Automatic Extension Board using Esp826612e (IoT)

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Abstract – The aim of this project is to design a prototype of Automatic Extension Board. The prototype will look like normal extension board but it can be controlled by a microcontroller using MQTT dashboard and can turn any ordinary home into an automated home without secondary construction. It will acquire the signal through Wi-Fi and then the Esp8266-12e (µc) will respond according to the acquired signal. Additionally, a user can control and check the status of the connected devices by using MQTT Dashboard, which is designed for managing the Internet of Things (IoT) projects. Therefore, the Automatic Extension Board can bridge the gap between ordinary homes and the automated homes.

Index Terms – IoT, MQTT Dashboard, Wi-Fi

1. INTRODUCTION

With the increasing development of cloud-based voice service, like Google Assistant and Amazon Alexa, there is an extensive demand for automation in homes. The objective of the Automatic Extension Board is to cost-effectively transform an existing home into an automated home without rewiring the home.

Once the Esp8266-12e (µc) has received an initiating signal, the microcontroller will switch a relay which in turn controls the socket of the extension board. The time period of on-off the sockets can be programmed by the µc. The Automatic Extension Board obtains information through a Wi-Fi connection.

The advantages of Automatic Extension Board are: -

1. It is capable of controlling multiple gadgets & devices at the same time from any corner of the world.
2. It is compact in size and portable. Control the connected devices from the comfort of your couch or bed.
3. Save energy and schedule the ON/OFF time of devices.
4. Transform ordinary home into an automated home without altering the existing wiring of the home.

2. IMPLEMENTATION

Fig. 1 shows the block diagram of the Automatic Extension Board. We have used an Esp8266 12e microcontroller + Wi-Fi module as an alternative to the Arduino microcontroller because it is a Wi-Fi enabled ESP8266 chip and can be programmed in Arduino IDE. The Esp8266 12e module is connected to the relay module. The Esp8266 12e accepts an input signal from the user through MQTT dashboard and makes the relay on or off according to the condition provided in the code. The relay's NO port is connected to the sockets to which any type of load can be connected and controlled.

The communication over Wi-Fi of the Esp8266-12e microcontroller is a two-way communication. Esp8266-12e fetches the information from a user through MQTT dashboard and the response is reverted back via an internet server namely Adafruit. It is a platform to control your IoT projects using MQTT protocol. Adafruit allows users to publish various feeds such as switches, buttons etc. and allows a 3-way connection between the Esp8266-12e, Adafruit server and the user interface, such as a mobile phone.

A TTL is used to flash the code in ESP8266-12e using I2C protocol. While flashing the ESP8266-12e should be given an external supply of 3.3V as TTL cannot provide the sufficient amount of current.

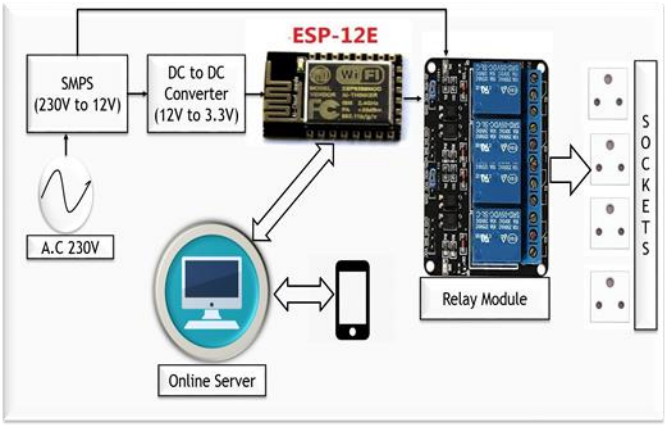

Fig. 1. Block diagram of Automatic Extension Board

Fig. 2 shows inside view of the Automatic Extension Board. It consists of a relay module (middle), a switched mode power supply [SMPS] (middle right), for ESP8266-12e and relay module supply, the Esp8266-12e microcontroller (middle), the black cord (bottom left), which is 230V neutral from the mains; and the red wire (bottom right) which is 230V phase from the mains running to the relays common port then to the sockets via NO ports of relay module.

Fig. 3 shows the ESP development board. It consists of a 5V power supply (left); Esp8266-12e (right); a relay bus (top left); a buzzer(middle); 5V to 3.3V converter (bottom left).

