Design Thinking and Advanced Prototyping

ELEC-C9821 – Framing and Idea Screening

Aalto University
School of Electrical
Engineering

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8.2.2023

Today’s agenda

09:15 - 10 Lecture

1. Foundations of identifying good ideas
2. Defining learning goals and requirements for prototypes

10:15 - 12 Workshop

3. Teamwork: Present your three ideas
4. Discussion

Learning goals

- **Learn the criteria for the early screening of ideas in order to find the best ones**
- **Learn to set your learning goals for your first prototype**

How do I recognize a good idea

It is about judgment:

How can you judge an idea?

What enables you to say that an idea is ‘good’?

What does it even mean than an idea is ‘good’?

Varieties of Goodness

Utilitarian goodness	**- Getting something done**
Instrumental goodness	**- Getting something done well**
Medical goodness	**- Being safe and healthy**
Hedonic goodness	**- Feeling good**
Technical goodness	**- Performing well**
Good of man	**- Wellbeing and happiness**

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von Wright, G. H. (1963). *The Varieties of Goodness*. Routledge.

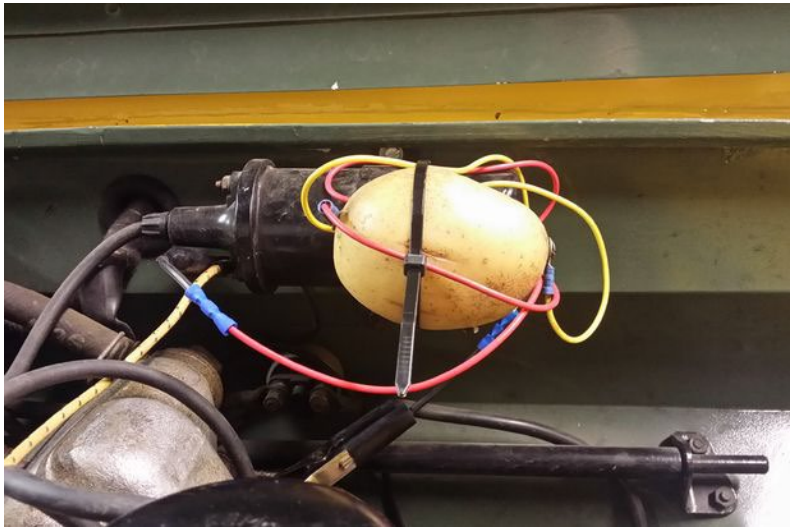
Goodness	Relative to	Context	What is 'good'
Utilitarian	Desired end of action	Task	Useful (yes/no)
Instrumental	Desired end of action	Task	Serving well
Technical	Requirements, competition	Activity	Excelling
Medical	Health, normalcy	Activity	Beneficial, not harmful
Hedonic	Pleasure, pain	Experience	Pleasure
Good of Human	Welfare	Life	Happiness and wellbeing

Table 1. Summary of the varieties of goodness.

Ylirisku, S., & Arvola, M. (2018). Varieties of Goodness in Design. In P. Vermaas & S. Vial (Eds.), *Philosophy of Design: An Exploration* (pp. 51–70). Springer.

