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AN ASSIST DEVICE FOR PEOPLE HAVING BOTH VISUAL AND AUDIBLE IMPAIREMENT

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Abstract - *People having both visual and audible impairment faces many challenges in their day today life. We introduce a text and object recognition based safety device for blind people who having conductive hearing loss. The device encompasses deep learning and Optical Character Recognition for object recognition and character recognition respectively. This project has been built around Raspberry Pi3 model B processor board. The camera which is mounted on the spectacles captures the images, and recognizes the text and pedestrian signs from the frames and then converted it into audio output which is given to the hearing system contain Eccentric Rotating Mass (ERM) vibrator for hearing. This device consists a panic switch for safety alert which update the current location using GPS(Global Positioning System) and IoT (Internet of Things) . A voice board is also implemented for communication purpose.*

Keywords **- Camera, OCR, Faster RCNN, Raspberry Pi3, GPS and ERM Vibrator**

1 INTRODUCTION

Being blind is really struggling. The problems of deafer are deeper and complex. Then what happen if a person having both deafness and blindness? They will suffer a lot to meet their personal needs independently. . Worldwide, between 300 million and 400 million people are visually impaired due to various causes. Of this group, approximately 50 million people are totally blind. Blind people faces many challenges in their day to day life. Major challenge is navigation in the out door settings. People can easily roam inside the home because of the familiar environment. There are many techniques used to help the visually impaired people by train them to navigate using their other senses, guide dogs and assist devices like smart cane, laser cane etc. But still they cannot cross the traffic signal on their own and they depend others to cross the road. The next major challenge is inability to read. Hearing loss is inability to hear. A hearing loss makes it more difficult for you to hear speech and other sounds. The most common causes of hearing loss are noise and ageing. In most cases a hearing loss cannot be cured. Hearing loss is typically treated with hearing aids. Hearing loss is divided into three types. Sensorineural hearing, conductive and mixed. Sensori neural hearing loss is caused by damage in inner ear and it can treated by surgery. Conductive neural hearing loss is due to the damage in outer and middle ear which prevent the transmission of the sound to the inner ear. It is caused by stenosis, wax impaction, exostosis, blockages etc. Conductive losses caused by wax impaction, foreign objects, abnormal growths or ear infections can often be corrected with extraction of earwax, antibiotics or surgical procedures. Abnormalities like stenosis of the ear canal, exostoses, otosclerosis and ossicular chain discontinuity are more difficult to treat surgically. These conductive losses may be treated with bone conduction hearing aids. There are many techniques used to help the visually impaired people by train them to navigate using their other senses, guide dogs, Braille language and assist devices like smart cane, laser cane etc. But still the blind people cannot cross the traffic signal on their own and depend others to cross the road. The conduction hearing loss can be treated by using bone conduction hearing aids. Many hearing aids are also available in the market. But it is too expensive.

This work involves panic switch for location alerting and bone conduction vibrator which gives the output for pedestrian sign detection, text reading and voice board for blind peoples who having conductive hearing loss. In bone conduction the sound waves reaches the inner ear as vibrations through the skull. The vibrator converts the sound into vibrations. Here we use ERM (Eccentric Rotating Mass) vibrator for hearing. Text reading can be done using OCR (Optical Character Recognition) technique. It is used to extract the character from the images of typed, handwritten or printed text into machine-encoded text, whether from a scanned document, a photo of a document, a scene-photo or from subtitle text superimposed on an image. Pedestrian signs can be detected using deep learning. It is an advanced type of Machine Learning, and the modern wonder of Artificial Intelligence. In this paper Raspberry Pi3 and camera is used for text reading and pedestrian sign detection.

2 PROPOSED METHOD

In the proposed system we using the camera to capture the images and given to the processor for detecting text and pedestrian signs using OCR and deep learning techniques. The output is given to the ERM vibrator for recognizing the signs and text for people having both

visual and audible impairment. This system is very helpful for crossing the roads, reading the boards in outdoor settings and helps to take the medicines by themselves. A panic switch is also implemented which update the current location to the relatives when the switch is pressed in any emergency situations. A voice board is also used to record the voice and given to the vibrator after amplification for hearing. We use Raspberry PI3, camera, GPS module, voice board, ERM vibrator for developing the device. Raspberry Pi 3 is a mini computer having high processing capacity, relatively low price, and its ability to adapt in different programming modes. It consist of 4 USB ports for connecting camera. All input and output devices are connected to the GPIO (General Purpose Input/Output) pins in the Raspberry Pi. The audio output is amplified and transmit to the vibrator. Fig. 1 illustrates the block diagram for proposed system.

