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Smart Stick for the Blind
A COMPLETE SOLUTION TO REACH THE DESTINATION

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Abstract— Visually impaired people find difficulties detecting obstacles in front of them, during walking in the street, which makes it dangerous. The project concept is to provide a smart electronic aid for the blind people. The system is intended to provide overall detection, real-time assistance through Global Positioning System (GPS). To aid the blind, the proposed solution is a smart stick with an infrared sensor to detect stair cases, a pair of ultrasonic sensors to detect any other obstacles in front of the user within a range of four meters. The ultrasonic sensors are placed at different heights to detect obstacles at different heights. Also, another sensor is placed at the bottom of the stick for the sake of avoiding puddles. The aim of the overall system is to provide a low cost and efficient navigation aid for blind which gives a sense of artificial vision by providing information about the environmental scenario of static and dynamic objects around them.
Keywords—Smart stick; artificial vision; GPS module; sensors

I. INTRODUCTION

Vision is the most important part of human physiology as 83% of the information human being gets from the environment is from the sight. It is difficult for blind people to move or live without help. So, the traditional way is to use white cane to guide them during moving.

Although it might be helpful, it doesn't guarantee saving people from risks. It has two major limitations:

- It can only detect obstacles up to knee-level. Hence, the user cannot detect raised obstacles like elevated bars and frequently collides with them.
- The cane can only detect obstacles within 1m from the user. Also, obstacles like moving vehicles cannot be detected until dangerously close to the person.
- Electronic Travel Aid (ETA) [1] devices have been introduced to be a mobility aid for the blind people.
- ETAs are devices containing sensors that alert the blind about obstacles existence through vibration and sound.

To record information about the obstacle's presence in road, active or passive sensors can be used. A passive sensor just receives a signal. It detects the reflected, emitted or transmitted electromagnetic radiation provided by natural energy sources. An active sensor emits a signal and receives a distorted version of the reflected signal. It detects reflected responses from objects irradiated with artificially generated energy sources. These kind of active sensors are capable of sensing and detecting far and near obstacles. In addition, it determines an accurate measurement of the distance between the blind and the obstacle. Overall, in the obstacle detection domain, three different types of sensors may be used: infrared, ultrasonic and water sensors.
Some advanced systems Global Positioning System (GPS) [2] integration with main system to provide the directions to reach the destination as audio output.

In our work we tried to overcome some of the disadvantages:

- We designed stick to detect obstacles and it's able to recognize and speak aloud the upward and downward stairs or puddles using speech warning message kit.
- With the aid of a Bluetooth earphone the speech warning message kit is able to speak aloud warning message to the blind.
- We use GPS system to direct the blind to his destination.

1.1. Existing System

Existing systems which provides guidance to blind like Guide Cane, Smart vision use ultrasonic sensors or laser sensors to detect obstacles in front of the blind by transmitting the wave and reception of reflected waves. It produces either an audio or vibration in response to detected obstacles to warn blind.

Systems like Sound View use single camera or stereo video cameras mounted on a wearable device to capture images. These captured images are resized, processed further and converted to speech, audio, musical sounds or vibrations. In such systems, the frequency of warning sound signal is correlated with the orientation of pixels. Some systems like UltraCane help blind people by collecting information through sensors and then transmitting recommendations through vibration or sound message to the user.

The above solutions have disadvantages for instance, they can't detect obstructions that are hidden but very dangerous for the blind such as downward stairs, holes etc.

II. PROPOSED SYSTEM

2.1. System Concept

The proposed system consists of two units:
1. The obstacle detection unit
2. The GPS unit

