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Haptic Navigation and Protecting Aid for the Visually Impaired

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ABSTRACT: The main objective of our project is to help blind people to walk with ease and to be warned whenever their walking path is obstructed with other objects. In order to help blind people we implement a wearable glove to assist the blind person and give information about the obstacle in the path by using some alerts and voice feedback. This glove not only navigates the path to the blind person but also raises the alarm and sends message to the caretaker when the accident is detected. This message can help his/her care taker (in case when the care taker is away from the blind person) to locate the person using the received coordinates from the communication module of the wearable glove having GPS (Global position system) and GSM (Global system for mobile communication) technologies and the raising of alarm is helped to alert the care taker (when the care taker is near to the blind person). This glove is physically realised by different sensors and communication modules (GPS and GSM) with Arduino UNO. Different modes of obstacle detection and alerts are provided by using various sensors to assist the blind person.

KEYWORDS: Arduino UNO, Ultrasonic Sensor, GPS, GSM, Voice Processor, Mercury switch.

I.INTRODUCTION

According to WHO (World health organisation), about 30 million peoples are estimated to be permanently blind in worldwide. These people are totally dependent on others. They even cannot walk on their own. So, one person will be available to take care of the blind person. But in the today's scenario, it is impossible due to the increase in technology as the people are busy in their own works. The idea behind the implementation of the "haptic navigation aids for the visually impaired" device which will be helpful to the blind people to walk independently. They can take care of themselves without taking help from the other people. In this device, we used only one ultrasonic sensor for the distance measurement between the blind people to the obstacle.

II.RELATED WORK

Arduino UNO is used for both hardware and software. So, it is called as an open source device. These boards are designed with variety of microprocessors and micro controllers. In our project, Arduino based on ATmega328p micro controller board is used. The Arduino IDE (Integrated Development Environment) software is used to write the code as for the requirement of the project results. The file extinction of this software is .ino.Which is used to write the code and is also used to dump the code into the Arduino board. In this software, various languages are used such as C, $C^{++,}$ and Java. In our project, C language is used to write the code.

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III.PROPOSED SYSTEM

Block diagram:

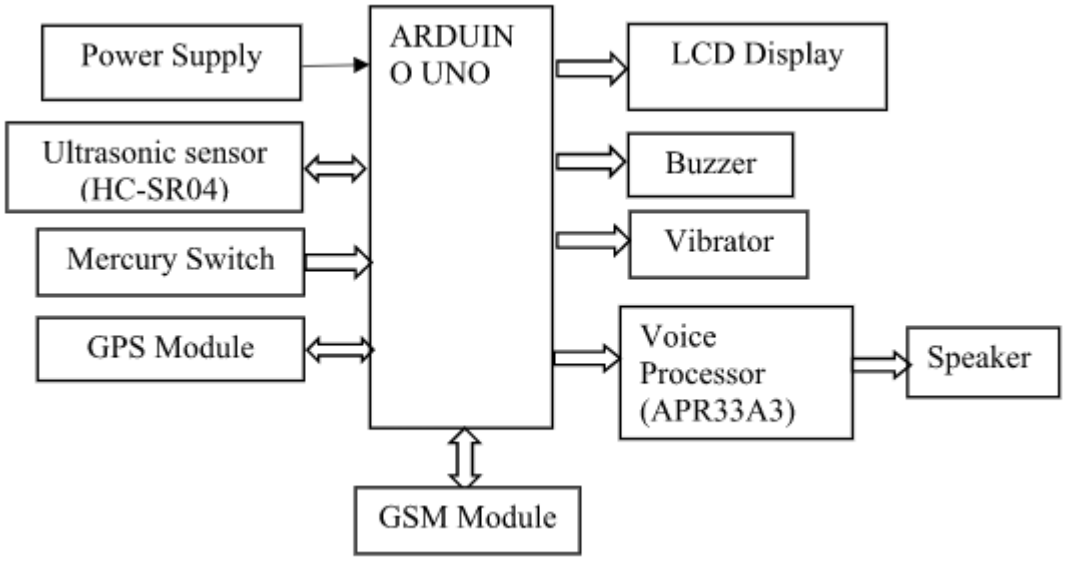

Fig. 1. Block Diagram

Arduino UNO is the major component of our project. It is a micro controller (ATmega328p) based on Bin the walking path of the visually impaired person. The LCD (Liquid Crystal Display) is used to display the distance information visually. The mercury Switch is used to detect whether the accident is occurred or not. The GSM module is a communication module interfaced with Arduino and sends an accident detection SMS to the care taker. GPS module is a navigation device it will indicate the position of the blind person when accident is detected.

