ProgX-Programmable Extension Board

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Abstract*—With the rapid increase in the users of internet over the past decade has made internet a part and parcel of life, and IoT is the latest and emerging internet technology. IoT (Internet of things) waves us to the world where we can connect, interact and command any device using the internet. As the technology is developing everything becomes automated. ProgX Programmable extension board using IoT is a prototype that can be controlled by a NodeMCU Esp8266 microcontroller and transform an ordinary home into an automated home without secondary construction. This prototype is designed to be low-cost and expandable allowing a variety of devices to be controlled. It will acquire the signal through Wi-Fi and then Esp8266(µc) will respond according to the signal. ProgX also allows the user to schedule and automate his/her devices by setting a clock-based interrupt using IFTTT. Additionally, a user can check the status of connected devices by a physical LEDs present on the device and storing the data in the cloud service.*

Keywords—Internet of Things (IoT), NodeMCU Esp8266(µc), Wi-Fi network, IFTTT, Cloud networking.

I. 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 Programmable Extension Board is to cost-effectively transform an existing home into an automated home without rewiring the home.
Once the Esp8266(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 ProgX obtains information through a Wi-Fi connection.
The advantages of ProgX 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.
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

II. Implementation

Fig. 1 shows the block diagram of the ProgX-Programmable Extension Board service interconnection. We have used NodeMCU Esp8266 (µc) and can be programmed in Arduino IDE. The Esp8266 module is connected to the relay module. The Esp8266 accepts an input signal from the user through IFTTT applet with the setting of clock-based interrupt 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 microcontroller is a two-way communication. Esp8266 fetches the relay information from a user through IFTTT protocol and the response can even be visualized with the LED as indicators and the response is reverted back via an internet server namely Google Firebase. User Interface platform with android studio was designed for operation purpose and connectivity. Google Firebase allows users to publish several feeds such as SSID, Device ID and switches and allows a 3-way connection between the esp8266, Firebase server and the user interface, such as a mobile phone.

A TTL is used to flash the code in ESP8266using I2C protocol. While flashing the ESP8266should be given an external supply of 3.3V as TTL cannot provide the sufficient amount of current taken care by Node MCU.

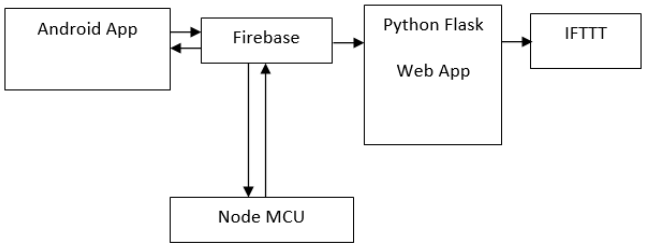

Fig.1. Block diagram of ProgX-Programmable Extension Board service interconnection

Fig. 2 shows inside view of the Automatic Extension Board. It consists of a relay module (middle), a 5 volt adapter (right corner) for ESP8266 node mcu and relay module supply, the Esp8266-12e microcontroller (middle right), AC supply and sockets (extreme left),from the mains from the mains running to the relays common port then to the sockets via NO ports of relay module.

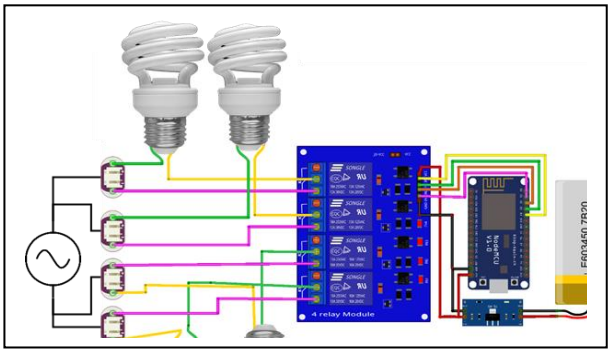

Fig. 2 Schematic of hardware implementation

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Fig. 3 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 schematic Fig 2.

Fig. 3 Inside view of prototype

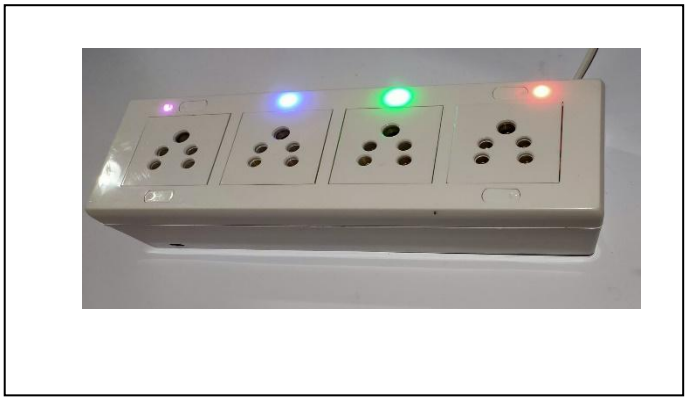

Fig. 4. Complete Prototype

TABLE I.
THE COMPONENTS USED IN THE PROTOTYPE

PART NAME	UNIT
NODE MCU ESP8266	1
4-Channel Relay Circuit 1	1
5 v Adapter	1
Sockets	4
LED Indicator	4
Miscellaneous parts (wires, insulation tape)	

III. Software

A. 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.

B. Android Studio

Fig. 5 Designed UI using Android Studio. The Android Studio was used to develop a mobile app user interface with backend data storage, real-time synchronization, and user-event logging uses Firebase. Java servlets running in the Google Cloud Platform (GCP) App Engine flexible environment listen for new user logs stored in Firebase and process them.

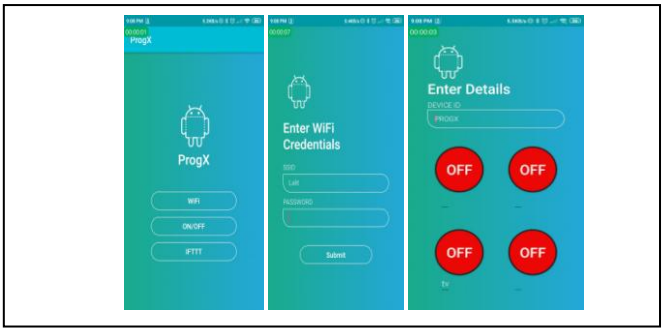

Fig. 5 Designed UI using Android Studio

C. 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.

IV. Conclusion

In this paper, a prototype of ProgX-Programmable Extension Board is presented. It can transform an ordinary home socket into an automated home socket and convert any standard device into an automated device. The difference between the ProgX Extension Board and ordinary Extension board is that in ProgX Extension Board we can control individual sockets. Furthermore, it can be controlled via voice command, timed automation or a using touch sensor which adds special features to ProgX.

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