Smart Assistance for Blind People using Raspberry Pi3

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Abstract--Object detection is technology of computer vision and image processing which deals with detection of instances of semantic objects of particular classes in digitalized images and videos. Outline of this paper is a system for detecting the type of obstacle; converting text into audio for reading purpose and detecting the kind of obstacle for blind people using Raspberry pi3.This technique helps the blind people to see the world virtually with an audio output. Optical Character Recognition (OCR) algorithm can be used to translate print version or hand-written text into audio output using Raspberry Pi. Ultrasonic sensors are attached with motor which detects the presence of obstacle in 180°. In this proposed model Raspberry pi3 is the medium which provides interface between Ultrasonic sensor and camera, which is implemented to provide the required output to the blind user that can be listened through headphones.

Keywords—OCR algorithm, ultrasonic sensor, Raspberry Pi3, motor

I. INTRODUCTION

By the survey of World Health Organisation (WHO), 254 million people are visually impaired,out of which 37 million are blind and 217 million people have low vision. Out of 37 million people 15 million people were from India and 26% of them were children [1]. The statistical analysis of percentage of blind people with various abnormalities is shown in fig.1. These people struggle every day from moving to other places without the help of others. As technologies has dominated the people's task in various fields, this research is to make the life of blind people in much easier way to walk from one place to another and to read like normal people with smart assistance. In the process of assisting the blind people, recent trends in development of computer vision, camera and Raspberry pi has made it easy to guide the visually challenged people with camera based products and existing products such as OCR [4]. With these, smart assistance can be built to assist the blind people in both guiding them from one place to another as well as to read. OCR system is sub-branch of computer vision and in turn a class of AI. OCR can be translated by scan bitmaps of print version or hand-written text into audio output using Raspberry Pi. OCR could be developed for global languages which are already under significant use. This OCR method is used in extracting region of moving objects by a mixture-of- Gaussian-based subtraction method. Text localization, recognition are always conducted to get text information [7].

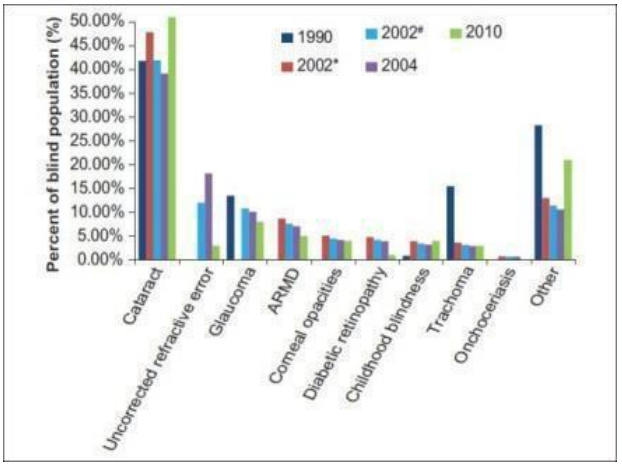

Fig 1. Percentage of blind population with various abnormalities.

For automatically localization of text from the objects, a text localization [7] and Tesseract algorithm [2] with learning of required features of stroke orientations and distribution of edge pixels in Ada boost model. The recognized text codes are the output to the blind people in speech recognization.The Performance of proposed text localization algorithm is, when recognition process is completed, the character code of the text file are processed by Raspberry pi on which characters are recognized using Tesseract algorithm [2],[7] and the audio output is listened through the headphones.

This paper is arranged that the next section describes the proposed methodology followed by Hardware and Software used in this model and final section contains the conclusion and future work of the project.