The camera captures the images and given to the raspberry pi. It converts every frame into grey scale and reduces the noise using Gaussian filter. Then it is converted into binary images. After image processing text extracted from the frame and converted into speech. It also check the traffic signs in the frame using deep learning and output is converted into speech. Both output signals are amplified and given to the vibrator. When the panic switch pressed GPS module transmit the data to the processor and the processor extract current location from the data and updated in the IoT mobile app cayenne. The voice board is connected to the vibrator through relay which record the voice and playback, if the button is pressed. A relay is used to connect both voice board and audio output of Raspberry pi to the vibrator.

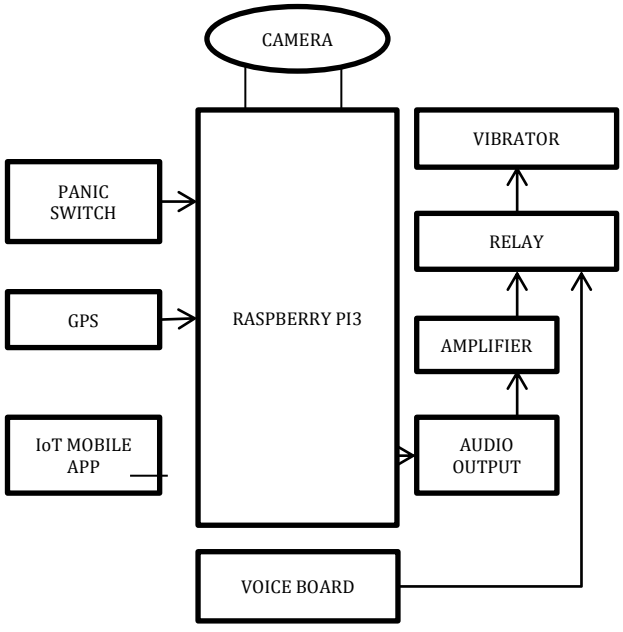

Fig-1: Block diagram of proposed system

2.1 TEXT READING

Text reading is possible by Optical character recognition or optical character reader (OCR). It is the electronic or mechanical conversion of images of typed, handwritten or printed text into machine-encoded text. To perform Optical Character Recognition on Raspberry Pi, we have to install the Tesseract OCR engine on Pi. . The implemented idea involves text recognition from image taken by camera and recognizes the text using OCR. The captured image is first converted to gray scale and then filtered using a Gaussian filter to reduce the noise in the image. The filtered image is then converted to binary. OpenCV (Open Source Computer Vision) is the library used for image processing. The system captures the frame and checks the presence of text in the frame. If there is any text in the frame, the portion of the text is cropped and loaded to the Tesseract (a library) so as to perform text recognition. Python Imaging Library (Pillow) is also used for read the text embedded in the images. The text is converted in to speech by pyttsx3 (a text-to-speech conversion library in python). The audio output is amplified and given to the vibrator for hearing.

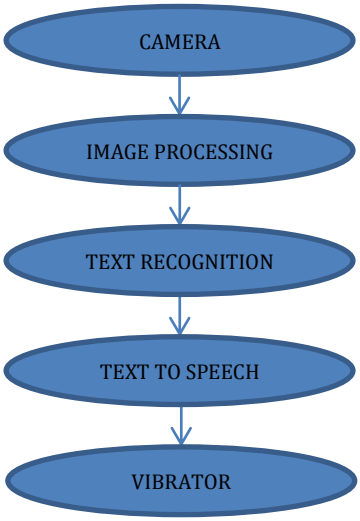

Fig-2: Flowchart for Text Reading

2.2 OBJECT RECOGNITION

Object recognition is a computer vision technique for identifying objects in images or videos. It is a key output of deep learning and machine learning algorithms. When humans look at a photograph or watch a video, we can readily spot people, objects, scenes, and visual details. Here we use deep learning for the pedestrian sign detection. Deep Learning technology is an advanced type of Machine Learning, and the modern wonder of Artificial Intelligence. Deep Learning is able to determine if the conclusions are correct all on its own, given enough time. This is important for pedestrian sign recognition for a blind person. How Deep Learning technology works is with something called neural networks. For image recognition, the kind of neural network used is called

