Technology-A Boon for Visually Challenged

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Abstract

Among the five senses, Vision is perhaps a special sense gifted by God to human beings. With the help of our eyes, we can see the things that happen in day to day life. But some visually impaired people can't experience these things. With the advancement of technology, Assistive devices are developed for the benefit of blind people. Nowadays, blind people are usually seen with the Cane (Blind stick) as their assistive device. Due to this device, they have to hold it in their hand. GPS (Global System for Mobile Communication) based system can't be affordable for a common person. This system focuses on a technology that is usually worn around the waist as an obstacle detector. This paper presents ultrasonic based path planning for blind people by detecting the obstacles nearby them. In this device, an ultrasonic sensor detects obstacles up to 4m. This proposed system uses Microcontroller interfacing with the arrays of ultrasonic sensors for detecting the obstacle in three different directions (Front, Right and left). It uses speech and vibrational feedback to aware blind people. According to the detected direction of the obstacle, the pre-recorded audio files stored in MP3 Module is played, and blind people get a message through an earphone. And it also helps deaf people by interfacing the microcontroller with the vibration motor (DC Motor). So by this vibration motor, deaf people can feel the response through vibration and change their path. Now it's time to change the world of visually challenged people by just wearing such assistive devices on their bodies and live their life as per their comfort zone.

Keywords: - AVR 8-bit microcontroller, Ultrasonic Sensors, Mp3 Module, Vibration Motor.

INTRODUCTION

As it rightly said that, where there is no vision, the people perish. According to the World Health Organization (WHO) records on disability, there are 285 million people who are estimated to be visually impaired worldwide:39 million are blind, and 246 have low vision. About 90% of the world's visually impaired live in low–income settings [1]. So, they can't afford advanced technology, and they have to suffer a lot. The

Sensor expansion module based on advanced technology sophisticated devices is developed for physically disabled people. Nowadays, many assistive devices available in the market for blind people. In existing methods, their available Infrared (IR Sensor) detectors based assistive device mobility for blind people, but IR sensor doesn't give that much effective and accurate result. The rays of sensors cannot be used for long-distance, and these rays are scattered in all directions. Infrared is not reliable if speed is considered. If we consider today's advanced technologies, the smart ultrasonic sensor is the one to use. With the help of this smart gadget, we can provide helpful support for visually impaired people using audible alerts and make this task a smart one [2]. This paper presents Ultrasonic based path planning for blind people for detection of surrounding obstacles by voice-based recognition system and by responses of vibration. In this proposed system, the heart of the device is a microcontroller. The microcontroller is interfaced with the ultrasonic sensor for detection of obstacles and also with the Mp3 module, vibration motor.

Fig.1:- Blind Man using White Cane[5]

SYSTEM DESIGN

The main aim of this paper is to design the ultrasonic belt with a voice-based alerting system for blind people. The usefulness of this device is speech and vibration-based announcement or feedback for easy navigation. Visually challenged people have to wear this belt on their waist, and by this, they can change their direction and walk freely.
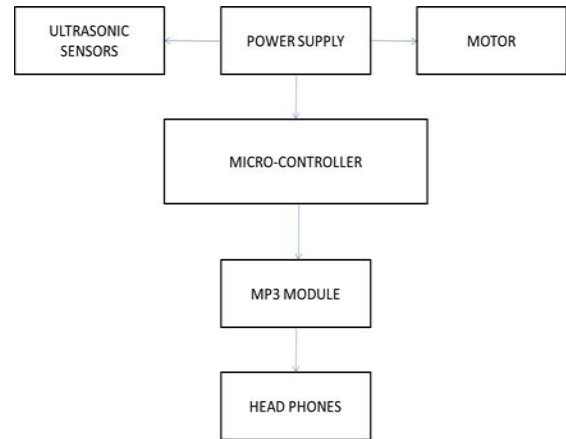

Fig.2: - Block Diagram of Proposed System

I. Ultrasonic sensor:

It measures the distance to a wide range of target objects regardless of their shapes, colours or optical characteristics. They can gauge whether an object is approaching or leaving even when objects are moving fast. Ultrasonic ranging module HC-SR04 provides a 2cm - 400cm non-contact measurement function. The ranging accuracy can reach 3mm. The modules include ultrasonic transmitters, receiver and control circuit.

The Basic Principles of Ultrasonic Sensor:

* It transmits high-frequency sound pulses at regular intervals in the air. It is using an IO trigger for at least 10μs high-level signal.

* If the signal returns through a high level, the time of high output IO duration is the time, the sensor requires from sending ultrasound to returning.

