Design of Blind Stick For Visually Impaired Person Using Raspberry Pi

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Abstract- *This paper has been built around Raspberry Pi processor board. It is controlling the peripherals like Camera, speaker and LCD which act as an interface between the system and the user. Optical Character Recognition or OCR is implemented in this project to recognize characters which are then read out by the system through a speaker. As shown in the project setup, the camera is mounted on a stand in such a position that if a paper is placed in between the area marked by angular braces, it captures a full view of the paper into the system. Also, when the camera takes the snapshot of the paper, it is ensured that there are good lighting conditions. The content on the paper should be written in English (preferably Times New Roman) and be of good font size (preferably 24 or more as per MS Word). When all these conditions are met the system takes the photo, processes it and if it recognizes the content written on the paper it will announce on the speaker that the content on the paper has been successfully processed. After this it speaks out the content that was converted in to text format in the system from processing the image of the paper. In this way Raspberry Pi Based Reader for Blind helps a blind person to read a paper without the help of any human reader or without the help of tactile writing system. The main aim of this work is to help blind people by providing a smart stick to them.*

Keywords- Ultrasonic sensors, Raspberry Pi, speaker.

I. INTRODUCTION

Vision is a very special gift provided by the god to humans. It is due to vision only that the persons are able to see and interact with the environment. But this vision may get lost due to some accident or due to the chronic eye diseases which are not cured on time leading to permanent blindness. According to the WHO report about 236 million people are visually impaired out of which 37 million are blind and are having severe or moderate vision impairment. The stick which is presented in this paper is very cost effective and can be taken into use by the blind persons to guide them though the obstacles which further enhances their mobility so that they can move independently with a greater accuracy. 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 inconveniences in their daily and social life. Blindness or visual impairment is a condition that affects many people around the world. 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 identifying objects.

II. OBJECTIVE

Blind people are having difficulty moving or surviving without support blind Stick is therefore a gift for people with blindness help a navigate through a public place independently. Raspberry Pi, Ultrasonic Sensor, speakers are used; we have design a blind stick. Raspberry Pi is a microcontroller that can very easily do all the calculations with great precision. The new blind stick allowing visually impaired people to navigate using advanced technology with ease. In addition to voice module, the blind stick is combined with ultrasonic sensor. The ultrasonic sensor senses the barrier, and the user is warned by the voice module. Persons with visual impairments have difficulty communicating and sensing their surroundings. They have little contact with the surrounding countryside. Physical movement is a problem for visually impaired people, because determining where he is and how to get where he needs to go from one location to another can become difficult. He will carry a sighted family member or his companion to assist him in exploring unknown locations. More than half of the world's legally blind are unemployed, because the types of jobs that they can do are minimal. We have less of a job rate. They rely on mobility and financial support for their families. They're opposed to their freedom from interacting with people and social activities. In the past, different systems have restricted functionality without a solid understanding of non-visual perception. Many devices are for indoor navigation only, and do not have any obstacle identification and position determination functionality in outdoor environments. Scientists have spent decades creating an interactive and responsive stick to support and warn visually impaired people from obstacles and provide

knowledge about where they are work has been carried out over the last decades on new devices to develop a good and reliable system for visually impaired people to identify obstacles and alert them in areas of risk. There are certain devices that have certain shortcomings.

III. LITERATURE SURVEY

It is a study of relevant literature materials in relation to a topic we have been given.

The authors proposed using ultrasonic sensors that detect the obstacles in the blind's way. It consists of three different directions, a microcontroller, buzzer, and DC vibration motor, to scan these sensors. When any obstacle is detected the buzzer and vibration motor is triggered.

AyushWattal, AshuthoshOjha, Manoj Kumar suggested Smart Belt for Blind to use an ultrasound sensor embedded belt to detect the barrier. The belt also has a buzzer which vibrates when it detects an obstacle.

The entire system is designed in such a way that the measured distance is sent to the blind person as an audio message, in which he hears the distance calculated using a speaker.

SriramaDivya, B. Navya, P. Suma Manasa, S. Chitra the paper introduces a theoretical model and program definition for providing blind people with intelligent electronic assistance. The system is designed to provide artificial vision and object detection overall measures. The overall system seeks to provide low-cost and effective navigation assistance to the blind by providing information on the environmental scenario of static and dynamic objects around them. Ultrasonic sensors are used to measure distance of obstacles to direct the user to the accessible route around the blind person. Input is in voice format. That can be heard by the blind person e.g. right, left etc. The hardware is composed of system Raspberry Pi, ultrasonic sensors and speaker.

