IoT Hub
Checkpoint 2 Presentation

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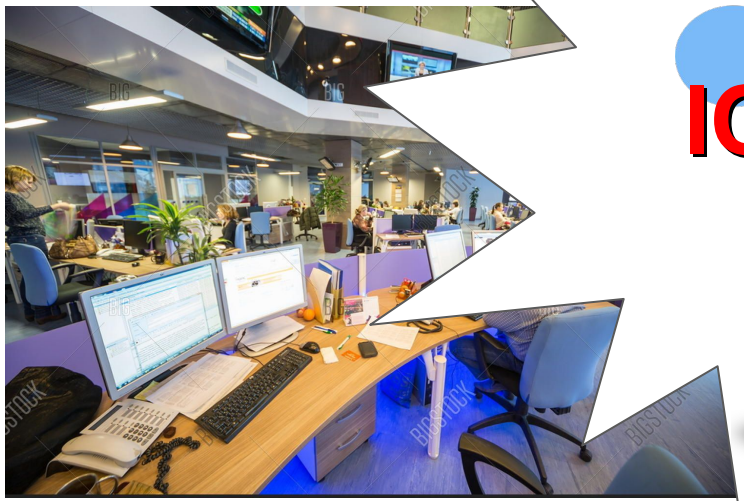
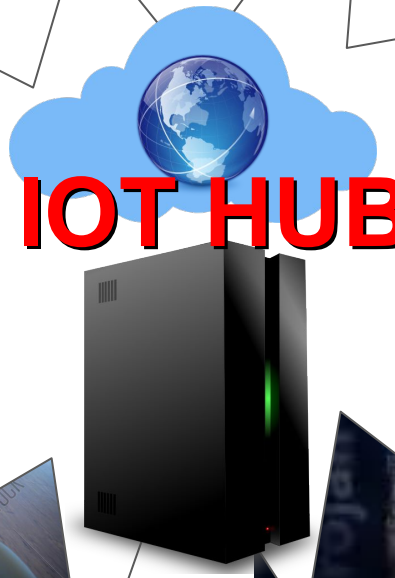
Goals & Milestones Recap

Lehao Sun

Motivation

What problem are w olving?





Functionality

What can we offer?

Initial Configuration

- Add device
- Set up user profile

Device Management

- Software update
- Delete device
- Packet monitoring
- Battery life monitor

Device Control

- Play video
- Play music
- Device status monitor

Challenges

What issues do we want to solve?

Extensibility

- Easy to add new features
- Apply to new devices/applications

Usability

- Aim to users even without tech background

Scalability

- Handle a large number of users and devices
- Make protocols simple

Compatibility

- Compatible to all the device

SYSTEM

USER

Problems and Solutions

What design decisions we have made?

System

- How to identify and manage new device?
  - Device metadata protocol
- How to make views consistent among different devices of the same type?
  - Content management
- How to define human-device relationship?
  - Many-to-many device control
  - Backend admin
  - Temporary account

User

- How to display dozens of devices in one page?
  - Device group
  - Search device
- How to display information that the user want mosted?
  - Popular device
  - Notification

Milestones listed in CP1

What we have achieved?

- [x] UI and backend implementation
- [x] Integration test
- [ ] ~~Improve system security~~
- [x] Improve system robustness
- [x] User studies
- [x] Iterative development based on users' feedback

Actual Progress

System and User

Ken Ling, Mengjin Yan

System Implementation

Server

Backend Server

Written in Nodejs as a web application. Aim at portability.
Web app server.
Websocket server.
Authentication server.

Built on Existing EAP-NOOB Authentication Framework

Scan QR code to add new IoT devices.
An easy way to add large number of IoT devices.

Read code and understand API.
Integrate our functions with existing framework.
Setup router, authentication server.

