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SPEECH RECOGNITION SYSTEM FOR BLIND PEOPLE USING RASPBERRY PI AND JASPER PLATFORM

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ABSTRACT

Speech recognition applications are becoming more and more practical nowadays. Various interactive speech aware applications are available in the market. But they are usually meant for and executed on the traditional general-purpose computers. Due to the rapid technological advancements, bigger and more complex tasks are being efficiently performed consuming less time and efforts. This can be further simplified with a more hands-free approach with the help of Voice Controlled System. For implementing this, we use an open source platform called Jasper for Raspberry Pi. Our aim is to build an automated personal secretary who could remind us of our schedule and optimize the rudimentary ways of performing tasks at one's commands.

KEYWORDS: Speech Interpretation; Speech Recognition; Voice Recognition; Raspberry Pi; Jasper; Hands-free.

INTRODUCTION

Communication is the purposeful activity of information interchange between two or more participants in order to convey or receive intended meanings through shared system. Communication in the category of humans usually occurs through visual and auditory means. Human communication is unique for its extensive use of language. Communication isn't restricted between humans, but it also connects humans and machines. With the evolution of technology, the process of communication is even more simplified. [1] With growth in the needs for embedded computing and the demand for emerging embedded platforms, it is required that the speech recognition systems are available on them too. Handheld devices are becoming more and more powerful and affordable as well.

It is possible to run multimedia on these devices. Speech recognition systems emerge as efficient alternatives for such devices.[2] Various computer programs that work as an intelligent personal assistant and knowledge navigator are available presently in the form of Siri (Speech Interpretation and Recognition Interface) and Cortana. These applications provide us with a more hands- free approach and help users to efficiently perform daily tasks. Although they are associated with a certain set of devices and not openly available for further development to anyone.[3] Jasper is an open source platform for making always-on, voice controlled applications. Jasper specifically works on Raspbian Operating system over Raspberry Pi. Using Jasper, users can ask for information, update social networks, controls various functions and much more. [4]

LITERATURE SURVEY

A.International Journal of Emerging Technology in Computer Science and Electronics Volume 13 Issue 2 March-2015.

This paper deals with the design and implementation Sound intelligence is added to a home automation based on acoustics for sophistication of physically challenged people as a broad perspective of the system Raspberry Pi operates and controls motion detectors and video cameras for remote sensing and surveillance, streams live video and records it for future playback, and finally manages operations on home appliances, such as turning ON/OFF a television or microwave.[4] B. International Journal of Computer Applications (0975 – 8887) Volume 116 – No. 11, April 2015.

The inability to enter and control the appliances from remote locations is one of the major reasons for energy loss. A web or an android application is used by the users to give instructions to these systems. This system can make

utilize of a host of communication methods such as Wi-Fi, GSM, Bluetooth, ZigBee. Different controlling devices and configurations can be found in existing systems. Such systems have been found already in too many places for a wide variety of applications. This paper present a survey of all such system.[5]

C. International Journal of Advanced Research in Computer Science and Software Engineering. Volume 3, Issue 4, April 2013.

This paper deals with the Using Wireless technology like ZigBee the cost of wiring of Home Automation System can be reduced as well as a reliable and secure communication can be achieved. ZigBee is a low data rate wireless network standard with added features like low-cost, low power consumption and fast reaction. ZigBee is most fitting for small area networks like homes. This System apply SAPI (Speech Application Programming Interface) a Microsoft Application to enable voice recognition when a user gives voice command to the system. This system contains of three main components: i) Intelligent Home Server with ZigBee module, ii) Intelligent environment detection sensor modules and iii) Voice command controlling module. The various utilities of the system include turning any home appliances or devices, playing media applications, etc.[6]

D IEEE Transactions On Audio, Speech, And Language Processing, Vol. 21, No. 4, April 2013.
This paper deals with the voice activity detector (VAD) tries to separate speech signals from background noises. It is an important front-end of modern speech signal processing systems. With the fast development of speech recognition, the machine-learning-based VAD techniques are receiving more and more attention. They are highly competitive to traditional VADs in the following three respects. First, the machine-learning-based VADs can be fused to the speech recognition systems naturally. Second, they have rigorous theoretical bases that guarantee the performance of the VAD. Third, they can fuse the advantages of different features much better than traditional VADs.

