Design Thinking and Electronic Prototyping

Week 5

Aalto University
School of Electrical
Engineering

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Project

Today (6.10.):

- Reflecting on experiences with users (storyboards/posters)
- Figuring out the overall system structure
- Sketching/mocking up and **iterative** modelling of the form
- Planning the project

In 1 week (13.10.):

Project Plan

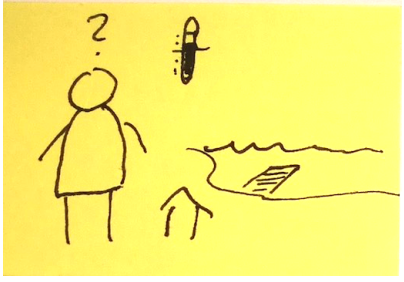
In 8 weeks (1.12):

Project Results with Prototype Demo

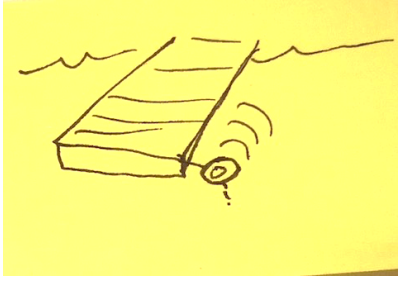
Experiences with Users?

Figuring out the overall system components

What functionalities/features?

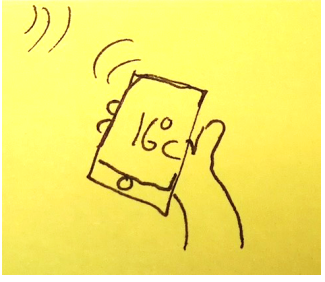


The owner of a summer cabin at a lake, Petra, wants to go swimming. She wants to know, before leaving home, how cold the water is.



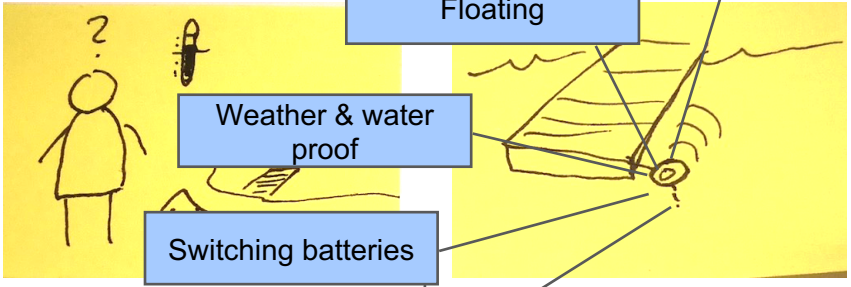
She has a wireless thermometer attached to her dock that measures water temperature.

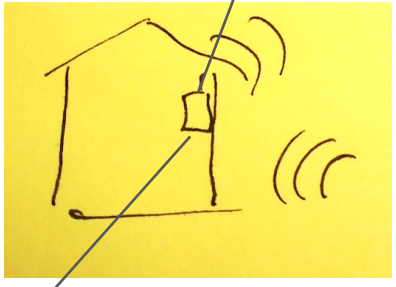
The wireless thermometer sends the temperature data to internet service once a day.

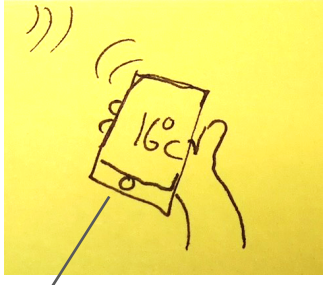


Petra can see the lake temperature on her mobile phone.

What functionalities/features?



