Efficient IoT based Smart Home Assistance System with Electrical Control Unit

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***Abstract*—Automation is defined as a technology which is proceeds by accepting the commands from a programmed code embedded with feedback control working automatically. Thus, this type of system ensures to show possibilities of completing a work with less human interaction. Among this automation home automation is one of the leading technologies which leads to a future where a normal household could have control and monitoring capabilities over each and every appliance just from any corner of the house. The use of "Internet of Things" had and still going to play a major role in managing the automation system. There are different types of IoT Wireless communication system's where the data is exchanged between the client and the devices among them Wi-Fi, Bluetooth and GSM play a vital role in allowing the client to exchange the data. In spite of all these, home automation has always been an extension rather than being an integration for an existing system. In order to overcome such problem, we are going to implement this work "Electrical Control Unit". This system mainly focuses on the scalability over already existing system using ESP32s and allowing the user to make their existing system smarter and also allows the user to make a routine or scheduled tasks via smart assistants (Alexa, Google),other than controlling the appliances over Manual Switches. This work also has Wireless communication capability over WIFI where it could communicate with over devices or assistants or over web Application.**

Keywords*— *ESP32 based Home automation, Manual Operation, Web application, Internet of Things (IoT), Cloud networking, Wi-Fi network.

I. INTRODUCTION

The Internet of Things (IoT) refers to the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors and network connectivity which enables these things to connect and exchange data [1-3]. The "Internet of Things" (IoT) is a network infrastructure that enables smart devices to communicate with each other and with the Internet. In the past few years, IoT has become increasingly popular in the public eye. It's arguably one of the most important technological innovations that we'll see in our lifetime - it will change how we live, work and play. The Internet of Things is revolutionizing every industry imaginable. Many existing home automation systems are based on extension type, where there are series of smart home devices controlled over a simple mobile application or via Smart Home assistant [4-10]. This does not pose a problem until the system is planned well so that these would be an uninterrupted wireless connection. In contrast, making a system which will be integrated in the control board with manual operation too when there is no proper connection over wireless communication which can be of great help for automation systems. With the advancement of wireless technologies such as Wi-Fi, cloud networks in the recent past, wireless systems are used every day and everywhere.

Home automation is a way of controlling all of the household appliances from one corner. Your lights, heating and cooling, security systems and more can be controlled from your hand held devices. Home automation allows you to be more time efficient and minimize the number of tasks to perform. It also eliminates the need for multiple extension devices which works over different mobile application. Instead, you can use a web application on any of the device with stable connectivity over Wi-Fi to control everything and this system can also be used to schedule your tasks and perform the required operations on time [4-10]. The major factors of such automation system are

- Saves Resources.
- Reduces Mobility.
- Makes Everyday Life Smarter.

II. SYSTEM ANALYSIS

This work is implemented with "Internet of Things". It's to make a ESP32 based controlling unit in order to control the appliances using a web Application and manual mode touch switches to control 4 Solid state relays with and without the internet. With this control system, it can control 4 appliances from the web application which makes the system to be controlled over any device and manual touch switches. If there is no wireless connections available still it can control the relay modules using manual touch switches.

A. System components:

In this control unit, the required following component for this ESP32 based operations for relays.

- ESP32 DEV KIT V1.
- ESP32S .
- 4-Channel 5v solid state relays via output with resistive fuse 240 V 2 A max.
- 4-channel 5v SPDT relay module.
- TTP223 touch sensors.

- LCD 20x4 display.
- Power Sockets.
- HLK-PM01 Hi-link - 5V 3W - AC to DC Power Supply Module.

III. System Implementation

This work is sub divided into two systems one consists of live physical updating to the server end and the other the advanced model in which all the integrations of 1st model are done.

