Home Automation Using IoT with Google Assistant

P. Hemanth Kumar[1], K. Mahesh[2], K. Pravallika[3], G. Mounika Sai[4], D. Sudha Sri[5], P. Santhosh Kumar[6]

[1,2]*Assistant Professor, Department of Electrical & Electronics Engineering, Sri Vasavi Institute of Engineering & Technology, Nandamuru, India*

[3,4,5,6]*UG Student, Department of Electrical & Electronics Engineering, Sri Vasavi Institute of Engineering & Technology, Nandamuru, India*

***Abstract*: Comfort is becoming a major priority in the 21st century. So the revolutions of computing and smart environment came into existence. Some technologies like pervasive and ambient intelligence satisfy the maximum need of smart world but these technologies are not tightly coupled with the internet, so the people need another technology extension. Internet of Things (IoT) is an ideal buzzing technology to influence the internet and communication technologies. IoT allows people and things to be connected anytime, anything and anyone, by using ideally in any network and any service. Home automation system achieved great popularity in the last few years and it increases the quality of life. This project presents design and prototype of the Home Automation system. The main part of this project is NodeMCU, which has inbuilt Wi-Fi module, which will help in controlling devices over the Internet. In addition to this blynk app would be developed which will allow the user to control their devices using the Google Assistant.**

***Keywords*: Internet of Things, NodeMCU, Blynk application, IFTTT application, Smart phone, Google Assistant.**

1. Introduction

Every day modern people expect a new device and new technology to simplify their day to day life. The developers and researchers are always trying to find new things to provide comfort to the people. In the past 1990s, Internet usage increased rapidly in enterprise and consumer markets but was still limited in its use because of the low performance of the network interconnects. But in the 2000s Internet connectivity became a part for many applications to provide access to information. However, these devices require more human interaction and monitoring through apps and interface. The Internet of Things is a new era of intelligence computing and it's providing a privilege to communicate around the world. Figure 1 describes the coupling of C's and A's. That reveals people and things can be connected, ideally by using in Any path/network and any service.

1. Resource usage (water conservation and energy consumption)
2. Security and
3. Comfort.

This paper introduces an IoT agent which is the brain of this architecture and it controls the devices through the Internet. At a very short period of time, the IoT agent receives the user data in the form of commands, which will be sent to control the systems through Google commands. This command will be received by Google assistant and control the devices.

Fig. 1. IoT objectives

2. Background study

When people think about home automation system, most of them get to a thought of living in a smart home: One remote controller for every household appliance, cooking the rice automatically, starting air conditioner automatically, heating water for bath automatically and shading the window automatically during the night. To some extent, home automation equals to the smart home. Then automatically these will bring out smart living condition and make our life more convenient and fast. Early home automation began with laborsaving machines. As per recent surveys, there exists system neither at cheaper rates nor easy to handle. Current systems are generally proprietary, closed and not very user-friendly based on Arduino or NodeMCU or low-cost home security system and home automation. In the year 2006, S. M. Anamul Haque, S. M. Kamruzzaman, and Md. Ashraful Islam designed a system "A System for Smart-Home Control of Appliances Based on Time and Speech Interaction" that controls the home appliances using the computer. The system is developed by using the Visual Basic 6.0 as programming language and Microsoft voice engine tools for the purpose of

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457

speech recognition. Appliances can be controlled either by the timer or by voice commands. On the basis of SMS takes a decision of a particular task.

3. System design and architecture

The designing of the system is divided into two main categories,

1. The Hardware: Hardware mainly deals with Control Unit which comprises of microcontroller NodeMCU, Relays, Driver IC (used for devices like motors).
2. The Software: The Arduino IDE Software, the Blynk app, the IFTTT app, and the Google Assistant constitute the software of the design and these applications would be integrated in the Android device. The Blynk app on an Android device communicates with the microcontroller and sends the desired signal via the internet. Figure 2 below shows the system design architecture.
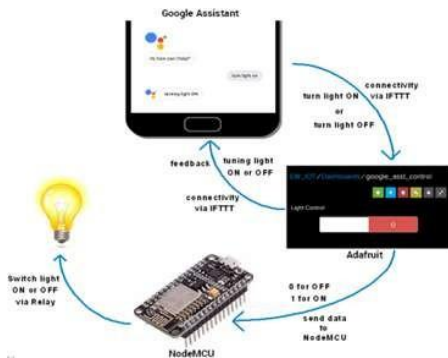