From the above papers we referred; we got to know the difference between different systems in which we can built this voice recognition system. It is much better to built in Raspberry Pi then building on Microcontroller.As an Arduino is a microcontroller motherboard.A microcontroller is simple computer that can run one program at a time, over and over again. It is very easy to use.A Raspberry Pi is a general-purpose computer, usually with a Linux operating system, and the ability to run multiple programs. It is more complicated to use than Arduino.[7]

Table I.Comparison Of Different System

System	Primary Communication	Remote Access	Number of Devices	Cost	Speed	Real Time
GSM	SMS messages	Access from anywhere in the world	Unlimited	High cost due to SMS charges	Slow due to delivery issues	No
Bluetooth	Bluetooth and AT commands	Restricted to Bluetooth range 10 meters	Unlimited	Fast due to proximity	Fast due to proximity	Yes
Phone Based	Phone lines	Anywhere with a phone line	12 due to frequencies of DTMF	Fast	Fast	No
Zigbee	Zigbee and AT commands	Around 10 meters	Unlimited	Fast	Fast	Yes
Wireless	Radio, infrared or other waves	Depending on range and spectrum of waves used	Unlimited	High cost due licensing and other spectrum issues	Slow due to interferences	Yes

SYSTEM ARCHITECTURE
Hardware Module
RASPBERRY PI 2 MODEL B:
The Raspberry Pi is made up of series of credit card–sized single-board computers developed in England, United Kingdom by the Raspberry Pi Foundation with the intent to promote the teaching of basics of computer science in schools and developing countries. The original Raspberry Pi and Raspberry Pi 2 are manufactured in several board configurations through licensed manufacturing agreements done with Newark element14 (Premier Farnell), RS Components and Egoman. The hardware is the same across all manufacturers.

All Raspberry Pi's include the same Video Core IV graphics processing unit (GPU) and either a single-core ARMv6-compatible CPU or a newer ARMv7-compatible quad-core one (Pi 2); and 1 GB of RAM (Pi 2), 512 MB (Pi 1 models B and B+) or 256 MB (models A and A+, and in the older model B).

They have a Secure Digital (SDHC) slot (models A and B) or a Micro SDHC one (models A+, B+, and Pi 2) for boot media and constant storage In 2014, the Raspberry Pi Foundation launched the Compute Module, for use as a part of embedded systems for the same determine power as the unique Pi. In early February 2015, the next-generation Raspberry Pi, Raspberry Pi 2, was released. That new computer board is initially available only in one configuration (model B) and has a quad-core ARM Cortex-A7 CPU and 1 GB of RAM with remaining requirement being similar to those of the prior generation model B+. Raspberry Pi 3 was released on 29 February 2016. The Foundation supply Debian and Arch Linux ARM distributions for download, and promotes Python as the main programming language, with support for BBC BASIC (via the RISC OS image), C, C++, Java, Perl, Ruby, Squeak Smalltalk and more also available.[10]

Fig. 1 Hardware of Raspberry Pi Model.

SOFTWARE MODULE
NOOBS (NEW OUT OF THE BOX SOFTWARE):
To get started with Raspberry Pi you require an operating system. NOOBS is an easy operating system install manager for the Raspberry Pi and it contains Raspbian and other operating systems. It also gives a selection of alternative operating systems which are then downloaded from the internet and installed. If you set up multiple operating systems then NOOBS gives you a choice when you start the Pi up hence it is a multi-boot system.

