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Smart Stick for Visually Impaired People

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ABSTRACT

Mankind is tremendously surrounded with technology. Technology has a great impact on the social life of humans. It can be merged with other methods to create a solution to a problem. The people with disability can take advantage of technology. One of them is visually impaired people who have to rely on others for different activities. It is tedious for visually impaired people to move safely and confidently without any human help. Existing system was a walking stick which helped them to navigate using GPS and identify distance between them and the obstacle. This proposed system proposes electronic aid for vision loss people by using Internet of things technology that can be used for intercommunication between different sensors by using signals or over network. The obstacle can be identified using different sensors. Thus this system will help visually impaired people to find the way back to home and get instructions about obstacle directly through headsets.

KEYWORDS*: *GPS, Headset, PIR sensor, Microprocessor, stick, Ultrasonic sensor

I.INTRODUCTION

There are approximately 36.9 million people in 2002 are blind according to World Health Organization in the world. Majority of them are using a conventional white cane to aid in navigation. The limitation in white cane is that the information's are gained by touching the objects by the tip of the cane. The traditional length of a white cane depends on the height of user and it extends from the floor to the person's sternum. Blind people have mobility issues. Mobility means the feasibility of moving around unfamiliar environments without any supplementary assistance [1]. Technology can be used to help visually blind people in mobility. Many researches are done to help visually impaired people. Electronic Travel Aids (ETAs) is a device that warns the user with help of some signals either the sound waves or by physical interaction with people [1].

Visually impaired people face problems in navigating from place to another in the town and the only way for them is guide dogs or white canes. The existing system provides an important measure to reduce accidents among blind people in common traffic areas and give away warning to them by creating a great tendency to detect objects and obstacles as blind death has become common due to their inability to see and manage situations in heavy traffic. The proposed system is based on a theoretical model and a system concept to provide a smart electronic aid for blind people. These different units are discussed to implement the design of a "smart stick".

II.LITERATURE SURVEY

1.Navigation Gadget for Visually Impaired Based on IoT

In [1] N.Sathya Mala, S. Sushmi Thushara, Sankari Subbiah suggested that, the portability of visually impaired people is confined by within their surroundings. Moving safely and confidently in a metropolitan area without any human assistance is a tedious work for vision loss people. The paper proposes theoretical model and a system concept to provide an electronic aid for visually impaired people. This work rely on developing a gadget that is, a walking stick and a Bluetooth headset (wearable), for blind people that helps them to find their way in this world.

2. Ultrasonic and Voice Based Walking Stick for Blind People

In [2] D.Sekar, S.sivakumar, P. Thiyagraajan, R. Premkumar, M. Vivek Kumar suggested that, the study hypothesizes a smart walking stick that alerts visually-impaired people over obstacles, and fire, water in front could help them in walking with less accident. It consists of a simple walking stick equipped with sensors to give information about the environment. GPS technology is integrated with pre-programmed locations to determine the optimal route to be taken.

3. Ultrasonic based Cane for Blind and Positioning System:

In [3] S.K. Bhatia, Shete Prasad Ramdas, Shinde Roshan Shukraji proposed that the purpose of this project is to develop the Electronic Travel Aid for the blind people. It will involve the ultrasonic technology to be more useful and reliable compare to the classical cane in order to provide fully automatic obstacle avoidance with audible notification.

4. An Indoor Navigation System to Support the Visually Impaired

In [4] Joselin Villanueva, Rene Farcy implemented Indoor navigation technology is needed to support seamless mobility for the visually impaired. This device provides current position, directions to a destination and information about indoor environment. This paper describes the construction of such a device which utilizes a commercial Ultra-Wideband asset tracking system to support real-time location and navigation information.

5. Optical Device Indicating a Safe Free Path to Blind People

In [5] Villanueva, Joselin, and René Farcy proposed that an active optical pathfinder using a LED and a photodiode is implemented as an electronic travel aid to improve the mobility of persons who are blind. The optimization of path was calculated by radiometric. The results in real configurations such as parked cars, trees, and dustbins are presented too.

