Wiki documentation

Team member:

- Veera Ihalainen
- Lucas Käldström
- Lac Truong (Sophie)

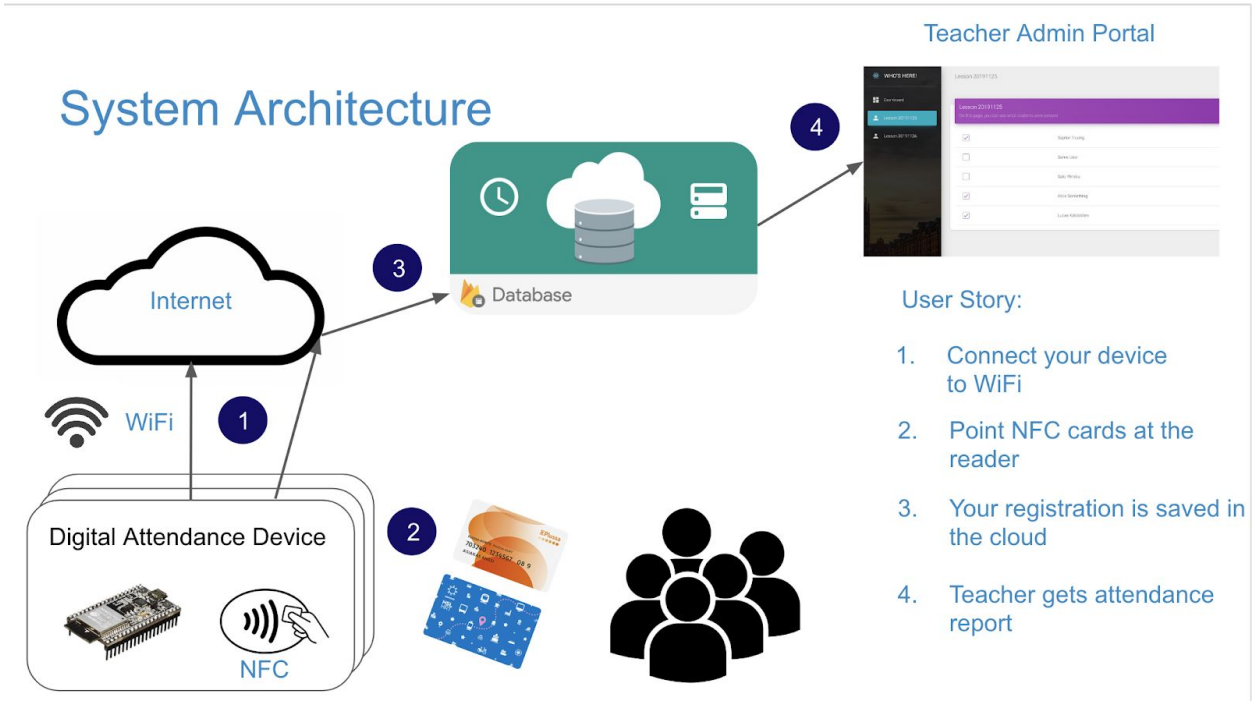
The Design concept:

Description of the purpose and overall design idea, visual presentation:

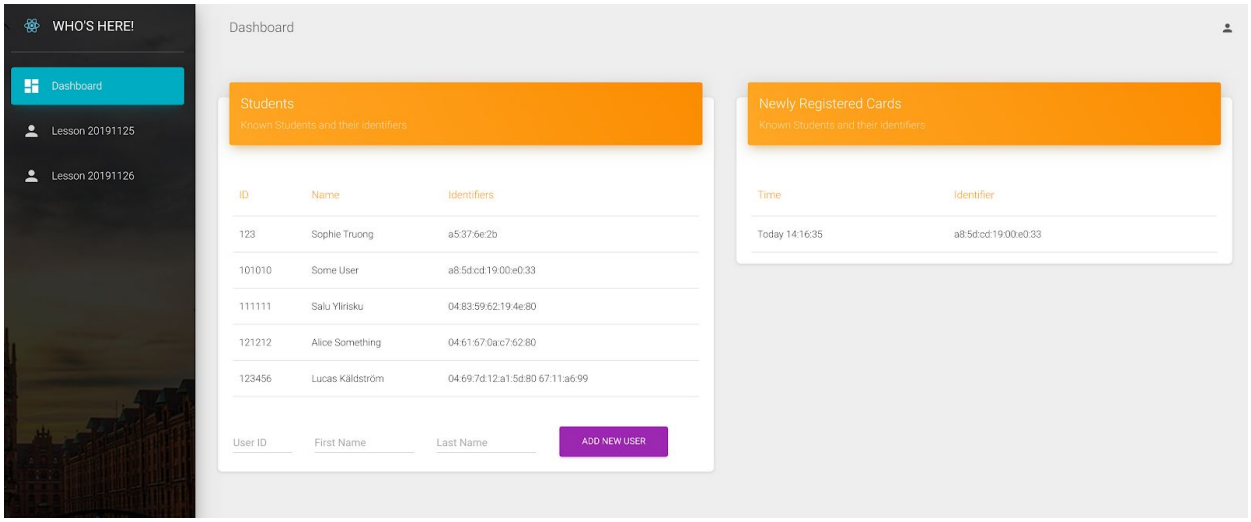
Problem: Paper-based Attendance checklist are error-prone for students and tedious for teachers to manually transfer information from paper to the system

