Tour-Tag (Mini Project)

ELEC-E8408 Embedded Systems Development

Ronal Bejarano

05/02/2021

Aalto University
School of Electrical
Engineering

Description

- Group effort: **Three** students in a group
- Recommended to form international groups
- Challenge different aspects:
  - Requirement engineering: **Software Requirements Specification**
  - Prototyping: Using hardware + software (Embedded system)
  - It is a **real world-like challenge**: use **Innovation**, **Version Control** and other online tools for teamwork

Stakeholders

- Finland is the country of the shipyards
- Two-thirds of the world’s icebreakers originate in Finland
- Finnish marine industry consists of moreover than **1000 companies** which employs **30000 people** with annual turnover of **8 billion €**
- Now Aalto University wants to contribute on the marine industry by developing a project. The project is expected to be used by the **FinTour consortium**, made of:
    1. Coastline cities
    2. Travel companies
    3. Shipping companies

Tour-Tag

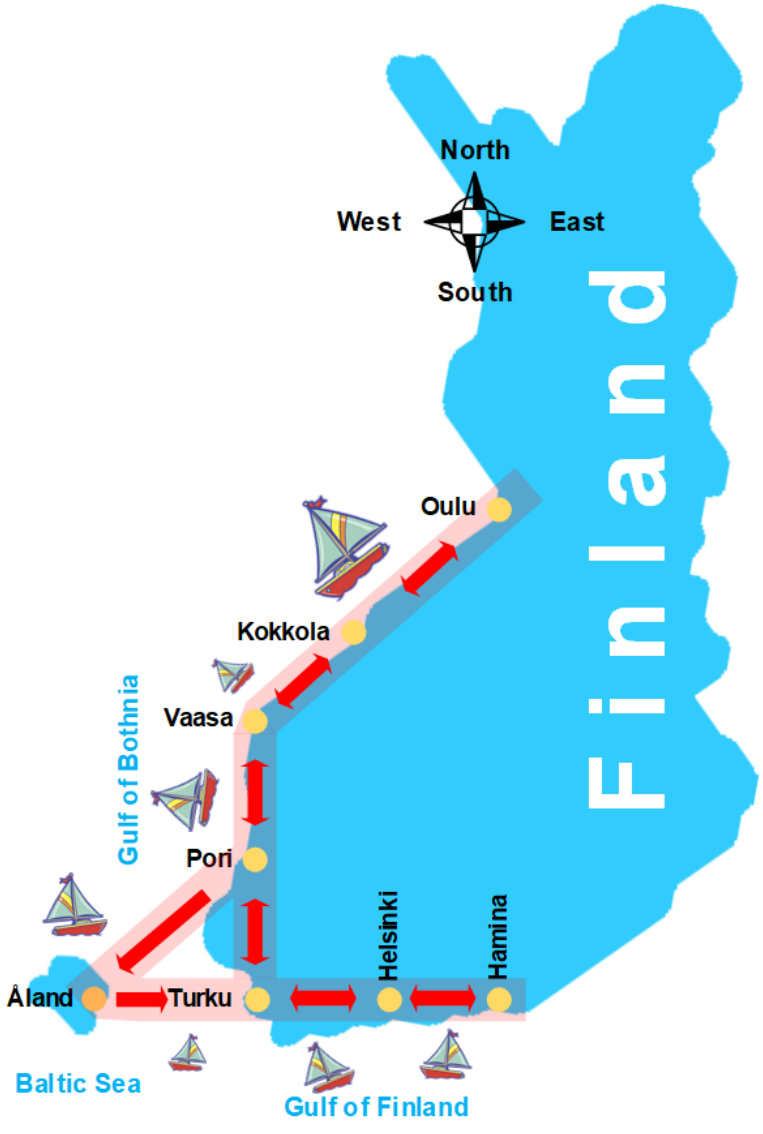
- In this project, FinTour decided to develop a special **software tag (Tour-Tag)** for its tour leaders. The device will allow to gather statistical information, control rules, provide some guide and help for tourists to make their trip more interesting.

- Tour-Tag is a software which should be implement on a **current available hardware**.

Tour-Tag: Operation

- The boats will transfer a group of tourists with a leader (tour guide) from the origin port to the destination port. All the leaders should be equipped with a Tag.
- The leader should set the origin and destination ports on the Tag at the beginning of the trip.
- The boats should follow the map routes, there are some one-directional and bi-directional routes (check the map)
- The boats should have a break time at all middle ports for short visits, fuel update and maybe boat or boat crew change.
- The Tags should be updated in each port at arrival and departure.