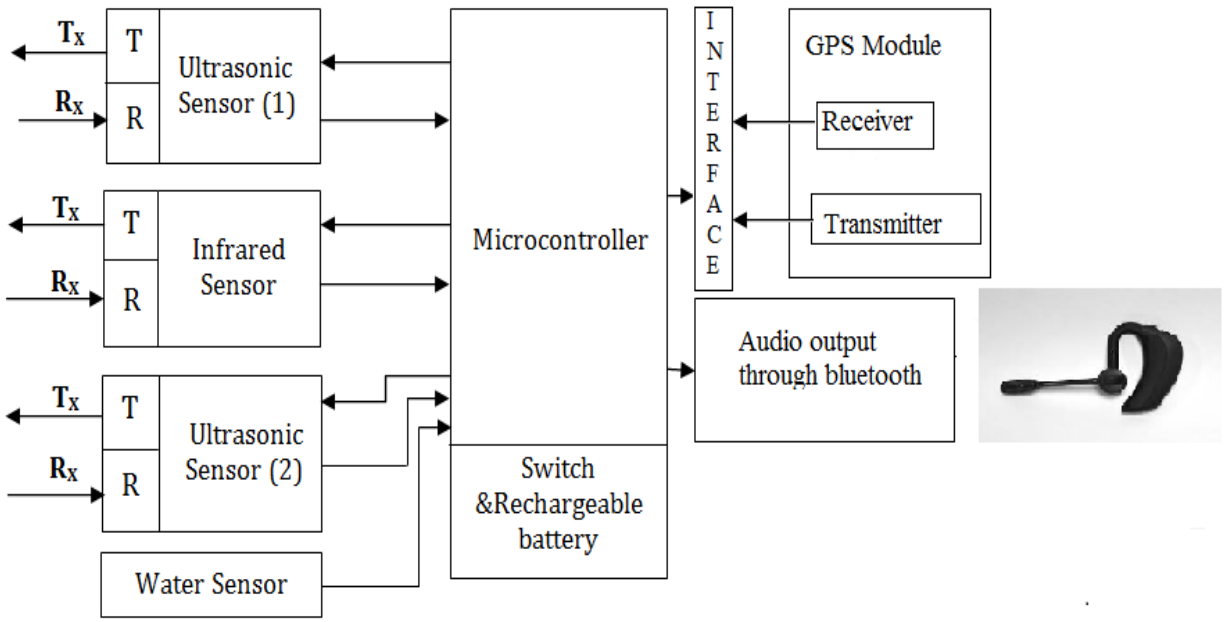

Fig. 1. Block diagram of Smart stick

2.2. Obstacle Detection Unit

This unit consists of sensors to detect obstacles and warn the blind by giving audio output. We use four sensors in the system: an infrared sensor, two ultrasonic sensors and a water sensor.

2.2.1. Infrared Sensor.

It recognize small obstacle but with less accuracy than laser sensor. However, using laser sensor is costly which contradicts our aim in obtaining affordable aiding devices. They perform almost the same within 2 meter.

2.2.2. Ultrasonic Sensor.

It works well for close obstacles. In the design we use two ultrasonic sensors at different heights along the smart stick to detect the obstacles at different heights.

2.2.3. Water Sensor.

It is used to detect water levels inside tanks and very expensive. Our objective is to detect water existence regardless its level.

2.3. GPS Unit

The interface to GPS system is given at the top of the stick. Voice or touch input is given to GPS system [2] and the shortest destination route is guided to the blind through voice output.

III. SYSTEM DESIGN

The smart stick, as shown in Fig. 2, is basically an embedded system integrating the following: pair of ultrasonic sensor to detect obstacles in front of the blind from ground level height to head level height of the stick in the range of 400 cm ahead, infrared sensor to detect upward and downward stairs, water sensor for detecting puddles. The sensors collect the real-time data and send it to the microcontroller for processing. After processing, the microcontroller invokes the right speech warning message through a Bluetooth earphone. The system is powered by a rechargeable battery

