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Smart Stick for Visually Impaired

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***Abstract*— This paper is about providing a compatible solution for visually impaired people and help them to walk independently and confidently. The hardware elements included are Raspberry pi microcontroller, obstacle detecting sensors, GPS module, speakers and other connecting components. That data is then processed and required instructions are given to the blind person.**

Keywords*— *Smart Blind Walking stick, sensors, GPS, Raspberry Pi

I. INTRODUCTION

A concept to provide a smart electronic stick for the visually impaired. Provides features like object detection, real time assistance via global positioning system.

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 receive through audio, along with a voice output for directions.

The proposed solution is a moderate budget navigational aid for the visually impaired. In addition, the system is incorporated with a GPS module that receives the latitude and longitude of the stick's location and sends it to the Guardian of the user. Thus, an mobile application (APP) was created that helps guardians to track contact immediately in any emergency situation.

In this system we are using the Ultrasonic sensor, GPS receiver, Buzzer Voice synthesizer, speaker or headphone and Raspberry Pi

The aim of the overall system is to provide a low cost and 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 objects around them, so that they can walk independently.

II. OBJECTIVE

The main objective is to provide voice based assistance to blind people. In this technology controlled world, where people strive to live independently, this project proposes an ultrasonic stick for blind people to help them gain personal independence. Since this is economical and not bulky, one can make use of it easily.

III. LITERATURE SURVEY

It is a study of relevant literature materials in relation to a topic we have been given. To know the development of a smart stick for blind , we need to go through existing technology related to it.

Brief study and survey has been carried out to understand various issues related to the project .Survey is made among the blind people finding difficulties while walking on the street.Our project focuses on visually impaired people.

The main aim of our project is to provide smart sticks which can avoid obstacles and provide GPS navigation to visually impaired people so they can walk independently in unfamiliar environments.

These are some literature papers

- "An electronic walking stick for blinds" [ref1]
- "Advanced guide cane for the visually impaired people" [ref2]
- "The Prevalence and Causes of Visual Impairment and Blindness among Older Adults in the City of Lodz, Poland."[ref3]
- "Smart Walking Stick for Visually Impaired"[ref4]
- "Implementation of Smart Stick for Obstacle Detection and Navigation."[ref5]

A variety of Electronic Travel Aids and various technologies have been applied for the betterment and safety of the blind society and to guide them by detecting obstacles on the ground,uneven Surfaces, holes, steps and puddles.

1. C-5 Laser Cane

The laser cane has three laser diodes and three photo diodes in it. This laser cane is based on optical triangulation. The photo diodes act as receivers. This laser diode can detect obstacles at head height and up to the range of 1.5m or 3m [1].

2. Sonic Torch

It is a hand held device operated using a battery, it operates by transmitting ultra sound and receiving back the reflected sound. The distance is calculated by using the time taken for the reflection of the ultrasound.

3. Sonic Path Finder

It uses the technology of acoustic difference. It helps the blind people by detecting the obstacles and alarming them. But it does not provide accurate outputs.

IV. SYSTEM DESCRIPTION

This smart stick is an electronic walking guide which has four ultrasonic sensors. Out of these four sensors are used for obstacle detection and are placed on the front and side of the stick. The smart stick gives the output through an earphone.

1) Raspberry Pi

Low cost high performance computer which can be plugged in TV and monitor and can be used as a computer even.

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- Its CPU is 700Mhz single core ARM1176JZF-S,
- It has 4 USB ports
- It has dual core video core iv multimedia co processor
- Size of its RAM is 512mb
- It has micro SDHC plot for storage
- Power rating of raspberry pi is 600mA i.e, 3.0W
- It has 17*GPIO plus the same specific functions
- This raspberry pi works as the computer of the smart walking stick

2) Ultrasonic Sensor

Ultrasonic sensor is a type of sensor that detects an object using sound waves. Its principle is similar to that of radar or sonar, which generates high frequency sound waves and receives it back. Sensors calculate the distance using the time taken for the reception of the echo signal sending the signals and receiving back the echo signals to determine the distance of an object

3) Vibration Motor

A vibration motor is used to inform the user about an obstacle detected by the ultrasonic sensors.

4) GSM/GPS 800L

When GSM modem receives a message the microcontroller will process the message with the keyword saved in it. Then, it will get the location of the stick from the GPS modem and transmit the location to the GSM modem in order to respond to the sender. In case of an emergency, the user of the stick can press the emergency button the microcontroller access the location from the GPS modem and transmit the location to the GSM modem which will send an SMS message to all saved numbers in the microcontroller.

5) Buzzer

A transducer (converts electrical energy into mechanical energy) that typically operates A buzzer is in the lower portion of the audible frequency range of 20 Hz to 20 kHz. This is accomplished by converting an electric, oscillating signal in the audible range, into mechanical energy, in the form of audible waves. Buzzer is used in this research to warn the blind person against an obstacle by generating sound proportional to distance from the obstacle.

V. SOFTWARE REQUIREMENTS

1) Android Studio

Android Studio is the official integrated development environment (IDE) for Google's Android operating system, it is designed specifically for Android development. It is available for download
on Windows, mac OS and Linux based operating systems.

Android is an open source and Linux-based operating system for mobile devices such as smartphones and tablet computers.

