Smart Home Automation Using Arduino

[1]P. R. Rodge, [2]Sanchita Patil, [3]Sanjana Patil, [4]Vinayak Sagar

[1]Head Of Computer Department, [2,3,4]Student

[1]Computer Engineering Department,

[1]Shivajirao S. Jondhale College of Engineering, Dombivli, India

Abstract: The rise of technology has drastically changed the living standards of contemporary society. Seeing the increasing number of electronic devices being used in a house, an automatic home system has become an increasing useful feature. Current systems, however, have issues with complexness, high costs, non-open sources and multiple incompatible standards; leading to the restricted venture of the house automation into the homes of the wealthy or hobbyists. This project intends to create an open source, low-cost and easy to operate home automation system, which would be done by interfacing the open source Arduino creating a effortless and handy system to manage home appliances. The main objective of this paper is to regulate the fan speed and the light with the help of Wi-Fi module via Arduino. Now-a-days most of energy gets wasted due to the detachment of fans and lights whenever it is not in use. This happens because most of the switches are being placed far from the users, so as to avoid this scenario, we've introduced an affordable system using Wi-Fi which will facilitate users to regulate the fans and light within certain distance from them. The automation system can have ability to be controlled from an applications based on mobile.

Index Terms - **Arduino Software, WI-FI module, PCB.**

I. INTRODUCTION

The concept of "Home Automation" has been around for many years. The concept of networking appliances and devices in the house has been introduced with the term "Smart Home" and "Intelligent Home". Home automation Systems (HAS) represents a great research opportunity in creating novel area in Engineering, and Computing. HAS includes centralized control of lighting, appliances, security locks of gates and doors and other systems, to offer improved comfort, energy efficiency and security system. HAS becoming popular nowadays and enter quickly in this emerging market. However, end users, particularly the disabled and elderly due to their complexity and price, don't always approve for these systems. As wireless technology has evolved, there are several varied connections which are introduced such as GSM, Raspberry pi, WIFI, and Bluetooth, having their own unique specifications and applications. Among the four popular wireless connections that often enforced in HAS project, WIFI is being chosen with its appropriate capability. The capabilities of WIFI are ample enough to be implemented in the design. Also, most of the present laptops/notebooks or Smart phones come with built-in WIFI adapter, indirectly reducing the cost of this system.

II. PROBLEM DEFINITION

Home automation has been a feature of science fiction for many years, and began to be put into practice in the early 20th century. Despite the great interest, however, problems have restricted the venture of home automation into the homes of the rich or hobbyists, among them including the quality, high costs and multiple incompatible standards. In today's day, home automation is becoming mandatory for the purpose of enhancing our life condition. Convenience and handiness of home appliances is what home automation is offering. Home automation offers a revolutionary way of life in which an individual can run his entire house using a smart phone, from switching on a TV to locking/unlocking the doors; offering an efficient use of energy.

III. RELATED WORK

According to our survey, there are many systems that can control household items using android-based phones / tablets. Each system has its unique features. Currently some companies are officially registered and are working to offer better home automation system features. Following model describes the work being performed by others.

N. Sriskanthan describe a home automation model using Bluetooth on a PC. But unfortunately the system lacks to support mobile technology [4].

Muhammad Izhar Ramli designed a prototype electrical device control system with the help of Web. They also set up the server for automatic restart when the server status is currently low [3].

Hasan has developed a telephone and remote PIC device to control the device, a pin check algorithm was introduced where it was via a cable network but not a wireless connection [2].

Amul Jadhav developed the program in a universal XML format that can be easily exported to any other mobile devices instead of targeting a single platform. Each of these system has their own unique features and on comparison to one another lacks some advancement [1].

IV. TECHNICAL REQUIREMENTS

4.1 ESP32 Wi-Fi Module

ESP32 functions reliably in industrial environments with an operating temperature ranging from –40°C to +125°C. Supported by high-level measurement circuits, ESP32 can vigorously eliminate errors in the external circuit and adapt to changes in external conditions. ESP32 interfaces with other application to provide WI-FI and Bluetooth functionality through its SPI / SDIOorI2C / UART connectors.

4.2 Hi-Link 5v Power Supply (5W)

HLKAC-5M05 Hi-Link 5V 5W AC to DC Power Supply Module is enclosed in plastic, which is mounted on PCB and is isolated switching step-down power supply module. It can supply 5V DC from 120VAC- 230VACandhas a power rating of 5 Watt. It is designed in such a way that it has to be mounted on the PCB and is the optimal solution to power pads that you take.

