Support System for Blind People

A. H. Ukarande[1] P. D. Jadhav[2] S. N. Sala[3] A. D. Salekar[4] N. G. Chavan[5]
[1,2,3,4,5]Department of Instrumentation
[1,2,3,4,5]Bharati Vidyapeeth College of Engineering, Navi Mumbai, India

Abstract— Support system for blind is a concept that devised to provide a smart electronic aid for the physically and visually impaired people. The system consists of ultrasonic sensors and GPS module, and the feedback is received through audio. Voice output is achieved through TTS (text to speech). The system is intended to provide object detection, and real time assistance via GPS, by making use of Raspberry Pi. The proposed system detects an object around the person and sends feedback in the form of speech and warning messages via earphones. It 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. This gives a sense of artificial vision by providing information about the environmental scenario of static and dynamic.

Keywords: GPS Module, Obstacles, Raspberry PI, TTS, Ultrasonic Sensor

I. INTRODUCTION

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. Visually impaired people suffer inconveniences in their daily and social life. Eyesight plays a major role in collecting most of the information from the real world and that information will be processed by the brain. Across the world, there are millions of people who are visually impaired, out of which many 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. India's population is currently at a whopping 133 crores, out of which, about 1.5 crore people are visually impaired, and 2.7 crore people are physically disabled.

Physical movement becomes a challenge for them every time. To move, especially in unknown places, they are in constant need someone's help. They are always dependent on a friend or family for doing small things in their lives.

As well, blind people must learn every detail about the home environment. Large obstacles such as tables and chairs must remain in one location to prevent injury. If a blind person lives with others, each member of the household must diligently keep walkways clear and all items in designated locations.

Keeping these things in mind, research has been conducted for new devices to design a good and reliable system for visually impaired persons to detect obstacles and warn them at danger places. There are some systems which has some deficiencies.

II. OBJECTIVE

The main objective of this project is to provide a voice-based assistance to blind people. Here we have developed an intelligent system that helps a blind person to travel without the help of anyone and that works efficiently. Current navigation system for the visually impaired focus on travelling from one location to another. The device is used to help blind people to move with the same ease and confidence as a sighted people.

III. LITERATURE SURVEY

Support system for Blind Using Raspberry Pi, we need to go through each and every technical aspect related to it.

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 Blind people, who find it difficult to detect obstacles while moving in the street .The focus is on the visually impaired, 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.

Some of the designed a smart stick for blind which can give early warning of an obstacle using ultrasonic sensors. After identifying the obstacles, the stick alerts the visually impaired people using buzzer. However the smart stick focused only for obstacle detection but it is not assisting for emergency purposes needed by the blind. And the IR sensors are not really efficient enough because it can detect only the nearest obstacle in short distance.

Some of the people proposed the smart white cane, called Blind-spot that combines GPS technology, social networking and ultrasonic sensors to help visually impaired people to navigate public spaces. The GPS detects the location of the obstacle and alerts the blind to avoid them hitting the obstacle using ultra-sonic sensors. But GPS did not show the efficiency in tracing the location of the obstacles since ultra-sonic tells the distance of the obstacle.

One person had developed a smart stick using laser sensors to detect the obstacles and down curbs. Obstacle detection was signalized by a high pitch "BEEP" using a microphone. The design of the laser cane is very simple and intuitive. The stick can only detect obstacle, but cannot provide cognitive and psychological support. There exists only beep sound that triggers any obstacle and there is no any assistance to direct them.

IV. EXISTING SYSTEM

Blind people generally use either the typical white cane or a guide dog to travel. The white cane is a widely used mobility aid that helps blind people to navigate in their surroundings. The idea of designing and manufacturing ultrasonic sensor combines the properties of sound motion, which benefit the blind and a vibrating alert feature.

All the studies which had been reviewed shows that, there are many types of smart sticks for blind people and all of them uses different techniques to give the required assistance for the blind person.

Ultrasonic sensors are used to detect obstacle in front, since ultrasonic sensors are good in detecting obstacle in few meters range. Here blind people might find it difficult in travelling without any emergency alert rather than having only ultrasonic sensors.

