

# IMPLEMENTATION ASPECTS OF SPEAKER RECOGNITION USING PYTHON LANGUAGE AND RASPBERRY PI PLATFORM

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**ABSTRACT:** The process of automation is becoming more popular because of its numerous applications. Home automation is something that deals with the control of domestic appliances. In the recent years, the Home Automation systems have seen rapid changes due to introduction of various wireless technologies. Home Automation industry is growing rapidly; this is fuelled by the need to provide supporting systems that are made to ease our life. An automation system is supposed to be implemented in existing home environments, without any changes in the infrastructure. The automation is based on recognition of voice commands and uses wireless technology module along with microcontroller.

This paper presents the overall design of 'Voice Controlled Home Automation', which we are currently developing. Voice Controlled Home Automation is a very useful project for the adults and physically disabled persons, who are not able to do various activities efficiently when they are at home and need one's assistant to perform those tasks. With the Voice Recognition the complication of wiring in case of wired automation is prevented. With the use of Home Automation considerable amount of power saving is possible and it is flexible and compatible with future technologies so it can be easily customized for individual requirements. Voice recognition system provides secure access to home.

The automation recognizes voice commands given by the user and transfers it to our microcontroller which detects the voice command and proceeds with the switching accordingly. We are using Raspberry Pi microcontroller module & ZIGBEE module to implement our vision. This home automation is an advanced method of with the

application of Raspberry Pi through voice. Python is used as the main programming language which is default, provided by Raspberry Pi. The voice is recognized by using DTW algorithm.

**Keywords:** *Raspberry Pi, ZIGBEE, Python, Bluetooth module.*

## INTRODUCTION

The demography of the world population shows a trend that the elderly population worldwide is increasing rapidly as a result of the increase of the average life expectancy of people. Home automation is one of the major growing industries that can change the way people live. Some of these home automation systems target those seeking luxury and sophisticated home automation platforms; others target those with special needs like the elderly and the disabled.

Home automation already in practice is by switching on or off a device via wired networks or through sensors. But this is inefficient for people with impairment in mobility or spinal cord disability due to ageing factors. So we introduce Sound intelligence to a home automation. It is sophistication of physically challenged people as a broad perspective of the thesis.

## RELATED WORKS

[1] Proposed a home automation system for elderly and physically challenged people which can control the home appliances by two methods by voice commands or by using mobile as remote controller. The voice recognition is done by the android

application and thus given to the controller to control the devices.

The home automation system Al-Ali and Al-Rousan [2] designed a Java based automation system that can monitor and control home appliance via the World Wide Web but it does not consider that case when server is down.

Alkar, Ali Ziya, and UmitBuhur [3] have presented proposal and execution of a low cost but flexible and secure internet based home automation system. The communication is wireless. The protocol between the units in the design is made such that it is suitable foremost of the appliances.

Thoraya Obaid et al. [4] proposed a voice controlled wireless smart home system for elderly and disabled people. The proposed system has two main components namely voice recognition system, and wireless system. Lab View software has been used to implement the voice recognition system. On the other hand, ZigBee wireless modules have been used to implement the wireless system. Based on the received data at the wireless receiver associated with the appliances desired switching operations are performed. The proposed system is a low cost and low power system because ZigBee is used. Additionally the proposed system needs to be trained of voice command only once.

The voice recognition based home automation system [5] uses the Microsoft speech API running on PC to recognize the voice commands. The RF transceiver is used to send these commands to the controller to control the various electrical devices. The use of computer makes this system more expensive and difficult to handle.

[6] proposed two ways to control home appliances that are by using timer or by using the voice commands. The software environment is developed on Virtual Basics 6.0 on PC and devices are controlled using PC parallel ports.

[7] Proposed a Bluetooth based home automation system which comprises of a remote controller interfaced with microcontroller which is additionally interfaced with the Bluetooth module to provide wireless control of the appliances. When key on the remote controller is pressed the controller sends the command via Bluetooth module to the receiver and corresponding action on the receiver side is taken.

[8] Proposed system which uses PC to convert the voice commands to text and send this converted text

to the cellular network via mobile phone, on receiver side the text is received by another mobile phone and this command is read by the microcontroller and corresponding control action is taken.

## PROPOSED METHOD

In our project we control the devices using the voice recognition method Existing methods are expensive and also speech recognition is available with different techniques but here we are using Steven hickson for speech recognition technology and Raspberry Pi for controlling Purpose. Human voice converted into text by using Steven hickson Google app and wirelessly transferred to Controlling section which is connected to Home appliances. According to text the corresponding application will works. Our system is designed by using ARM 32-bit micro controller which supports different features. Our system is designed by using BSC2836 micro controller developed by BROADCOM which was called as Raspberry Pi.