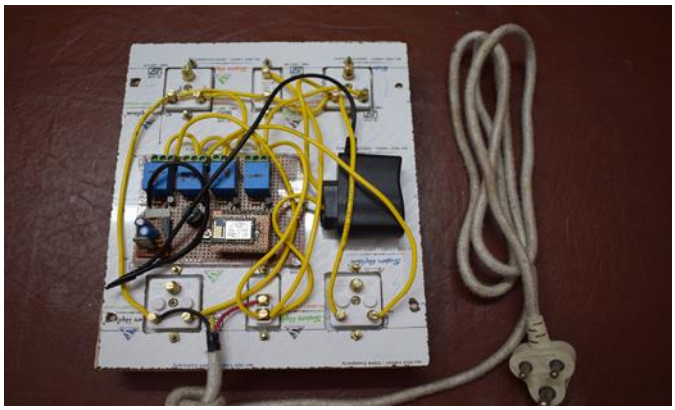

Fig. 2. Microcontroller, relay and socket

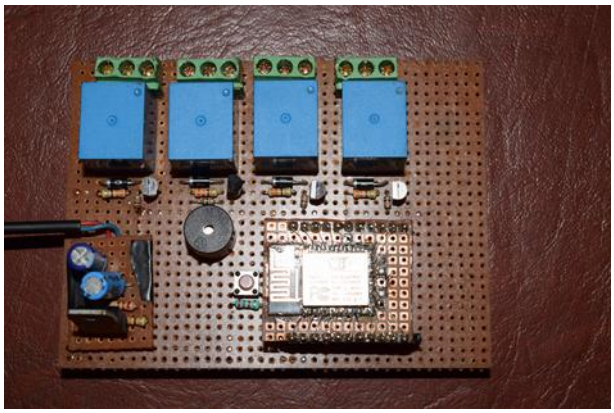

Fig. 3. Esp8266-12e development board

Fig. 4 shows the inside view of the prototype. Most power-strips are a set of buses that run the length of the strip. One bus controls the phase wire and the other one controls the neutral wire. The phase wire is connected to the NC port of the relay and is shared with all the relays. The NO ports of the relays are connected to the sockets 1, 2, 3, and 4 respectively as depicted in Fig 2.

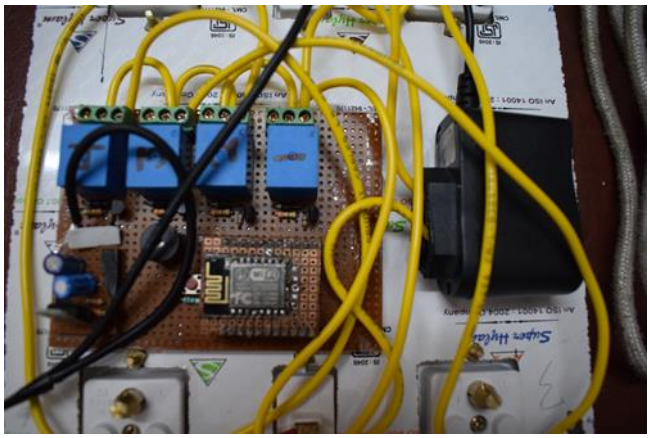

Fig. 4. Inside view of the prototype

The final prototype is shown in Fig. 5. Table 1 shows the components used in the prototype.

Fig. 5. Complete Prototype

TABLE I. THE COMPONENTS USED IN THE PROTOTYPE

Part Name	Unit
Esp8266-12e Microcontroller + Wi-Fi Chip	1
4-Channel Relay Circuit	1
Buzzer	1
DC to DC converter (5V to 3.3V)	1
Sockets	4
Switch and Indicator	1
Wooden Box and Sheet	1
Miscellaneous parts (wires, insulation tape)	1

3. SOFTWARE

3.1. Arduino IDE

Arduino Integrated Development Environment (IDE) is an open-source software that makes it easy to write and upload code to the board. It runs on Windows, Mac OS X, and Linux. The code can be written in languages like C/C++ and Embedded C. In Arduino IDE, we need to include the Adafruit MQTT library. The library can be added through include library option in sketch in IDE and then in manage libraries search for Adafruit IO Arduino & Adafruit MQTT library and install. The code can be uploaded only after uploading the libraries of Esp8266 and MQTT in the software.