System Implementation

Device & User

Devices

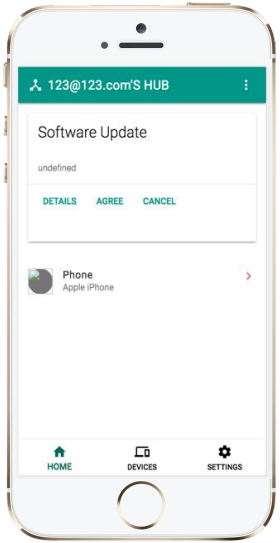
Use laptop as IoT device.

Run Ubuntu system.
Write a websocket client in python to communicate with backend server.

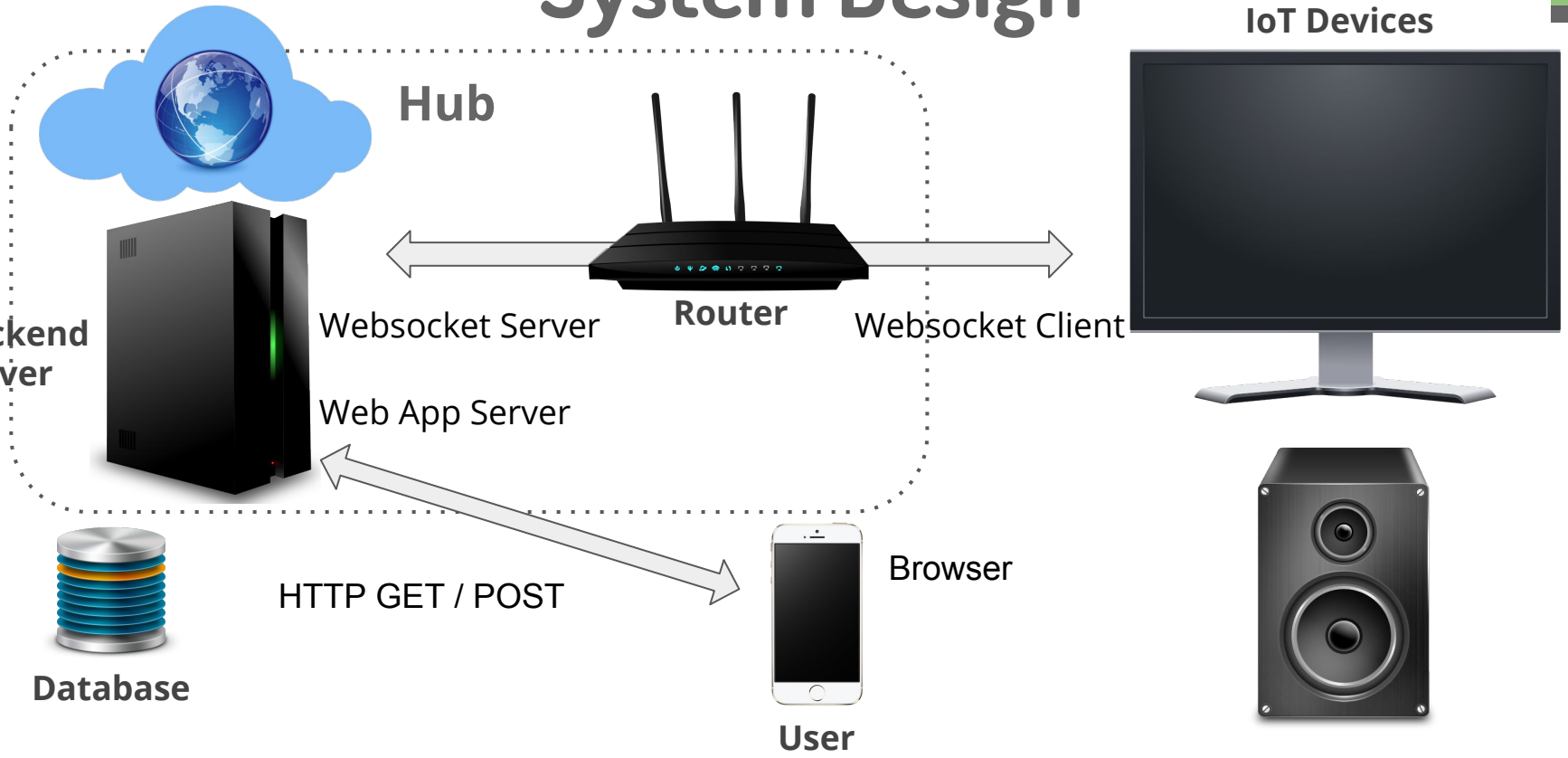
ubuntu python™

User

Use browser to connect to the server and login to the hub.