The three alerting systems are used to give the information about the obstacles in the path. Buzzer will activate when it indicates that the object is present at the long distance (Distance is between: 30-50cms). When the Vibrator obtained as the feedback then the person will identify that the object is nearer (Distance is between: 20-29cms). The voice message can be obtained as the feedback when it indicates that the object is very closer to the blind person (Distance is between: 0-19cms).

A. *Ultrasonic Sensor (HC-SR04):*

The major component used in this project is Ultrasonic sensor which transmits high frequency sound pulses and then calculates the time to the signal of the sound echo to reflect back. The Sensor has two circles. One of the circle acts as the transmitter and transmits the Ultrasonic sound waves and the other cycle acts as Receiver and receives the echo sound signal. The sensor is calibrated according to the speed of the sound in air. With this calibrated input, the time difference between the transmission and reception of sound pulse is determined to calculate the distance of the object. It contains four pins such as ground, trig, echo, Vcc. The range of this sensor is 2cm-400cm and its supply voltage is 5V.

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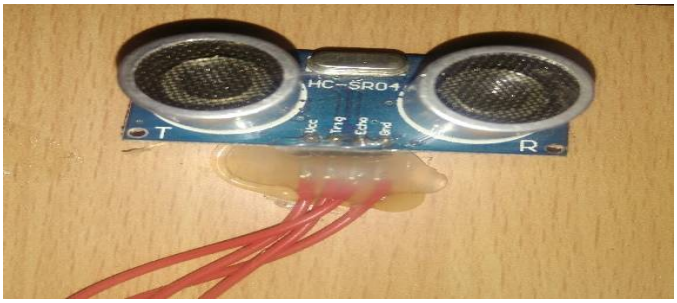

Fig.2 .Ultrasonic Sensor

B. *Mercury Switch*:

A mercury switch is one which opens and closes an electrical circuit in which it contains a small amount of the liquid mercury. This liquid mercury makes in contact with metal electrodes to close the electrical circuit. The mercury switch envelope may also contains air, inert gas or vacuum. This mercury switch is used to detect whether the accident is detected or not. When the liquid mercury in the switch is initially in non-contacting position indicates that the accident is not occurred else the mercury is in contact with the metal electrodes then, the electrical circuit is closed which means that the accident is detected.

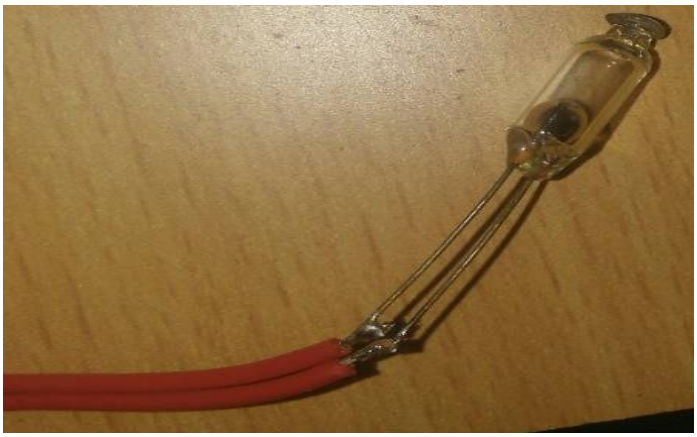

Fig. 3. Mercury Switch

C. *GPS module:*

GPS (Global position system) module is capable of receiving the information from GPS Satellites along with the time slots and to calculate the person's geographical position. GPS has the major application in military fields to locate the position of the terrorist's based on the triangulation principle. It contains four pins such as transmitter, receiver, ground and cc pins. At least three satellites can see the object and determines the location. If more than three satellites can see more accurate the determination of the object location.

The purpose of adding GPS module is to determine the location of the blind person (when accident is detected) and sends message to the care taker through the mobile device.

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Fig. 4 .GPS Module

D. *GSM Module (SIM800C):*

GSM (Global system for mobile communications) is a standard developed by the European TelecommunicationsStandard institute in order to determine the protocols for the Second – Generation (2G) cellular networks used by the mobile devices. GSM is a digital cellular network. The main function of the GSM is to provide SMS Services to the users and sends SMS via AT (Attention) commands. The purpose of including GSM module is to send message to the care taker when accident is detected (i.e. when the blind person is in danger or fall down). The SIM800C is a low power consumption module (sleep mode). The minimum input voltage to this module is 6v and its operating Voltage is 7.5v.