3.2. MQTT Dashboard

MQTT (Message Queuing Telemetry Transport) messaging protocol unstable networks. It is a machine to machine / Internet of Things connectivity protocol. MQTT decouples publisher and subscriber, so a connection of any client requires a broker. MQTT Dashboard is an app which can be downloaded for free from Play Store. It uses The HiveMQ MQTT broker. In the application, a user can publish the desired numbers of switches, buttons, and sliders etc. to control and check the status of connected devices. The switches and buttons are virtually operated through the app. When the plugged-in device connects to the Adafruit server to transmit and receive data, the status of the plugged-in device is shown in the app. Fig. 6 shows the interface of the MQTT Dashboard. We need to create a connection with a client name and the following data as shown.

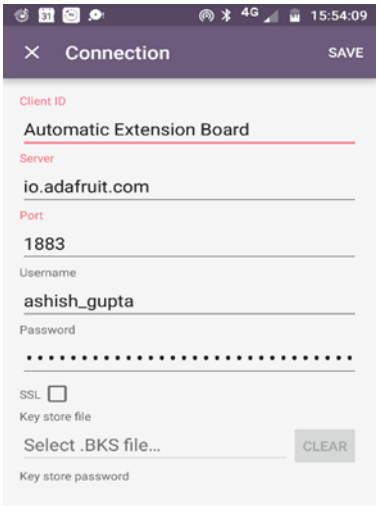

Fig. 6. Creating a client

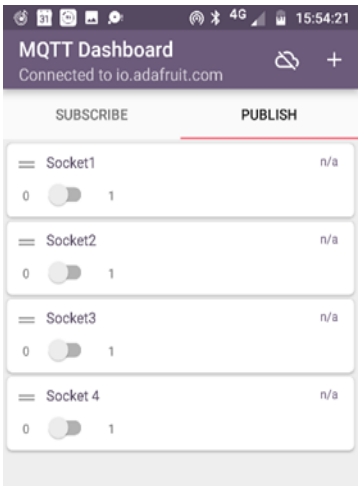

Fig. 7. Example of 4 switches

Once we create the client, we can add our plugged-in devices switches, buttons etc. to the same client id and virtually control all the plugged-in devices. Fig. 7 shows an example of the same.

3.3. IFTTT

IFTTT stands for If this, then that. We can control this extension board with the help of Google Assistant. IFTTT plays the major role in doing so. We can create a custom voice commands for our Google Assistant. There are many applets in which we can alter Google Assistant according to ourselves.

After creating an applet for this, we just need to command Google Assistant and the work will be done.

Fig. 8 shows some applets of the IFTTT for Google Assistant.

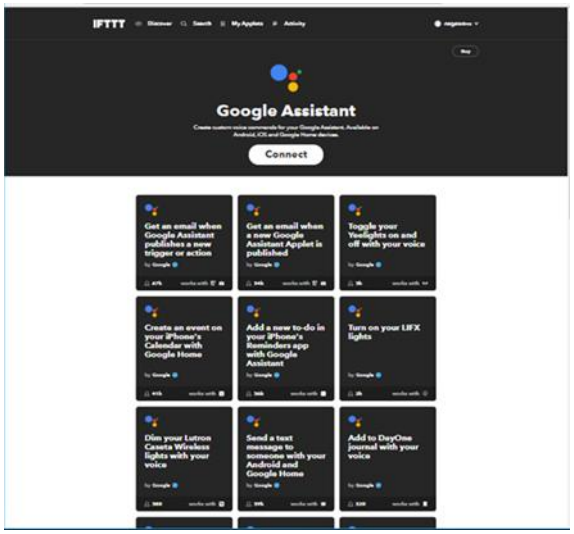

Fig. 6. Applet of IFTTT

4. CONCLUSION

In this paper, a prototype of Automatic Extension Board is presented. It can convert any standard device into an automated device. The difference between the Automatic Extension Board and other Extension board is that in Automatic Extension Board we can control individual sockets. Furthermore, it can be controlled by voice and the status can be checked in the smartphone using MQTT Dashboard, which is designed for the IoT.

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