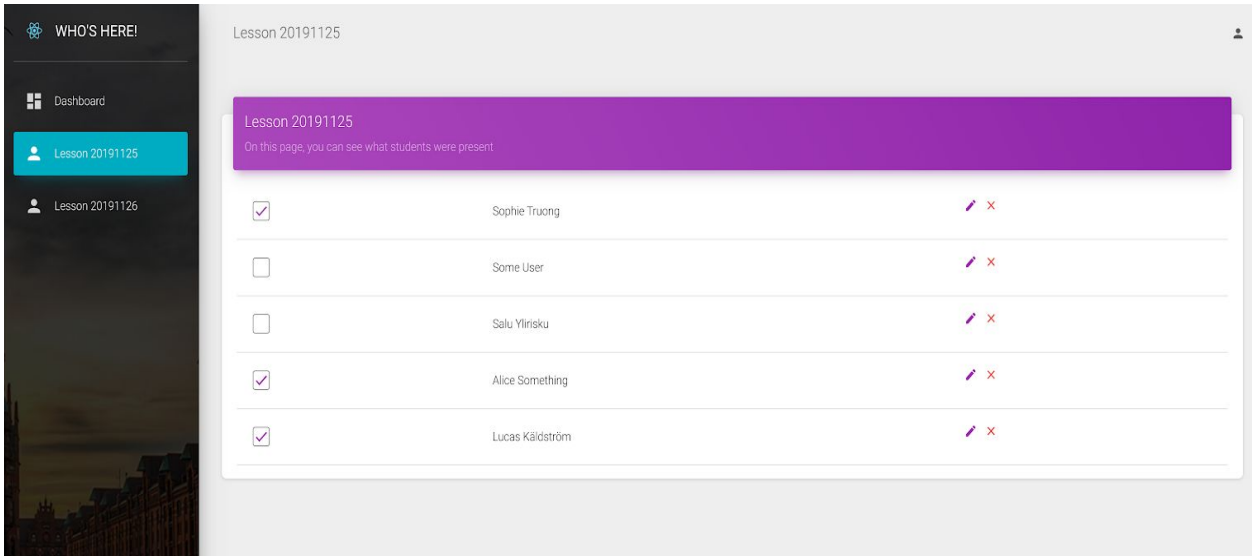
Our solution: Digitalize Attendance using NFC. Students register to class through their NFC-enabled card, and the teacher gets the attendance report through the web UI.

Overall system architecture:

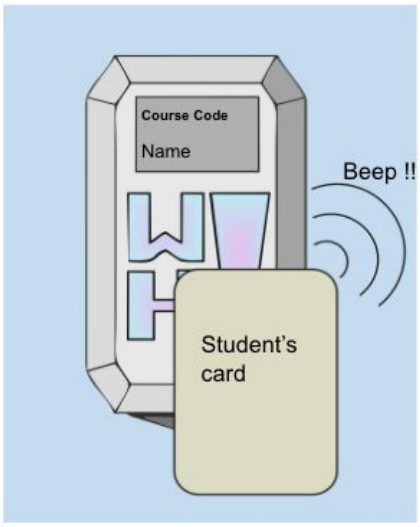


Web UI:

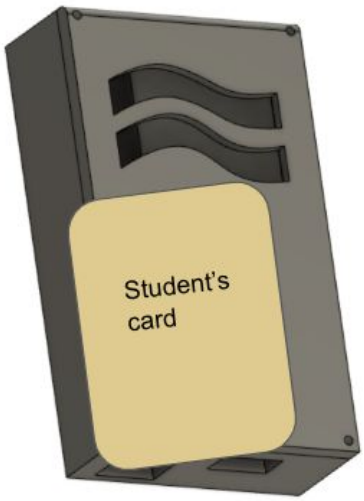




Physical design and End Result:



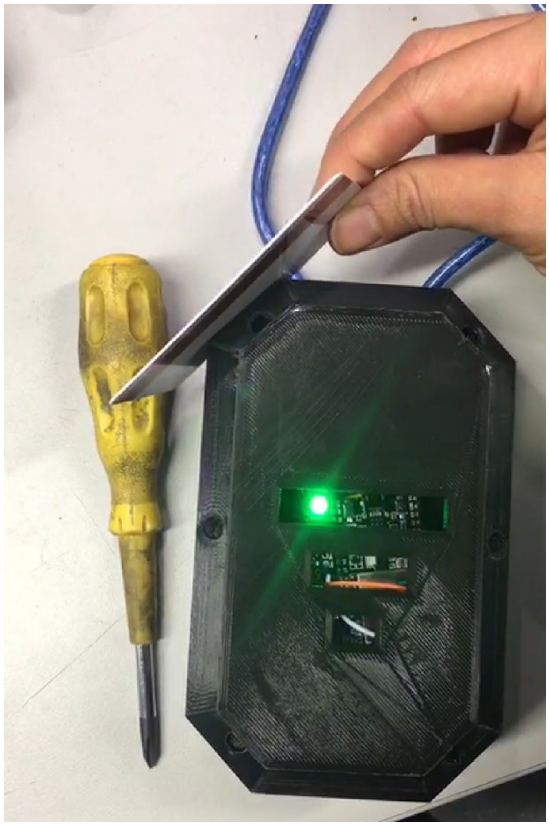
Original design



Current design

Final 3D-printed design, exterior.

Final 3D-printed case design, interior



Initial case design in the middle of the process.

The Implementation of the Experience Prototype:

Add Video here

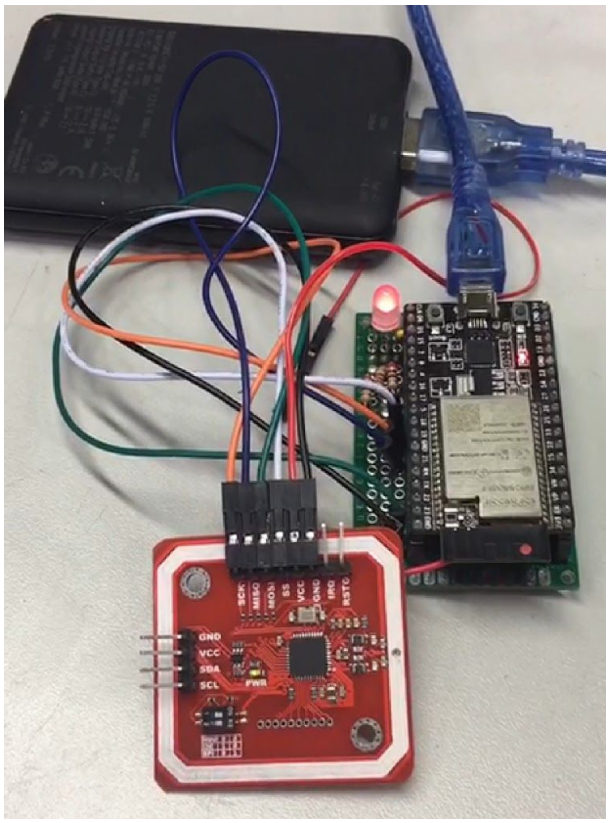
1. Registration Flow (video 1 and 2):
    a. The student comes to class, shows their card to the teacher when asked
    b. The teacher writes in the student's name and ID, and connects their card ID to the system
    c. Note: This data would be sourced from MyCourses and idcard.aalto.fi in "real life"
2. Attendance Flow (video 3):
    a. The student arrives to class, shows their card to the device, waits for the 1-ish second beep to finish (registration succeeded), and can proceed with their daily life
    b. In case the student does not have a card with them, they can go to the teacher, who can manually register the student as present in the web UI
    c. At the end of the lesson the teacher has a list of students present.