V. PROPOSED SYSTEM

The proposed system consists of three main units:

a) Ultrasonic Sensor & Camera unit.
b) GPS Module unit.
c) Text to Speech unit.

In this system ultrasonic sensor is detects the obstacle in the path and the output signal of the ultrasonic sensor is given to the Raspberry Pi, which process the signal and trigger the camera. Camera scan the obstacle and compare it to the library present in Raspberry Pi. It also uses text to speech conversion to give name of object to user. GPS module is used to navigate them to a specific location. FIG.1 shows interfacing of all the hardware with Raspberry Pi-4.

VI. SOFTWARE USED

A. *Python*

Python language is a high & can be characterized by all of the following buzzwords:

a) General-purpose interpreted.
b) Interactive.
c) Object-oriented.
d) High-level programming language.
e) Open source.
f) Compile on the fly to byte code

B. *Tensor Flow*

Tensor Flow 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. It is used for both research and production at Google.

Tensor Flow was developed by the Google Brain team for internal Google use.

While the reference implementation runs on single devices, Tensor Flow can run on multiple CPUs and GPUs Tensor Flow is available on 64-bit Linux, macOS, Windows, and mobile computing platforms including Android and iOS.

Its flexible architecture allows us for the easy deployment of computation across a variety of platforms like CPUs, GPUs, TPUs and from desktops to clusters of servers to mobile and edge devices.

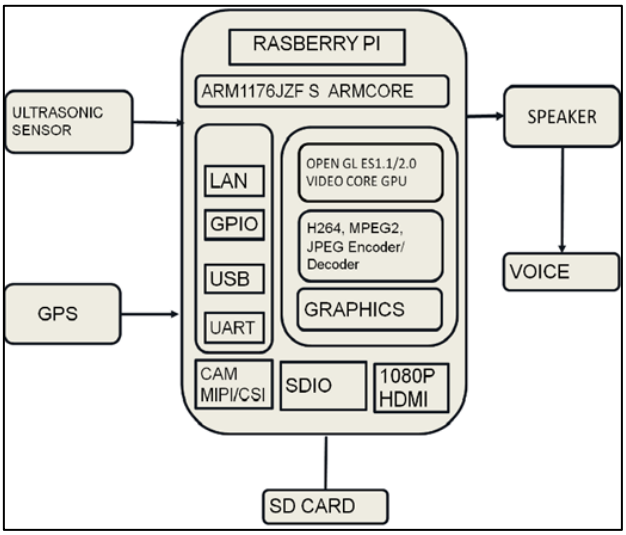

Fig. 1: Interfacing Block Diagram

VII. HARDWARE USED

a) Raspberry PI-4
b) Ultrasonic Sensor
c) Camera Module
d) GPS module
e) LDR and Buzzer

A. *Raspberry PI-4*

Fig no.2 shows the model of raspberry pi-4. The Raspberry Pi 4 Model B is the latest version of the Raspberry Pi computer. The Pi isn't like your typical machine, in its cheapest form it doesn't have a case, and is simply a credit-card sized electronic board of the type you might find inside a PC or laptop but much smaller.

Raspberry Pi is the name of a series of single-board computers made by the Raspberry Pi Foundation, a UK charity that aims to educate people in computing and create easier access to computing education. The Raspberry Pi launched in 2012, and there have been several iterations and variations released since then.

The original Pi had a single-core 700MHz CPU and just 256MB RAM, and the latest model has a quad-core 1.4GHz CPU with 1GB RAM All over the world, people use Raspberry Pi to learn programming skills, build hardware projects, do home automation, and even use them in industrial applications.

Fig. 2: Raspberry Pi

The Raspberry Pi is a very cheap computer that runs on Linux, but it also provides a set of GPIO (general purpose input/output) pins that allow you to control electronic components for physical computing and explore the Internet of Things (IoT).

