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# Research on Efficient Through Convergence of IoT Interaction Device and Opened Platform

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***Abstract***

*In this paper, we propose a design configuration of a unified remote controller under IoT environment using IFTTT services. This unified controller approach is necessary to avoid the limited functionalities of smart phone App approaches without unified control. The proposed system design can be implemented with one-chip IoT interaction module that can be used in wearable devices.*

***Keywords****: Internet of Things, Smart Home, Remote Control, IFTTT, WiFi*

## 1. Introduction

In the Internet of Things (IoT) paradigm [1], many of the objects that surround us will be on the network in one form or another. Based on such paradigm, related technologies have been advanced to the hyper-connected society that connects not only 'between things' but extend the concept to connect things with environment (IoE) with intelligence [2]. The most visible changes in related application might be some efforts to extend existing smart home technologies to the IoT environment [3-5].

In this paper, we are interested in designing a unified remote controller to combine smart home devices under IoT environment. There exist studies to develop a smart phone application for such control [6] which is very convenient to access but it also has intrinsic limitations on its device-dependency and functional commonalities under different platforms. However, the recent available service called IFTTT (if-this-then-that) [7] allows users to automate a variety of different task. The service connects to large amount of web services to a simple user interface that allows the user to create rules based certain events that can trigger other events.

Thus, we choose to develop a unified remote controller platform that can control smart home devices and IoT related devices including devices controlled by the infrared light. In this paper we propose a design configuration and related mobile App system design for the unified remote control.

## 2. Proposed System Configuration

Firstly, this system is not designed for smart phone application. Rather, this is a unified controller design thus users are not limited to smart phone users.

Secondly, we support user defined functions operating under IFTTT server thus this system is not dependent on the device related platforms. Thus, we design a simple user interface that can control smart home devices under IFTTT.

### 2.1. System Configuration

Figure 1 demonstrates the overall system configuration for proposed unified controller.

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**Figure 1. Remote Controller System Configuration**

We define our terminologies used in this paper as following.

A Unified Remote Control (URC) is defined as a controller that controls smart devices and home electronics under IFTTT service and also controls home electronic devices with remote controller buttons defined under remote controller server.

A Universal Remote Control Application (URCA) is defined as a smart phone application that sets up buttons and connections to WiFi and registers users and devices to the service server.

A Universal Remote Control Server (URCS) is defined as a service server that manages user and device information that can be controlled under infrared light control and performs IFTTT automation service and remote control calls and push events.

### 2.2. Hardware and Firmware Configurations

Figure 2 shows the hardware configuration that consists of WiFi module with built-in node MCU, LED module for verifying behavior and connection controls, infilled type battery, touchpad, and OLED for verifying button setups.

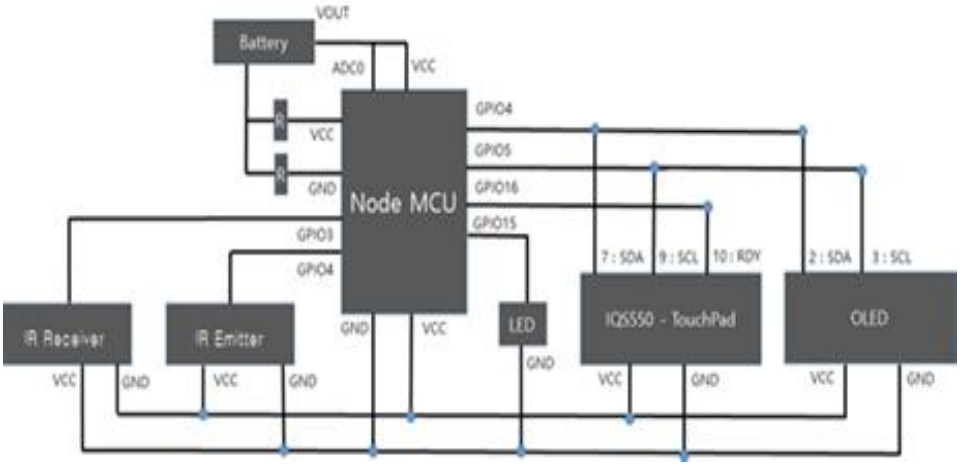


**Figure 2. Hardware Configuration**

Figure 3 shows the firmware configurations and functionality of each module is defined as the following.

