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RASPBERRY PI BASED PERSONAL VOICE ASSISTANT USING PYTHON

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Abstract— **The purpose of this paper is to demonstrate the implementation of a voice user interface (VUI) as a personal voice assistant that can perform several assignments or tasks for the user such as setting up the alarm, reminders for the day, knowing the weather forecast, reading news feed, to play a song from the playlist, ask about the details of a movie, finding out the meaning of an unknown word, to read a article from Wikipedia, controlling electronic gadgets (such as Television, air-condition, blinders etc.) [Pearl 2017].**

The system's hardware model is designed in a way, where the main component is the raspberry pi to which various other peripherals (such as microphone, speaker, picamera, PIR sensor, buzzer etc.) are connected. The system works on the principle of speech recognition, the speech is fed through the microphone as an input which upon further parsing is converted to text and the system searches for desired key words to deliver to appropriate output and again the textual output is converted to speech (text-to-speech) and delivered through the speakers. The system provides great hands-free user experience to the user and can be beneficial to a visually challenged person as well as a normal human being to connect to the world.

Keywords—Speech Recognition, Raspberry Pi, Voice User Interface, Python, Speech to Text, Text to Speech, Hands-free User Experience.

I. INTRODUCTION

A **Voice User Interface** (VUI) is an interface that allows us to interact with a system through the medium of voice commands. The voice user interface can be called or referred as various names such as Intelligent personal assistant, voice assistant, smart assistants etc. The good thing about these VUI'S are that these allow hands-free user experience and usability [Pearl 2017**].** An Intelligent personal assistant or voice assistant can help the user with some basic tasks. These can recognize human voice commands and can perform tasks like setting reminders, reading latest newsfeed, current weather forecast, playing any media file etc.

It uses python's speech recognition module to recognize the voice command and translate speech to text and vice versa. One most important part of speech recognition is the speech, this speech acts as an input to the system which further processes the command by converting the received speech to text and return appropriate output in textual form, which is later converted to speech. The evolution of voice assistants in the recent years has been quite indulging and how it made its way to the everyday life of a normal human being.

According to Global Market Insights Inc, the market share for the voice assistant technology is likely to increase at a rate of 30-35% annually between 2016-2024, as more and more sectors are adapting this technology. This technology can be observed in smartphones, smart speakers, Infotainment systems, Healthcare, automobile industry etc. Some of the mainstream voice assistants are Siri, Google Assistant, Amazon Alexa and Google Homepad [Smartsheets 2020].

II. METHODOLOGY

A. *Proposed System*

The proposed system is a voice assistant that uses speech recognition to recognize human speech and deliver relevant results in speech form. This system provides hands-free user experience and is deployed on a mini computer called Raspberry Pi. This device acts as a personal assistant that can help the user in everyday tasks. This device is portable and suitable for usage in workplaces, home etc.



Figure 1: User Defined Commands

B. *Block Diagram*

The Raspberry Pi is the main part or element as the system as it is necessary to connect various parts or component and to process the requests. Peripherals such as microphone, speaker, picamera, switch, PIR sensor are connected to it.

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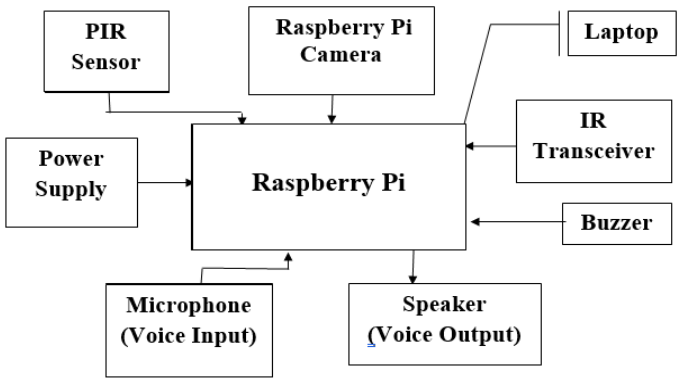


Figure 2: Block Diagram

C. Hardware Configuration

Raspberry pi

Raspberry pi is a computer which consists of a series of single board computer that is the heart of the system to which the I/O devices are connected. It also provides the GPIO pins to which the PIR sensor and buzzer are connected using jumper wires. The Raspberry pi runs on Linux OS and Raspbian is its main supported operating system which is open source. It requires a standard power supply of 5v, 2.1 mah [Monk 2012].