B. Ultrasonic Sensor

High frequency sound waves are generated by ultrasonic sensor. It evaluates echo which is received back by the sensors. The distance between object and ultrasonic sensor is determined by calculating the time interval between transmission and receiving of the signal. Ultrasonic sensor and infrared sensor are same where they will reflect on a surface of any shape, but ultrasonic is better when comes to range. In robotic and automation industry, ultrasonic has been highly accepted because of its range. 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 give the distance measurement of the obstacle in front of the blind, and then the distance measured is stored in the SD card. We are connecting transmitter and receiver of ultrasonic sensor at pin numbers GPIO 23 and GPIO 24 respectively. Ground and Supply to the pin numbers GPIO 1 and GPIO 3.

For one way distance, formula used:

- Distance = (Duration/2)/29.1
- Speed of sound= 0.0345 cm/microseconds

C. Camera Module

The Pi's camera module is basically a mobile phone camera module. Mobile phones digital cameras are larger more expensive compared to pi's camera. The most important of these, for understanding the Pi's camera, is that many mobile cameras use a rolling shutter to capture images. The notion that the camera is effectively idle until we tell it to capture a frame is also misleading. The camera may seem idle, and your script may be doing nothing with the camera, but still numerous tasks are going on in the background .So when we request the camera to "capture a frame" what we're really requesting is that the camera give us the next complete frame it assembles, rather than using it for gain and exposure then discarding it as happens constantly in the background otherwise. Raspberry pi has a default camera slot where camera is connected. In this project we are connecting pi camera in given slot.

D. GPS Module

GPS module, a very popular, cost-effective, high-performance GPS module with a ceramic patch antenna, an on-board memory chip, and a backup battery that can be conveniently integrated with a broad range of microcontrollers. This module deals with the navigation of blind person from particular source to destination.

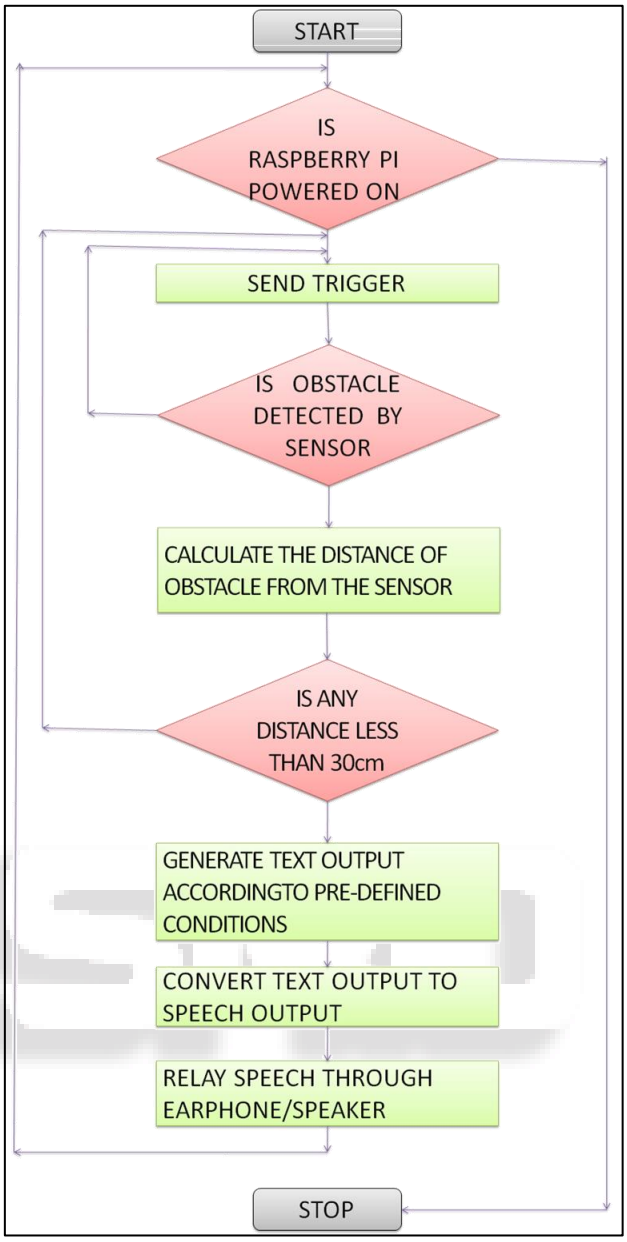

Fig. 3: Flow chart

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.