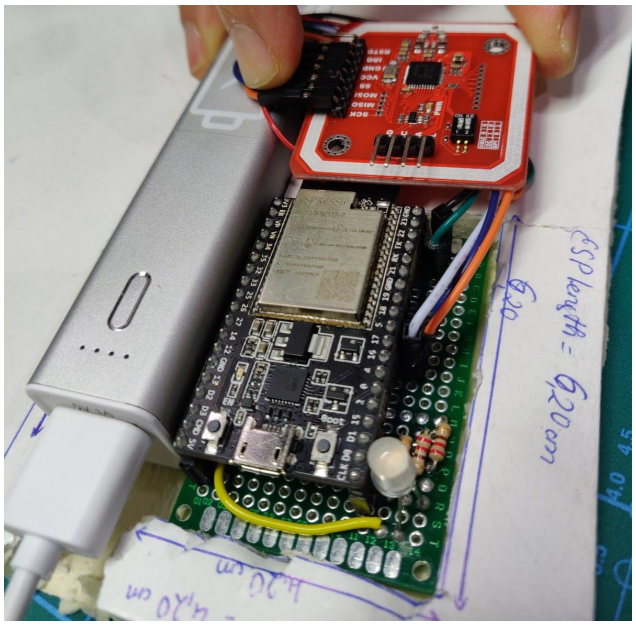
Explain the main functions and parts:

Hardware Components:

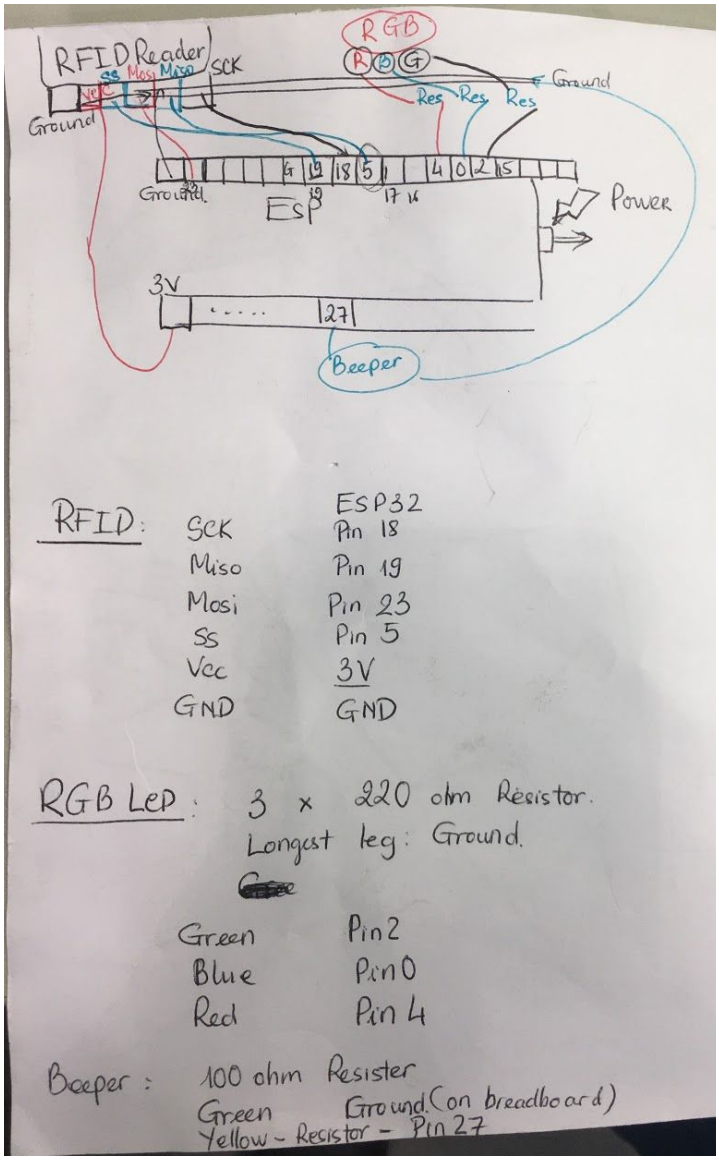
- ESP32
- NFC Reader (PN532 NFC RFID module V3 from Elechouse)

    - Connected to the ESP32 through the SPI interface
- 3D-printed shield
- Power Bank (Battery Pack providing 5V through e.g. Micro USB for the ESP32)
- RGB LED
    - Connected to the ESP through 3 wires, can adjust all colours (2^24 options).
- Buzzer
- Custom-built PCB to connect all the pieces together