4.3 Terminal Connector

Terminal blocks are the connectors that connect to a circuit or other system by terminating a singlewire. Terminal blocks comes in different shapes, size and ratings, but every time terminates a single wire (single pole) and are never multipole. Terminal blocks are available as rows, and each terminal connects to only a single wire. The use of screw , wherein wires are inserted and then clamped down with the use of a single screw is the most common connection method for terminal blocks.

4.4 5V Relay

1channel 5V Relay Board Module for Arduino PIC AVR DSP ARM. A extensive variety of microcontrollers like Arduino, AVR, PIC, ARM and so on can control it. Each requires a 15mA-20mA current driver and is equipped with a high current transmission: DC5V / 10A, AC250V / 10A. Standard interface which can be compatible with microcontroller.

4.5 DiodeIN4007

A diode is a device which allows current flow from only one direction. That is, the current must always flow from the Anode to cathode. The 1N4007 Diode, carries the maximum current up to 1A and it can withstand up to 30A. Hence, we can use this in circuits which are designed for less than 1A. The negligible reverse current is 5uA. The power dissipation of this diode is3W.

4.6 TransistorBC547

A transistor is basically an electrically controlled switch. There is an input, output, and control line called emitter, collector, and base respectively. When the control line (base) is triggered, it will connect the emitter and collector in the same manner as switching a switch. Since the power between the transmitter and the collector can be higher than the base, transistors are often used as amplifiers. The BC547 is a NPN transistor which means when the power is applied to the base (control pin) it will flow from the collector to the emitter.

4.7 Resistor330ohm¼W

Resistor is a ductless electrical component with two terminals that use electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, to adjust signal levels, to separate constraints, to interlocking objects, and to eliminate transmission cables, among other uses. They are made of steel or carbon and are designed to maintain a stable level of resistance to various environmental conditions. Unlike lamps, they do not emit light, but they do heat up as the electrical energy is

dissipated by them in the active station. Generally, however, the objective of the adversary is not to produce usable heat, but simply to provide a fair amount of electrical resistance.

V. System Design

5.1 Block Diagram

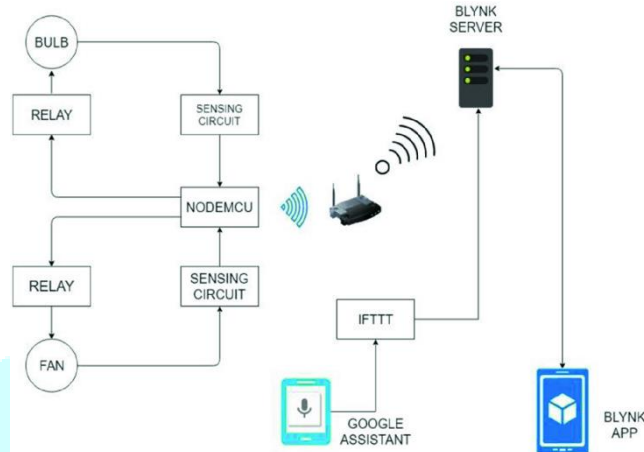The block diagram of the Home Automation system is shown in the Fig 1.

Figure 1: Block Diagram of Home Automation System

In this home automation system, the user can control the home appliances with the help of the Blynk app or by using Google assistant. Google assistant cannot directly communicate with Blynk. For creating a link between Google Assistant and Blynk we use IFTTT. Also to handle a web service i.e Blynk, we make use of Webhooks on IFTTT. For that, firstly the user should have an android smartphone in which Google assistant should be installed. When the user gives the commands through Google assistant, the commands will be checked with the commands in the IFTTT website which are already set. The next step will be setting up the virtual switches in the website. If the commands in the IFTTT website matches with the commands given by the users, then depending on that commands the virtual switches in the Blynk app will turn ON and OFF. This will be recognized by the Node microcontroller and it will turn ON/Off the relays depending on the commands.All this will be done over the Internet.In this, the relay will act as a switch and the home appliances connected to relay will be turned on or off.
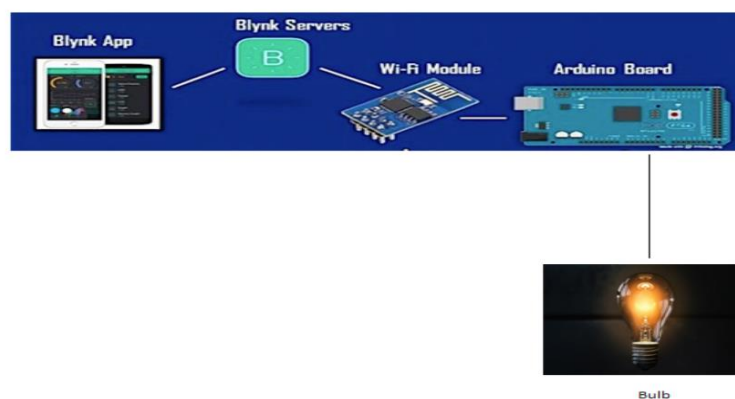

