Raspberry Pi Home Automation with Voice Control

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Abstract: Automation control means the use of various control systems (sensors) for operating equipment without human interference. Home automation is exciting field when it is blow up with new technologies like voice control. It is computerization of the home or household activity. The suggested implementation of home automation bring under one control of lighting, heating, ventilation and it is fully controlled by using any smart phone through the particular android/iOS application and also with voice commands. Also, the Home appliances are controlled by voice command using google speech API. The main advantage of this is small device can be part of internet so it is easy to communicate, manage and control without human interferences. Also, it provides a high degree of security, safety, comfort, and energy saving. The Raspberry Pi is small(85.60 mm x 56 mm x 21 mm), inexpensive(2,950 INR), portable, credit-size single board computer with support for a large number of peripherals like USB port, HDMI port, SD card slot and network communication like Ethernet port. Raspberry pi a group of technologies now exist that join the capacity of PC, communication and multimedia technologies of web and portability of the mobile device.

Keywords: ALPHA, Home Automation, Internet of Things, Raspberry Pi, Sensors, Voice Commands, Android/iPhone app.

I.   INTRODUCTION

The Internet of Things (IoT) is the network of actual objects or "things" embedded with electronics, software, sensors, and network communication like Ethernet or wifi dongle, which enables these objects to collect and exchange data [1]. In home automation smart devices and sensors that sense the physical experience and convert into the stream of information data. The major element of home automation based on IoT is sensor network and raspberry pi. Sensors or sensor networks are used for sensing and monitoring while raspberry pi collect the data monitor the data and depends on collected mange the device like fan, light, door motion and opening-closing of curtains. Suppose the ambient light is less that I am going to feel darkness then according to ambient light its automatically open the curtains. Thus, home automation can be defined as a system of parts working together in a machine removing as much as a human interaction which technically possible and desirable in various domestic processes and replacing them with programmed electronic systems. Ultimately it is a system that aims to heighten quality of life with the automation of household activity that may be controlled over the Internet or telephone [2]

Fig. 1 Complete Home Automation Using Raspberry pi.

II. HISTORY OF HOME AUTOMATION

Concepts for home automation were around for decades before becoming reality and featured in the writing of the 19th century. The Electronic Computing Home Operator (ECHO) was a highlight in the April 1968 edition of Popular Mechanics and had been expanded from a set of spare electronics. The ECHO never went commercial and a number of large companies played with the idea of computerizing the home, however, it was the birth of the modern era of home automation technology. The X10 standard was designed to allow transmitters and receivers to work over existing electrical wiring systems by broadcasting messages such as "turn off" and "turn on" via radio frequency.

- X10 has a number of disadvantages,
- Issues in wiring and interference.
- At the time of transmission, command may lose.
- Supporting product are less.
- Available commands are in limited scope.
- Signal transmission speed is slow.

The dot.com boom was a small step from PC to PC communication to the appliance to PC communication. With the arrival of Raspberry Pi which is small(85.60 mm x 56 mm x 21 mm), inexpensive, portable, credit-size single board computer with support for a large number of peripherals and network communication like Ethernet port, USB port, HDMI port, SD card slot. Raspberry pi group of technologies now exist that join the power of PC, communication and multimedia technologies for web and portability of the mobile device. Pi is an open source hardware technology combined with a programming language like python, C, C++ and an Integrated Development Environment (IDE). Operating systems that are available to install the Raspberry is Raspbian or Debian. Raspbian is based upon the Debian Wheezy Linux operating system and has been a rewrite for use with Raspberry Pi. The Raspberry Pi is connected to the Raspberry Pi's GPIO pins, and with the inclusion of the software, I will be able to communicate between our electronic devices, the Raspberry Pi's operating system, and web-based propose model.

III. MODULES

The detailed algorithm to control the home appliances from voice commands is as follow:

1) : while(1)

2) : Start

3): Input from mic(any mic)

4) : Create .FLAC file.

