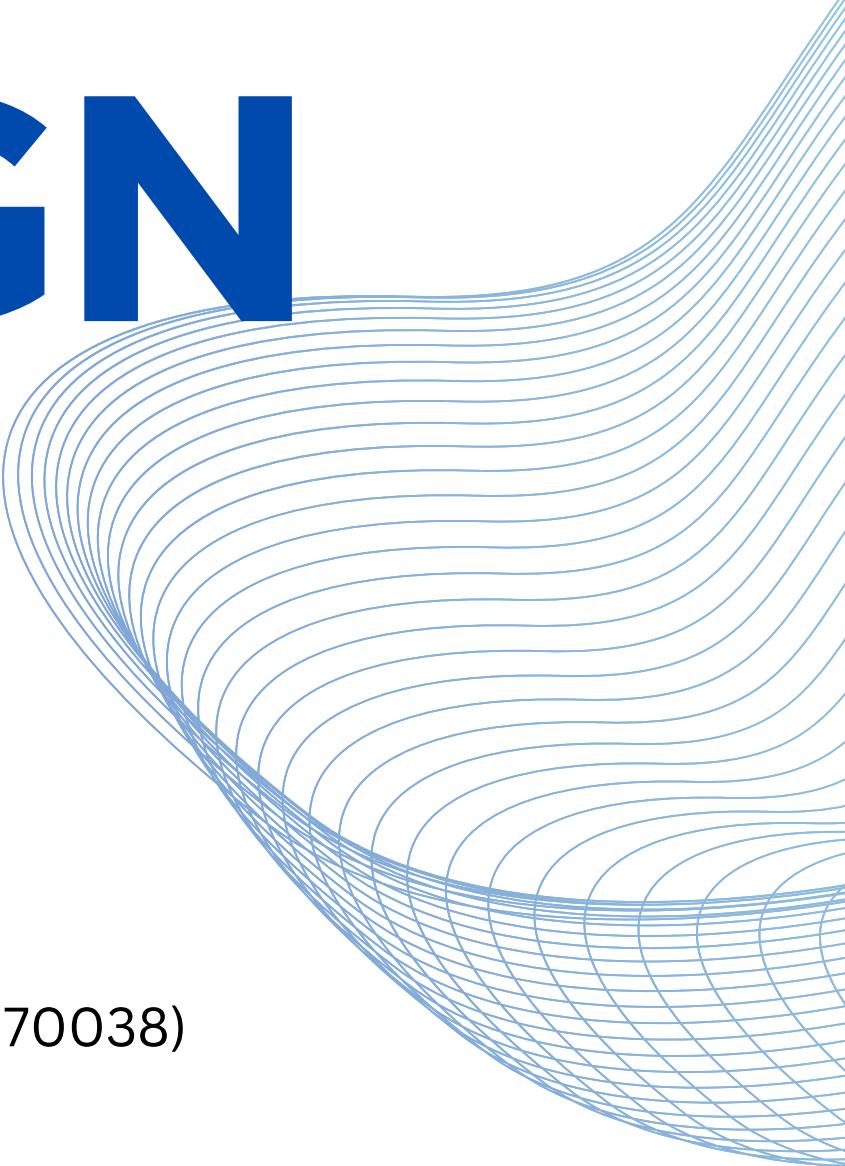


# **PCB & CAD DESIGN**

## **OVERVIEW**



**RFID based wireless inventory  
management system**

**TUE-02**

### **Team Members :**

- Kadiyala Sai Susrush (210070038)
- Om Unhale (210070058)
- Prince Kumar (210070062)
- Soumyadeep Jana (21D070075)