Figure 2: Block Diagram of Blynk app

Blynk is a platform compatible with both iOS and Android phones. It can interact with various microcontrollers. It was designed for the Internet of Things (IOT) and is able to control hardware remotely and display data from sensors for any desired project. If the user wishes to turn on the indoor light bulb, they simply have to press the button widget associated with the light bulb. After the generation of request, the boolean data travels to the Blynk's servers, which tells Arduino to turn on the light.
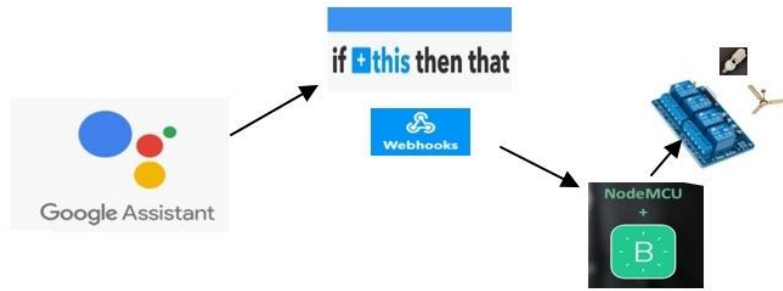
Figure 3: Block Diagram of IFTTT

IFTTT (If This Then That) is both a website and a mobile app service with which you can connect all your "services" together so that tasks are automatically triggered and completed. There are many ways with which you can connect all of your services. IFTTT is used to create simple chain of conditional statements like if else statement, called as applets. An applet connects two or more than two apps or devices together. It enables us to do something those apps or devices couldn't do on their own. Applets are made of triggers and actions where triggers tell an Applet to start, and actions are the end result of an Applet run.

5.2 Connection Diagram

All the required components are connected in the circuit diagram as shown below in the Fig 4.
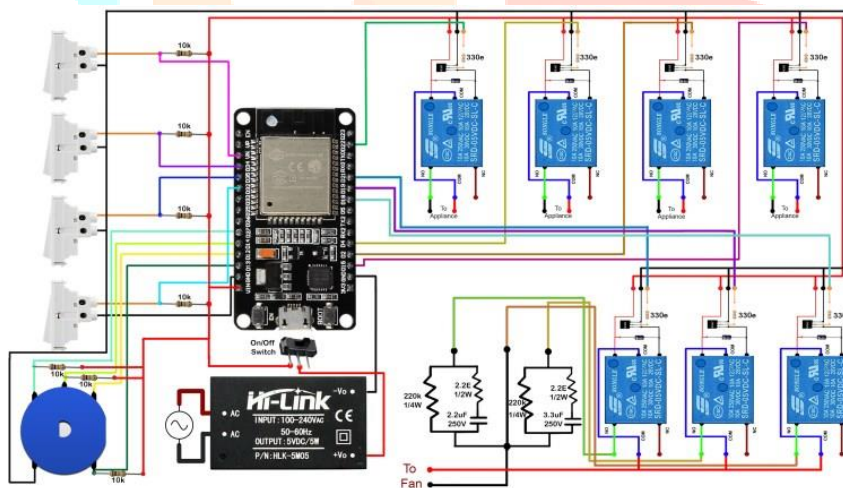

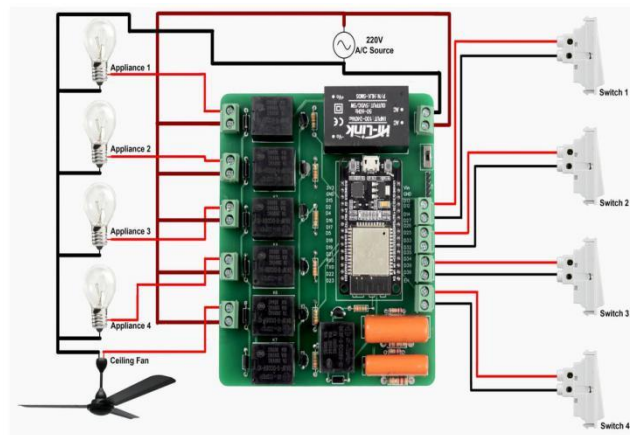Figure 4: Circuit Diagram

5.3 Wiring Diagram

Figure 5: Wiring Diagram

While connecting bulb with the relay module, one of the wires of the bulb is directly connected to power supply and the other wire of the bulb will be given to the power supply through relay module as shown in the Fig 5.