Images of utilitarian goodness

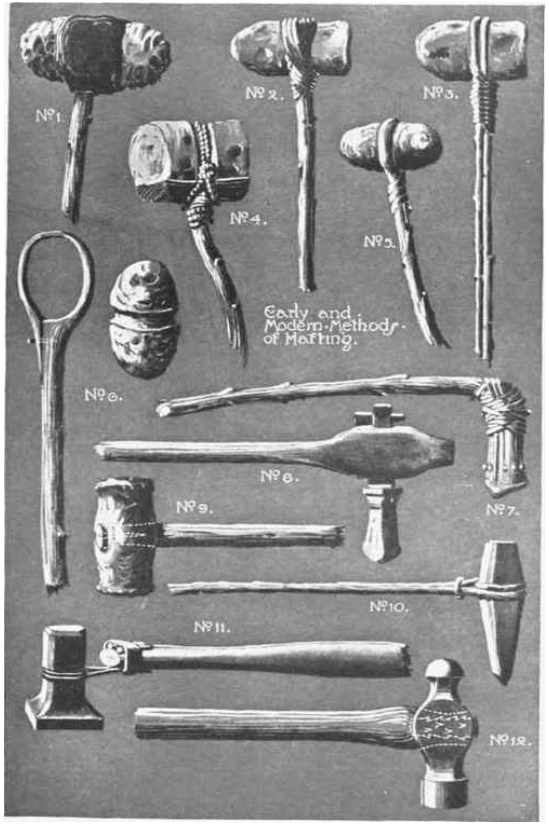
Starting a car with a potato



https://www.mirror.co.uk/news/weird-news/aa-mechanic-fixes-car-potato-5193266

Images of instrumental goodness

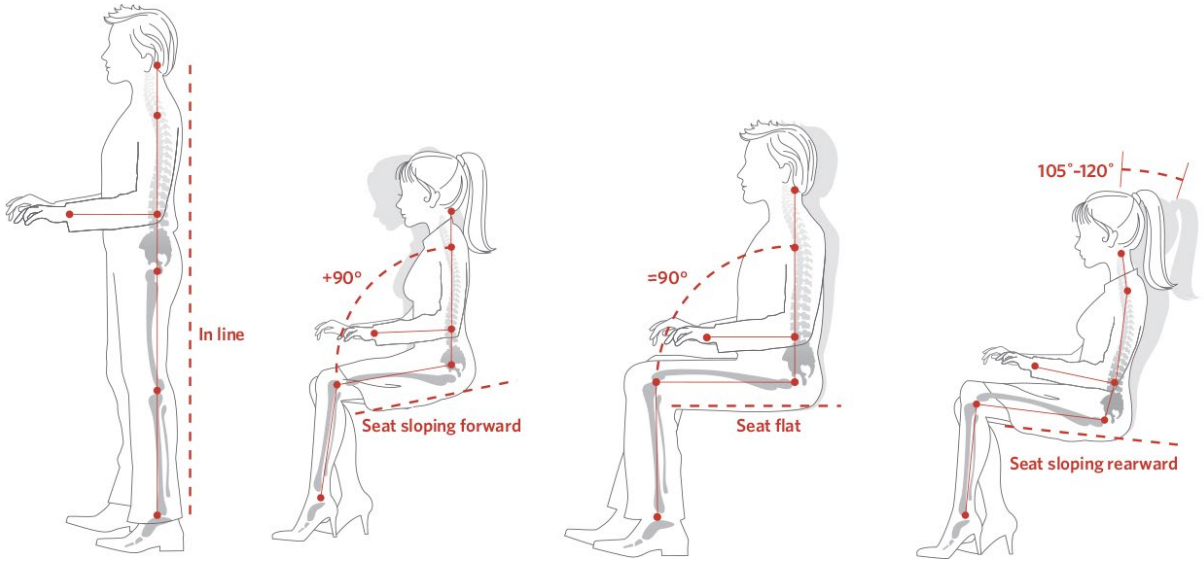
Evolution of the hammer



https://chestofbooks.com/home-improvement/woodworking/Handcraft-in-Wood-And-Metal/The-Evolution-Of-The-Hammer.html

Images of medical goodness

Adjustable Sit Stand Desks



https://workriteergo.com/ergonomics-research/

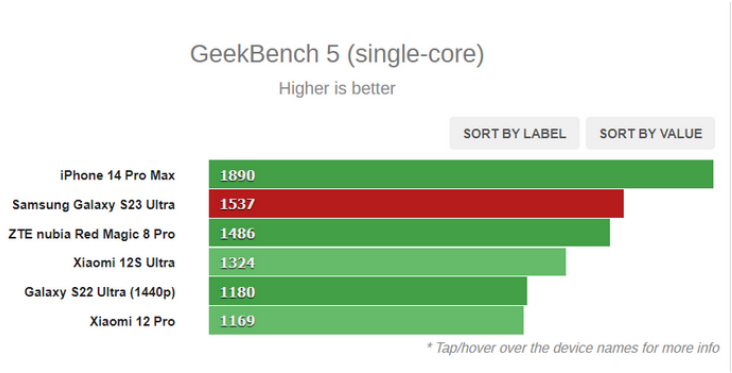
Images of hedonic goodness

Varieties of coffees

https://i.redd.it/4srd5kjvlib31.jpg

Images of technical goodness

Domain-specific performance



https://i.teknolojioku.com/2/727/348/storage/files/images/2023/02/06/1-2Jt9.png

EVGA INTERNATIONAL CO.,LTD Default string

Single-Core Score	Multi-Core Score
5773	24260

Geekbench 4.1.1 for Windows x86 (64-bit)

