

Electronics II (MATR335) 2024 – Final project instructions

1 Deadlines

Deadlines related to the final project can be found on the course page.

<https://electronics.physics.helsinki.fi/teaching/electronics-ii-2024>

2 Description

In the final project you are to create your own IoT device. The only hard requirement for the device is that it should communicate something wirelessly. Try to come up with something that you would use/improve after the course. Each group gets an 80 € allowance to order any parts not found in the Arduino kits.

Keep track of your time usage, send it weekly to Petteri and compile a complete logbook for the final documentation. Tracking exercise time is not required, but if you do, keep it separate from the time used for the final project. Tip: Excel is good for this.

The project is divided to three parts: Planning, Demo and Final documentation.

3 Planning

There are “checkpoints” in the planning phase to help you spread the workload over the course. Return the reports as a PDF file. Attach non-PDF files as a zipped file.

Preliminary plan

Should include problem specifications, design specifications, a testing plan, and components that need to be ordered. Problem specifications should explain the problem to be solved with the project. Design specifications should explain what kind of functionality will be needed and how it will be implemented.

Testing plan covers what functionality of the device must be tested, in what way, and what is the expected result. Following the testing plan should ensure that your device functions properly during normal usage and edge cases. Identifying maximum/minimum usage cases of your device will help compiling documentation and presentation materials.

You should compile a list of components you need. See below for instructions. You can also include the parts you already have but remember to mark them clearly (don't include a link).

The plan should be about one page long, excluding the component list and figures. Include an annotated block diagram of the device and a flowchart of the code.

Ordering components Electrical components are ordered from [farnell.com](https://www.farnell.com). Other components, such as crafts supplies can be ordered from any supplier. Make sure that your products are not out of stock. Shipping doesn't need to be included unless it's reasonable to believe that no one else will order from the same supplier. This applies mainly to specialized products produced by small companies to niche applications.

Components are ordered for you based on the list you attach to the preliminary plan. For each component you should include the link to the component, their prices, and how many of them are needed (including spares). If Farnell doesn't have what you need and no alternatives are available, you can also use other sites ([mouser.com](https://www.mouser.com), [digikey.fi](https://www.digikey.fi)).

Tip: DigiKey has good search capabilities. You can narrow your search there and then search for the exact parts from Farnell. Remember to select "In stock" .

If you have problems finding what you need or have some other component-related problem before or after this plan, please contact the course assistants as soon as possible. Remember to include detailed specifications on what you need, so we can help you better. The assistants will contact you if changes need to be done to your order. To simplify processing the orders, if we find a Farnell alternative to your non-Farnell component, we will contact you to ensure it suits your needs and change your order if it does. Similarly, we may group non-electronic components to a single supplier. We will also inform you if over- or underestimated your budget.

"Version 0"

You are expected to have at least started to work on the critical features.

Submit a report of your progress and possible problems with some figures of the setup. The figures should include circuit diagrams, flowcharts, and a clear photo of the setup. The report should be about one page long, excluding figures.

At this point the weekly exercises have ended but the exercise sessions will still be held to help you with your projects. Consider attending even if you have no immediate problems. You can discuss ideas and solutions with other groups and the course assistants. The course assistants may be able to provide tools and inexpensive materials (contact in advance).

"Version 1"

You are expected to have the minimum viable product (MVP) mostly working. Try to have your device in such shape that you could get a passing grade (working device, IoT implemented) at this point.

Once again, you should submit a report of your progress (and possible problems) with some pictures of the setup. The report should be about one page long, excluding figures.

Demo rehearsal

There will be a demo rehearsal with the course assistants. The demo presentation should be prepared according to the "Demo" section below. The purpose of this rehearsal is to ensure each group has a passable demo prepared, and to give feedback on the presentations. **Be on time! The schedule will be tight.**

Present with the materials you intend to use during your demo (slides, video etc.). If your device is still in progress, present your current setup and use placeholder figures where necessary.

The presentation should include short technical specs and "marketing material" to showcase the features and convince the audience of your solution. Compare with commercial products if possible. Calculate how many devices you would need to sell to "break even" with the work hours you used. Keep this as an extra slide.

There are no limits to the length of the materials other than the demo time limit. The materials should complement the live demo without exceeding the time limit given to you.

Final presentation materials

The final materials (slides, video etc.) you intend to use during your demo. You can make changes to the materials after submitting them, but the materials you submit should be presentable as is. These materials will be used in case of technical difficulties.

4 Demo

A working demo is required to pass the course. Structure your work so that you have a fallback if something goes wrong or is too hard to implement.

The demo session is held in person at the university. Each group has 25-30 minutes to present their project and answer questions regarding the project. The demo should contain these parts in the following order:

- Marketing: Present your device and convince the audience that your device is worth buying (e.g. 5 min).
- Technical: Present the technical aspects of your project in detail (e.g. 5 min).
- Demo: Practical demonstration of your project. Interactive if possible (e.g. 10 min).
- Sales: Short session where you sell your device to your peers and answer questions. Reserve 5 minutes for this.

Rehearse your demo and ensure you don't exceed the time limit. A slightly short demo is better than going overtime.

Have your device assembled and tested before the start of the demo session. Consider transporting the device in one piece. If your device can't be used in the classroom for some reason, show what you can in person and use a video to show the device in action. **A working demo must be presented to pass the course.**

5 Final documentation

This report should cover critical parts of the hardware and the software implementation.

Explain what physical parts and software blocks you are using and why. If you use 3rd party libraries, briefly explain what they do and why you decided to use them.

The documentation should contain enough information so that someone could build a similar device based on the documentation.

Include the (commented) source code of your project as a zip file. Remember to remove sensitive information like passwords. You can include some commented snippets or pseudocode to the report itself to aid writing.

The report should also include a [contributions matrix](#) and a complete work log (weekly hours + cumulative).

This report doesn't have a length limit. Include everything relevant but be concise.

6 Grading criteria

The final project equals a total of 50 % of the course grade. The final project consists of a demo (25 %), final documentation (15 %), and meeting deadlines (10 %) (total course grade percentages).

In addition to the larger checkpoints, a weekly report is to be sent. **The first missed report results in a warning.** Missing a report after the warning causes a course grade deduction of 5 % for each of the reports missed. For example, if the course grade before deductions is 60 %, missing three reports after the warning results in a course grade of 45 %.

NB: Other reports do not replace the weekly report.

Planning

The checkpoints listed below are graded as pass/fail and affect the "deadline" grade of the final project equally. A passing grade is awarded for submission before the respective deadlines. Returning all reports before the final documentation deadline is mandatory for passing the course.

- Preliminary plan
- Version 0
- Version 1
- Presentation materials, first draft
- Demo rehearsal
- Presentation materials, final version

Demo & documentation

A working demo must be presented to pass the course. The demo and the final documentation are graded separately with the following criteria. The deadlines are non-negotiable.

Demo

- Cleanliness/Clarity 4x(2-0) p
- Correctness 3x(2-0) p
- "Coolness" 2x(1-0) p
- Difficulty 1x(2-0) p

Final documentation

- Cleanliness/Clarity 4x(2-0) p
- Correctness 3x(2-0) p
- Difficulty 1x(2-0) p

7 Project ideas

- Cameras (CCD, CMOS, IR)
- Tracker (GPS)
- Encoders/decoders
- FPGA-based monitoring
- GPS in general
- Accelerometers (for boxing)
- Games
- Batteries