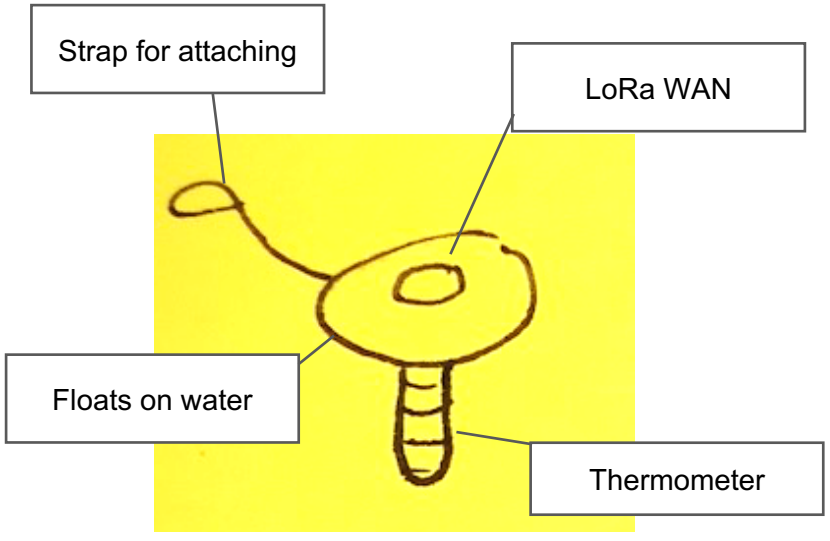




- Attaching
- Floating
- Weather & water proof
- Switching batteries
- Powering on/off
- Indicating that power is on/off
- Computer connection & admin interface needed!
- Metering the temperature
- Connecting to router (LoRaWAN)
- Indicating that connection ok/not
- Mounting
- Connecting to internet
- Setting up access point
- Computer & admin interface needed
- Installing the app
- Creating an account
- Connecting to user's account
- Showing the measurements

Poster

Wireless Remote Water Thermometer



Safe to use
2 x AA battery
Batterylife up to
3 years

Cloud service
(0.99 €/month)

Free Mobile App

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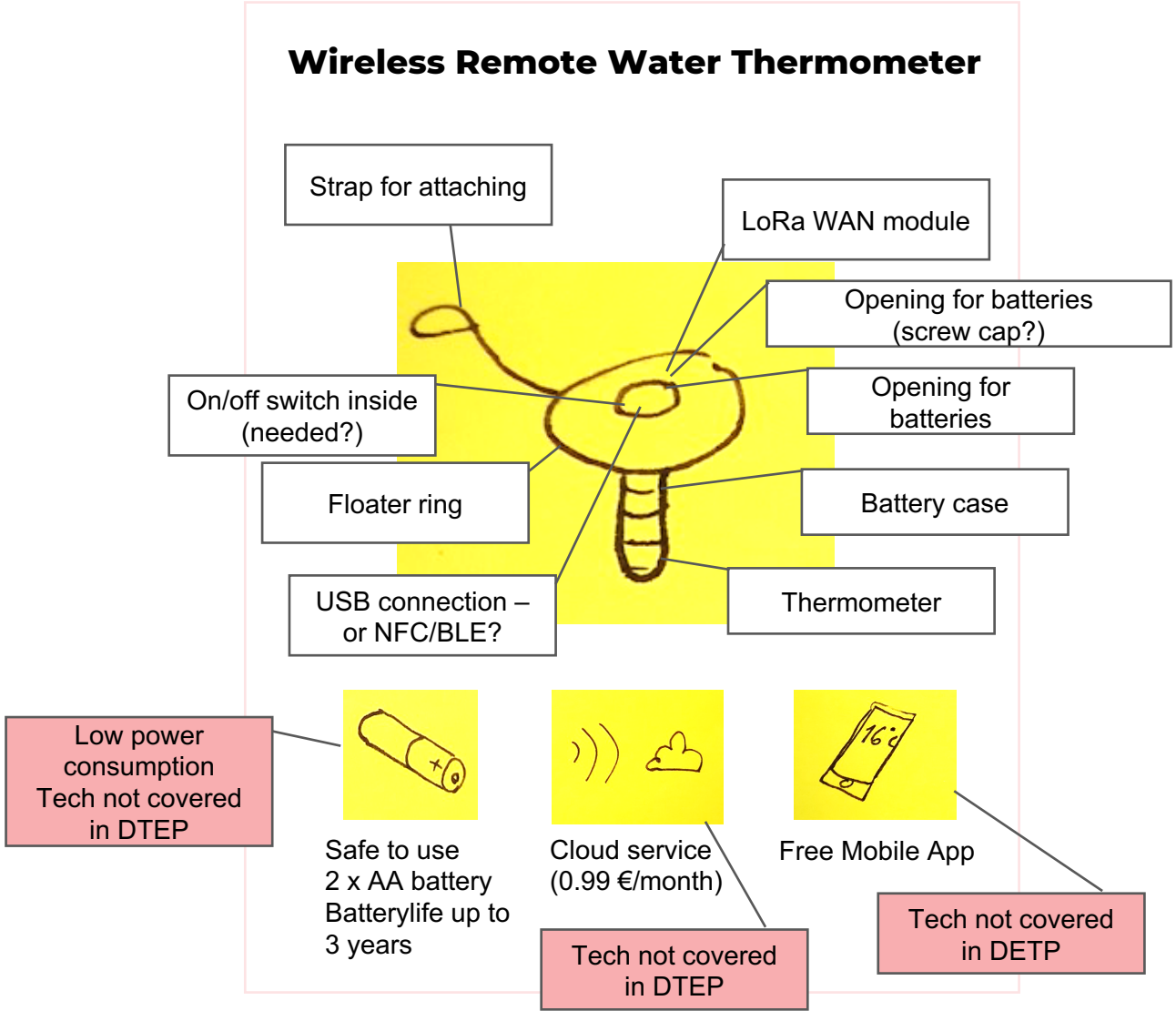
Poster