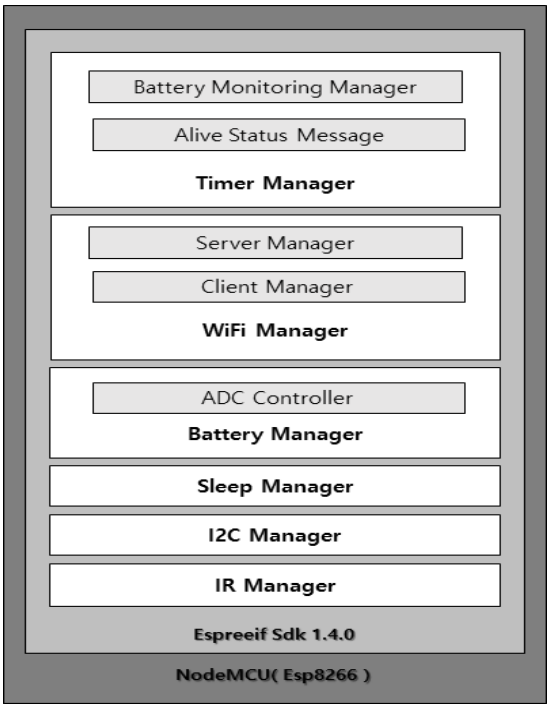


**Figure 3. Firmware Configuration**

Timer Manager: It calls extracted button click events (one click, double click, long click) to Node MCU.

- WiFi Manager: It consists of server and client manager for communication.
- Sleep Manager: It manages sleep mode to save electricity.
- Battery manager: It verifies charging status and ADC control for supplying electricity to Node MCU.
- I2C Manager: It controls 0.96 OLED and IQS550 touch sensor with I2C communication.
- IR Manager: It manages IT learning function and controls smart devices.

Click events for Timer Manager are also defined as follows.

- One Click event: After touching the screen, the sensitivity is over the threshold but there is no other input after 500ms.
- Double Click event: After touching the screen, the sensitivity is over the threshold and there is another input within 500ms.
- Long click event: After touching the screen, the sensitivity is over the threshold and the touch continues more than 800ms.

Alive Status manager in Figure 3 transfers the amount of battery currency to server in every 50 minutes (extracted in every 10 minutes) with HTTP through Battery Monitoring manager.

## 3. System Design

### 3.1. Unified Remote Control Application (URCA)

URCA consists of four modules as explained as following.

- HW manager: It performs initial network setup for WiFi communication and infrared signal processing for learning functions between smart phone application and remote controller.
- Server manager: TCP/IP module for data communication
- Application manager: Module for user information and button setups.

- SQLite: Internal Database management engine.

