

Design and Implementation of IOT based Smart Home Automation System

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Abstract:

This paper presents a design and prototype of the Google assistance controlled Home Automation system. The main equipment used is NodeMCU, which has inbuilt Wi-Fi module in it, which will help in controlling devices over the Internet. It supports a wide range of home automation devices like power management systems, Lights, fans, motors and for industrial purposes. In addition to that, an application is used as voice command instructor which allows the user to control their devices using the Google Assistant.

Keywords: Smart home automation, IOT, google assistant.

1. Introduction

In today's world people are expecting new devices and different technology to make their life smart and energy. The developers and researchers are trying to implement or invent new equipments and new technology to provide comfort to the people. In the past 1990s, Internet usage had been increased rapidly in consumer and enterprisemarkets of the interconnecting networks and cost of the mobile data and internet is high in those days. But in the year 2000s Internet connectivity became a huge part for several applications to provide access to information and to run the applications. The Internet of Things is a new technology of intelligence computing and it's providing a special advantage to communicate all around the world. This paper introduces an IoT system which is the brain and heart of this architecture and it controls the devices through the internet by using specific device/component called wifi module. At a very short span of time, the IoT agent receives the user's data in the form of commands or we can say it as voice commands, which will be sent to different channels to control the systems through Google commands. This command will be received by Google assistant, then the information is sent to different channels and it controls the devices.

2. Literature Review

Chayapathy et.al [1] developed an IOT based home automation using personal assistant, in this paper they have developed the voice commands for giving a better sense of control. The main objective was to help users to operate home appliances with help of speech which is given by the user. Raspberry Pi, which communicates with the Google's Speech Recognition, has been used. Google's personal assistant uses speech commands to interact with the appliances in the house such as fans, lights, doors etc. Haque et.al[2] designed a system which controls the home appliances with the speech. Visual Basic 6.0 programming language and Microsoft voice engine tools for recognizing speech were used. Appliances can be controlled by the timer or by voice commands. As in today's world Microsoft voice engine is not user friendly. Instead of Microsoft voice engine, Google assistant is easy to communicate with the appliances. Controlling multiple home appliances through Google assistant and monitoring sensor's data from server was presented by Mukherjee et.al [3]. They have implemented by using simple devices which are cost effective and consists of mainly Node-MCU, relays. Google assistant along with IFTTT software has been used to write the command for controlling devices with Google assistant. Temperature Sensor and Humidity sensor has been used in the system. Krishna et.al [4] developed an Intelligent Home Automation System using Bit-Voicer. This system consists of recognizing the speech automatically by the voice commands, control units, remote framework and home appliances. Automatic speech recognition has been done by the computer applications. Kumar et.al [5] has designed an IOT based monitoring and controlling home appliances for smart home. Home appliances were monitored and controlled by using either GUI (graphical User Interface) or WWW (world wide web). Mainly raspberry pi2 and an Arduino board where the all home appliances connected to the raspberry pi were used which can control those appliances in online or offline the entire system provides the status of those whether ON/OFF. The user will be able watch his/her family from anywhere in world in smartphone or desktop. According to this project the user will log on to smartphone it will provide then status of the appliances, and it also provide smart door lock system it is helpful for both owner and entering person, if it is an unauthorized on the owner will be remained by SMS or alarm. Shinde et.al [6] proposed the system of home automation using IR, Bluetooth, GSM and Android. They have made the controlling of home appliances by using Bluetooth, IR remote, this IR remote is used to communicate with the appliances and performs the action. They also came up with the updation

