VOICE BASED ELECTRONIC WALKING CANE FOR VISUALLY IMPAIRED USING RASPBERRY PI AND IMAGE PROCESSING

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***Abstract*:** Visually impaired persons find themselves challenging to go out independently. There are millions of visually impaired or blind people in this world who are always in need of helping hands. For many years the white cane became a well-known attribute to blind person's navigation and later efforts have been made to improve the cane by adding remote sensor. Blind people have big problem when they walk on the street or stairs using white cane, but they have sharp sensitivity. The electronic walking stick will help the blind person by providing more convenient means of life. The stick consists of 3 ultrasonic sensors, one camera, RF receiver and an earphone. The ultrasonic sensors are used for obstacle detection. The camera is used for text and object recognition. The RF module is used to find the stick when misplaced or dislocated. Thus, it works as a virtual eye for blind people. The output will be from an earpiece.

Keywords: Raspberry pi, Ultrasonic sensors, Image processing, RF Transmitter and Receiver.

I. INTRODUCTION

Eye sight plays a major role in collecting most of the information from the real world and that information will be processed by brain, visually impaired people suffer inconvenience in their daily and social life. Blindness or visual impairment is a condition that affects many people around the world. [1] This condition leads to the loss of the valuable sense of vision. Worldwide there are millions of people who are visually impaired, where many of them are blind. The need for assistive devices was and will be continuous. There is a wide range of navigation systems and tools existing for visually impaired individuals. The blind person truly requires an object identifying device. There are many guidance systems for visually impaired travellers to navigate quickly and safely against obstacles and other hazards faced. [1, 2] Generally, a blind user carries a white cane [2] or a guidance dog as their mobility aid. With the advances of modern technologies many different types of devices are available to support the mobility of blind. These mobility aids are generally known as Electronic Travel Aids (ETAs). The most important function of ETA for the blind persons is to get information on the shape of the road and the position of obstacles when they are in unknown places. With this information, they need to arrive at their destinations, avoiding unexpected obstacles [2,3]. Our smart walk stick is also an ETA which helps the blind people to know about the objects opposite to them [5], colour of the objects [6], and text reading. In this smart walking stick we use Raspberry pi to control the sensors and camera. The feature of object identification helps the blind people to recognize what kind of object is before them and helps them to move around safely.

II. OBJECTIVE

The main objective of our project is to develop a voice based assistant device for blind people. This project is intended to provide artificial vision and object detection by making use of raspberry pi. The proposed system consists of ultrasonic sensor, pi camera, earphone, RF transmitter and receiver. The feedback is received by blind people through audio voice output which works through (text to speech)

converter. The proposed system that helps blind person to travel independently and works efficiently. The proposed device is used for guiding individuals who are blind or partially sighted. The device is used to help blind people.

III. LITERATURE REVIEW

A Brief study and survey have been carried out to understand various issues related to the project which involves providing a smart electronic aid for blind people to provide artificial vision and object detection. Real time assistance via GPS module by using raspberry pi. A survey is made among the blind people finding difficulties in detecting obstacles during walking in the street our mainly focuses on the visually impaired people who cannot walk independently in unfamiliar environment. The main aim of our project is to develop a system that helps the blind people to move independently. The smart stick helps blind people travel with a greater degree of psychological comfort and independence through sensing the immediate environment for obstacle and hazards, providing information to move left or right and orientation during travel.

- “An electronic walking stick for blinds”, Shashank Chaurasia and K.V.N. Kavitha.
- "Advanced guide cane for the visually impaired people", S. Gupta, I. Sharma, A. Tiwari and G. Chitranshi.
- "The smart guide cane: An enhanced walking cane for assisting the visually challenged", M. Varghese, S. S. Manohar, K. Rodrigues, V. Kodkani and S. Pendse.

IV. EXISTING SYSTEM

Blind people generally use either the typical white cane or the guide dog to travel. The white cane is a widely used mobility aid that helps blind people to navigate in their surroundings. Although the white stick gives a warning about few meters before the obstacle, for a normal walking speed, the time to react is very short. The idea of designing and manufacturing ultrasonic sensor combines the properties of sound monition and that benefit the blind. Sensor can detect obstacles within the designed range to avoid the blind person through the issuance of distinctive sound or vibration can be issued by the sense of the deaf by putting his finger on the button at the top of the device vibrate when there is a risk. This system involves more manual work and it does not provide better result. The existing system doesn’t provide proper navigation and is not much effective.

