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Obstacle detection glasses

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Abstract

This paper presents a we arable glasses with an ultrasonic sensor to help blind or partially sighted people navigate safely by themselves. The purpose of this article is that by using this project, blind or partially sighted people can move more confidently and recognize obstacles. The current method of statistical community research is sampling and virtual space tools, validation and final review and diagnostic analysis. Findings include system design and analysis, processing and control, system analysis and test review. The result is that this system is useful to help people who are blind or do not have a normal lifestyle and can do their daily activities independently with this system. This system is simple, portable and easy for the blind to use on a daily basis.

Keywords: Sensor glasses, mobility aid, sense obstacles, sense sight

Introduction

problem statement

Due to the exponential growth of population and industrialization in urban areas, physically disabled people have to rely more on able-bodied people for their daily activities. This increased dependence on a certain group of people and constant attention to the needs of others is very difficult for the people who rely on them. This is what happened with the detection of obstacles in glasses. They allow the visually impaired to move about independently and actually find their way around some small things rather than having to push non-impaired people for the minor needs they may want. be fulfilled [1].

Sensors are devices whose function is simply to detect some kind of input signal from the physical environment or environment and respond appropriately to the input signal and situation. These input signals can be heat, light, motion, pressure, or any other of a number of environmental phenomena. The response of a sensor, the output, is usually a signal that is processed through electronic transmission over a network, or converted into a human-readable display signal at the sensor location A sensor usually transmits certain types of energy, such as ultrasonic waves or light beams, and detects if an object in the path of transmission interrupts the flow of energy [1].

The importance of the subject

This work will show how sensors will revolutionize the way people see the visually impaired and open anew gateway to more productive impacts on the society from them, and also how it can spark a series of inventions and discoveries in order to help other disabled communities too become more useful to the society and less of a de ad weight. Compared to previous works in this area, this project allows for flexibility and integration with other devices that serve a similar purpose of being mobility aids. It has no complex functions or interface that might cause distress for the user, as it is very easy to use and operate. This device comprises of lightweight materials that do not cause stress or weariness on the wearer. It is very cheap and easy to produce and even more marketable as compared to its counterparts in the market.[2].

Research objectives and hypotheses

The goal of this project is the possibility of flexibility and integration with other devices that perform the same purpose of mobility assistance. This system does not have any complicated functions or interfaces that may cause user discomfort, as it is very easy to use and operate. This device is made of lightweight materials that do not cause stress or fatigue to the wearer. It is very cheap and easy to produce and it even sells more than its counterparts in the market. [2].

Literature and history

A sensor is a device that detects changes in quantity. A specific quantity can be light, heat, motion, distance, gases and pressure. It provides a corresponding output, generally as an electrical system that can be controlled. Most sensors in use today are able to communicate with an electronic device that performs the measurement, calculation and re-encoding. The first sensor invented was the electric thermostat type sensor by Warren Johnson, which entered the market in 1883 [3]. This thermostat was able to maintain the temperature within a degree of accuracy. Later in 1940 infrared sensors were introduced. This was followed by the invention of the motion sensor, which was used by Samuel Bango for an alarm system. This sensor used ultrasonic frequencies to determine the position of a person in a room and then used it to calculate the movement of the stars. These motion sensors were widely used in World War II with me. Mines placed underground detonate when they sense movement on the surface. Non-modern technology in radar is used to track enemies and helps air traffic control to prevent aircraft accidents [4].

In the research field of visually impaired people, various advances have been made in the field of smart glasses and ultrasonic sensors. Mohammad H. Mahmood, Rana Saha and Saimol Islam developed a smart walking stick to assist visually impaired people with primary locomotor assistance using a micro controller [5].

This hardware includes a microcontroller with a sonar ping sensor, a distance sensor, a wet detector, a micro pager engine, and additional equipment. This blind assistance system can be designed to use a portable and classic device that can be mounted on a regular white cane or blind stick. Another research by Jinqiang Bai, Shiguo Lian, Zhaoxiang Liu, Kai

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Wang, and Dijun Liu presented a simple multi-senso rbased obstacle detection algorithm [6]. It uses a depth sensor and an ultrasonic sensor to solve the problem of detecting small obstacles as well as transparent obstacles. Further research was presented by Dania Abdul Rasool and Suzanne Sabra on Mobile Embedded Smart Guide for the Blind [7].