to this project by adding up the GSM Module which is for security purposes to take care of the home from intruders when we are far away from the house. Door wave Home Automation System was developed by Almarwani et.al [7]. The main objective was to control the room temperature, sundry devices and lighting along with the security. They also used wireless sensors and actuator networks for remote control of the home automation system. Giorgetti et.al [8] have proposed an Integrated Solution for Home Automation. In this paper the authors have clearly stated the solutions for the present days technology on how to control the appliances without any problem and also mentioned how to solve if any technical problem occurs in the system. The main description was about the room control, room and external communication and signals delivery. Furukawa et.al [9] have presented development of ultrasonic sensor, which is flexible and has good sensitivity along with the duration. Ultrasonic sensor can receive an impulse ultrasonic pulse which has been transmitted by the spark discharge. This sensor can detect the range up to 1 meter distance which is essential for home automation systems. WenchaoJia et.al [10] have presented Design and Realization for controlling of Servomotor. This paper demonstrated how the servomotor works on the parts of mechanical and electrical parts. Also there is a detailed hardware design of the servomotor. Singh et.al [11] have proposed a topic named as “step towards Home Automation using IoT”. In this system they have made an in depth discussion on both the application and technology domain in making of the system, which consist of temperature controlling system, security and alarming systems and data collection from the sensors.

3. Proposed System

“Google Assistant Controlled Home Automation” will make the life smarter and simpler, at the same time we can reduce the usage of energy. The whole process is Internet of Things enabled and reduces the human energy. By the help of Google Assistant we are able to control the appliances inside the home, for example we are sleeping on the bed or else we are unable to get up but we want to switch on the light so without getting up open the smart phone and say “ok google switch on the light” then the light will be switched on. In the similar way we are proposing a new idea that is very much helpful for the people that is if we are in the car and we want to open the gate so as to park our car in the parking zone of our house so for this we have get out from the car and we have to open the gate and park the car, so our idea is to implement

this project which will be helpful for the person not to get out of the car for opening the gate. Another idea is to implement the door locking system with the help of google assistance, so that there will be no usage of key for opening the door we only need google assistance in our smart phone. The combination of all these ideas makes a perfect home automation based on IoT with the help of Google Assistance.

4. Technology Used

4. 1 Internet Of Things

Internet of Things is the most important technology that is increasing tremendously. The term IoT stands for Internet of Things that consists of all the devices are connecting to the internet, but it is continuously being used for the objects that "converses" with each other. Essentially the basic sensors used in the smart mobile phones and wearable devices are also connected to the Internet of Things. By combining all the related devices with the automatic systems, it is imaginable to "accumulate data, inspections it and then creating an activity" for helping somebody in a specific project, or how to handle the project can be learnt. Internet of things are used for allowing the devices on the some websites on the internet and then can be used to communicating with the all other devices and all the systems are bringing together by using the Internet of Things at one place. And also we can make the devices or the sensors that will talk to each other on their own by the use of Internet of Things.

4.2: Future of Internet of Things:

As we know that the internet of things is increasing rapidly and it is already in full form in the foreign countries and now it's time in India to adopt for the Internet of Things. It is believed that by the end of 2020, there will be nearly 22 billion devices may connect to the internet and as a result the internet usage will also increase rapidly.

4.3 Embedded Systems

Embedded Systems consists of both hardware and the Software components used everywhere in our surrounding like in homes, in hospitals for the health checking of the patients. In order to have computer program, there must be a put to store the executable code and brief capacity for

runtime information control. These take the frame of ROM and SRAM, individually. All inserted frameworks moreover contain a few sort of inputs and yields. It is nearly continuously the case that the yields of the inserted framework are a work of its inputs and a few other components. The inputs to the framework more often than not take the shape of sensors and tests, communication signals, or control handles and buttons. The yields are regularly shows, communication signals, or changes to the physical world. In arrange to have program, there must be a put to store the executable code and transitory capacity for runtime information control. These take the shape of ROM and SRAM, individually. All implanted frameworks too contain a few sort of inputs and yields. It is nearly continuously the case that the yields of the implanted framework are a work of its inputs and a few other components.