### **Guided by :**

- Prof. V Rajbabu
- Prof. Siddharth Tallur

### **TA/RA reviewer :**

- Rohan Bagchi
- Alok Kumar

# Feedback received in milestone 2 evaluation and actions taken

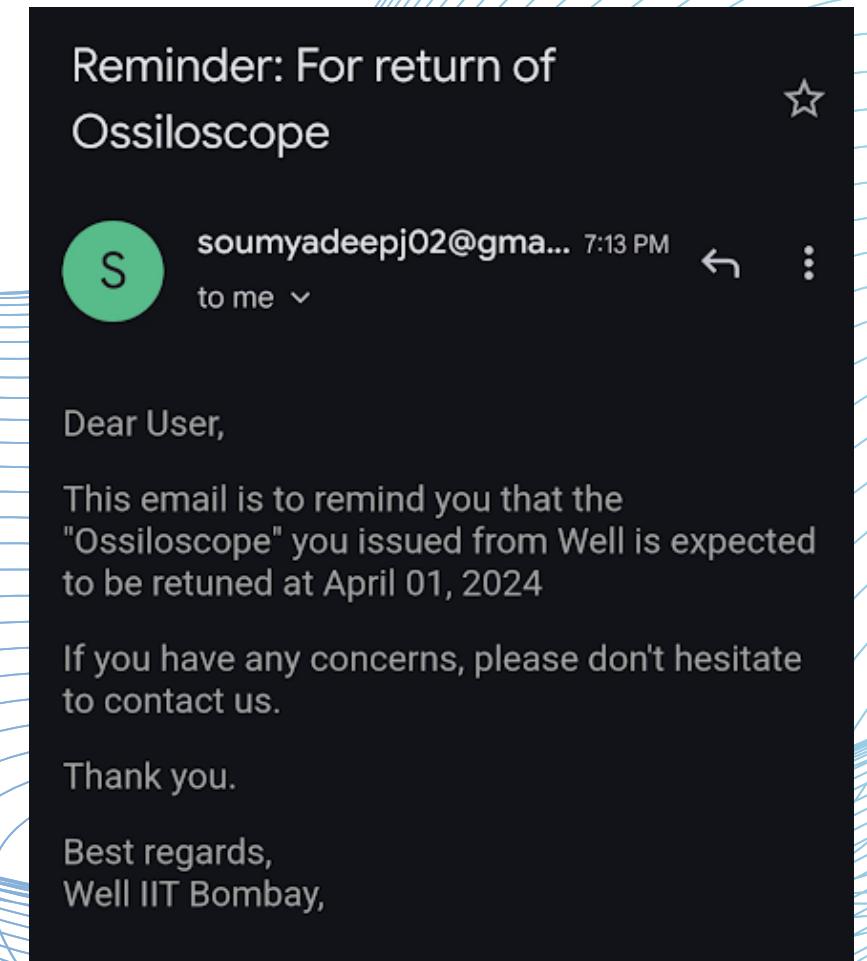
## How to ensure Card Reading is done Properly?