II. PROPOSED SYSTEM

In proposed system, a prototype system shown in fig. 2 reads printed text on hand-held objects for assisting blind persons has been described. OCR is a vast field of

professional research in recognizing patterns and in artificial intelligence and computer vision [4]. It is widely used as a form of information entry from printed paper. It is a method of digitizing printed text so they can be electronically edited, searched, stored, more compact, displayed on-line and used in machine process such as cognitive computing, machine translation ,text-to-text, key data and text mining. In order to solve the common aiming problem for blind users, a motion-based method to detect the object of interest has been proposed, while the blind user simply shakes the object for a couple of seconds. The automatic detection of region of interest, text localized algorithm was evaluated individually as unit tests to ensure its effective and robust features of the whole system. This prototype system of assistive text reading using images of hand-held objects captured by ten blind users in person has been evaluated. Two calibrations were applied to prepare for the system test. First, instruction is given to the blind users to place hand-held object within the camera view. Since it is difficult for blind users to aim their held objects, a camera with a reasonably wide angle range has been employed.

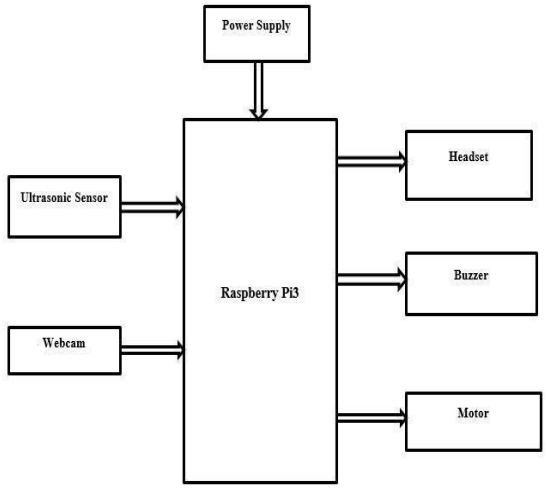

Fig. 2 Block diagram of the proposed work

Second, in an applicable system, a text localized algorithm may prefer higher recall by sacrificing some precision and accuracy. By using ultrasonic sensor, distance between the blind people and the obstacle can be measured and then the distance is heard through ear phones[3]. Also as the motor has been attached to the ultrasonic sensor, the object at an angle of 180° in front of the blind user can be detected and the output recognized by OCR algorithm [4]. This output is the electronic conversion of images of typed, handwritten or printed text, to form a scanned document; a scene-photo text is superimposed on an image. In existing system, images of each character are to be trained, and worked on one font at a time. Advanced systems are worthy enough to produce high degree recognition of accuracy for most of the fonts which are usual now and with support for a variety of digital image file format inputs. Some systems are capable of reproducing formatted output that closely approximates the original page including images, columns, and other non-textual component.

III. HARDWARE IMPLEMENTATION

Raspberry pi3 is a single board computer which is used to detect the object and read the content. The program to accomplish the required task is installed in Raspberry pi in python language.

Ultrasonic sensors are used which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively[3]. It generates high frequency sound waves and evaluates the echo which is received by the sensor, sensor calculates the time interval between sending the signal and receiving the echo to determine the distance to an object and the resultant output is given out in the form of audio. It is mainly used to detect the presence of obstacle in front of the user and the output is indicated with the help of the headphones. It provides precise, non-contact distance measurements within a 3cm to 3m range.

Camera is as main device in detecting image of the product or board then image is processed internally and separate labels from images by Open CV library and finally identifies the product and identified product name is pronounced through voice.

IV. SOFTWARE IMPLEMENTATION

Raspbian OS is Debian based computer OS for raspberry pi3. It is a free operating system. Raspbian was created by MIKE THOMPSON and PETER GREEN as an independent project. It was built over 35000 Raspbian packages which are based on best performance on Raspberry pi. It is still under gradual development with an importance on improving the performance and stability. This software is the platform in which all the process is been carried out.