Result Information

Upload Date	September 08 2017 08:43 AM
Views	3090

System Information

	EVGA INTERNATIONAL CO.,LTD Default string
Operating System	Microsoft Windows 10 Pro (64-bit)
Model	EVGA INTERNATIONAL CO.,LTD Default string
Processor	Intel Core i7-8700K @ 3.70 GHz 1 processor, 6 cores, 12 threads
Processor ID	GenuineIntel Family 6 Model 158 Stepping 10
Processor Codename	Coffee Lake
Processor Package	Socket 1151 LGA
L1 Instruction Cache	32 KB x 6
L1 Data Cache	32 KB x 6
L2 Cache	256 KB x 6
L3 Cache	12288 KB
Motherboard	EVGA INTERNATIONAL CO.,LTD 121-KS-E375
Northbridge	Intel Coffee Lake 07
Southbridge	Intel Z370 00
BIOS	American Megatrends Inc. 0.01
Memory	16342 MB 1200MHz

Single-Core Performance

Single-Core Score	5773
Crypto Score	5169
Integer Score	6015
Floating Point Score	5710
Memory Score	5473

https://overclock3d.net/gfx/articles/2017/09/11061950174l.jpg

Images of the good of man

What truly matters

- **Think further and wider**

https://unsplash.com/@emmanuelphaeton

Varieties of Goodness in Design

Utilitarian goodness	**Conceptual Design**
Instrumental goodness	**Usability Design**
Medical goodness	**Ergonomics Design**
Hedonic goodness	**Experience Design**
Technical goodness	**Engineering Design**
Good of human	**Sustainability Design**

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Ylirisku, S., & Arvola, M. (2018). Varieties of Goodness in Design. In P. Vermaas & S. Vial (Eds.), *Philosophy of Design: An Exploration* (pp. 51–70). Springer.

Foundations of Judgment

1. Perception

- **You must somehow be able to perceive (see, conceive) the design object**
- **You can only perceive what you are sensitive to**
- **You can cultivate your response-sensitivities**

Ylirisku, S., Buur, J., & Revsbæk, L. (2016). Resourcing of Experience in Co-Design. *Proceedings of the 11th Design Thinking Research Symposium, DTRS'11*. The 11th Design Thinking Research Symposium, DTRS'11, Copenhagen, Denmark.

Foundations of Judgment

2. Valuation

- **Valuation begins with your own emotional response to what you perceive, i.e., I like this, I feel this is ugly, …**
  - Cultivated judgment goes beyond your own emotions
- **Valuation is about relating**
  - A) the design object in to various contexts, and
  - B) the contexts embody different requirements.

Ylirisku, S., Buur, J., & Revsbæk, L. (2016). Resourcing of Experience in Co-Design. *Proceedings of the 11th Design Thinking Research Symposium, DTRS'11*. The 11th Design Thinking Research Symposium, DTRS'11, Copenhagen, Denmark.

How do you create something you can reasonably expect to be good?

Creations are based on imagination

What is imagination?

- **It is not something only in your head.**
- **Imagination is about generating ‘images,’ testing these, and filtering out those that work for you**
- **I use the term ‘image’ in its broadest sense, as an idea**

Articulation

- You need to have the ‘resources’ that enable you to articulate something that you may reasonably expect to be good
- These ‘resources’ are partly comprised of contextual knowledge (user knowledge, technology knowledge, ..) and partly of your capabilities to express ideas in a way that sticks
- You need to study in order *learn* and ***create*** these resources

Sharing an idea

- **Before you can expect someone else to ‘get your idea’ you must articulate it, i.e. giving it a perceptible form**
  - Verbal
  - Textual
  - Visual
    - Sketchy
    - Photographic
    - Diagrammatic
  - Physical

