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Research Article

Third vision- Gloves for blind using Ultrasonic sensor

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Abstract

One of the most important senses possessed by the human species is vision. From the survey of WHO, 39 million people are blind all over the world. It is a quite miserable statement. The main problem for visually impaired people is their navigation and movement. Currently used ways by blind people to overcome this problem are by using a white cane and specially trained dogs, but it requires proper maintenance and high cost. This project works by detecting an obstacle and alerting the person. A key feature of this project is alerting the person by audio assistance. There will be recorded instruction audio files. Based on the obstacle's height and width sensed by the device, appropriate audio will be sent to the end-user using a mesh network for communication. By implementing this project, blind people can understand and think about what kind of obstacle it is, its size, and the distance between the obstacle and that person. It is compact and easy to carry, does not create any kind of disturbance to the environment and surrounding people.

Keywords: Visually impaired; Blind; Mesh network; Audio assistance; White cane.

Introduction

According to the World Health Organization, there are nearly 285 million people with some form of visual impairment out of which 86% people have low vision and 14% people are blind [1]. Vision is one of the most important senses to humans to survive. One of the biggest problems faced by the visually impaired is navigating from place to place, be it indoors or outdoors [3]. Further, the adverse conditions of the roads make it even more difficult for them to walk outdoors.

They have to be alert at all times to avoid consequences like colliding with stable or moving obstacles, ascending or descending staircases, slipping down wet terrain [5]. Using the Ultrasonic sensors, blind people can detect the objects in a five dimensional view around them and can easily travel anywhere [6]. When the Ultrasonic sensor detects obstacle the device will notify the user through audio assistance.

For sensing the distance the system uses a HC-SR04, a Ultrasonic Range Finder Distance Sensor Module [8]. The sensor module is designed to measure the distance using the principle of SONAR or RADAR, of using ultrasonic wave to determine the distance of an object. The Ultrasonic sensor here used as a transceiver. The ultrasonic waves are emitted by the transmitter when the objects are detected [10].

Existing system

Existing systems like canes can guide blind people by helping them detect the obstacles in their path through touching/poking. Alternative to the above method some other aids include smart belts, smart rings, smart canes etc., which can assist them by detecting obstacles using ultrasonic or laser sensors. These systems produce either an audio or vibration in response with respect to the detected obstacles to warn them. The limitations of existing systems are as follows:

- Expensive
- Not very effective and reliable
- Have very limited features and usabilit

Proposed system

This research work aims in detecting an obstacle's altering the people. A key features of this project is altering the person by audio assistance. There will be a recorded instruction audio files. Through this application visually

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challenged user can always connected with the world. This project is an innovative one which helps the visually impaired people to move around and go from one place to another with speed and confidence by knowing the nearby obstacles using help of the wearable band which produces the ultrasonic waves shows in fig. 1. which notify them with audio assistances. It allows the user those who are visually impaired to walk freely by detecting the obstacles. They need to wear the device in hand and leg. Thus the aim of this project is to develop a cheap, affordable and more efficient way to help the blind people to navigate with greater comfort, speed and confidence. This is wearable technologies for the blinds which helps resolve all the problem of the existing technologies shown in fig. 2.