## DESIGN OF PROPOSED HARDWARE SYSTEM

The System Architecture has two sections. They are  
1. Transmitter Section 2. Receiver Section

### 1. Transmitter Section

In this section we are performing Voice data collection and sending to the home section. This module is given to the Disable/elderly people for giving the information. It consists of Bluetooth Module, Raspberry Pi, and ZIGBEE Module.

In this by using Mobile App we are collecting Voice Information and that information converting the voice data into Text format. In this Converting we are using Steven hickson software. After converting that information send to Raspberry Pi by using Bluetooth Technology. In this Rasberr Pi converts Text information received from the Bluetooth module into numbering format and send to controlling section by using wireless communication technology Zigbee Transreceiver.

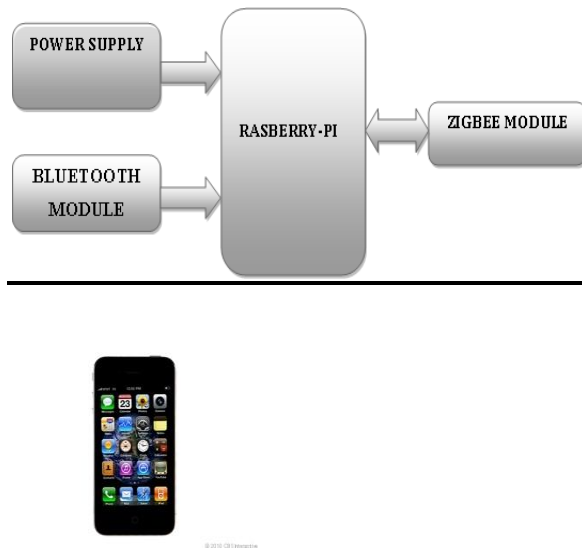


Fig.1.Transmitter Block diagram

## 2. Receiver Section

In this section we are performing device controlling operation based on receiving input. In this we are using Zigbee Transceiver for collecting the information and that information given to the LPC2103 (ARM7) controller. In this controller take decision according to the received information. In this we are using Relay circuits for controlling the devices.

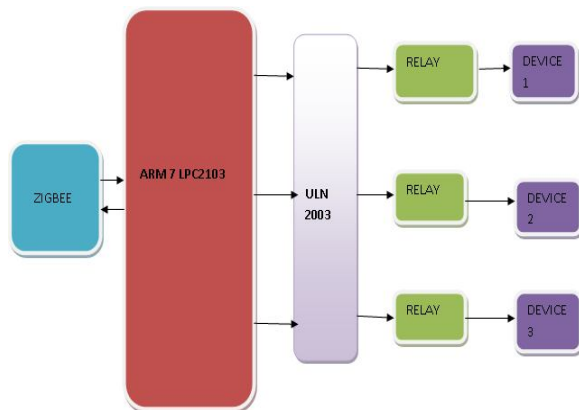


Fig.2.Receiver Block diagram

## MODULES USED IN THIS PROJECT

### Raspberry PI 2

Raspberry Pi has been chosen as the processing unit for the system because of its user friendly features and economical benefits. The python coded algorithm has been fed into the Raspberry Pi and then it is connected to the microphone.

The raspberry pi 2 is a small credit-card sized computer that plugs into monitor, keyboard or touch display. The Raspberry pi 2 model B is used in this project and it gives six times the processing speed of other previous models. The raspberry pi 2 model B has Broadcom BCM2836 processor. BCM2836 is high powered ARM cortex-A7 based quad-core processor and runs at frequency of 900MHz with memory capacity to 1Gbyte. It has 40 pin GPIO Header for interfacing the external devices to communicate with processor. The communication media's are like I2C, CAN, SPI and in this project GSM is used by direct connection with TRX and RXI pins in GPIO. It has quad USB ports, 10/100 BaseT Ethernet socket, DSI Display connector, Micro SD card slot, 5v Micro USB, HDMI port, CSI camera connector and 4-pole 3.5mm jack.

This raspberry pi 2 works on the basis of raspbian OS. Different types of raspberry pi are work on different operating systems. Raspbian is an open source operating system based on Debian optimize for the Raspberry Pi hardware.

Qt Creator is used in this project to create the application. Qt creator is uses C++, JavaScript and QML integrated development platform and which is part of the SDK for the Qt GUI Application development. It contains a visual debugger and forms designer. It has editor's features include pattern symbols highlighting and completion automatically. Qt Creator uses different compilers for different operating systems. For Linux C++compiler from the GNU Compiler is used and On Windows it can use MinGW or MSVC with the default install.