VI. PROPOSED SYSTEM

The objective of the project is to assist the blind person to navigate conveniently and independently.

The Hardware unit consists of Raspberry pi, mounted on a PVC pipe to be used as a stick, which is a processing device with more features like wifi, more memory storage, etc.The wifi module in Raspberry pi used to connect with android applications on the phone.User will Enter its destination location into the app using Voice Command Assistance on Android Phone.

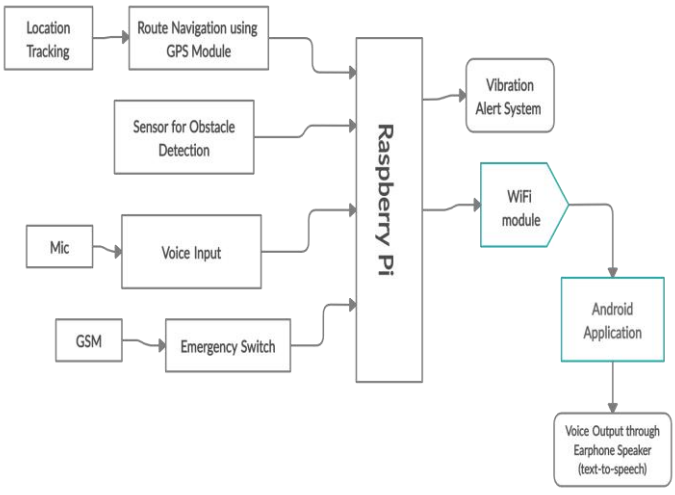
The obstacle detecting sensors, speakers are attached to the Raspberry Pi. The programmed Raspberry Pi then gives the respective instruction about obstacles sensed by sensors. The voice output is generated through TTS(Text to Speech) IC.

The software part consists of an android application installed in the user's phone, which is synced with the hardware module. The user will set the location through the app with voice command, then the GPS will navigate him to the destination set,with the information of obstacle faced by him on the way.The system also has the emergency switch.When a user faces any difficulty or is in a dangerous situation the emergency message will be sent to guardian.Voice interaction will make it easier for a blind person to navigate.

VII. ALGORITHM

STEP 1: Start
STEP 2: connect Raspberry pi to android phone through wifi
STEP 3 :set location on android application of phone
STEP 4: through GPS navigation it will direct through speaker and vibration alert.
STEP 5: if sensor detects obstacles it will vibrate stick and give output through speaker if obstacle at right it will say right through speaker,similar to left and front
STEP 6: if person get emergency he will press SOS button on stick it will send emergency message to person family with location
STEP 7: if person not finding his stick he will find stick using the application
STEP 8:stop

VIII. BLOCK DIAGRAM



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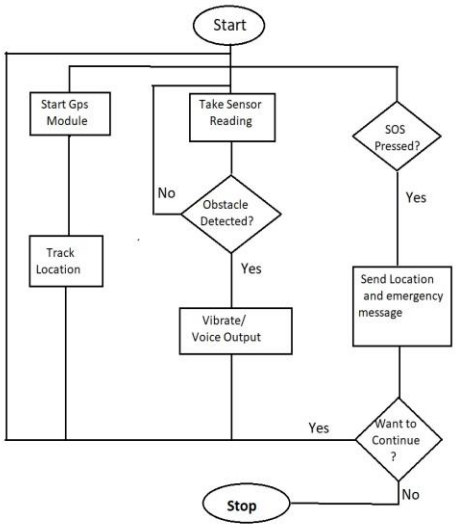
IX. FLOWCHART



X. FUNCTIONAL DESCRIPTION

In the stick, WiFi Module is used for receiving and processing the information received from the Raspberry Pi board.

The stick consists of 3 ultrasonic sensors at the front side to cover the surrounding area (front, left and right side) of a visually impaired person and the sensor's detected distance of the obstacle is sent to the user's headphone via a mobile app. Push button connection of the stick Raspberry pi and WiFi module will be connected to the stick

When any of the three sensors gets a new obstacle in its path then it will automatically buzz the vibration module, if the obstacle is very near the buzzer will go off and User will have to stop.

There is also a push button at the handle of the stick. It is used for the emergency text transmission purpose from the user to its Guardian, and android phone will help in that. There is an android phone to send an emergency text message to two /three family members of the blind person containing the location details of the blind person, if he/she gets lost In mobile application through which the threshold distance of the obstacle can and any three emergency contact numbers can be predefined. So that if the visually impaired person gets lost then he/she can send his/her current location through a push button on the stick.

XI. CONCLUSIONS

This system gives the result for all 270 degrees from the position of the smart walking stick. So this system provides overall support for the blind society in guiding. The broad beam angle ultrasonic sensors help in wide range obstacle detection. The main aim of this system is to act as a secure guard and help the blind to be aware of their surroundings.

Where the Stick acts as a basic platform for the coming generation of more aiding devices to help the visually impaired to navigate safely both indoor and outdoor. It is effective and affordable. It leads to good results in detecting the obstacles on the path of the user in a range of three meters. This system offers a low-cost, reliable, portable, low power consumption and robust solution for navigation with obvious short response time. Though the system is hard-wired with sensors and other components, it's light in weight.

Future work includes the addition of face recognition to find out the people before them.

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