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Low Cost Smart Electric Switch Board

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ABSTRACT: In this era of digitization and automation, the life of human beings is getting simpler as almost everything is automatic, replacing the old manual systems. Now-a-days humans have made internet an integral part of their everyday life without which they are helpless. Internet of things (IoT) provides a platform that allows devices to connect sense and control remotely across a network infrastructure. This prototype uses NodeMCU interfaced with the relay circuit using GPIO pins to control domestic appliances such light, fans, air conditioner and so on remotely. The web app created provides graphical user interface containing graphical buttons for controlling respective appliance. The main intent of this prototype is to provide a low cost, user friendly and scalable system.

KEYWORDS: IoT, NodeMCU, Wi-Fi, Web App, MQTT protocol.

I. INTRODUCTION

In this world with fast implementation of internet in each and every daily appliance, we aim at increasing the ease of using the day-to-day appliances. It becomes difficult for the handicapped people to operate these appliances. Also if the person is not physically present he cannot either control or know the status of the appliance. This may result in wastage of electricity. So we provide a solution by developing a Smart switch board which provides control over accessing all household appliances. In this smart board we can control fans, tube lights, etc., over a web application. IoT provides an easy way of implementing this smart switch board concept. NodeMCU sends signals on cloud and further these readings are used to check the status of the appliances. With the help of these monitored results, user can analyze power consumption by the appliances.

II. LITERATURE SURVEY

Smart home system is comprised of different devices like fan, light, air cooler and table Lamp is attached with the relay and relay will communicate with the NodeMCU board. ESP8266 is built on NodeMCU board and responsible to establish connection between computer and mobile phone. Responsive web app makes it easy to access [1]. The system contains the wireless technology to control the home appliances with the help of Android Smart phone. NodeMCU, the ESP8266 Wi-Fi board, is USB powered and is interfaced with various home appliances like light, fan, bulb and charger. This system uses NodeMCU which is inexpensive and android application which increases accessibility [2]. Wi-Fi is chosen as the mode of communication in the system and the devices are controlled through MQTT protocol

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implemented using ESP8266. MQTT works on TCP. MQTT is well suited for IoT based systems which have limited nodes. MQTT is thus a light weight protocol that occupies low bandwidth and consumes less power [3].

III. HARDWARE COMPONENTS

2.1 Relay Module

A relay functions as a switch that has the capacity of switching multiple circuits which can be either individual, simultaneous or in sequence.

The proponents use a relay to accommodate 3 output devices. NodeMCU's output pins are connected to each of the input pins of the relay module.



Fig. 1.1 Relay Module

2.2 Node MCU

Node MCU is an open source IOT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC, and hardware which is based on the ESP-12 module.

Node MCU is used to establish internet connection between the module and cloud. It is a microcontroller specific to the network layer.



Fig. 1.2 Node MCU

III. SYSTEM ARCHITECTURE

The architecture consists of the following components, which will work together. The first component is the API, which has a specific implementation for different microcontroller solutions. The function of this API is very important, because with this, NodeMCU gives instruction to IoT protocol. The system will use the same code for sending data to MQTT Server or to the Cloud Server. The second component is NodeMCU, which is an IoT chip, that can be programmed to the most common IoT protocols like MQTT, SMQ, etc. which helps in sending information to the cloud. NodeMCU will be used as dedicated microcontroller for network layer. NodeMCU will be configured to connect to cloud service. For that we developed the Cloud Server, which includes all the components needed to manage appliances from anywhere in the world. Cloud Server is used to manage devices, set rules and to manage the data.

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Context Broker is used as an implementation of the Publish/Subscribe Protocol. It helps in sending data from the device to the IoT stack and it also sends command from application to the device. The relay module is used to trigger the appliances as per the instructions received through the NodeMCU. As per Fig.1.3.