This smart guide integrates several different technologies into a portable housing consisting of a Bluetooth antenna, a sensor, a central processing unit, a memory and speakers. The sensor of the device sends a signal to the mobile application when it detects any solid object in the moving path. Then the mobile device notifies the user and gives him an alarm to change his route and take the right route. Interviews and surveys with doctors and a group of blind people at an organization for the disabled in Kuwait, where the patent is currently held, helped. Received very positive feedback about the success of using the device. Rohit Agarwal, Nikhil Lada, Mohit Agarwal et al. invented a device that consists of a pair of glasses and an obstacle detection module embedded in its center. A processing unit, a beeper and a power supply are included. The obstacle detection module and the output device are connected to the processing unit. With the main purpose of these glasses being easy to use, light weight, user-friendly and cheap, these glasses clearly help them avoid obstacles [8]. Feng Lan, Guangtao Zhai, and Wei Lin wrote a paper on a smart glasses system with voice input for instructions and guidance through wireless bone conduction headphones. They claimed that this system would help visually impaired people gain more independence in their daily lives [9].

Research method

The current method of statistical community research is sampling and virtual space tools, validation and final review and diagnostic analysis, which is related to the research on glasses for blind people, for the spatial analysis of blind people, which is considered as a practical method as well as a basic method. In this way. Research tools including Windows Linux, Word 2021, Photo shop 2023, Adobe PDF 2021, internet search engines, scientific sites have been used in the media space.

Findings

Design and Analysis

In the proposed system we introduce an ultrasonic sensor and its importance for design of spectacles models for helping the blind persons. Ultrasonic sensor is used to detect the obstacles in the path of the blind, we use Power supply at sensor section, which is used for supplying electrical or other types of energy to an output lo ad or group of loads is called a power supply unit or PSU [10].

The present system uses an on-board minicomputer named as AVR 8-bit micro controller, which consists of number of input and output ports. The input and output port of the micro controller are interfaced with differentin put and output modules depending on the requirements [11]. The current system uses Ultrasonic sensor smodule, as input to the micro controller and the buzzer as output module. In other words, the micro controlleracts as a communication medium for all the modules involved in the project. The system also performs a healthcheck indication of the microcontroller using LED indicators [12].

Analysis

This section presents how the device works and which patterns have been developed to inform the user of itsown localization. Obstacle detection is one of the main problems to solve to ensure safe navigation for blindusers. We use the multi sensor architecture of our system to develop new obstacle avoidance abilities.The process starts when power is supplied to the device. As the device boots up its operating system, ittriggers the ultrasonic sensor to start sending burst signal. All the sensors are triggered at approximately the same time thus, there is very less delay. After the signal returns back to the receiver of the sensor as an echo the device calculates the time taken from transmitting and receiving the echo. Using this time we calculate thedistance of an obstacle from any of the sensors. Next, it checks if any of the distance calculated is less than theminimum distance specified that is 0.7m in our case. If none of the sensors have distance less than theminimum distance, the entire process starts again. However, even if one of the sensors detects distance less than 0.7m, it triggers the pre-defined conditions.[12].

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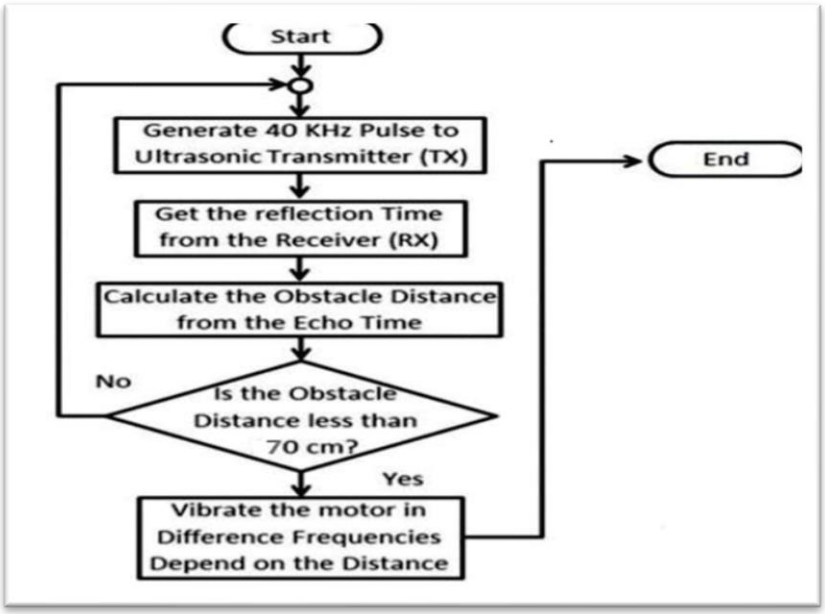

Fig.1. Flowchart of the Working Principle

The ultrasonic sensor we use here is HC-SR04 which contains 4-pins. To first pin power supply is given,the second pin is connected to P2.1 pin of controller to trigger ultrasonic rays, fourth pin is connected to groundand third is connected to P2.2 pin of controller which receives echo's when any obstacle is detected byultrasonic rays the rays gets reflected and reflected rays is received by the this third pin and gives indication tocontroller obstacle is present in that direction. Once it detects the obstacle the controller will give voice alertinformation through voice and play back circuit. Thus we can easily identify any obstacle present around theblind people [13].