5. Block Diagram

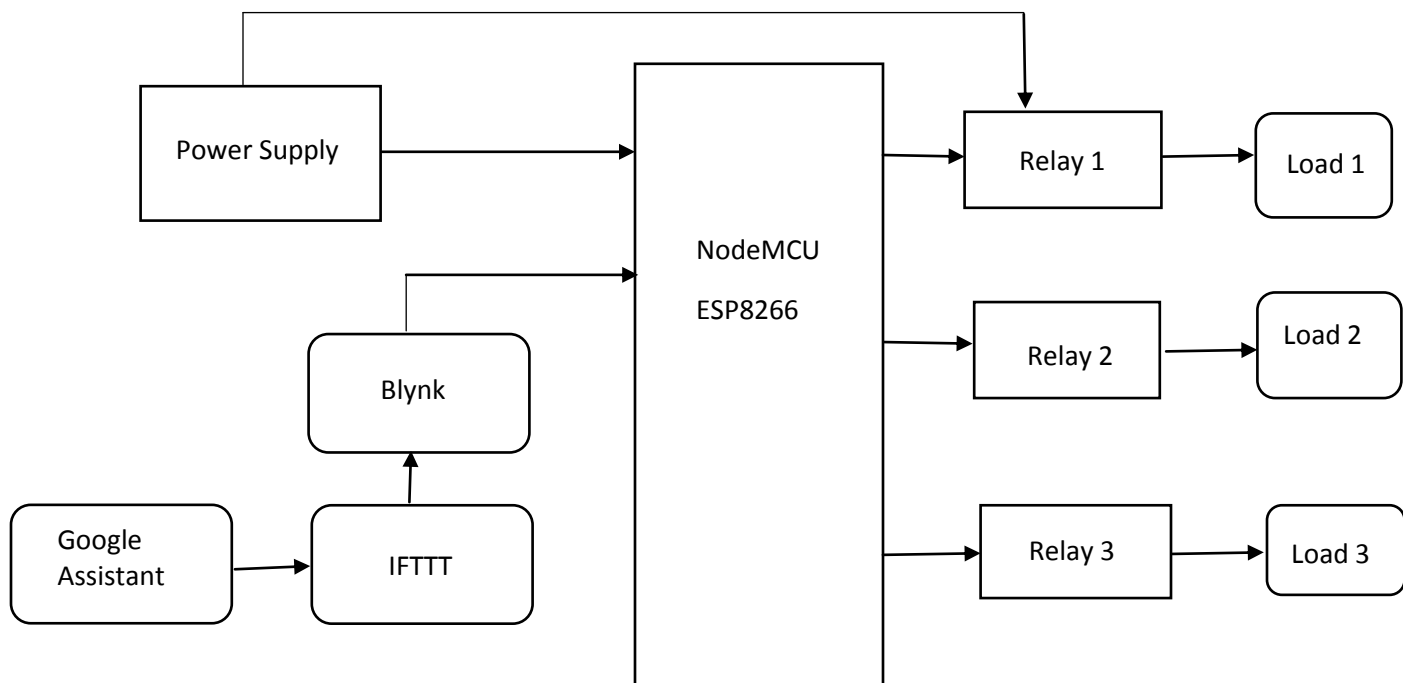


Fig.1. Block Diagram of the proposed system.

Block diagram seen in Fig. 1 gives the complete idea of this project which we are going to implement. The Google assistant sends the information based on our voice commands to the IFTTT server which acts as a link between Google Assistant application and the Blynk server, the Blynk server sends the further information to the NodeMCU based on the information given by

the Google assistance. Now the Nodemcu allows the relays by operating the loads to switch on/off. Power supply is given only to the Nodemcu as well as Relay board.

6. Hardware Description

6.1. Node MCU

ESP8266 Wi-Fi chip is made up of firmware that uses the LUA script programming language for the applications. By discovering the value with the chip ESP8266, ESP8266 Advancement is used for the NodeMCU firmware. The ESP8266 is made by EspressifSystems, that comprises of all critical components of the progressed computer: CPU, Crush, and without a doubt a cutting edge working system and the SDK. When obtained high, ESP8266 chip costs because it were 2 dollars a chunk. That produces a very good choice for IoT wanders of all sorts.



