Blind's Mate- A Navigation System for Blind People

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ABSTRACT

Visually challenged people rely on companions around them on daily basis. Basic chores of day to day life pose a challenge for people with impaired vision. Walking on streets while dodging obstacles and navigating through roads to reach desired destination independently is one such challenge. Proposed system 'Blind's Mate' is a combination of software and hardware technology that can be used to improve the walking experience of blind people. Blind's Mate is a combination of smart stick and a mobile app that can alert people of impending obstacles and water pits while providing audio feed to the users about obstacles encountered during walking. This stick is embedded with ultrasonic sensor to detect any obstacles in front of the user. The app gives live feed to the user continuously via earphones. Speech warning messages are activated when any obstacle is detected. The proposed stick is of low cost, has fast response, low power consumption, light weight and an effective means to help blind people finding their way on streets with ease.

Keywords: Smart Stick, Mobile App, Audio Feed, Ultrasonic Sensor, Speech Warning, Low Cost

I. INTRODUCTION

Blind or visually impaired people often find difficulties while walking on the streets. With so many obstacles present around them, being able to walk safely to their desired destination isn't exactly a piece of cake. Often, visually challenged people need to rely on their friends or companions in order to help them reach their destination safely.

But luckily, owing to the advancements in the field of technology, this doesn't pose to be a problem anymore. Keeping the concerns of blind and visually impaired people in mind, we have come up with the idea of a 'smart stick'.

Visually impaired people are the people who can't identify smallest detail with healthy eyes. Those who have the visual acuity of 6/60 or the horizontal extent of the visual field with both eyes open less than or equal to 20 degrees, these people are considered blind[1]. As described in [2] such people are in need of aiding devices for blindness related disabilities.10% of blind have no usable eyesight at all to help them move around independently and safely.

The electronic aiding devices are designed to solve such issue. To record information about the obstacles presence in a road, active or passive sensors can be used. In case of a passive sensor, the sensor just receives a signal. It detects the reflected, emitted or transmitted electro-magnetic radiation provided by natural energy sources. In case of using an active sensor, the 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 [3].

Overall, in the obstacle detection domain, four different types of active sensors may be used: infrared, laser, ultrasonic, in addition to radar sensors [4].

Table 1.1.General Characteristics of some active sensor

	Laser	Infrared	Radar	Ultrasonic
Principle	Transmission and reception of light waves	Transmission and reception of pulse of IR light	Transmission and reception of pulse of microwave	Transmission and reception of pulse of acoustic wave
Range	SLR: 15cm to 120cm LLR: about 10- 50 m	From 20 cm to 150 cm	About 15-200 m	From 3 cm to 10 m
Beam Width	Narrow	Fairly thin	Depended on size of antenna	Wide
Atmospheric Condition	Affected	Affected	Affected	Not affected
Cost	Very high	Low	High	Low

The proposed system called 'Blind's Mate' consists of a smart stick. This smart stick comes equipped with sensors that would help with obstacle detection and hence, let the blind person know whenever an obstacle arises in his path. To make things even easier, there is an Android app to go along with the stick. Whenever an obstacle is detected, the app would let the blind person know about it via voice instructions. The blind person needs to wear earphones for this purpose.

The main motivation behind this project is to help blind or even visually challenged people to get to their destination safely and with ease. The proposed system is an effective as well as low cost aid for the visually challenged. The sensors are very quick in detecting obstacles and respond immediately.

II. METHODS AND MATERIAL

For setting up the hardware part of our project, we first gathered all the hardware components. To program the hardware components, they are to be attached to the different pins of the Arduino Uno one by one. A hardware component (for example, ultrasonic sensor) is first attached to the Arduino Uno. Then, the Arduino Uno has a USB port to which a USB cable is attached and the whole thing is then attached to a laptop/ PC. After opening Arduino IDE on the laptop/ PC, the following hardware component is programmed. This is how the programming of all hardware parts is done. The language used for programming is C.

After all the components were programmed, we took all the components and attached them to the different pins of Arduino (every hardware component was attached to a particular pin which was the same pin that we used while programming) with the use of jumper cables. All the components were then integrated on the stick.