5) : Automatically stop recording at values silence

6) : audio file encoded flac format to communicate between our electronic with 16000 sample rate

7) : GS API

8) : load flac file using file-get-content() to a variable

9) : create array of data form flac file

10) : initialise cURL request

11) : create new output buffer

12) : execute cURL request and post the flac file

13) : close cURL

14) : clean output buffer

15) : get the contents from flag to text

16) : create array of comma separated

17) : elimination

18) : check for ALPHA

19) : if present

20) : check primary keyword and secondary keyword from database

21) : if GPIO is not null

22) : read GPIO

23) : if GPIO value and command is not equal

24) : write GPIO

25) : change status

26) : else give voice command of status of appliances

27) : end if loop

28) : end if loop

29) : no keyword found

30) : end while loop

The above algorithm has controlling home appliances through the voice command which support the google API. The raspberry pi doesn't have the audio input means it cannot take direct audio as input so in this usb mic is going to use. I am using the iball mic. It gets the audio input and convert it into. Flac audio file format. It automatically stops recording after a silence, for this sox is used. This audio input saves in one .flac extension in the same folder or a different folder. A.FLAC (Free Lossless Audio Codec) file is a file which has audio samples compressed with the FLAC audio encoding algorithm, which is a very good, open source and lossless. This audio file is sent to google API with a version number, language for converting speech to text and developer key. After checking the developer key it sends the text output as a json response. The responded text contains a number of possibility of command or speech, among this confidence factor tell about the most matching text to command. From this, I am going to create one array which contains comma separated words. From tnis sort the word and check for ALPHA word. ALPHA word is going to use to wake up for listening to the command. After executing the script, is continuously listening for command but take speech as a command only after ALPHA. In simple ALPHA is name of system which control the home appliances by voice command. After listening ALPHA it checks for other primary keyword and secondary keyword. If it successful to listening keywords it check gpio status of raspberry pi. If gpio status and voice command is not match, then it updates the status of home appliance else status remains same.

In IoT application template having different buttons to control home appliance which control through mobile, PC or tablet. Initially, it checks status gpio pin. Suppose status of light in the living room is on then it shows about that and supposes we want to update the status then only pressing the button we can able to change status. The following figure gives the complete flow of IoT based smart home.

The proposed system modules are as follows:

A. Thermometer
A thermometer is a device used for recording temperatures and changes or difference in temperatures. The introduction of microelectronics has allowed us to build our own digital thermometers. This can be useful for checking the temperature in parts of our home. Our thermometer will return its readings in three types of temperature, namely Celsius, Kelvin, and Fahrenheit to the Raspberry Pi and display it.

B. Curtain Automation Open and Close the Curtains Based on the Ambient Light
For this, I am going to use a photoresistor and a motor shield in conjunction with Raspberry Pi. Once these are combined into a single device, it can be used to open and close blinds or curtains. I can use a photoresistor as part of our circuit to tell when it is getting dark in a room and send this information back to the Raspberry Pi. The Raspberry Pi can then process this data and use it to control an electric motor. When I am going to attach the motor to the blinds/curtains will need to calculate the number of seconds required to open/shut the blinds and also adjust the values either speed up or slow down your motor.

C. Switch off or on of Light
Switch off or on of light and according to exterior light brightness may increase or decreases and it can also handle manually because in some case I require bright light such as reading. To control LEDs from our voice control, using Raspberry Pi's digital signal with pulse width modulation (PWM). What is Pulse Width Modulation (PWM)? Pulse width modulation [7] is a technique controlling power. By PWM I get analog results using a digital signal, which forms square waveforms that a signal is oscillating between on and off. On again, Off-again Relationship with Duty Cycle [8] let's say, the digital signal pulses rapidly between 0V and 5V. When I turn the LED on for 100% of the time, it is at full brightness, while when turn it on 50% and off 50%, the LED will appear half as bright.

