

INDUSTRIAL AUTOMATION USING ANDROID APPLICATION AND GOOGLE ASSISTANT

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Abstract - This paper will help you in better understanding of Industrial Automation using Google Assistant. An Industrial Automation is a system which will help us in controlling all the Electronics appliances like lighting (LED's), entertainment systems etc. It uses IoT (Internet of Things) based communication. It also helps in saving one's efforts and saves energy. Earlier in the era it was basically used to save the labor's efforts and now it has developed to the point where one can control all the system in the house while not being present physically there. Earlier it used to be costly but now as the technology grew it has even come down to the rates which middle man can afford i.e. with the usage of microcontroller, smart phone, Google assistant etc. It is basically a path which interfaces the user with the controlling devices. All of these devices are connected to a main node point gateway from where we may control these devices. We may give a particular command to the Google Assistant or through the application building. We have to use IFTTT (IF THIS THAN THAT) application and BLYNK application through where the command given travels and then decoded, and are to given to the microcontroller (which in this case is Node-MCU i.e. ESP-8266) which helps the command to follow the given instruction and turn ON or OFF the devices. The connection between the Google Assistant and the microcontroller have to be maintained through the Wi-Fi. This has one advantageous feature that all of these connections can be easily controlled on the app through the smart phone or through a voice command.

Key Words: INDUSTRIAL AUTOMATION, IFTTT (IF THIS THAN THAT) APPLICATION, BLYNK APPLICATION, NODE MCU (ESP 8266), GOOGLE ASSITANT, IoT, Wi-Fi, VOICE COMMAND.

1. INTRODUCTION

Industry is a place where one works. It is a place where one is accommodating all the smart devices applications now-a-days. The devices which were electronically controlled are now being available to be administered with the help of IoT. Industry is the place where one has to work

If one is worn out because of all the work they have done in the office and because of the scorching heat they are even dripping in sweat they can provide some commands to ON the air conditioner, so that their office is already cooled down to a certain temperature you have asked it to.

Similarly, if it is a frosty day you can command the heater to turn ON and set a maximum temperature till which the heater will work and when it has achieved that temperature it will stop working afterwards.

As we know, we will be using LED's also so we can use them three ways, we may use it to brighten the room when one starts walking, and we set these LED's to detect the mobility and if there is no movement around it will get OFF automatically and we can also use it at the closing time i.e. when one goes to sleep they may set a timer and lights will slowly start to get subdued in their respective homes also.

It also proposes the revamping of the appliances' functionality. A smart Industry alleviates the working of these appliances such as an air conditioner will help keep the temperature if the room stable, an LED will dampen or brighten according to the commands we have already set in it, it helps in self locking of the house when nobody is present inside which may help in the precautionary purposes of the Industry, it can remind us of when is the time to take out the bins, it can help you in entertainment purposes i.e. if some music has to be played, you just need to hit a button on the phone and the music system activates.

The main advantage of this project is that differently abled people are able to use it. If a person is blind he/she can use the Google assistant voice command to provide the instructions. Even if the person is illiterate they can use this Google assistant in their native language i.e. if a person speaks Marathi so we can configure the Google assistant according to it and that specific person is able to provide the directives in the same language. The circuit diagram for the same is shown in fig.1

2. SYSTEM DESIGN AND ARCHITECTURE

The system design is divided into two main parts, these two main parts are:

1. **HARDWARE PART** - It can be connected to router. It would also be able to turn on/off specified devices, such as lights and fans and various loads of house. It is called the 'Master Of Industrial Automation'. [1]

a) Node MCU(ESP8266)- Node MCU is made of two word Node and MCU. Node in computer science branch stands for a basic unit of structure and MCU is a Micro-Controller Unit which is defined by IBM. ESP8266 is widely used in IOT application, the ESP8266 can be controlled Wi-Fi network or from internet as well. The module has GPIO pins that can be programmed to turn on LED or a relay ON/OFF through the internet. [1 & 6]

b) Relay Board- Relay boards are computerized boards which has an array of relays and switches.

These board have input and output terminals and which can control the voltage supply. Relay boards provide independently programmable channel.