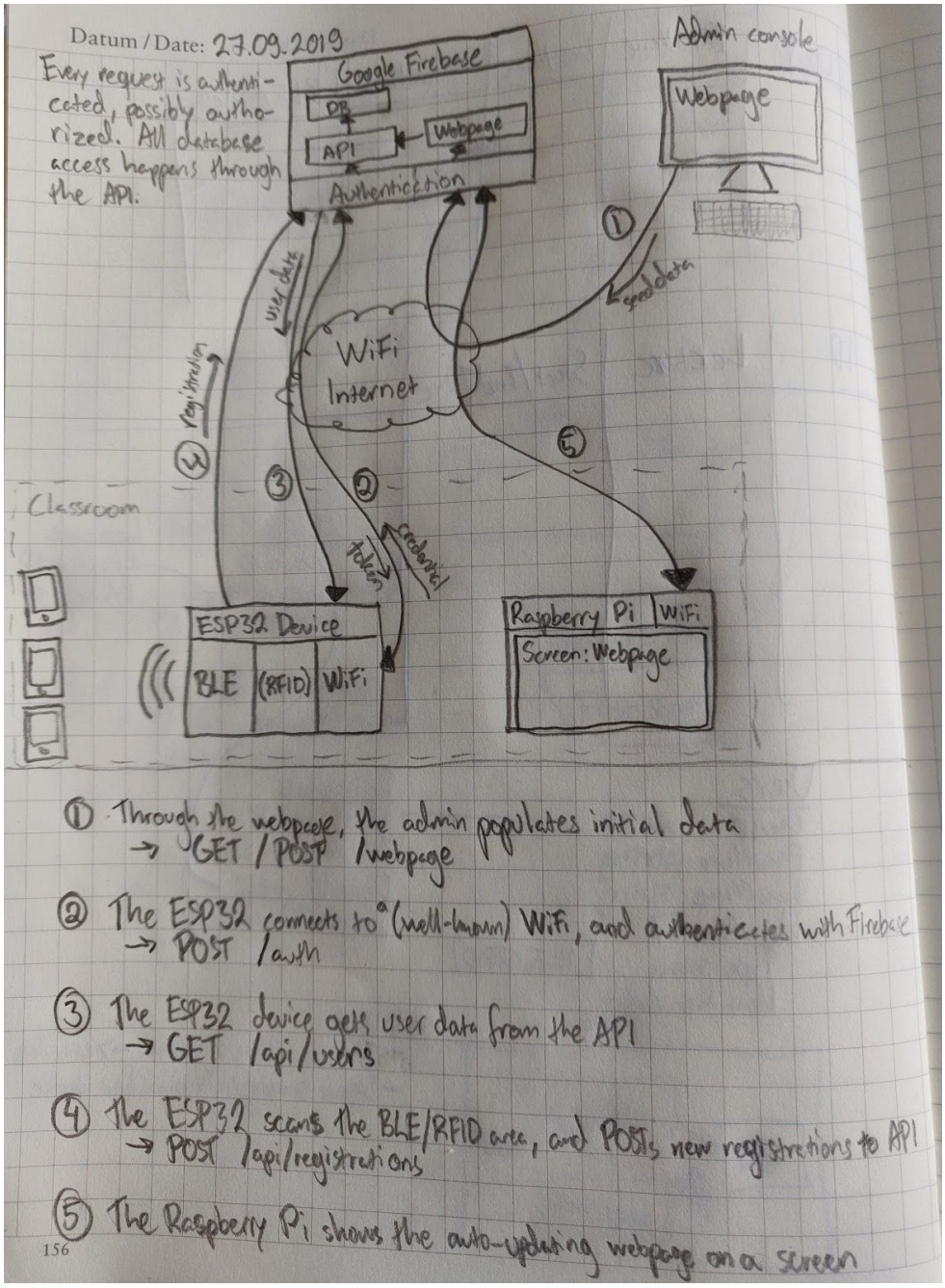




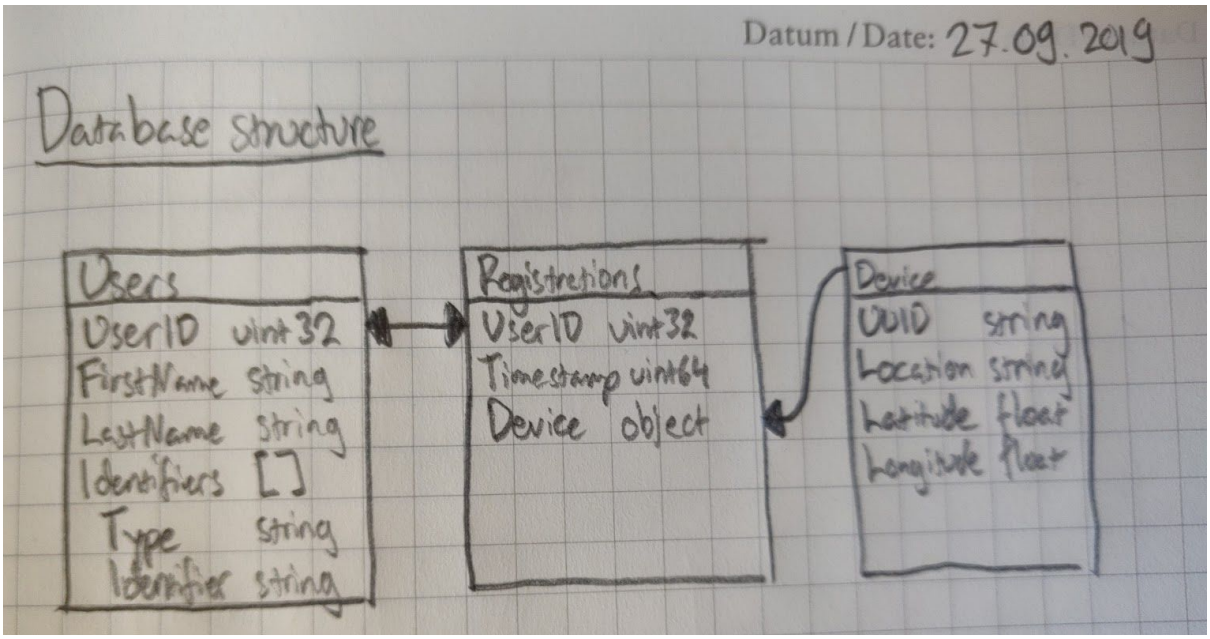
Two pictures of the PCB design, and all the electronics. Based on this layout the final case was created.



Schematic used for creating the PCB.