Image vs Story

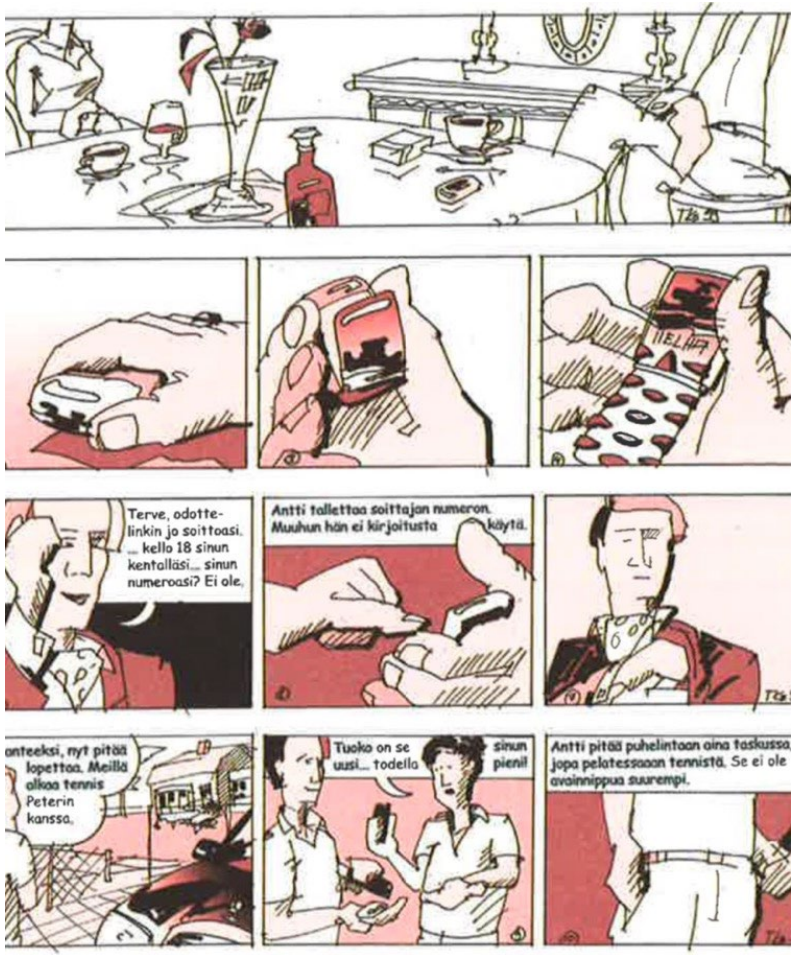
Image

Cybertruck

BETTER UTILITY THAN A TRUCK WITH MORE PERFORMANCE THAN A SPORTS CAR

Story

Nokia’s tiny phone



Design Concepts

- **What makes this concept this?**
- **What is the valuable & significant difference that this makes in relation to other concepts?**
- **You should be able to state this in terms that matter to**
  - users
  - managers
  - developers
  - investors

We shall get back to this today

Towards Prototyping

Requirements definition

Learning goals

Storyboard example revisited

Deriving the key requirements for a prototype

Prototype is not prototype unless..

You test it!

What does a test mean?

In a well-thought manner, it should be as follows:

1. **Define what do you want to learn with this prototype**
2. **Define the requirements for the prototype**
3. **Build the prototype**
4. **Test the prototype**
5. **Express what did you learn with this prototype**
6. **Reflect and iterate**

Learning goals - Example

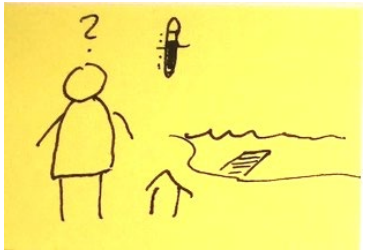
What do I want to learn with this prototype?

- **Utilitarian qualities?**
- **Interactive qualities?**
- **Physical qualities?**
- **Perceptual, identity, and brand qualities?**
- **Technical qualities? Manufacturing qualities?**
- **Sustainable qualities? Ethical qualities? Life-value qualities?**

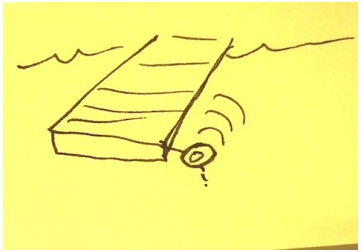
The prior learning goals are the big ones

Yours are closer to the storyboard example from the last week

Example – Remote Temp Sensing

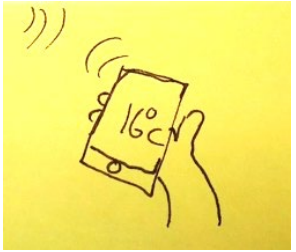


The owner of a summer cabin at a lake, Petra, wants to know how cold the water is at her summer cabin.



