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Smart Gadget for Visually Challenged People using Raspberry PI

T.N.Ramaswamy[1], P.Siva[2], S.Suresh[3] and C.Amarsingh Feroz[4]

[1,2,3]*UG Students, Department of Electronics and Communication Engineering, Francis Xavier Engineering College, Tirunelveli, India.*
[4]*Associate Professor, Department of Electronics and Communication Engineering, Francis Xavier Engineering College, Tirunelveli, India.*
Email: ramaswamytnr@gmail.com, sivaeajan733@gmail.com, sureshraina@gmail.com, amarferoz@gmail.com

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ABSTRACT

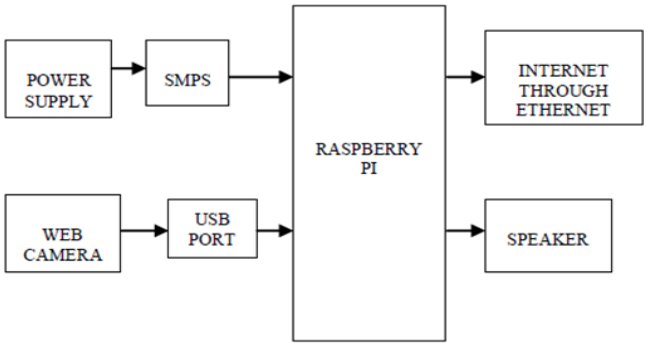
This project assists blind people by helping them to read a newspaper or any magazines or book without human intervention or any other tactile reader by means of OCR(Optical Character Recognition) using a package in raspberry pi and make them to speak by using a TTS (Text To Speech). In this project raspberry pi acts as a processor and it controls other peripherals such as speaker, camera module and LCD (Liquid Crystal Display) screen .Here the image is captured in camera by using raspberry pi and then it is converted to its equivalent codes by means of an installed package in raspberry pi.

Keywords: Raspberry Pi, OCR, TTS.

1. INTRODUCTION

The majority of people with poor vision are in the developing world and are over the age of 50 years. In this project we addresses the problem faced by the blind people that is their inability to access the computers on their own and not able to read get the products by their own without the assisting of any other people [1-12]. Few techniques available in market such as the Braille Translator which translates the document into the format which is understandable by blind people. This project assists blind people by helping them to read text directly and helps them to reduce cost and energy [13-15]. The design is motivated by preliminary studies with visually impaired people, and it is small-scale and mobile, which enables a more manageable operation with little setup. A methodology is implemented to recognition sequence of characters and the line of reading [16-20, 27-34]. Most of the access technology tools built for people with blindness and limited vision are built on the two basic building blocks of OCR software and Text-to-Speech (TTS) engines. It is widely used to convert books and documents into electronic files for use in storage and document analysis [21-26]. OCR makes it possible to apply techniques such as machine translation, text-to-speech and text mining to the capture / scanned page. The final recognized text document is fed to the output devices depending on the choice of the user.

2. BLOCK DIAGRAM



Block Diagram of Proposed System

3. SYSTEM DESIGN

3.1. Raspberry Pi

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 is an on-chip interconnect specification for the connection and management of functional blocks in system-n-chip (SoC) designs [35-38]. It facilitates development of multi-processor designs with large numbers of controllers and peripherals. The GPIO pins of the Pi differ by the model. In model B there are 40 pins, out of which there are 4 power pins and 8 ground pins.

3.2 USB Camera

The Raspberry Pi camera module size is 25mm square, 5MP sensor much smaller than the Raspberry Pi computer, to which it connects by an flat flex cable. Features are

1. 1080p video recording to SD flash memory cards.
2. Simultaneous output of 1080plive video via HDMI, while recording.
3. Sensor type: Omni Vision OV5647 Color CMOS QSXGA (5-megapixel).
4. Sensor Size: .67*2.74 mm
5. Lens focal length = 3.6mm

3.3 Python

Python is an interpreted high-level programming language for general-purpose programming created by Guido van Rossum and first released in 1991.Python has a design philosophy that emphasizes code readability, and a syntax that allows programmers to express concepts in fewer lines of code, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales. Python features a dynamic type system and automatic memory management.