VI. FUTURE SCOPE

Home Automation is slowly but surely becoming part of everyday life around the world. As time passes by, you should be able to connect more and more of your home devices, automating every aspect of your home life. Voice command technology will be seen everywhere, and remote controls will be a thing of the past. Home Automation products aim to simplify your home life in ways you did not even realize you wanted or needed. It involves making homes even smarter. Homes can be interfaced with sensors including motion sensors, light sensors and temperature sensors and provide automatic switching of devices depending on the circumstances. A lot of energy can be saved by making sure the occupation of the house before turning on the devices and checking the lights and turning off the lights when not needed. The system can be integrated closely with home security solutions to allow greater control and security for homeowners. The next step would be to expand the program to a larger area, such as offices and factories. Home Automation provides a global standard for interactive products. Establishment empowers smart homes to be able to control electrical, lighting, environment, energy and safety management and increased connectivity with other networks.

VII. RESULTS

Smart Home Automation system is successfully designed and implemented. The system designed is used to help the users to control their household appliances with the Google assistant and the Blynk app. Users especially the disabled and elderly people can benefit from this system as it provides a great ease of use. The outcome for Smart Home Automation is shown below.
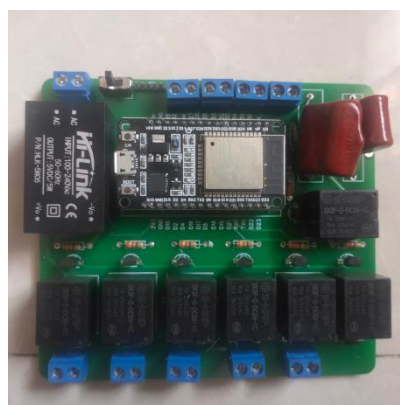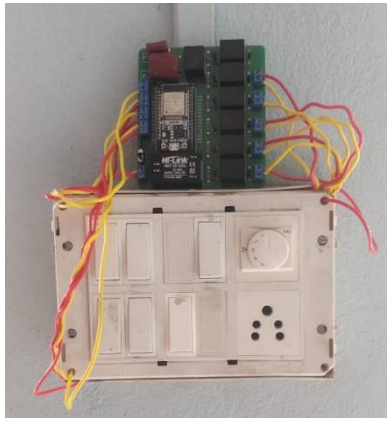

Figure 6: Connection of all the components

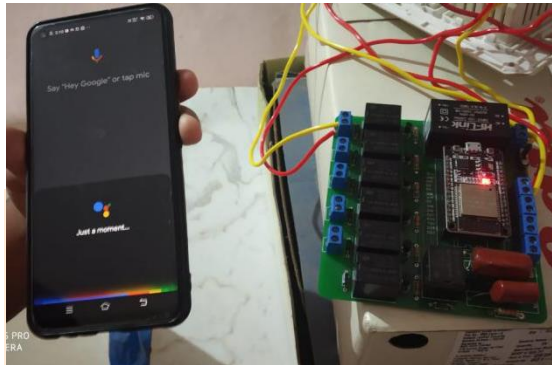Figure 7: Connection of circuit to the Switch board

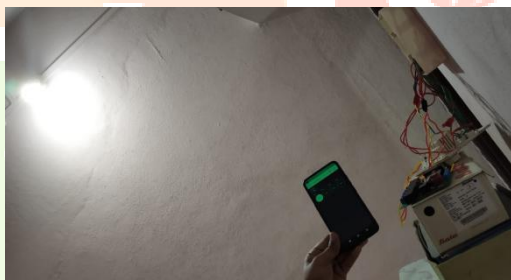Figure 8: Connection of Google assistant controlled Home Automation

Figure 9: Light turning On - Result of Google assistant controlled Home Automation

VIII. CONCLUSION

Android an open source operating system has always been on the top of the hustle when you think about mobile application as it can be seen in almost each and every house. The aim of this article is to use the Smartphone to control the home appliances using android platform and help you to implement such a fabulous system in our home at a very affordable price using cost-effective devices. Switch mode and voice mode are used to control household items. In this system, the user has given commands via switch mode or speech mode, where voice commands are given through the Google assistant. Home appliances like Fan, Bulb, Motor etc are controlled as per the given commands. Overall, it overcomes the problems like inflexibility, security, cost etc and in addition, offer greater advantages by reducing energy consumption and improves the comfort of the house.

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