AN ASTUTE ASSISTIVE DEVICE FOR VISUALLY IMPAIRED PEOPLE

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***ABSTRACT*:**

Visual impairment is a global health concern that causes blindness or partial blindness to any people irrespective of their age. According to the World health Organisation (WHO), there are 65% people who are visually impaired over the world population. Among the total world population, 82% people are blind. Several blind guidance systems and Travel aids have been developed earlier, to support and improve their quality of their lives but, Most of these systems are limited in their capabilities to function the best as possible. It also cannot provide any navigation information to the user. In this paper, we present a comparative study of the wearable and portable astute assistive device that senses the path (Example: Obstacles, Location, Hazards) immediately. This paper aims in addressing the issues of the existing Electronic walking aids and developing a better design to ensure safety, ease and independent mobility to the visually impaired people. The system described here focuses on developing an improved system that makes use of GSM, GPRS, Accelerometer sensor, Ultrasonic sensor on integration with google assistant interfaced to the device with google map and other mobile application for object identification, collision detection and path finding for the blind people

***KEYWORDS*:** Obstacle detection, Visually impaired people, Navigation system, Travel aids, Google assistant.

I. INTRODUCTION

According to the famous philosopher and scientist Aristotle, our knowledge about the outside world depends on five sense organs and sight is one of those five organs. And visually-impaired are those unfortunate people who are completely or partially suffering with eye sight issues. According to the survey of World Health Organization (WHO) and International Agency for Prevention of Blindness (IAPB) approximately 285 million people around the world are visually –impaired among which 39 million are completely blind. Blind stick is a special device used by visually disabled people for centuries. But in recent times Electronic Travel Aids (ETAs) with sensors and sound systems are designed for improved navigation of blind people. Here we proposed an advanced blind stick that allows visually challenged people to navigate using advanced technology like ultrasonic sensors, LDR, water sensor and accelerometer. We already know about traditional blind sticks. But the question that comes into our mind is that how this system can give idea about the surrounding by using ultrasonic and water sensor system. The advantage of our project is that it can detect any obstacle with the help of ultrasonic sensors and it can detect whether any water bodies near them. Thus it will help blind people when they are walking outside from their home. Besides that if blind people missed their stick using accelerometer they can identify the position and location of the stick. This can be intimated to the person through the speaker and if any obstacle is detected near him is intimated through vibration motor. Thus, the contribution of this literature survey is to discuss in detail the most significant devices that are presented in the literature to assist this population and highlight the improvements, advantages, disadvantages, and accuracy. Our aim is to address and present most of the issues of these systems to pave the way for other researchers to design devices that ensure safety and independent mobility to visually-impaired people.

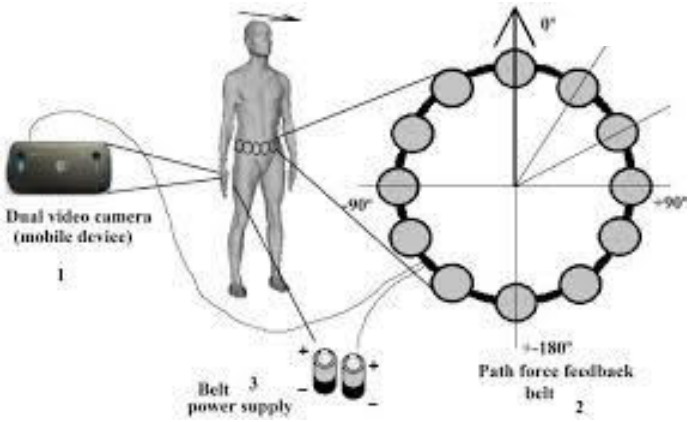
II. OBSTACLE DETECTION

Ultrasonic sensors are used for obstacle detection and calculation of its adaptive distance from the visually impaired person as in Fig. shown below Ultrasonic sensors are used in pair as transceivers. One device which emits sound waves is called as transmitter and other who receives echo is known as receiver. These sensors work on a principle similar to radar or sonar which detects the object with the help of echoes from sound waves. An algorithm is implemented in C-language on AT89S52 microcontroller. The time interval between sending the signal and receiving the echo is calculated to determine the distance of an object. As these sensors use sound waves rather than light for object detection, this can be comfortably used in ambient outdoor applications also.

