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A Study on Smart Home Controller for Control of Internet of Things Devices

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Abstract

This paper researches about Internet of things remote control that directly controls by transmitting button input events to other IoT devices through service server, connected to internet through WiFi. It provides automation service, interlocking diverse internet service information through IFTTT automation service other than simple device control. Furthermore, it will research about service environment that can manufacture various smart home service by enrolling DIY products through open platform of onem2m standard method.

Keywords: *IoT, IFTTT, MQTT, Smart Home*

1. Introduction

IoT remote control is IoT controller device that can control diverse IoT device and internet service and its commercialization target market is the field of smart home service. In IFTTT, the common IoT automation service platform, 114 of smart home service related IFTTT-service such as Samsung, LG home appliances, smart electric bulb and smart plug enrolled in 2017 and it keeps increasing [1-2].

Moreover, internet information such as smart phone interlocking function, weather and news that can utilized through IFTTT diversified. This thesis researches about diverse smart home appliances and related IFTTT-service control through IoT remote control device that interlock with IFTTT automation service platform [3-4].

This system, which is very familiar remote control button operation to us (turning on TV or channels), is a smart home controller that can control various IoT device. It provides smart phone interlocking service and automation service that interlock with diverse internet information. Furthermore, it constructs service environment that directly manufacture diverse smart home service by enrolling DIY products through open platform of onem2m standard method. Figure 1 indicates the diagram of system that will researched [5-6].

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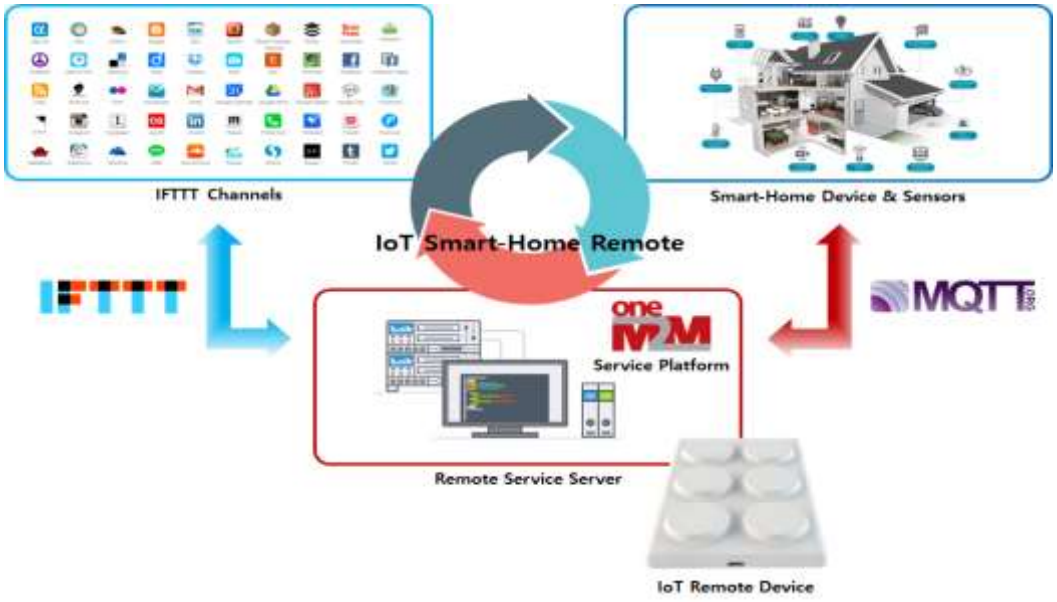

Figure 1. System Configuration Diagram

2. Relative Work

In smart home environment, the communication medium for equipment control evolved into home hub and exceeded the function of existing communication gateway. It draws the customer responses by maximizing the communication with users through new user interface equipped with artificial intelligence. Due to its costly price, hub leans towards enhancing the value of the products by being equipped as fundamental option, rather than persuading customers to buy new products. In recently built apartment or studio, IoT is equipped into home appliances, lighting facility, security and curtain as fundamental option. However, most smart home service enables users to be alarmed and control things through smart phone application. It means, however, the users have to hold their smart phone on their hands to use smart home and in generally people put their phones somewhere at home. Moreover, smart phone does not fit as family unit interface due to its private characteristic [7-8].

