Smart Reader for Visually Impaired People Using Raspberry Pi

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ABSTRACT:Nowadays realtime hardware implementation of Text to Speech and Speech to text conversion systems playing a crucial role in several real time applications such as reading aid for blind people and talking aids for vocally handicapped people and robotics etc. This paper describes the design and implementation of a system which involves conversion of text information present in the image to speech information and conversion of speech information given by user into text information. In this context raspberry pi has been chosen as a hardware platform to implement the proposed method. For the implementation proposed system Logitech C170 camera module and Bluetooth HC-05 module were interfaced to raspberry pi device. The concept used in this project are tesseract OCR(Optical Character Recognition),espeak TTS(Text to Speech) engine,AMR(android meets robots) voice to text application software. The code which is used in the proposed system is used in the python programming language. The proposed system which is implemented on raspberry pi is used for many real time applications.

Keywords: TTS(Text to Speech) engine, Raspberry pi,AMR voice app,Logitech C170 camera module

INTRODUCTION: Human communication is mainly depends on speech and text information.To access the information in text,person needs to have vision.However,those who are deprived of vision can not access the information in text.To express the information,person needs to have speaking capability.Those who are deprived of speaking capability can not express their information effectively.Hence rapid development of technology can make the impaired people's life more easier.Man-machine interaction devices like computers,mobiles,consumer electronics etc. are very helpful for every individual's daily life.These man-machine interaction techniques can be easily understood and operated by users.Therefore technologies are being developed which are capable of transalting user requirements into corresponding commands without much difficulty.

Text to Speech is a system which is based on the automatic generation of the new sentences or words. This is a method where a computer is made to speak and display the text information. To extract the text from an image we use Optical Character Recognition(OCR) technique. It has become one of the most successful applications of the technology in the field of pattern recognition and artificial intelligence. Optical Character Recognition(OCR) is the process of converting images of machine printed or hand written text(numerals, letters and symbols) into a computer format text. Speech synthesis is the artificial synthesis of human speech. A Text to Speech synthesizer is a computer based system that should be able to read any text aloud, whether it was directly introduced in the computer by operator or scanned and submitted to an Optical Character Recognition(OCR) system

In speech to text conversion, computer is made to display the text information given by the user in the form of speech..A speech to text conversion and display can also improves system accessibility by providing data entry options for blind, deaf or physically handycapped users.

EXISTING METHOD: There exists different methods for text to speech conversion and speech to text conversion separately. By using

MATLAB text to speech conversion can be achieved.But speech to text conversion is not possible in this. By using ARM processors also text to speech conversion can be achieved. But integration of text to speech conversion and speech to text conversion is not implemented upto now. So in this proposed method we are implementing a system which implements text to speech conversion and speech to text conversion with more user-friendly nature, reliability and efficiently.

PROPOSED METHOD: The block diagram of the proposed system is shown in Figure1.The major components used in this method are raspberry PI 3[model B], Logitech C170 webcam HC-05 Bluetooth module ,android mobile and earphones. Logitech webcam has been used to input the text image for image text to speech conversion and android mobile has been used to input speech for speech to text conversion. AMR voice app has been used in the mobile for speech to text conversion.
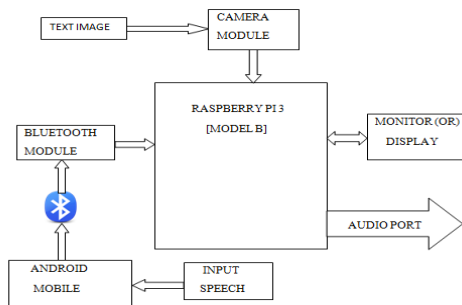

Figure1:block diagram of proposed method

RASPBERRY PI 3[MODEL B]: Raspberry pi is SOC(System On Chip),that integrates several functional components into a single chip or chipset .Raspberry pi is an ARM based credit card sized single board computer created by Raspberry Pi foundation. The OS for raspberry pi should be installed in SD card apart from this it store all program files needed by the Raspberry Pi .The SD card should be formatted before installing the OS .An Ethernet cable is inserted in its slot for network connection. Raspberry pi has a on chip DSP processor which is used to perform the floating point operations. The Raspberry Pi uses AMBA(Advanced Microcontroller Bus Architecture) which an on chip inter connection and management of functional blocks in System On Chip(SOC) designs.

The technical specifications of raspberry pi 3 model B are: Broadcom BCM 2837 processor, Quad core ARM Cortex-A53,Clock speed of 1.2GHz,1GB RAM,Rj45 for network connectivity,wireless LAN(WIFI) and Bluetooth 4.1, 4 USB ports,GPIO's,camera interface is a 15 pin MIPI,power supply is of 2.5A.

LOGITECH C170 WEBCAM: The Logitech C170 webcam module is used to input the text image. This module is connected to Raspberry Pi using USB port. Specific drivers need to be installed in raspberry pi to run the camera module. This webcam helps in capturing 5MP resolution image.

HC-05BLUETOOTH MODULE:HC-05 module is an easy to use Bluetooth SPP(Serial Port Protocol) module, designed for transparent wireless serial connection setup. Bluetooth is a wireless technology standard for exchanging the data over a short distances(using short wave length UHF radio waves in the ISM band from 2.4 to 2.485GHZ)from fixed and mobile devices, and building personal area networks(PAN'S).Bluetooth range is approximately 10 meters.