A. Model A Block diagram

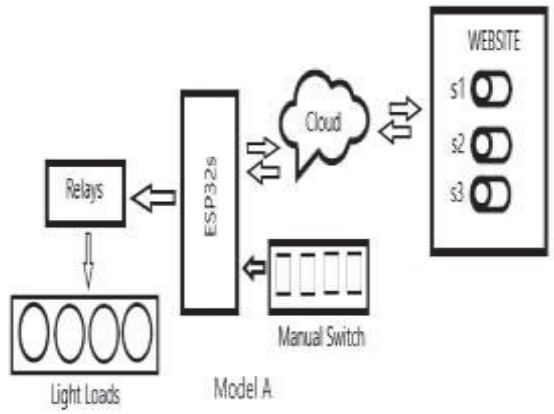

Fig. 1. Model A- Block Diagram

B. Working of Model A

The mains supply is turned on in order to wake the esp32s deployment board. Model A is depicted in fig.1. At the initial stage, the ESP32s sets all the relay and status terminals as LOW. As all the pin modes are set, the relays are now in in-active mode.

```
digitalWrite(output1, LOW);
digitalWrite(output2, LOW);
digitalWrite(output3, LOW);
digitalWrite(output4, LOW);
```

Mostly relays work in the following manner as depicted in fig.2 :

1.If the IN pin is connected to LOW (0V), the switch is open. The device is OFF.

2.If the IN pin is connected to HIGH (5V), the switch is closed. The device is ON.

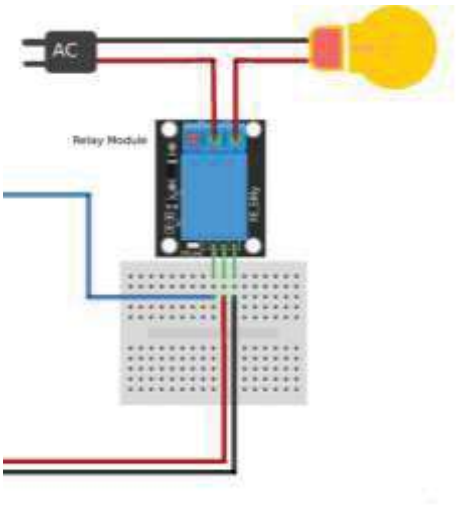

Fig. 2. Relay Operation.

After the connection is made with the wireless communication network, the network status LED starts to blink. If no connection is observed the LED remains in OFF state.

```
WiFi.begin(ssid, password);
while (WiFi.status() != WL_CONNECTED) {
delay(500);
}
server.begin();
```

After successful connection with the network. Now the user can operate the relay outputs via WEB application.

```
client.println("HTTP/1.1 200 OK");
                client.println("Contenttype:text/html");
                client.println("Connection:close");
client.println();
if (header.indexOf("GET /1/on") >= 0) {
                        Serial.println("Relay 1 on");
                        Output1State = "on";
                        digitalWrite(output1, HIGH);
                }
else if (header.indexOf("GET /1/off") >= 0) {
                Serial.println("Relay 2 off");
                Output1State = "off";
                digitalWrite(output1, LOW);
}
```

Fig. 3. WEB application

If the manual switches are operated then the real time feedback is updated into the server and the webpage as in fig.3. Fig.4 illustrates the hardware setup.

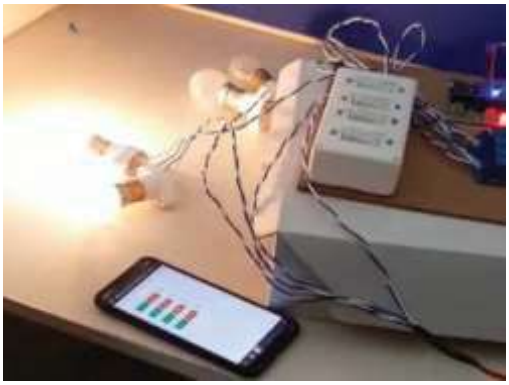

Fig. 4. Hardware setup

C. *Website application*

The website was programmed using html,css,javascript for the frontend and for the backend PHP is used in order to connect to the database and respond in the front end. This webpage has login and signup form for the user to get registered and has his/her own dashboard for organizing his smart home setup as in fig.5 and fig.6.

Fig. 5. Signup page

Fig. 6. Sign In page

For hosting the webpage live, "**000WEBHOSTING**" service is used.