Tour-Tag:
Tour routes

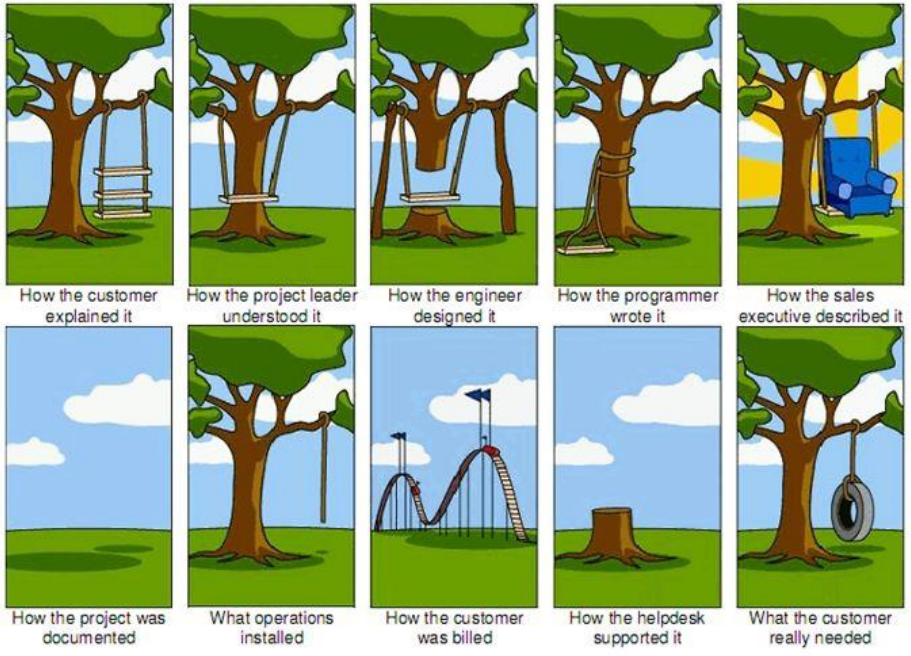


Tour-Tag: Main functional requirements

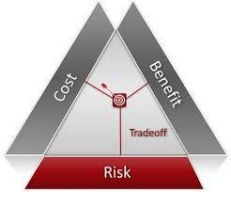
- The leader should set the origin and destination ports for the Tag at the beginning of the trip
- The states of the Tags should be updated in each port at the arrival during the tour for information and statistical purposes
- Tags should be connected to the backpack of the leader, where all the group's people can see it during the tour, to help people find their leaders and current trip status
- The Tags' interface should be accessible via mobile or laptop browser by using the ID code of the leader
- Every stop takes at least 2 hours. The boat riders should have access to the time remaining before the departure. Also, he/she should submit the departure time on the Tag
- Tags should be nice, user-friendly, suitable for marine travels.

Tour-Tag: requirements

- You know about this famous picture:



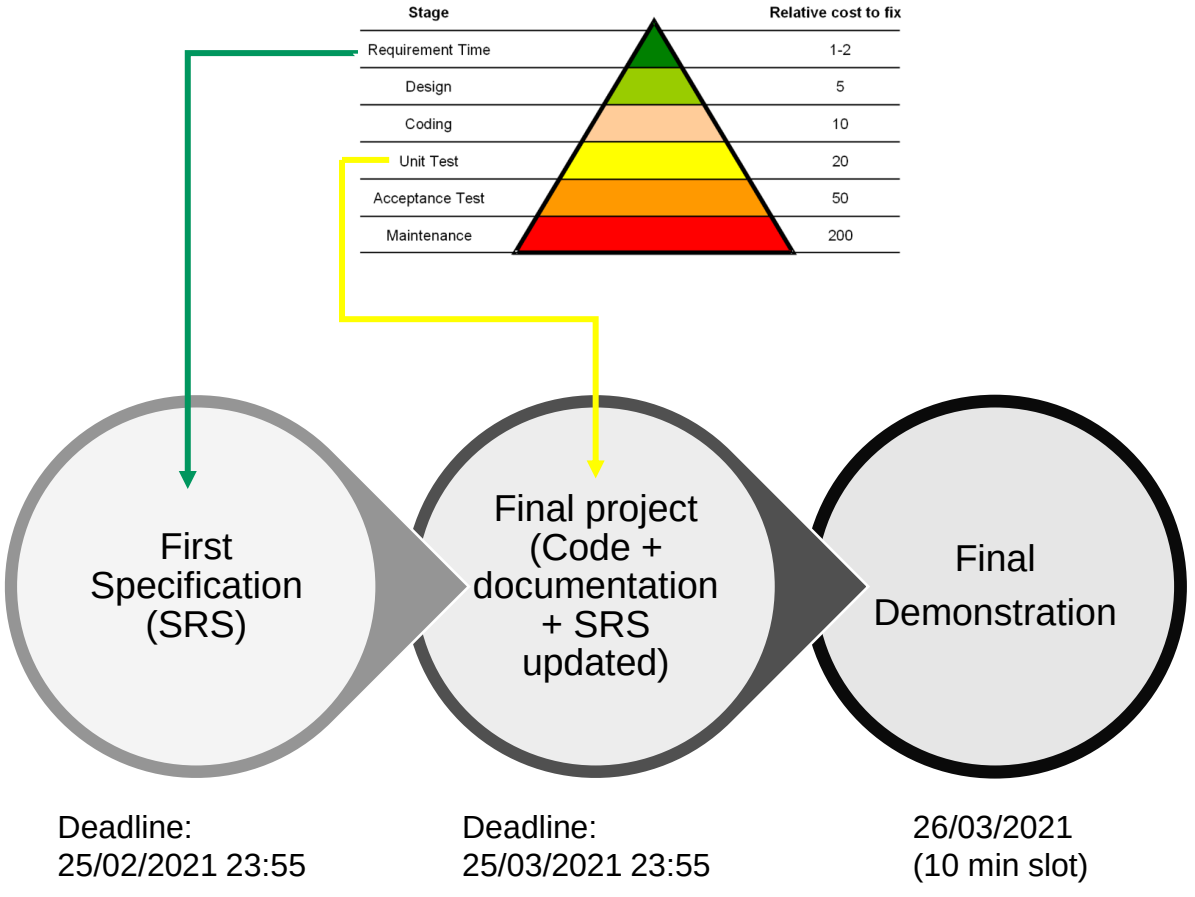
- So, The listed requirements are not enough
- You should:
  - Ask and consult
  - Assume
  - Be innovative
  - Do tradeoff