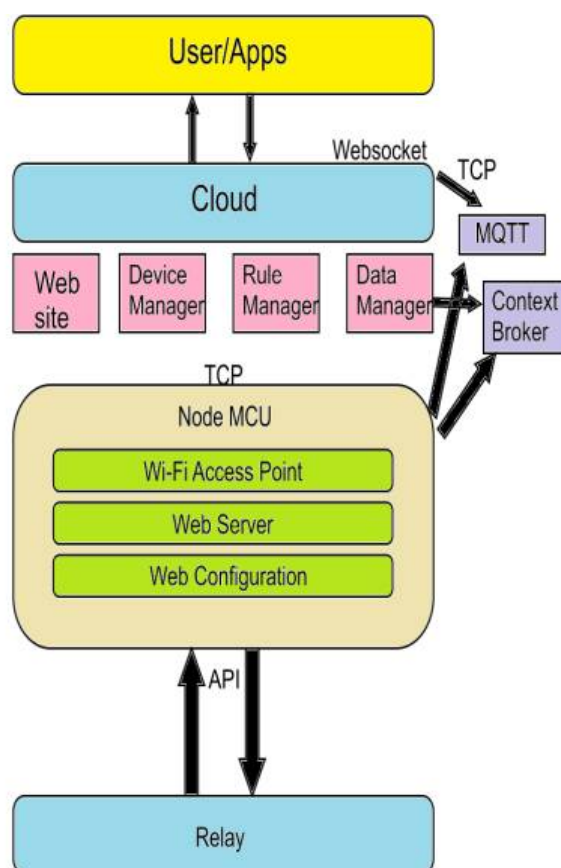


Fig. 1.3 Hardware Architecture

IV. ALGORITHM

1. Start
2. Turn on the smart board (connected with NodeMCU).
3. Connect to the internet connection (Wi-Fi router).
4. Start web application using VPS (host IP).
5. Login through the Web application.
6. Establish connection with the server and cloud (database).
7. Take user input through web application.
8. Web application sends commands to the board.
9. Relay will trigger devices.
10. User send stop command to board (stop working of devices).
11. Close the web application.
12. Turn off the smart board.
13. Stop

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V. HARDWARE ARCHITECTURE

The hardware architecture of the system consists of NodeMCU that is USB powered and is interfaced with 4 channel relay module by means of 230V power supply. Various home appliances can be connected through the relay. The NodeMCU has been programmed to act as a web server with port address 80. The client can upload the data to it and the status of the GPIO pins is modified. This result in controlling the relay connected to the corresponding GPIO pin.

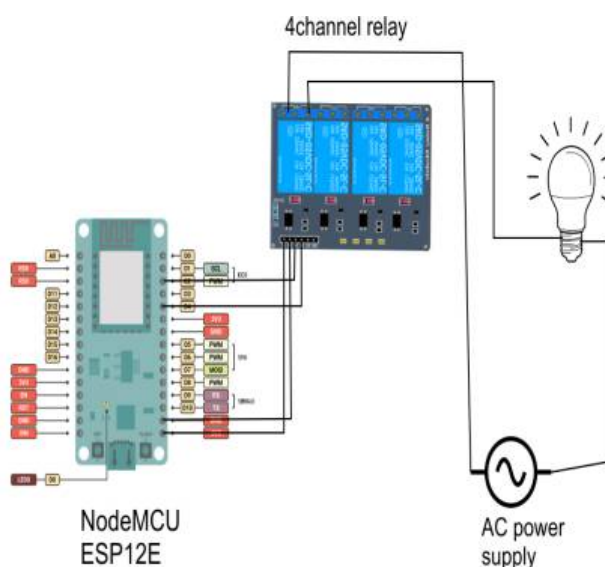


Fig. 1.4 Hardware Architecture

VI. RESULTS

The Fig. 1.5 shows the initial circuit when the bulb is off. A bulb is connected to the relay module. Any appliance can be connected to it. This is a 4-channel relay module, thus, maximum four appliances can be connected. If number of appliances exceeds, then relay modules are available in sizes such as 8-channel, 16-channel, and so on.