Early architecture design for the system.



Initial planned database design.

Software Components:

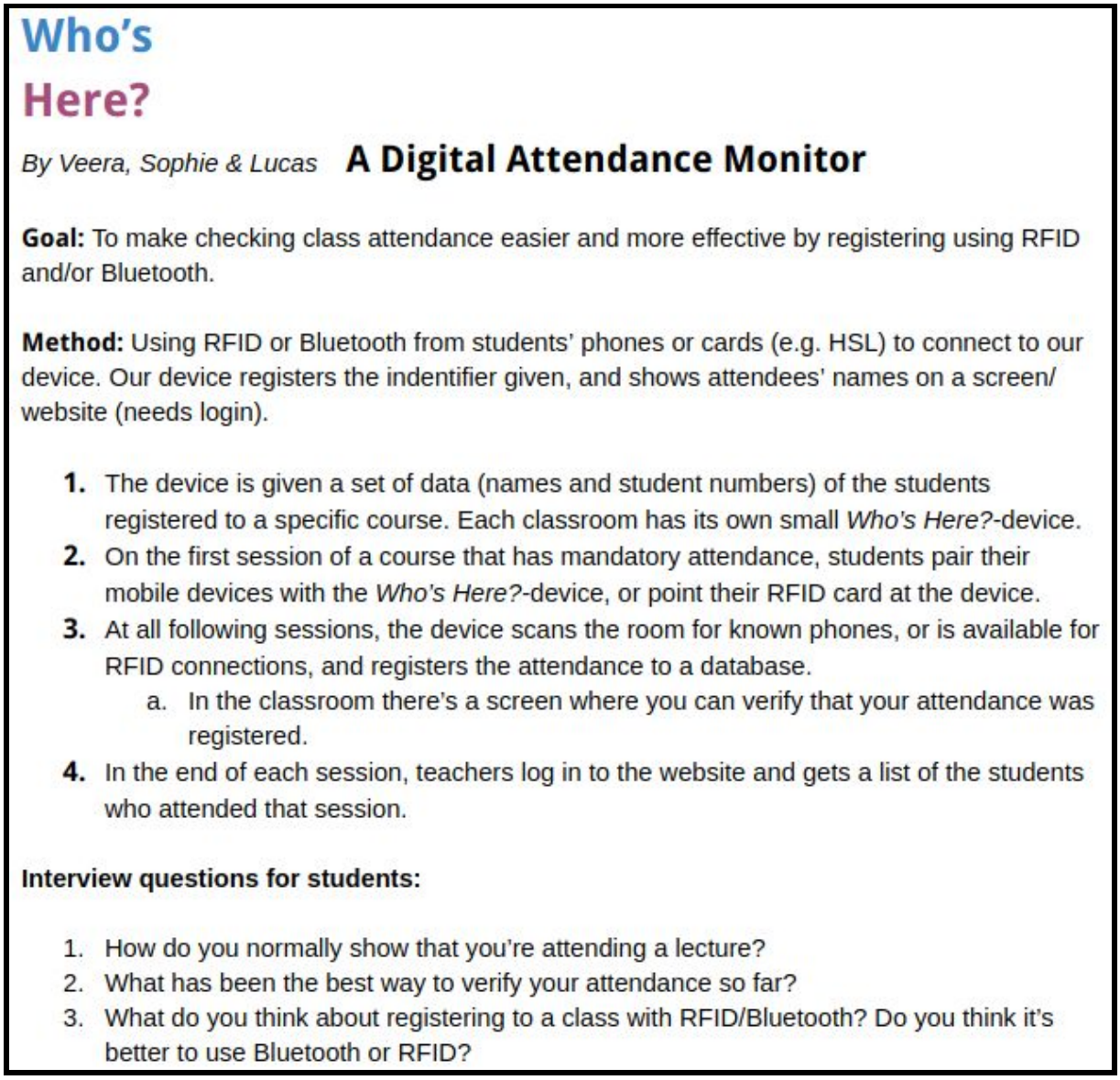
- Embedded C++ code running on an ESP32
- Firebase backend acting as a database
- Web Frontend written in React