III. MATERIAL DIFFERENTIATION:

IR transmitters are used for the transmission of light. Thus, a pulse of light is transmitted and reflected back by the material. The emitted light is reflected from the target and its intensity is measured at the detector. However, it is often not possible to make reliable distance estimates based on the value of a single light intensity that is reflected back, because the return depends on the geometry and properties

of the reflecting target. Likewise, the properties of the target cannot be deduced only from the intensity returns without knowing its distance and angular location. Depending on the characteristic of the material, a part of light may be absorbed by the material and some are reflected back. The reflected light is captured by the Light Dependent Resistor (LDR). LDR is used to measure the intensity of the light that is reflected back. Thus with the property of difference in light absorptive by different materials, this can be used to differentiate between different materials.



IV.COMPONENTS

(a) ULTRASONIC SENSOR

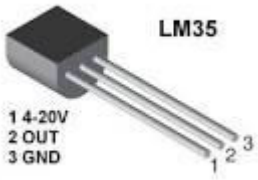
The ultrasonic sensors used in this work are PING sensor and HC-SR04 ultrasonic sensor.The HC-SR04 Ultrasonic Sensor has a 4-pin header used to supply power (5 VDC), ground, trigger and echo signal as shown in the Fig.5.1 the Ultrasonic ranging module HC-SR04 provides 2cm - 400cm non-contact measurement function and the ranging accuracy can reach up to 3mm. This module includes ultrasonic transmitters, receiver and control circuit. The signal processing involved using HC-SR04 are listed below,

i. Using input output (IO) trigger for at least 10μs high level signal
ii. The Module automatically sends eight 40 kHz and detects whether there is a pulse signal back.
iii. If the signal is back through high level, time of high output IO duration is the time from sending ultrasonic to returning.

The code loading process of microcontroller is called dumping. The microcontrollers understand only the machine level language, which contains '0 or 1s'. So we need to load the hex code into the microcontroller. There are many softwares available in the market for loading the code to the microcontroller. Here we have used 'PICFLSH' programmer softwareto dump the code to the PIC microcontroller. The programmer kit comes with the hardware kit along with the software.

(b) TEMPARATURE SENSOR:

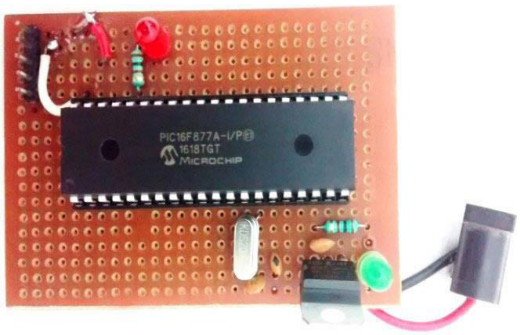
It uses various sensors which would provide physical properties and temperature variation which converts them into electricity.



The regularity will change in physical properties of the main body of the temperature sensor, which is a core part of the measuring instrument. In accordance with the measurement technique remains separated hooked happening interaction then non-contact binary main groups. The characteristics of the sensor materials and electronics components are put into the thermal resistance and thermo-couple. The temperature sensor model which is used here is LM35.

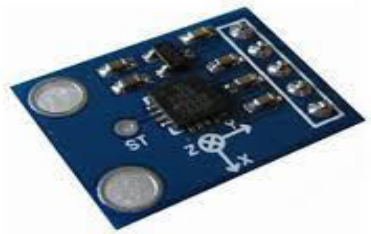
(c) WATERLEVEL SENSOR:

A water sensor can detect the presence of water, often by measuring the electrical conductivity of the water present and completing a circuit to send a signal. Some water sensor systems can be programmed to shut off the water to the house to prevent a small leak from becoming a large one.