To resolve these issues, recently, home hub man adopted user interface in the form of command and being alarmed in words by equipping voice recognition technique into hub equipment. It enables users to control things and provided with services more conveniently without smart phones on their hands at home. However, voice recognition interface is such an expensive service products, inconvenient to use outside and its availability does not meet due to poor recognition accuracy and complex of settings. Accordingly, this paper suggests smart home service remote control that control diverse IoT devices through cheap IoT controller device such as smart phone camera button, difference from costly smart home hub [9].

3. System Configuration

This paper researches about IoT remote control product that can directly control by transmitting button input events to other IoT devices or services through service server, connected to internet through WiFi. Apart from simple device control, the paper tries to provide automation service that interlock various internet service information through IFTTT automation service, and to construct service environment that can manufacture diverse smart home services by enrolling DIY products through open platform of onem2m standard method. Figure 2 is the target system diagram.

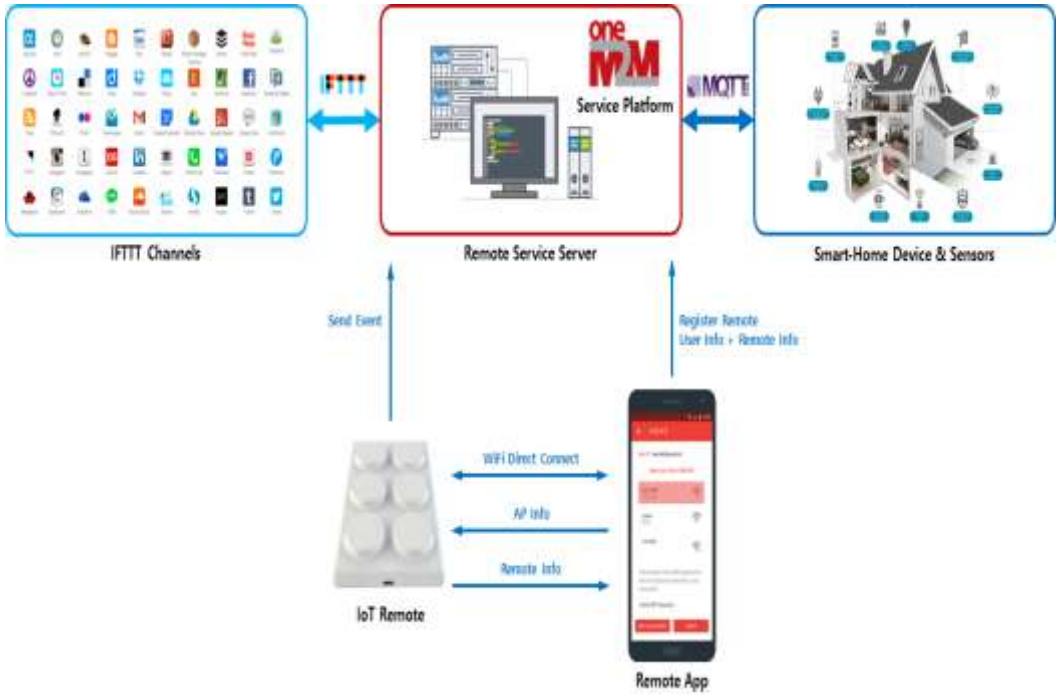

Figure 2. Target System Configuration Diagram

4. System Design

4.1. Remote Hardware and Firmware

Smart home remote control hardware consists of six buttons for WiFi module embedded with node MCU, led module to check the state of motion and network connection and for rechargeable battery and control input. Buttons of smart home remote control communicate by connecting to each GPIO in the form of I/O interrupt. It supplies power to node MCU and led through rechargeable battery (lithium ion polymer battery 3.7v 2500mah) connected to micro USB port. Figure 3 is a hardware diagram.