III.EXISTING SYSTEM

The existing system combines obstacle detection and help them to get back to their home with the help of navigation system. The headset and walking system are connected by Bluetooth. As soon as the data is received from in the Bluetooth headset, it is converted to text sensing voice recognizer. Then send to walking stick where GPS device is located. The GPS identifies the current location and find the way to their destination.

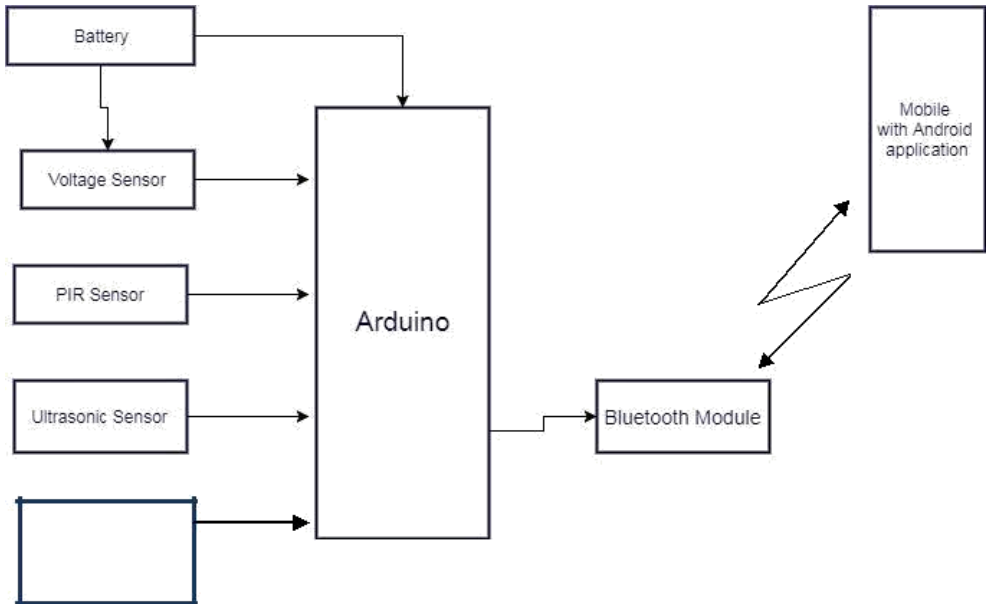
PRODUCT	USE	COST (RUPEES)	DISADVANTAGES
WHITE CANES	Going up or downstairs navigating escalators, finding doorways, helping to find dropped objects.	500-1500	Does not provide any guidance and also it does detect obstacles accurately.
SMART CANES	Electronic travel aid which fits on the top of the white cane	1000-3000	Does not help them to navigate to desired destination
RFID BASED MAPPING SYSTEM	RFID based map-reading system which provides technical solution for the visually impaired to pass through public locations easily using RFID tag grid, RFID cane Reader, Bluetooth interface and personal digital assistance.	Not been widely manufactured. 4500-8000	Development cost is quite high and chances of interference in heavy traffic. Need PDA's to be carried always during navigation.

Table 1: Comparison of Existing Products

IV. PROPOSED SYSTEM:

Objective of project is to help visually impaired people by guiding them in smarter way. The proposed system has smart android application which will give voice notifications to guide blind people by giving directions. The application first take source location of user from his mobile GPS and then user will give his destination by voice command, so the application will recognize voice command and will generate directions for that particular source to destination.

All sensors will be placed on stick of blind person and sensors will continuously send real-time sensor values to application through Bluetooth connectivity. If any obstacle came then application will generate voice commands like turn left or turn right. Also according to directions generated on map, application will generate commands and guide that user in his journey. During this the battery will be continuously sensed and if it reaches below the threshold the user's family gets notified with location.