System Design



IoT devices always have to go through the hub.

Add Device

Authentication Server

EAP-NOOB

Server generates a unique ID for the device.

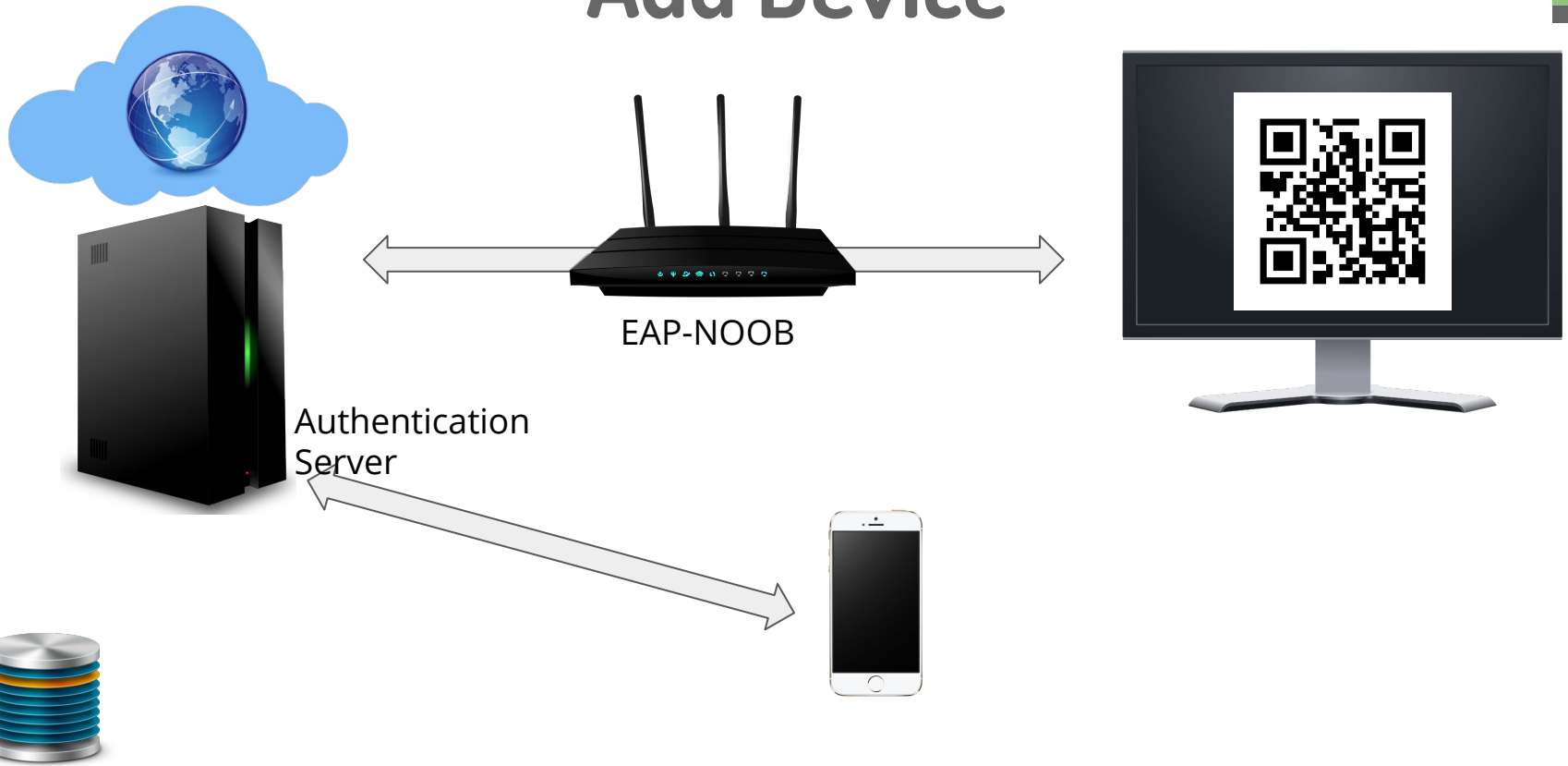
Add Device

EAP-NOOB

Authentication Server

Server binds the device with authorized user.

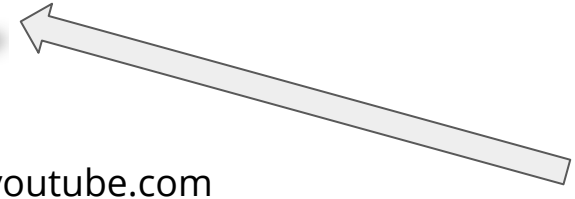
Add Device



Device initiates a connection to websocket server with the assigned ID.

