SMART ASSISTIVE CAP FOR THE VISUALLY IMPAIRED

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An unprecedented growth in the healthcare sector delivers a wide variety of solutions for different types of physically challenged issues. Despite the discovery of many solutions, one of the unpalatable truths is the lack of intelligent systems for visually challenged people. The synergy between healthcare sector and image processing provides a better solution with the help of Image Processing in terms of narrating the visual scenes. This is a conglomerate of both health care and image processing which helps the visually impaired to cognize the world through the narrated text using artificial intelligence enabled voice assistant. This can be accomplished by using Image Processing technology, deep learning, artificial intelligence and text-to-speech technology. It provides a novel idea in processing the captured image and an analysis is done to generate the text of the visual which in turn will be synthesized via a speaker. This system can be effectively used to describe the captured image in both text and in speech formats. The attainment of the above-mentioned objective is accomplished by using a raspberry Pi module which has the potential to capture the image and analysis is performed. As a result, the visually impaired person can now experience the visual scenes of the world through the narrated text of the scene and with the help of personal assistance.

Keywords- CCD, IVA, TTS.

I.INTRODUCTION

In this world many people's are visually impaired by birth or they become visually impaired due to accidents. According to the World Health Organization, there are approximately 285 million people who are visually impaired, 39 million of them are blind and 246 million have a decrease of Visual acuity. Almost 90% who are visually impaired are living in low-income countries. In India, 130,000 people have visual impairments, including13.3% of them are blind. Because of these visual impairment they suffer from many disabilities like reading books, arranging clothes, getting things done independently and so on. They also feel embarrassment many times while performing these tasks when they are unsuccessful in performing them, because of their visual impairment deficiency. They are unable to experience the planet the way we do. One of the biggest challenges for the blind person, especially the one with the complete loss of vision is to navigate around places. In the computer vision community, developing visual aids for handicapped persons is one of the most active research projects. Mobility aids are intended to explain the environment on the brink of the person with an appreciation of the surrounding objects. These aids are essential for fine navigation in an environment. Recently, several electronic applications are developed for visually impaired people. Different developing technologies that plan to help visually impaired people in their daily lives are of more interest. However, identification task remains the main difficulty for visually impaired people. Although there are many applications that can be used for this task, there are some limitations that require more improving. A comparison between the applications that use human computation is provided in order to spot the simplest features

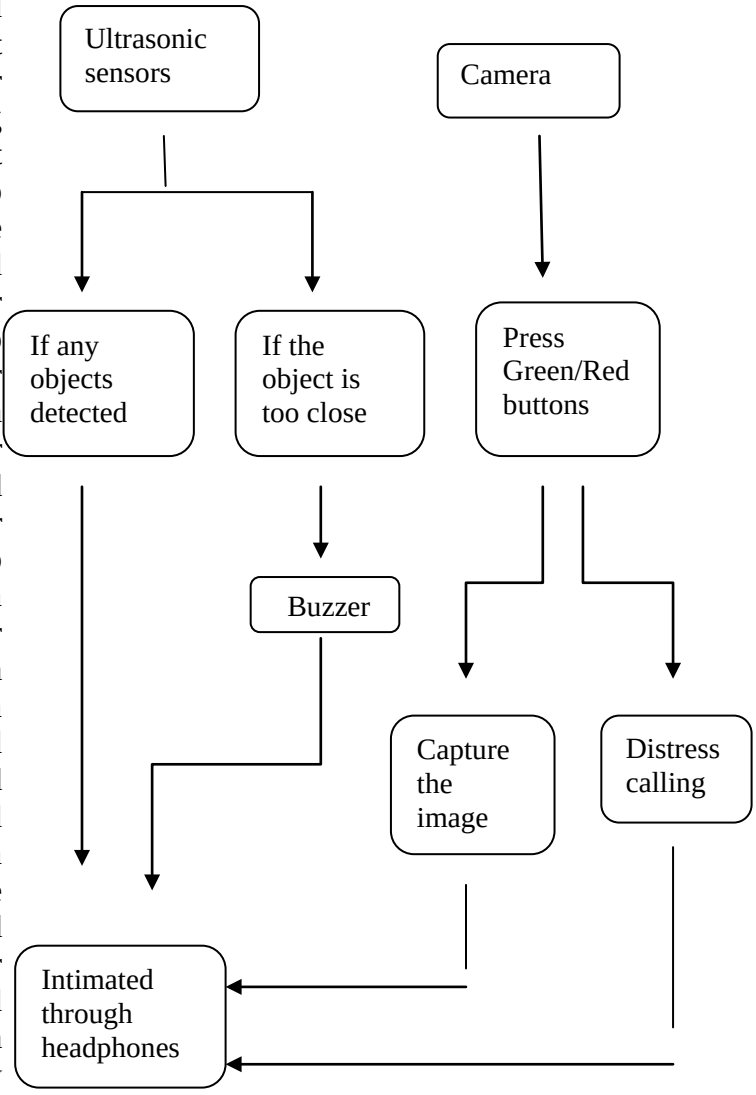
which will be considered in designing efficient application to spot objects and converting the knowledge of the recognized object in to the speech form. Converting the detected object information into speech makes it easier and friendly to spot object for the visually impaired person.

