SAFETY HUB

TEAM 18
CDR PRESENTATION

University of Massachusetts Amherst
BE REVOLUTIONARY™

MEET THE TEAM

Soumark Ray
CompE

Anthony Panarelli
EE

Dhanush Palarapu
EE

Rohit Draksha
CompE

Yadi Eslami
Faculty Advisor

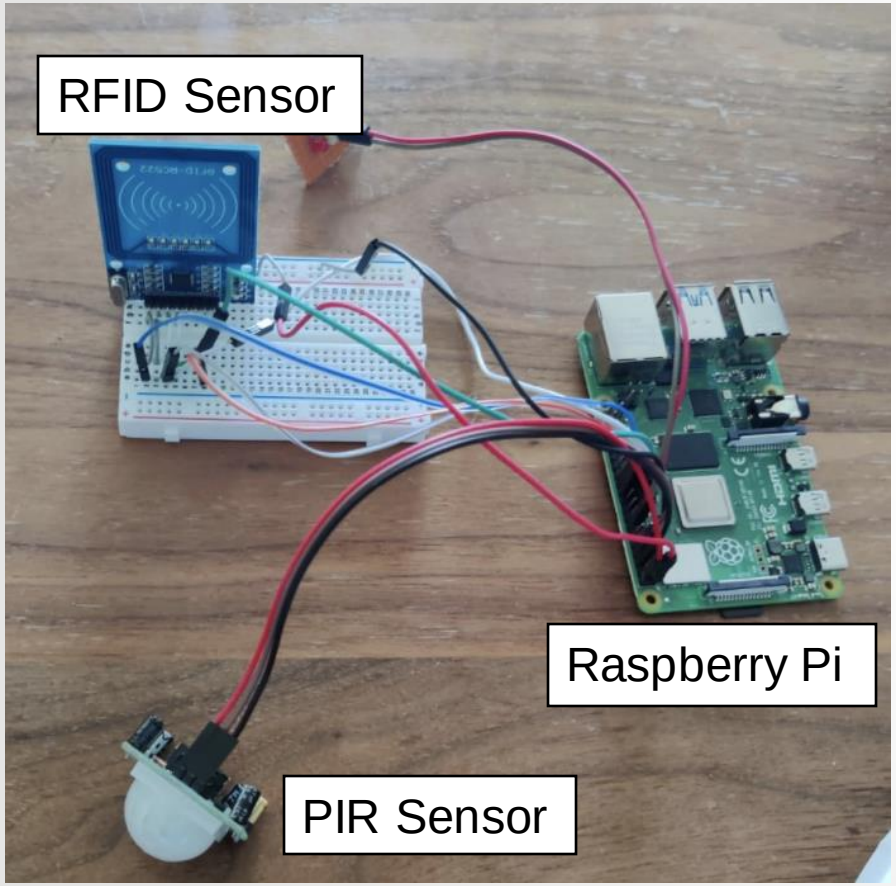
PROBLEM STATEMENT

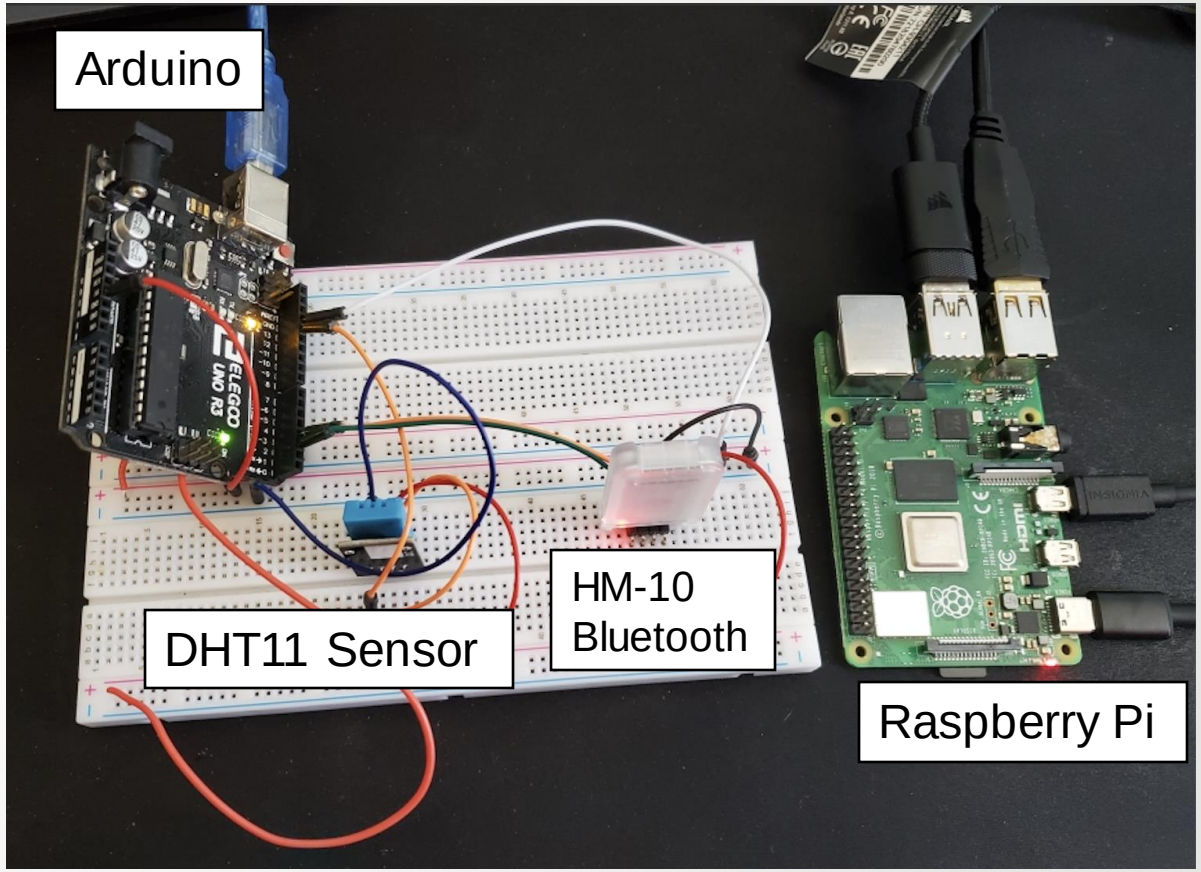
In a laboratory environment, there are many safety and security issues which can arise on a day-to-day basis which can cause harm and damage to sensitive equipment. Many of these problems are caused due to human error and negligence and can have serious infrastructural and financial setbacks. For instance, if the temperature in the lab were to change drastically due to a window being left open, the change in temperature and humidity could have serious effects on delicate temperature sensitive equipment. Modern sensors today are not equipped with reprogrammable thresholds for temperature and humidity to alert lab owners of potential harm to their equipment. Moreover, lab equipment safety is of paramount importance, with many sensors unable to notify owners of who has entered the lab and at what time.

