Abstract:
The Smart walking stick helps visually impaired people to perform navigation and to do their work easily and comfortably. In a normal stick, obstacle detection is not possible and is not efficient for visually impaired person, because the visually impaired person does not know what type of things or what type of the objects come in front of them. It is difficult for the visually impaired person to move around. In smart walking stick, ultrasonic sensor is used to detect the obstacle. When the obstacle is detected camera turns on and the object is recognized with the help of a camera. If any obstacle is in front of visually impaired person, they will be alerted by the sound generated by the earphone. This is implemented using Raspberry Pi 3 Model B. We have also implemented an SOS system Whenever a visually impaired person feels any discomfort while navigating then he presses an SOS distress call button on the stick to give the current location to his family member via SMS. The system is very useful for people who are visually impaired and are often need help from others.

Index terms: Smart Stick, Object detection, Object recognition, TTS, GPS location.

I. INTRODUCTION

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. The need for assistive devices was and will be necessary. There is a wide range of navigation systems and tools existing for visually impaired individuals. The visually impaired person truly requires a tool for identifying and detecting objects. Visually challenged people face many difficulties in their daily routine. Usually, in many cases, they need to depend upon others, which makes them unconfident in an unfamiliar environment. A global position system (GPS) module, and alert-providing components. Sensors help to detect obstacles, and the user is informed through the earphones. The GPS module is used for Emergency purposes. The system is very useful for people who are visually impaired and often need help from others. Visually impaired 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 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, warning messages via earphone and also provides an emergency distress signal transmission signal to family members with specific location through GPS.

II. LITERATURE REVIEW

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 visually impaired people to provide artificial vision and object detection, real time assistance via GPS module by using Raspberry Pi.

A survey is made among the Visually impaired people finding difficulties in detecting obstacles while walking in the street. Our project mainly focuses on the visually impaired people who cannot walk independently in unfamiliar environments.

The main aim of our project is to develop a system that helps the visually impaired people to move independently. Smart Stick for Visually impaired systems usually consists of three parts to help people travel with a greater degree of psychological comfort and independence: sensing the immediate environment for obstacles and hazards, providing information to move left or right and orientation during travel [3].

Initially, they just depended upon others for their basic needs and mobility. After that, many visually impaired persons used the traditional white cane and trained dog as assistance to guide their path, but they have certain limitations. Although the white cane is inexpensive, it cannot detect obstacles accurately, and it can only detect obstacles by touch, so the user may get less time to react to situations, which is very dangerous for the user. A trained dog is expensive, and though it is an animal, it may have the chance of getting hurt or sick. Thus, these solutions are not so efficient. A large number of research works are being performed by various researchers to provide an efficient navigation aid for visually impaired persons [4].

Smart Stick for the Blind a complete solution to reach the destination. This system uses IR sensor, Ultrasound sensor and water sensor to detect the obstacle. However, this system just gives an alert if any one of the sensors is triggered, it uses a buzzer to alert the blind person. This system does not use any location indicator or object recognition [1].

Pothole detection for visually impaired which uses a camera that captures image 15 frames per second and based on the concept of image processing the pothole is detected. Problem with this system is that a lot of images captured per second increases overhead and storage requirements [2].

Systems use various sensors with different techniques to detect obstacles such as ultrasonic sensors, IR sensors, and sonar sensors. Ultrasonic sensors and sonar sensors are quite related, as both sensors work based on the principle of reflected sound waves, whereas IR sensors work based on reflected light
waves. IR sensors have a drawback in dark conditions, so in bright conditions they have better performance, but sometimes they may fluctuate in various light conditions and also get interfered with from sunlight. Thus, these are some limitations of using IR sensor-based devices [2].

III. PROJECT BLOCK DIAGRAM

The system used as a smart stick has the components as mentioned in Fig. 3.1 below

![Figure 3.1: Block Diagram](image)

The elements of Efficient Smart Stick for Visually Impaired are:
- Power Supply
- GPS Module
- Ultrasonic Sensors
- Pi Camera
- Raspberry Pi 3 Model B+
- Earphone

The Raspberry Pi is the central controller of the system. The Raspberry Pi allows the ultrasonic sensor to continuously measure the distance of the obstacles appearing across it. The ultrasonic sensor calculates the distance by using the time taken for the ultrasonic waves to reach and reflect from the obstacle. If the obstacle is within 50cm range then the ultrasonic sensor sends the signal to the Raspberry Pi. When an obstacle is detected, the Raspberry Pi enables the web camera attached to it. When the camera is activated, the image is captured.

This image is also sent to the Raspberry Pi at the same time and Raspberry Pi contains an image dataset which consists of many sample images of different obstacles. Earphone is connected to the Raspberry Pi to give voice-based communication to the user. When the captured image and the stored image are the same, it gives the output of the object name as voice through the headphone to the user. Whenever the person feels discomfort, he can press a button on a stick and then a message is sent to his family member with his live location using Twilio.

IV. FLOW OF THE CIRCUIT

![Figure 3.2: Flow chart](image)

- When power supply is provided, The Raspberry Pi will get initialized and the Ultrasonic sensors will start detecting Objects.
- If an object is detected, the Pi camera will be turned on and it will take pictures and save the image. It will Execute the image to text conversion using python and save the output and executes text to audio conversion.
- The user will be notified about the object through earphones.
- If the emergency button is pressed by the user, the GPS and SMS containing the location (Latitude and Longitude obtained via GPS) of the user will be sent to a preassigned contact number using the Twilio.

V. IMPLEMENTATION

A. Components Required

1) Raspberry Pi 3 –
This device is the brain of our system. It will handle all the processing and communication of data.

2) Pi Cam –
It is a portable camera specially designed for Raspberry Pi with 8 Megapixels specifications.

3) Ultrasonic Sensors (HC-SR04) –
These are portable sensors which produce ultrasound waves that reflect from the nearby objects and come back to the sensor, which ultimately helps the sensor to estimate the distance of the obstacle.

4) GPS Module –
- Global Positioning System (GPS) makes use of signals sent by satellites in space and ground stations on Earth to accurately determine their position on Earth.
- Radio Frequency signals sent from satellites and ground stations are received by the GPS. GPS makes use of these signals to determine its exact position.
● The GPS itself does not need to transmit any information.
● The signals received from the satellites and ground stations contain time stamps of the time when the signals were transmitted. By calculating the difference between the time when the signal was transmitted and the time when the signal was received. Using the speed of the signal, the distance between the satellites and the GPS receiver can be determined using a simple formula for distance using speed and time.
● Using information from 3 or more satellites, the exact position of the GPS can be triangulated.

5) SOS button –
It is simply a push button which will be involved in switching the mode of operation of the system.

VI. RESULTS

VII. FUTURE SCOPE
It can be further enhanced by using VLSI technology to design the PCB unit. This makes the system compact. Also, use of active RFID tags will transmit the location information automatically to the PCB unit, when the intelligent stick is in its range. The RFID sensor doesn’t have to read it explicitly. The global position of the user is obtained using the global positioning system (GPS), and their current position and guidance to their destination will be given to the user by voice. We can further improve the system by providing live google map navigation through voice signals to the user. We can use solar panels as an alternative power source. The use of solar panel is more advantageous as it uses sunlight to get recharged.

VIII. CONCLUSION
With the proposed architecture the blind people will be able to move from one place to another without depending on others. Which will lead to increased autonomy for the blind. The developed smart stick that is incorporated with multiple sensors will help in navigating the way while walking and keep alarming the person if any sign of danger or inconvenience is detected. The prototype gives good results in detecting obstacles in front of the user; it will be really helpful for the blind.

XI. REFERENCES