2 Level of Assurance:-

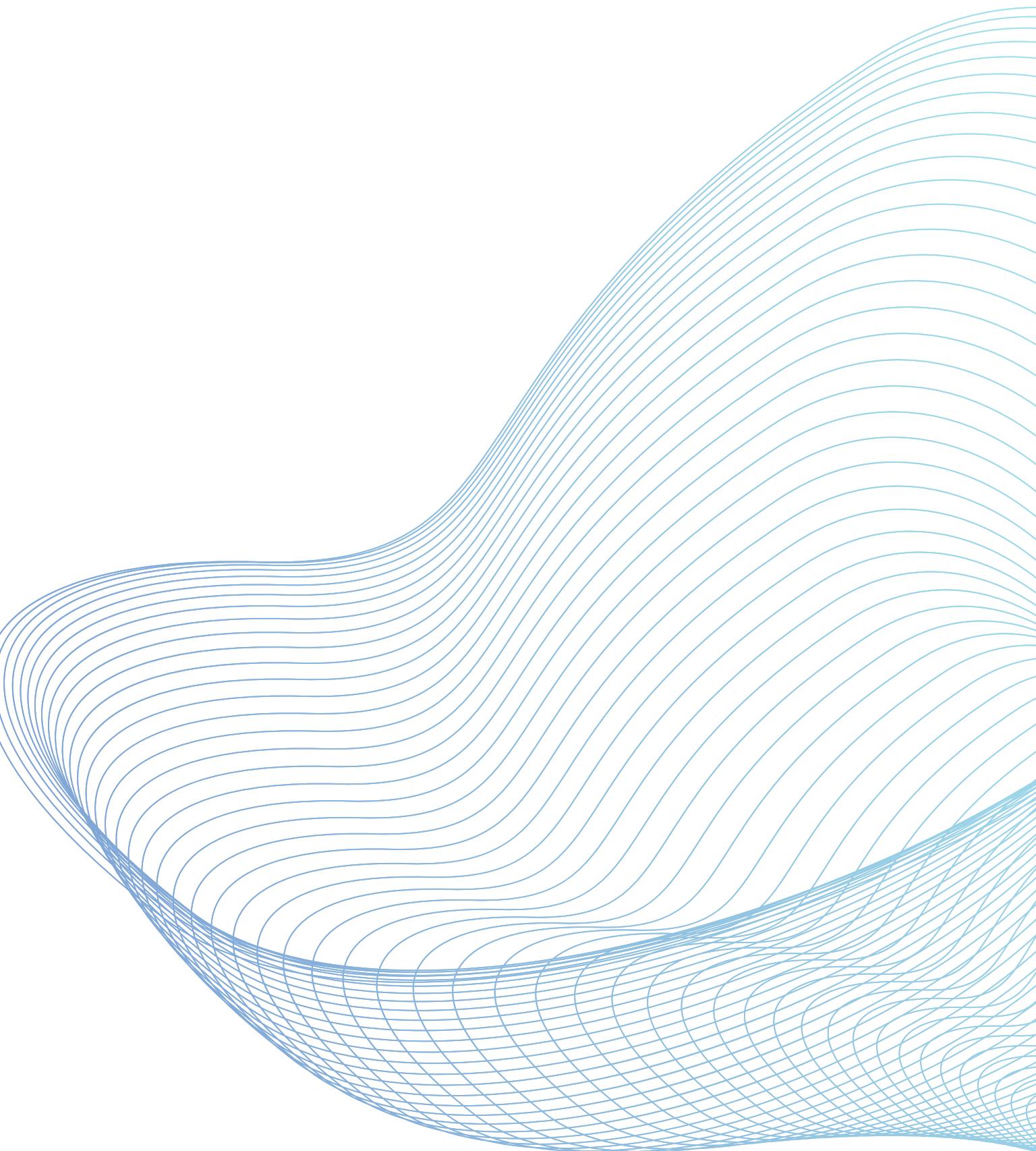
- User can get visual feedback from the buzzer and LED attached to the reader module
- Can check the database directly if the ID is visible or not