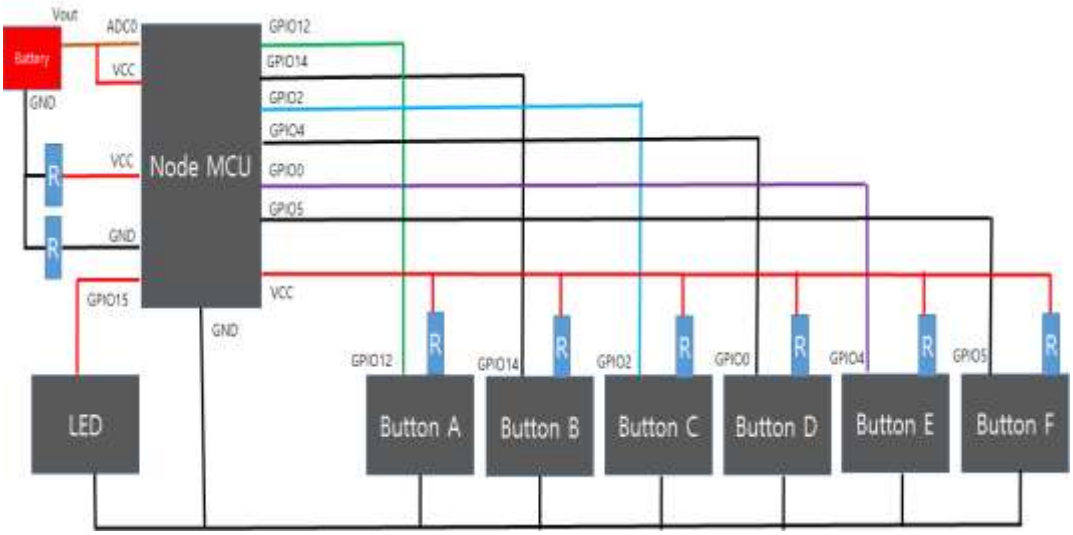

Figure 3. Hardware Configuration Diagram

Figure 4 is a module diagram of smart home remote control firmware and its functions are as follows.

- Timer manager: detects types of button clicks (one click, double click, long click) and invokes available events to node MCU

- Wifi manager: server manager to communicate with smart phone during primary communication and client manager for server and communication

- Sleep manager: manages sleep mode to save the amount of electricity according to the remote control use status
- Battery manager: checks the charge state of rechargeable built-in battery and ADC control for power supply of node MCU.

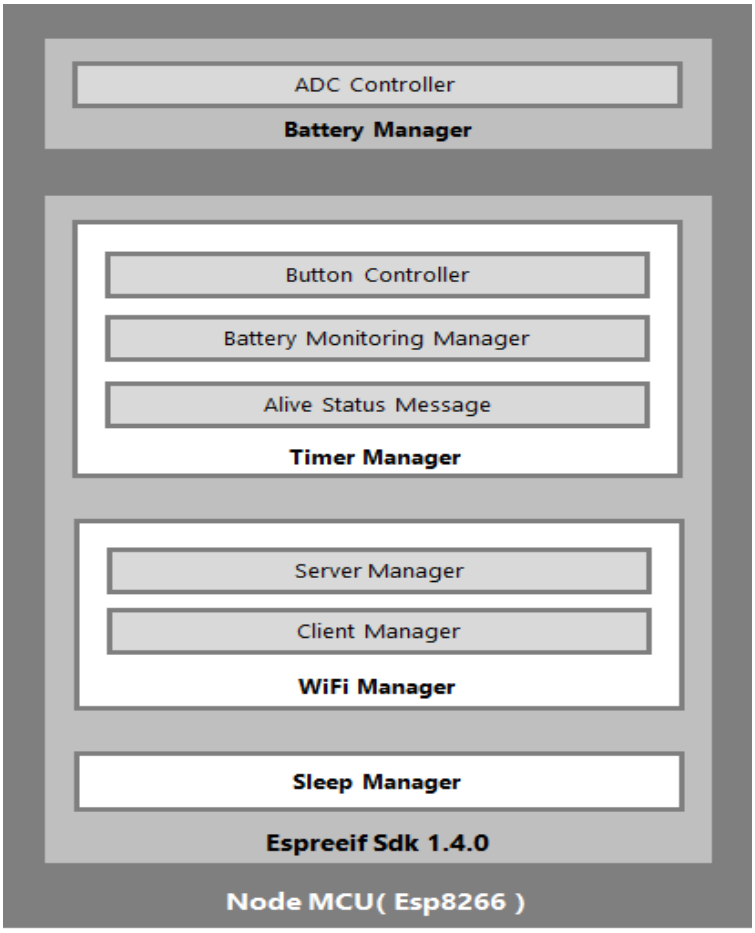

Figure 4. Configuration Diagram of Smart Home Remote Controller Firmware Module

4.2. Remote Service Server

Remote control service server is a managing server that deals with control calling of remote control and push events, interlocking with IFTTT automation service and MQTT broker. It manages WiFi information and home remote control button that user established, and does monitoring the state of remote control device. Figure 5 is a module diagram of remote control service server software.