II.LITERATURE SURVEY

In developing the visual impairment aids many researches have been done. Design and implementation of text to speech conversion for visually impaired people [1] published on 2014.This paper proposed a simple conversion of input text to synthesized speech that reads out to the user and it can be saved in mp3 file. Object detection and identification for blind people in video scene [2] published on 2015 ,this paper aims to introduce the proposed system that restores the central function of the visual system by identifying the surrounding objects and they use SIFT algorithm to show the visual substitution system based on the feature extractions and matching to recognize and locate the objects in images. Wearable object detection system for the blind [3], this paper proposed a support for the blind in searching some object using RFID device design. It provides information about the distance and to simplify the search. Real time assistance prototype-a new navigation aid for blind people [4] published on 2010, this paper presents a new prototype and it includes two Stereo cameras and a portable computer for processing the information, it is used as a travel aid for blind people. Multi sensor strategies to assist blind people [5] published on 2009 , this paper is based on multi sensor strategy and adopts smart signal processing to provide the user with suitable information about the position of objects hindering their paths. A cloud and vision based navigation system for blind people [6] published on 2017, this paper includes a helmet molded with stereo cameras in front, android based smart phone, web application and cloud computing .cloud computing is the main platform of this system and the blind people can interact with the system in voice. Blind user wearable audio assistance for indoor navigation based on visual markers and ultrasonic obstacle detection [7] published on 2016, this proposes visual markers to identify the environment and the location status and it indicates the distance and direction between closer points, building a virtual path. Audio assistance is provided to know the instructions. Text–to-speech [8] published on2014, this paper presents the conversion of written text from descriptive form to a spoken language that is easily understandable by the end user. It provides one way communication interface where the computer communicates with the user by reading the textual document. Design and development of indoor navigation and object identification system for the blind [9] published on 2004, this paper presents a new system consisting of sensor modules which can be used as flashlight for searching objects in the surrounding environment. Smart guide for blind people [10] published on December 2011, this paper includes a prototype device which gives guidance to the user by informing about the nearby objects.

III.DESIGN AND IMPLEMENTATION

Flow Chart



The Raspberry Pi is embedded with Python code to implement object detection using Image processing, to get the text output from Tensor flow about the object and to convert the text into speech using Text to Speech Engine. The Text to Speech Engine then converts the Text into suitable audio format which can be heard using the audio output device. Other important feature enabled in this prototype is the distress button. In case of Emergencies the user can utilize this option by pressing the button embedded in the project. Once the distress button is pressed, the user is allowed to send a distress message to an emergency contact. The message obtained from the user will be in an audio format and speech processing is done on the same. After the processing is complete, the message is sent in text form to the respective emergency contact along with the GPS location.