## What about Automation and Authentication?

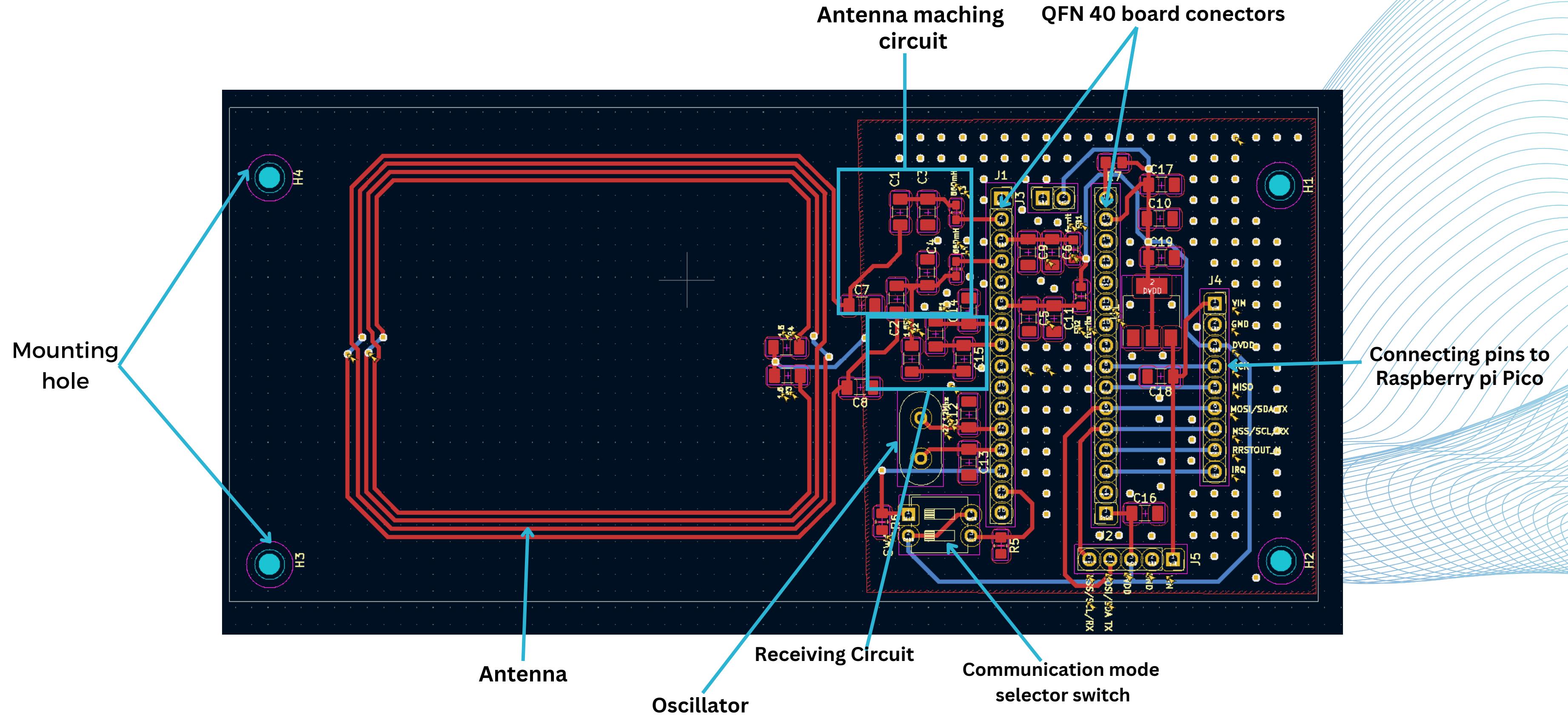
- Completed the automated email management system where user will get a reminder email 2 days before the esteemed return date of the product he/she using
- Authentication part yet not done working on it



Demo



# PCB Design



# Review Stage

Audit-trail of PCB fabrication

Project title: RFID Inventory management system.

Group ID: TUE -02

Student point of contact (name and roll no.):

Undertaking:

- I certify that my team has thoroughly reviewed the correctness of schematic and layout of this PCB design.
- We all understand that all PCBs that we need immediately have been submitted in this order.
- We all understand that we will not be allowed to submit any more orders up to one week from "Approval for mask printing and start of PCB fabrication" (step 4 in table below)

Signature of all group members:

Justification for cases where all group member signatures are not present above:

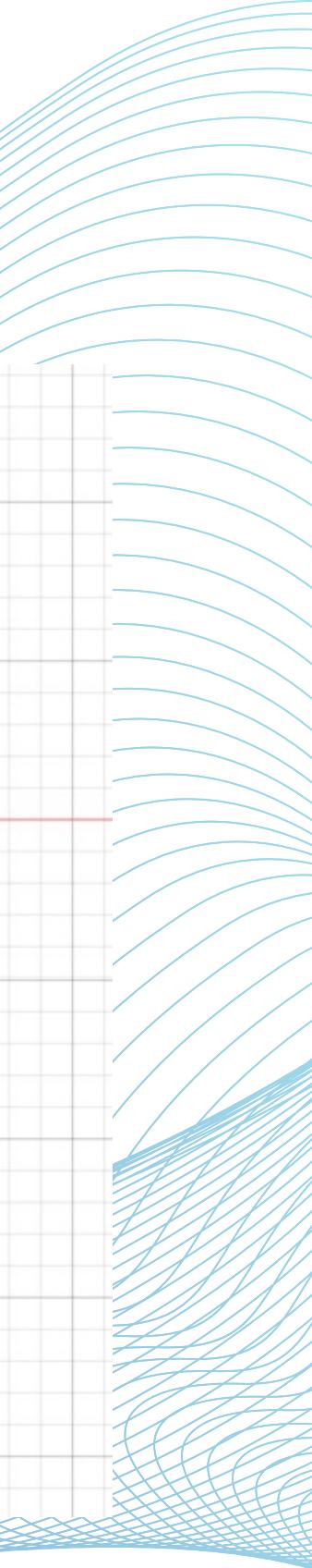
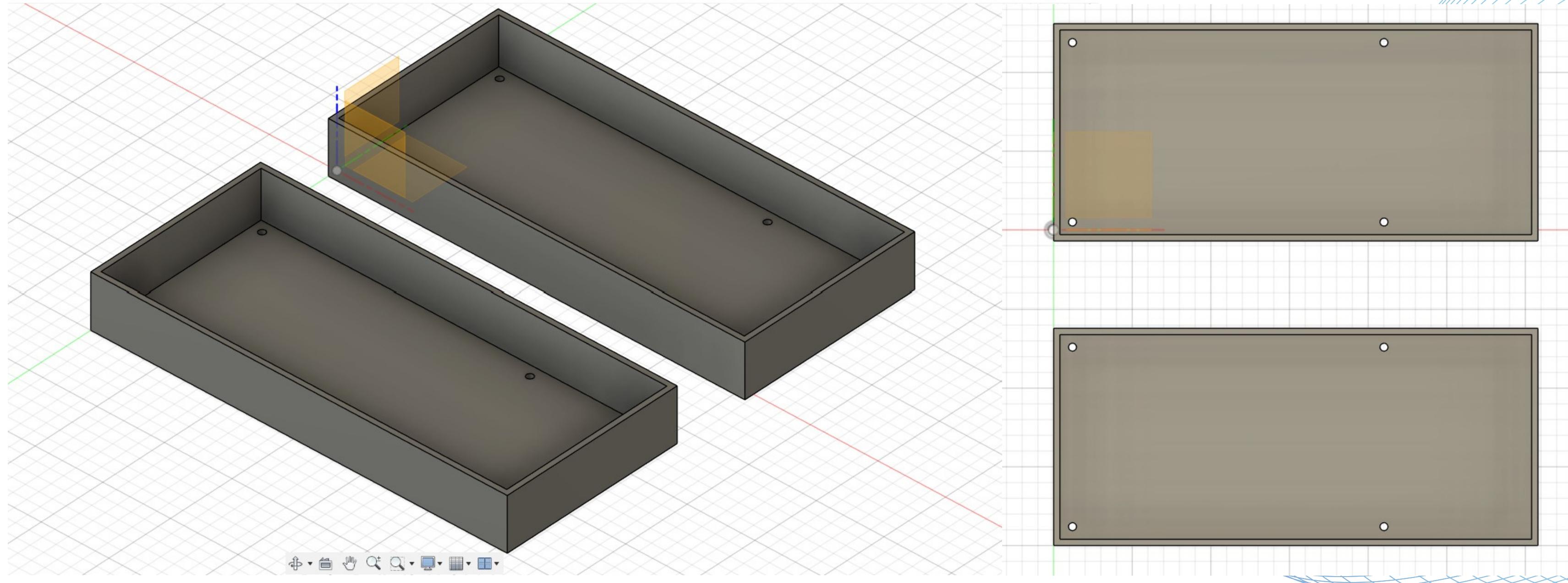
Sr. no.	Task	Reviewed/executed by (name & sign)	Date & Time	Remarks
1	Layout footprint and floorplan review (WEL) Expected time to completion: 1 day	Aravindakshan/Rajesh		Note: Students should take photo of components placed on printout of board layout(s) on A4 sheet and show these during review in step 2 below Recommended PCB format: A. Single-sided, no solder mask B. Double-sided, no solder mask C. With solder mask D. External vendor
2	Layout approval and process selection (WEL) Expected time to completion: 1 day	Maheshwar/Ankur 02	22/03/24 2:45 PM	
3	CAM file review process compatibility (PCB Lab) Expected time to completion: 1 day	Hitesh/Srinidhi/Vinish Srinidhi	14/03/24	Accepted
4	Approval for mask printing and start of PCB fabrication (PCB Lab) Expected time to completion: 5 days	Yadnik yadnik	14/03/24	Order ID: TUE -02/14032024/02
5	Receipt of PCB (from PCB lab)	Received by: Name: Om Udwale Roll no.: 210070058	22/03/24	