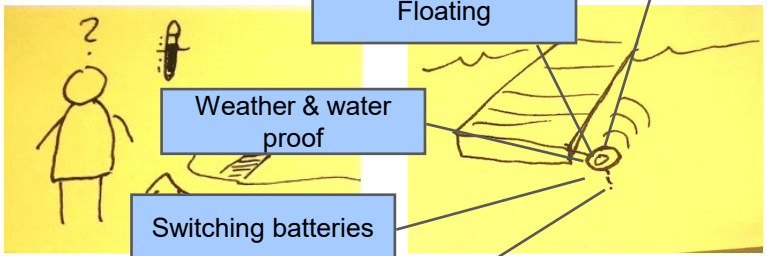
She has a wireless thermometer attached to her dock that measures water temperature.

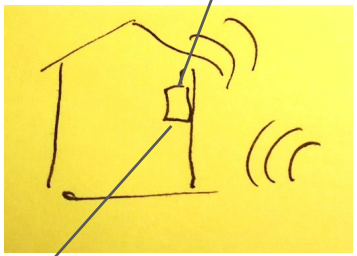
The wireless thermometer sends the temperature data to internet service once a day.



Petra can see the lake temperature on her mobile phone.

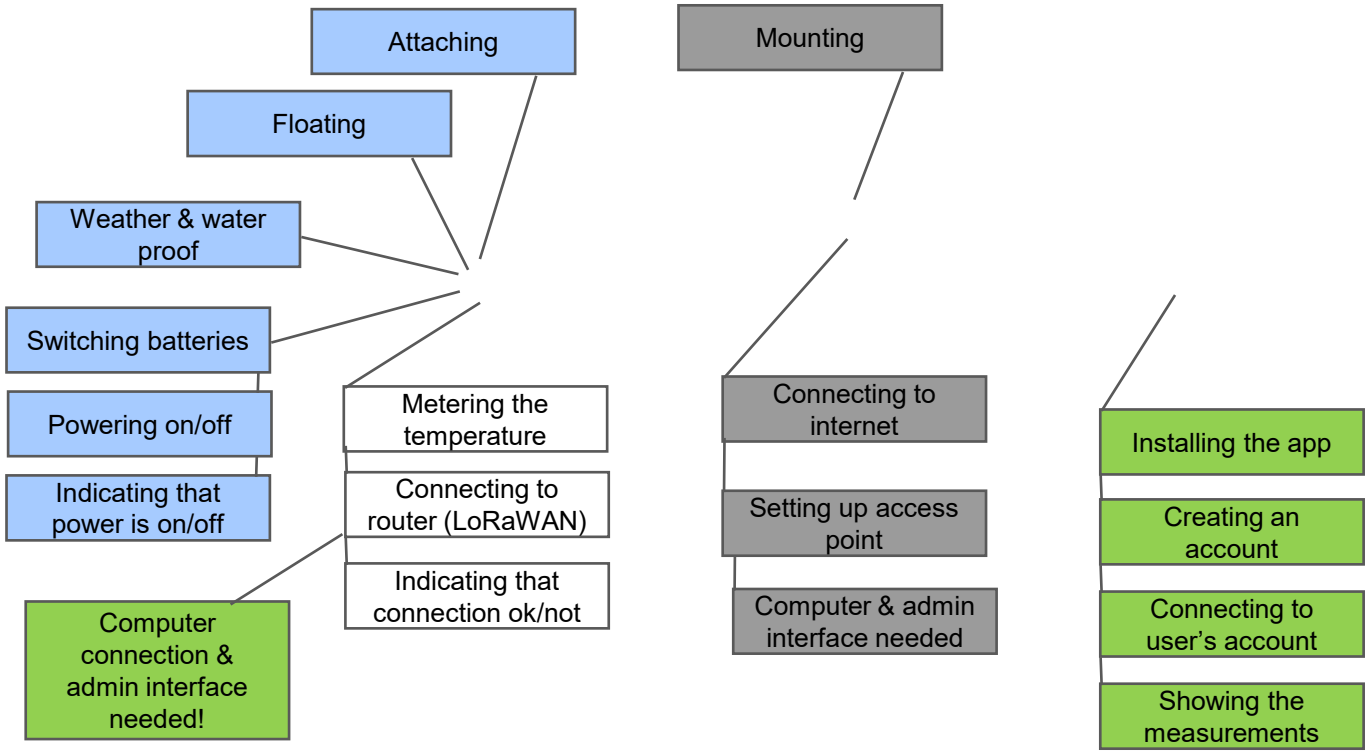
What functionalities/features?