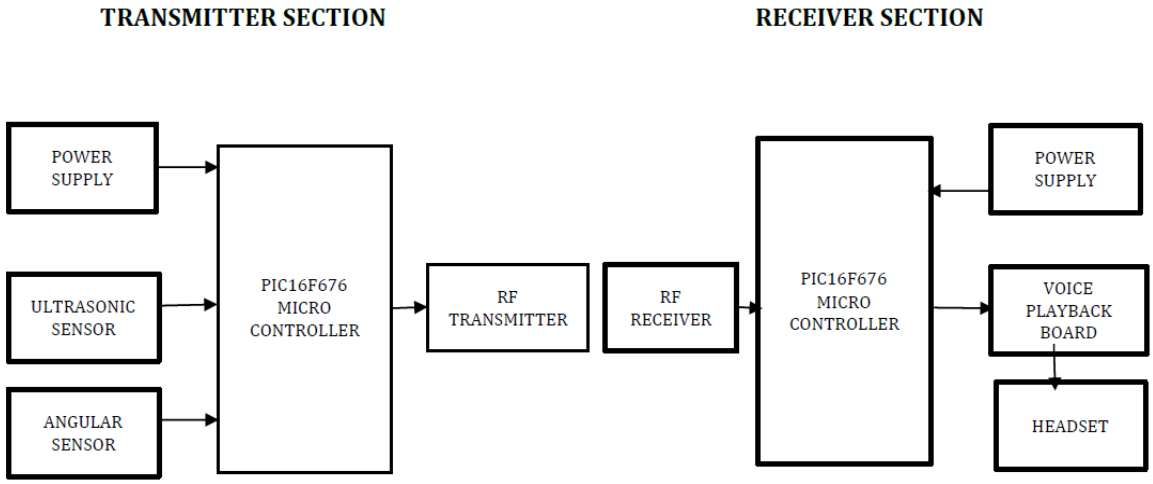

Fig. 1. Block diagram for proposed system

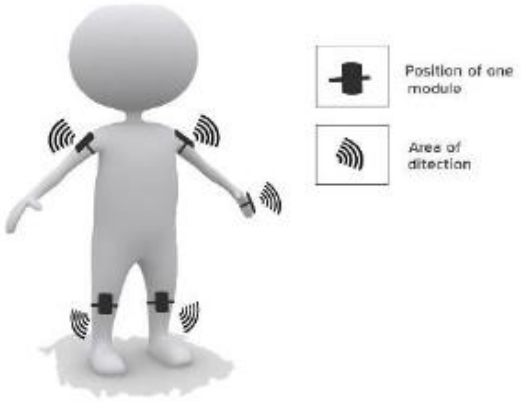

Fig. 2. Wearable Band which produces the Ultrasonic Waves

Hardware used

PIC microcontroller

PIC16F676 is is an 8-bit PIC microcontroller that comes with a 14 pin layout design as shown in fig. 3. PIC16F676 contains program memory with memory space around 1.7 KB, while RAM and EEPROM memories are 64 bytes and 128 bytes respectively. One ADC module is added in the device that is 10-bit and comes with 8 analog channels.

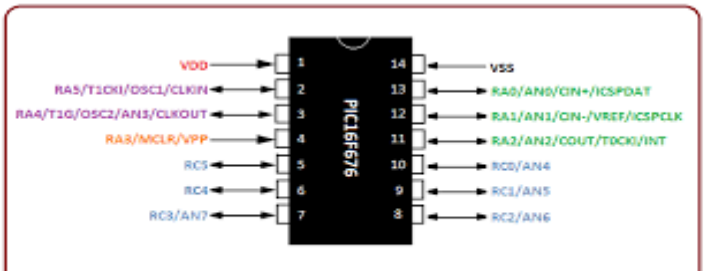

Fig. 3. PIC16F676 layout design

Ultrasonic sensor

An Ultrasonic Sensor is an electronic device that measure the distance of a target object by emitting ultrasonic sound wave, and convert the reflected sound into an electrical signal as shown in fig. 4. Ultrasonic waves travel faster than the speed of audible sound. The visually impaired have to face many challenges in their daily life. The problem get worse when there is an obstacle in front of them. Ultrasonic sensors are used to calculate the distance of the obstacles around the blind person to guide the user towards the available path.

Fig. 4. Ultrasonic Sensor

Voltage regulator

LM7805 Voltage regulators are very common in electronic circuits as shown in fig. 5. They provide a constant output voltage for a varied input voltage. In our case the 7805 IC is an iconic regulator IC that finds its application in most of the projects. The name 7805 signifies two meaning, "78" means that it is a positive voltage regulator and "05" means that it provides 5V as output. So our 7805 will provide a +5V output voltage. The output current of this IC can go up to 1.5A. But, the IC suffer from heavy heat loss hence a heat sink is recommended for project that consume more current. For example if the input voltage is 12V and you are consuming 1A, then (12-5) * 1=7W. This 7 watt will be dissipated as heat.