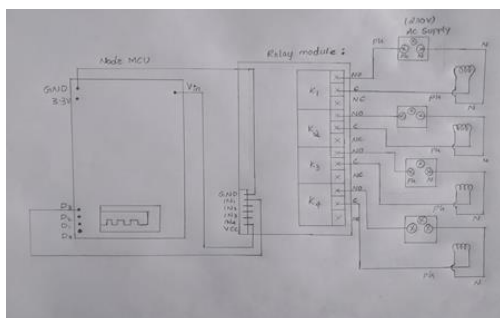Fig. 2. System design architecture

Fig. 3. Block diagram
D3 - IN1   D5 – IN2   D5 – IN3   D6 – IN4
Vcc – Vin   GND - GND

A. Node MCU

Node Microcontroller Unit is named as Node MCU which is open source software and firmware that is built around System-on-Chip (SoC) called the ESP8266. The ESP8266 is designed and manufactured by Express. It contains the crucial elements like CPU, RAM, networking (Wi-Fi), modern operating system and SDK. The Node MCU aims to simplify ESP8266 development. It has an operating voltage of 3.3v. It has an operating temperature range of -40˚c ~ 125˚c. Figure 4 shows the Node MCU development board.
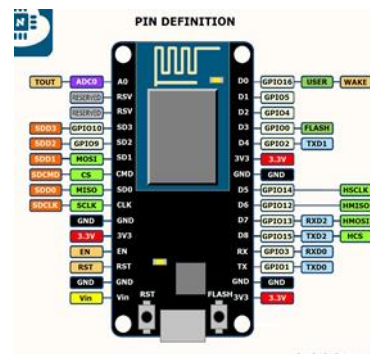

Fig. 4. Node MCU diagram

ESP8266 Wi-Fi SoC is embedded with the memory controller, including SRAM and ROM. Micro Controller Unit can enter the memory units through iBus, dBus, and AHB interfaces

B. Relays

A relay is a switch that opens and closes electronically and electromechanically. It consists of mainly 5 pins. They are 2 coil pins, 1connection pin, 1 no connection pin, 1 common pin. Initially, at the off state, it is connected to no connection pin. But when we give the input from the microcontroller then magnetic field between the coil pins produces current so it shifts to connection pin and the current will pass through the load. Figure 5 shows the 4 channel relay board.

Fig. 5. Relay board

In this system, the relay is used to turn ON/OFF the appliances. The signal is supplied from the NodeMCU microcontroller may be high/low. Whenever a low voltage signal is given to the relay which is connected to a device it is turned off and whenever a high voltage signal is given it is turned on.

C. Software implementation

The software part consists of mainly Arduino IDE software, Blynk Application, IFTTT Application.

4. Arduino IDE

Arduino IDE stands for Arduino Integrated Development Environment which is a cross-platform application for Windows, Linux. The programming language mainly used in this Arduino software is Java. Using special code structuring it also supports languages like C and C++. Figure 7 shows the picture of the Arduino IDE software.

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458

Fig. 6. Arduino IDE software

The Arduino IDE employs the program to convert the executable code into a text file in the hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Program:
1. #define BLYNK_PRINT Serial
2. #include <ESP8266WiFi.h>
3. #include <BlynkSimpleEsp8266.h>
4. // You should get Auth Token in the Blynk App.
5. // Go to the Project Settings (nut icon).
6. char auth[] = "YourAuthToken";
7. // Your WiFi credentials.
8. // Set password to "" for open networks.
9. char ssid[] = "YourNetworkName";
10.   char pass[] = "YourPassword";
11.   void setup()
12.   {
13.   // Debug console
14.   Serial.begin(9600);
15.   Blynk.begin(auth, ssid, pass);
16.   }
17.   void loop()
18.   {
19.   Blynk.run();
20.   }

A. Blynk application

The Blynk application was mainly designed for the Internet of Things (IoT). It can control hardware Arduino, Raspberry Pi, NodeMCU and several other boards over the Internet using Android, IOS apps. It can show us the sensor data, store data, visualize it and do many other cool things. Figure 8 shows the functioning of Blynk App.

There are three major components in the platform:
- Blynk App: It allows us to create interfaces for our projects using various widgets that we can provide to it.
- Blynk Server: It is responsible for all the communications between the smart phone and hardware kit. We can use the Blynk Cloud or run private Blynk server. Its open-source, could easily handle thousands of devices.