2. **SOFTWARE PART**- Our Software Part Include-

a) Android App (BLYNK App)- It is an android application through which all loads can be controlled with a single click of button. [5 & 10]

b) IFTTT- IFTTT, is a web-based service which is totally free of cost, it helps in creating bundles of chains of simple conditional statements, called **applets**. [1, 6 & 9]

c) Google Assistant- Google Assistant is an artificial intelligence assistant which is developed by Google. Google assistant has played a important role in our project as all voice command will be relayed to our hardware through this Google assistant only. Here is the basic circuit diagram for it:

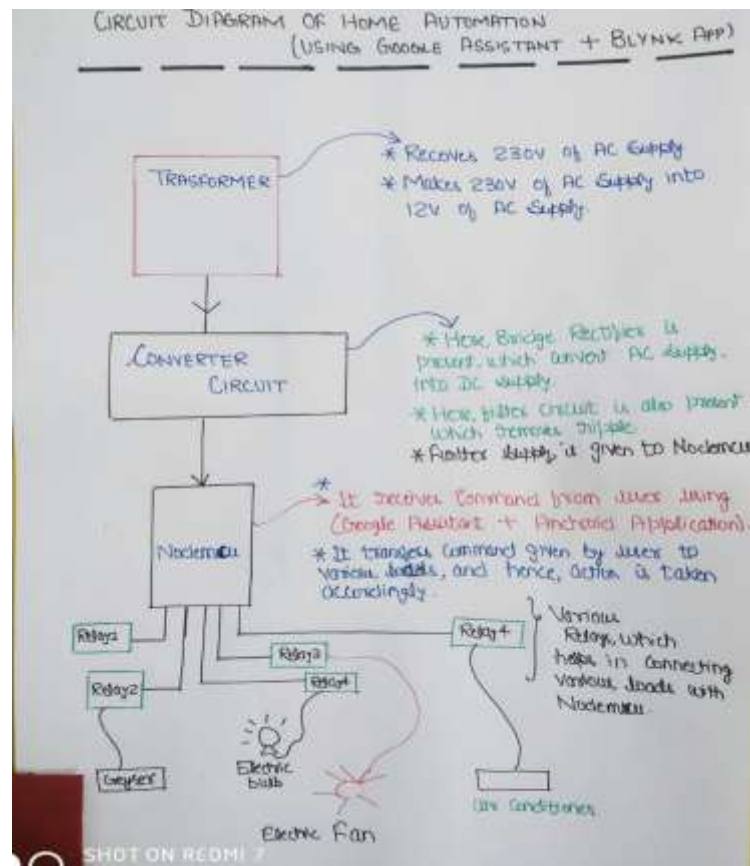


Fig 1 : Circuit Diagram

2.1 NodeMCU (ESP 8266)

The Node MCU (Node Microcontroller Unit) [1, 3 & 7] provides an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi System-On-a-Chip (SoC). It operates with the scripting language called 'Lua'. Here we need to code both the arduino and wifi module individually which has a wide range of applications in the field of IoT. It is single-board microcontroller and uses XTOS operating system which has a memory of 4Mbytes. The main components which are being used in Node MCU are CPU, RAM, networking (Wi-Fi), modern operating system and SDK as shown in fig. 2. It mainly focuses on the overall simplification and development of the ESP266. The voltage at which it performs is 3.3v and the temperature at which it functions is in the range of 40° to 125°C. We can access it by both WiFi and Bluetooth. Node MCU was developed by the ESP8266 Open source community developer.

In our project, it works as the Brain by allowing the ESP 8266 to accepts input through android applications and voice command with the help of Google Assistant and relays these commands to various types of loads of house such as bulbs, fans and an electric board which can connect any appliance over it. Hence, we will be able to control the appliances of our Industrial which provides the security also on a wider picture.

