International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 2 225 - 227

Automated Mobility and Orientation System for Blind Person

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***Abstract*—** This paper is intended to provide a model for object detection and real time assistance via Global Positioning System (GPS).This paper aims at the development of an Electronic Travelling Aid (ETA) kit to help the blind people to find obstacle free path. This ETA is fixed to the wheel chair. When the object is detected near to the blind it alerts them with the help of voice play talkto which speakers are connected . Ultrasonic sensors are used to evaluate distance of the objects around the blind person and to guide the user towards the secure and available path. The hardware of entire system contains ARM7 (LPC2148),ultrasonic sensors and voice input kit, speakers, Global positioning system (GPS) module and Global System for Mobile (GSM) module.

Keywords*-ARM7, ultrasonic sensors, GPS, GSM.*

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I. INTRODUCTION

Mobility is the main problem usually faced by blind people. About 90% of the blind people find difficulty in navigating on their own. This people require some kind of navigational help. This method propose such a navigational aid to help the blind people to travel around easily. There are various navigational aids which are already in existence. These are white canes, guide dogs etc. Long white cane is a traditional tool used to detect obstacles in the path of the blind person. The guide dogs are assistance dogs, trained to lead the visually impaired around obstacles. The use of white canes depends on the surrounding situation and also on the user. Guide dogs are also limited in their usage as training a guide dog is time intensive Different methods are available to measure the distance of obstacle from blind person. One of the methods is by means of ultrasonic sensor. Many applications are available in the field of robotics and self - propelling vehicles. Self propelling vehicles are very much used in industries that are totally dependent on automatic machines.

15 million blind people are from India and37 million across the globe. There should be a system which would make life of blind persons very much easier. The main objective of this project is to provide guidance to the visually impaired person and also gives location of blind person to his parent. In this way the visually impaired and blind people can live an independent life. The first part of the paper provides information about the ultrasonic sensors based on the output waveform whose pulse width varies with round trip delay time of sonic pulse or distance measured[1].

II. LITERATURE REVIEW

In [1] Author proposed an ultrasonic method with temperature compensation to reduce the error in distance measurement using sensors. In [2] an obstacle detection system using ultrasonic sensors and USB camera based visual navigation was used, identification of human presence was done based on face detection and cloth texture analysis. In [3] a survey was done on various ETAs available based on features and performance parameters. In [4] the author designed a Navigational system that uses RFID technology, GPS and compute. In [5] a device was designed based on multisensory strategy and smart signal processing. In [6] a smart phone based ultrasonic wireless ranging and collision detection and warning system was designed. Bluetooth technology and a smart phone along with Text to Speech Feature was used. In [7] RFID based walking stick was designed which facilate blind person during walking on a sidewalk. In [8] a bus detection mechanism for the blind in travelling from one place to other using RFID system was developed. In [9] IR sensors with microcontroller and Vibrating motor Alarm was designed. In [10] analysis of ultrasonic sensor in ETAs was done. In [11] the device contains a sonar module and an IR sensor with microcontroller architecture and 5 LED based attention system was developed. In [12] the author proposed a stereo vision based wearable device consist of a computing device, camera and earphone subjected in a helmet. In [13] author analysed a number of methodologies and multisensory strategies to handle the security of people with depressed receptors. In [14] the author proposed method for position estimation of surfaces with IR sensors. In [15] the author explains the influence of temperature, pressure and humidity on ultrasonic sensor distance calculation. In [16] a point to point distance measurement using ultrasonic sensor was developed and result were tested on six types of obstacles.

III. METHODOLOGY

This paper contains a method to implement a mobility aid for blind person. Model contains signal processing unit with ARM7 (LPC2418) microcontroller which receives information about distance from ultrasonic sensor and gives alert to the blind person using voice play back kit through the speaker. Global Positioning System module is used to find the location of blind person and after pressing a switch is pressed message is transmitted through SMS to parent of blind person about the position of person ..

IV. SYSTEM ARCHITECTURE

The system contains ultrasonic sensor as the input units. Different types of ultrasonic sensor are available in the market and in a given system HC-SR04 is used respectively due to their low cost and great features over other sensors. Ultrasonic sensor measures the round trip delay which is directly proportional to output pulse width. The microcontroller unit provides an interface between sensor and computer. The power unit provides power to all devices. The block diagram of proposed system is shown in Figure1

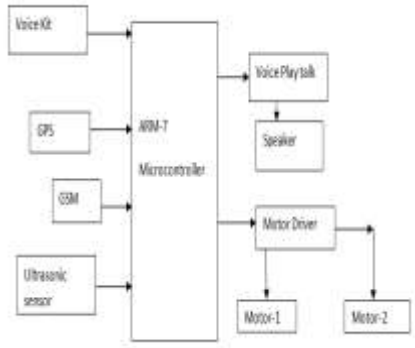

Figure: 1Block diagram

The microcontroller unit triggers the ultrasonic sensor and receives echo. The microcontroller collects distance information from ultrasonic sensor. The microcontroller requires 5v TTL signal and the computer provides RS-232 signals. For TTL to RS-232 and vice versa conversion we require MAX-232 IC. The details about the obstacle is conveyed through the speaker. The GPS system is used to find the location of the blind person .GSM is used to send the msg to the blind person family member. The blind person can also give the voice input and travel to place he wants through the GPS technique.