Verified by TAs and PCB Lab



We printed  
double sided PCB  
without solder  
mask

# CAD Design



# Critical tasks in progress and pending actions

- Incorporating Raspberry Pi Pico W and Battery Management System to make the PCB more compact.
- Transitioning hardware coding from MicroPython to C for improved efficiency.
- Integrating a Buzzer and LED in the Reader module to provide visual feedback on card reading instances.
- Enhancing card reading range, inclination, and stability within the module.
- Designing a user-friendly, compact 3D enclosure to accommodate the entire system.
- Conducting a survey to assess market feasibility and identify areas for product enhancement.
- Continuing work on improving the UI of the website and Android app to enhance real-world compatibility.

# key risks

- **PCB Debugging**:- Our PCB worked properly on every first try after debugging but after some time it failed to detect the ID. We are quite unsure about the error
- **3D Design**:- As our PCB debugging is in progress we are quite unsure about the final dimension of our system. Due to this we are not able to start full fledge 3D design
- **Hardware Language**:- Our whole proof of work till now is based on MicroPython, We are still facing lots of problems to shift in C language like understanding the SPI protocol and interfacing with the WIFI
- **User Requirement** :- Till now We have developed our whole system on a basic level, but after getting feedback from senior faculties we have realized that market value of our product is not so good. We are now collecting feedback from Library, Malls where real inventory management is used and we are into the task of improving our system

# **Progress made against test plan (Gantt chart):**

- All of us except Susrush completed their personal commitment of making a base model and now trying to test it.
- There are no major deviations from the original plan but we are including some extra features which we didn't think of, at the start.
- The coding part which is being done by Susrush is difficult in the case of C language and was underestimated, so he coded initially in micro python after realizing the difficulty of C language where the module could successfully run so that at least the PCB can be tested and now he is trying to implement the code in C by taking the help of micropython code.

# Work distribution until final demo

**Soumyadeep:** Improve functionality and user experience in the existing Inventory Management Web Application by optimizing performance, adding new features, and enhancing the overall design to streamline inventory tracking and management processes.

**Susrush:** Ensure smooth integration of RFID technology and Raspberry Pi Pico W using the C programming language, focusing on establishing robust communication protocols and implementing efficient data processing algorithms to enable seamless interaction between the RFID reader and the Pico W.

**Prince:** Generate detailed CAD designs for the Printed Circuit Board (PCB), incorporating considerations for size, component placement, and routing to accommodate the integration of external battery power management systems. Develop strategies for efficient power distribution and ensure compatibility with the overall system architecture.

