

Smart Glass for Visually Challenged Person's

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Abstract: The main aim of the project is to assist the blind person without human need. To overcome the travelling difficulty for the visually impaired people. It is well known that the blind people carry a hand stick with them whenever they need a support. Sometimes, when they use this stick there is no guarantee that the person is safe in reaching their destination. There may be an obstacle in their path but it's not encountered with the person by the help of stick. For this reason, the device has been developed and provide them a clear identification by using the glass. Thus, the person may be safe and secure, if the obstacles is big enough or dangerous. The device consists of Webcam, Microprocessor and Battery mounted on the frame of glass. With the help of open CV method, the processor gets real time objects identification using the webcam and check with the database for shape of the object. If the shape of the object is matched with the database, it gives the voice intimation. Thus, the user will change his direction to avoid any kind of injury.

Key Words: Visually impaired people, Glass, Webcam, Microprocessor, Headphone, Battery.

I. INTRODUCTION

This system uses a new technology to improve visually challenged person's mobility. Moving through an unknown place becomes a challenging situation where it will nor relay on our own eyes. Since uneven obstacle usually produces a noise while moving, blind person develop their sense of hearing to navigate them. A blind person commonly uses this technique for navigation [3]. It is a simple, easy and purely Electronic (Wireless) device to detect obstacle on the lower or ground, traffic or crowd places, dynamic surfaces and steps into simple feedback loop [1][5]. Proposed device is weightless, portable and its range is limited to particular space where the response will be clearer. It is established for night vision also. The system represents a theme to provide a smart electronic kit for blind people [6]. The aim of the system is to provide a cost efficient electronic aid for blind which provide a sense of artificial vision by giving information about the real time scenario of objects around them [4]. The system consists of Glass, Webcam, Raspberry pi3, Headphone and Battery. Smart glasses are designed for people who are severely sight impaired, but not completely blind. The device has the video camera mounted on the frame of the glasses. It helps viewers to identify shapes, determine distance, and are able to detect objects up to some specific distance [9]. The glasses do not replace lost vision but assist with spatial awareness. The glasses look through them to make the most of their existing sight with the additional images appearing in their line of sight to give information about who or what is in front of them. Open CV method work on a principle for capturing images, videos, image manipulation, blob detection and object detection. It captures frames from the camera and displays on the ON Screen. The Open CV library has an image buffer [10]. The function can be performed by capturing a camera frame will put the frame into buffer. This calculates the difference between two images. If the shape of the image is matched it gives the voice command.

II. PROPOSED SYSTEM

This work focuses on obstacle avoidance and object positioning. The people who are severely sight impaired but not completely blind [2].

The device has the webcam or video camera mounted on the frame of the glass. It helps the viewer to identify what is in front of them, because each people differ based on the height category. This device does not replace lost vision, but it will assist with special awareness.

The system which gets the real time data using camera placed in the glass, mounted with microprocessor unit. The camera will capture the live stream video then sense the object shape and orientation.

The processor separates the object shape and compare with database. It checks the detected shape and gives speech through headphone.

For live stream video capturing, OPEN CV process is used for detecting shape and orientation of the object [11]. Because it is fast to access and process for live video capturing and processing.

Instrument is basically an electronic system integrated with the following:

- Camera is used to capture the live stream video in normal light condition and night time also
- Microprocessor gets the data, process it accordingly and gives the output in the form of speech.
- Headphone is used for giving clear voice notification to the blind people.
- Lithium Polymer battery is used for instance high power performance image processing which requires more power for process the data.

2.1 Microprocessor

The Raspberry Pi is a system on chip board with Broadcom BCM2835 SOC.

It comes with

- 700 MHz
- 512 MB of SDRAM
- ARM1176JZF-S core CPU

The graphics, specialized chip is designed to speed up the manipulation of image segmentation and processing. It is in built with Broadcom video core IV cable. Broadcom BCM2835 SoC full high definition multimedia processor.

Video Core IV multimedia coprocessor which provides direct accessible processor pins as GPIOs. So, prototyping your vision project or learning computer science from scratch in such a device is better. One can learn in PC also but implementation at hardware level is not feasible as PC does not provide much hardware details. One of the most popular microcontroller platforms of all times is Arduino. It doesn't run an operating system; just a bootloader and firmware.



Fig -1: Raspberry Pi – Model B

Its upsides are real-time signals processing, analog value measurements etc. A Raspberry doesn't do very well here since the latency (even when running a "preempt-rt" i.e. real-time optimized kernel) may rule it out of some applications.