Python IDE coding tool is platform where the code detects an obstacle and the obtained code is used to convert the captured image into audio output. Python language has been chosen as coding tool because the language is very compatible and easy for coding and user friendly in nature. IDE stand for Integrated Development Environment which is a coding tool that is used to write text and also for testing and debugging the code in most easier way, as they generally offer code completion or code insight by highlighting, resource management, debugging tools, and even though the IDE is a strictly defined concept, it started to redefine as other tools such as notebooks started gaining more and vast features that traditionally belongs to IDEs. For example, debugging code could also be possible in Jupiter Notebook. Because of all the features that IDEs offer, they are extremely useful for development: they

make the coding more efficient and comfortable and this would be no different for data science. However, given the fact that there aren't only the traditional IDEs to be considered, but also new tools, such as notebooks, you might be wondering which development environment to use when you're just starting out with data science.

V. SYSTEM ARCHITECTURE

A system is proposed to read printed text and to detect the obstacle. As shown in fig.3, the components are connected in such a way that buzzer, webcam and ultrasonic sensor are connected in GPIO and monitor and keyboard are connected in USB port and headphone is connected in of Raspberry pi [3]. Raspbian OS is stored in 16GB micro SDcard and connected in micro SDcard slot. A power supply of 230V AC supply is given to the Raspberry pi to start the process. Rectifier is used to convert alternate current to DC current in order to support the step down transformer produces 12 AC constantly. Raspberry pi board should be placed on any non-metal surface in order to avoid short circuit.

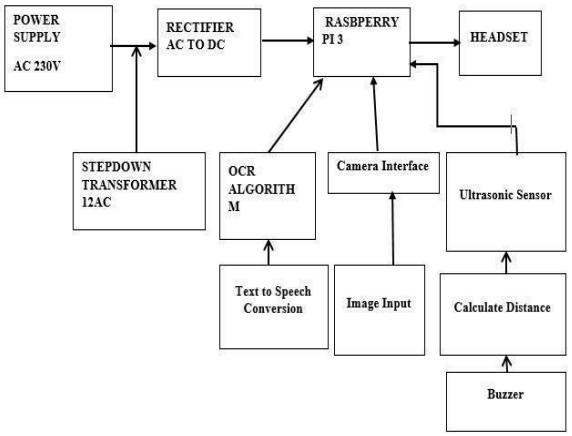

Fig 3. Block diagram of system architecture

In order to make the ultrasonic sensor work, a python coding is fed into the Raspberry pi and the program is executed. The distance of the minimum ultrasonic range, which is set to a range of 200 cm in the program. To run the python code, Python IDE is used. The output of the code is results in alarming the buzzer.

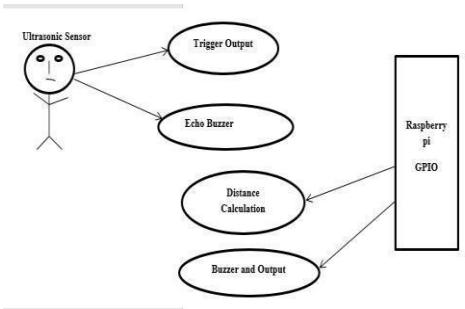

Fig.4 User case diagram for object detection[5]

From fig.4, the working of ultrasonic sensor is explained very clearly[3]. The trigger output and echo input are connected to the Raspberry pi GPIO. Once the echo input is transmitted by the ultrasonic sensor, gets reflected by the obstacle and is received by the trigger output [3].The distance is measured by the formula, Pulse duration = Pulse end – Pulse Start ----- (1) Distance = Pulse duration * 17150 ---------- (2)

The output of the program is shown in Table I

TABLE I. OUTPUT OF BUZZER WITH MEASURED DISTANCE

Distance(cm)	Buzzer output
2000	OFF
200	ON
145	ON

Usage of webcam is very useful as it captures the image as input which is to be converted into audio output. Webcam used here is an 360° camera which covers the entire view of the user. To process the input image, OCR algorithm is fed. OCR algorithm converts the captured image into the machine readable format, which is converted and stored. Text to Speech Conversion coding is executed simultaneously so that once the OCR algorithm coding converts image into machine readable form , this coding performs the task of converting the stored machine readable format into audio output[6]. Then the resulted output is obtained with the use of headphones.