(d) ACCELEROMETER SENSOR:

The basic principle of operation behind the MEMS accelerometer is the displacement of a small proof mass etched into the silicon surface of the integrated circuit and suspended by small beams. This is the source of the limited operational bandwidth and non-uniform frequency response of accelerometers.The rate of change of velocity of the body with respect to time is called acceleration. According to relative theory, depending upon the relative object taken to measure acceleration, there are two types of acceleration. The proper acceleration, which is the physical acceleration of the body relative to inertia or the observer who is at rest relative to the object being measured. Accelerometers are available as digital devices and analog devices. Accelerometers are designed using different methods. Piezoelectric, piezoresistive and capacitive components are generally used to convert the mechanical motion caused in accelerometer into an electrical signal.



(e) PIC (16F877):

Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877.

(f) GSM AND GPRS:

GSM is a mobile communication modem; it is stands for global system for mobile communication (GSM). A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot.GSM and GPRS two-in-one function module. It is based on the latest GSM/GPS module SIM808 from SIMCOM, supports GSM/GPRS Quad-Band network and combines GPS technology for satellite navigation. The latest firmware support Bluetooth function. The key element of GPRS technology was that it uses packet switched data rather than circuit switched data, and this technique made much more efficient use of the available capacity. This is because most data transfer occurs in what is often termed a "bursty" fashion. The transfer occurs in short peaks, followed by breaks when there is little or no activity.The GSM and GPRS elements of the system operated separately. The GSM technology still carried the voice calls, while GPRS technology was used for the data. As a result voice and data can be sent and received simultaneously.

(g) 20*4 LCD:

A liquid-crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light

modulating properties of liquid crystals. Liquid crystals do not emit light directly. Here, in this we're going to use a monochromatic 20x4 alphanumeric LCD. 20x4 means that 20 characters can be displayed in each of the 4 rows of the 20x4 LCD, thus a total of 80 characters can be displayed at any instance of time. LCD accepts two types of signals, one is data, and another is control. These signals are recognized by the LCD module from status of the RS pin. Now data can be read also from the LCD display, by pulling the R/W pin high. As soon as the E pin is pulsed, LCD display reads data at the falling edge of the pulse and executes it, same for the case of transmission.

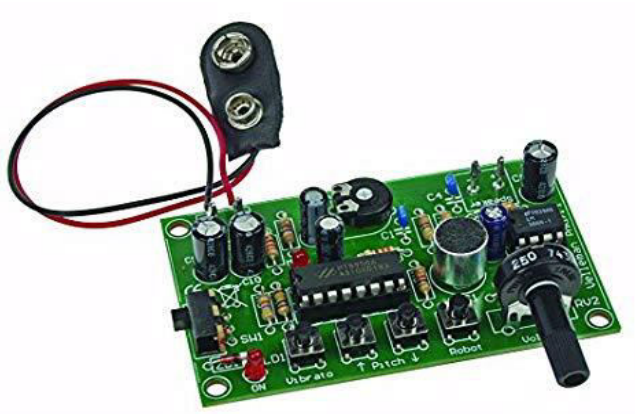
(e) LDR SENSOR:

Photo resistor or light-dependent resistor (LDR). The confrontation of a photo resistor decreases through increasing incident light intensity; in extra arguments, it exhibits photo conductivity. A photo resistor container is applied popular light - sensitive sensor circuits, and bright- and dark activated swapping circuits. A photo resistor remains made of a high resistance semiconductor.

(f) VOICE SYNTHESIZER:

Speech synthesis is simply a form of output where a computer or other machine reads words to you out loud in a real or simulated voice played through a loudspeaker, the technology is often called text-to-speech. Synthesized speech can be created by concatenating pieces of recorded speech that are stored in a database. Systems differ in the size of the stored speech units; a system that stores phones or diphones provides the largest output range, but may lack clarity. For specific usage domains, the storage of entire words or sentences allows for high-quality output. Alternatively, a synthesizer can incorporate a model of the vocal tract and other human voice characteristics to create a completely "synthetic" voice output.

Early electronic speech-synthesizers sounded robotic and were often barely intelligible. The quality of synthesized speech has steadily improved, but as of 2016 output from contemporary speech synthesis systems remains clearly distinguishable from actual human speech. Kurzweil predicted in 2005 that as the cost-performance ratio caused speech synthesizers to become cheaper and more accessible, more people would benefit from the use of text-to-speech programs



(g) BUZZER:

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.