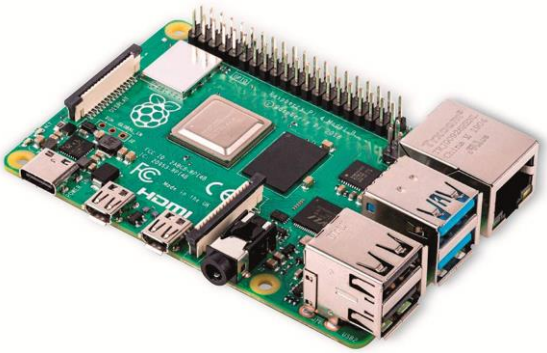


Figure 3: Raspberry Pi

Microphone

Microphone is a device that enables one to record audio or speech, it basically converts the sound vibrations to electronic signal. The audio input (i.e. Speech) is fed via the microphone as input to raspberry pi.

Speaker

Speaker is an output hardware device that generates or produces sound. Speaker converts the received electrical input from the device to sound waves that is nothing but text to speech. These are connected to the 3.5mm audio jack of the raspberry pi.

picamera

The picamera is a camera designed for the raspberry pi. The picamera communicates with the raspberry pi using MIPI camera serial interface protocol [McGregor 2006]. This picamera is used for capturing images and recording video with high quality resolution.

PIR Sensor

PIR Sensor (Passive Infrared Sensor) is an electronic device that allows to sense motion usually up to a range of 6 meters. It is connected to the GPIO pins of the raspberry pi. It acts as an input device that sends the data when the PIR sensor is true.

Buzzer

Buzzers are an audio signaling device. It is connected to the GPIO pins of the raspberry pi. It acts as an output device that beeps when the motion sensor output is true that is when PIR senses a motion. The Buzzer is connected to the GPIO pins of the raspberry pi using jumper cables.

IR transceiver

IR transceiver is an infrared transmitter and receiver that is grouped together in a single unit. The transceiver is used here to transmit infrared signals to the electronic device or appliances such as television or air condition. This IR transceiver can act as a universal remote to communicate with the devices.

D. Some Python Libraries Used

Python libraries are nothing but some collection of functions and method.

RPi.GPIO

This package provides functions or classes that provides controllability to the GPIO pins of the raspberry pi using this package we can read the devices connected to the GPIO pins as well as write/change state.

There are two numbering schemes, one is board numbering scheme which follow the pin numbers on header pin-1 and another BCM (Broadcom chip specific pin number) which follow the lower level numbering system defined by raspberry pi's Broadcom BCM2711 chip.

datetime

This module works with date and time, when the datetime object is called it returns date and time in required format.

picamera

The picamera module provides several classes that can allow the picamera to access the raspberry pi interface, using this module one can capture images, record videos, view live display of the camera's input also record slow-motion videos etc. [McGregor 2006].

smtplib

smtp stands for 'Simple Mail Transfer Protocol', this module is responsible for sending and receiving email using python. This smtplib creates a smtp client session object at client/user side which connects to the smtp or esmtp server of another system establishing a bridge connection making communication possible via emails. Some of the smtp objects are HELO, EHLO, LOGIN, STARTTLS, SEND MAIL.

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SpeechRecognition

The SpeechRecognition is a module that enables to recognize human and translate speech to text and text to speech. It requires audio input and instead of building various scripts for accessing the microphone's input, this speech recognition module can configure it quickly without any additional packages such as pyaudio which are required in various other python packages.