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Two ways to create the plan

- **Full plan**
  - Basically you need to know almost ***all that you are building*** when you do the plan!

- **Iterative plan (agile)**
  - Planning to ***grow*** your prototype, rather than finish at once
  - Functions and features are added incrementally

Project planning

Finished Prototype

1. Proto V1 (in 2 weeks)
    1. Read temp
    2. Connect to WiFi
    3. Send temp 1 value / 10 sec
    4. Setup server + websocket
    5. Setup app with websocket
    6. Display raw numbers from socket
2. Proto V2 (in 4 weeks)
    1. …

WBS – Work Breakdown Structure

Finished Prototype (100%)

1. Electronics (15%)
   1. Getting LoRa module (Arduino MKR?)
   2. Building the temp reading
   3. …
2. Protocols/connectivity (20%)
   1. Studying LoRa connectivity
   2. Stydying BLE / NFC
3. Programming (40%)
   1. LoRa connection – setup
4. Physical casing (10%)
   1. Floater design
   2. Screw cap + container design

Sketching

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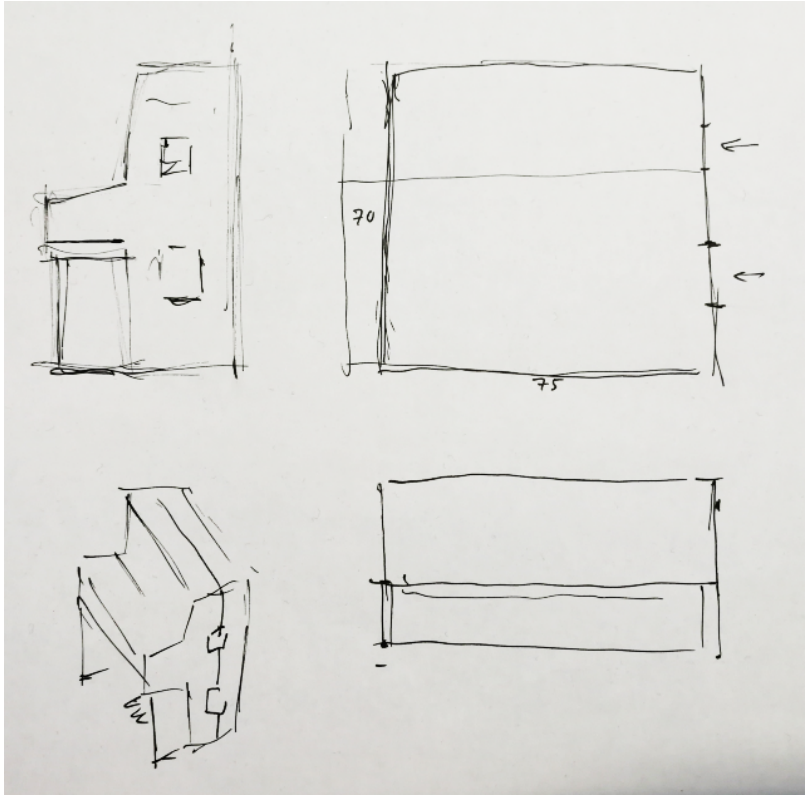
3D sketching (front, side, top) – 1:1

Create a sketch of **your prototype** to scale (1:1)

- Side, front, top, 3D
- Include all the technical components (circuit boards, motors, sensors, etc.)

