

ENERGY EFFICIENT HOME AUTOMATION SYSTEM USING VOICE RECOGNITION

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Abstract - A smart home is a residence that uses electronic devices along with an Internet connection to operate the devices through the ease of just a finger touch as well as through voice commands. With the increase in smart home, technologies also have their effects on the environment. Environment conservation has become a major concern since past few decades. Energy management has proven beneficial as it helps in reducing greenhouse gas emissions, reducing demand for energy imports, and lowering our costs on a household on an economy-wide level. The Home Automation System which we propose is a system which controls the home appliances using IOT (Internet of Things) and Voice Recognition technology in an android application connected to Raspberry pi 3. This proposed system also provides greater conveniences to the user by providing ease in handling the home appliances along with less power consumption.

Key Words: IOT, Voice Recognition, Energy Efficiency, Raspberry Pi, IR Sensor, HTTP.

1. INTRODUCTION

1.1 Home Automation

Home Automation is additionally referred to as conveniences installed and designed to perform simple daily home activities. Smart homes are often stated as intelligent homes as they provide services enhances and enriching our life. The automated system initially, waits for an input from the user. Once an input is detected, the speech recognizer analyzes it. If the detected command is understood, the speech recognizer sends respective digital representations to the microcontroller. Further, it understands the representations and sends signals and collates with database and then output is obtained. Currently, techniques for home automation include a microcontroller or a computer. Since, Microcontroller cannot run multiple programs at a time and also very complex to perform the multiple functions simultaneously also we can achieve this with the Personal Computers, but using the Personal computers is highly expensive for this purpose and consumes more power. Thus, we have used Raspberry Pi which is a combination of Microcontroller and Computer in our proposed model. Raspberry Pi has gained popularity since rise of the IOT

technologies. It is cheaper and provides greater benefits than simply a basic microcontroller.

Our project includes a home automation system built on Internet of Things (IOT) along with Voice Recognition technology to provide added benefits to the user along with ease of operating the home appliances. Since, there has been a notable rise of smart homes and automation systems recently, it is greatly affecting the environment as well. Due to environmental issues arising because of these technologies, energy-efficiency has become a major aspect while developing a smart home system. Our proposed model along with being user-friendly and smart is also energy-efficient. We have used IR sensor in order to avoid any energy wastage caused by accidentally appliance being kept on.

We have used Voice Recognition or also known as Speech Recognition Technology to provide the user benefits of controlling appliances by the Voice commands. It uses software programs known as ASR (automatic speech recognition). The User's voice needs to be trained into these programs so that they give desired results. For.eg. After giving command for open the browser it will automatically open and start the browser.

With Voice Recognition technology along with energy-aware system, the project promises to provide the user with multiple benefits without any complications.

2. LITERATURE REVIEW

Various researches were carried out as well as diverse models were created in this Automation domain.

[1] Home Automation Using Internet of Things authored by Shopan Dey, Ayon Roy, Sandip Das.

This paper proposes a home automation model using smart phone and a computer. The basic working of the model includes a single admin which controls the devices connected through a cloud server. It facilitates the users which are connected to multiple sensors and control nodes. In this system, the admin has an access as well as control over all the nodes connected to each user whereas the user can only access the node connected to itself. The authors

propose that this system based on the Internet of Things (IOT) will allow any mobile device and computer to function remotely from anywhere in the world over an internet connection.

[2] Internet of things-based Energy Aware Smart Home Control System authored by Murad Khan, Bhagya Nathali Silva and Kijun Han.

This paper focuses on a smart home which is energy-aware. They have proposed a smart home control system which uses a coordinator-based ZigBee networking. The working of the system includes three folds, first one being the smart interference control system which controls the interference caused due to the co-existence of IEEE 802.11x-based wireless local area networks and wireless sensor networks. Second fold explains how energy conservation is done by integrating the sunlight with light source and reducing the unnecessary energy demands and the third and the last fold explains how the system efficiently controls the operating time of the electronic appliances.