This module reads the microphone input and stores in the recognizer() instance and is integrated with other function to return a value/output [Dhanush Kumar et al. 2018].

Pyowm

Pyowm library is a wrapper library for openweathermap web API. It allows us to interact with the following API. It can used to get the current weather data, weather forecast, soil data, satellite imagery search, acquiring data on air pollution such as co, o3, no2 levels in atmosphere etc. [Anonymous 2020].

VLC

The VLC module is useful in accessing the VLC media player in the system, it can play any media file such as audio or video. The play () command plays the media file and stop () command stops the media file.

IMDb

This IMDb API offers various information related to movies such as cast, crew, plot characters, ratings etc.

wikipedia

This wikipedia module uses the Wikipedia API to retrieve information from the Wikipedia page. It returns suggestions and articles related to the keyword searched. This module provides summary, contents, categories, images and links.

oxforddictionaries

This is a wrapper library for the oxford dictionaries API (Application Program Interface). It provides a list of features such as matching words, synonyms and antonyms, meaning, verb, noun, adjective etc.

LIRC

LIRC stands for "Linux Infrared Remote Control". This module allows the users to transmit and receive infrared signals using a Linux based operating system with LIRC and IR transmitter, the device can act as a remote control and control appliances such as tv, ac, blinders etc. [McGregor 2006]. A Sub-tester such as a remote is used to translate the IR pulses of the buttons/keys of the remote and stores in the LIRC config file. This config file describes how to map a key such as mapping a key to a number (0 or 1), which will be further encoded into a series of pulses. Similarly, when the IR pulses are recorded and stored, the sub-tester uses LIRC to send IR signals to control set-up boxes and smart TVs etc. [Manley 2014].

III. WORKING

The system works on the principle of speech recognition. Firstly, the user starts the device (Raspberry Pi), on start up the Pi greets the user. The python script which consists the program code is executed automatically (auto-start) on system startup. The input to the system is fed through the microphone in speech form, the system records this speech form until a pause is observed to know the user has finished the request and then it is converted in text form for the machine to understand. The algorithm is built in such a way that the system processes the request and searches for the keyword and deliver appropriate output in textual form, which is the later converted to speech using the speech-recognition module. This speech is delivered via output speakers connected to 3.5 mm audio jack.