Control Device

Play Video

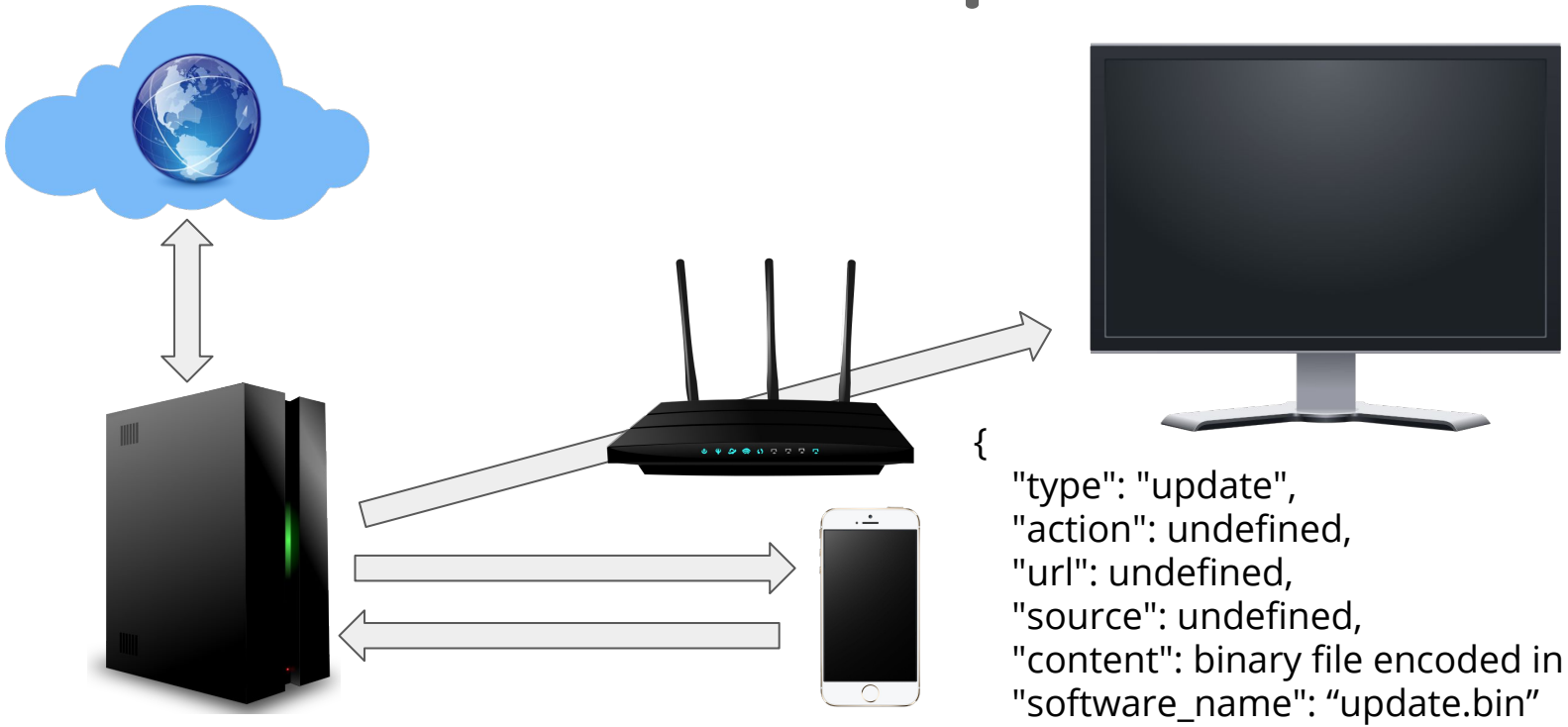


YouTube API
User authentication.
Fetch content from YouTube.


```
{
   "type": "video",
   "action": "play",
   "url": "https://www.youtube.com
/watch?v=iAmI1ExVqt4",
   "source":"youtube",
   "content": undefined,
   "software_name": undefined
}
```


Why don't we directly use smartphone to connect to the device?
Simplicity of IoT device.
Uniform experience.

Software Update

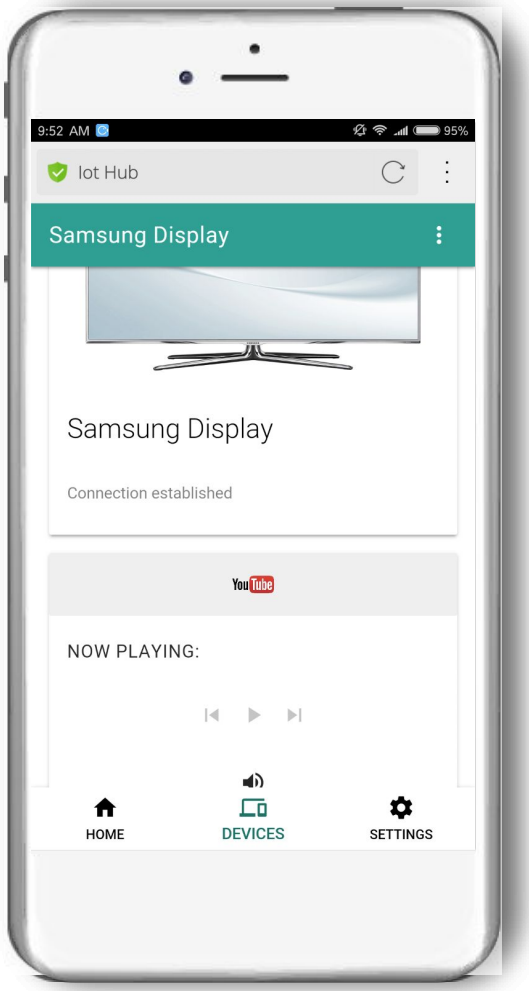


```
{
   "type": "update",
   "action": undefined,
   "url": undefined,
   "source": undefined,
   "content": binary file encoded in base64,
   "software_name": “update.bin”
}
```

Why we need software update from the hub? **Scalability**

User Interface

Design & Implementation: Mobile Web App



Reasons

- **Portability**: web application
- **Convenience:** on mobile phone

Pages

- Home Page:
  - **Notifications** on the top
  - **Popular** devices
- Devices Page:
  - List all the devices (**Search** & **Group**)
- Customized Device Page:
  - **Manage** and **Control** the devices