Jayant, Pratik and Mita, 2012 proposed to give the visually impaired individual a smart stick assisted mobility. The system is based on standard ultrasonic sensors and a microcontroller with ATMEL. It operates with two rechargeable batteries which can be recharged with USB cable or AC adapter. The control unit is programmed using the microcontroller ATMEL AVR, ATMEGA328P. On detection of any obstacles, vibration will start and buzzer will start to alert the user. It has the potential to cover up to 3 meters in distance. A smart Ultrasonic Sensor Stick was introduced. This stick gathered information on the user's pathway via the ultrasonic sensor. This knowledge is used to create an artificial smart that would be used to control the movement of the attached DC motor to avoid an obstacle. The user of the stick has little or no contribution to navigation, thus making the user look like a zombie and a less truck-pushed brake; Smart walking stick, which is designed to detect and alert the user in. This is similar to the one proposed in this paper, it contains voice and vibration alert, but the actual direction of the obstacles cannot be specified.

S.Gangwar created a smart blind stick that can give early warning of an obstacle using Infrared (IR) sensors. The stick warns visually impaired people using vibration signals after they recognize the obstacles. Nevertheless, the smart stick focuses only on the identification of obstacles, but it does not help the blind for emergency purposes and the IR sensors are also not really effective enough because they can only detect the nearest obstacle in a short distance.

Benjamin etal had developed an intelligent stick with laser sensors to detect obstacles and curbs down. Obstacle identification was indicated using a microphone with a high pitch "BEEP." Laser cane concept is pretty simple and intuitive. The stick can only sense obstacles, but cannot have psychological and cognitive help. There is only beep sound which triggers any obstacle and there is no help to guide it.
Shruti and A.DambhareSakhare developed an artificial vision and object detection with real-time assistance through GPS to provide low cost and efficient navigation aid for blind people that gives a sense of artificial vision by providing information on the environmental scenario of static and dynamic objects around them.

For thorough development of the device Smart Stick for Blind Using Raspberry Pi, we need to go through each and every technical aspect related to it. This chapter provides an introduction to the area of research. A Brief Study and Survey has 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.

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 and vibrating alert feature, which benefit from the experience of deafness. 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 three main units:

- Controller
- Ultrasonic Sensor unit
- GPS Module unit.
- Espeak Text to Speech unit.

"Smart stick for blind using Raspberry Pi" system is easy to understand and maintain. This system uses Raspberry pi, it is a small processing device which works as computer at relatively low cost. Blind and visually impaired people find difficulties in detecting obstacles during walking in the street. The system is intended to provide artificial vision and object detection, real time assistance via GPS by making use of Raspberry Pi. The system consists of ultrasonic sensors, GPS module, and the feedback is received through audio. Voice output works through TTS (text to speech).The proposed system detects an object around them and sends feedback in the form of speech that is warning messages via earphone and also provides navigation to specific location through GPS. The aim of the overall system is to provide a low cost, efficient navigation and obstacle detection aid for blind which gives a sense of artificial vision by providing information about the environmental scenario of static and dynamic object around them, so that they can walk independently.

A. Controller

Controller In this model, we make use of raspberry pi for controlling system. Raspberry pi is programmed using python language. Based on various signal obtained from different sensors, pi work as decision making controller [1]. Pi 3 model B has 1GB RAM which suitable for operation which is used in this system.

FIG 5.1 Raspberry PI Pico

B. Ultrasonic Sensor

High frequency sound waves are generated by ultrasonic sensor. It evaluates the echo which is received back by the sensors. The time interval between sending the signal and receiving the echo is calculated by sensor to determine the distance to an object. Ultrasonic is like an infrared where it will reflect on a surface in any shape, but ultrasonic has a better range detection compared to infrared. In robotic and automation industry, ultrasonic has been highly accepted because of its usage. In our Project the Ultrasonic sensor distance measurement Module deals with the distance measurement between the obstacle and the blind person. This module starts the process when the user turns on the device using power supply. Firstly when the device turns on, the ultrasonic sensor will automatically gives the distance measurement of the obstacle in front of the blind, and then the distance measured is stored in the SD card.