SYSTEM SPECIFICATIONS

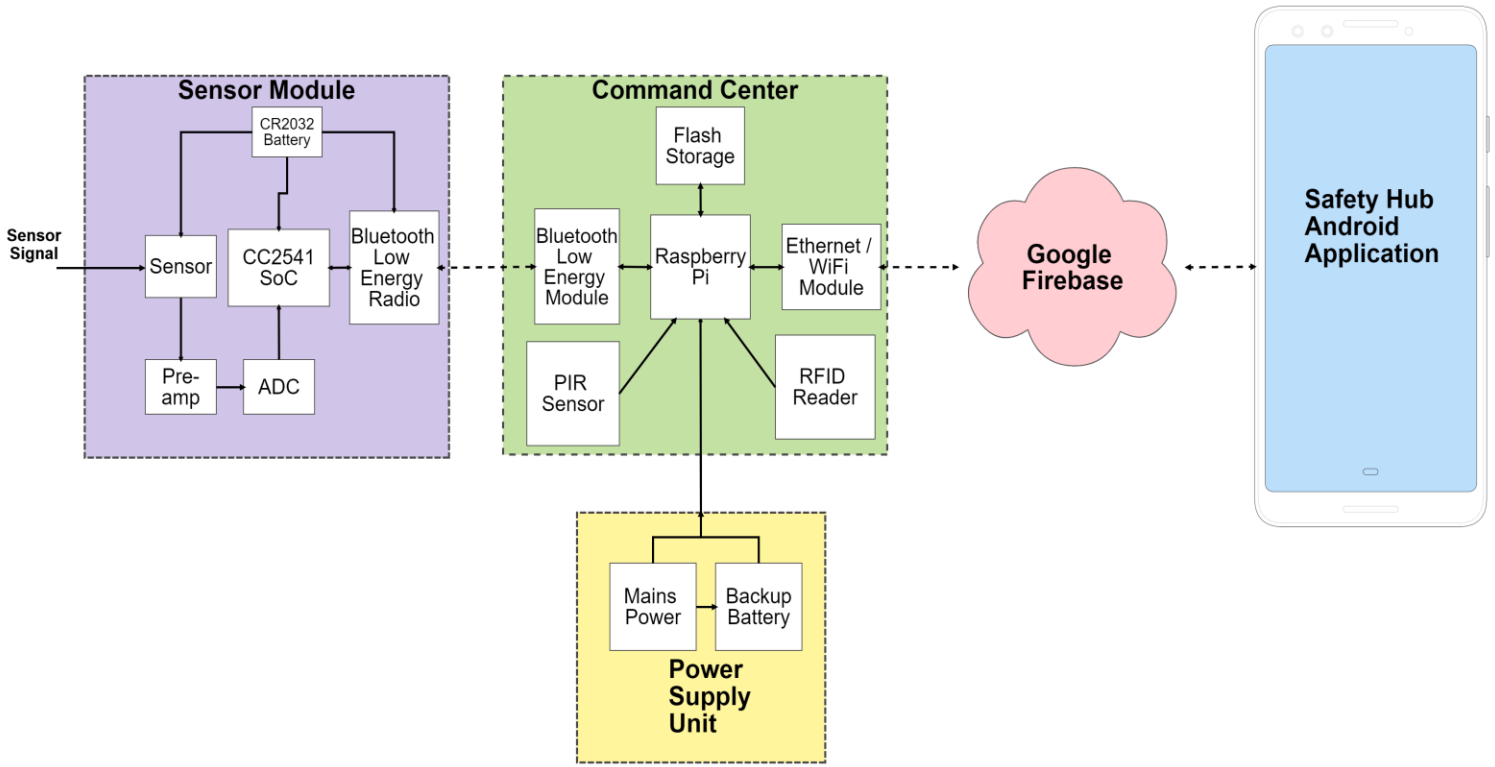
- Weight - The sensor device should be portable enough such that it can be mounted strategically to an area of interest without reliance on power from an outlet – about 80mm x 60mm and about than 150g
- Resilient - The Command Center should be powered from a wall outlet and have a battery backup with enough energy to last one week in case the power goes out
- Ease of Use - The system should have user friendly interface to receive notifications and calibrate the connected sensors and devices (app with touch controls)
- Modularity - The device design should be modular and customizable to customer requirements (each component can be connected through a Bluetooth connection).
- Portable - Sensor module should have freedom to be placed in location of interest without relying on power from a wall outlet, and communicate to command center wirelessly