All software needed can be found on Github at https://github.com/luxas/aalto-whos-here.

Some interesting files:

- https://github.com/luxas/aalto-whos-here/blob/master/aalto-whos-here.ino has most of the embedded C++ logic, talking to Firebase and encoding how the device works
- https://github.com/luxas/aalto-whos-here/tree/master/vendor contains the libraries used for building the project, for reproducability
- https://github.com/luxas/aalto-whos-here/tree/master/website is based on a template project, but is heavily modified to fit our needs
- https://github.com/luxas/aalto-whos-here/blob/master/website/src/components/Firebase/firebase.js contains the logic to get the Firebase data from the web UI
- https://github.com/luxas/aalto-whos-here/blob/master/website/src/views/Dashboard/Dashboard.js contains the code for the overview page of students, their IDs and registering new cards and students
- https://github.com/luxas/aalto-whos-here/blob/master/website/src/views/Lesson/Lesson.js contains the website code for a specific lesson

User Study Materials:



Who's Here?

By Veera, Sophie & Lucas **A Digital Attendance Monitor**

Goal: To make checking class attendance easier and more effective by registering using RFID and/or Bluetooth.

Method: Using RFID or Bluetooth from students' phones or cards (e.g. HSL) to connect to our device. Our device registers the indentifier given, and shows attendees' names on a screen/ website (needs login).

1. The device is given a set of data (names and student numbers) of the students registered to a specific course. Each classroom has its own small *Who's Here?*-device.
2. On the first session of a course that has mandatory attendance, students pair their mobile devices with the *Who's Here?*-device, or point their RFID card at the device.
3. At all following sessions, the device scans the room for known phones, or is available for RFID connections, and registers the attendance to a database.
    a. In the classroom there's a screen where you can verify that your attendance was registered.
4. In the end of each session, teachers log in to the website and gets a list of the students who attended that session.

Interview questions for students:

1. How do you normally show that you're attending a lecture?
2. What has been the best way to verify your attendance so far?
3. What do you think about registering to a class with RFID/Bluetooth? Do you think it's better to use Bluetooth or RFID?

In the beginning of the design process, we did an user study to know better what to create.

Supported use case:

The prototype is currently supported for multiple students, with 1 teacher having 1 course. Use cases 1-3 mentioned below were implemented in the prototype

Prioritized list of use cases:

1. For old students: Register attendance to the database

2. For new students: Register student card ID to database and pair name to ID address

3. For the teacher: Log in to the website and administer the wanted course

4. For the teacher: Import/export data in formats that integrate well with the environment

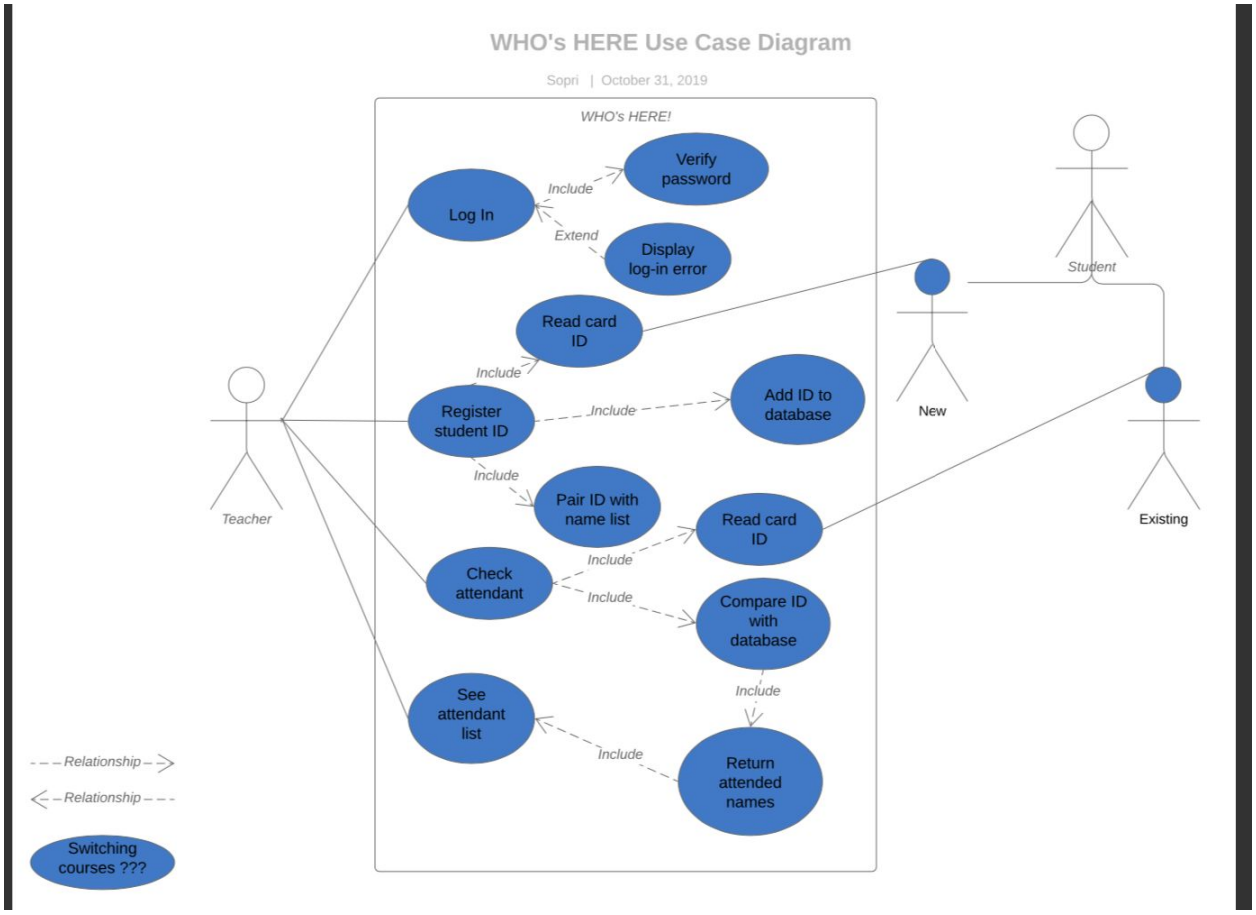
User Feedback (for future improvements):

1. Integrations are important!
2. Move the card registration to be school-wide (beginning of year)
3. Visualization of the attendance that allows better monitoring over time
4. The device should be portable

Future Challenges and Considerations:

1. Multiple Teachers, Classes, Courses and Lessons
2. Resiliency: Coding the system to handle also unexpected conditions
3. Integrations with existing systems (like MyCourses, Oodi, idcard.aalto.fi)
4. Data Privacy, and consent management (GDPR)

Use Case diagram:



Key Milestones and Project Timeline:

The product (100%)			Previous weeks	W44	**W45 (current)**	W46	W47	W48	W49
1.1.	Case (25%)					* 11.11. M1			
	1.1.1.	Sketching and mock-up building (5)							
	1.1.2.	3D sketching case (10)							
	1.1.3	Finding the components needed for the project (5)							
	1.1.4.	3D printing (5)							
1.2.	Embedded ESP32 module (25%)						* 18.11. M2		
	1.2.1.	Connecting all the components together (2)							
	1.2.2.	Software for registering students (23)							
1.3.	Administrative website & backend (35%)						* 21.11 M3	*27.11 M4	
	1.3.1.	Database (9)							
	1.3.2.	Website (26)							
1.4.	Product Integration Testing and User Feedback (15%)								*3.12 M5
	1.4.1.	Internal Testing (5)							
	1.4.2.	External User Testing & Feedback (5)							
	1.4.3.	Bugfixing (5)							*15.12 M6

M1	11.11 3D printing device shield structure
M2	18.11. all components with basic interfaces done, integration tests start
M3	21.11. first prototype version ready for user testing feedback
M4	27.11. final test version (fully functional) ready for user testing and feedback
M5	3.12. all ready to demo and show
M6	15.12. all documented and done