Speaker/He

adphone

Fig 1: Architecture of System

4.1 MICRCONTROLLER: Arduino receives input signals and can effects its surroundings by controlling lights, relays and other devices. The microcontroller on the board is programmed using Arduino software. [2]

4.2 ULTRASONIC SENSOR: Generating, detecting & processing ultrasonic signals Ultrasonic is the production of sound waves above the frequency of human hearing and can be used in a variety of applications such as, sonic rulers, proximity detectors, movement detectors, liquid level measurement. [3]

4.3 PIR SENSOR: Passive Infra-Red. It passively detects the infrared radiations coming from the human body in the surrounding area.

4.4 VOLTAGE SENSOR: Voltage sensors facilitate monitoring of supply voltage levels. They identify under voltage or overvoltage concerns and help protect critical motors and electronics.

4.5 SPEAKER/HEADPHONE: The input will be taken through microphone and transmitted back through headset. The operation will be done at the system level. [1]

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4.6 BLUETOOTH MODULE: Bluetooth Module is a wireless technology standard for exchanging data over short distances.

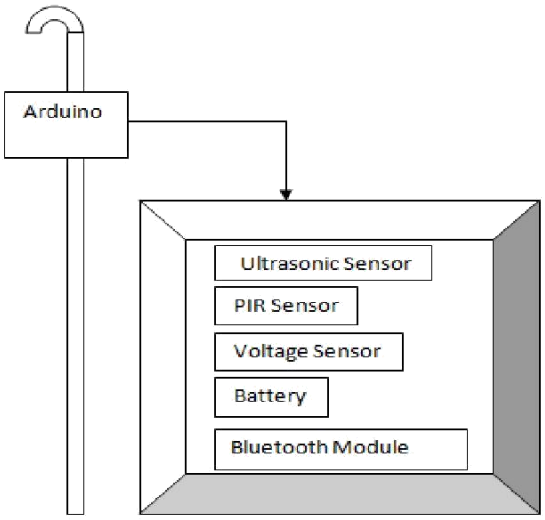

Fig 2: Hardware Setup

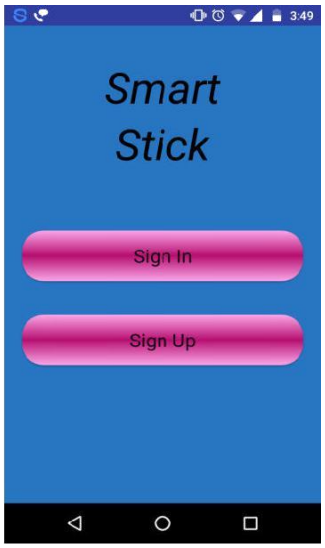

Fig 3: Application GUI

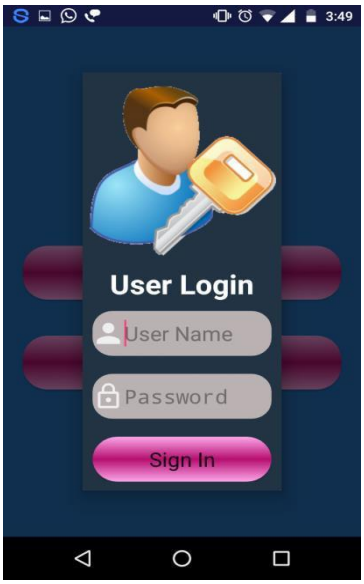

Fig 4: Login GUI

Fig 5: MAP

V.COMPONENTS

1) Registration-Login: Every user will have to register in our application before using our app. IF user successfully registered then he can easily login to system.
2) Authentication: With this feature we are authorizing every user where it is authorized user or not. We will check this with the help of unique username and password.
3) Generating directions: Through mobile GPS we will get source location of user and then user will provide destination using voice command. Through latitude and longitude of this location, directions on Google map will get generated.
4) Generating navigation commands: Through PIR sensor which detects motion of stick, it will generate navigation commands like left or right turn. This feature will guide person in navigation and can easily travel his desired route.
5) Notify on obstacle detection: When user will have any obstacle in between his road or route like then using ultrasonic sensor it will notify that person in voice command.
6) Battery low SMS: Since our smart stick will work on battery, there may be the case that battery will get discharged or get critically low. In this condition SMS will be sent to emergency contacts of that user. SMS will contain lat long values of current location of user and warning alert of battery low.

