Automated Mobility and Orientation System for Blind

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Abstract – *Now-a-days, blind people use a traditional cane as a tool for directing them when they move from one place to another. Although, the traditional cane is the most wide spread means that is used today by the visually impaired people, it could not help them to detect dangers from all levels of obstacles. In this context, we propose a new intelligent system for guiding individuals who are blind or partially sighted. The system enables blind people to move with the same ease and confidence as a sighted people. The system is linked with a GSM-GPS module to pin-point the location of the blind person and to establish a two way communication path in a wireless fashion. Moreover, it provides the direction information as well as information to avoid obstacles based on ultrasonic sensors. A buzzer, an accelerometer sensor and Pit sensor (IR) are also added to the system. The whole system is designed to be small, light weight and is used with the white cane.*

Key Words: GSM, GPS, Ultrasonic Sensor, Pit (IR) Sensor, Accelerometer, AT mega Microcontroller, Buzzer.

1. PROBLEM DEFINITION

Walking stick or cane is the most important equipment needed by the blind people for mobility. The conventional stick used by them which is a long white cane that is relatively easy to use, light weight and not expensive. However its range of detection is very limited and it is only used to detect the object which is near to the user. The user has to tap the ground or the object to detect the obstacle. The disadvantage of the conventional cane is its failure to detect obstacles outside of its reach.

The visually challenged people can avoid the object better if the walking stick can produces audible warning when there is an object in the specific range of distance. This kind of travel aid is able to alarm them about the object in front of them by producing sound when the distance sensor detects the object in the specific distance range. Moreover, it would be great if able to locate and trace the position of blind person which has been satisfied by our proposed system.

2. LITERATURE SURVEY

Many people with serious visual impairments can travel independently, using a wide range of tools and techniques. A huge number of research works are being performed in various institutions across the globe to provide with a cost effective and efficient navigation aid for the blinds. Initially the visually impaired persons were assisted by sighted persons for their basic needs and mobility.

Tools such as the walking cane can be a great help to them to move freely. Mostly the cane used by the visually challenged people is a white cane with a red tip which is the international symbol of blindness. White cane can detect obstacles present on the ground, pits, uneven surfaces and also steps. White canes are made up of very light materials and provide an ease of carrying it as it is foldable and easily fits into ones pocket. As a result, the initial cost for white cane is very less. But speaking of overall cost, the case is not the same. A user requires a practice session of about 100 hours to get comfortable with the device so that he can walk safely and properly.

Figure 1: White Cane with Red Tip

Then came the era of guiding dogs. Some people employ guide dogs to assist in mobility. Guide dogs are assistance dogs trained to lead blind or vision impaired people around obstacles and to indicate when it becomes necessary to go up or down a step. However, the helpfulness of guide dogs is limited by the inability of dogs to understand complex directions.

The user is able to feel the behaviour of his dog, analyze the situation and also give him appropriate orders. But guide dogs are not affordable, about the price of a nice car and their average working time is also limited, around an average of 7 years.

Figure 2: Blind Man with Guide Dog

Laser cane is based on optical triangulation by three laser diodes and three photodiodes acting as receivers. These photodiodes are silicon photodiodes. The cane is capable of detecting obstacles at head level; ground level as well as in-front of the user. The device can detect obstacles in between a range of 1.5-3.5 m ahead of the user.

Figure 3: Laser cane

There are several disadvantages attached with use of a laser cane. . The photodiodes used at the receiving ends are most likely to respond to various ambient temperatures. Moreover, in hot and smoky areas the efficiency of the cane drops drastically. The use of laser cane can be harmful if proper precautions are not taken and can affect the eyes of an individual without any proper eye wear. But this solution was not effective researchers put their effort and designed a number of Electronic Travel Aids (ETA).

3. PROPOSED SYSTEM

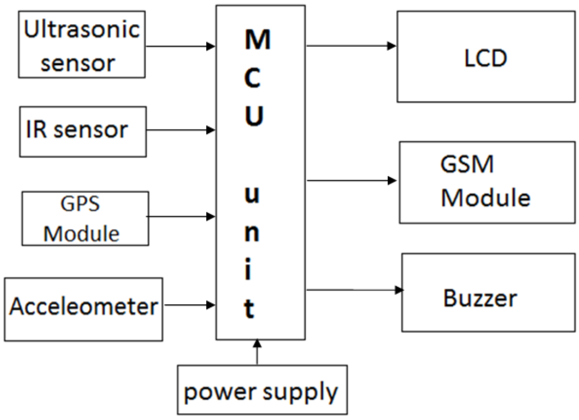


Figure 4: Block diagram

4. HARDWARE DESCRIPTION

Ultrasonic Sensor:

Ultrasonic sensors are proximity sensors that are able to measure distance of objects, within the specific range and without any physical contact. It works on a principle similar to radar or sonar which evaluates attributes of a target by interpreting the echo from radio or sound waves respectively. Ultrasonic sensor generates high frequency sound wave and evaluate echo to determine the distance from an object. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

Figure 5: Ultrasonic sensor

Accelerometer Sensor & Pit Sensor:

By sensing the amount of dynamic acceleration, the accelerometer can find out how fast and in what direction the blind is moving. If it rotates around X or Y axis, a vibration signal will switched on, then a buzzer signal is switched on and SMS message will be sent including the location of the blind. IR sensor is simply used for pit sensing purpose that varies its output in terms of voltages sensed by controller as per the distance down to the stick.

