Hub for Internet of Things

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Project Overview

Hub for IoT is a centralized system that manages and controls IoT devices. It grants network connection for those devices and controls them to play videos and music. It also checks for software update for devices and manages user access.
It is implemented as a web app and users can interact with it through web browser.

Motivation

- Number of IoT devices is rapidly increasing
- There lacks an easy and secure way to add new bought IoT devices to home network
- IoT devices are prone to cyber attacks (e.g. IoT DDos Botnet)
- People find it hard to manage dozens or hundreds of devices

Contribution

- Built a system to configure, manage and control multiple IoT devices
- Used EAP-NOOB protocol to grant network access to IoT devices
- Designed **Device Metadata Protocol** to identify and configure new device
- Designed **User Access Control Protocol** to define human-device relationship

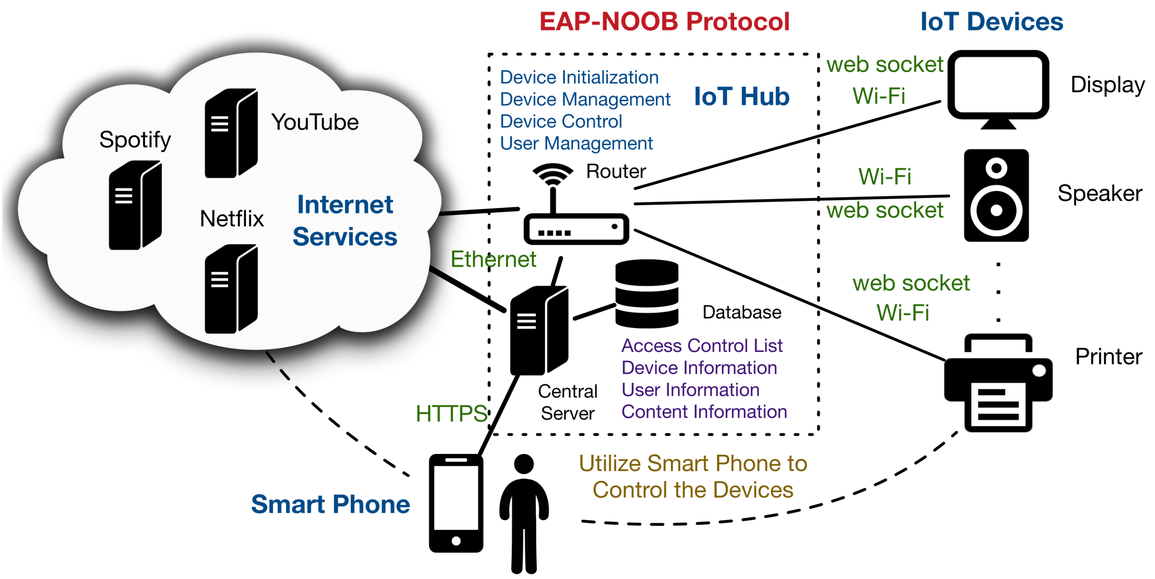
Future Work

- Accelerate the process of QR code scanning and authentication.
- Group multiple devices of the same type in device page
- Refactor the system using React framework

Acknowledgement

Special thanks to Prof. Jason Hong, Dr. Mohit Sethi, Prof. Mahadev Satya, Prof. Dan Siewiorek, Prof. Asim Smailagic, participants in our user study and all the people helped us in the project

System Architecture



Challenge

Scalability
- System should be capable of handling a large number of users and devices
- Make the protocols as simple as possible to support low-end devices

Compatibility
- We want our system to work on different kinds of devices

Extensibility
- Make the system open for new features and new devices/applications

Usability
- System should be easy to operate even for users without technology background

Design Decisions

Mobile Web Application (Compatibility)
- Platform independent with high portability

Stateless Client (Scalability)
- Allow multiple users to control the same device
- Mitigate consistency problem

Centralized Device Management (Usability)
- Provide user with an overview of status of all devices
- Provide a venue for monitoring behaviors of devices

Uniform Metadata Protocol (Extensibility)
- Support adding devices from different manufacturers in a uniform way
- Information type is pre-defined
- Phase I: exchange device identifier
- Phase II: exchange basic information

User Access Control (Usability)
- Support fine grained user access control
- Provide device specific user authorization

System Operation

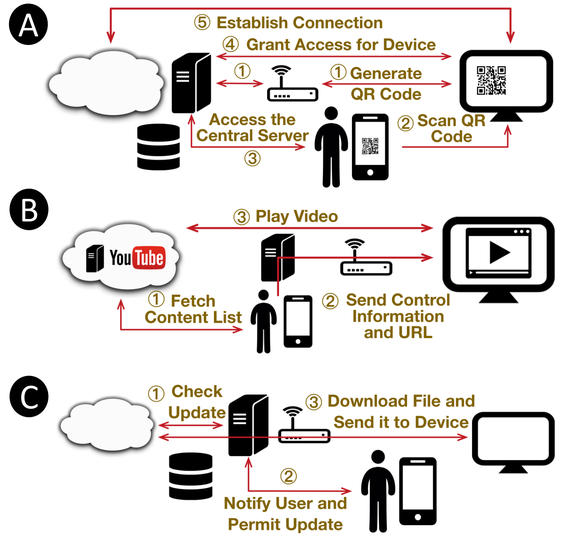
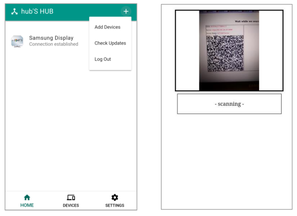


Figure A: Add a new device Figure B: Play YouTube video
Figure C: Check software update for device

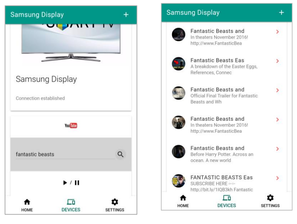
User Interface Implementation

First Iteration
Draft UI design and a **Low Fidelity User Study** with 5 participants to gather feedbacks.

Second Iteration
Improvement based on the feedback from the user study



QR Code Scanner
Added in-app QR code scanner to avoid confusion of the third-party QR code scanner



Search Bar
Added the search bar when fetching content to improve the usability