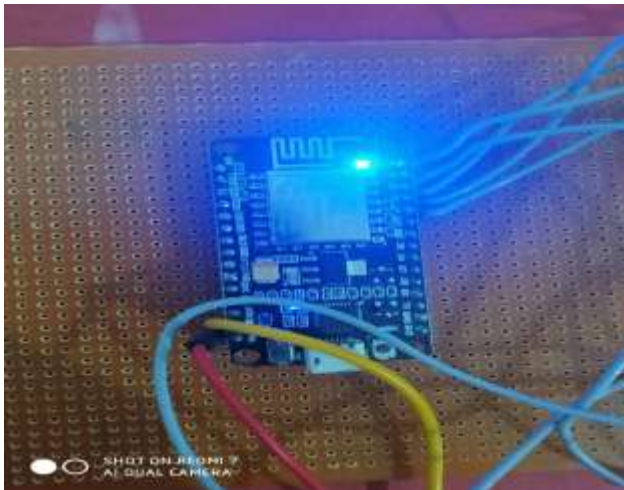


Fig 2: Node MCU

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2.2 RELAY BOARD -

Relay Board [3 & 1] is an electromagnetic switch operated by a which need a small electric current that can turn on or off a much larger electric current. It has an electromagnet i.e. it is a temporary magnet when electric current flows through it. There are various variant of Relay Board i.e. 4-channel relay board and 8-channel relay board. These are simple switches that can open and close circuits electromechanically or electronically as well. Relays control one electrical circuit by opening and closing contacts in another circuit as shown in fig.3.

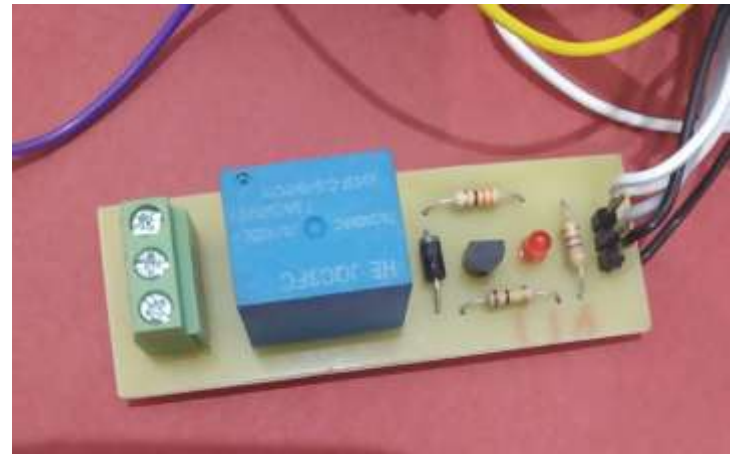


Fig 3 : Relay Board

During, normally open (NO) condition, there is an open contact when the relay is not energized. Various variant of Relay Board are-

4-Channel Relay Board- This 4-Channel Relay[3] interface board helps in controlling various appliances, and other equipment's with large amount of current. Various Micro-controller can control it i.e. Aurdino, Rasberry Pi ,ARM ,PIC etc.



Fig 4 : 4-channel relay

In the shown Figure 4 a 5V 4-channel relay interface board is shown, it needs a 15-20mA driver current to drive. It can be used to control various appliances and equipment with large current. .It can be controlled directly by microcontroller.

8-Channel Relay Board-

This 8-Channel Relay[3] interface board helps in controlling various appliances, and other equipment's with large amount of current. Various Micro-controller can control it i.e. Aurdino, Rasberry Pi ,ARM,PIC etc. as shown in fig.5.

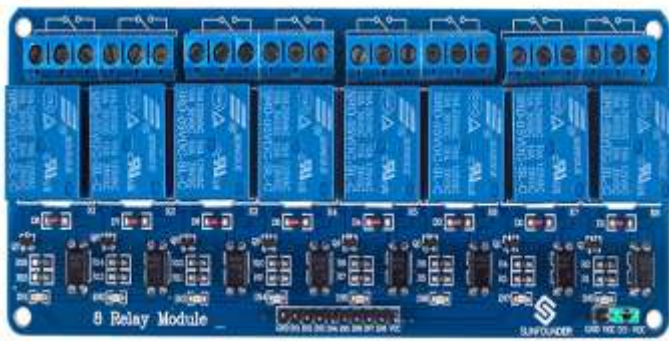


Fig 5 : 8-channel relay

Principle of Relay

In the shown figure

A is an Electromagnet,

B - Armature,

C - Spring,

D - Moving contact, and

E - Fixed contacts.

There are two fixed contacts, a normally closed one and a normally open one.

When the coil is not energized, the normally open contact is the one that is off, while the normally closed one is the other that is on.

