

# • THERMONITOR

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Team A6

# • Problem Statement

## Handheld Thermometers

4 in. detection radius

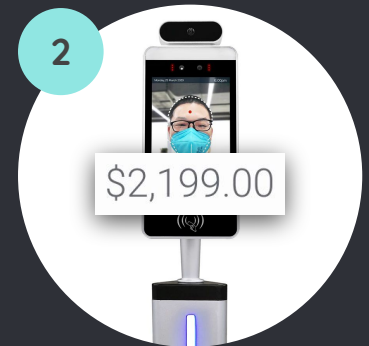
Does not conform with social distancing



## Standalone Kiosks

High price point

Marketed towards businesses and companies



# • Use Cases

## Improved safety

- Standalone smart thermometer
- Placed near entrance of rooms
- Mask detection

## Temperature Monitoring

- Scan ID to initialize temperature check

## Contact Tracing

- Record individual profiles

## One-stop Management Platform

- Accessibility on mobile devices through IoT



# • Requirements

## Temperature Sensing

Accurately detect temperature of person standing in front of the camera

## RFID

Scan and send RFID information and turn on Jetson accordingly

## Low Power

## Facial Detection

Detect and show bounding box around person's face. Identify if they are wearing a mask.

## IoT External Platform

Show logs of recorded temperatures mapped to corresponding RFID on admin accessible external platform