If your project idea is not that physical, you can sketch out a LED-illuminated soap holder for your bathroom

- There is a sensor to detect if soap is there



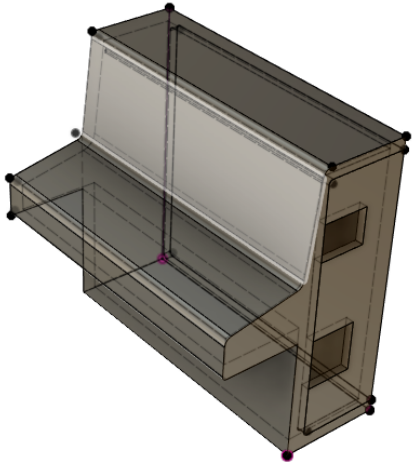
Mocking up

Create a 1:1 mock-up of your idea

Be extremely careful with the knives!

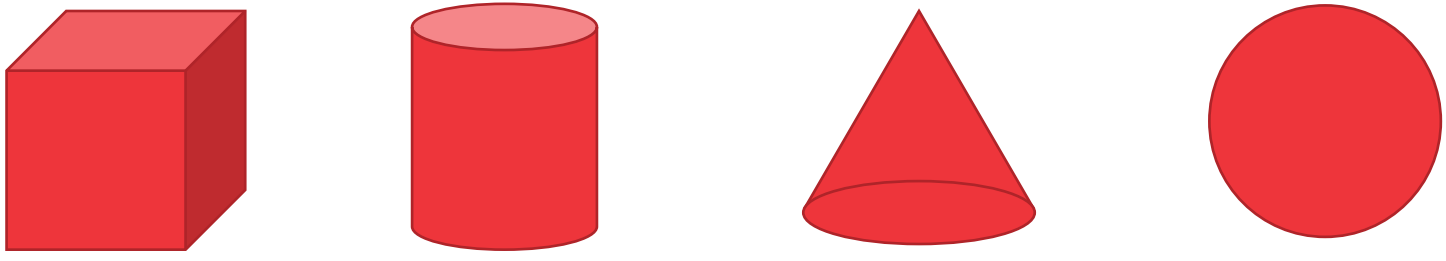
From Cardboard to 3D

- **Cardboard model can serve as a good basis for 3D modelling**
- **With a cardboard model you will learn how the scale of the design feels, and how the technical components fit inside**
    - Also where the holes and cuts should be