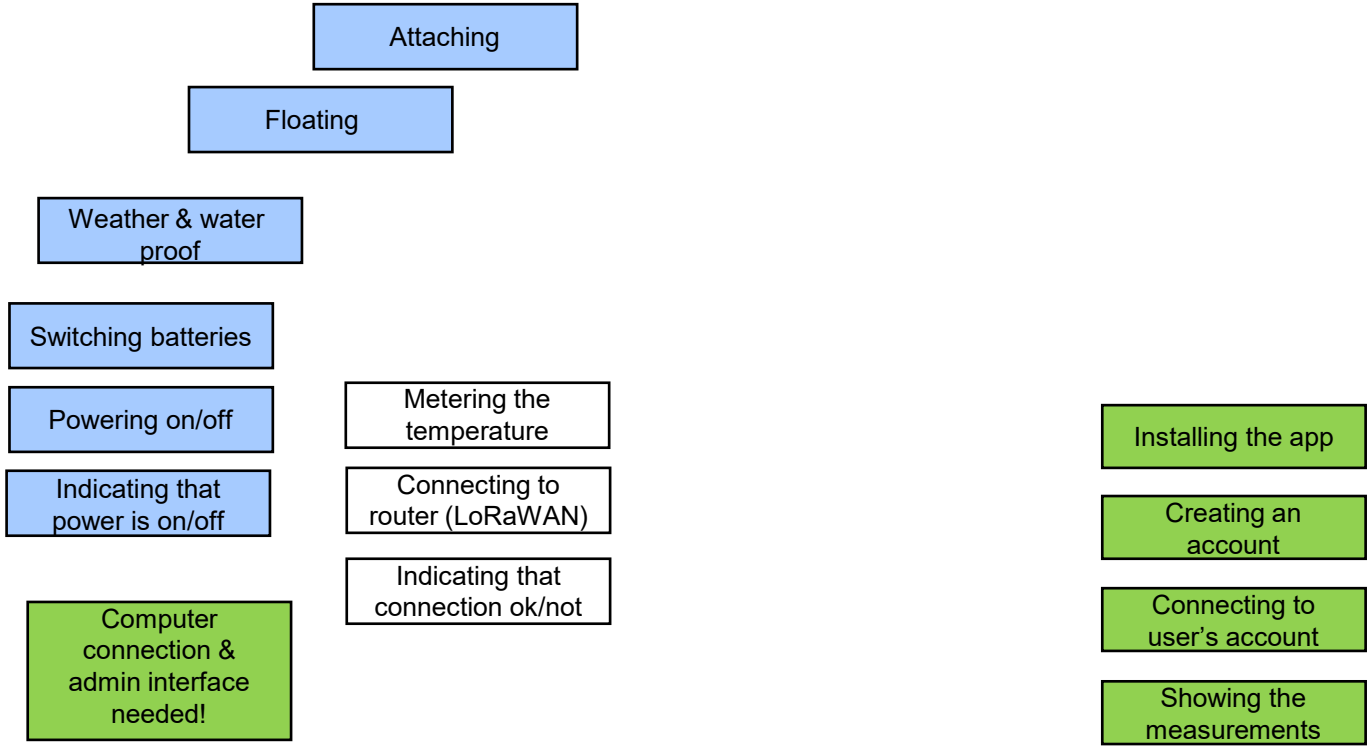


- Attaching
- Floating
- Weather & water proof
- Switching batteries
- Powering on/off
- Indicating that power is on/off
- Computer connection & admin interface needed!
- Metering the temperature
- Connecting to router (LoRaWAN)
- Indicating that connection ok/not
- Mounting
- Connecting to internet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