- Blynk Libraries: It is mandatory for all the popular hardware platforms that enable communication with the server and process all the incoming and out coming commands.
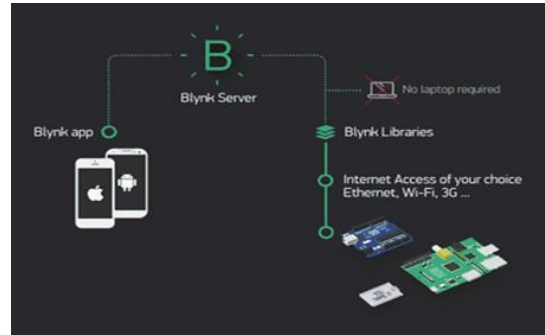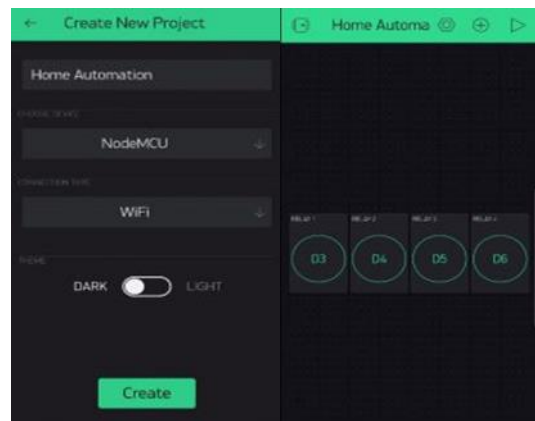

Fig. 7. Functioning of blynk app

Now imagine every time we press a Button in the Blynk app, the message travels to the Blynk Cloud, where it will find its way to our hardware. It works the same in the opposite direction and everything happens in a Blynk of an eye.

B. IFTTT application

IFTTT stands for "IF THIS THEN THAT". IFTTT is a website and a mobile app that was launched in 2010 and has the slogan. The idea of IFTTT is to automate everything from your favorite apps and websites to app-enabled accessories and smart devices. What the company provides is a software platform that connects apps, devices, and services from different developers in order to trigger one or more automation involving those apps, devices, and services. Here, IFTTT application will bridge the gap between the Google Assistant commands and the Blynk app. When we are setting up the IFTTT application first requires logging in after which we need to create an applet and then "This", i.e. the trigger, we have to select is Google Assistant and then we will type in the commands to which the Google Assistant should respond and to this command it should control the appliance/relay associated with it. The response command from the Google Assistant can also be typed in as desired. After configuring the trigger, Google Assistant hears the command which we just configured.

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459

This will be decided by setting "That" of the app. We click "That" and then select webhooks and click connect. Webhooks service will allow us to send commands to the Blynk Server. Now, in the URL we type the IP address of the Blynk server followed by the Authentication token sent by the Blynk and then the pin number of the microcontroller to which the device to be controlled is connected.

The URL should be in the following format:

http://188.166.206.43/AuthToken/pin/CorrespondingDigitalPinNo

Then in the method we select 'PUT' and the content type is 'Application/JSON' and in the body, we write ["1"] to turn ON and ["0"] to turn OFF. This creates the action for the trigger i.e. the Google Assistant command. Finally, the microcontroller is programmed with the actions it needs to do once it receives the signal from the Blynk application. Before that action, the Blynk and the microcontroller should communicate and the communication is done via the internet and since the microcontroller. Figure 9 shows the initial page setup of IFTTT application. Figure 10 shows the trigger creation.
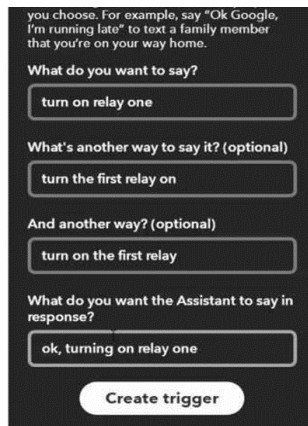

Fig. 9. IFTTT application

Fig. 10. Trigger creation in IFTTT

5. Result

Fig. 11. Final output

Here once applet is created in IFTTT then the device to be turned on is given to that particular relay for which the applet is created. So if we want to turn on the first device then it must be connected to relay 1. When we give command turn on the bulb then automatically the bulb will turn on.

6. Conclusion and future work

A. Conclusion

The home automation using the Internet of Things has been proven to work by connecting simple appliances to it and the appliances were successfully controlled through internet. The designed system processes according to the requirement, for example switching on the light when we give the command. This will help the user to get an overview of various parameters in the home anytime anywhere. Low cost and flexible home Automation system using NodeMCU microcontroller is proposed and implemented. Overall, NodeMCU is easy to understand and its coding is easy. By implementing this type of system, we can ensure that the energy conservation can be done. By help of this system we can increase, the efficiency of the appliances. We can have the complete control over the home appliances from a long distance. This will Increase the comfortability of human being and it will reduce the Human efforts.

B. Future work

Using this home automation system as a reference, the system can be expanded to include various other options which could include home security feature like capturing the photo of a person moving around the house and storing it onto the cloud. Moreover, if we want to operate a particular device at some place then this will be helpful to do that. But this can make better by thinking out of the box and by innovating ideas.

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