Radio Frequency project – 5MEO

Description

The project is a PCB design of a RF solution with some basic functionalities, all together should be working or proved to be well designed. The proof of concept (POC) specifications have been realized in collaboration with the company named Goéland.
https://www.goeland-tech.com/

As the POC aims to be an industrial product, you will be expected to describe your product in a similar way of a development board (datasheet, specification and/or tutorials) as well as RF characterizations and test for the antenna. The hardware and software will be **provided** and **tested** to proof the good working principle.

The theoretical aspect the most expected are the antenna design, simulation, implementation and characterization.

Basic software are required but not graded.

AI tools can be used, however be sure of the information's/code/answer provided. As reminder, any information that is settle as a knowledge has to be cited correctly and jutified.

Every Lab session will start with a client-developer meeting of 10 minutes where you explain your choices and advanced in the development. (grades 5 out 20)

Specification

- 2 * FR4 PCB with 2 Layers fabricated with the rules of JLCPCB[1] - One PCB for the Antenna and one PCB for the embedded solution.
- MAX size JLCPCB 10x10cm
- PCB antenna matching 868Mhz (Lora frequency)
- GPS capabilities
- Wifi/BLE communication (antenna provided)

[1] https://github.com/labtroll/KiCad-DesignRules

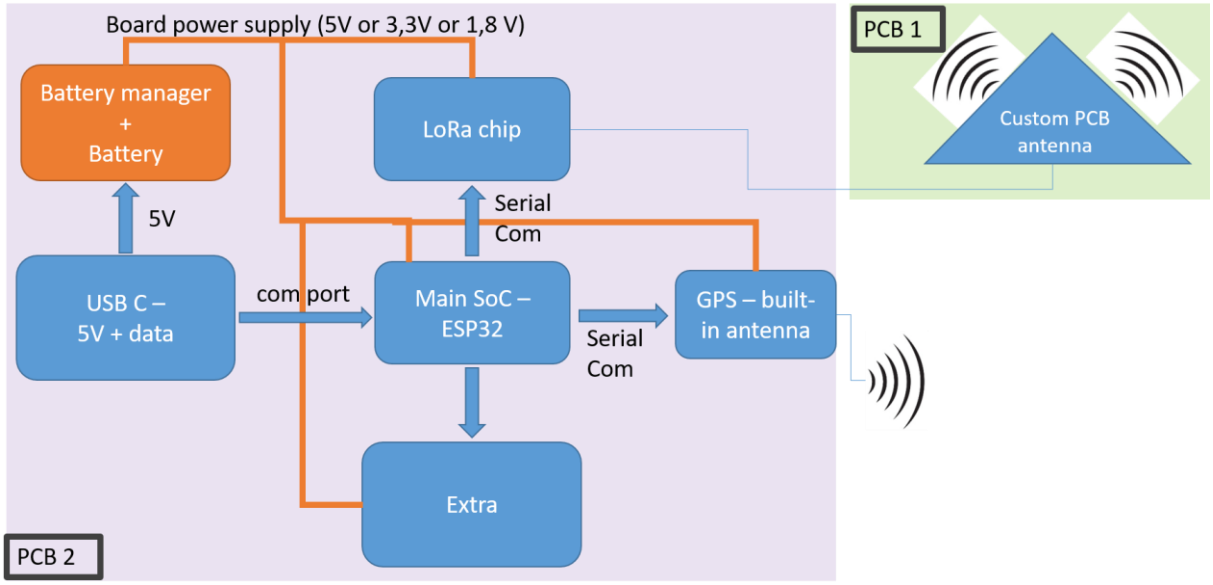
Tools and software

As part of industrial process, you will use Kicad[2] to design the board (similar to Altium but with some differences)

The design, the simulation of the antenna and the transmission line can be performed with OpenEMS, Qucs (opensource version of the UCL Lab software). The PCB static rf characteristics will be performed with other open source tool for EMI/CEM.
Some lab session (phase 2) will be focusing on it with tutorials to help you designing the antenna and (phase 4) for the EMI/CEM simulation.

Minimum BOM and basic block diagram

- GPS - AM-M8Q-0
- ESP32 (S6 or C3)
- Lora Module RFM95 (868 MHz - without antenna, to be designed)
- Battery Power management 2S – BQ 25798
- USBC charging and programming pin
- SMA for custom antenna (868 MHz)



[2] https://www.kicad.org/

Journal Log

In a shared word and drive Files, you will keep track of your implementation, screenshot and testing, this will be the base of discussion at each session and will be graded continuously. A good quality report will make the difference. Start early to have less work at the end of the semester.

Schedule

- Phase 1: PCB Implementation (+ fabrication) – (W2 to W5 due date - Sunday 19th October)

  Expected work : PCB with given specification

- Phase 2: Software and Lab concept (W6, due date – Sunday 26th October)

  Expected work : Training output + antenna choice

- Phase 3: Simulation and Antenna implementation (+ fabrication with CNC) (W7 to W9, due date – Sunday 23th November)

  Expected work : designing and simulate a PCB antenna for LoRa Network

- Phase 4: Protocol and implementation of HW and SW Testing (dev board available), antenna characterization, additional simulation for extra demonstration or improvement. (W9 to 10 due date – 30th November)

  Expected work : Test protocol, PCB EMI/CEM simulation, antenna pre-analysis, pre-software implementation.

- Phase 5: Implementation of HW and SW Testing on the POC, antenna characterization, additional simulation for extra demonstration or improvement. (W10 to 12 due date -14th December)

  Expected work : Test on with instrument (VNA, spectrum, oscilloscope), integrated software validation.

- Phase 6: Oral exam 18th December – 30 minutes discussion with the company and explaining your final product, how it works and all the validated tests. More informations coming.

  Expected work : Presentation and report based on your LOG.

Grading:

- 5 out of 20 for continuous work and lab meeting (0 , 0.5 or 1 grade given at the end of each phase of work)
- 5 out of 20 for working PCB
- 5 out of 20 for Antenna PCB and simulation
- 5 out of 20 for final oral exam

Groupe size:

Two to three students per group.

S.L.O:

Cfr plus.ecam.be

Extra Software:

https://www.broadcom.com/info/wireless/appcad

https://docs.openems.de/index.html

https://www.freecad.org/

https://octave.org/

https://qucsstudio.de/