The description of the flowchart, first the camera will capture the objects and will compare that image with the dataset and will intimate about that object to the user through headphones. There will be two buttons green and red, to capture the image the user should press green button, and the red button is used in-case of emergency. Ultrasonic sensors will detect the object distance , buzzer is connected to this so that it will vibrate if the object is too close to the user and alerts them by intimating them through headphones.

HARDWARE

The hardware model consists of Raspberry pi 4b with two USB 2 ports and two USB 3 ports which helps in transferring the data ten times faster than the previous versions. The cap has a 2-lane MIPI CSI camera port which takes high –definition videos and photographs. Ultrasonic sensor is used to measure the distance between the user and the object.

A tensor flow is attached for emergency uses.TTS synthesizer converts a text into word and then into speech which can be heard through headphones attached to the cap. Distress button is used to send GPS location and to send messages to the user's family and friends in case of emergency. Virtual assistant uses natural language processing (NLP) to match user voice input into executable commands. virtual assistant is similar to google assistant, it can be activated easily by saying "Hey google". It performs all the functions like used in mobile phones. Helmet camera has a CCD sensor it is used for live video streaming it can be connected to video recording device with video input capability.

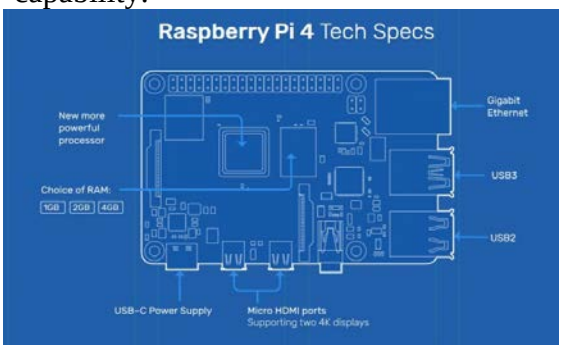


Fig.1 RASPBERRY PI 4B MODEL

Fig.2 HARDWARE VIEW

CAMERA

The camera module is attached to the CSI port on the raspberry pi by using 15cm ribbon cable. It can be accessed through MMAL and V4L APIs. Camera used here is Sony IMX219 8-Mega pixel sensor, it takes high definition videos and photographs. It supports 1080p30, 720p60 and VGA 90 video modes and still photographs.

ULTRASONIC SENSOR FOR NAVIGATION

This works on three different blocks: Arduino microcontroller, Ultrasonic sensor, and vibration motors. All these three blocks communicate with each other. Arduino microcontroller is the main block , it receives ultrasonic signals from the ultrasonic sensor and rotates DC vibrating motor with speed according to the distance from the object. Ultrasonic sensor is used to measure the

distance of the object from the blind people. This sensor is attached to the cap below the camera module.

LOCATION DETECTION

To know about the location five application designs have been implemented: mobile client, an application server, a database, GPS system, and a map service. Mobile client has mobile and GPS receiver which is used to find the location of the user. In order to share the location, the mobile client sends the location details to other users only if the authentication is provided by the user.

TTS ENGINE

In Text-To-Speech (TTS) engine, text file is given as input which is initially converted into words and then the conversion of words into sound. It has dragon speak, Microsoft TTS engine and Microsoft cortana. The text or picture format will be converted to speech which can be heard through headphones attached to the cap.

DISTRESS BUTTON

This application gives the GPS location of the user. It helps them to stay connected with their family and friends by sending them messages along with location details in case of emergency. It can interact with mobile devices and message accordingly. It also provides immediate video recording.

VIRTUAL ASSISTANT

An Intelligent Virtual Assistant uses natural language processing (NLP) to match the user text or voice input to executable commands. The system is implemented with machine learning and deep learning algorithm to find solution to the question asked by the user.

It has artificial intelligence enabled voice assistant. To activate it we can use wake word like “Hey Google” ,” Hey Siri”, “Ok Google”.

LIVE STREAMING VIDEO

A closed circuit television camera is attached to the cap. This camera is also known as helmet camera, it generally falls under two categories like CMOS and CCD type. The camera used here has CCD sensor. It has features like on-screen menus, high definition format, wireless transmitting to an offsite recording device, waterproof closures. It has GPS module .This live stream helps the family members to keep location track on the blind person.