Processing and Control System

Ultrasonic sensors work on a principle similar to sonar, which evaluates attributes of a target byinterpreting the echoes from sound waves respectively. Ultrasonic sensors generate high frequency soundwaves and evaluate the echo, which is received back by the sensor. The time interval between the sent signaland received signal is determined to measure the distance from an object [13].

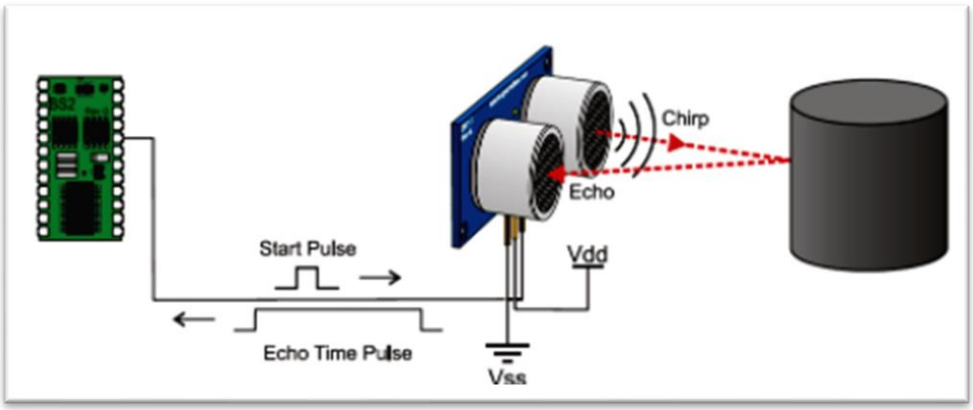

Fig.2. Working Principle of the Ultrasonic Sensor

The HC-SR04 Ultrasonic Module has 4 pins, Ground, VCC, Trig and Echo. The Ground and the VCCpins of the module needs to be connected to the Ground and the 5 volts pins on the Arduino Board respectivelyand the trig and echo pins to any Digital I/O pin on the Arduino Board[14].

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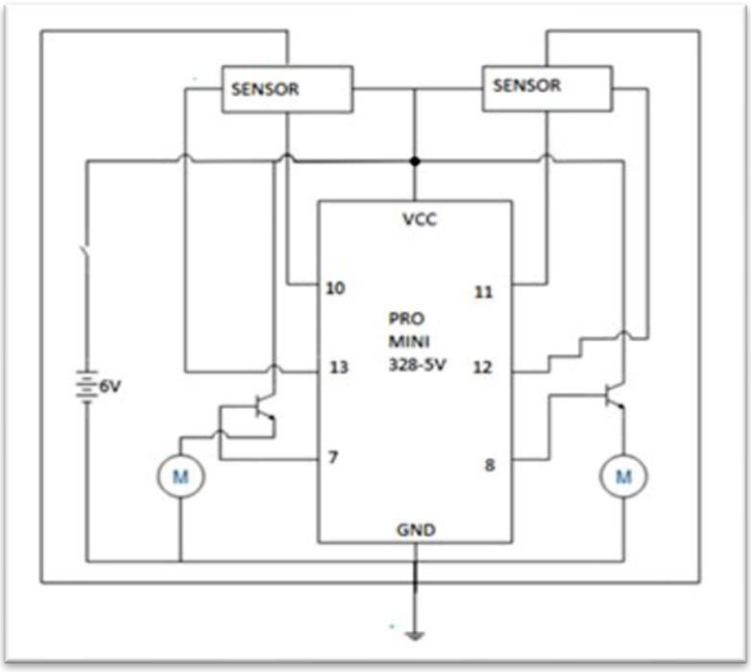

Fig.3. Schematic Diagram of Design

Analysis

This project looks at an obstacle detector that is easy-to-use, with minimal effort, and lightweight forvisually impaired persons.In the figure given below, we can see that with the assistance of two ultrasonic range sensors (5) on eachside of the glasses giving haptic feedback on the relative distances on both sensors through the two vibratingmotors (4&6), in order to assist and allow the wearer to position him/herself towards the center of an indoorpassage. These connections are possible through the presence of the Arduino Pro Mini Chip (1), with powersource from the battery (2). The switch (3) is added to the system in order to turn off the power of the system,when the gadget is not in use. Finally, transistors (7&8) are used to make the motor produce vibration[14].