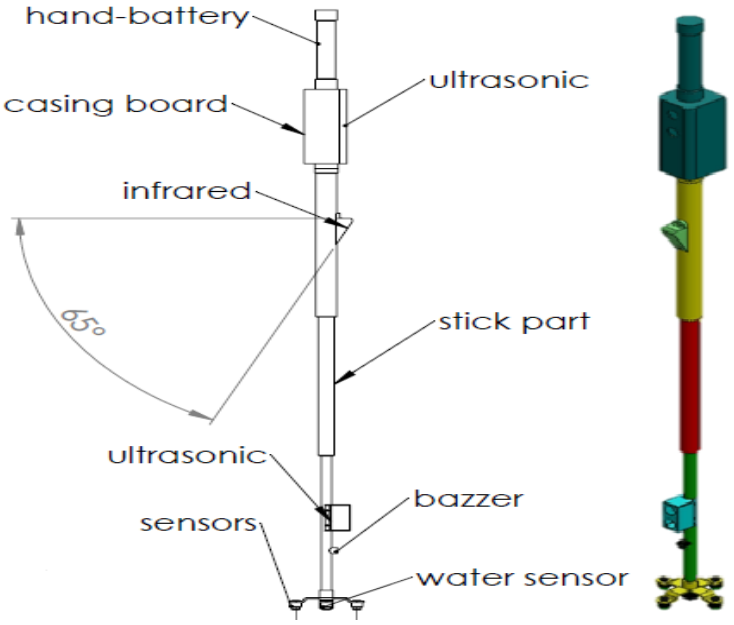

Fig. 2. Design of Smart Stick

The GPS based blind device with user input interfacing get alert the blind person when he reaches his destination by voice. This consists of microcontroller module, GPS Unit and a voice

module to generate voice output. It stores the data of the current location which it receives from the GPS system, so that it can make use of the data stored to compare with the destination location of the user. By this it can trace out the distance from destination and produce an alarm to alert the user in advance.

3.1. Sequence Diagram

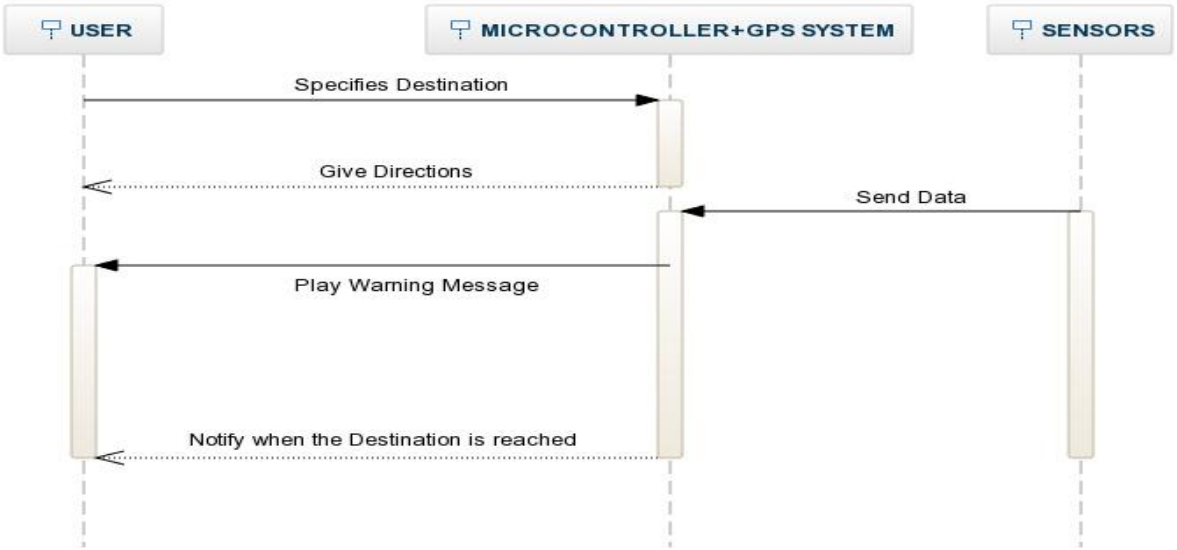

Fig. 3. Sequence diagram

IV. CONCLUSION

The paper proposed provides the design of a smart stick, which helps visually impaired people in making them self-reliant while travelling. It guides the blind person with directions to reach his/her destination using GPS system. This system provides a robust way of detecting obstacles of different sizes and at different heights with the help of infrared and ultrasonic sensors. The system provides a real-time assistance in navigation of the blind to reach the destination using GPS (Global Positioning System). It enables voice output to direct the blind person to his/her destination through Bluetooth earphone. The proposed design is cost-effective, safe and secure.

A prototype of the proposed design is being prepared currently to enable complete navigation from source to destination.

REFERENCES

[1] "Effective Fast Response Smart Stick for Blind People"- By Ayat Nada, SamiaMashelly, Mahmoud A. Fakhr, and Ahmed F. Seddik
[2] "Smart stick for Blind: Obstacle Detection, Artificial vision and Real-time assistance via GPS"- By ShrutiDambhare
[3] "Assistive Infrared Sensor Based Smart Stick for Blind People"- By Ayat A. Nada, Mahmoud A. Fakhr, and Ahmed F. Seddik
[4] 'Smart' Cane for the visually impaired: Design and controlled field testing of an affordable obstacle detection system.