**Om:** Design and finalize the layout for the PCB, integrating the Raspberry Pi Pico W and RFID reader onto the same board while incorporating provisions for the external power management system. Emphasize optimization of space utilization, signal routing, and thermal management to achieve a compact yet efficient PCB design.

# Individual contribution

## Sai Susrush

### **Prepare Bill of Materials (BOM) for All Components :**

- Compile a list of all components required for the project including RFID readers RC520 and PN532, Raspberry Pi Pico, WiFi module, and any additional components.
- Specify quantities and specifications for each component to ensure accurate procurement.

### **Interfacing Pico with RFID Readers RC520 and PN532 :**

- Connect Raspberry Pi Pico to RFID readers RC520 and PN532 for data exchange.

### **Connecting Pico WiFi Module to Local Device :**

- Establish connection between Pico's WiFi module and a local device to retrieve Pico's device ID.

### **Coding in Thonny to Retrieve Device ID from PCB :**

- Develop code using Thonny IDE to extract the device ID from the PCB.

### **Testing Printed PCB Design with Teammates :**

- Collaborate with teammates to test the functionality and compatibility of the printed PCB design.

# Individual contribution

## Om Unhale

### **PCB Design for RFID Module PN532 :**

- Develop schematic and layout design for the PCB accommodating the RFID module PN532 and associated components.

### **Antenna and Matching Circuit Design :**

- Design and optimize the antenna layout to ensure efficient RFID communication.
- Develop matching circuits to maintain impedance compatibility between the antenna and the RFID module.

### **Coordinate PCB Printing with Lab :**

- Liaise with the PCB fabrication lab to convey design specifications and requirements for manufacturing.

### **Review with TA & Maheshwar Sir :**

- Seek feedback and approval from the Teaching Assistant (TA) and Maheshwar Sir on the PCB design before production.

### **Component Soldering :**

- Assemble the PCB by soldering components onto the designated positions according to the finalized design.

### **Circuit Verification and Testing :**

- Test RFID module and antenna for correct operation with other teammates.
- Troubleshoot and resolve any issues for desired functionality with teammates.

# Individual contribution

## Soumyadeep Jana

### **Web Development:**

Developed a web-based interface for efficient inventory management, facilitating the issuance of equipment, development boards, and modules.

### **Local Server Setup:**

Established an online database and integrated it with the global network, ensuring scalability and accessibility beyond a single user.