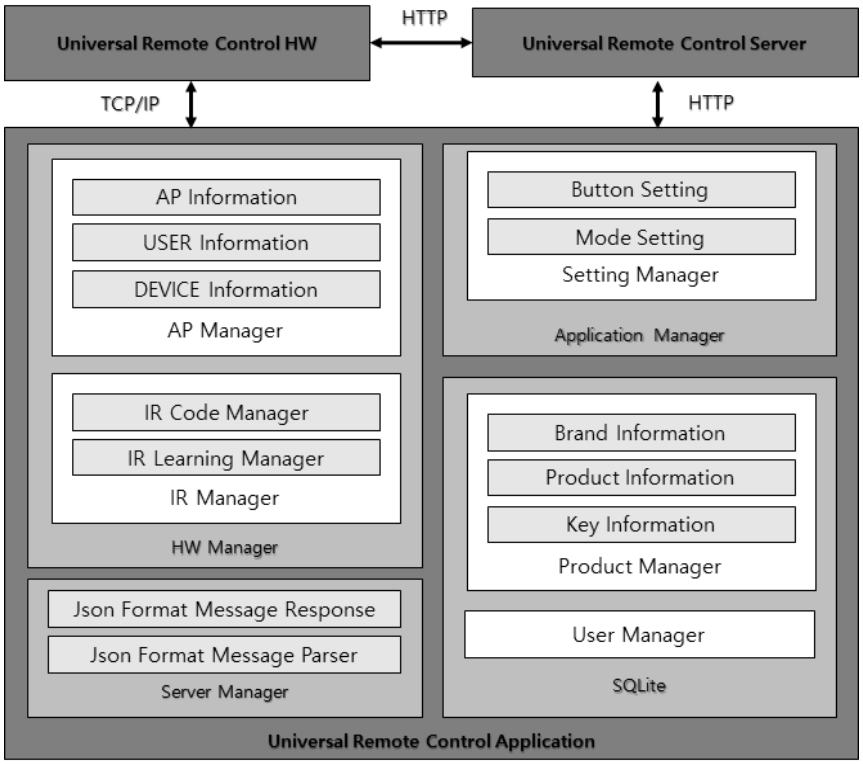


**Figure 4. URCA Configuration**

In order to setup the WiFi for the remote controller, we execute AP mode first and then transfer necessary information such as SSID, BSSID, password of WiFi and user id and device id. Then as shown in Figure 5, register a button with long click and associate the product name, brand, model name with search or input necessary information of not registered.

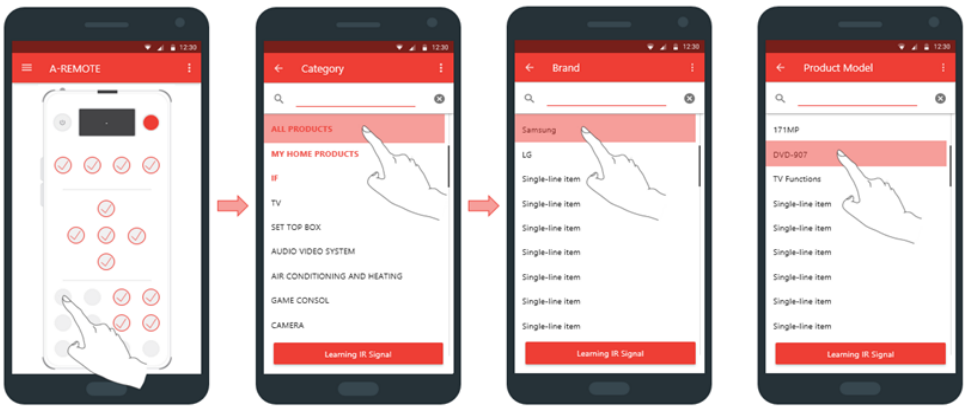


**Figure 5. Search Product and Functions for Button Setup**

The user can change the button position or even delete the button if necessary. As shown in Figure 6, the user gives a long click to a button to be changed. If the user wants deletion, one may drag the button to the trash box. Position change is done in a similar way to move the button to the desired location.

