Arduino based Safety Device for Visually Challenged

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***Abstract*—** In this paper, Our proposed device is an automated one, which helps a visually impaired person detect the obstacles either through beep or vibrations allowing him to walk confidently and smartly even in a crowded area. According to World Health Organization (WHO), it is estimated that approximately 1.3 billion people live with some form of vision impairment where India is said to be the home to world's largest number of blind people. Thus, we have come up with the solution of this innovation using multidisciplinary subjects which is reliable and cost effective. The device uses Arduino Uno microcontroller. It uses ultrasonic sensors to detect the closeness of the obstacle (up to 50 cm) which instantly signals the user with variation of beeps and vibrations with respect to the closeness of the obstacle. Wearing one of these devices is desirable but it would be more efficient if it is worn at five different parts of the body - two for shoulders, two for knees and one in palm.

Key words: beep or vibrations, reliable, more efficient, Arduino uno microcontroller, obstacle.

1. INTRODUCTION

Building low-power VLSI system has emerged as significant performance our proposed device is an automated one, which helps a visually impaired person detect the obstacles either through beep or vibrations allowing him to walk confidently and smartly even in a crowded area. The device uses Arduino Pro Mini which is worn like a band. It uses ultrasonic sensors to detect the closeness of the obstacle (up to 50 cm) which instantly signals the user with variation of beeps and vibrations with respect to the closeness of the obstacle. The ultrasonic sensor detects the obstacles ahead and communicates with the Arduino. When there is an obstacle detected by the ultrasonic sensor the GPS module is activated and the location coordinates are displayed on the LCD and an SMS is sent to the predefined mobile numbers through GSM module. There is also a panic button is provided to the user for emergency purpose. In case of any emergency, the user can press the panic button which enables the GPS and GSM modules to send the location coordinates to the predefined numbers. A vibrating motor is also provided to give the vibrating sense to the user along with a buzzer sound. Wearing one of these devices is desirable but it would be more efficient if it is worn at five different parts of the body - two for shoulders, two for knees and one in palm. The aim is to develop an effective wearable navigation system which can locate the user, follow the virtual-blind-road and avoid obstacles at the same time, in order to provide automatic navigation for the visually impaired people.

2. DESIGN AND EXPERIMENTAL DETAILS

BLOCKDIAGRAM

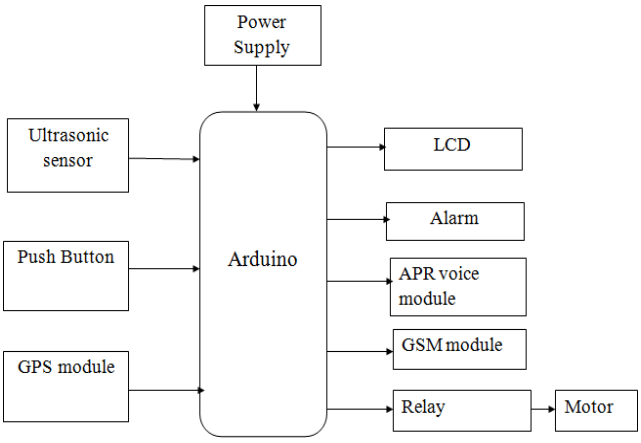


Fig: block diagram of Arduino based safety device for visually challenged

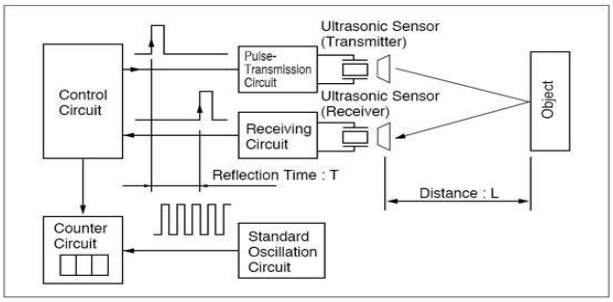
above block diagram clearly shows that the Ultrasonic Sensor, push button and GPS module act as input devices to the Arduino to send data and the LCD,GSM module ,a vibrating motor, APR9600 and the speaker act as the output devices to perform task specified in the commands of Arduino and thereby generating the suitable output.