So, this is the starting point for your group work to prepare a Software Requirements Specification (SRS) for the new product for FinTour. As you can see, there are numerous open issues that you must address yourself to be able to prepare such a comprehensive document.

Schedule

- **Introduction** 05/02/2021 10:00 to 11:00
- **Group conformation open in MyCourses** 05/02/2021 12:00 to 10/02/2021 12:00
- **Handout of hardware** 11/02/2021 10:00 to 14:00
- **Deadline for part A - requirement engineering** 25/02/2021 23:55
- **Deadline for part-B implementation and final project document** 25/03/2021 23:55
- **Presentation day** 26/03/2021 10:00 to 13:00
- **Deadline for peer grading** 01/04/2021 23:55
- **Hardware return** 09/04/2021 10:00 to 14:00



Software Requirements Specification

- Requirement's engineering is the first phase of the software development process for embedded systems

- In such an extreme scenario, it does not matter how well the system was designed or implemented

- A decent recovery from inadequate requirements engineering can be costly and lead to considerable losses of revenue; some amount of redesign and reimplementation—including testing—must be done, and hence the product may come to market with a significant delay.

Software Requirements Specification (SRS)

It is highly recommended to base your SRS on good practices and standards:

IEEE 830:1998 IEEE Recommended Practice for Software Requirements Specifications
https://ieeexplore.ieee.org/document/720574

ISO/IEC/IEEE 29148-2011International Standard - Systems and software engineering -- Life cycle processes -- Requirements engineering

https://ieeexplore.ieee.org/document/6146379

Be aware that both are large documents. It takes some time to read and understand.

Use Aalto VPN to access the documents.

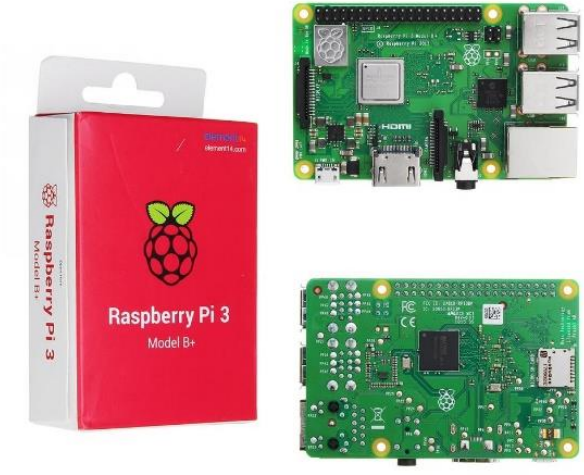
Deliverable part A : SRS

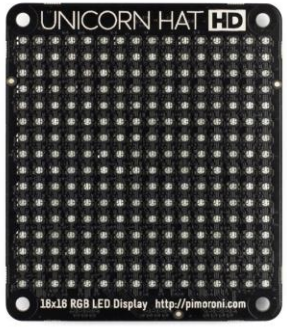
Minimum content:

- Context diagram with complementary definitions
- External interface requirements for inputs and outputs
- Functional requirements (formal/semi-formal/informal specification techniques as seen appropriate)
- Performance requirements
- Design constraints (such as hardware, operating environment, and possible standards)
- Software-system attributes (including, for example, maintainability, reliability, and security)

Hardware

Raspberry Pi 3B+ + Memory card + power adapter + case + HDMI cable





Unicorn Hat HD Matrix LED
https://github.com/pimoroni/unicorn-hat-hd

You are expected to use a cell phone, laptop or desktop for demonstration

https://www.aalto.fi/en/aalto-university/information-on-coronavirus

Hardware handout:
11/02/2021 from 10:00 to 14:00
Aalto Factory of the Future
Konemiehentie 2 H
Computer Science building, room B141
https://goo.gl/maps/craDk8mKt6YTW68SA

Deliverable part B

Documentation:

- A design report which might allow your work to be used and maintained in the future for other people
- A user manual to operate the system (Including a test plan)
- The updated versions of your SRS document
- A back up of your code and if available, the link to your public repository
- **Bonus points** for repositories with comprehensive readme

Presentation Day

- Your group should present the prototype in a 10-minute pitch.
- The presentation should go based on your test plan from your documentation
- You should comment about how you meet the requirements from the SRS in your system
- Be creative and serious :)

Peer review

- After the submission date you will receive by email a project from another random group to grade.
- Check the content and fill the grading format attached (ELEC-E8408 Mini-project grading 2021.xlsx)
- Submit your format before 01/04/2021 23:55
- Your final grade for the MiniProject will be recorded only after your group complete successfully the peer review

Hardware return

Return the hardware in original box.

Please write your team number on the top cover.

Date: ~~01/04/2021~~ 09/04/2021 from 10:00 to 14:00

Place:

Aalto Factory of the Future,

Konemiehentie 2 H

Computer Science building, room B141

https://goo.gl/maps/craDk8mKt6YTW68SA

(Same as pick up point)

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Project bid

If you have a project idea for a different system that fits better your technical skills, you can present it to the course staff for further consideration.

- Make a group of 3 people
- Only one of the groups tendering will be selected and sponsored to implement their proposal as an alternative for the Tour-Tag mini-project
- The deliverables and schedule are the same as presented in the *schedule* section, starting from the deadline of part A (requirement engineering) on 25/02/2021 23:55
- To participate in the bidding, please fill the tender format attached and submit it before 10/02/2021 10:00 on MyCourses. (ELEC-E8408 Mini-project tender format 2021.xlsx)
- The course staff will publicly announce the bid winner on 15/02/2021 at 12:00

Project bid

- The tender format includes fields for the system description, functional requirements, and bill of materials.
- The system description and functional requirements can be presented in the same fashion as they are for Tour-Tag (bullet points).
- For the bill of materials, please specify all the materials needed to prototype your idea and include a link from one of the following online stores for each item: RS, DigiKey, or Farnell.
- The awarding of the bidding is the exclusive responsibility of the course staff.
- The tendering process can be considered void.

Tips

- There are no requirements about what programming language should be used. You can use the one of your preference. However, the course staff recommends Python, since the LED matrix has a very convenient library for it

- The staff highly recommends using web services (REST) and HTML for interfacing and other functions. Some frameworks in Python as Flask or Django and CSS as Bootstrap, Bulma or Foundation simplify the creation of your system. Libraries as SQL alchemy simplify the handling of databases. However, you are free to pick your favorite components, libraries or programming languages.

- If you feel lost coding, remember you are not alone. Always try to read online documentation, comments on communities (like Stack Overflow) or take tutorials at https://www.w3schools.com/

Why a web app?

- IoT
- Compatible with Linux, Windows, Mac
- Easy to render from mobile devices and workstations
- Easier to update and maintain
- Easier to scale
- Popular among IT (many tools available for development)

ALWAYS:

FOLLOW THE RECOMMENDATIONS FROM AALTO UNIVERSITY AND THE OFFICIAL ORGANIZATIONS ABOUT THE CORONAVIRUS RESTRICTIONS

Take care of yourself and your community

https://www.aalto.fi/en/aalto-university/information-on-coronavirus

https://thl.fi/en/web/infectious-diseases-and-vaccinations/what-s-new/coronavirus-covid-19-latest-updates/situation-update-on-coronavirus/the-covid-19-epidemic-regional-situation-recommendations-and-restrictions

https://www.hus.fi/en/newsroom/coronavirus-covid-19/regional-situation-coronavirus-epidemic-and-issued-recommendations

Have fun!

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