NodeMCU Improvement board is highlighted with the capability of Wi-Fi that it can be connected to, only one analog pin, and the advanced pins and the protocols for the serial communication during the applications. To induce begin with utilizing NodeMCU for IoT applications to begin with we have to be known around how to write/download NodeMCU firmware in NodeMCU Advancement Sheets. And some time recently that where this NodeMCU firmware will get as per our requirement. With the help of an online NodeMCU custom are used for building the accessibility for the use of that it can be able to effectively get our board NodeMCU firmware as per our projects. NodeMCU is like brand title of a board that encompasses a Wi-Fi module ESP8266 and a few related circuit.

ESP8266 module in tune contains a miniaturized scale controller with Wi-Fi. You'll be able program ESP8266 utilizing Arduino, NodeMCU IDE or ESP8266 SDK. The NodeMCU is additionally a sort of advancement board for ESP8266, Which is Wi-Fi chip with 32bit

6.2. Relay

A relay is a switch that opens and closes electronically and electromechanically. It consists of mainly 5 pins. They are 2 coil pins, 1 connection pin, 1 no connection pin, 1 common pin. Initially, at the off state, it is connected to a pin called 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 below shows the single channel relay board.



In this project relay is the major components which is used to switch ON and OFF the devices. The whole information is sent by the NodeMCU whether to switch ON or OFF. when a high voltage signal is given it is turned on and if we give low voltage then it is turned off.

7. Software Description

7.1 Arduino IDE

Arduino IDE stands for Arduino Integrated Development Environment which runs on different platform application for Windows, Linux. The programming language that has been used in this Arduino software is Java. Using special code structuring it also supports languages like C and C++. 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 with the help of loader program in the board's firmware.

7.2 Blynk Application

The Blynk application was mainly designed for the Internet of Things (IoT). It can control hardware equipments like Arduino UNO, Raspberry Pi, NodeMCU and several other boards over

the Internet using Android, IOS apps. It can show us the sensor data and the data which is stored, so that we can visualize the data and can work on it for many things.

Blynk consist of three types of components in the platform:

Blynk Application – This will allow the user to create interfaces for the projects using various widgets that we can provide to it.

Blynk Server –This server will be the responsible factor for all the communications between the smart phone and the hardware kit. We can handle the devices by Blynk cloud or else we can also run a private server. Its open-source, which can easily handle thousands of devices.

Blynk Libraries - It is mandatory for the popular hardware platforms which enables the communication with the server and processes all the incoming and out coming commands.

7.3 IFTTT Application

IFTTT stands for “IF THIS THEN THAT”. It is a website as well as mobile application and was launched in the year 2010 and has a slogan. In this project IFTTT acts as an intermediate for Google Assistant and the Blynk application. The main function of this application is when ever we give command from the Google Assistant, the command information will be sent to the Blynk Application. In simple words we can say, If google assistant then Blynk Server.

8. Conclusion

Google assistant controlled home automation using the Internet of Things will be very popular in coming days. Interfacing different sensors and equipments the whole project will be controlled through internetsuccessfully. The system is designed as per theprocesses,we give the command through the google assistant application. This project will be helpful for the user to get an overview on how the sensors are working in the home which we frequently use anytime. Low cost and flexible home Automation system using Node MCU microcontroller is designed and will be implemented. As we all know that NodeMCU is easy to understand & its coding is easy. By implementing this type of system, we can ensure that the energy conservation of the human can be definitely done. By help of this system we can increase, the efficiency of the appliances as well as the power consumption. We can have the complete control over the home appliances anywhere from a long distance. This will increase the comfortability of human being and it will reduce the Human efforts easily

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