VI.METHODOLOGY

6.1 Ultrasound sensor distance calculation formula

Time taken by pulse is actually for **to and from** travel of ultrasonic signals, while we need only half of this. Therefore time is taken as time/2.

Distance = Speed * Time/2

Speed of sound at sea level = 343 m/s or 34300 cm/s

Thus, **Distance = 17150 * Time (unit cm)**

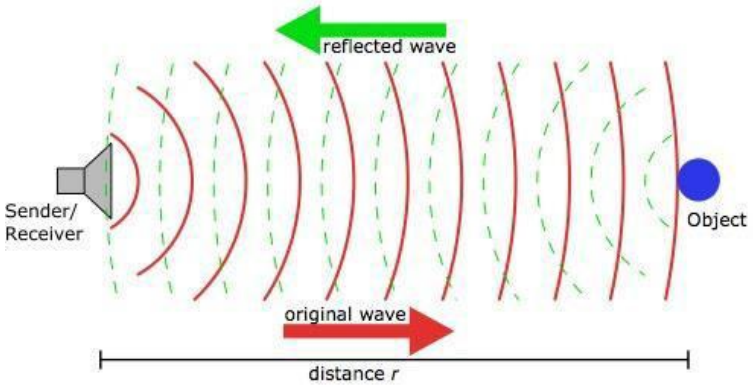

Fig 6: Ultrasonic sensor

6.2 PIR sensor working

```
battery_voltage=Read_ADC_Ch(BATTERY_CH);
battery_voltage=(battery_voltage*250)/4095;
battery_voltage = battery_voltage * 2;
```

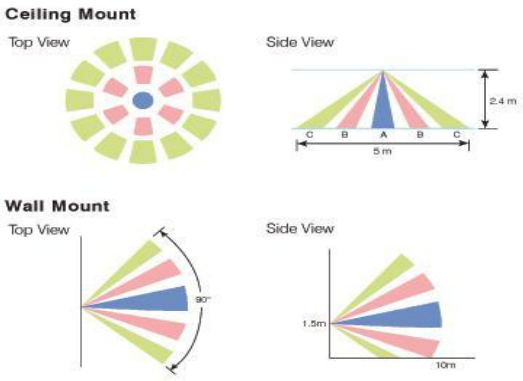

Fig 7: PIR sensor

VII.RESULT

Parameters	Existing System (Navigation gadget system)	Proposed System (Smart Cane System)
Weight	Cane used weighs up to less 57gms	Cane used weighs up to less 55gms
Hardware Components	Walkingstick,Ultrasonicsensor, ATMEGA microcontroller, Headset, GPS Module, Battery, Speech Synthesizer	Walking stick, Ultrasonic sensor, PIR sensor , Arduino, Headset, Voltage Sensor, Battery
Software Used	None	Xampp server, Android studio, Google Map API
Cost	High cost (4500-8000)	Medium cost (1000-3000)
Set of operations	1. To guide blind people. 2. Alert people through vibration.	1. To detect living or non living things. 2. Calculate distance between obstacle and the device. 3. Navigation from source to destination.

		4. Converting distance into steps of user. 5. Notification about user location to friends and family.

Table 2: Result

Software application will have very less size so it will not consume large space on our mobile. Since it is android application it will not have any cost issues, because android is open source language, so in development we will not require any software cost. Only hardware cost will be our project cost estimation. Map results will be based on real time locations of user based on internet connectivity. Notifications will be sent to user's friends and family.

VIII.CONCLUSION

Visually impaired people 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 is used to blind person's navigation and later efforts have been made to improve the cane by adding remote sensor. The smart stick will help the blind person by providing more convenient means of life. The solution developed uses sensors with microcontroller and the application is integrated to make convenient system. The system will notify the user about the distance from obstacle, identify the type whether it is living or non-living and notify the user's friends and family about its location when battery discharges.

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