IoT Based Smart Home Automation Using Raspberry Pi

Anand Sutar, Abhilash Sinha, Ashlesh Sonde, Ramasai Tatikonda, Vicky Soni

Professor, Student, Student, Student, Student
Dept. of Electronics And Telecommunication,
Bharati Vidyapeeth College Of Engineering, Navi Mumbai, India

Abstract : IoT (Internet of Things) is a new way of connecting and controlling the electronic devices over the internet and it is going to used it to convert a normal home into a smart home whose appliances can be controlled via the internet from anywhere around the world. Also voice control is going to be implemented into the Smart home that uses simple speech to control the devices.

IndexTerms - **internet of things; raspberry pi; home automation; sensors; voice control**

I. INTRODUCTION

Internet of Things(IoT) is a modern way of connecting the electronic appliances over the world by the help of internet and it can be used to change and compare various parameters of those devices using the internet. This is a network of connection of electronic devices and various embedded systems & sensors that can communicate with each other over the internet to perform the desired tasks required by the individual. IoT is used to connect various non-internet devices to the internet and have a control over these devices.

In this following project, the **Raspberry Pi** is used which is a microcomputer that performs various difficult operations. It is popular in the computer sector and it is considered as the third most popular computer in just 6 years of being released. This was due to its compact size & its been mostly used by DIY computer community. The main reason was there GPIO Pins that allowed various third-party modules to connect to it.
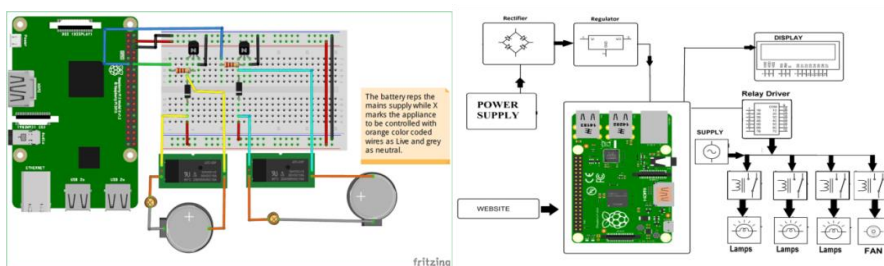
Home Automation nowadays growing in popularity due to the rise of various smart devices such as Raspberry Pi. This process is very expensive and our main goal is to make a inexpensive one with great reliability. The Raspberry Pi is used to connect the standard home appliances to the internet and have a control over them from anywhere around the world. This will allow total control over the lights, fans, air conditioners and various other devices over the internet by using an online IoT server. Raspberry Pi can be used to integrate voice commands into the project. So it can also be controlled by using Voice commands by using a simple **Voice control** software. This is more useful when the user is at home and can control their appliances directly using voice commands.

II. PREREQUISITE

This is not a very complex project even if it may seem so at the beginning. There is no need to have a lot of knowledge in order to execute this project. This project requires some basic knowledge of electronic devices like **Resistors**, **Relays**, **Connection Blocks**, **LEDs** and how to connect a basic electronic circuit is enough for this project.

On the software side, some knowledge of python is required as the Raspberry Pi uses **Python** in its command line interface. Some knowledge of the interconnections of the Raspberry Pi and about its **GPIO** Pins is necessary since those Pins are the most important part of the project as all the sensors viz. **Temperature Sensor (DS18B20)**, **Humidity Sensor (DHT11)**, **PIR Sensor (HC-SR501)** and the **Light Bulb** are all going to be connected to these Pins.

III. CIRCUIT DIAGRAM AND BLOCK DIAGRAM

IV. METHODOLOGY

As you can see from the above block diagram and circuit diagram the project is mostly about implementing home automation using the Raspberry Pi. It is actually a hub that will take the commands from the user via the internet and then pass them along to the respective appliance.

Raspberry Pi needs to have an O.S. installed in it. In this project, the **Raspbian O.S**. is used, which is freely available over the internet and can be installed directly on 8 or 16 GB Memory card only. This O.S. provides a user-friendly interface to pass commands on to the Pi. Pi needs to be updated using the CLI (Command Line Interface) that is available in the O.S. After updating, the components can be connected to the Raspberrry pi by the help of block diagram. These connections need to be made precisely.