E. LDR AND Buzzer

The light-dependent resistor or also known as the LDR sensor is the most important piece of equipment in our circuit. Without it, we wouldn't be able to detect whether it is dark or light in the light, this sensor will have a resistance of only a few hundred ohms while in the dark, it can have a resistance of several mega ohms.

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. In this project we are going to use buzzer to

notify the user about obstacle. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. The buzzer will be turned on and turned off depending on the light intensity in the room. This project can also be used for day and night detection.

FIG 3, Shows the working of whole project in short. When we start the build system the ultrasonic sensor gets triggered. It starts the detection of object. If the object is in the distance less than 30cm. camera will send appropriate signal to trigger the camera. Meanwhile, ultrasonic sensor will calculate the distance between stick and person. Camera start scanning the object. Raspberry already has inbuilt library of scanned object. It compares the scanned object with the ones in the library. Then it generates the output according to the predefined condition speech to tell the person about obstacle.

VIII. INTERFACING

Basically we required only monitor, keyboard and mouse. For that we have to connect the monitor and the raspberry pi with HDMI cable. After that power the raspberry pi and it will open login window. Raspberry pi having default username 'pi' and password 'raspberry'.

To interface the raspberry pi with laptop we need IP scanner. We use Remote Desktop Connection to connect raspberry pi to laptop. Before that we have to find out the IP address of raspberry pi for that we can use any ethernet IP address scanner software. Once we get IP address we put that address into the remote desktop connection. After that it will open raspberry pi home window.

We can change the username and password after entering the raspberry pi window.

IX. 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.

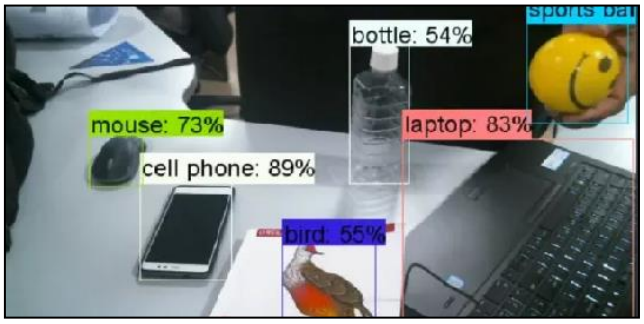

Fig. 4: Observed Image

X. CONCLUSION

The project "smart stick for blind people" is designed to create a system using ultrasonic sensors, GPS module and providing voice command through headphone 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. The system takes measures to ensure their safety. It also aims to solve the problems faced by the blind people in their daily life. The design this smart stick using ultrasonic sensors and GPS with voice output is of great benefit to blind people when it comes to independent mobility.

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 e-Speak text to speech conversion to provide voice command as output. Blind people can easily navigate from one place to another as our product provides voice messages. It is therefore capable of guiding a visually impaired person reach his/her destination.

REFERENCES

[1] David Castells, Joao M. F. Rodrigues; "Object Detectiom and avoidance on sidewalk" Volume-2, JAN 2010.
[2] Donald P. M.; "Optimizing sensor selection" volume 3; 2000
[3] Herdawatie A. Kadir, Ayob Jodhari; "Smart cane: for visually impaired people"; JULY 2011
[4] Mohammad Hazzaz Mahmud, rana saha, sayemul islam, "Smart walking stick – an electronic approach to assist visually disabled person".
[5] S.Gangwar (2013) designed a smart stick for blind which can give early warning of an obstacle using Infrared (IR) sensors, "A Smart Infrared Microcontroller-Based Blind Guidance System", Hindawi Transactions on Active and Passive Electronic Components,Vol.3, No.2, pp.1-7, June 2013.
[6] Han Y. an d Hahn H., "Localization and Classification of Target Surface Using 2 Pairs of Ultrasonic Sensors", IEEE International Conference on Robotic and Automation, Detroit Michigan, pp. 1-2, 22 May 1999.