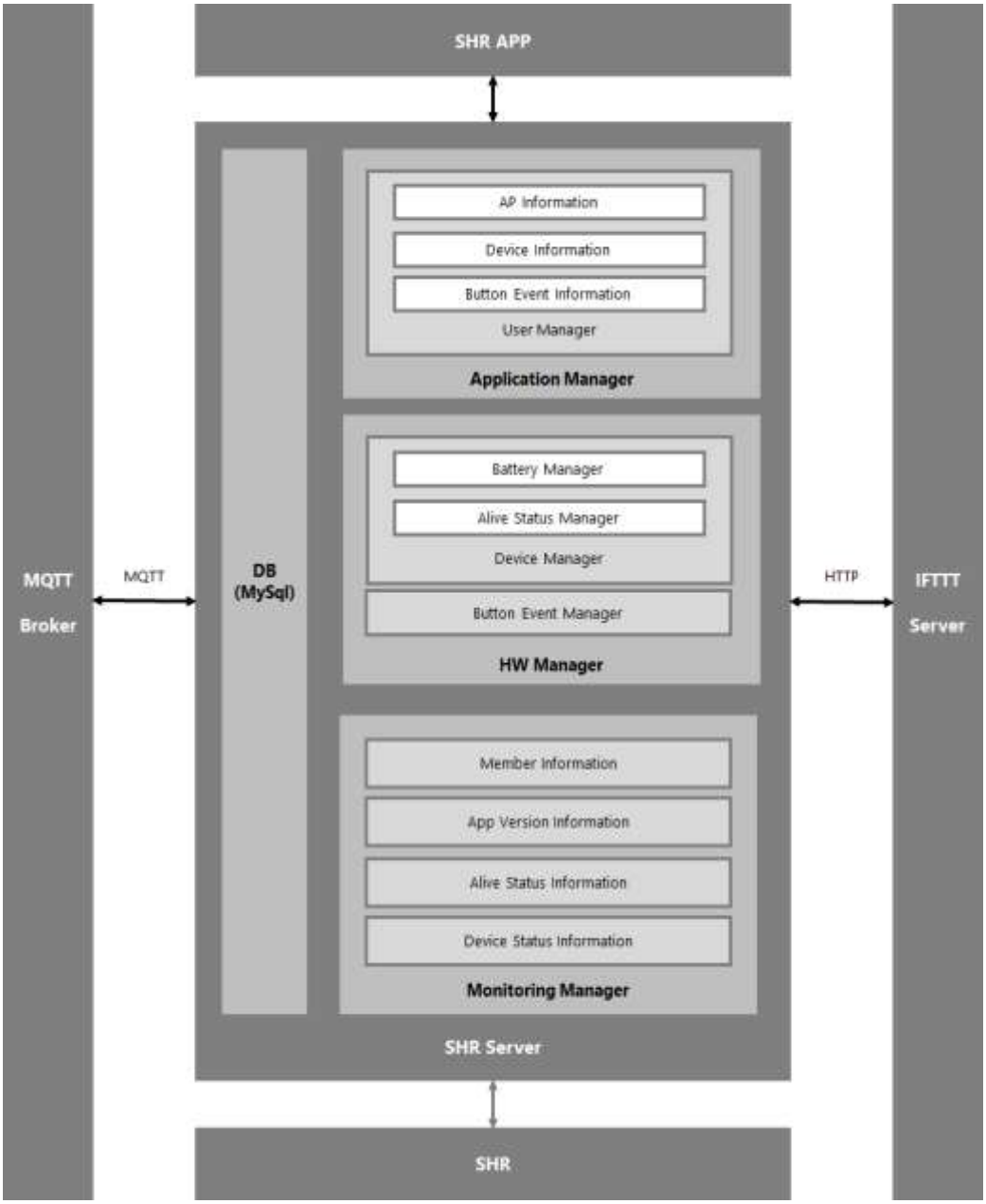

Figure 5. Configuration Diagram of Smart Home Remote Controller Software Module

(1) HW Manager

- Receives button input events transmitted through smart home remote control.
- Receives JSON form data transmitted from smart home remote control.
- Transmission data information: types of buttons, types of button input, IFTTT action URL

(2) Application Manager

- Completes network settings and device enrolment of smart home remote control in remote control smart phone applications.

Received enrolment information: user id, installation id, installation name, information value about WiFi network connection.

- Data sending and receiving of applicable information receives http form of information. INPUT 'success' when succeeded and receives cause of failure when failed.