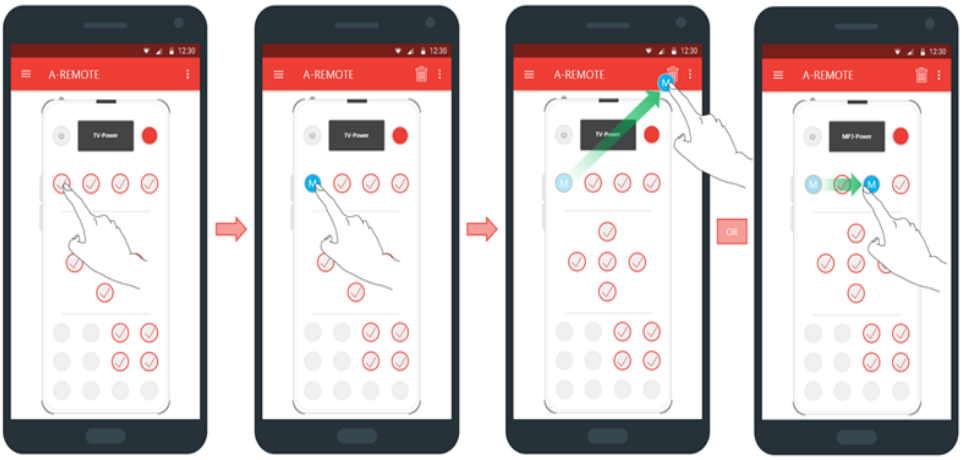


**Figure 6. Button Position Change or Deletion**

### 3.2. Unified Remote Control Server (URCS)

URCS manages button information and WiFi communication information and monitors user and device information and remote controller status. It also performs push events and control calls of the remote controller with IFTTT service. It consists of Hardware Manager, Application manager, and Monitoring Manager shown in Figure 7.

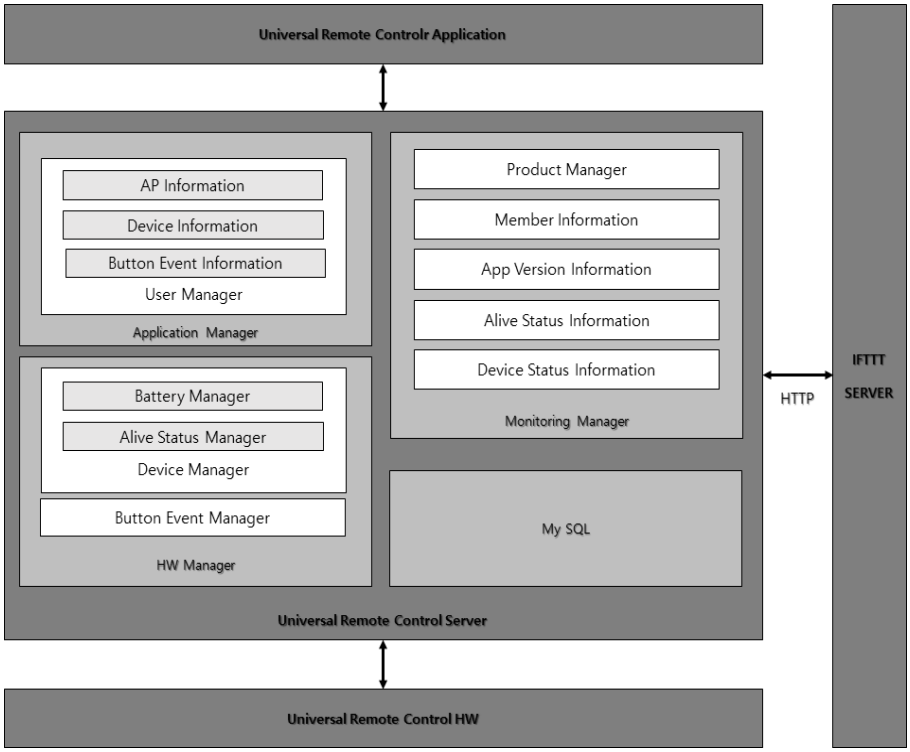


**Figure 7. URCS Configuration**

When it uses IFTTT, it transfers HTTP protocol data such as type of button, type of button input and IFTTT action URL that calls IFTTT recipe action associated with input button.

## 4. Conclusion

In this paper, we propose a unified remote controller design for combining smart home devices under IoT environment. Since this proposal is not designed as a smart phone application but as more general concept of device controller, we provide associated hardware and firmware configuration as well. Since this method uses IFTTT service, it is not dependent on a specific device related platform. With supporting IoT interaction functions, it can be a built-in one chip module for wearable devices with MCU built-in ESP8266 WiFi module.

## Acknowledgements

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