V. PROPOSED SYSTERM

In this proposed system, the role of this system is to provide information by getting the location of the user and identifying the obstacles in their path. Ultrasonic sensors

are designed for contactless and wear free detection of a variety of targets by means of sonic waves. It is not important, whether; the target is transparent or coloured, metallic or non-metallic, firm, liquid or powdery. Environmental conditions such as spray, dust or rain seldom affect their function. An ultrasonic sensor transmits ultrasonic waves from its sensor head and receives the ultrasonic waves reflected from an object. By measuring the length of time from the transmission to reception of the sonic wave. This system is also light and very convenient. Furthermore, this system overcome the issue of narrow cone angle of the path

The known relationship between distance, time and speed is used here (distance is the product of speed and time). Distance calculated is twice the actual distance because it includes returning time also. Hence, only half of the distance is considered. Using equation 1 the distance is calculated.

$$D= [(EPWHT) * (SV)/2]$$

Where, D = Distance in cm

EPWHT = Echo pulse width high time

SV = Sound velocity in cm/s

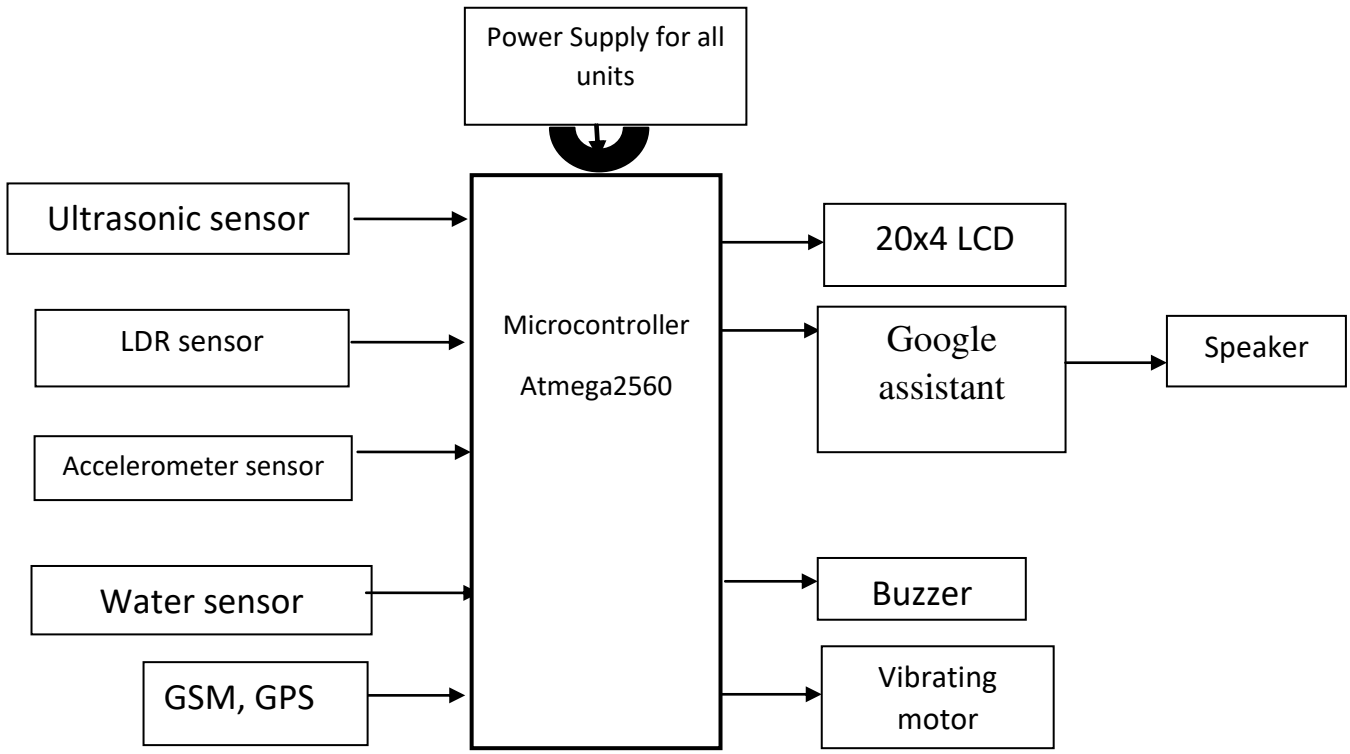
However, the basic principle of sound is that, the sound velocity in atmosphere changes with respect to different temperatures. When the temperature is 0°C, the sound velocity in the atmosphere reaches 331.45 m/s. For every 1°C temperature rise the sound velocity increases by 0.607 m/s. The sound velocity at different temperatures can be calculated with the following formula.