DOCUMENTATION OF CURRENT PROTOTYPE

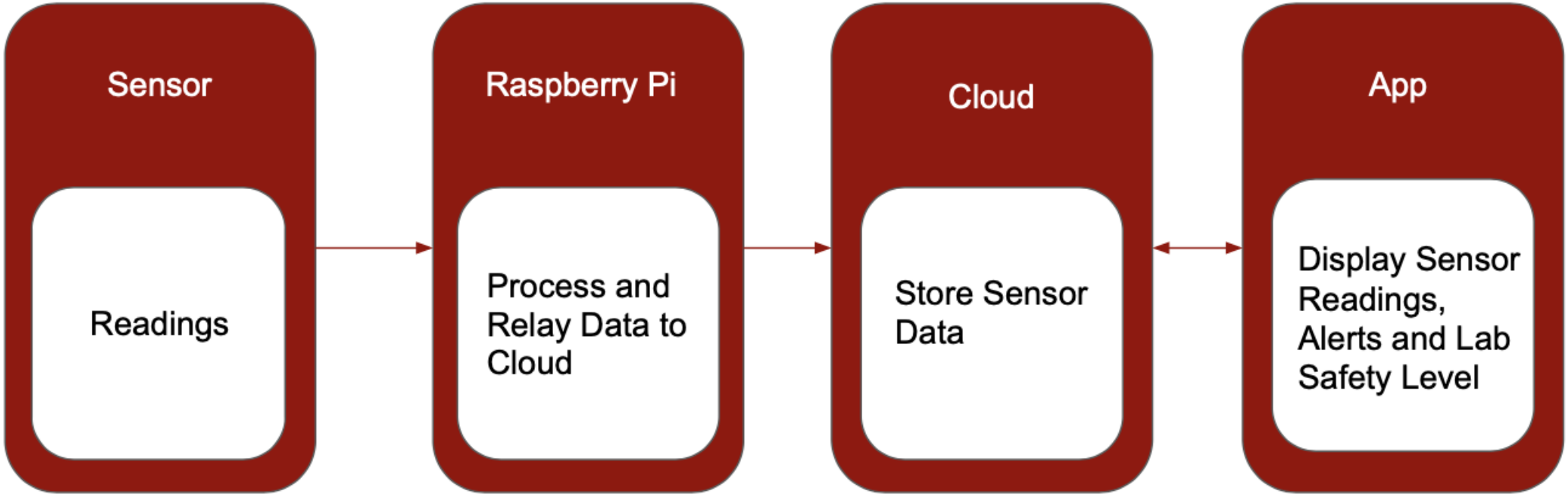




UPDATED SYSTEM DESIGN - HARDWARE

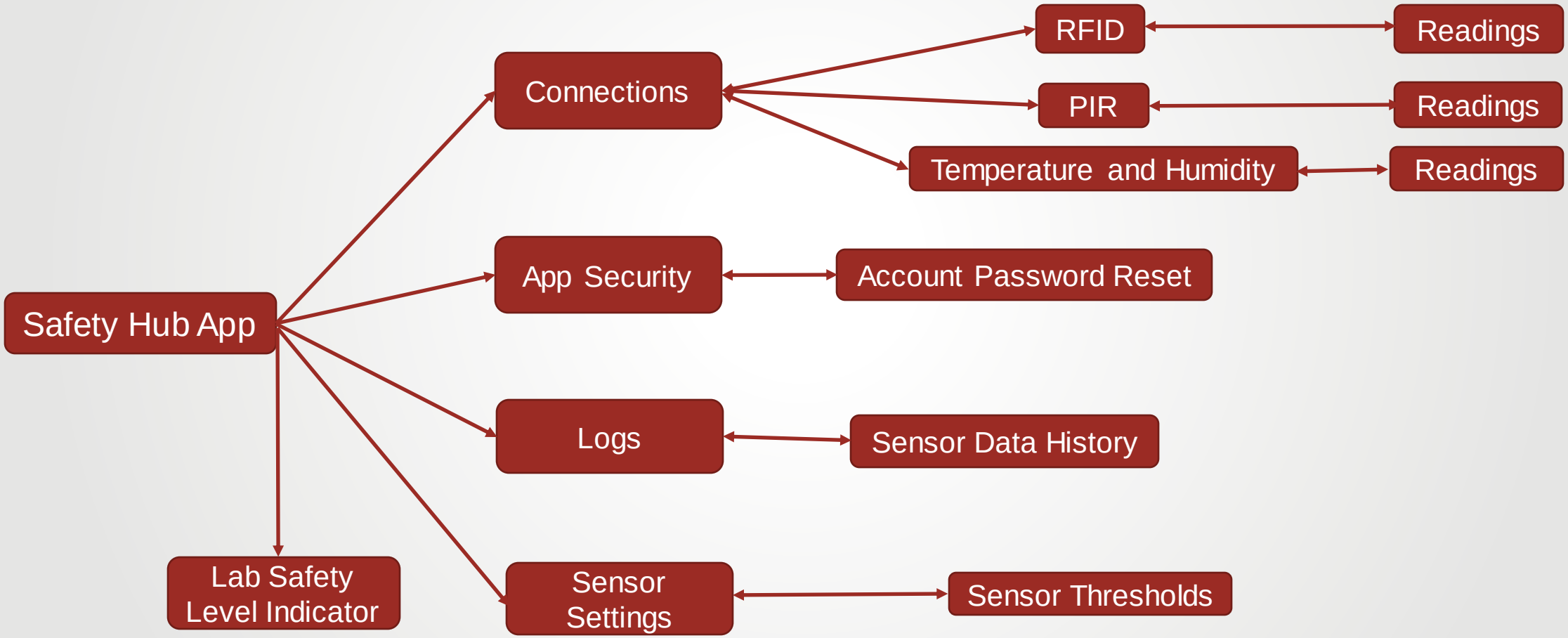


UPDATED SYSTEM DESIGN - SOFTWARE



*Sensors = RFID/ PIR/ Temperature and Humidity

SAFETY HUB APP DESIGN



LIST OF HARDWARE & SOFTWARE

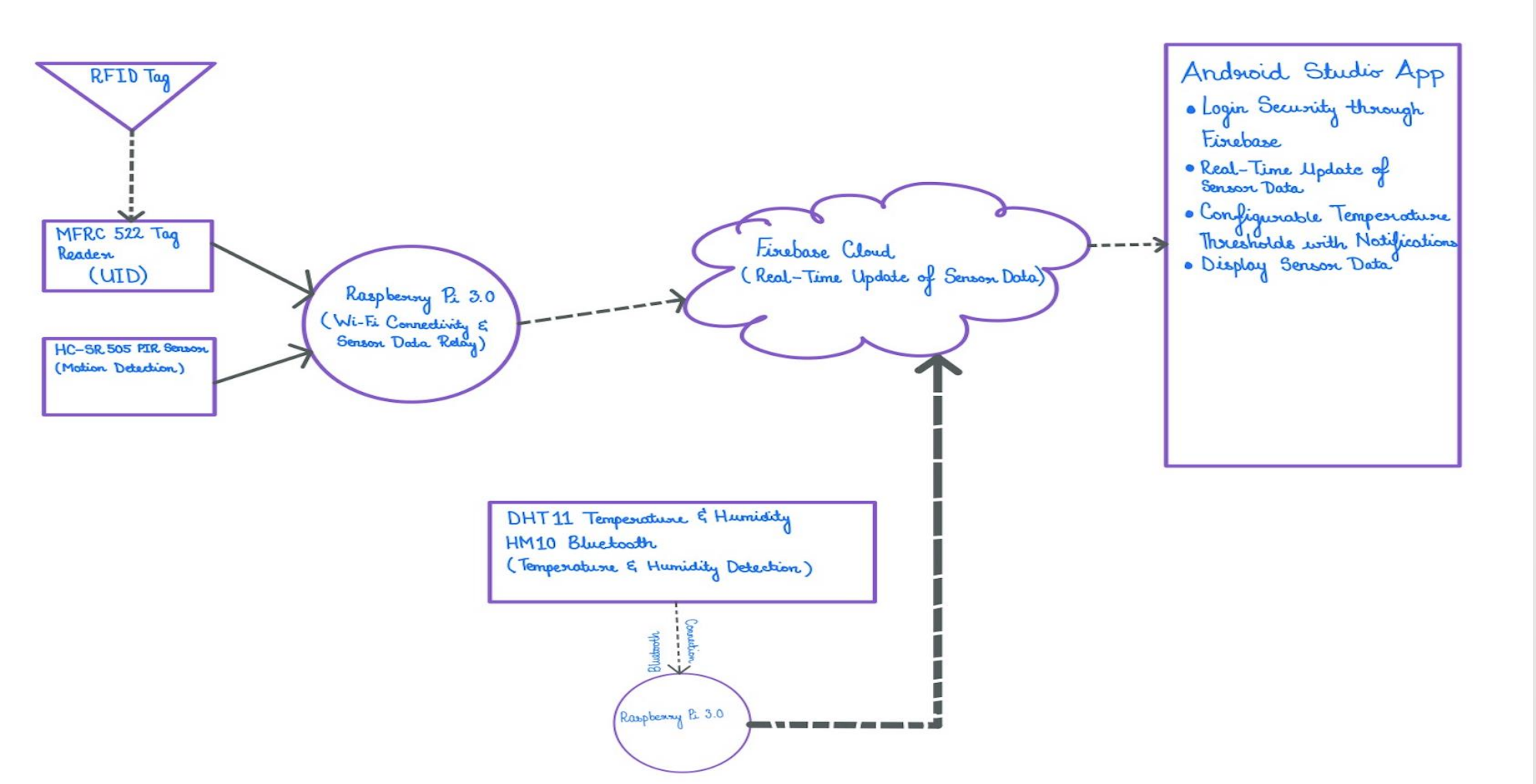
Hardware

- Currently used:
  - Raspberry Pi 4.0