[3] Mobile based Home Automation Using Internet of Things (IOT) authored by Kumar Mandula, Ramu Parupalli, CH.A.S. Murthy, E. Magesh, Rutul Lunagariya

In this paper, the proposed model of home automation is developed using Arduino Board microcontroller along with Android mobile app. They have used high speed mobile networks like 3G and Long-Term Evolution (LTE) coupled with cheaper and accessible smart phones while creating this model. Authors have presented this model using two more functionalities such as Bluetooth and Ethernet.

[4] Smart Home: Integrating Internet of Things with Web Services and Cloud Computing authored by Moataz Soliman, Tobi Abiodun, Tarek Hamouda, Jiehan Zhou, Chung-Horng Lung.

In this paper, the proposed model of smart home application is built using IOT along with Webservices and Cloud Computing. The approach followed by the authors mostly focuses on setting an intelligence into the sensors and actuators using Arduino Platform. Also, using the ZigBee Technology for the networking of smart things, along with using Cloud Services for facilitating interactions with smart things. Overall, the proposed model focuses on implementing three use cases that are measuring the home conditions, monitoring home appliances and controlling the home access.

3. PROPOSED METHODOLOGY

The approach of the project mainly focuses on three aspects which are Internet of Things (IOT), Client-Server Communication and Sensors. IOT is an idea which builds a bridge for objects like electrical appliances and sensors, etc. The devices like tablets, smart phones and computer are

connected easily to the other devices which are not smart with the help of IOT as it widens the connectivity through the internet. In short, an IP is assigned to objects to ensure communication with them for commanding or monitoring. In this instance, we made use of the android application to control a LED bulb and an iron which are connected to our Raspberry Pi 3's GPIO pins via sockets using python language.

Socket programming was applied in this project. A communication channel between the two terminals i.e. Raspberry pi and android phone is provided by a Socket using Transmission Control Protocol (TCP). IP address and port number are utilized in Server Socket which assists in communication with the client by using these parameters. After the connection of TCP is established successfully, HTTP GET request is sent to the server by the client to get back the webpage it needed to display. As soon as the server sends the response, it closes the connection of TCP. There are kinds of HTTP method, GET requests is one such kind of the method a client can use to call.

This proposed system framework comprises of a Raspberry pi computer which provides with management of network and allocation of remote access. The configuration of the Raspberry pi can be done according to the need of our home system. With the use of WIFI network, the user will be able to communicate with the Raspberry pi. The project chiefly comprises of modules that includes User Interface, Internet connection, Raspberry pi, Relay Circuit, Motion sensor and Electrical Appliances.

3.1. Process

Our approach involved creating a system with IOT to provide ease at controlling home appliances. The process of the project mainly involves the path followed through the connections obtained between software and hardware devices by using IOT along with other technologies. The representation of the process is shown below.

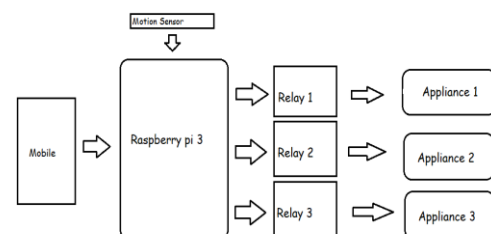


Fig-1: Block diagram of the project

The process starts from the mobile device of the user followed by the commands getting received by the

Raspberry pi which is connected physically to the Relay board and the motion sensor. The Raspberry pi will analyze the instruction and further will pass the signals to relay board which is connected with the home appliances and will produce the output accordingly. For.e.g. The relay board will switch the light ON when such command is given by the user and vice versa.

3.2. Android Application

The Android Application created for controlling the appliances consists of basic four pages. First and foremost being the Login Page, in this, the user needs to login using the registered credentials in order to use the application for controlling appliances. If there is new user, the user needs to go to Sign Up page, where he/she can register the credentials. The credentials of the users are stored in the Authentication database in the Firebase. Further, after successfully logging in the user reaches the Home Page, in which user is given two choices as in to give voice commands or manual commands. If User chooses Voice commands the Voice Command Page appears and the user's voice is obtained from the microphone in the mobile device and the speech recognizer in the app analyzes the command and sends Http requests to the Raspberry pi. Similarly, if user chooses Manual Commands, Manual commands page appears which consists of buttons for particular commands and Http requests are sent accordingly. The UI of the App is shown below.