### **Automated Management:**

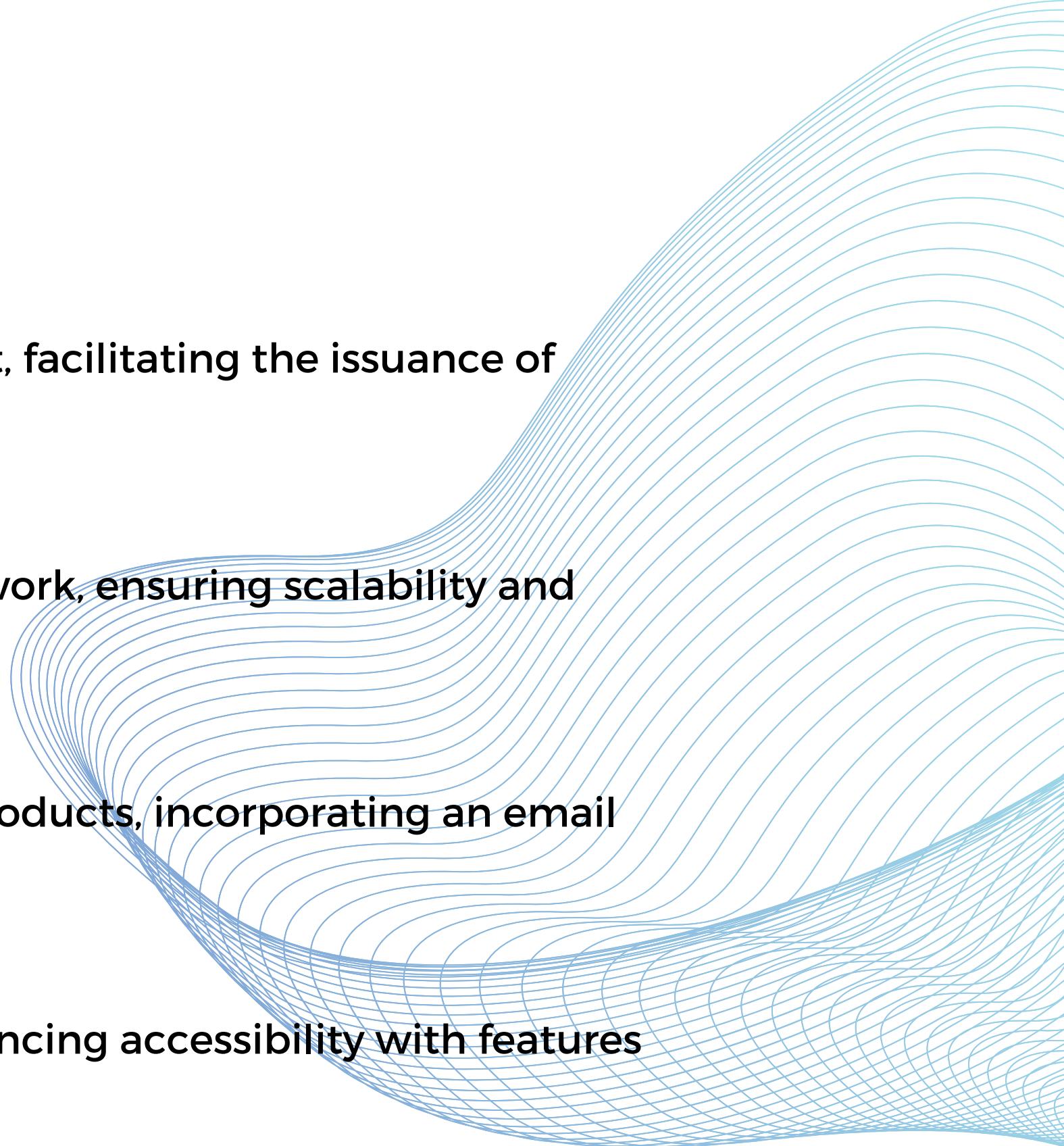
Implemented an automated management system to track issued products, incorporating an email alert system for timely return date reminders.

### **Android Development:**

Created an Android application mirroring website functionality, enhancing accessibility with features such as Add, Delete, Issue, and Return.

### **Testing in real time:**

Conducted real-time testing of the entire system alongside teammates, validating performance on soldered PCBs.



# Individual contribution

## Prince Kumar

### **Component Soldering :**

- Soldered SMD components onto the RFID model, ensuring precise connections and optimal functionality.

### **3D Design**

- Designed the frame for the RFID inventory management system using AutoCAD, ensuring accuracy and compatibility with the system components.

### **Report and Slides**

- Maintained work history through comprehensive report writing, documenting project progress, challenges encountered, and solutions implemented. Ensured transparency and accountability throughout the development process.

### **Power management**

- Developed and implemented battery management strategies for the RFID module and Pico W, focusing on efficient power distribution, charging, and monitoring to maximize system longevity and reliability.

# Plan for final demo

1. We have shown the upgraded Inventory Management Web App, making it easier to use with faster performance and new features to help track and manage inventory better.
2. We demonstrate how we smoothly connected RFID technology with Raspberry Pi Pico W using simple C programming. This allows them to talk to each other effectively, ensuring efficient data processing.
3. We reveal the final layout of the PCB, combining the Raspberry Pi Pico W and RFID reader on one board. We've made sure it's small, efficient, and manages heat well while still being powerful enough for our needs, along with using CAD to design and print the final structure for the RFID reader. This ensures precise fitting and assembly, enhancing the overall reliability and performance of the system.

THANK YOU...