Fig:- Arduino UNO Microcontroller Boar

Arduino UNO microcontroller board as a platform for open source hardware and software. The Arduino UNO consists of ATmega328p microcontrollers. Arduino hardware is programmed in a wired language (syntax and library), such as C++ with minimal

modification and a combined processing environment. It allows communication between computers through programming. It receives the input signal from the sensor, and then generates the output voltage

ULTRA SONIC SENSOR

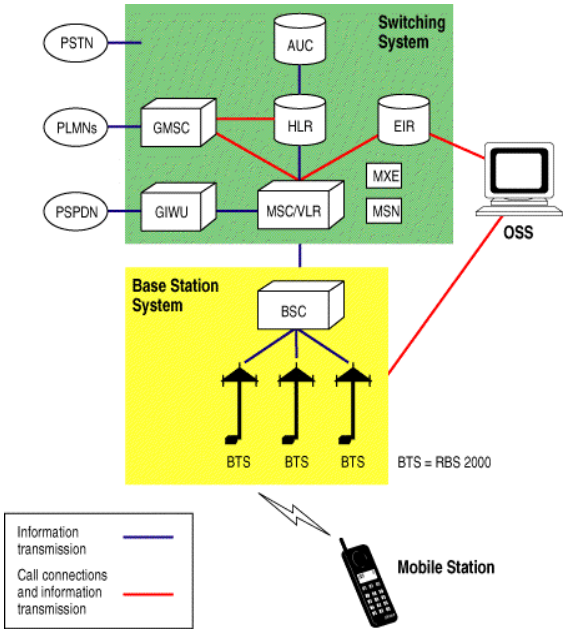


Ultrasonic sensors are industrial control devices that use sound waves above 20,000 Hz, beyond the range of human hearing, to measure and calculate distance from the sensor to a specified target object

GLOBAL SYSTEM FOR MOBILE(GSM):

Global System for Mobile Communications (GSM) modems are specialized types of modems that operate over subscription based wireless networks, similar to a mobile phone. A GSM modem accepts a Subscriber Identity Module (SIM) card, and basically acts like a mobile phone for a computer. Such a modem can even be a dedicated mobile phone that the computer uses for GSM network capabilities.

Traditional modems are attached to computers to allow dial-up connections to other computer systems. A GSM modem operates in a similar fashion, except that it sends and receives data through radio waves rather than a telephone line.



APR 9600 VOICE IC:

The APR9600 device offers true single-chip voice recording, non-volatile storage, and playback capability for 40 to 60 seconds. The IC is 28 pin device used to record & playback of maximum of 8 messages. The device supports both random and sequential access of multiple messages. Sample rates are user-selectable, allowing designers to

customize their design for unique quality and storage time needs. the device is ideal for use in portable voice recorders, toys, and many other consumer and industrial applications.

The replayed sound exhibits high quality with a low noise level. Sampling rate for a 60 second recording period I s 4.2 kHz that gives a sound record/replay bandwidth of 20Hz to 2.1 kHz. However, by changing an oscillation resistor, a sampling rate as high as 8.0 kHz can be achieved. This shortens the total length of sound recording to 32 seconds.

Total sound recording time can be varied from 32 seconds to 60 seconds by changing the value of a single resistor. The IC can operate in one of two modes: serial mode and parallel mode. In serial access mode, sound can be recorded in 256 sections. In parallel access mode, sound can be recorded in 2, 4 or 8 sections. The IC can be controlled simply using push button keys. It is also possible to control the IC using external digital circuitry such as micro-controllers and computers.

This APR9600 voice IC has 28 pin DIP package works in supply voltage between 4.5V & 6.5V. During recording and replaying, current consumption is 25 mA. In idle mode, the current drops to 1 mA. The APR9600 experimental board is an assembled PCB board consisting of an APR9600 IC, an electrets microphone, support components and necessary switches to allow users to explore all functions of the APR9600 chip. The oscillation resistor is chosen so that the total recording period is 60 seconds with a sampling rate of 4.2 kHz. The board measures 80mm by 55mm.

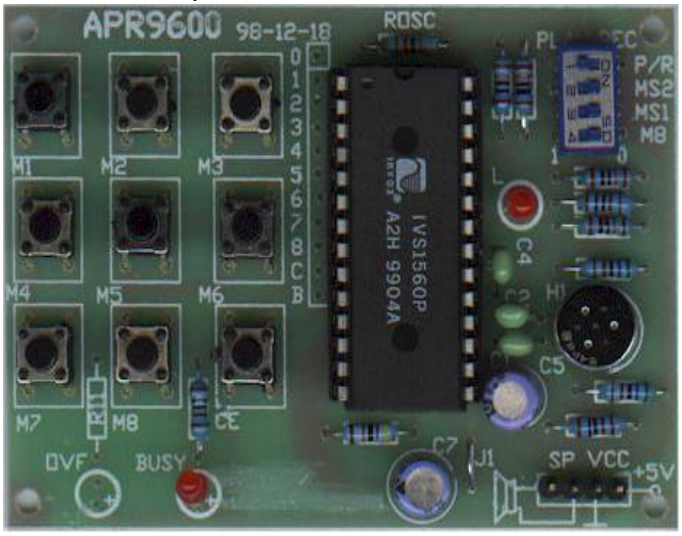
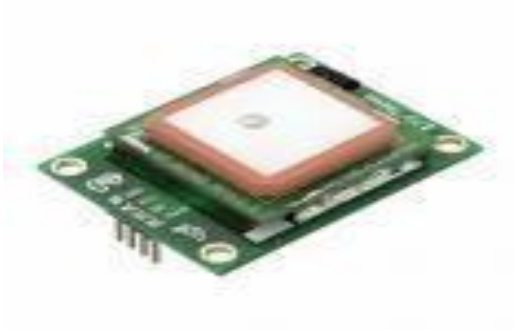