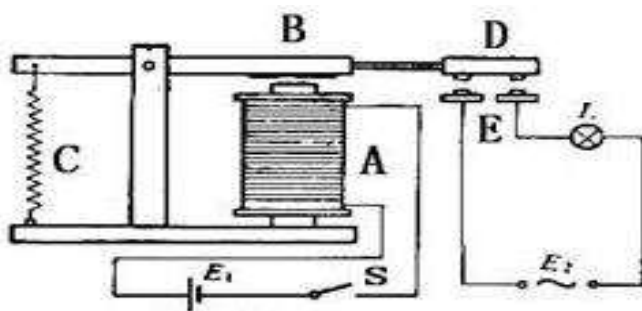


Fig -4 Principle of relay

2.3 BC 547

BC 547 [4 & 7] is a semiconductor device like a transistor which act as a switch and controls electrically. It consists of three terminals like an i/p, o/p & a control line as can be seen with the help of fig. 6.

Three terminal of transistor are-

1-Emitter (E)

2-Collector(C)

3-Base (B).

A transistor works like a switch as well as an amplifier to convert the waves from audio to electronic.

It is basically an NPN transistor which is mainly transfer of resistance which amplifies the current. In this small current of base terminal of this transistor will control the large current of emitter and base terminals.

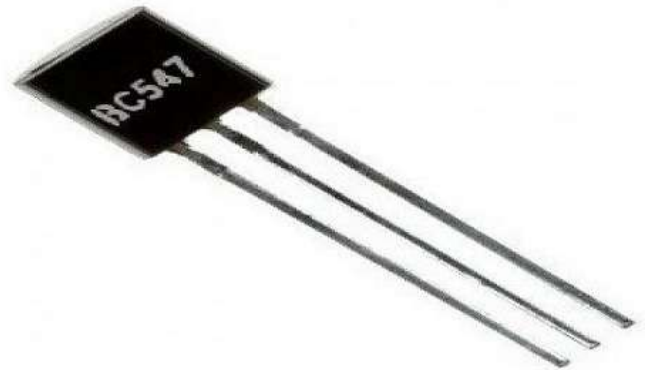


Fig 6 : BC-547

A preferred region of fixed DC voltage is necessary for working of BC547 this characteristic of transistor is called as **biasing**.

Working of Transistor:

There Are Two working state of Transistor-

1-Forward Bias.

2-Reverse Bias.

1-Forward Bias

In a forward bias mode, current flows through two terminal i.e. collector as well as emitter.

2-Reverse Bias.

In a reverse bias mode, current doesn't flow and it simply works as an open switch.

It is an NPN Bipolar Junction transistor which is used for switching purpose as well as for amplification purposes. In this, smaller amount of current at the base is used to control the larger amount of currents at collector and emitter as well.

Basic applications of this transistor are -

1- Switching

2- Amplification.

2.4 CONVERTER CIRCUIT

In the shown fig. 7 this Circuit Receives 230V of AC Supply.

It Consist of Bridge Rectifier which convert AC supply into DC supply.

It also consist of filter circuit which helps in removing ripples.



Fig 7 : Converter Circuit

2.5 SOFTWARE

2.5.1 BLYNK Application

In this software part basically consist of two things-

- 1-BLYNK Application
- 2-IFTTT Application.

BLYNK Application-

BLYNK application [5 & 7] is a software based platform which runs on Android as well as iOS platform[1]. No matter , where the user is we can control it from anywhere in the world. This mobile application basically provides an user interface which acts as a gateway through which the user passes the command to hardware and then our hardware respond according to command provided[2]. We can maneuver the BLYNK application through two ways[1,3 & 4] i.e. :

- 1)BLYNK cloud
- 2)BLYNK server

BLYNK application have been provided us with a number of virtual pins which are Digital and Analog Input/Output (I/O) pins[1 & 6] which is being implemented in fig.8. These pins are being connected to the microcontroller which can be used to operate or connect different sensors and actuators.

This Mobile Application basically helps in controlling Arduino, Raspberry Pi and various devices too.

Through this application hardware can be controlled remotely, this application helps user in various ways such as display of sensor data, store of data, visualize it too.

BLYNK Server responsible for all the communications between the our mobile and hardware.

We can also run BLYNK server locally.



Fig 8 : BLYNK application

Things Which are needed for BLYNK Application-

- 1-Hardware
- 2- A Smartphone.

Hardware here refers to an Arduino, Raspberry Pi ,or a development kit of similar kind.

The BLYNK App has an user interface which works on both iOS and Android platform, hence a smart phone is needed to operate this application.