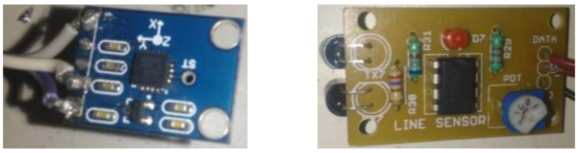


Figure 6 : Accelerometer & Pit sensor

GSM & GPS Modules:

The Global Positioning System (GPS) and Global System for Mobile communications (GSM) are interfaced to the microcontroller to detect the blind person location .The proposed architecture consists of a GPS signal receiver and GSM, vibratory circuitry connected to Microcontroller. This complete setup will be fixed to stick. The GPS will be sending the location information to the controller continuously. The same will be routed to the GSM modem through the controller. GSM will forward this information to the pre fed mobile nos. the user after receiving the message.

Figure 7: GPS & GSM module

5. WORKING PRINCIPLE

The main part in the system is the microcontroller that controls other components in the system. When the ultrasonic sensors detect any objects or obstacle in 180 degree path it will activate the buzzer. In addition to that, GPS continuously track the location of blind person and send co-ordinates of blind to the GSM modem via microcontroller. When the GSM modem receives a message it will get the location of the stick from the GPS modem and transmit the location to the visualized person.

In case of an emergency, the user of the stick will press the emergency button and the signal from the button will go to the microcontroller which will get the location from the GPS modem and transmit the location to the GSM modem which will send a SMS message to the saved number in the system. On the other part of this system, there are two sensors three-axis accelerometer sensor and IR sensor. Three-axis accelerometer sensor plays an important role in tracking the co-ordinates of the blind stick and IR sensor is simply used for pit sensing purpose that varies its output in terms of voltages sensed by controller as per the distance down to the stick.


Figure 8: Hardware implementation

6. FLOWCHART

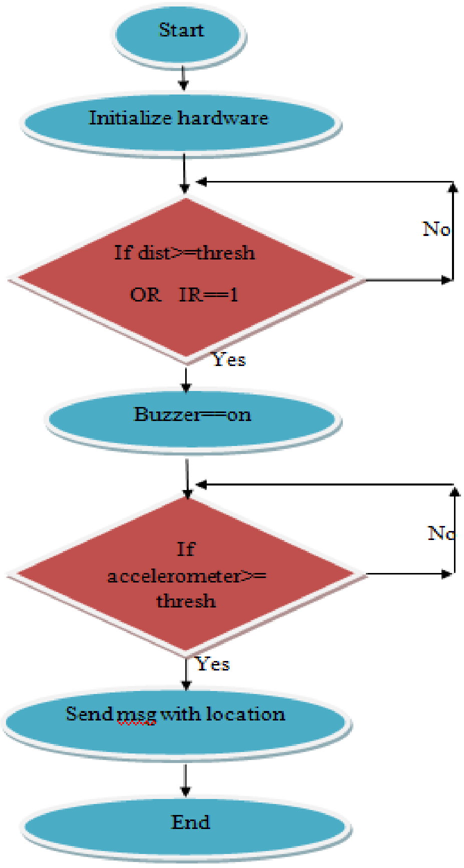


Figure 9: Flowchart

7. RESULTS AND DISCUSSIONS

Ultrasonic Sensor:

Ultrasonic sensor actually provides distance ranging from 2cm to 3m as shown by lcd d=55cm in the fig.

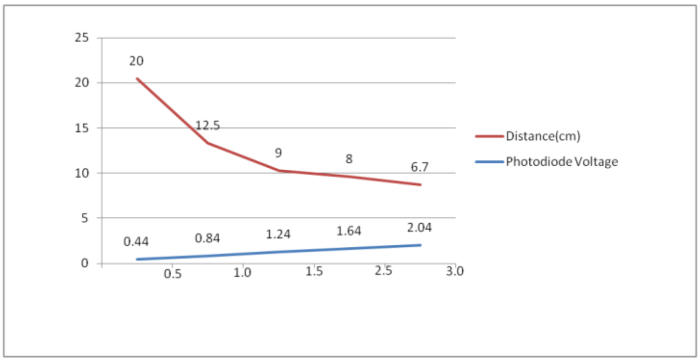
Accelerometer Sensor:

The different readings for an accerometer sensor in case of tilting and straight position resulted are shown in table and fig as well as follows:

Position	Accelerometer Readings
Straight	330
+ve Tilting	390
-ve Tilting	274

Figure 10: Results for Accelerometer & Ultrasonic sensor

PIT (IR) Sensor:



Above Graph shows that as output voltage of photo diode increases, distance goes on reducing which is located on X and Y axis respectively.

8. CONCLUSIONS

Most of blind people do not refer electronic guides previously, and make use of conventional canes or guide dogs only. This is due to relatively highly cost and not being to provide service to users with existing electronic systems. That's why we developed a cost effective and easy to use system for blind people. This approach is providing an alternating way in order to replace the conventional methods of guiding blind person. This system is implemented with Ultrasonic sensor, Accelerometer sensor, GPS receiver and GSM transmitter.

Even though, this system is not being able to receive GPS signals in indoor regions and also delays in responding because of GPS. Since GPS delays in receiving data from satellite side.

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BIOGRAPHIES

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