(3) Monitoring Manager

- As for monitoring manager of remote control service server, manager does monitoring enrolled information through smart home remote control and remote control smart phone applications.
- Information that manager does monitoring: user id, user name, enrolment day, enrolled name of smart home remote control, enrolled id of smart home remote control, information value (SSID, BSSID, PASSWORD) about WiFi, alive status message recorded every 50 minutes.

5. System Implementation

Figure 6 is a module of smart phone application software and its functions are as follows.

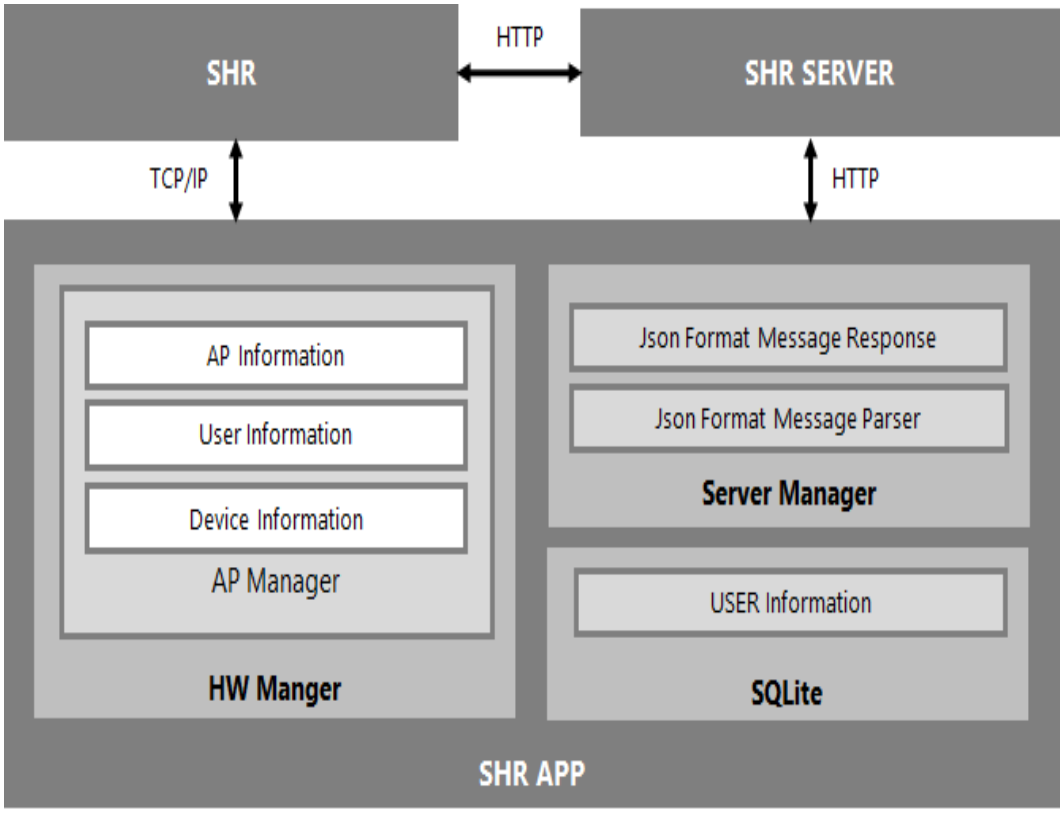

Figure 6. Software Module of Smartphone Application

- H/W manager: network set module that deals with early settings to connect remote control to WiFi by connecting with smart home remote control of APP mode.
- Server manager: TCP/IP module for sending and receiving of server and http protocol after WiFi connection of smart home remote control.
- SQLite: smart phone database for saving various setting values and user information

Figure 7 is smart home remote control enrolment and its procedure is as follows.