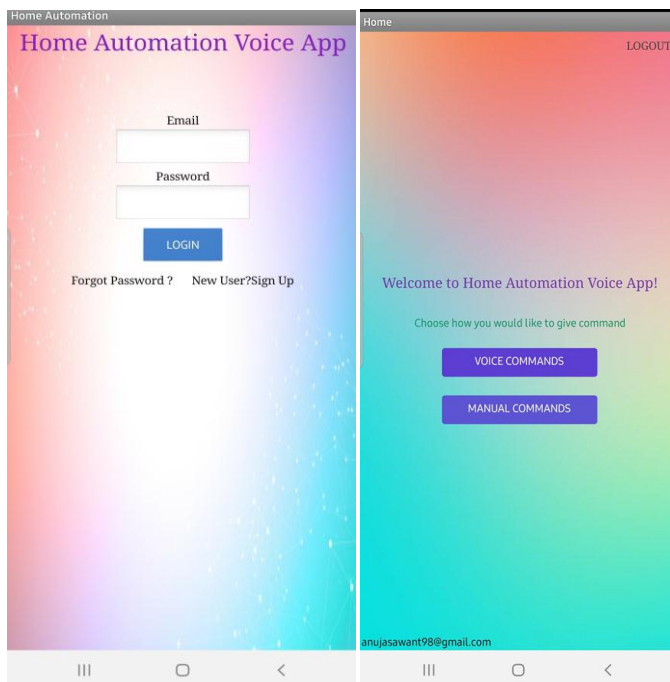


Fig-2: Login Page and Home Page of the Application

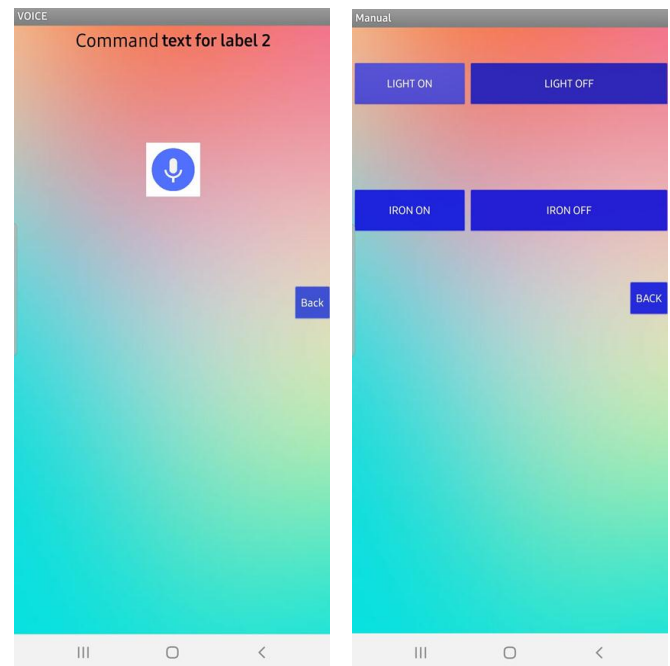


Fig-3: Voice Page and Manual Page of the Application

3.3. Connection between Application and Raspberry Pi

For acquiring the connection between the Android application and the Raspberry pi 3, we have used Client-Server Communication technique using Socket Programming.

Initially, the Android Application and the Raspberry pi will be connected in the same WIFI network. When they are connected successfully, the Raspberry pi will act as a server and will be initiated in order to receive the HTTP requests from the client which is the android application.

So, in order to communicate with the Server, the client will send a GET HTTP request. That is the commands given on the android application by the user will be in sent to the Server Raspberry Pi as the GET HTTP requests.

After receiving the GET requests from the client, the server will execute the instruction which is assigned to it and sends signals to the Relay board which will show the output of the command.

3.4. Hardware Connections

The Hardware of the Project involves a Raspberry Pi 3 Model B Board, A 4-Channel Relay Board, A LED Light Bulb, A Home Iron and an IR-Proximity Sensor.

Raspberry Pi is basically a single board computer which functions like a small computer also it consists USB and GPIO ports. With the help of these ports and along with sensors it can help in controlling the appliances.

