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Use of ultrasonic sensors, GPS and GSM technology to implement alert and tracking system for Blind Man

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Abstract

There is number of blind people in the society, who are suffering while exercising the basic things of daily life and that could put lives at risk while travelling. So to provide them with necessary equipment we use the technology for human welfare, so came the idea of this research in the design of obstacle detecting system using ultrasonic sensors and providing details of his location with the help of GPS via SMS to his/her relative.

1. Introduction

With the increasing population and development there are a number of obstacles which occur and can cause collisions which is a big threat to blind people. It is a necessity these days to provide security and safety to Blind people. There have been few aids and devices designed to help the blind.

There are certain devices which are used today for helping the blind. The basic ideas used were the white cane, and Guide dogs. White cane is the most successful and widely used travel aid for the blind. White cane purely mechanical device is used to detect obstacles on the ground, uneven surfaces, holes, steps, and other hazards. The main problem with this device is that users must be trained in its use for more than 100 hours; in addition, the white cane requires the user to actively scan the small area ahead of him/her. The white cane is also not suited for detecting potentially dangerous obstacles at head level. Guide dogs are very capable guides for the blind, but they require extensive training, and they are only useful for about five years. Furthermore many blind and visually impaired peoples are elderly and find it difficult to care appropriately for another living being.

Technology provides the solution to all sorts of needs of the human today; therefore applying the existing technologies can provide a solution to the stated problem. There are these two systems, System for localization and Positioning of vehicles using GPS and GPRS Technology and Device using ultrasonic sensors for blind and deaf person combines voice alert and vibration properties. These are being developed for sending command to the system in the form of SMS by system registered Cell phone and the system responds to it by transmitting its current co-ordinates in the form of Latitude and Longitude using a reply SMS to same Cell phone. And the device uses the sensors to detect obstacles within the designed range to avoid the blind person through the issuance of distinctive sound.

Therefore using these concepts we come up with an idea of designing a device which could alert the blind person and also get information about his location using GPS and provide the same to his relatives via SMS using GSM technology.

This project presents a theoretical model and a system concept to provide a smart electronic aid for blind people. We design an intelligent device which alerts the person on occurrence of obstacles based on distance between the person and the obstacle. Here, this intelligent device not only alerts but also traces the location of the person and informs the current position of the person to his/her relatives.

2. Literature Survey

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

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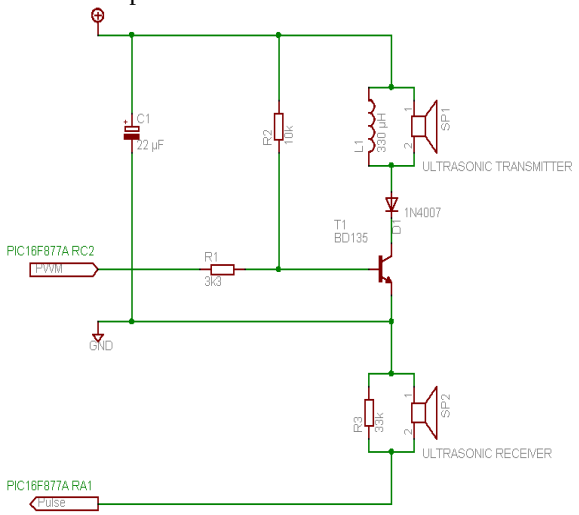
from radio or sound waves respectively. Ultrasonic sensor generates high frequency sound wave sound evaluate echo to determine the distance to an object.

Ultrasonic rays are used because of following properties:

1. Ultrasonic rays do not cause harm to human body as infra red rays do.
2. They are not affected by atmospheric condition like temperature, pressure and humidity.
3. They are operated at the frequency of 40 to 50 kHz which is frequency of RF signal.
4. Ultrasonic rays travel at the speed 330m/s i.e. speed of light.

Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be used for measuring: wind speed and (anemometer), fullness of a tank, and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water.



To measure the amount of liquid in a tank, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultrasonography, burglar alarms, and non destructive testing. Systems typically use a transducer which generates sound waves in the ultrasonic range, above 20,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed. Apart from distance measurement, they are also used in ultrasonic material testing (to detect cracks, air bubbles, and other flaws in the products), Object detection, position detection, ultrasonic mouse, etc.