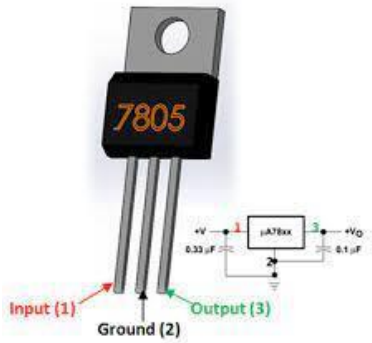

Fig. 5. Voltage regulator

Speaker

A Speaker is an electro acoustic transducer; a device which convert an electrical signal into corresponding sound. The most widely used type of speaker is the dynamic speaker. The sound source must be amplified or strengthened with an audio power amplifier before the signal is sent to the speaker. The buzzer is in the lower portion of the audible frequency range 20 Hz to 20 KHZ. It can send the signal to microcontroller when the obstacles can be detected and also send the signal to headphone for altering the blind person. It also detect water and alter the blind. One more feature is that it allows the blind to move surrounding without the help of white cane, trained dog or guide people.

Angular sensor

Angular sensor is a angular and linear position sensors are electronic device used to simultaneously measure both angular and linear position change relative to a reference position as shown in fig 6. The most common technologies used to hall effect, inductive, magneto-resistive and resistive. Optical position sensors operate using one of two principles. In the first type, light is transmitted from an emitter and sent over to a receiver at the other end of the sensor. In the second type, the emitted light signal is reflected from the object being monitored returned towards the light source.

Fig. 6. Angular sensor

Digital FM

The FM transmitter is a single transistor circuit, in the telecommunication, the frequency modulation transfers the information by varying the frequency of the carrier wave according to the message signal as shown in fig. 7. Generally, the FM transmitter uses VHF radio frequencies of 87.5 to 108.5 MHZ to transmit & receive the FM signal. This transmitter accomplishes the most excellent range with less power. The performance and working of the wireless, audio transmitter circuit depend on the induction coil & variable capacitor. The FM transmitter is a low power transmitter and it uses FM waves frequency is equivalent to the audio signal of the amplitude and the FM transmitter produces a VHF band of 88 to 108 MHZ.

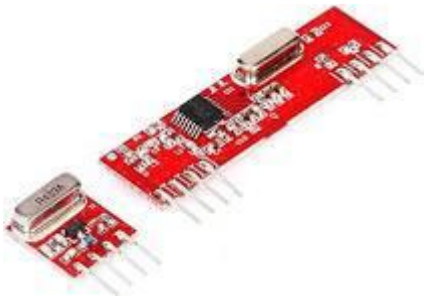

Fig. 7. FM Transmitter

Working of prototype

The hardware prototype is shown in fig. 8. Using ultrasonic sensors, blind people can detect the object in a five dimensional view around them and can easily travel anywhere. When the ultrasonic sensor detects the obstacle the device will notify the user through audio assistance (Table 1). For sensing the distance the system uses a HC-SR04, a Ultrasonic range finder distance sensor module. The sensor module is designed to measure the distance using the principle of SONAR or RADAR, of using ultrasonic wave to determine the distance of an object. The ultrasonic sensor here used as a transceiver. The ultrasonic waves are emitted by the transmitter when the objects are detected. Both the transmitter and receiver resent inside the ultrasonic sensor. We calculate the time interval between the transmitter and receiver signal. The distance between the object and sensor is calculated using this. When we increase the distance between the object and the sensor the coverage angle will decrease. When the obstacles can be detected by ultrasonic sensor transmitter can send the signal to receiver. The receiver are headphone or speaker for alter the blind people.

Fig. 8. Hardware prototype

Table 1. Various sensors and instructions

SENSOR	INSTRUCTION
001	Obstacles on right side
002	Obstacles on left side
003	Obstacles on front
004	Obstacles on back
005	Be steady

Conclusion

The aim of this work is the design and implementation of a Third eye for blind has been fully achieved. The Ultrasonic sensor acts as a basic platform for the coming generation of more aiding devices to help the visually impaired safety both indoors and outdoors. It is effective and affordable. It leads to good results in detecting the obstacles on the path of the user in a range of three meters. This system offer a low-cost, reliable, portable, low power consumption and robust solution for navigation with the obvious short response time. Further aspects of this system can adding the image processing and increasing the range of the ultrasonic sensor.

Conflict of interest

Authors declared no conflict of interest.

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