## Low Cost

# • Solution Approach

## Temperature Sensing

FLIR IR Lepton 3 Camera

PureThermal 2 Smart I/O Board

Radiometric measurement

## RFID

X-NUCLEO-NFC02A1 RFID scanner

Connected to STM32 Nucleo-L476RG board

## Low Power

Nucleo board used to send a “wake up” signal to the Jetson nano

## Facial Detection

Raspberry Pi Camera Module V2

Haar classifier algorithm

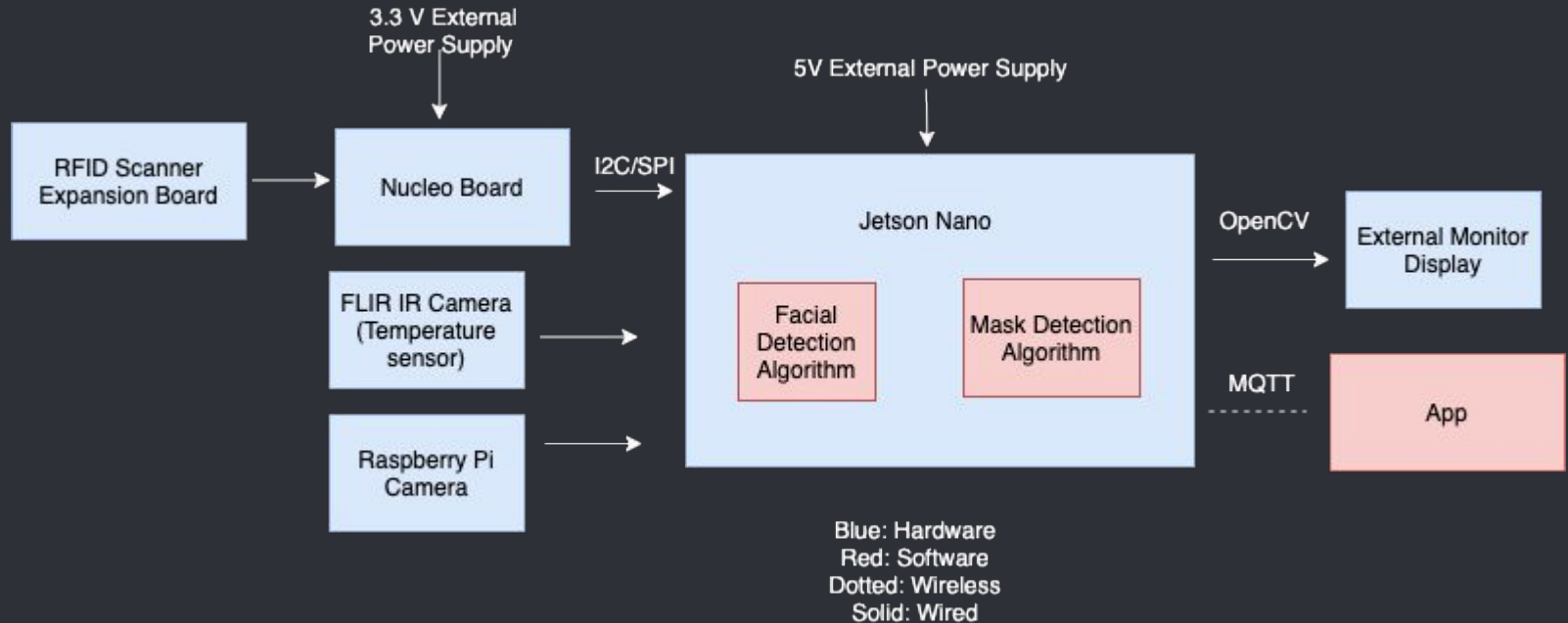
Online data training sets

## IoT External Platform

Database for RFID profiles

App to visualize temperature logs

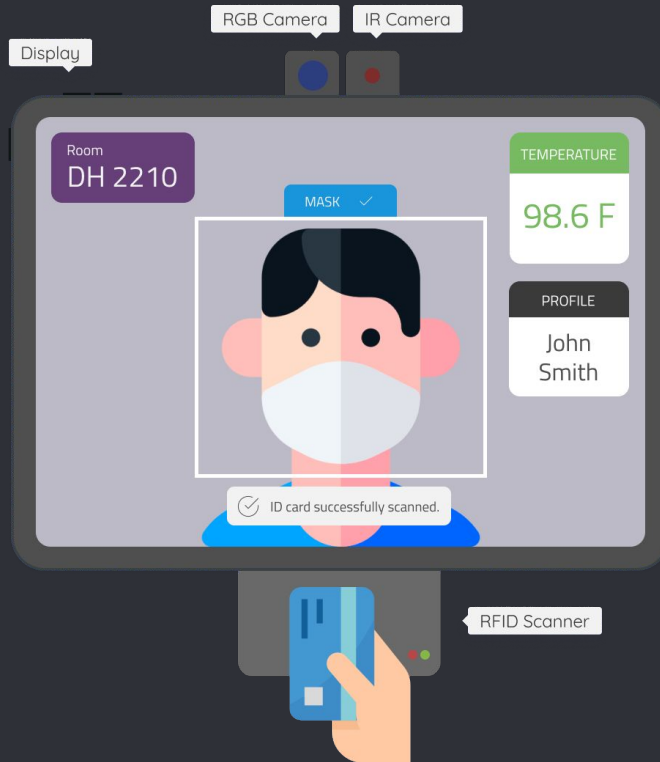
# Overall Design



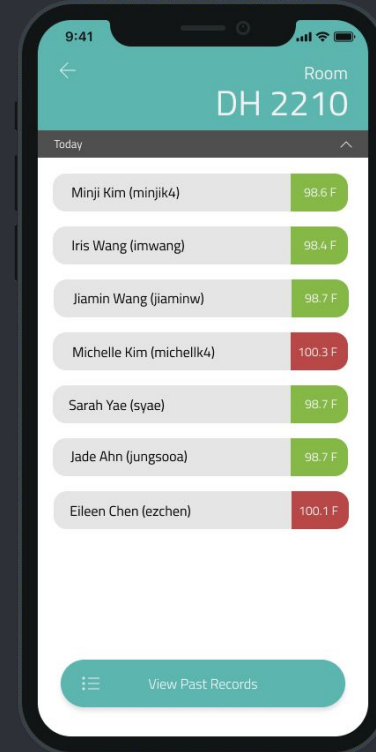
- IoT Architecture



# Device Design



# Platform Design





## • Technical Challenges

- High frame accuracy of facial and mask detection
- Sending data through the cloud
- Encryption and decryption of messages
- External platform with creation of a database
- Choosing the most optimal communication protocol

# • Metrics and Validation

| Components                   | Validation Methods   | Metrics   |
|------------------------------|--|---|
| <b>RFID Scanner</b>          | Testbench with multiple sample RFID's  | 99% accuracy  |
| <b>Facial Detection</b>      | ML facial test data with and without masks   | 90% face detection<br>80% mask detection<br>10% false positive<br>1-2% false negative |
| <b>Temperature Sensing</b>   | Verify objects with different temperatures (cold/warm/hot)   | Within 2 degrees of error<br>2s measurement response                                  |
| <b>IoT External Platform</b> | Check if logs are accessible and mapped to correct RFID<br>Test samples to ensure platform is easy to navigate | User testing and feedback   |

# • Division of Labor

## Jiamin

Hardware Focus

- RFID scanner functionality with Nucleo
- Nucleo controlling on/off of Jetson for power efficiency
- Communication between Nucleo and Jetson

## Iris

Software Focus

- RPI and IR camera integration with Jetson
- Facial/Mask detection implementation
- Broadcast of information on display

## Minji

Software Focus

- Communication from Jetson to cloud
- Message transmission
- IoT solution development

# Gantt Chart