GPS (Global Positioning System) is a worldwide radio navigation system formed from a constellation of 24 satellites and their ground stations. GPS uses these "man-made star" as reference points to calculate positions accurate to a matter of meters. Advanced forms of GPS make measurements to better than a centimeter. Devised by the U.S. Department of Defence for fleet management, navigation, etc. Although the U.S. military developed and implemented this satellite network as a military navigation system, it soon opened it up to everybody else.

A GPS receiver's job is to locate four or more of these satellites, figure out the distance to each, and use this information to deduce its own location. This operation is based on a simple mathematical principle called triangulation or trilateration.

3.0 System Architecture

Going through the various existing systems mentioned above we come to know the benefits and drawbacks of all the systems referred. Taking into consideration all these factors we aim at making a device which helps the blind person in all possible way. Hence, we design a device which is capable of detecting obstacle and tracing the location of the blind person. The requirement of our device is to sense the obstacle; to obtain the location of the device and provide this information to the relative of the blind person using the device.

Therefore, to implement the requirements; we need a sensors to sense the obstacles and the sensors we will be using for this purpose will be ultrasonic sensors; also the blind person must be made aware of the obstacle if its nearby. Hence, we will be using buzzers to alert the blind person if the obstacle is nearby. To locate the position of the blind person GPS will be used and SMS will be sent using GSM to the relatives of the blind person.

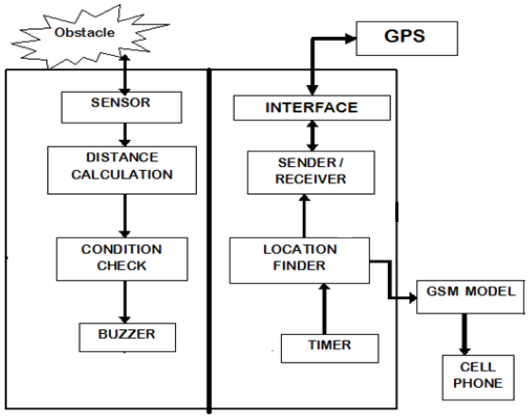


Fig: 1. Block diagram of proposed system

The system in this paper is designed in two parts: First module is for sensing the obstacle and alerting the blind person. And the second module is of tracing the location of the blind person and at the same time sending an SMS to the relative of the blind person about his location.

Module 1: This module consists of microcontroller, ultrasonic sensors, and buzzers. The microcontroller controls the functioning of the sensor and buzzer; and it is also responsible for functioning of these devices.

Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

The module which we will be using has 3 pins that are VIN, GND and signal. VIN and GND are connected to power the module. Signal pin work as in I/O pin to trigger the signal for transmitting the ultrasonic pulse and output the electric counter part of the received signal. An ultrasonic pulse is sent at time 0. The pulse is reflected by the object. The sensor receives the signal back. It converts it into an electrical signal and output to signal pin. When the echo signal is faded away, the next pulse can be sent away. The time period between two pulses should be not less than 50ms.

We need to program the sensors to calculate the distance of the obstacle in front of the blind person. This sensor sends a ping at a given moment and receives the ping bouncing back on an obstacle at another given moment. A ping is nothing but a sound that is inaudible for the human heart. The sensor sends a ping at a time given and receives the bouncing ping at a time t2. Knowing the speed of sound the time difference $\Delta t = t2 - t1$ can give us an idea of the distance of the obstacle.

Module 2: Here, in this module we will be working for tracing of the location of the blind man using GPS. This module is basically functions in decoding the data sent by the satellites into GPS which contain the position, speed etc. of the device. Here we only need the position; we can obtain them via latitudes and longitudes.

In this module we will be designing a system for sending the location of the blind person via SMS to his/her relative. We will be using a GSM system, and to make it function we need to program it and will be making use of certain algorithm for GPS, GSM based system.

4.0 Result Expected

The practice range of blind device is (15-115 cm). The expected results of system are with distances (15-35 cm) alert signal should be continuous as there is no safety distance between person and obstacle. While in distances between ranges (40-80 cm) the alert signal fast when the obstacle closed near from person.. When the distance increased to the range (85-115 cm) the vibration of device will be slow because the obstacle became near from blind and they should be avoided this obstacle.

Table: 1. The Range Of Blind Device.

D, cm	T, sec	S (Alert signal)
15	0	Continuous beeps
35		
40	0.75	Fast beeps
80		
85	1.75	Slow beeps
115		

D: distance between device and obstacle in cm, T: time between impulses in sec, S: alert signal.

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