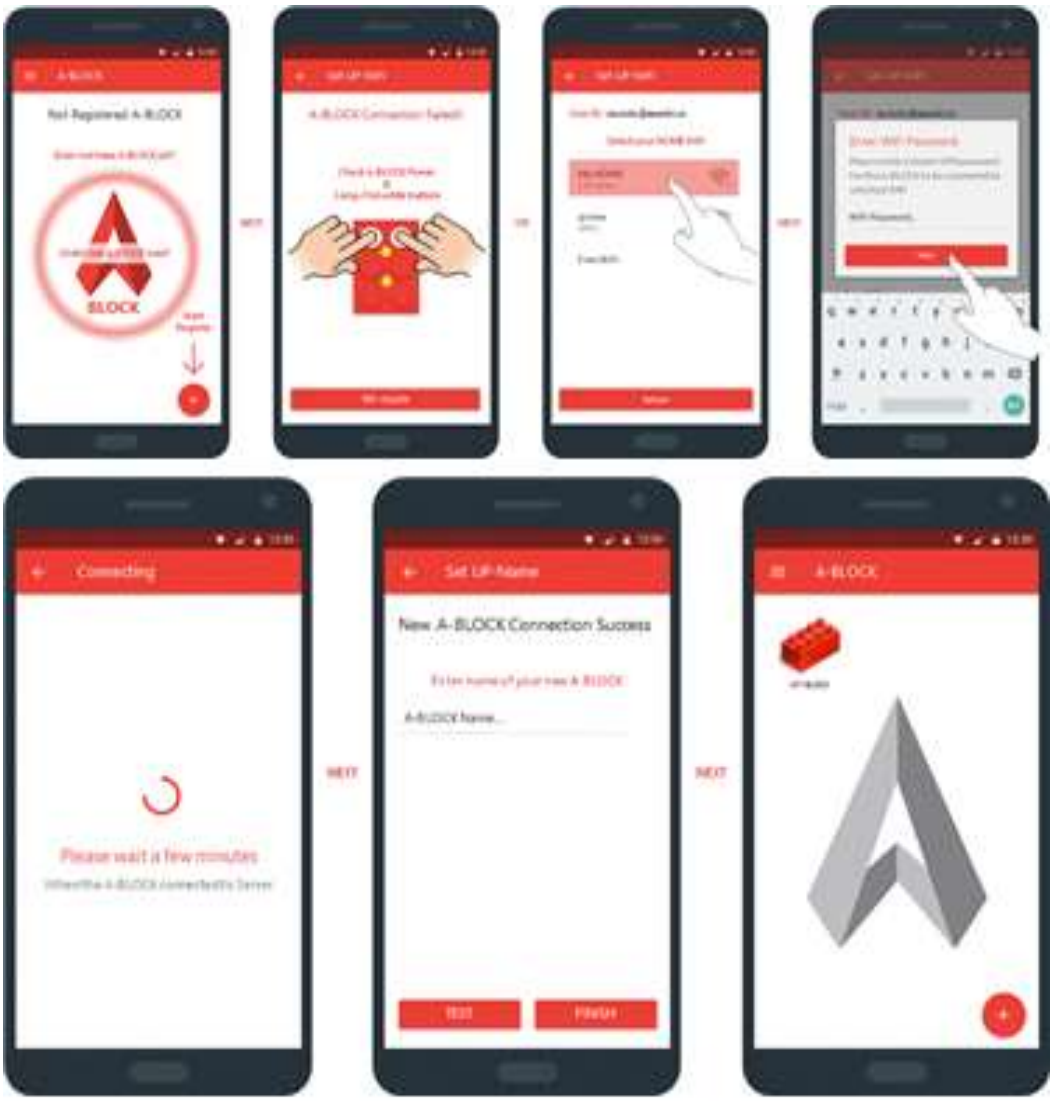

Figure 7. Smart Home Remote Control Registration

1. It begins the enrolment of new remote control device using smart phone application.
2. After pressing enrolment button, connect to remote control by pressing the button on the upper sides of smart home remote control.
3. Implement the remote control as AP mode for WiFi setting of smart home remote control and directly connect smart phone with remote control device using WiFi.
4. Connecting to remote control implemented in AP mode using smart phone app, establish network connection of remote control by transmitting connectable WiFi lists and user information.
5. When connected, send selected WiFi information and wait until smart home remote control connected to WiFi.
6. When connected to wifi, enroll equipment name of smart home remote control smart phone application ends direct wifi connection with remote control and transmits remote control device information enrolled by attaching to remote control service server.
7. Check with smart phone application when new remote control device enrolled in server.

6. Conclusion

This paper designed and implemented system about IoT remote control that can directly control by transmitting button input events through service server with remote control connected to internet through WiFi. For this, this paper enabled 18 motion's control with six physical button and three inputs (one click, double click and hold). This paper presents remote control of IoT smart home to connect almost DIY products through open platform, IFTTT. Apart from simple device control, accordingly, this system provides automation service interlocking diverse internet service information through IFTTT automation service. Along with this, it provides service environment that can manufacture various smart home service by enrolling DIY products through open platform of onem2m standard method.

Acknowledgments

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