  - HC-SR501 PIR Sensor
  - MFRC522 RFID Reader
  - RFID tags
  - DHT-11 Temperature and humidity sensor
  - CC2541 Module for BLE
- Future Additions
  - UPS HAT Battery Module

Software

- Currently Used:
  - Firebase Cloud Server
  - PyCharm Python
  - Android Studio

INTEGRATED SYSTEM DEMONSTRATION



CDR DEMO

CDR DELIVERABLES

- **Delivered:**
  - **App Integration with FireBase**
  - **SafetyHub App backend**
  - **Relay sensor data (Sensor -> Raspberry Pi -> Cloud -> App)**
  - **Display Data on App**
  - **Notification when Temperature Threshold is updated**
  - Custom PCB design
  - **RFID and PIR Module Integration**
  - **Temperature and Humidity Module Integration with Bluetooth**

CDR DELIVERABLES

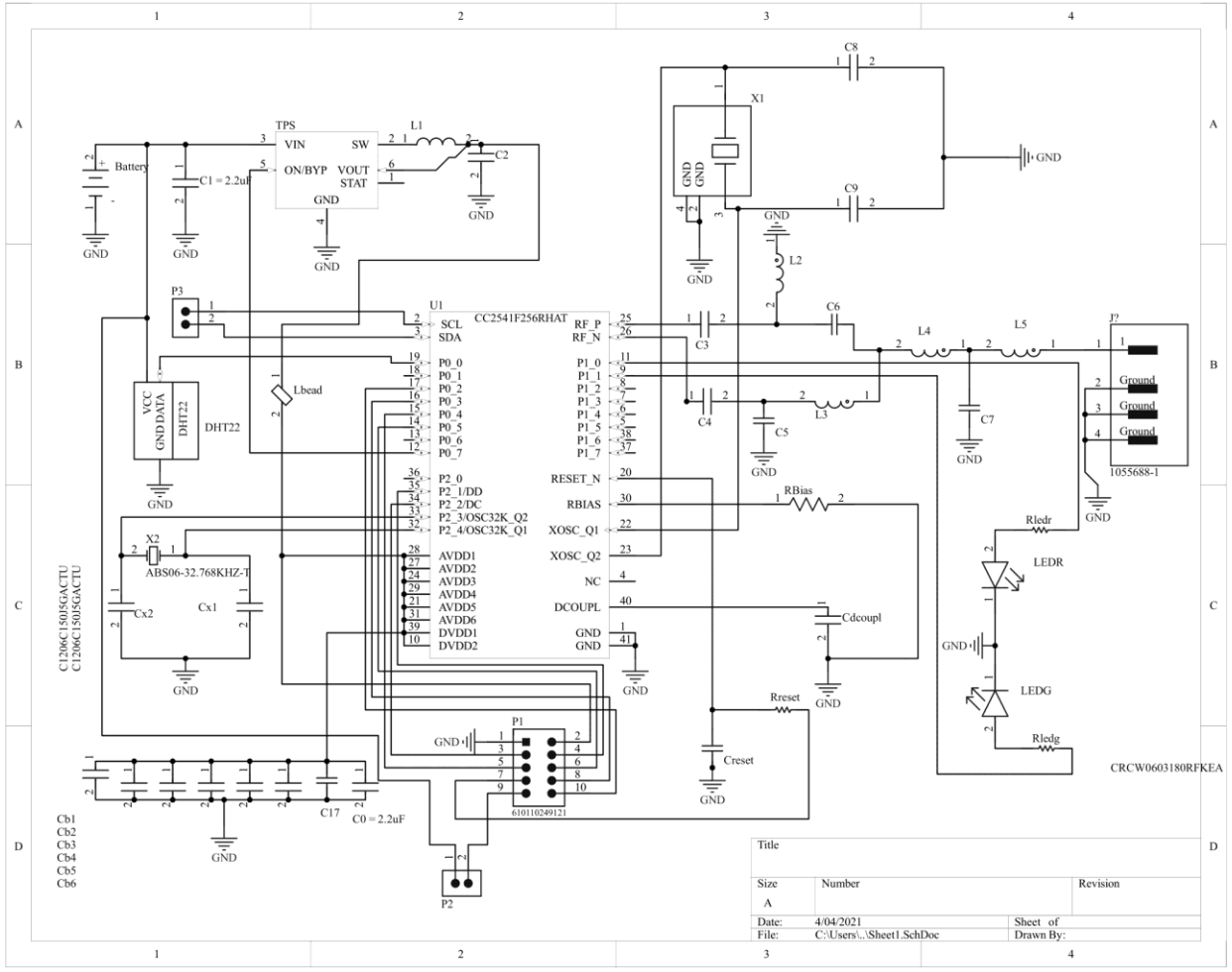
In Progress:

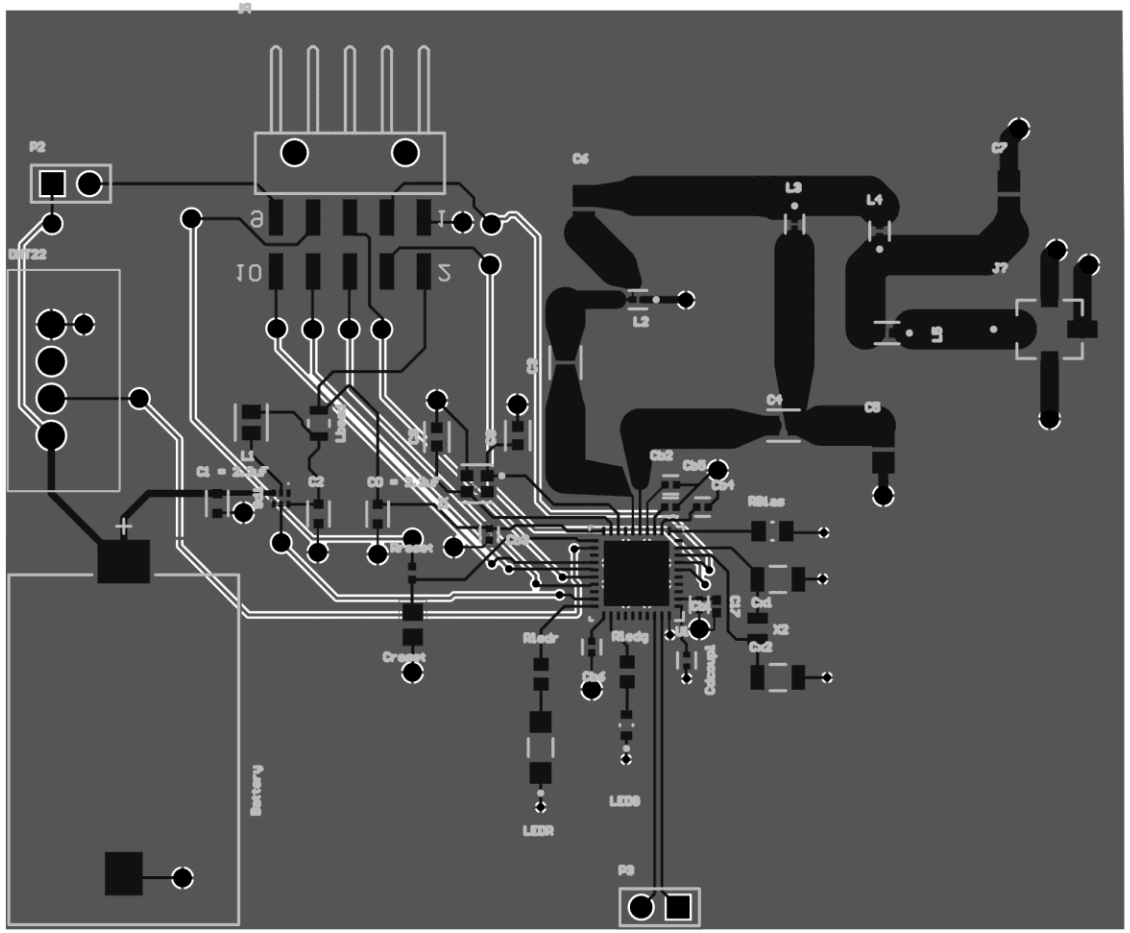
- **SafetyHub Lab Safety Meter**
- **Alert Notifications based off thresholds**
- **Logs containing Past readings (updated using Firebase)**
- **Battery Backup Unit connections**
- **PCB integration to overall project**