FIG 5.2 ULTRASONIC SENSOR

C. GPS Module

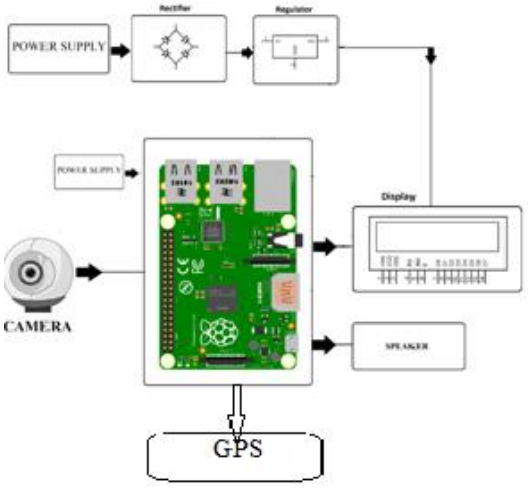
This module deals with the navigation of blind person from particular source to destination. This phase starts by obstacle Detection. First the ultrasonic sensor gives voice command about the distance measurement between the obstacle and the blind person, based on that the navigation route instruction will be provided to blind by GPS Module via voice command. The navigation route is provided based on the latitude and longitude values. The latitude and longitude values will be stored so that when that value is matched the blind person gets the voice command to move left or right.

FIG 5.3 GPS MODULE

D. Voice Command Module

This module deals with giving the instructions to the blind user about the obstacles via Earphone. After detecting the Obstacles it gives the instructions about the obstacle and based on that GPS Module Provides route to the Blind.

VI. BLOCK DIAGRAM



HARDWARE REQUIREMENTS

The working of the system begins when the power supply is given. The ultrasonic sensor is then used to detect obstacle and provides distance between obstacle and the device. GPS Module provides navigation. When obstacle is detected, the distance and the navigation will be processed using Raspberry Pi device. The processing happens in such a way that if the obstacle is on to the right side, a voice command will be given to take left and vice versa.

SOFTWARE REQUIREMENTS

- Python 3 compiler
- Programming Language: Python

RESULTS

To evaluate the performance of the proposed method the experiments were conducted. The results in this paper shows the beginning of our efforts to build a compact travelling aid that allows the visually impaired to negotiate everyday environment. As previously mentioned, the sensor circuits give information about the environment. The circuit that has been designed for the object detection has provided an accuracy of 1 meter. For providing navigation GPS module has been used.

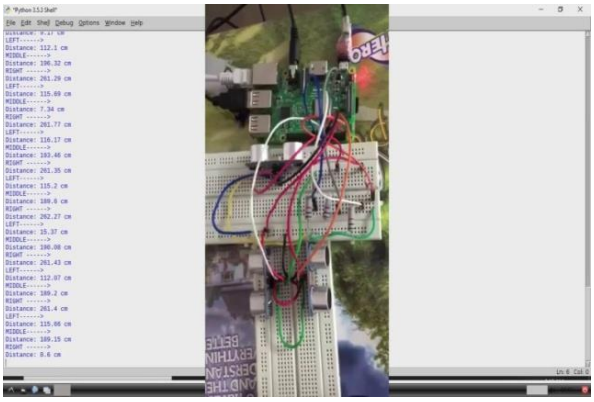


Fig 8.1 Result of Proposed system

VII. CONCLUSION

The project “Blind Stick for visually impaired person Using Raspberry Pi” is designed to create a system using Ultrasonic sensors, Raspberry Pi, and providing Voice command through speaker to the blind people. It would help a visually impaired person navigate through a public place independently. The proposed system tries to eliminate the faults in the previous system. It aims to solve the problems faced by the blind people in their daily life. The system also takes measures to ensure their safety. The design smart cane for Blind using ultrasonic sensors with voice output is of great benefit to blind people when it comes to independent mobility. The advantage of the system lies in the fact that it can prove to be very low cost solution to millions of blind person worldwide. The proposed combination of Ultrasonic Sensor and GPS makes a real-time system that monitors position of the user and provides feedback making navigation more safe and secure. We are using Espeak text to speech conversion to provide voice command as output. Blind person can easily navigate from one place to another as we are providing voice message. The prototype of Smart Stick for Blind is able to detect obstacles in front of the user. And, it is therefore capable of guiding a visually impaired person for navigating his environment.

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