OpenCV

- First and foremost, OpenCV is available free of cost
- Since OpenCV library is written in C/C++ it is quite fast
- Low RAM usage (approx. 60–70 mb)
- It is portable as OpenCV can run on any device that can run C

OpenCV-Python is a library files which have the Python bindings designed to improve the computer vision problem [10]. OpenCV-Python making use of NumPy, which is a highly optimized and specified library for numerical operations with a MATLAB-style syntax.



Fig -2: OpenCV

The OpenCV array structures which has converted to and from NumPy arrays. This also makes easier to integrate with other libraries that use NumPy such as SciPy and Matplotlib [11].

2.2 USB Camera

USB camera come with variety of different model where some are wireless and some can zoom, while others have movement sensor and night vision capabilities. USB camera is usually cheaper than a standard video camera.

USB webcams are detected of having less overheating and contain dedicated castings that allow heat will disperse quickly and easily.

The webcams come with a stand or specific surface for placing the webcam on an even surface or other area. USB webcams contain large case, adjusting lenses that will result in better picture quality than built-in webcams in mobile phone or laptops.



Fig -3: OpenCV

An adjustable lens facility enables you to fine tune to make the focus control in higher quality and also adjust the focal length for near or larger distance, so that the subject what are all recording is always in good quality and in focus.

Night Vision Camera has put a control on illicit motion up to a great extent as they put an eye in everything of a particular area, even at night and very low light.

The main advantage of using device is that it captures all the incidents at night, very clearly.

Its lens is adept to capture the motion and conditions, especially at night. It is extremely effective at the dark hours and keeps your aware even at night.

Such device work effectively in both day and night time. These systems have a great vision at night time and provide security 24x7. With all its advantages, it is an excellent choice to security. This security system has special functionality that makes it different from all other security systems.

2.3 Earphones

The advantage of unified communication technology has combine together data and voice into a single communication, allows employees to communicate with others in new ways.

Earphones optimize sound quality. They are easy to listen, because they have high-quality speakers which will held onto the ear with a position that you determine.



Fig -4: Earphones

The earphone which is in a perfect position where to pick up your voice call while being out of the way for your facial movement and rubbing and scratching sound that they can cause.

2.4 Lithium – Polymer Battery

The advantages of Lithium-Polymer battery cells having four times of energy density of nickel cadmium or nickel metal hydride batteries.

Lithium-polymer batteries are lightweight and pliable and can be made to almost any shape based on requirement. They have banded around, punctured, dropped or run over with a car and still not explode, making them with more resistant to physical trauma than most of the batteries.



Fig -5: Li-Po battery

This type of battery can be in credit card thin design while holding relatively good battery life. High conductivity semisolid (gel) polymers form this electrolyte. These batteries provide a higher specific energy than other lithium battery types.

III. PROPOSED FRAMEWORK

The process overview describes the process of reading the information and transmits in the form of speech.

- Initially camera is turned on to capture the real time video streaming to capture the objects in normal light condition and night vision also.
- Using the night vision, the blind can use this system in night or dark places to detect the object in front of them.

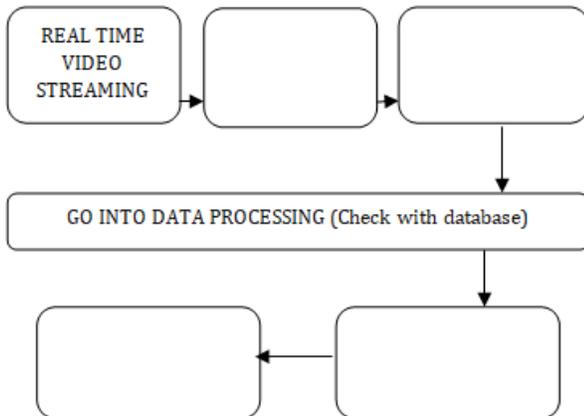


Fig -6: Process overview

- The processor which identifies shape and orientation of the object in front of the blind person.
- The identified shape is extracted and specified based on the declared shape in the database on the server.
- If the specified shape is matched with the database, it gives the speech output based on the defined shape.

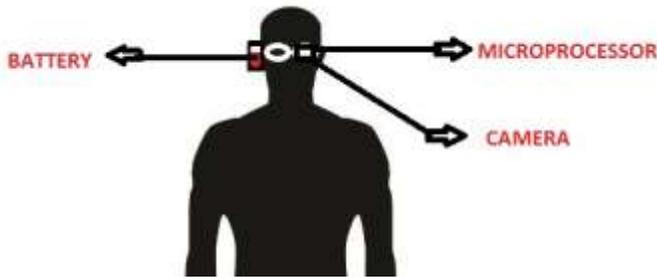


Fig -7: Overview

3.1 Shape Analysis

The camera is focused, which captures the image and the shape is converted into speech which the person can then hear. All this is using a Raspberry pi, camera and audio jack. This proves out to be a cheap and an elegant solution.