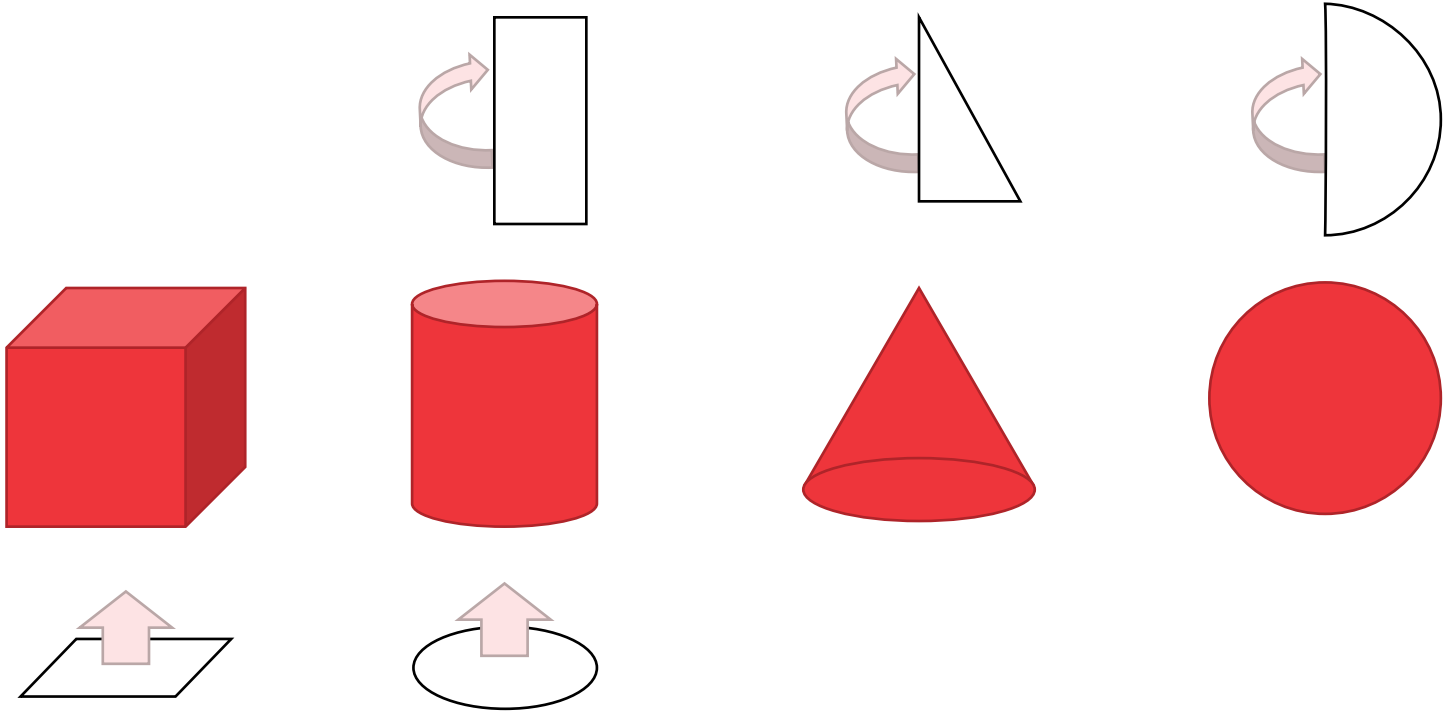


Seeing ‘primitives’ in objects

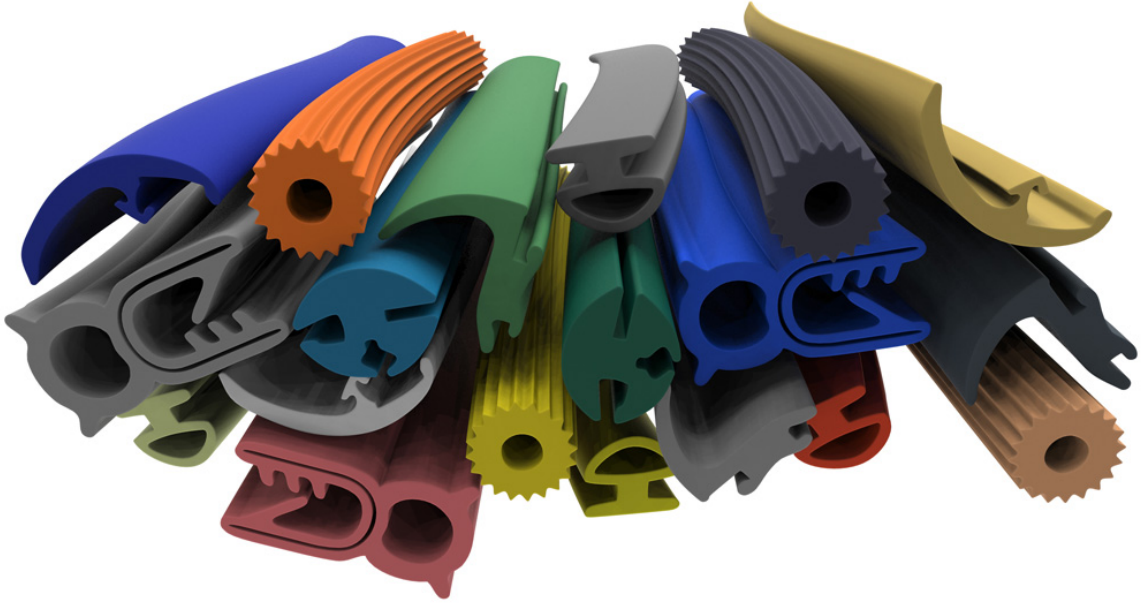
- **Many objects can be seen as a combination of primitive forms: boxes, cylinders, cones, and balls**