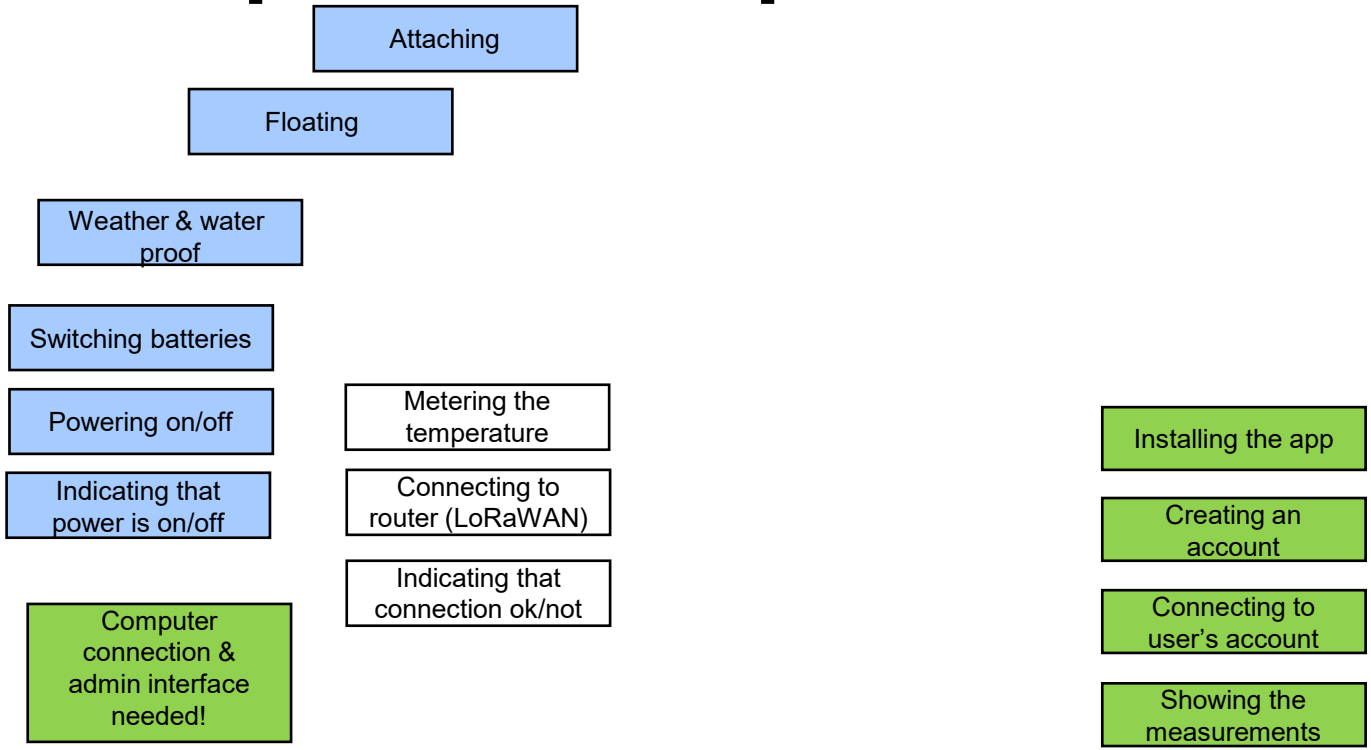
What functionalities/features?



What functionalities/features?



What is important for proto V1?



What is important for proto V1?

Essential in V1 proto

- Powering on/off
- Metering the temperature
- Connecting to router (LoRaWAN)
- Indicating that connection ok/not
- Sending the data
- Cloud service that receives the data

Later or in parallel

Physical design

- Attaching
- Floating
- Weather & water proof
- Switching batteries
- Indicating that power is on/off

App Design

- Installing the app
- Creating an account
- Connecting to user's account
- Showing the measurements

Device Admin interface

- Computer connection & admin interface needed!

Learning goals?

G1: Learn to send the temp readings to a Cloud Service via a LoRaWAN connection

Essential in V1 proto

- Powering on/off
- Metering the temperature
- Connecting to router (LoRaWAN)
- Indicating that connection ok/not
- Sending the data
- Cloud service that receives the data

Requirements (Proto V1)

R1: The device must read temperature correctly

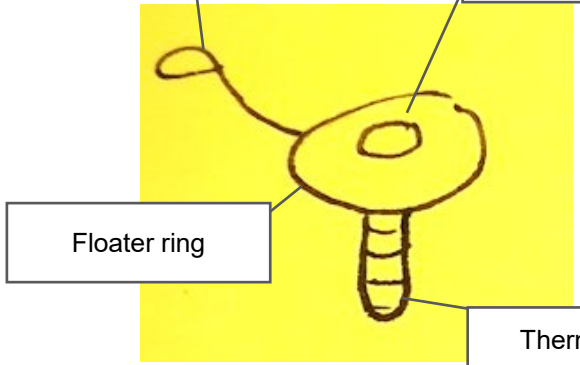
R2: The device must connect to a LoRaWAN router