Low Fidelity User Study

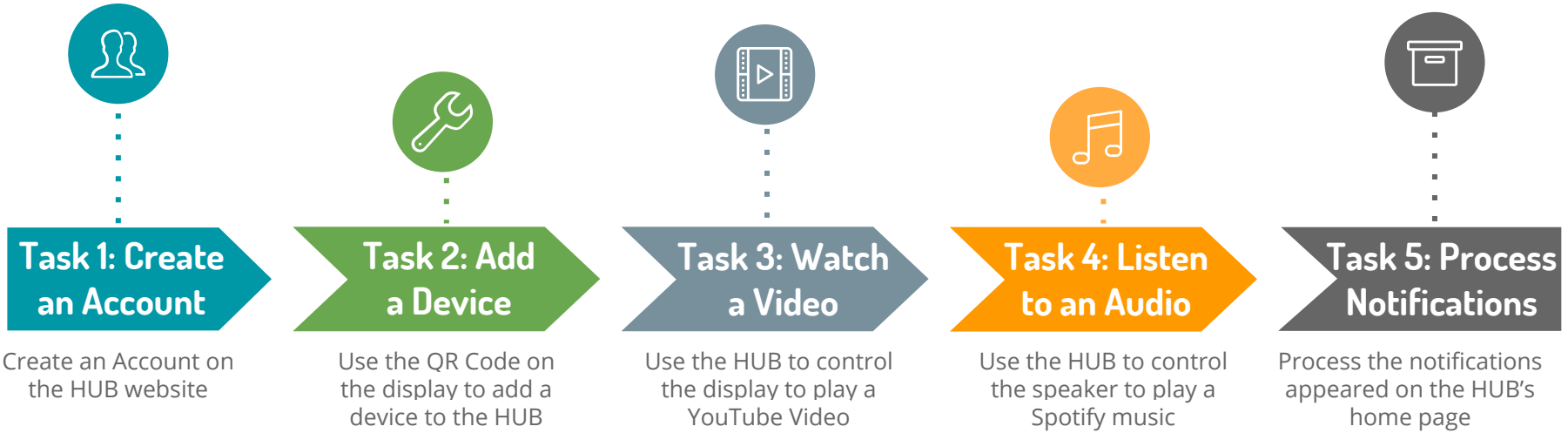
Design & Process

Main big goal: **Usability**

5 main tasks with questions before tasks and an exit survey.

Use **Balsamiq Mockup** for the prototype and a laptop to simulate the devices.

5 participants from different majors participate in the user study.



Low Fidelity User Study

Results

OBSERVATIONS

Most of the tasks can be finished correctly by the participants though there were some confusions through the process. A usability score is given by the participants for each of the tasks.

Task 1: Create an Account
Avg. Score: 4.6

The process for login and create an account is **standardized**.

Most of the participants can finish the task correctly.

Task 2: Add a Device
Avg. Score: 2.4

Not participants have experienced

Confusions including involving third party QR code scanner

Task 3: Watch a Video
Avg. Score: 4.4

Easy task

Suggestions including adding **search bar** and putting the control buttons **fixed** at the footer

Task 4: Listen to an Audio
Avg. Score: 4.8

Easy task and similar to the previous one.

Task 5: Process Notifications
Avg. Score: 4.4

Easy task

Suggestions including **prioritizing** different types of notifications

Our Road Ahead

Mengjin Yan

Design Goals Recap

What we need to do next?

Extensibility and Scalability

We already have set up the **whole system structure** and the **communication** between different parts of the systems.

More advanced features to enhance extensibility and scalability need to be added.

Usability and Compatibility

We already have the **basic user interface design** and **the user study** give us insights about how to improve the system's usability.

For the next step, we need to **refine the implementation** according to the results of our user study.

Design Goals Recap

What's our specific tasks?

Extensibility and Scalability

- General Metadata Protocol
- User's Access Control

Usability and Compatibility

- Improve the process of QR code scanning when adding devices
- Content management
- Make the play/resume control pad fixed on the footbar

Schedule Ahead

4-Week's Planning before the Final Demo

Nov. 8th ~ Nov. 14th

DESIGN

Design the new features on System and User aspect

Nov. 15th ~ Nov. 22th

IMPLEMENTATION

Implementing all the features

Nov. 23th ~ Nov. 29th

IMPLEMENTATION

Continue implementing all the features

Nov. 30th ~ Dec. 6th

WRAP UP

Refine our system and prepare for the final poster session

IOT HUB

THANK YOU