### Software

**QT CREATOR** Qt Creator is a cross-platform C++, JavaScript and QML integrated development environment which is part of the SDK for the Qt GUI

Application development framework. It includes a visual debugger and an integrated GUI layout and forms designer. The editor's features include syntax highlighting and auto completion, but purposely not tabs (although plug-ins are available). Qt Creator uses the C++ compiler from the GNU Compiler Collection on Linux and FreeBSD. Whether you are creating a mobile app, desktop application or a connected embedded device, Qt Creator is the cross-platform IDE that makes application and UI development a breeze. Since time-to-market is key, the IDE includes productivity tools that speed up your development time. Here we have used QT creator to write a source code. In the source code we will read the data from a file where the voice converted text is saved. Then it will compare the converted text to predefined text and the devices will be operated accordingly.

**Steven Hickson** We have used voice recognition software in mobile by Steven Hickson. The software's presented by Steven use google voice APIs, this is very accurate and precise. This use google speech, so that the system can be manipulated to talk back and respond to your commands and queries. The software is used because it has a simple and straight forward interface. Here, we will be able to define each of your voice commands and link them to particular tasks in the form of bash commands. These are defined inside a configuration file.

### LPC2103

The LPC2103 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation that combines the microcontroller with 32 kB of embedded high-speed flash memory. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate.

### ULN 2003

ULN is mainly suited for interfacing between low-level circuits and multiple peripheral power loads. The series ULN20XX high voltage, high current darlington arrays feature continuous load current ratings. The driving circuitry in- turn decodes the coding and conveys the necessary data to the

stepper motor, this module aids in the movement of the arm through steppers.

### Relay

A relay is an electrically operated switch used to isolate one electrical circuit from another. In its simplest form, a relay consists of a coil used as electromagnets to open and close switch contacts. Since the two circuits are isolated from one another, a lower voltage circuit can be used to trip a relay, which will control a separate circuit that requires a higher voltage or amperage. Relays can be found in early telephone exchange equipment, in industrial control circuits, in car audio systems, in automobiles, on water pumps, in high-power audio amplifiers and as protection devices.

### ZIGBEE Technology

ZIGBEE is a new wireless technology guided by the IEEE 802.15.4 Personal Area Networks standard. It is primarily designed for the wide ranging automation applications and to replace the existing non-standard technologies. It currently operates in the 868MHz band at a data rate of 20Kbps in Europe, 914MHz band at 40Kbps in the USA, and the 2.4GHz ISM bands Worldwide at a maximum data-rate of 250Kbps. The ZIGBEE specification is a combination of Home RF Late and the 802.15.4 specification. The specification operates in the 2.4GHz (ISM) radio band - the same band as 802.11b standard, Bluetooth, microwaves and some other devices. It is capable of connecting 255 devices per network. The specification supports data transmission rates of up to 250 Kbps at a range of up to 30 meters. ZIGBEE's technology is slower than 802.11b (11 Mbps) and Bluetooth (1 Mbps) but it consumes significantly less power. 802.15.4 (ZIGBEE) is a new standard uniquely designed for low rate wireless personal area networks. It targets low data rate, low power consumption and low cost wireless networking, and its goal is to provide a physical-layer and MAC-layer standard for such networks. Wireless networks provide advantages in deployment, cost, size and distributed intelligence when compared with wired networks. This technology allows users to set up a network quickly, and allows them to set up networks where it is impossible or inconvenient to wire cables. While the performance of a Bluetooth

network drops when more than 8 devices are present, ZIGBEE networks can handle 65000+ devices.

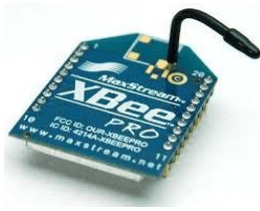


Fig.3. ZIGBEE module

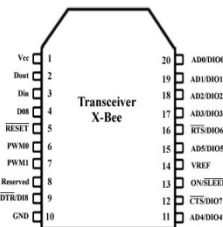


Fig.4. Pin diagram of X-Bee Transceiver

**FLOW CHART**

Once the project setup is done we can control devices. When we say “Light ON” Voice is converted to text as per commands given in configuration file of voice recognition software. Converted text is compared to predefined text and if the comparison is matched Light will be turned on. Similarly all devices are controlled with our voice commands as shown in Fig 7