Now set up the IoT server. This server will be made and stored on the Raspberry Pi's memory. This will be a web server that will be used to control the states of certain pins of the Raspberry Pi and to get the data from various sensors that are connected to the Raspberry Pi. The goal is to receive this data over the internet and to control the devices connected to the Pi. To complete this various web server application that needs to be installed on the Pi called **Apache Web Server**. This is a popular web server application that can be used to server the web pages. The server contains web pages that are creating using **HTML**, for a static webpage, or **PHP** for a dynamic webpage. After installing Apache on the Raspberry Pi, the web server needs to be tested, this can be done simply by opening a web browser on the Pi and enter the respective IP address of the Raspberry Pi. This will open the Default webpage for Apache that is a Demo page that has some instructions in it and it also explains what Apache is all about. This default page is the one that has to be replaced with our own web page.

The webpage is build by the help of HTML and it has switches that will be used to turn on and off the Leds. This webpage contains **Python** code files that will change the GPIO pinout code state. The webpage will also show sensors that are connected to the Raspberry Pi by the help of **GUI**. This web page is mainly access by help of the browser on the Pi and then enter the IP address of the Pi. This works in closed network only or devices that connects to the same network. Thus, a computer or mobile can be connected to the web page by web server over wifi network.

Remot3.it is an software which connects Raspberry Pi over the internet and gives access to the webpage created using HTML/CSS. The Remot3.it access the **port 80** of the raspberry pi to avail all the services. An account has to be made on the Remot3.it software in order to connect the Raspberry Pi to the GUI page that has been created. Web server created on the Raspberry Pi can now be connected by the help of the remot3.it software and the GUI stored in the Apache folder. The Bulb can be turned on or off by the click of a button. After the button is clicked the data is sent to the Raspberry Pi which changes the state of GPIO pin to HIGH. This GUI also displays the data from the various sensors and displayed using remot3.it software.

Voice Control for the Pi is a simple Voice control software that was developed by Steven Hickson. This software uses Google's Voice and Speech API in order to convert the audio input it receives to text. The Mic that has been connected to the Pi to take the voice commands from the user and converts it to text and then sends it to the Pi for further processing. The Pi then receives the text command from the software but it does not know what to do with that command. A code has to be written on Raspberry Pi that will convert speech to text. After this, the Pi will be ready to receive commands from the software and then execute the command as desired.

V. ADVANTAGES

A Smart Home is a very efficient technology since it can control the devices from any place around the world.

A Smart Home is a secure way for home as it makes use of sensors that detect the presence of a human being as well as security cameras & smart locks can also be implemented in it.

The electrical efficiency is also higher as compared to a conventional home as the appliances can be turned off or on from anywhere around the world but the only condition is it should be connected to the high speed internet.

The ability to check the status of any device in the house and to be able to monitor the usage hours of every device in order to reduce the power consumption is critical.

VI. CONCLUSION

By the help of this project, we have able to understand the disadvantage of a standard home against a smart home & why it is more reliable and efficient solution. The Smart home is also more future proof as the popularity of IoT increases and it becomes more mainstream.
.

VII. REFERENCES

[1] Vamsikrishna Patchava, Hari Babu Kandala and P Ravi Babu et al. "A Smart Home Automation technique with Raspberry Pi using IoT" International Conference on Smart Sensors and Systems (IC-SSS), 2015 International Conference on IEEE, 2015.

[2] Alaa Alhamoud, Arun Asokan Nair, Christian Gottron, Doreen Böhnstedt and Ralf Steinmetz et al. "Presence detection, identification and tracking in smart homes utilizing bluetooth enabled smartphones" 39th Annual IEEE Conference on Local Computer Networks Workshops, 2014, International Conference on. IEEE, 2014.

[3] Basim Hafidh,Hussein Al Osman , Juan Sebastian Arteaga-Falconi, Haiwei Dong and Abdulmotaleb El Saddik et al. "SITE: The Simple Internet of Things Enabler for Smart Homes", IEEE Access(Volume: 5), 2015, IEEE Access, 2015.

[4] Arun Cyril Jose, Reza Malekian and Ning Ye et al. "Improving Home Automation Security; Integrating Device Fingerprinting Into Smart Home", IEEE Access (Volume: 4), 2016, IEEE Access, 2016.

[5] Murad Khan, Bhagya Nathali Silva, and Kijun Han et al. "Internet of Things Based Energy Aware Smart Home Control System", IEEE Access(Volume:4), 2016, IEEE Access, 2016.

[6] F. A. Qayyum, M. Naeem, A. S. Khwaja, A. Anpalagan, L. Guan and B. Venkatesh et al. "Appliance Scheduling Optimization in Smart Home Networks", IEEE Access(Volume: 3), 2015, IEEE Access, 2015.

[7] Odunlade Emmanuel -"IoT based Web Controlled Home Automation using Raspberry Pi" Oct 23, 2017, Circuit Digest.

[8] Arvind Sanjeev - "How to Automate Your Home With Raspberry Pi and IBM Cloud" June 25, 2015 Maker.Pro.