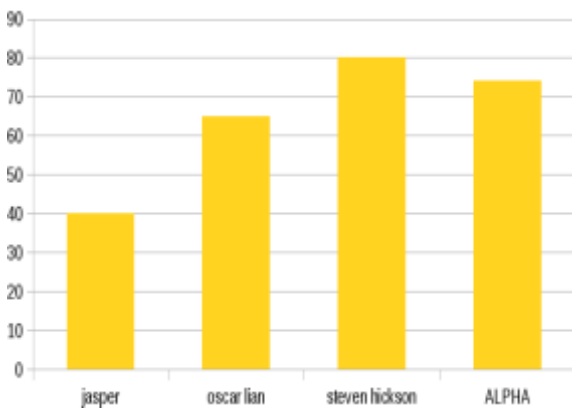### D. Comparison with Similar Systems
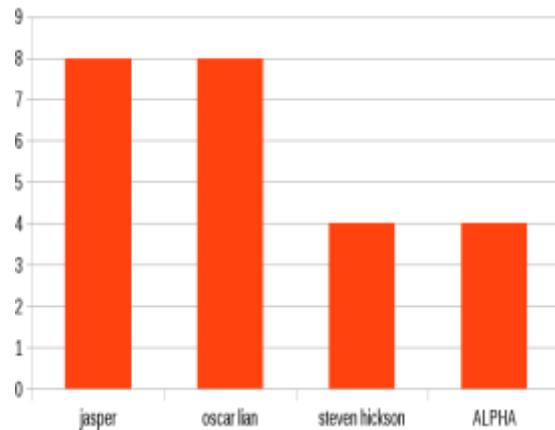

Fig. 2 Comparison Based on Accuracy

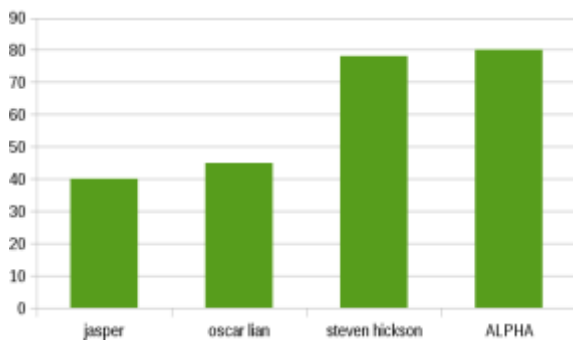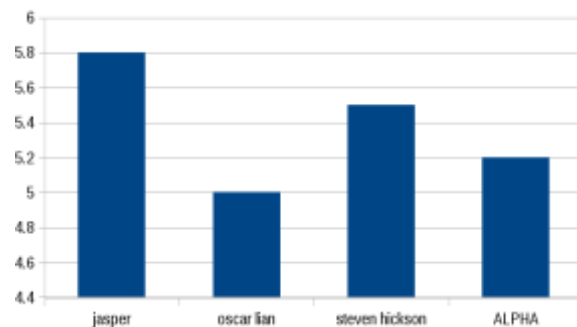**Fig. 3 Storage Required for Each System**

Fig. 4 Performance

Fig. 5 Speed

IV. CONCLUSIONS

The application voice control of the IoT technology, in home automation, means a combination of all electrical devices like smart mobile phone, personal computer, tablet and their monitoring, controlling and alerting in ways not possible before. This proposed system provides many advantages including, safety, security, improved comfort, and energy and cost savings. In order to address the issues of flexibility and functionality, a novel, standalone, flexible and low cost home controlling and monitoring system using Web services as an inter-operable layer for communicating between the remotely present user and the home devices is being designed. Performed research has shown that by using the Raspberry Pi and open source software it is possible to programmatically control many devices in a home in such a way that user can create his/her own solution customized to meet his/her individual needs. Thus, the proposed system is better from the scalability, flexibility and security frame of reference.

ACKNOWLEDGMENT

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