A library for image analysis and detect the edges of the shape that we want to read. Then we do some image correction to adjust the brightness and contrast of the image such that the text part is completely visible.

The shape is then passed to any standard shape-to-speech software's, which renders the shape to audio which the person can easily hear.

This sounds quite tedious but we have developed a working prototype of the same.

The solution is quite cost effective (considering the cost of an Raspberry Pi and USB camera). Everything is then compactly put in the form of a "cap like glasses". The system needs only the power source of the Raspberry Pi and nothing else which means no Internet.

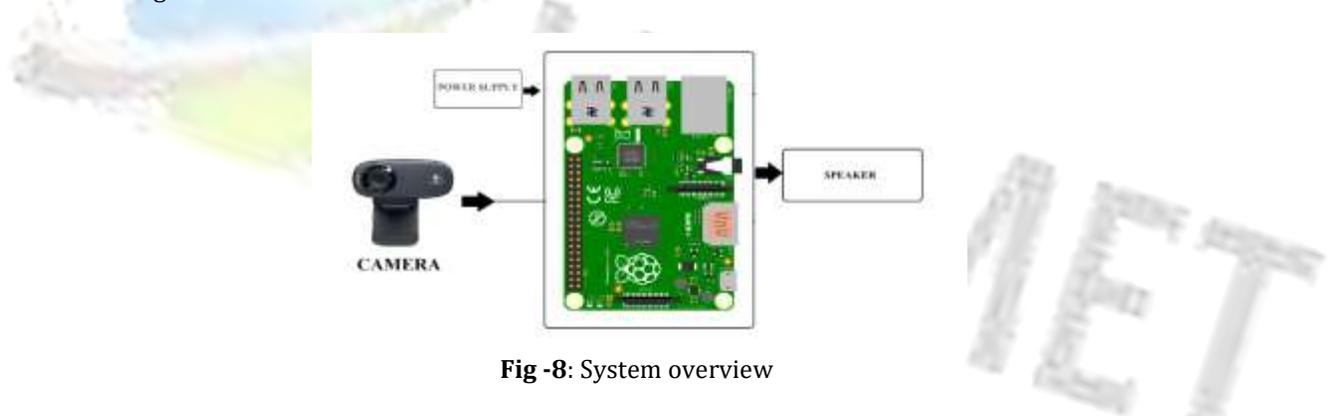


Fig -8: System overview

Once it takes an input from the Raspberry Pi's camera and add depending whether it is able to recognize the image or not, it places in training images so that it can identify such face in future or correctly predicts the familiar face.

3.2 Speech Conversion

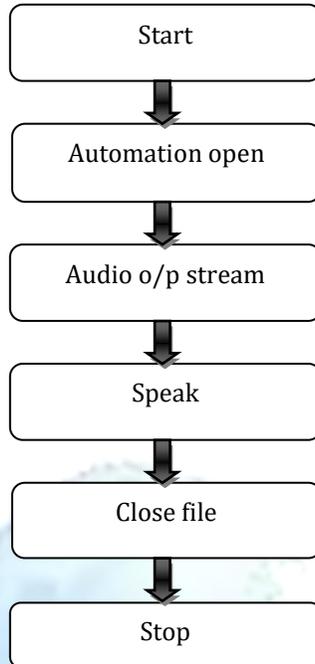


Fig -9: Process of speech conversion

- The process of speech conversion is happen based on the shape detection of the Raspberry pi.
- Initially some of the source files of the voice is placed in the database with the link of shape detection in live stream capturing.
- The set of speech files were detected with different shapes and orientation.
- Based on the detection of shape, the specified speech file is get played.
- In the live stream video processing, if multiple number of person's will arrive in same time there is a possible for giving same command continuously.
- To avoid this problem, the speech has to specified separately for the situation happen in crowd area or in the area where the more number of objects in single area.

VI. Conclusion

The algorithm is simple but offers a very elegant solution to the ones who actually need it the most.

To overcome the travelling difficulty for the visually impaired group, this paper presents a smart guiding device in the shape of a pair of eyeglasses for giving this to blind people guidance efficiently and safely.

Different from existing works, a novel multi-sensor fusion based obstacle avoiding algorithm is proposed, which utilizes both the depth sensor and ultrasonic sensor to solve the problems of detecting small obstacles, and transparent obstacles, e.g. the French door.

For totally blind people, three kinds of auditory cues were developed to inform the direction where they can go ahead.

5. Future Work

- The person can read road signs and directions, number plates, and so on, independently.
- Improving the shape detection in dark light.
- Adding different shapes in the server to improve the function of detection.

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