$$C=331.45 \text{ m/s} + (0.607 \text{ m/s} * T°C)$$

Where, C-Sound velocity, T-Current temperature

In this proposed module, the device is interfaced with the google assistant and integrated applications such as google map is also connected with the device using a mobile application. With the assistance of google, the device provide intelligent, independent mobility to the visually impaired and partially visually impaired people.

VI . BLOCK DIAGRAM



VII. CONCLUSION

In this paper, design and development of a real-time for assisting visually impaired and blind people has been discussed. The system performed two main tasks of collision detection and obstacle detection allowing the user to navigate his route independently. Our system managed to overcome the hurdle of developing an assistive system which was both efficient and affordable enough for the visually impaired people especially belonging to the low-income households. Future research work involves refining our system so that a more hands free assistive system experience can be provided for the visually disabled people.

VIII. RESULT AND DISCUSSION

The astute assistive device for visually impaired people project was designed and implemented successfully. It is useful to visually impaired people for obstacle detection and it also helps in finding the blind people if lost somewhere using GPS and to assist them with google assistant integrated with google map to help them to travel independently both in day and night. The need for developing a low-cost assistive system for the visually impaired and blind people which has increased with steady increase in population worldwide. The tasks of collision detection and obstacle identification utilizes ultrasonic sensors to alert the user of the obstacle appearing in the route, This system managed to demonstrate the important characteristics of affordability, high efficiency, mobility and ease of use.

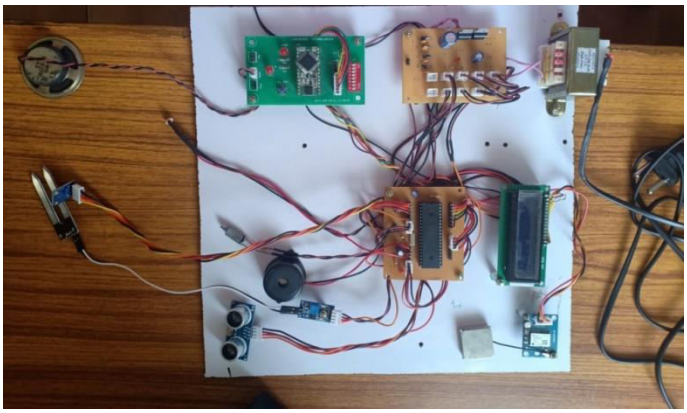


Fig. Prototype model of astute assistive device for using impaired people

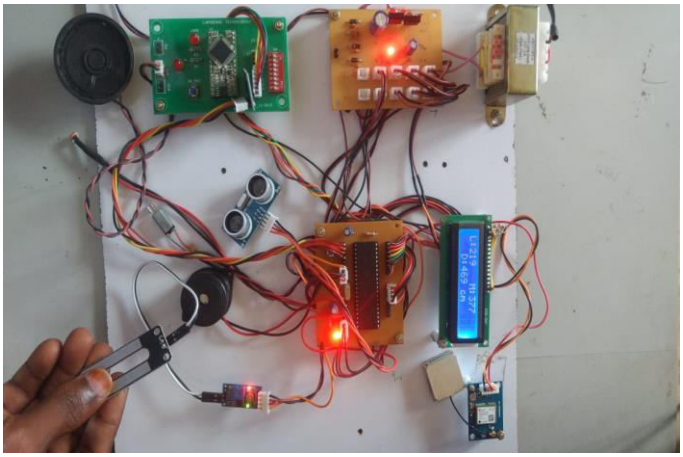


Fig.Display of Obstacle Identification module

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