All these shapes can be created also by extruding or rotating

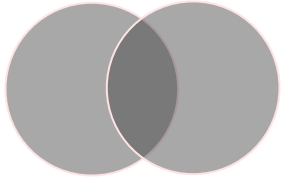


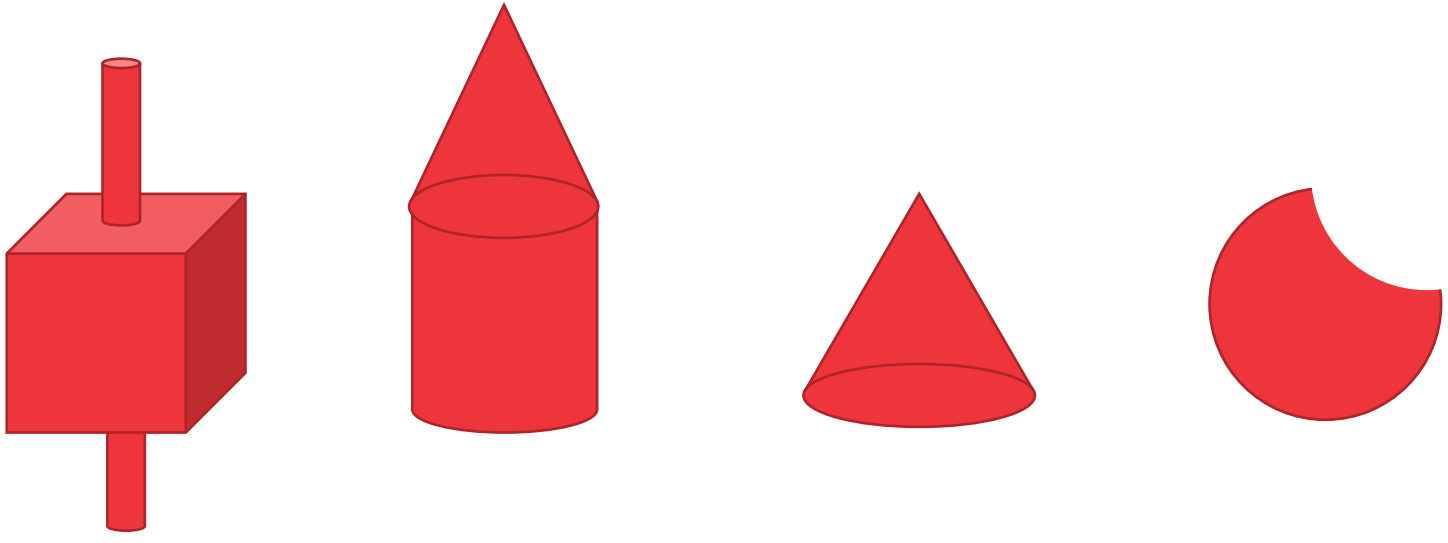
Extruding a figure makes an interesting shape



More complex shapes can be done with Boolean operations

- Join, cut, intersect





Project planning

1. **Goal**
    1. What are you trying to create
2. **Tasks**
    1. What functionalities/features/components you plan to create
    2. Which activities are necessary to get to your result
    3. Remember – time is needed for exploring, integrating and testing!
3. **Resources**
    1. Who is available, for how many hours, and when
    2. Who will be in Finland - when
4. **Schedule**
    1. Add key milestones (internal project goals / iteration)

This week's tasks

1. **Diary + PROJECT PLAN – Deadline on Monday at 10 AM**
2. **Reading: Chapter 3 – until p. 105**
   - Knowledge in the Head and in the World
     - Precise Behavior from Imprecise Knowledge
     - Memory Is Knowledge in the Head
     - The Structure of Memory
     - Approximate Models
3. **Exercises**
   06. UART bus
4. **Project**
   - Make the project plan