CURRENT CONSUMPTION

- **Battery Backup Unit:**
  - Using a Power Bank with a 5V and 3A output.
  - Current Consumption of Raspberry Pi 4.0 while running: 541 mA
  - Current Consumption of HC-SR501 (PIR): 0.5mA (From Datasheet)
  - Current Consumption of MFRC522 (RFID): 30mA (From Datasheet)
  - Current Consumption of HM-10 (BLE): 30mA (From Datasheet)
  - Current Consumption of DHT11 (Temperature & Humidity): 0.3mA (From Datasheet)
  - Time the Battery Backup Unit (Power Bank) will run: 1000mAh/541mA
    : 18.5 hours approx.

PCB SCHEMATIC AND LAYOUT





PRIMARY RESPONSIBILITIES FOR FPR

- End to end integration to perform entire set of operations with APP integration (entire team)
- Transition to PCB – Anthony
- Have PCB tested and integrated – Anthony
- Complete the SafetyHub App with Alert Notifications – Rohit
- Complete Testing of App and SafetyHub safety Meter – Rohit and Soumark
- Complete integration of battery backup unit – Dhanush

PLANS FOR FPR

Current

- RFID and PIR
  - Grant Access if user is in DB
  - Unauthorized entry detection with time stamp
- Temperature and Humidity
  - Temp. And Humidity displayed to User through app
- Arduino Code
- Android App
- Cloud Functionality

FPR

- RFID and PIR
  - Add Push Notification for Unauthorized Entry Alerts
- Temperature and Humidity
  - Temperature and Humidity Threshold Trigger Notifications
- Code fully ported to C and running on custom sensor PCB
  - Add low power sleep and wake states

PROJECT EXPENDITURES

Current Expenses

- Raspberry Pi 4 Board - $35 x 2 = $70
- RFID Readers – $6.76 x 3 = $20.28
- HC-SR501 PIR Sensors = $7.99
- HC-SR505 PIR Sensor = $11.99
- AM312 PIR Sensor = $8.49
- HM-10 Bluetooth 4.0 Module – $ 9.99 x 7 = $69.93
- Shipping and Taxes - $4.99

- Total Budget Spent = $193.67

Projected Expenses

- PCB costs - $40
- Shipping and taxes - $5
- Total projected budget = $45

Projected total expenditure = $238.67

Final System Cost

PCB = $40
HM-10 Bluetooth 4.0 Module = $9.99
RC552 RFID Reader = $6.76
DHT11 Sensor = $2
Raspberry Pi 4 = $35
HC-SR505 PIR Sensor = $11.99
Final Cost = $106.74

PROJECT MANAGEMENT

- **Rohit Draksha (Team Coordinator)**
  - SafetyHub App User Interface and Backend
- **Soumark Ray (Budget Management Lead)**
  - Firebase Cloud Service
  - SafetyHub App Backend (Firebase and Android Studio)
- **Anthony Panarelli (Altium Lead)**
  - Custom PCB design
  - Connecting PCB to Raspberry Pi via Bluetooth
- **Dhanush Chandra Palarapu**
  - Battery Backup unit
  - RFID and PIR Module