Fig. 5.GSM Module

E. *Arduino* UNO:

Arduino UNO is one of the major component of our project. It is the most common version of Arduino family. The Arduino UNO is a microcontroller board based on ATmega328. Arduino has 14 digital input/output pins (out of 14 pins 6 pins can be used as PWM outputs), 6Analog input pins, 16 MHZ ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. The Arduino UNO is one of the great choice for the beginners because it contains everything which is needed to support the micro controller. This is simply connected to computer with USB cable or power with an AC-to-DC adapter or battery to get started. It has 16MHZ crystal frequency, 32KB Flash Memory, 2KB SRAM, 1KB EEPROM.

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Fig.6. Arduino Uno

F. *LCD Display:*

LCD (Liquid Crystal Display) and is used to display anything on the screen. LCD's consume very less power when compared to LED. It is the combination of both solid and liquid states. The purpose of using this component in our project is to display the information about the distance of the object in the walking path of the visually impaired people.

Fig.7. LCD Display

G.*Voice processor:*

The audio signals are the representation of sound waves. APR33A3 is a powerful audio processor along with high performance audio analog-to-digital and digital-to-analog converters. This processor contains all the functionality required to perform the audio/voice services. The high quality voice/audio systems with low cost can be implemented with this processor (APR33A3) because of its analog data converters and sample rate converters. APR33A3 processor is specially designed, then user can record and play back averagely for 1, 2, 4, 8 voice messages by switch. User can keep the chip enter power-down mode when unused. The operating voltage range is from 3 to 6.5v. The purpose of using this module is to give the voice feedback to the blind person about the objects information in the walking path.

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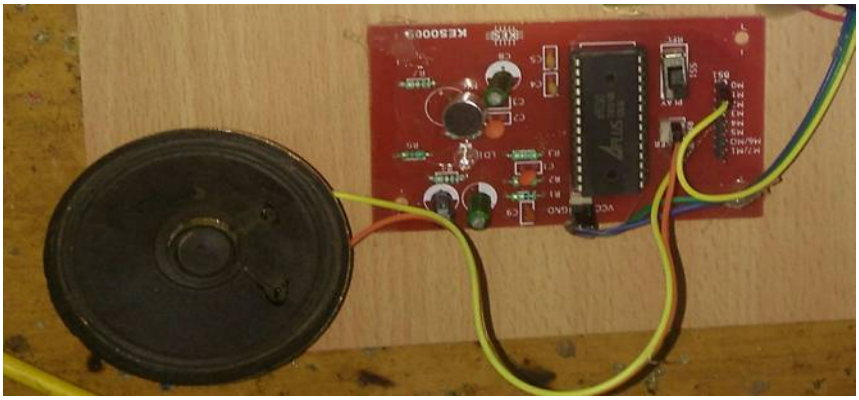

Fig.8.Voiceprocessor

IV.HARDWARE IMPLIMENTATION

Arduino UNO is connected to PC using USB cable and uploads this code in to the Arduino UNO using USB cable. Three levels of identifying the objects in the walking path of the blind person are at high distance (50-30cm), medium distance (20-29cm) and low distance (up to 19cm from the person) by giving some alerts (Buzzer, Vibrator, Voice feedback) to the blind person. This distance can be measured by using the ultrasonic sensor which is placed at the front part of the system and it is capable of measuring the distance accurately. When the blind person falls down or in danger, can be detected by using the mercury switch (liquid in the switch is non- contacting with metal electrodes).When the accident is detected, GSM and GPS technologies can be used to send the SMS along with the location of the blind person to the care taker.

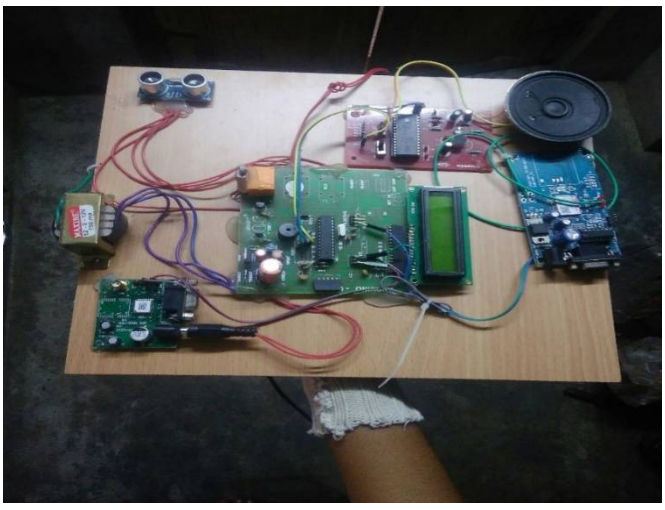

Fig.9.Overall prototype

V. RESULTS

1.Object detection at three levels:

At level 1: If the object is detected, then buzzer gives the feedback to the blind person (Distance between: 30-50cm) about the obstacles in their walking path.

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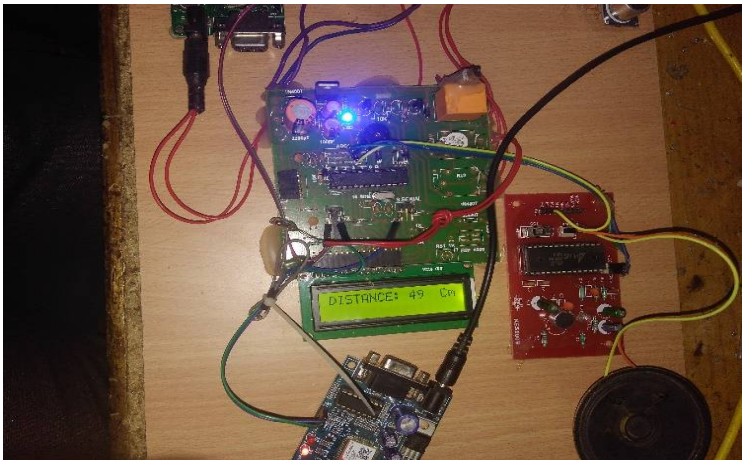

Fig.10. raise Buzzer

At level 2: If the object is detected, then vibrator gives the feedback to the blind person (Distance between: 20-29cm) about the obstacles in the walking path.

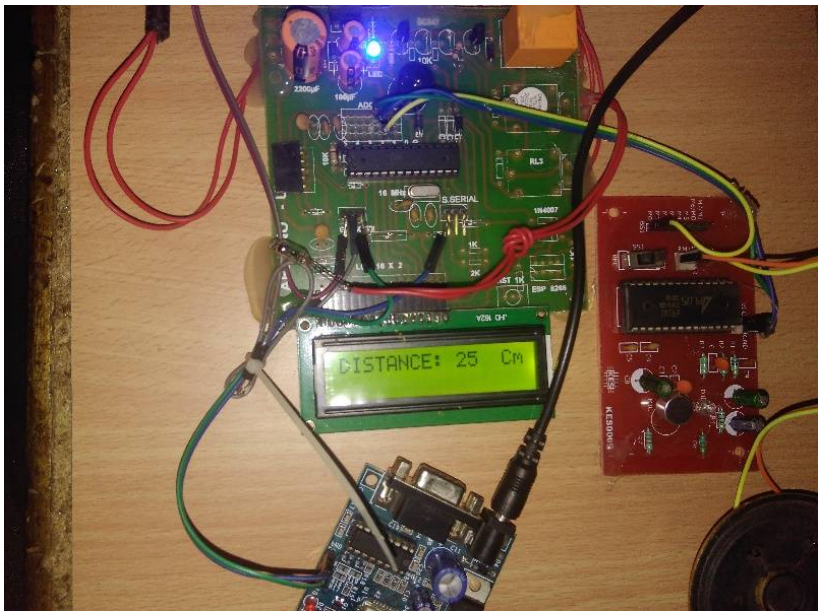

Fig.11.Raise Vibrator

At level3: If the object is detected, the voice message gives the feedback to the blind person (Distance is between: 0-19cm) about the obstacles in their walking path.