RASPBIAN OPERATING SYSTEM:
Raspbian is a free operating system found on Debian optimized for the Raspberry Pi hardware. An operating system is the set of basic programs and utilities that make your Raspberry Pi run. However, Raspbian supplies more than a pure OS: it comes with over 35,000 packages, pre-compiled software bundled in a nice format for easy installation on your Raspberry Pi. The initial build of over 35,000 Raspbian packages, developed for best performance on the Raspberry Pi, was completed in June of 2012. However, Raspbian is still under active development with an emphasis on improving the stability and performance of as many Debian packages as possible. A TTS engine does the exact opposite of an STT engine. It takes written text and transforms it into speech. Jasper supports many different TTS engines that differ by voice and intonation.
i..eSpeak TTS:
It is a compact open-source speech synthesizer for many platforms. Speech synthesis is done offline, but most voices sounds very "robotic".
ii.Google TTS :
It is same as Text-to-Speech API which is also used by newer Android devices. The Synthesis itself is done on Google's servers, hence we need an active internet connection and also can't expect a lot of privacy while using it.[9]

INTERFACING OF RASPBERRY PI
Raspberry Pi to Monitor
The Raspberry Pi controller is interfaced with the monitor by Serial to HDMI cable. The monitor displays the computer's user interface and open programs, allowing the user to interact with the computer, typically using the keyboard and mouse.

FIG 2 Raspberry to Monitor interface

Raspberry Pi to WiFi Adapter

Wi-Fi adapter is a device that adds wireless connectivity to a laptop or desktop computer. They provide connectivity to the local area network (LAN) in the home or office.

FIG 3. Raspberry Pi to WiFi adapter interface

Raspberry Pi to other peripherals

The Raspberry Pi is connected to various other components such as SD card, LAN, Mouse, Keyboard, Microphone and Speakers.

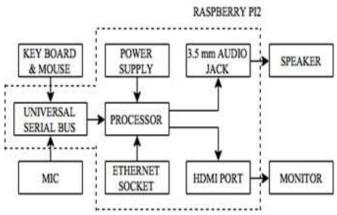*Fig 4.Raspberry Pi to other peripherals*

BLOCK DIAGRAM

Fig. 5 Block Diagram of Raspberry Pi

The Microphone is interfaced with Raspberry Pi via USB port, which is the input device for Jasper. The output is taken via 3.5mm audio jack, which is connected to the Speakers. The Raspberry Pi is connected to the internet via a Wi-Fi adapter. The keyboard and mouse are the input peripherals.
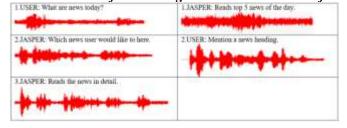
SIMULATION RESULT

TABLE I.Result for "Goggle Calendar" with Audio Waveform

TABLE II . Result for "WiKi" with Audio Waveform

TABLE III. Result for "Time" with Audio Waveform

TABLE IV.. Result for "Reading News" with Audio Waveform

To invoke Jasper, we need to call with a predefined word which is 'Jasper' in our case. After invoking Jasper, it checks for keywords from the user and responds appropriately. These tasks are handled by the specific STT and TTS engines installed by the user. In some cases, Jasper may not recognize the keywords from the user. This is because of the default STT engine (Pocketsphinx) used by Jasper. To overcome this problem, we can go for much efficient engines such as Google STT etc. We need to develop different Python Scripts for performing different operations. These scripts consist of keywords to which Jasper responds with the appropriate actions defined in the scripts. If no predefined keyword is recognized by Jasper, it prompts the user that no operation has been defined in the scripts for such keyword.

CONCLUSION

Using Jasper, we have built a Voice based Control System which helps to perform routine tasks in a much simplified way. Which is very useful for blind people also for physically handicapped people too. A microphone is used as the input to it. There is much scope for further development in various applications such as Home Automation, Artificial Intelligence, Health Monitoring, Mobiles etc. Jasper can also be integrated with Internet of Things (IoT) for superior performance and detailed analysis in order to make. Jasper even more streamlined and structured.

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