V. PROPOSED HARDWARE DESIGN

A. ARM7 LPC2148 MICROCONTROLLER..

To make obstacle detection system for visually impaired people respond faster, it should be equipped with advanced microcontroller to decrease computational complexity. LPC2148 was chosen to detect any switch triggered and generate the audio sounds. it is preloaded with many inbuilt peripherals making it more efficient and a reliable option for the beginners as well as high end application developer. Full Speed device, multiple UARTs, SPI, SSP to I2Cs, and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. It does not have an operating system and simply runs the program in its memory when it is turned on. The system is featured by its small size and low cost when it is compared with other systems that use separate microprocessor, input/output devices, and memory. Microcontroller operates at +3.3V which can be regulated using the voltage regulator (L7805) which conserves voltage at +5V if the input voltage for it exceeds +5V input power is converted to 3.3V using 1117 IC.

B .ULTRASONIC SENSOR

Distance of obstacle depends upon speed of ultrasonic and time required for its traveling. If the time required in traveling the pulse from ultrasonic sensor to obstacle and return back to sensor can be measured, then the measurement of distance can be done. This is achieved by using an ultrasonic module. The output pulse width will vary in proportional to the distance travel by the ultrasonic wave. The principle behind ultrasonic distance measurement is that the sensor sends an ultrasound wave that reflects back when it hit the object on its path. As the wave bounces off, it travels back to the receiver end of the sensor (as shown in Fig.2).

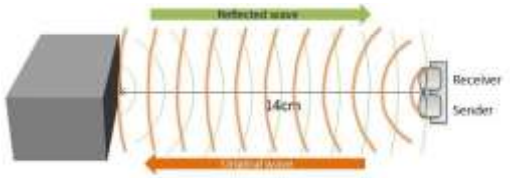

Fig.2: Ultrasonic Sensor uses Sound Waves to Measure Distances.

The sensor measures the time it takes for the emitted wave to travel from a sender to the object and back to the receiver. Knowing the round-trip travel times and the speeds of the wave in the medium, ultrasonic devices calculate the distance that the sound travelled. We use the following equation to calculate the speed of sound.

Distance that sound travels = speed of sound in the medium x time that sound travels
That is, for calculating the distance that sound travels;
distance = velocity x time.

Hence, the distance between the sensor and the object is one-half the distance travelled by the sound wave.
Distance between sensor and object = 0.5 X distance that sensor travels

The above equation is used to determine the distance between the sensor and the object. The sensor transmits an ultrasonic wave and returns an output pulse that is directly proportional to round trip delay. By measuring the pulse width of output wave, the distance to target can easily be calculated. Ultrasonic sensor consists of 4 pins. These are Trigger, OUT, VCC and GND as shown in fig.3

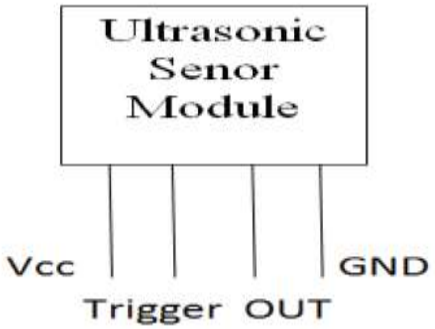

Figure: 3 Ultrasonic sensor module

GND and VCC are ground and supply pins. Trigger input receives 10µs trigger pulse module generate 8 ultrasonic burst of 40khz. ARM 7 LPC2148 will make this pin HIGH then delay for about 10 µs and make pin LOW again. OUT pin gives the Output pulse width depending

upon distance travel. After the trigger is given to LPC2148, it measures pulse output on OUT pin. Timing diagram of ultrasonic sensor output wave is shown in Figure. 5.1[1].

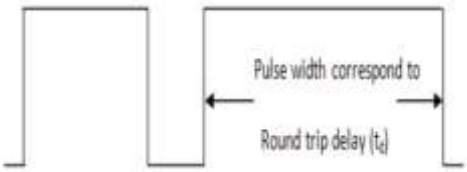

Figure:4 Ultrasonic sensor output wave

Ultrasonic sensor has three pulses first is a short pulse which is transmitted as input pulse. Second pulse is the pulse reflected by an object and third pulse is the signal that the sensor receives and converts it to a pulse of variable duration[9].

C. SPEAKERS.

Speakers is the main indicators of the designed system through which the blind can easily determine the shape and material of surrounding bodies around him/her by amplifying the predefined signal. There are two speakers: left and right. If the blind person receive the sound from left speaker then there is an object on the left side, and when person receive from the right, it means that an object is on the right side of blind person .When both speakers give the output , it means that the obstacle is in front of blind. Another advantage for speakers is their small weight and size, so they do not constitute a burden to blind.

D .VIBRATION MOTOR DRIVER.

L293D is quad push-pull drivers designed to provide bidirectional drive current up to 1A or 600mA per channel. All channels are TTL-compatible logic inputs, and each output is a complete totem-pole drive circuit with Darlington transistor sink and pseudo- Darlington source. The main function of L293D in this system is to control the current that is delivered to vibration motor using an enable pin that is connected directly to LPC248. Vibration motor indicates how much the detected body in range is closer to blind in both left and right sides, and when the vibrator works with the left or the right speaker, then it indicates that there is a body in front and left or right according to speaker that was working.

VI .CONCLUSION

In this paper, we have presented new intelligent system for guiding individuals who are blind or partially sighted, and described how the system can be used to enable these people to move with the same ease and confidence as a sighted people. The system is designed to receive the data from the sensing. We have integrated the ultrasonic sensor data in order to detect obstacles, and to obtain more detailed regarding the blind's environment. Evaluations of the system that we have to be developed can be conducted by attaching the prototype to the wheel chair.

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