Fig. 7. Dashboard

The Dashboard as in fig.7 consists of the following

1. Device Manager.
2. Profile.
3. Dashboard main page.

Device manager as in fig 9 consists of all the connected devices to your account and their present status i.e, whether they are online for performing automation task or offline.

Fig. 8. Device Manager

2. Profile

This profile consists of the user's login information, Which he/she have entered during the registration process. User page is depicted in fig.9.

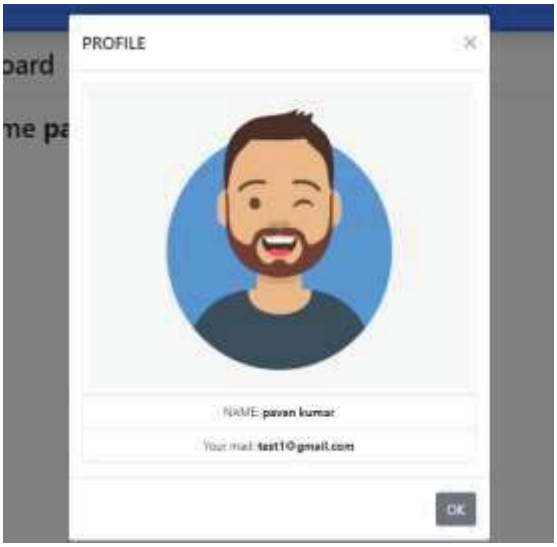

Fig. 9. User page

D. Model B Block diagram

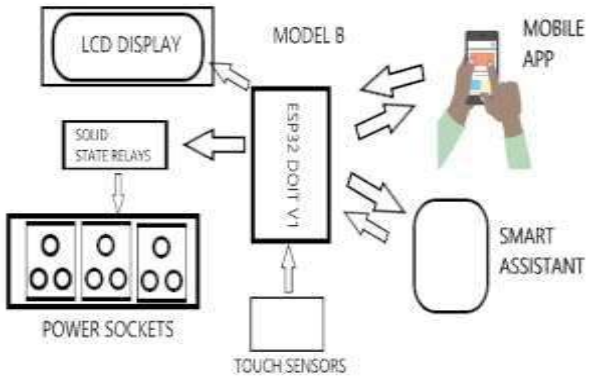

Fig. 10. Model B- Block Diagram

E. Working of Model B

It has the same working as the previous model A but the only difference is that Model B as in fig.10 can be operated via smart assistant app or smart home pod. This model B is implemented using better components which decrease the sound factor and better power efficiency with user acknowledgement feature. Model B can be interfaced to any assistant like "Alexa" and "Google home" and can be smartly operated using the application of the respective assistant's.

Fig. 11. Smart home Assistants.

These kind of home assistants as illustrated in fig.11 can be used if available else can also operate via a smart phone app which is dedicated for the home assistant. For example: Amazon Alexa app can be used to control the sockets without having an "ECHO" device around. The following screenshot as in fig.12 is taken during the operation of Model B. With the security factor of the website is managed using the authentication system and automation processes through linking the system with smart home as well as Web application in order to control relay as depicted in fig.13. Table I illustrates the feature comparison of model A and Model B.

Fig. 12. Through Alexa App Controlling.

Fig. 13. Hardware Implementation

TABLE I. MODEL A & MODEL B- FEATURE COMPARISON

Features	Model A	Model B
Web Application	Model A supports Web application	Model B also supports Web application
Smart Home Support	No Smart Home or assistant support is included	Supports Smart Home.
Noise Factor	It is noisy because of of the standard relay usage	Its completely noise-less.
Usability	User is only be acknowledged by the led and the website regarding the status and its easy to use and operate.	Must have a separate application for accessing some of the features.

IV. CONCLUSION

In this paper, a web application as well as smart aassistant based control system for automation or controlling the appliances is proposed and executed with satisfied outputs. Along with the security factor of the website is managed using the authentication system. This work has experimentally proven that automation processes through linking the system with smart home as well as Web application in order to control relay and have a smooth experience while operating the relays.

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