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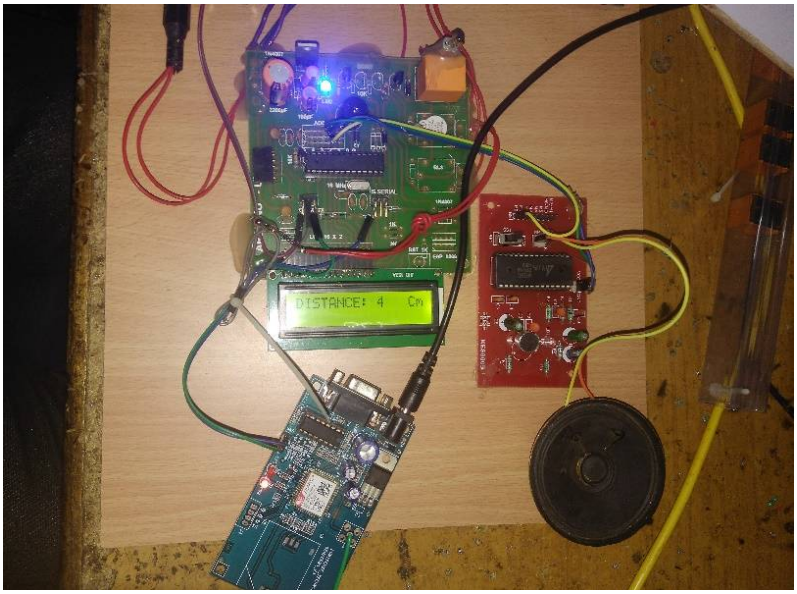

Fig.12.Voice feedback

2. Accident detection: Initially mercury switch is in non-contacting position it means that accident is not occurred. When the mercury switch is tilted in one direction (upward), then accident is detected as shown in the figure. The raise alarm and send SMS along with the latitude and longitude coordinates to the care taker as shown in fig.13 (a), 13(b).

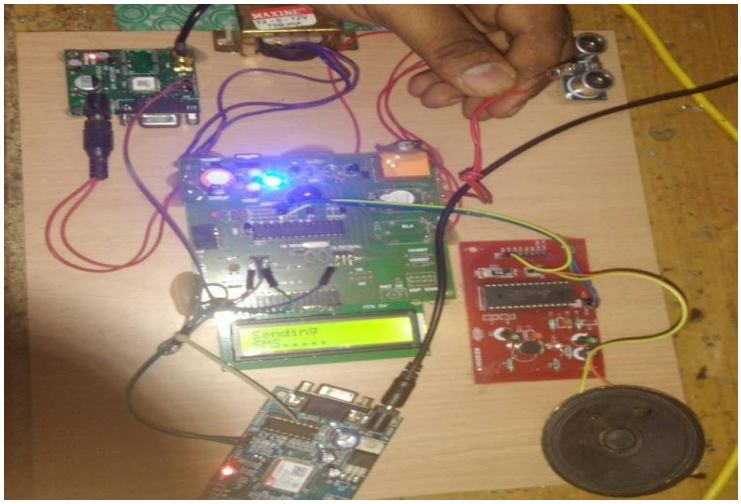

Fig.13 (a).Accident detection (raise alarm)

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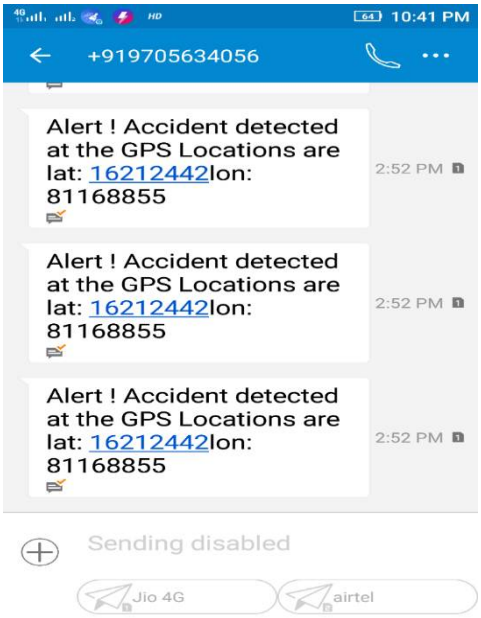

Fig.13 (b).sending message output

VI .CONCLUSION

The prototype system has been successfully designed and verified. Now, this system can be implemented to give information about the object in the walking path of the blind person by giving some alerts and voice feedback. The designed system is comfortable to the blind person as he/she can wear the glove very easily.

VII.FUTURE SCOPE

At present, all the blind people cannot survive by their own. They will depend on others for their minimum needs. We have taken a step to comfort the blind person without depending on the others through this project by implementing a wearable glove device.

Camera is placed in the wearable glove to continuously monitor the blind person situation and protect the persons from accident. Further, the components used to design the wearable glove is heavy the blind person is unable to wear the glove for a long time. They feel pain so, smaller version of the components are used in designing the glove in the future i.e., VLSI version components.

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