning practical skills on how to implement engineering solutions and how to connect theory with practice.
- Learning how to design a solution, measure outcomes, iterate design as needed, make informed design choices, and provide engineering justifications for them.
- Learning soft skills such as project planning, time management, and teamwork.
- Learning how to present your work in different formats and answer relevant questions.

Project Scope

- You are expected to use and emphasise the methods and topics covered in ELEN90061. The goal is to learn/practice these topics. Alternative solutions from beyond the scope of ELEN90061, irrelevant to the subject, will not get marks even if they work well in practice.
- You are expected to take initiative. This is your project. You decide what to do and how as long as they are aligned with objectives and ILOs.
- The project application area is not that important; it is there for motivation and in alignment with your other interests. Groups doing a project in Area A are not advantaged or disadvantaged over Area B in any way.
- You are not expected to come up with novel or fully complete solutions to big problems. This is only a 5-week student learning project, <u>not</u> a capstone or MPhil/Ph.D. thesis.
- You are encouraged to seek help from your demonstrators and instructor. **You have to discuss the broad project plan with your instructor and receive feedback before starting.**

Project Tasks and Suggested Timeline

Each project will have an overarching theme or area. *We will provide you with specific choices*, e.g., routing on GNS3, client-server communications *and* respective *starter kits*. Those who wish to propose their own theme should talk to the instructor <u>before the project starts</u>.

Given the limited time (5 weeks), you are expected to carefully scope your project following the recommendations below. **Priority should be given to learning**. This is not a capstone and the goal here is <u>not</u> achieving the big goal (e.g. creating a fully working autonomous driving solution). The goal is to learn/apply ELEN90061 topics as much as possible under the umbrella theme. A working solution does not guarantee and may not even lead to full marks.

Methodology

1. Within the scope of the chosen topic, the project should design and implement at least one communication network system.
2. Each project should create its *unique* architecture and/or implementation in suggested simulation or software environments.
3. Given the chosen system, you should implement multiple alternative solutions (architectures), and then compare, contrast, and discuss them.
4. Projects should clearly explain the design process and how design objectives/constraints shape the specific problem formulations.
5. Projects should compare/contrast approaches, and methods and discuss outcomes (metrics, solutions) using ELEN90061 knowledge.
6. Self-proposed projects beyond the given options with *starter kits* are welcome as long as the students intending to do that contact the instructor as early as possible. If you are late, then

you have to work on a standard project. *As you can imagine, self-proposed projects often mean more work because you will effectively create your starter kit!*

Suggested Timeline

Week	Tasks	Achieve
before	• Choose a project and discuss it with the instructor and/or demonstrators	• The project was chosen by Week 1 of the project workshop.
1	• Setup relevant simulator or environment • Scoping and formulation of tasks	• Setup completed. • Initial project scoping
2	• Design your approach and problem formulation for the chosen task. • Implement the initial solution. • Plan your report	• Create a basic working solution. • Initial results • Report skeleton (section headers)
3	• Design your approach and problem formulation. • Try at least two variants, compare and contrast. • Continue documenting your progress	• Further results • Some result graphs/tables within the report
4	• Iterate your designs. • Preliminary report progress	• Additional results • Preliminary report almost ready.
5	• Discuss problems, designs, and results. • Clarify the theory-practice connections. • Enough results for the draft report	• Complete and submit a draft report

Project Deliverables

- By the end of Week 12 (see announcements on Canvas)
  - Draft report plus initial code
- During the Final Exam in Week 1 (see announcements on Canvas)
  - Q&A session and oral exam
- End of the Final Exam Week 2 (see announcements on Canvas)
  - Full project report and project code

Guidelines for Deliverables

Here are basic guidelines regarding what is expected in the deliverables. *We will also create and disseminate specific rubrics in alignment with these guidelines*.

- **Presentation slides**: at most 10 slides in total, at least 6 content slides (other than the title, table of contents, thanks, intermediate title etc.) summarising the project and showing initial/partial results. *The idea is to use these slides as notes/cue cards summarising what you have done as part of the Oral Exam Q&A.* **You will not present these slides, they will be only used as part of Q&A.**

- **Draft report**: around 4 pages per student excluding title, references, and table of contents. The full report structure as (sub)section headers should be included even if some sections are empty. *The goal is to structure your report properly and give you some feedback for the final report. It can be incomplete with content in some sections missing. Initial results/graphs/tables are encouraged. An introduction and overview of the project should be there.*

- **Initial project code**: This can be a work in progress but still should be structured and commented on to some extent. Code can be in the form of a Jupyter notebook with text sections briefly explaining it or a zip file containing Python scripts along with a brief README explaining which script is doing what.
  This submission will allow us to provide you with feedback and suggestions.

- **Full project report**: at most 10 pages per student including everything, i.e. 20 pages for a group of 2 and 30 pages for groups of 3. You should identify who has written which parts in section headers. The report should be written in clear language, present the project results, discuss ELEN90061 topics, and follow the best practices. A report structure and content suggestions will be provided.

- **Final project code:** This will be integral to the report and follow the same guidelines as the initial report. Projects without code will receive zero marks.

- **Oral Examination:** approximately 5 minutes per student in the form of Q&A led by the instructor. **You will not present your slides; they will be only used as part of Q&A (like notes or cue cards).**

- Please focus on the actual tasks, design, implementation, and results of the project. Specific rubrics will be provided in Canvas.

Suggested Report Structure

- Introduction (10-20% of page allocation)
    - Overview and background (especially relevant for self-proposed projects, otherwise keep short)
    - Project scope and tasks (important to clarify at a high level!)
- Problem, Design, Results, and Discussion (60-80% of page allocation)
    - Problem formulation
    - Solution design process (objective, constraints)
    - Theory section (explain the theoretical background of the solution method used in the project)
    - Results and discussion
- Conclusion (10-20% of page allocation)
    - Reflection and broad discussion
    - Future directions that immediately follow from the project (e.g., tasks for which you did not have time)
- References
    - Practice best practices in this important area!

Special Remarks for PhD Students

If you are a PhD student and formally enrolled to the subject, you are:

1. encouraged to work alone on standard projects,
2. very welcome to design a project aligned with your PhD topics (as long as the project satisfies the principles described) and work on it alone. *Please contact the instructor as early as possible on this.*

Note that, these are for fairness purposes (a group with a PhD student has an unfair advantage). Moreover, only pass/fail matters for PhD students because they don't have a reported WAM/GPA in their studies.