Initially, the Raspberry Pi is connected with a power source then it is connected with the 4-Channel Relay Board and an IR-Sensor through multiple Female-to-Female Jumper Wires.

4-Channel Relay Board is a serviceable board used to control high current and high voltage loads. It is connected to the Home Appliances we have such as LED Light Bulb and Home Iron.

IR(Infrared) Proximity Sensor is used to detect objects and obstacles which are in front of the sensor it continuously transmits infrared light as soon as any object comes near it, it detects it by supervising the reflected light coming from the object. We have used this sensor in our project so as to detect the motion around appliance to avoid wastage of energy caused when the appliances are kept on accidentally. For Advance applications of this model, PIR sensor can also be used as it provides to a greater reach of the objects.

4. RESULTS AND DISCUSSIONS

The working of the project involves basic functioning of the regular home appliances without much hassle along with energy conservation. Main working of the system is such as: The appliance switches ON when the user's motion is detected by the sensor and respective command is given by the user.

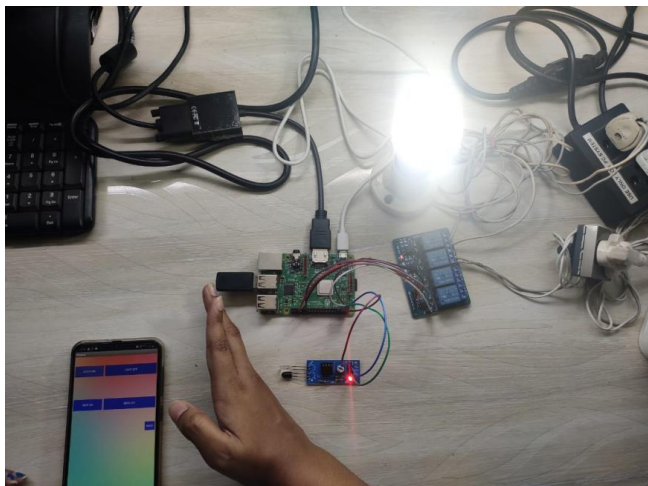


Fig-4: Working of the appliance after motion is detected.

When no motion is detected after a particular time, it switches OFF the appliance.

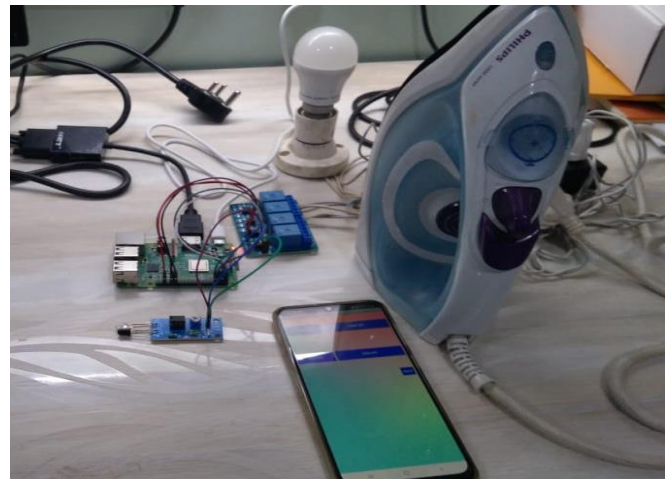


Fig-5: Appliance is switched when no motion detected.

5. CONCLUSIONS

This Voice controlled home automation project is an energy-efficient system which helps in reducing power usage. The application of voice-controlled motion sensors for the devices has three important benefits:

Conveniences: There is no need for you to reach for a switch on the wall to light the room or worry if any lights are left on.

Safety: Motion sensor lights may scare off the criminals in case of the break in the house. It's a constructive way to increase your home security instead of spending more money on security system.

Energy consumption: Upto 35-45 percent energy consumption can be reduced and can go up to as high as 75 percent.

This system is especially beneficial in the case of handicapped or aged people who find it difficult to walk and operate the electrical switches to turn on or off the loads.

This system solves such issues as the user now just has to give the voice commands to turn on or off the loads.

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