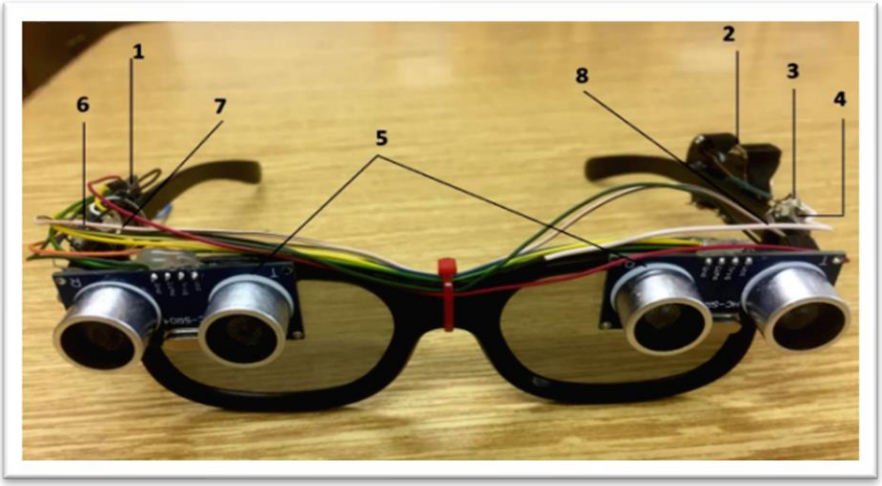

Fig.4. Frame Design and Positioning of component

The tests run on this device were successful as they achieved the following results:

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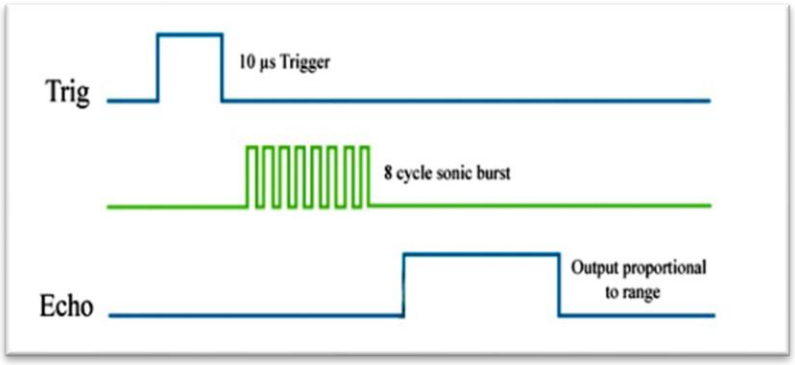

Fig.5. Trigger and Echo Relation 1

As observed from figure 3, in order to generate the ultrasound you need to set the Trig on a High State for10 µs. That will send out an 8 cycle sonic burst that will travel at the speed sound and it will be received in theEcho pin. The Echo pin will output the time in microseconds the sound wave travelled[14].

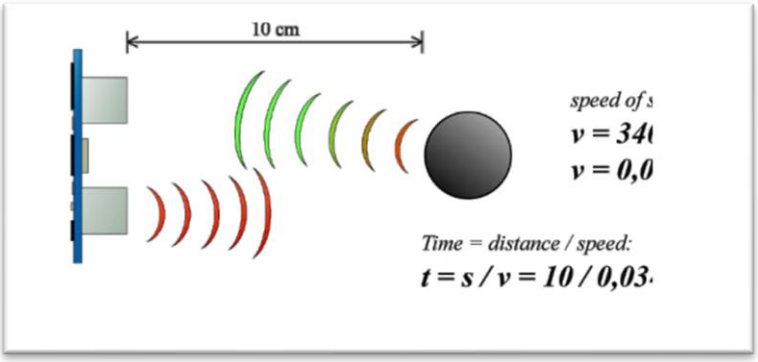

Fig.6. An Example of Trigger and Echo Relationship

For example, we noticed from figure 4 that if the object is 10 cm away from the sensor, and the speed ofthe sound is 340 m/s or 0.034 cm/µs the sound wave will need to travel about 294 u seconds. But what you willget from the Echo pin will be double that number because the sound wave needs to travel forward and bouncebackward. So in order to get the distance in cm, we need to multiply the received travel time value from theecho pin by 0.034 and divide it by 2 [14].