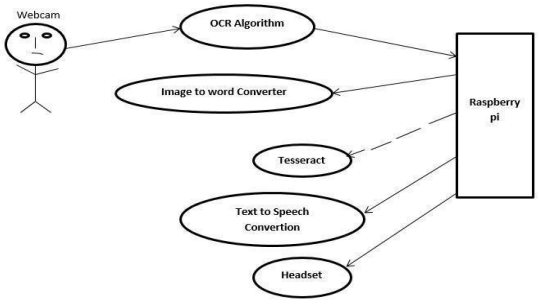

Fig.5 User case diagram for text to speech conversion

From fig.5, the working of the webcam with OCR algorithm and text to speech conversion can be viewed. First, when the image is captured by the webcam, the image is processed by the OCR algorithm by Tesseract [2],[4],[6]. Then it is processed by text to speech conversion process, which results in audio output through headphone[6].

VI. CONCLUSION AND FUTURE WORK

In this proposed model the Text to Speech conversion technique, Image and obstacle detection technique has been successfully implemented using Raspberry pi3and ultrasonic sensor[3],[6] .The OCR algorithm is used for processing the image and audio output that is obtained is audible and clear [4]. It is an economical device which anyone can afford and can be used very efficiently and accurately. This system is very

compatible and really helpful device for the blind people.In future systems, the finger point detection and tracking can be added to adaptively instruct blind people to aim for the object. Also image processing is used to identify the type of object which can be added as a useful feature to help the blind user to detect the kind of object in front of them. The concept of YOLO is a real time neural network which is added to detect the type of object which is in front of them and address the blind user in the form of audio output, which makes the user to see the real world

VII. REFERENCES

[1] Advance Data Reports from the National Health In-terview Survey (2008).

[2] An overview of the Tesseract OCR (optical charac-ter recognition) engine, and its possible enhancement for use in Wales in a pre-competitive research stage Prepared by the Language Technologies Unit (Canol-fan Bedwyr), Bangor University April 2008.

[3] E. Cardillo, V. Di Mattia, G. Manfredi, P. Russo, A. De Leo, A. Caddemi, G. Cerri "An Electromagnetic Sensor Prototype to Assist Visually Impaired and Blind People in Autonomous Walking", IEEE Journal,2017.

[4] MallapaD.Gurav, Shruti S. Salimath, Shruti B. Hatti,VijayalaxmiI.Byakod,ShivaleelaKanade"A Reading aid for the Blind People using OCR and OpenCV", IJSRET Journal 2017.

[5] Miss. Kirti P. Bhure, Mrs. J. D. Dhande "Object Detection Methodologies for Blind People", IJRIT Journal 2017.

[6] Mrs.Shilpa Reddy K, MounikaS.k, Pooja K, SahanaN, "Text to Speech for the Visually Impaired", IRJCSJournal, 2017.

[7] S. M. Lucas, "ICDAR 2005 text locating competi-tion results," in Proc.Int. Conf. Document Anal. Recog-nit., 2005, vol. 1, pp. 80–84.

[8] Shahab, F. Shafait, and A. Dengel, "ICDAR 2011 robust reading competition:ICDAR Robust Reading Competition Challenge 2: Reading text in scene imag-es," in Proc. Int. Conf. Document Anal. Recognit., 2011, pp. 1491–1496.

[9] Suchita Wankhade, MrunaliBichukale, Shruti Desai, ShraddhaKamthe, Archana Borate "Smart Stick for Blind People with Live Video Feed",IRJETJournal, 2017.

[10] . Chen, J. Yang, J. Zhang, and A. Waibel, "Auto-matic detection and recognition of signs from natural scenes," IEEE Trans. Image Process.,vol. 13, no. 1, pp. 87–99, Jan. 2004