SOFTWARE DESIGN: The various phases involved in the designing of proposed method comprises of: image text to conversion using Tesseract OCR,text to speech conversion using TTS(test to speech)software, Speech to text conversion using AMP voice app.For image to speech conversion ,initially camera captures the

image and stores it as image file with .jpg extension. The tesseract software is installed in the raspberry pi by a command.The command is sudo apt-get install tesseract-ocr.This file is used to convert the image file to text file by extracting the texts from image and storing it in the file with .txt extension.It cannot recognize hand written texts .Espeak is a software which can be easily used in raspberry pi by installing espeak engine.The espeak software can be installed in Raspberry pi by using a command.The command is sudo apt-get install espeak.Here it is used for converting text file to audio file. The converted speech information is heard through earphones.

In speech to text conversion android phone(master) and IIC05 module(slave) are paired.Permt pairing device to connect as default. By default Auto-pairing PIN as "12345".This password can be changed as user requirement. Bluetooth HC-05 module is connected to raspberry pi through USB port by using USB to TTL module.HC-05 module is used as serial communication between android phone and Raspberry PI 3 controller.Bluetooth HC-05 module is used to receive the converted text from the AMR app(android phone).AMR voice app takes voice as input from android phone and converts it to text string using android mobiles internal voice recognition(Google Voice app) and sends this converted text serially over Bluetooth. This HC-05 received string is displayed on the terminal screen of the monitor connected to raspberry pi 3 controller. For example if you say hello as input speech, the android phone will return a string *Hello# to your Bluetooth.* and # indicate the start and stop bits can be used with any controller which can handle strings. The received text is transmitted to the controller through USB PI connection. The received text is displayed on the monitor in the format in the form as*Hello#.

IMPLEMENTATION: Initially raspberry pi OS should be installed in SD card apart from this it should store all the program files needed by Raspberry PI. The SD card should be formatted before installing the OS. The SD card is inserted in the slot. Network connectivity is provided. Raspberry PI is connected to laptop using VNC viewer. NC(Virtual Network Connectivity) viewer as graphical desktop sharing system that allows you to remotely control the desktop interface of one computer(running VNC server) from another computer or mobile device(running VNC viewer).VNC connect from real VNC is included with Raspbian. It consists of both VNC server, which allows you to control raspberry pi remotely and VNC viewer , which allows you to control the desktop computers remotely from your raspberry pi should you want to. All upgrades and updates performed in Raspberry pi. Necessary software's and packages were installed. The configurations are set, camera and earphones are set ,android and Bluetooth module are paired. The software design process is implemented and codes are executed. Thus speech output is displayed and text output is also displayed. The Figure 2 shows the setup of this project.

Figure 2:Hardware setup of the project

AREA OF SCOPE: Text to speech and speech to text conversion techniques are used in real

time applications. Some of the application where these can become more helpful are given below:

- Assistive device for vocally handicapped people who want to express their words and for an visually impaired people who want to read a printed text and can hear the voice.
- Speech synthesize can be used in several kinds of machine human interactions and interfaces.For example in warning,alarm systems, clocks synthesized speech may be used for exact information.
- Speech synthesis can be used in robotics.

RESULTS: The results obtained from the proposed method are indicated in the below figures.Figure 3 indicates the image from Logitech C170webcam.Figure 4 shows the output of text to speech conversion.Speech is heard through earphones.Figure 5 indicates the text output displayed in the monitor from given speech input.
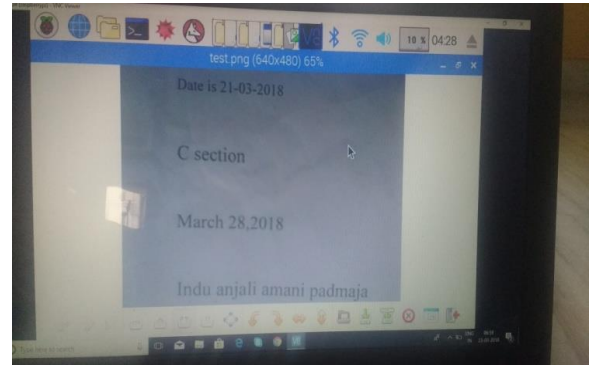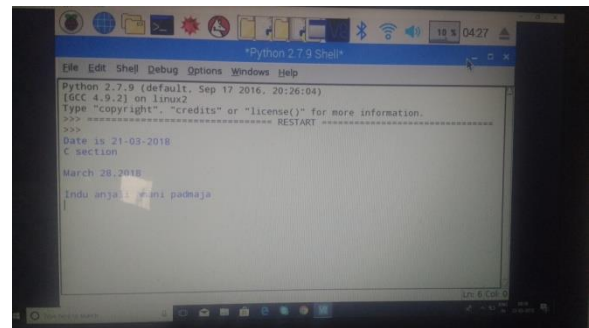

Figure 3:Text image taken from Logitech C170 camera

Figure 4:Console output for text to speech conversion

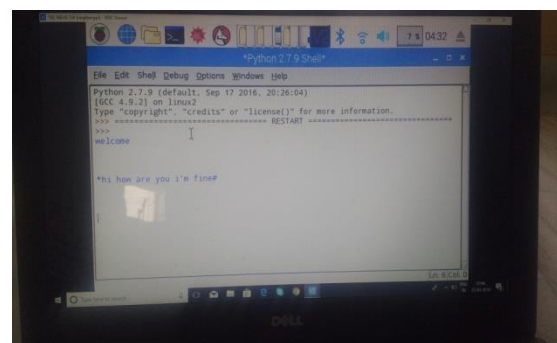In text to speech conversion,speech is heard through earphones.

Figure 5:console output for speech to text conversion

CONCLUSION: This paper describes the implementation of image to text,text to speech and speech to text conversion using Raspberry pi.This project is useful for visually impaired

and vocally handicapped people.However due to less resolution of the webcam,the output obtained is not 100% accurate.The accuracy can be improved by making use of a HD camera or mobile camera.For speech to text conversion,the input voice should be clear and pronounciation of words must be perfect.So that the AMR voice app recognizes the words correctly.

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