- The system contains components like Arduino Uno R3 microcontroller, Ultrasonic sensors are object detectors, Wi-Fi module ESP 8266, moisture sensor, buzzer and vibrator motor.
- The whole system is powered by with regulated DC power supply. Either a transistor battery of 9Volts or an adapter of 12Volts, 2Ampere can be used to power the system.
- A micro-controller does all the work of detecting ultrasonic signals and sending back respective messages to the blind person [5].
- An ultrasonic sensor is used to detect the obstacles in front of the blind to alert the user.
- Arduino Uno is a connecting interface used to mount the sensor and output indicators such as buzzer and vibrator.
- The stick apparatus is connected to the mobile application via the Wi-Fi module ESP 8266.
- One pair of moisture sensor probes are used along with calibrator to detect the presence of moisture or water.
- Audio instruction will be given to user via earphones to alert the user about obstacles.

A. System Requirement

(a) Arduino Uno

Arduino is an open source, computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world [6].

(b) Ultrasonic Sensor

Ultrasonic sensors are devices that utilization electrical– mechanical vitality change, the mechanical vitality being as ultrasonic waves, to gauge separate from the sensor to the objective question. [6]

(c) Moisture Sensor

Soil moisture sensors are used for measuring the water content of soil. Multiple soil moisture sensors are combined to form a soil moisture probe.

(d) Buzzer

A buzzer or beeper is an audio signalling device, may be mechanical, electro –mechanical. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke [7].

(e) Vibrator Motor

It is the smallest DC vibration motors, perfect for lightweight applications or where space is at a premium. They include miniaturized DC coreless motors with eccentric masses, both in cylindrical and coin form.
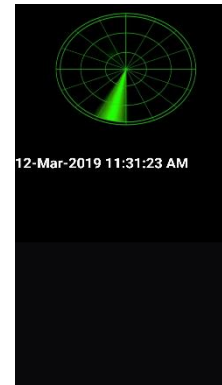
B. System Architecture
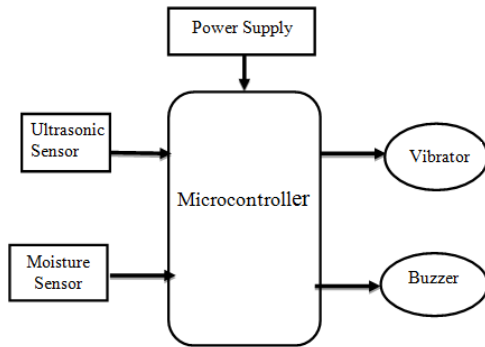
(f) Architecture

III. RESULTS AND DISCUSSION

The proposed stick comes with an android app that reflects the status of the stick by providing timely alerts.
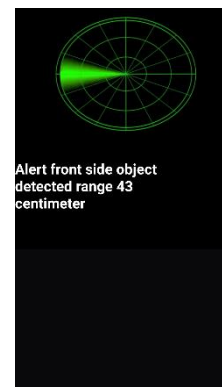
C. App Interface

Module 1:

When you'll open the Blind's Mate app, you'll be greeted by the screen as shown.

This will indicate that the app is connected to the stick through hotspot.
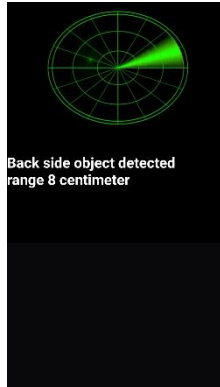
Module 2:

When an obstacle is detected by the front ultrasonic sensor, the stick vibrates.

The software equivalent of this action is as shown at the screen.

The blind person gets an audio feedback "Alert front side object detected" along with distance from the obstacle.
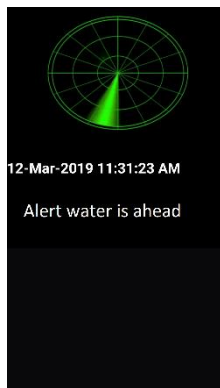
Module 3:

When an obstacle is detected by the back ultrasonic sensor which is for pit holes or ditches, the stick vibrates.

The software equivalent of this action is as shown at the screen.

The blind person gets an audio feedback "Back side object detected" along with distance.

Module 4:

When the probes of the moisture sensor detect presence of water at the bottom end of the stick, the stick sets the buzzer off.

The software equivalent of this action is as shown at the screen.

The blind person gets an audio feedback alert about the presence of water.

IV. CONCLUSION

The designed system is highly efficient along with being user friendly. The system is very easy to use and hence, can easily be used by blind persons without any assistance. With the help of this system, visually challenged people can travel to their desired location without having to worry about getting there safely. The sensors are super quick to detect obstacles and respond too, making the stick highly proficient. The stick is well co-ordinated with the app, making the system work in an extremely efficient manner. This system also promotes independency as the need for another person to constantly accompany them is removed.

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