V. PROPOSED SYSTEM

The proposed system consists of 4 main units:

- Ultrasonic sensors
- Camera
- RF module
- Text to speech converter

This project is built around raspberry pi which is a fast processing control device. It controls the peripherals like ultrasonic sensors, camera, LCD screen. The visually impaired people find difficulties in recognizing the obstacles around them. This project helps the blind society by detection of objects with accurate distance through ultrasonic sensors. These ultrasonic sensors detect the objects around him and acts as an artificial vision. The camera captures the image of the object therefore the object is recognized through image processing. The feedback is provided through earphone, the audio output is provided through text to speech converter. The RF module is used so has to produce the beep sound when the walking cane is misplaced or lost. The ultimate aim of this project is to provide low cost, object detection and recognition device with audio, so the visually impaired people can move with same ease and confidence as normal people.

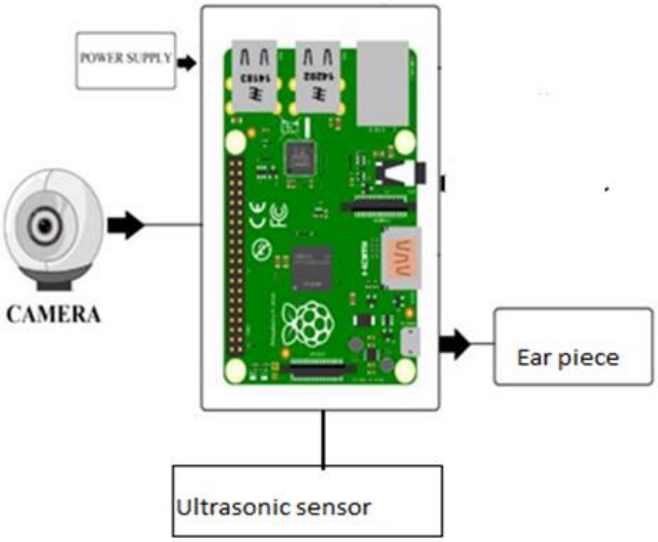

FIG 5.1 Block diagram

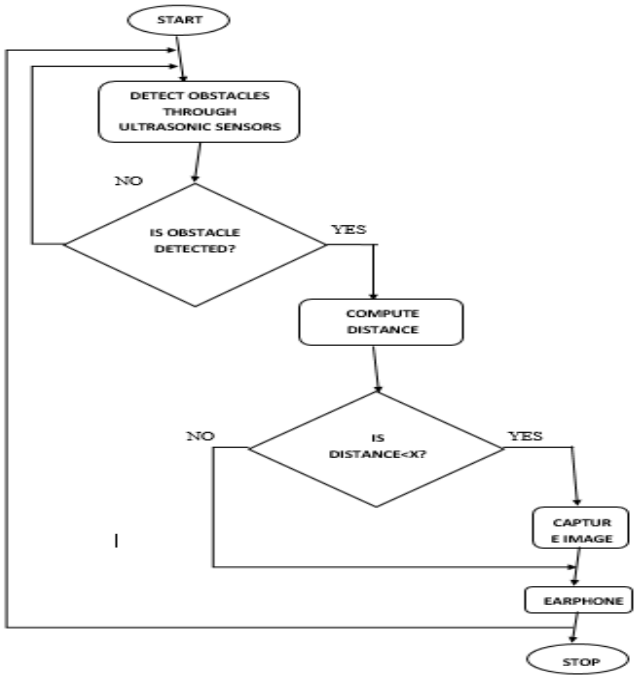

FIG 5.2 Proposed Flow Chart

A. Ultrasonic sensors

The ultrasonic sensor is a device that send pulses of ultrasound which is in audible to humans, this impulse strikes the object and echo back to the receiver of the ultrasonic sensor. Then the sensor uses speed of the sound to calculate the distance between the sensor and the object. The speed travels at a speed of 343 metres in air.