R3: The device must show the status of the connection

R4: The device must connect to an online web service that can show the temperature readings on a web browser

Poster

Wireless Remote Water Thermometer



Safe to use
2 x AA battery
Battery life
up to 3 years

Cloud service
(0.99 €/month)

Free Mobile App

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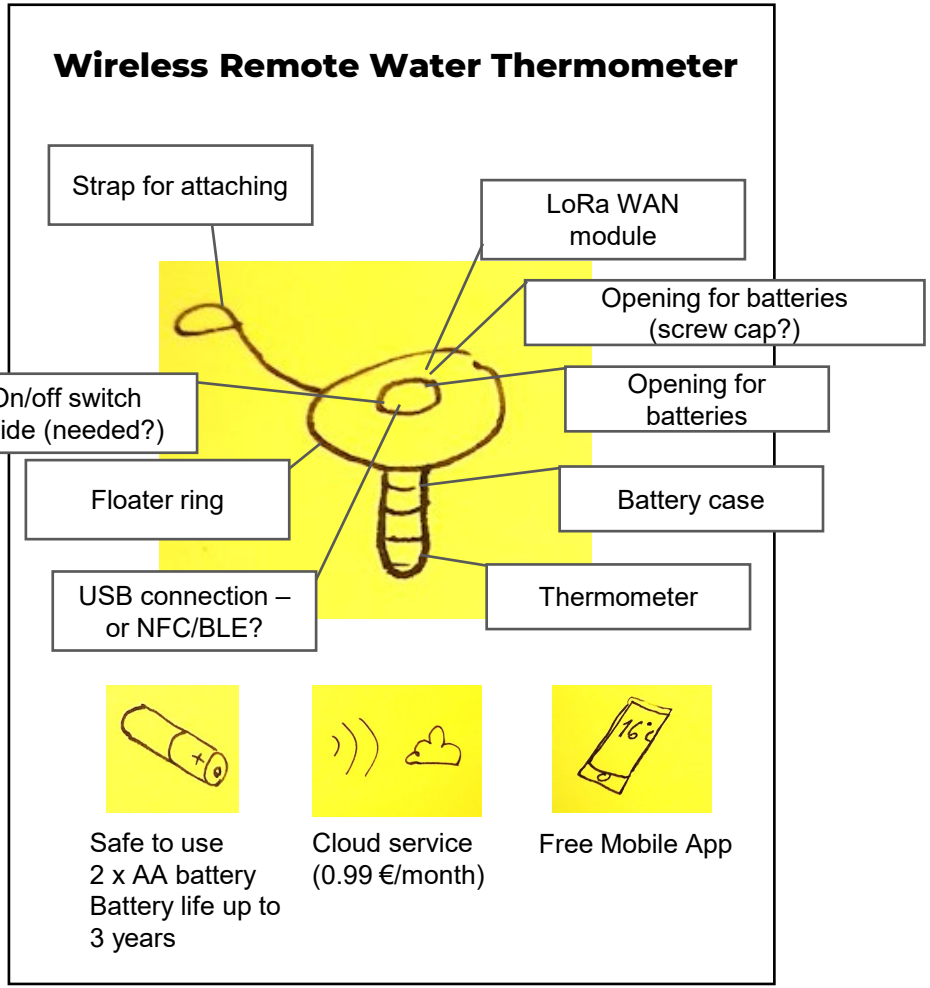
Poster



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-- Presence Check --

Workshop:
Create a presentation for your 3 ideas

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Present your 3 ideas

- **What is the value of your design idea?**
  - Explain this as simply and accurately as possible
- **What are the essential parts of the idea?**
- **Why is IoT the right technology for the purpose?**

Circuit Shop Schedule

We have a scheduler on MyCourses to help you to distribute across the week so that the small space does not get too full.

Circuit Shop (piiripaja) is located in front of the Electronics Workshop (Sähköpaja).

Available times are during the regular exercise times (may be adjusted if needed)

This week

- **Project: Focus on one idea – presentations next week**
- **Write your weekly diary and submit it (the periodical diary is due on Fri 17th)**
- **Exercises (Fri 14-16, Mon 14-16, Tue 10-12)**
  - There are REQUIRED – and you need to reflect on them in your diaries