Table 1. A table showing the variation of Intensity and frequency with respect to change in distance

Distance	Vibration Intensity	Freq.
<2cm	No vibration	--
30cm	High	208.33Hz
50cm	Medium	133.33Hz
70cm	Low	83.33Hz
>70cm	No vibration	--

From Table 1, it can be seen that the closer the object to the sensor, the higher the intensity and frequencyof vibration of the motor. From 2cm to 35cm, high intensity was recorded, and 65cm to 70cm gave low vibration intensity. Distances less than 2cm and greater than 70cm are out of range and therefore, no vibration will occur[14].

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Table 2. A table showing the variation of speed and corresponding response with respect to change in surface

Surface	Speed in Media	Response
Glass/Hard	4540m/s	Very Fast
Wood	3960m/s	Fast
Person/Tissue	1540m/s	Medium

From Table 2, we notice that the harder the surface/object, the faster the time of response of the sensor.

- Some surfaces (soft/permeable) can absorb some or part of the transmitted wave and make the system
- response slow, while some surfaces (solid/hard) reflect the transmitted wave instantaneously.

Review of Test Results

1.All the components of the device worked in cohesion and no errors recorded by the sensor from thecomputer readings.

2. The device was able to measure the distance with every turn at ultrasonic speed and in turn, sent afeedback to the Arduino, which triggered the motors in due process.

3. As programmed on the microcontroller, whenever an object was with 2-70cm from the user, the motors vibrated. As the obstacles get nearer, the frequency of vibration increases.

4. Stair location was conceivable with the gadget. A proximity alarm cautioned the user, to keep them from running into obstacles.

5. The power supply battery lasts for 2 hours plus standby time. This is the area where improvements needto be made.

The given figure below shows the side view of the arrangement of some of the components of the obstacle-detecting glasses[14].

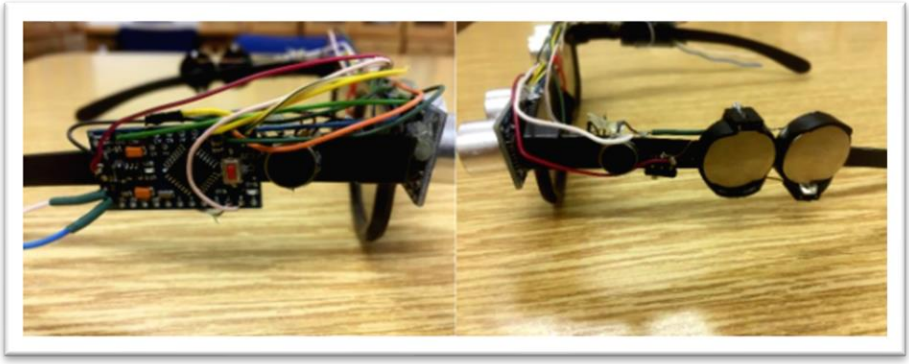

Fig.7. Side view of the Glasses

The results

Conclusion and discussion

In this paper, the designed system uses the integration of sensors and motors to help the visuallyimpaired navigate through obstacle while traversing. This system is fashioned to perform the action ofobstacle detection and also warn of the proximity to detected obstacle. It serves as what is called a 'MobilityAid', to assist those who are visually disabled, have what is close to a normal lifestyle and perform certaindaily activities independently. With this in mind, the information system is simple, portable and easy to use.With some improvements in the hopes to extend the up time and make it last longer. There is also works inprogress to add voice feedback to the users so as to still make things easy for them. These upgrades wouldinclude a GPS tracker and Bluetooth function so as to be integrated into an automated wheelchair and thetechnology can only skyrocket from there.To conclude, it is clear that not all users will be able to grasp this kind of technology, as most of themobility still relies mainly on their feeling of their environment and through natural instincts. However, theproject and research can actually open up the flood gates to new sets of advancement in human developmentas it aims to bring disabled people back into the society, as most they have become a discriminated section ofthe modern day community.It is worth mentioning that the result of this research is consistent with the researchers of this article and has no contradictions

Proposals

Due to the small size of the tool, this system can be installed in other tools used by the blind, such as canes, so this tool can be installed on clothes, etc., the circuit of this system can be made smaller, other sensors can also can be added to this circuit.

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