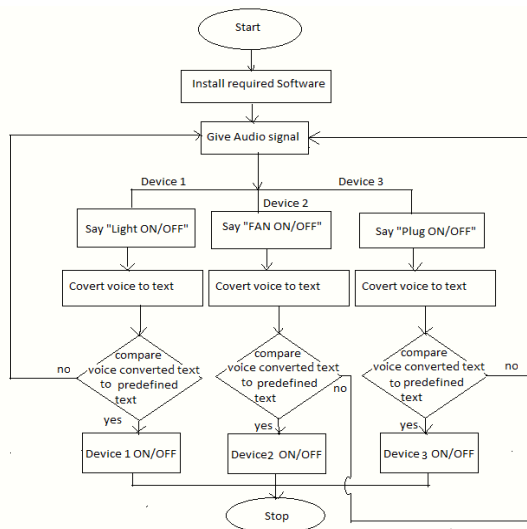


Fig.5. Flow Chart

**RESULTS**

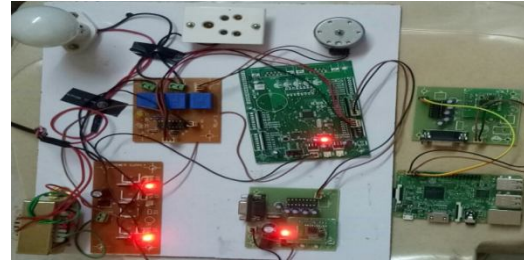


Fig.6. Hardware setup

This Fig8 indicates the complete hardware connections of the project.

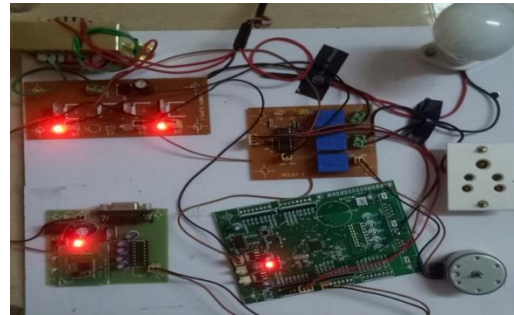


Fig.7. Receiver section

This Fig9 indicates the home appliance interfacing with the LP2103 by using this we are controlling the devices according to the receiver information.



Fig.8. Transmitter section

This Fig10 shows how raspberry pi interfacing with Bluetooth and Zigbee module.

## Working steps

In this project by voice commands using Raspberry Pi to control 3 devices like Light, fan, plug has been implemented.

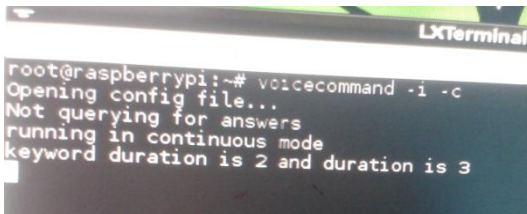
### To control Device 1 (Light)

**Step 1:** Run the executable file.

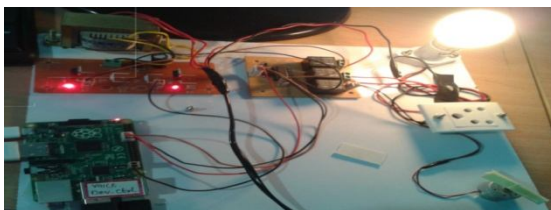
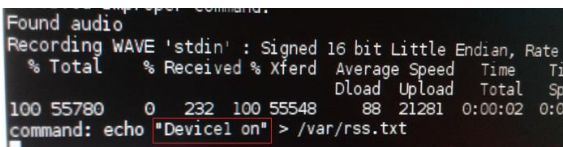


**Step 2:** Open the terminal window.

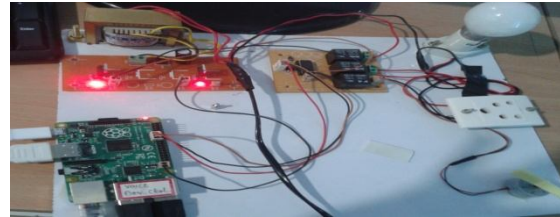
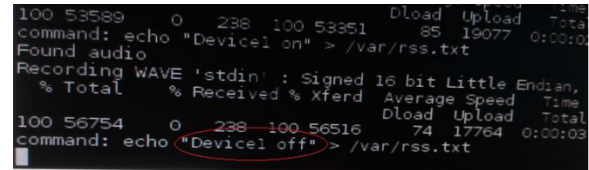
**Step 3:** Give the command “Voice command – i – c”



**Step 4 :** Say “Light ON” in micro phone



**Step 5:** When we say “Light OFF” in microphone



These steps are repeated for ON/OFF the remaining devices.