2.5.2 IFTTT Application

IFTTT(If This Then That)[6], is a web-based service which is totally free of cost, it helps in creating bundles of chains of simple conditional statements, called **applets**. [1]

These applets are set off because of the changes that happens in every web services. This IFTTT not only runs the web based applications but it also trickles on iOS and Android[5]. The IFTTT was initially brought out to the market in the year 2011 (7th September) and is also an application based with a web based server. We may use it for automation purposes i.e. it acts as an interface between the

BLYNK application and the Google assistant. It will help in the connection i.e. if we have to send command through the BLYNK app then will it also work and if we use the Google assistant then it will also work. It also works only in English.

Services are the basis of IFTTT[1, 5 & 6]. They have all the data and see its patterns. Now, according to the patterns they represent it, may it be in whether or in stock.

Triggers are the part which prompts the actions performed in the services.

Action is the output or the result we get after the services have performed it function.

Ingredients are the basic body of the action i.e. the trigger. It is mainly the part which contains certain information i.e. in the case of an E-mail, the body or if we ascribe an attachment to the mail, or the subject we write etc.

3. RESULT:

During initial stage of our project, we implemented our project idea on breadboard using ESP8266, Relay Board and used this circuit through with the help of Android Application.

In this experiment our circuit responded well, and hence results were positive.

A complete prototype implementation of the proposed figure 9 and 10 that are given below-

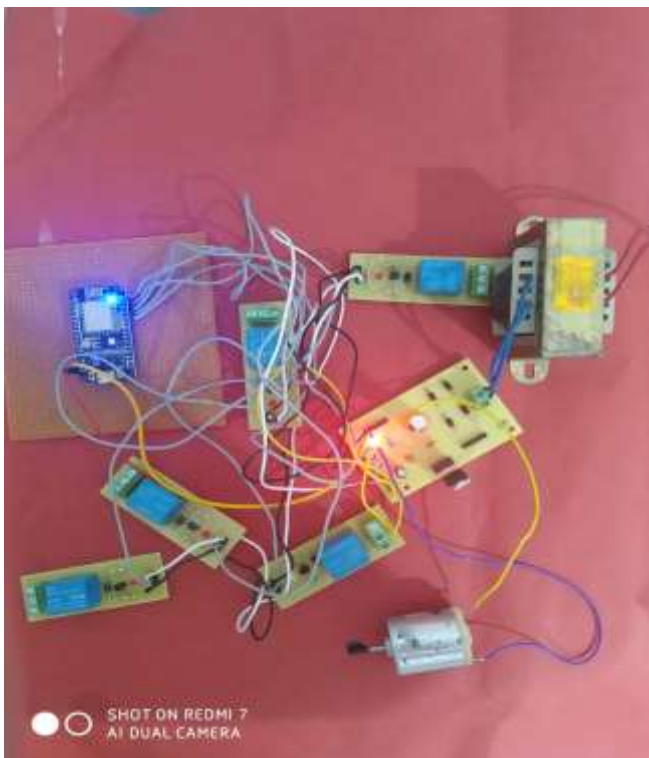


Fig 9 : Result



Fig 10 : Running Electric Motor

4. CONCLUSIONS

Our aim of this paper is to propose a voice controlled (Google Assistant) Industrial automation which can control general appliances found in one’s Industrial such as Fan, Light etc. The approach which is discussed in this paper was found successful as our project (Google Assistant Controlled Industrial Automation)][1, 5 & 6] design was successfully implemented. This idea is really going to be helpful for aged people as well as differently abled person on a wheel chair who cannot reach the switch for the switching ON/OFF the device and are dependent on others.

The future scope of this project can be huge. There are many factors needed to improve in this project to make it more powerful, intelligent, and finally to become better for overall Industrial automation. For example, controlling the speed of the fan, more number of devices can be integrated, like a coffee machine, air conditioner etc. To make the system respond more faster and secure a private BLYNK server can be made. Well, no system is ever perfect. It always has a scope for improvement.

Advantages of Industrial Automation:

1. Through this all Industrial devices can be controlled from one place only.
2. Flexibility for new devices and appliances.
3. Industrial Appliances can now have remote facility
4. Increase in energy efficiency
5. Appliance Functionality improved now because of this automation

6. Most important advantage of this Industrial automation is that it is really going to be helpful for aged people as well as differently abled person who generally depends on some other person for such small things

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