RESULT

An image captured by the pi camera. The Raspberry Pi is embedded with the Python code to implement object detection using Image processing and to get the text output from Tensor flow about the object. Figure 3 shows the objects in the image being detected using image processing. A person and a horse is being detected. The processed image is then analyzed to form a meaningful sentence from the obtained keywords. ‘A person riding a horse’ is the output sentence. The TTS then converts the text into audio form which can be heard using headphones. Other important feature enabled in the prototype is the distress button. In case of Emergencies the user can utilize the option by pressing the button embedded in the hardware. Once the distress button is pressed, the user is allowed to send a distress message to an emergency contact. The message is obtained from the user in an audio format and speech processing is done on the same. After the processing is complete, the message is sent in the form text to the respective emergency contact along with the GPS location. The Figure 6 displays the message ‘I met with an accident please help me’ being sent to the emergency contact number with the GPS coordinates.

Fig.3 CAPTURED INPUT IMAGE

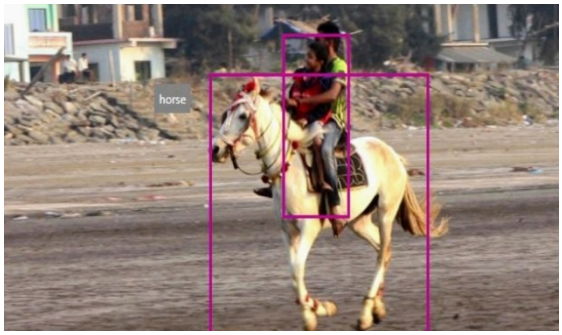


Fig.4 OBJECT IDENTIFICATION

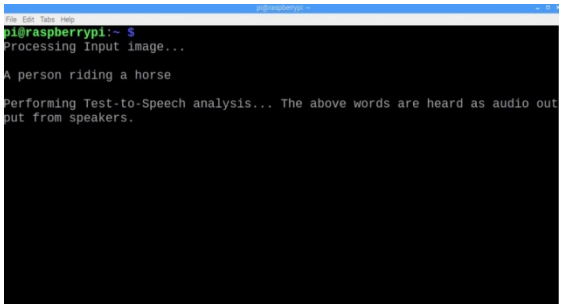


Fig.5 OBJECT DETECTION OUTPUT

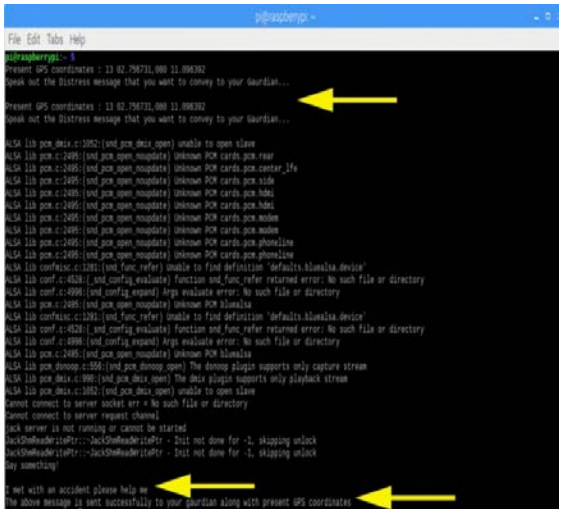


Fig.6 DISTRESS CALL OUTPUT

CONCLUSION

This system is a stepping stone towards an advance system for visually impaired. The advancements in our system will result in low Latency, higher processing speed, higher accuracy, higher efficiency, more features such as live location updates and navigation. This device is capable to aid any blind person and its features make it very portable and user friendly. They just need to recharge the battery. It will be very useful for blind pedestrian where Ultrasonic sensors are used to detect the object or obstacle in path and navigate the blind person by the use of audio instructions. It includes live stream video for the user's guardian that can be seen through mobile phones or any connected devices.

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