Specifications:

* Power supply: 5V DC

* Quiescent current: <2mA

* Effectual angle: <15°

- Ranging distance: 2cm – 500 cm
- Resolution: 0.3 cm

There are four pins out of the Module: VCC, Trig, Echo, and GND. So, it's a straightforward interface for the controller to use it ranging. The whole process is: pull the Trig pin to a high level for more than 10us impulse, and the module starts ranging; finish ranging, if you find an object in front, Echo pin will be high level and based on the different distance, it will take the different duration of high level.
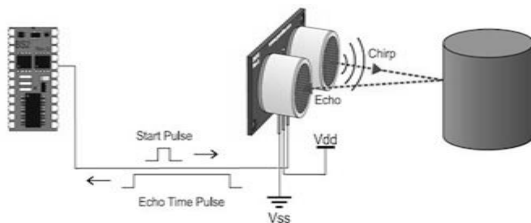

Fig.3:- Basic Principle of Ultrasonic Sensor[9]

ATMEGA 328:

The Atmega328 is a very popular microcontroller chip produced by Atmel. It is an 8-bit microcontroller that has 32K of flash memory, 1K EEPROM, and 2K of internal SRAM. The Atmega328 is one of the microcontroller chips that are used with the popular Arduino Duemilanove boards. The Arduino Duemilanove board comes with either 1 of 2 microcontroller chips, the Atmega 168 or the Atmega328. Of these 2, the Atmega328 is the upgraded, more advanced chip. The Atmega328 has 28 pins. It has 14 digital I/O pins, of which six can be used as PWM outputs and six analogue input pins. These I/O pins account for 20 of the pins.

General Features:

- 28 Pin AVR Microcontroller
- Flash Program Memory: 32kbytes
- Input / Output pins: 23

- A/D Converter: 10 bit 8 Channels
- External Oscillator up to 20MHz (Maximum operating frequency)

MP3 MODULE:

The embedded MP3 module is a universal and compact circuit for playing audio files stored in the module.
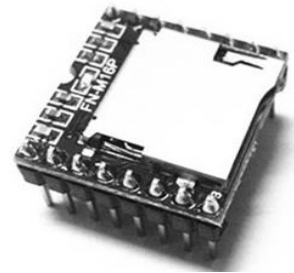

Fig.4: - Mp3 Audio Module [6]

VIBRATION MOTOR:

For vibration purposes, as it rotates at 9,000 rpm vibration speed. Its operating current is 70mA.

POWER SUPPLY

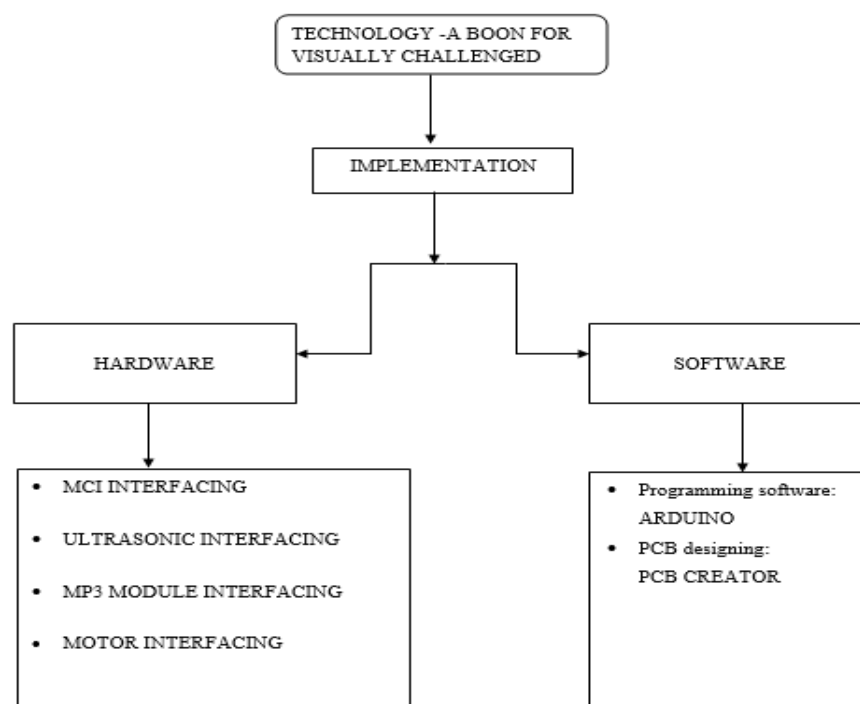For supplying power to all the electronic components:

METHODOLOGY

Hardware Implementation

To implement the idea of an ultrasonic belt, the first step is to design the power supply to provide proper voltage to each component. After that, the proposed system's second step is to develop a development board by using ATMEGA328 (8-bit microcontroller). Now the main part of the system is interfacing ultrasonic sensors with a microcontroller. As we know that the ultrasonic sensor plays a major role in the development of the proposed system. In this system, three ultrasonic sensors are placed in as many different directions (front, left and right). Ultrasonic sensors are also known as Trans-receivers. The sound waves are continuously transmitting from the sensor as soon

as some obstacle is detected. The sound waves will be reflected in the receiver part of the sensor as this system used audio-based feedback, MP3 MODULEinterfaced with microcontroller. As a microcontroller controls the whole system so when the signal is received on the receiver part of the ultrasonic sensor, the mp3 module will play the pre-recorded audio files. And the played audio file will be conveyed to blind people through an earphone. Here the vibrational feedback is also used as an altering system. So, a microcontroller is interfaced with the vibration motor as pre-recorded audio file played along with that motor can vibrate, and this feature is incorporated for deaf people. This whole circuitry is developed on GPB (General Purpose Board). To implement a proper prototype next step is to develop a PCB (Printed Circuit Board) of circuitry. After designing of PCB, mounting of components is done on hardware. Now the final step is to develop the prototype on the belt.

Software Implementation

For working on the hardware part, coding is most necessary. Here the proposed system is coded with Embedded C. Programming is done in ARDUINO software. PCB created in PCB CREATOR software.

FEATURES

- Cost-effective
- Reliable
- Less weight
- No need for any guidance
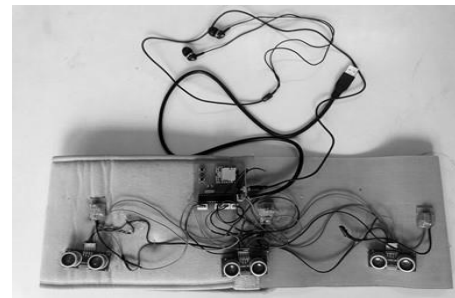- Dynamic system
- Low power consumption

Fig.5: - Final Prototype

WORKFLOW

CONCLUSIONS / RESULTS

By designing of this 'ULTRASONIC BASED PATH PLANNING' We can save many blind peoples life who are facing the problem in seeing the things or for blind person with the help of growing technologies. As using ultrasonic sensors which are too much advance and AVR Microcontroller having many inbuilt features which is helpful for giving accurate result, detection of the obstacle. As having light weight, they can easily wear on the waist and this is also affordable to all.

FUTURE SCOPE

For better enhancement of performance of the proposed system, after designing of ultrasonic belt, further this technology can be developed by making ultrasonic spectacles, ultrasonic shoes to detect obstacles from head to ground level.

Fig.6: - Ultrasonic Shoe

REFERENCES

1. Mr.YadlaArunababu, Mr.Ragu Ram, "Design of Ultrasonic sensors based spectacles and waist belt for blind using low cost Arduino" INTERNATIONAL JOURNAL & MAGAZINE OF ENGINEERING, TECHNOLOGY, MANAGEMENT AND RESEARCH.

2. Sushant Mahalle, Himanshu lokhande, "Ultrasonic Spectacles and Waist-belt for Visually Impaired and Blind Person." , IOSR Journal of Engineering (IOSRJEN).

3. K.P.Reshma, "Ultrasonic Spectacles and Waist-belt for Visually Impaired and Blind Person.", International Journal Of Engineering Research & Innovative Technology

4. Anika Nawer, Farhana Hossain, Md. Galib Anwar, "Ultrasonic Navigation System for the visually impaired & blind pedestrians", American Journal of Engineering Research (AJER)

5. http://www.lacrosseplayground.com/wpcontent/uploads/2012/10/Screen-shot-2012-10-27at-3.56.57-PM.png

6. http://digitalwizard.net/images/pages/sensor_set.jpg

7. http://www.hobbytronics.co.uk/image/data/tutorial/arduino-hardcore/atmega328-arduino-pinout.jpg

8. http://i.cbc.ca/1.3090780.1432819565!/fileImage/httpImage/image.jpg_gen/derivatives/original_620/iaid.jpg

9. https://hackster.imgix.net/uploads/attachments/254995/picture5_cbyw7qxqrh_YB3NVfizBG.jpg?auto=compress%2Cformat&w=680&h=510&fit=max