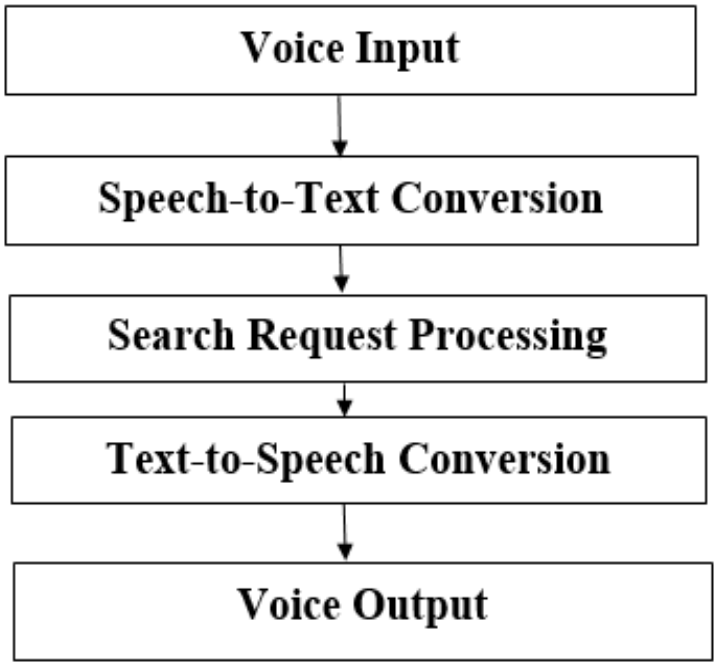


Figure 4: System Flow Process

IV. RESULTS

The voice assistant works as per the idea and algorithm it was designed with. The system starts with a power switch button and greets the user upon start-up as per the time of the day. The commands given to the system are designated with some keywords or wake-up words, upon identifying these keywords the system executes the appropriate python code block. There are several modules that uses API feature to retrieve information from the web such as Wikipedia, pyowm, oxforddictionaries, news and IMDb etc. The voice assistant responds quickly in no time very effectively and with adequate accuracy. The system requires stable internet connectivity to respond back to the user, the system can work without internet connection but may not function completely as some information is retrieved from the web. If the system fails to respond or find the appropriate match from the keywords in the voice command, then the voice assistant apologizes to the user asks to repeat the command.



V. CONCLUSION AND FUTURE WORK

The personal voice assistant is very reliable and offers hands-free user experience to the user and is quite indulging how it has transformed in recent years. Our system resolves many drawbacks observed in current systems making it more reliable and scalable for future. Further many additional modules or packages can be introduced to expand the network and improving the user-end experience. But can it be possible to make a world completely reliable on VUI (Voice User Interface) technology [Pearl 2017].

VI. REFERENCES

[1] Bill Lubanovic. (2014). Introducing Python :Modern Computing in Simple Packages. 2nd Edition. O'Reilly Media. (pp. 109-121).

[2] Emad S. Othman, (2017), "Voice Controlled Personal Assistant Using Raspberry Pi.", International Journal of Scientific & Engineering Research, Volume 8, Issue 11, (pp. 1611–1615).

[3] Wadhwani, Preeti, and Saloni Gankar, (2017), "Intelligent Virtual Assistant Market Size & Share: Global Report 2024." *Global Market Insights, Inc.*, www.gminsights.com/industry-analysis/intelligent-virtual-assistant-iva-market.

[4] Uday Kamath et al, (2019), *Deep Learning for NLP and Speech Recognition*, Springer, (pp. 141–174).

[5] Dhanush Kumar S, Lavanya S, Madhumita G, Mercy Rajaselvi V, (2018), "Journal on Speech to Text Conversion." *International Journal of Advance Research, Ideas and Innovations in Technology*, 4(2), (pp. 867-872).

[6] Stephanie Diamond. (2014). Dragon NaturallySpeaking for Dummies. 4th Edition. Wiley Publishing. (pp. 11-14).

[7] Pearl Cathy, (2017), Designing Voice User Interfaces: Principles of Conversational Experiences, O'Reilly.

[8] Li Deng and Dong Yu, (2015), Automatic Speech Recognition: A Deep Learning Approach, Edition-1, Springer-Verlag London, (pp. 221-231).

[9] Smartsheet. (2020). How Voice Assistants Are Changing Our Lives | Smartsheet. [online] Available at: https://www.smartsheet.com/voice-assistants-artificial-intelligence [Accessed 24 Feb. 2020].

[10] En.wikipedia.org. (2020). Voice user interface. [online] Available at: https://en.wikipedia.org/wiki/Voice_user_interface [Accessed 26 Feb. 2020].

[11] Components101.com. (2020). Pi Camera Module Pinout, Features & How to Use. [online] Available at: https://components101.com/misc/pi-camera-module [Accessed 26 Feb. 2020].

[12] Pyowm.readthedocs.io. (2020). PyOWM — pyowm documentation. [online] Available at: https://pyowm.readthedocs.io/en/latest/ [Accessed 26 Feb. 2020].

[13] McGregor Colin, (2006), "The Linux Infrared Remote Control (LIRC) Project." *Linux Journal*, www.linuxjournal.com/article/8811.

[14] Monk Simon, (2012), Programming the Raspberry Pi: Getting Started with Python, McGraw-Hill, (pp. 1-159).

[15] Manley William. (2014). "Tester : Creating LIRC Config Files - Part 1: Theory." *Stb,*, stb-tester.com/blog/2014/06/10/creating-lirc-config-files-part-1-theory.

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