convolutional neural networks. The Images of the signs from different angles and shades are trained and tested to recognize the sign board. Convolution neural network is used for labeling and predicting the images. A computer using Convolutional Neural Networks (CNNs) processes information by labeling, predicting, and recognizing specific patterns. It breaks the images down into numbers. Convolution is the combination of two functions that produce a third function. A neural network that uses convolution is merging multiple sets of information, pooling them together to create an accurate representation of an image. After pooling, the image is described in lots of data that a neural network can use to make a prediction about what it is. A neural network will learn over time if its predictions are accurate. Here we use Faster RCNN and Tensor flow for pedestrian sign detection. TensorFlow is a free and open source software library for dataflow and differentiable programming across a range of tasks. It is a symbolic math library, and is also used for machine learning applications such as neural networks**. Faster RCNN** is an object detection architecture used in tensor flow. It is very easy to do pedestrian sign detection using Faster RCNN. Collect some pictures of pedestrian signs in different angles, backgrounds and distance. Then rename and divide the images for testing and training. After that move the training images to .jpeg folder and testing images in to test image folder. Next label the training data by cropping the object from the picture and saved in .xml file. Then convert the data to tensorflow record format. After this train the object till the loss will be below 0.1. Finally test the trained object. So the system is ready for image recognition. The video captured by the camera is processed and compare with the trained images. If the frame contains any pedestrian signs the system detect the sign and converted in to speech and audio output is given to the vibrator.

2.3 LOCATION ALERTING

GPS stands for Global Positioning System. An unlimited number of users with a civil or military GPS receiver can determine accurate time and location, in any weather, day or night, anywhere in the world. The system makes use of a medium earth orbit satellite constellation transmitting microwave signals allowing a GPS receiver to determine its position, velocity and time. A panic switch is connected with the device for safety detection system and alert the neighbors using cloud. GPS receiver gets the location information from satellites in the form of latitude and longitude. If panic switch is pressed, the processor collect the information from the GPS module and update the information in the IoT mobile app called cayenne. IoT is the conjunction of internet, wireless network, and computing. Here, the current location is transmit to the mobile through IoT.

2.4 VOICE BOARD

A single mode voice board is placed for recording the voice for frequent communication. The ISD1820 Recording Module Voice Board with On Board Mic is used for voice recording and Playback. The Module can be operated by using the 3 Push-Buttons . A microphone is implemented directly on the board. The recordings can be saved even without power due to the non-volatile storage on the ISD1820. This module uses the ISD1820 voice record and playback IC to record a single voice message of up to 10 seconds in length. The recorded message is stored in its specialized analog flash memory that will keep the message stored even when power is removed. It consist of three buttons. **REC Button is used to** record by pressing and holding and release the button to stop the recording. **RLAYE Key is used to play the recording. PLAYL Key** *is a* jog mode playback, press and hold until playback, release to stop playback. The voice board always consist of a loud speaker but we use vibrator for converting the audio output to vibrations.

3. CONCLUSION

The implemented safety device which recognize text and pedestrian signs using OCR and deep learning technique can ensure more convenience to people having both visual and audible impairment. Portable camera capture the video to extract the text and pedestrian signs and converted it into speech using gTTS and then given to the vibrator for hearing. Continuous audio recording using voice board helps to eradicate the communication lag to impaired persons. Location alerting panic switch helps to always keep in touch with beloved ones. Our method works only with the persons who having conductive hearing loss. Extending our system to deal with them is an important direction for future research.

3.1 FUTURE SCOPE

In future satellite communication can be used for guidance to understand the location and nearby shops to the user. Providing speech signals in any language to the user is also future scope by downloading the trained data from official github page and add it up to the package . To improve the prototype efficiency we can use more advanced high resolution camera which can mounted on the spectacles and it can improvised for detecting moving vehicles on the road and update information to the user.

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