## CONCLUSION

Voice Controlled Home Automation is a very different concept than what is presently available in market. This would make automation more easy and intuitive. The people will be able to interact with the system. It also is an important aspect in the present world where people are so busy, this would help them in easing the basic functionality of their life. The world around us is going digital in every aspect we can imagine and it is happening fast, we also need to move forward with it. Our system is a great initiative step in automation, it would also provide with security. As it is based on voice recognition we can assign particular password to each user and the automation will respond to the correct passwords only.

This is low cost because the cost of raspberry Pi board is less, software used like voice reorganization software, Qt creator, SD card formatter and Raspbian OS all are open source software's.

## FUTURE SCOPE

We would increase the scale of the control of appliances such as controlling speed of fan, temperature of AC, changing particular channel of TV, choosing music tracks, etc., We are trying to develop an intuitive interface for the user so as to ease the process of controlling and make it interesting. In this instead of using mobile app a wireless microphone to be used.

## REFERENCES

- [1] Norhafizah bt Aripin and M. B. Othman, "Voice Control of Home Appliances using Android," in International Conference on Electric Power, Electronic, Communication, Control, And Informatic Systems, Malang ,pp. 142-146, August 2014.
- [2] R. Al-Ali and M. Al-Rousan, "Java-Based Home Automation System", 2004, Vol. 50, Issue 2, EEE Transactions on Consumer Electronics, 498 – 504.
- [3] Alkar, Ali Ziya, and UmitBuhur. "An Internet based wireless home automation system for multifunctional devices.", 2005, Vol. 51 No. 4, IEEE Transactions on Consumer Electronics , 1169-1174.
- [4] Thoraya Obaid, —Zigbee Based Voice Controlled Wireless Smart Home System, International Journal of Wireless & Mobile Networks (IJWMN), Vol. 6, No. 1, February 2014.
- [5] T.Kirankumar and B. Bhavani, "A Sustainable Automated System for Elderly People Using Voice Recognition and Touch Screen Technology," International Journal of Science and Research (IJSR), vol. 2, pp. 265-267, August 2013.
- [6] .S. M. Anamul Haque, S. M. Kamruzzaman and Md. Ashraful Islam1, "A System for Smart-Home Control of Appliances Based on Timer and Speech Interaction," in Proceedings of the 4th International Conference onElectrical Engineering & 2nd Annual Paper Meet 26-28 , pp. 128-131, January, 2006.
- [7] Jia-Ren Chang Chien, Cheng-Chi Tai, "The Information Home Appliance Control System—A Bluetooth Universal Type Remote Controller," in Proceedings of the 2004 IEEE. International Networking, Sensing & Control. Taipei, Taiwan, vol. 1, pp. 399-400, March 21-23. 2004.
- [8] N.P.Jawarkar, Vasif Ahmed and R.D. Thakare., "Remote Control using Mobile through Spoken Commands," in IEEE - International Consortium of Stem Cell Networks (ICSCN) 2007. 22-24, pp.622-625, 2007
- [9] Piyare, Rajeev, and M. Tazil. "Bluetooth based home automation system using cell phone." Consumer Electronics (ISCE), 2011 IEEE 15th International Symposium on IEEE, 2011.
- [10] T Marciniak, R. Weychan, A. Stankiewicz, and A. Dabrowski, "Biometric speech signal processing in a system with digital signal processor," Bulletin of the Polish Academy of Sciences Technical Sciences, vol. 62, no. 3, pp. 589-594, 2014.
- [11] S. Davis and P. Mermelstein, "Comparison of parametric representations for monosyllabic word recognition in continuously spoken sentences," Acoustics, Speech and Signal Processing, IEEE Transactions on, vol. 28, no. 4, pp. 357-366, Aug 1980.
- [12] H. Beigi, Fundamentals of speaker recognition. Springer Science & Business Media, 2011.
- [13] P Lenarczyk and Z. Piotrowski, "Speaker recognition system based on GMM multivariate probability distributions built-in a digital watermarking token," Przegląd Elektrotechniczny, vol. 89, no. 2a, pp. 59-63, 2013.
- [14] R. Weychan, T Marciniak, and A. Dabrowski, "Analysis of differences between MFCC after multiple GSM transcodings," Przegląd Elektrotechniczny, pp. 24-29, 2012.
- [15] R. Weychan, A. Stankiewicz, T. Marciniak, and A. Dabrowski, "Improving of speaker identification from mobile telephone calls," in Multimedia Communications, Services and Security, ser. Communicationsin Computer and Information Science, 2014, vol. 429, pp. 254-264.