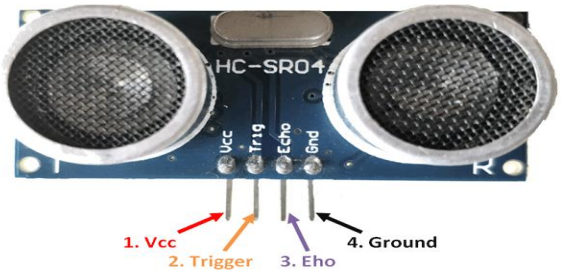

FIG 5.2 Ultrasonic Sensor

B. Camera

Camera is used to capture the images and record high definition videos. The camera consists of a small circuit board, which connects to the raspberry pi's Camera's Serial Interface (CSI) bus connector via a flexible ribbon cable. The software supports full image resolution still images up to 2592x1944 and video resolutions of 1080p30, 720p60 and 640x480p60/90.

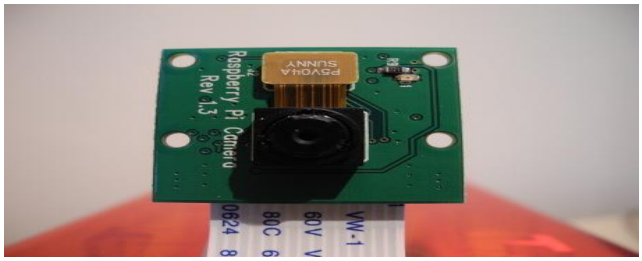

FIG 5.3 Camera

- *Image processing*

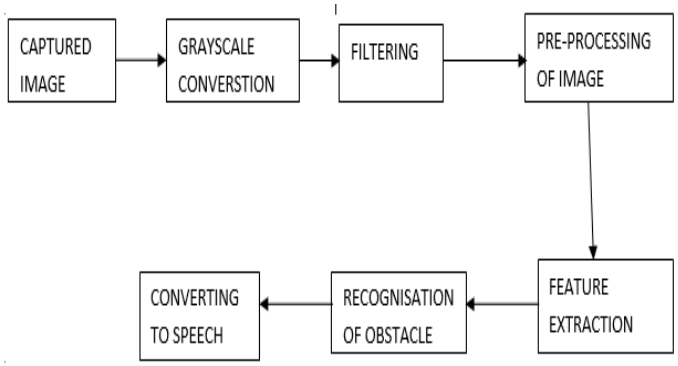

FIG 5.4 Block Diagram Of image Processing

The main module in Smart Stick is: Obstacle Detection, Image acquisition, Pre-processing and Feature extraction.

- Obstacle Detection- by using sensors.
- Image Acquisition module - task of is to obtain Image from a camera.
- Pre-processing module - used to smooth the digitized characters.
- Feature Extraction - feature will be extracted from processed image and stored in the database for recognition.

The video is captured by using camera and the frames from the video is segregated and undergone to the pre-processing. First, get the objects continuously from the camera and adapted to process. Once the object of interest is extracted from the camera image and it converted into gray image. Use haar cascade classifier for recognizing the character from the object. The work with a cascade classifier includes two major stages: training and detection. For training need a set of samples. There are two types of samples: positive and negative. To extract the hand-held object of interest from other objects in the camera view, ask users to shake the handheld objects containing the text they wish to identify and then employ a motion-based method to localize objects from cluttered background. The recognized text codes are recorded in script files. Blind users can adjust speech rate, volume and tone according to their 1preferences.

C. RF module

A RF module is a small electronic device used to transmit and/or receive radio signals between two devices. In the modern communication system, it is desired to communicate with another wirelessly. The wireless communication is accomplished through radio frequency communication. In this project short range frequency device is used, whose frequency is 315Mhz.

D. Text to speech converter

Text to speech synthesis application is used to create the speech sound of the text using the file in the computer or using a web page. In this project the Text to speech converter is used to augment the reading of a text message so as to provide voice assistance to the visually impaired people.

FIG 5.5 Proposed model

VI. RESULTS

To evaluate the performance of the proposed system the experiments are conducted. As said earlier, the circuit is designed to detect the object within two metre range. For recognition of object camera and image processing is used. To find the lost stick within one metre RF module is used.

VII. CONCLUSION

The proposed system detects the obstacle and provides the result 360 degree from the position of the smart walking stick. This system provides overall support for the blind society in guiding. The broad beam angle ultrasonic sensors help in wide range obstacle detection. Image processing helps in obstacle recognition accurately. This system eliminates the problems which were there in the existing system and helps the blind society move around safely and independently with confidence.

VIII. REFERENCES

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