Fig -APR9600 Experimental board

GLOBAL POSITIONING SYSTEM:

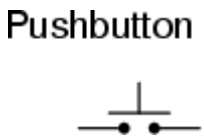
The Global Positioning System (GPS) is a satellite based navigation system that can be used to locate positions anywhere on earth. Designed and operated by the U.S. Department of Defense, it consists of satellites, control and monitor stations, and receivers. GPS receivers take information transmitted from the satellites and uses triangulation to calculate a user's exact location. GPS is used on incidents in a variety of ways, such as:



GPS is made up of three parts: between 24 and 32 satellites orbiting the Earth, four control and monitoring stations on Earth, and the GPS
Receivers owned by users. GPS satellites from space that are used by GPS receivers to provide three-dimensional location (latitude, longitude, and altitude) plus the time.

PUSH BUTTON:

Pushbutton switches are two-position devices actuated with a button that is pressed and released. Most pushbutton switches have an internal spring mechanism returning the button to its "out," or "un pressed," position, for momentary operation. Some pushbutton switches will latch alternately on or off with every push of the button. Other pushbutton switches will stay in their "in," or "pressed," position until the button is pulled back out. This last type of pushbutton switches usually have a mushroom- shaped button for easy push-pull action.



DC MOTOR:

A DC motor in simple words is a device that converts direct current (electrical energy) into mechanical energy. It's of vital importance for the industry today. A DC motor is designed to run on DC electric power. Two examples of pure DC designs are Michael Faraday's homo-polar motor (which is uncommon), and the ball bearing motor, which is (so far) a novelty. By far the most common DC motor types are the brushed and brushless types, which use internal and external commutation respectively to create an oscillating AC current from the DC source—so they are not purely DC machines in a strict sense.

Fig: DC motor

BUZZER:

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, house hold appliances such as a microwave oven, or game shows. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound.

Fig: Buzzer

SPEAKER:

The most widely used type of speaker in the 2010s is the dynamic speaker, invented in 1924 by Edward W. Kellogg and Chester W. Rice. The dynamic speaker operates on the same basic principle dynamic microphone, but in reverse, to produce sound from an electrical signal. When an alternating current electrical audio signal is applied to its voice coil, a coil of wire suspended in a circular gap between the poles of a permanent magnet, the coil is forced to move rapidly back and forth due to Faraday's law of induction, which causes a diaphragm (usually conically shaped) attached to the coil to move back and forth, pushing on the air to create sound waves. Besides this most common method, there are several alternative technologies that can be used to convert an electrical signal into sound. The sound source (e.g., a sound recording or a microphone) must be amplified or strengthened with an audio power amplifier before the signal is sent to the speaker.

Fig:-speaker

RTL schematic diagram:

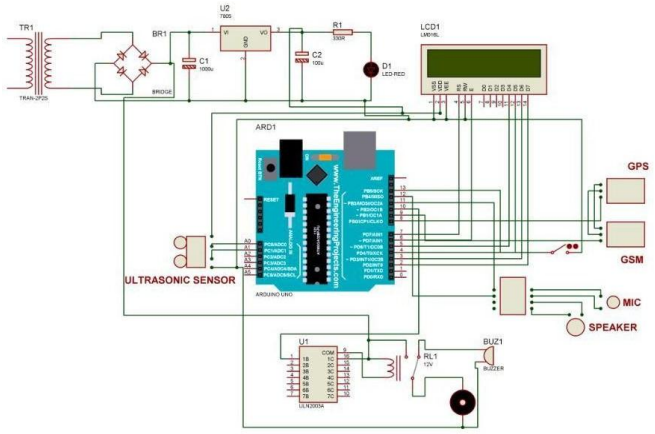


Fig-schematic diagram

Observing the above figure 230 volt is supplied to the system by connecting it to the Arduino through bridge rectifier and voltage regulator decreasing its voltage to Arduino Operating voltage 5V. LCD display is connected to Arduino to display the status of the GPS GSM and ultrasonic sensor. The location coordinates of the user is displayed on the LCD display. The ultrasonic sensor detects the obstacles ahead and communicates with the Arduino. When there is an obstacle detected by the ultrasonic sensor the GPS module is activated and the location coordinates are displayed on the LCD and an SMS is sent to the predefined mobile numbers through GSM module. There is also a panic button is provided to the user for emergency purpose. In case of any emergency, the user can press the panic button which enables the GPS and GSM modules to send the location coordinates to the predefined numbers. A vibrating motor is also provided to give the vibrating sense to the user along with a buzzer sound

3. RESULT:

Fig: Data reception from the GPS module

The above figure represents the data reception from the GPS module. The accurate location coordinates are obtained from the GPS receiver connected to the GPS module

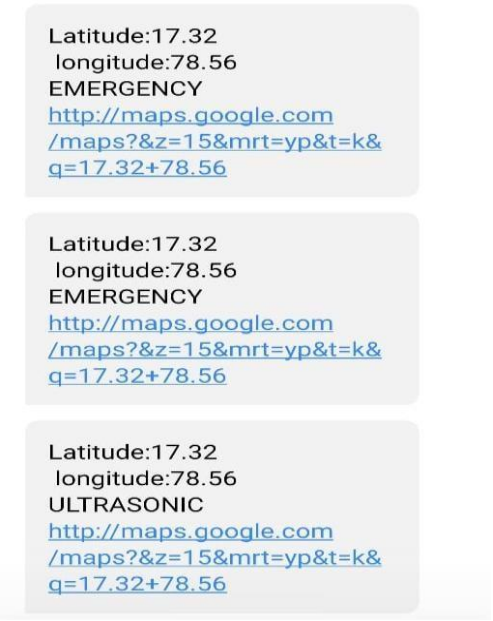


Fig: GPS coordinates displaying on the LCD

Fig: GPS coordinates and google maps location links received from GSM module

The GPS module communicates the location coordinate of the user to the arduino and the GSM module generates an sms with the coordinates from the GPS module. The sms will be sent through a working sim card placed in the GSM module. The message due to an obstacle and the message due to emergency button can be differentiated as shown in the above figure.

4. CONCLUSION:

The project proposed the design and architecture of a new concept of safety device for visually challenged. The advantage of the system lies in the fact that it can prove to be a very low cost solution to millions of visually challenged people around the world. The proposed system is a combination of various working units makes a real-time system that monitors position of the user and provides dual feedback making navigation more safe and secure. It can be further improved to have more decision taking capabilities by employing varied types of sensors and thus could be used for different applications. It aims to solve the problems faced by the blind people in their daily life. This system also takes measures to ensure their safety.

5. REFERENCES

1) H.ZhangandC.Ye,"An indoor way finding system based on geometric features aided graph SLAM for the visually impaired," IEEE Trans. NeuralSyst.Rehabil.Eng.,vol.PP,no.99,pp.1- 1,2017.

2) D. Dakopoulos and N. G. Bourbakis, "Wearable obstacle avoidance electronic travel aids for blind: A survey," IEEE Trans. Syst., Man, Cybern., vol. 40, no. 1, pp. 25- 35, Jan.2010.

3) R. Mur-Artal, J. M. M. Montiel and J.D. Tardós, "ORB-SLAM: A Versatile and Accurate MonocularSL AM System, "IEEE Trans. Robot., vol. 31, no. 5, pp. 1147-1163, Oct.2015.

4) R. Mur-Artal and J. D. Tardos, "ORB- SLAM2: An open-source SLAM system for monocular, stereo, and RGB-Dcameras,"IEEE Trans. Robot., vol. PP, no. 99, pp.1-8.M. Kanaan, F. O. Akgul, B. Alavi and K. Pahlavan, "A study of the effects of reference point density onToa –based UWBindoor positioning systems," 2006 IEEE 17th Int. Symp. Pers., IndoorMobile Radio Commun., Helsinki, 2006, pp.1-5.

5) H.Wu,A. Marshall and W.Yu, "Path planning and following algorithms in an indoor navigation model for visually impaired," in 2nd Int. Conf. Internet Monitoring and Protection (ICIMP 2007), San Jose, 2007, pp. 38-38

6) W. C. S. S. Simões and V. F. de Lucena, "Blind user wearable audio assistance for indoor navigation based on visual markers and ultrasonic obstacle detection," in 2016 IEEE Int. Conf. Consum. Electron. (ICCE), Las Vegas, 2016, pp.60-63