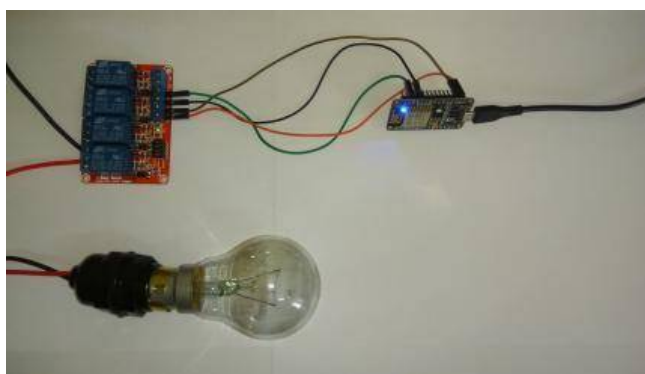


Fig. 1.5 Bulb is OFF

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Fig. 1.6 shows the on state of the bulb after the user clicks the ON button. When user clicks on the ON button the NodeMCU triggers the specific relay and thus the appliance connected to it is switched ON. The circuit contains a NodeMCU that controls the system and sends data values from hardware circuit to the web app and vice versa.

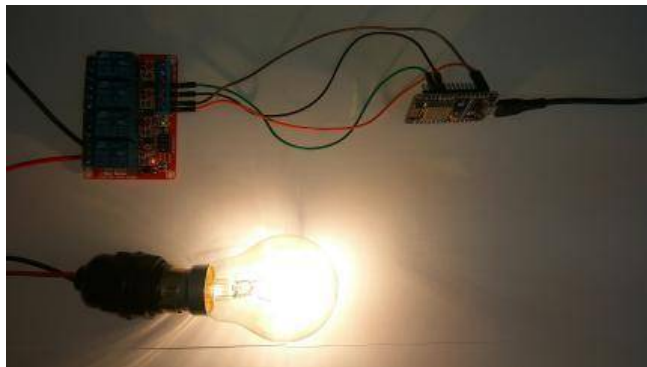


Fig. 1.6 Bulb is ON

The user has to login from the login page provided in the web app as in Fig. 1.7. When user opens the web app this will be the first page that appears on to the screen. Then user has to enter the credentials provided to them i.e. username and password. Passwords are stored in encrypted format.



Fig. 1.7 Login Page

After successful login of the user, they will be redirected to the home page wherein the control buttons are provided as shown in Fig. 1.8. They will be able to control the appliances using these switches.

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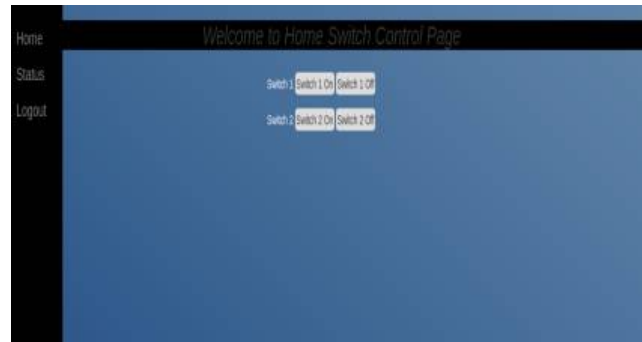


Fig. 1.8 Home Page

VII. CONCLUSION

Using IoT based Smart Switch Board user can control the home appliances. Web application provides platform for controlling the home appliances. The smart board uses the NodeMCU for controlling all components inside the smart board. The NodeMCU is low cost and powerful board. Compared with existing home automation systems, this system has following characteristics: Low cost, other home automation system is costlier. It is simple and portable board, which can control basic home appliances like fan, tube light. The smart board analyses use of electricity parameters and create an electricity usage report. The smart board is controlled through web application which can work in mobile phones, browsers etc. We have built the smart board which can control the basic home appliances. In future, we plan to extend the board which can be accessed through the iOS application as well as through smart wearable devices.

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