3.4 Tesseract – OCR

Tesseract, originally developed by Hewlett Packard in the 1980s,was open-sourced in 2005.Tesseract is a free software optical character recognition engine for various operating systems. It is available for Linux, Windows and Mac OS. An image with the text is given as input to the Tesseract engine that is command based tool.

3.5 E-Speak

E-Speak is a compact open source software speech synthesizer for English and other languages, for Linux and Windows .E-Speak uses a "formant synthesis" method. This allows many languages to be provided in a small size. The speech is clear, and can be used at high speeds, but is not as natural or smooth as larger synthesizers which are based on human speech recordings. This package is used for the audio output in the raspberry pi. In this package the text format is spoken out by means of installing this package into raspberry pi. This package is comes in line with the Google Text To Speech (TTS) engine.

3.6 LX Terminal

The terminal (or 'command-line') on a computer allows a user a great deal of control over their system. All of these tools allow a user to directly manipulate their system through the use of commands. These commands can be chained together and/or combined together into complex scripts that can potentially complete tasks more efficiently than much larger traditional software packages.

4. SYSTEM ARCHITECTURE

4.1 Main Functions

The main function is to convert the image of the document or any product or magazines into the text file and then read out by means of a speaker.

4.2 Working Principle

The steps for converting an image to text is discussed below.

1. Step 1: Image Processing
2. Step 2 :Text Conversion
3. Step 3: Speaking of Text

4.3. Image processing

In this step the acquired image is converted into the equivalent gray codes by means of converting the background of the image and it performs skeletonising to get the structure of the image. This happens in the Tesseract package in raspberry pi without any knowledge to the user.

4.4. Text Conversion

In this step the skeletonised image is converted to its equivalent optical character and then it is converted into a text file. The output is in the form of a text file and it happen implicitly at Tesseract package.

4.5 Speaking of text

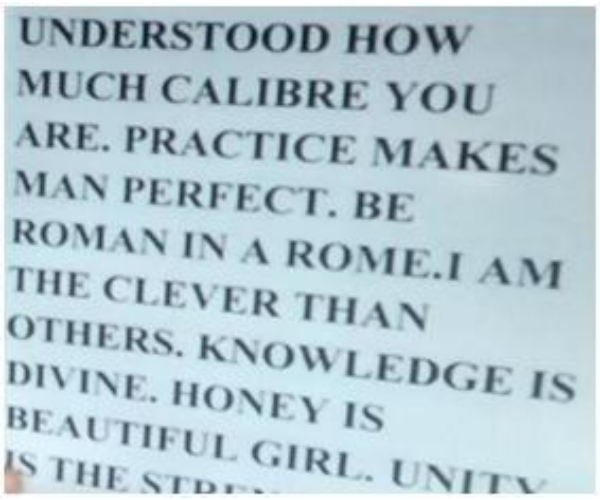
The final step of the project involves with speaking of a text file which is given as a output by Tesseract package.

5. RESULTS

In this setup the raspberry pi act as a processor and it is a standalone computer. It has an RAM (Random Access Memory) of 1GB so it is able to process many operations. The peripherals are attached to the raspberry pi. The main peripherals are USB camera which is connected to the USB port of the processor. The camera captures the image of the document or magazines or any papers or the product label and then it is converted to text form and then the image is read out by the speaker. The text document which has to be read out has to be placed at a considerable distance from the webcam so that the image is clear enough with proper illumination. This shows a terminal window which is seen at once we switch on to raspbian OS. In the terminal window the command for image to text

conversion has to be given. Immediately a form window opens. In the form window, a dialog box is seen named 'image to read'. That option has to be clicked to enable the webcam. The webcam auto focuses the image and it is captured. This shows a sample image which has been captured using the webcam. The image which has been processed is displayed in the form window. The displayed image is read out by the text to speech engine ESPEAK.

Overall System



System Output Using Text Image

System Output Using Product Image

6. CONCLUSION AND FUTURE ENHANCEMENT

In this paper, a camera-based assistive text reading framework is proposed to help blind persons read text labels and product packaging from hand-held objects in their daily lives. The framework is implemented on a Portable platform Raspberry Pi board. To extract text regions from complex backgrounds, algorithm based on External regions is used. By implemented this system visually impaired can easily listen whatever they want to listen. And with the help of the translation tools he can convert the text to the desired language and then again by using the Google speech recognition tool he can convert that changed text into voice. By that they can be independent. And it is less cost compared to other implementations.

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