## SMART BLIND STICK WITH GPS TRACKING USING GSM

**K Suresh** Associate Professor Electrical and Electronics Engineering Hyderabad Institute of
Technology and Management Hyderabad, India Sureshk.eee@hitam.org
**K Srikanth** Electrical and Electronics Engineering Hyderabad Institute of Technology and
Management Hyderabad, India katakamsunny228@gmail.com
**A Karthikeya** Electrical and Electronics Engineering Hyderabad Institute of Technology and
Management Hyderabad, India karthikeyaasam94@gmail.com
**S Uday Krishna** Electrical and Electronics Engineering Hyderabad Institute of Technology and
Management Hyderabad, India udaysiddam1411@gmail.com
**G Rahul** Electrical and Electronics Engineering Hyderabad Institute of Technology and
Management Hyderabad, India godugurahul151@gmail.com

Abstract— Blind sticks are the supporting devices to help visually impaired individuals in scanning their surroundings and identifying the obstacles without the need of assistance from external agents. The current mechanical form of the blind sticks needs up-gradation for better support to the subject. This system integrates a smart blind stick with GPS tracking capabilities and GSM communication, enabling real-time tracking and remote assistance. The smart blind stick utilizes ultrasonic sensors to detect obstacles and provide haptic feedback to the user. It also incorporates a GPS module that constantly updates the user's location. The GSM module facilitates communication between the blind user and their caregivers or family members, allowing for immediate assistance in case of emergencies or navigational challenges. The integration of GPS tracking and GSM communication empowers visually impaired individuals to navigate more confidently and securely in their surroundings.
KEYWORDS : GPS,GSM,COMMUNICATION SYSTEM.

**INTRODUCTION:**

Blindness is a very common disability among the peoples throughout the world. According to the World Health Organization (WHO) 285 million people are visually impaired worldwide, 39 million are blind and 246 have low vision. About 90% of the world's visually impaired live in developing countries. For the indigents blindness is a curse. They need help to walk outside and all other daily essential works. So the paper glows a system that tries to remove the curse of blindness and make them self- dependent to do their daily chores. It is a walking stick, normally used by the blinds. But it is fully automated, easy to maintain, cheap and it is very comfortable to use. The power consumption is low and can be operated easily. Above all the stick is very economic over the conventional one. The walking stick mentioned above is a stick that consists of a circuit board that

contains a PIC micro controller, different sensors, and buzzer. The entire project is designed using micro-controller based upon its reliability. The micro-controller is code protected so its security bridge cannot be override except the vendor or owner. Here one micro-controller is used, that is PIC16F876a. All sensors data are taken by the micro-controller and it produces the sensors of output.
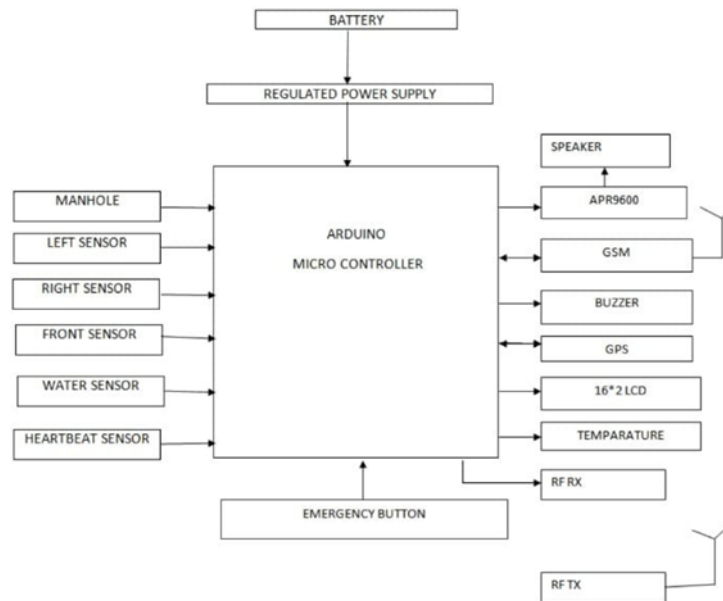
BLOCK DIAGRAM:



Fig: Block diagram of Smart Blind Stick with vibration and alarm system

Hardware Components:
1.      Regulated Power Supply.
2.      Arduino MEGA2560
3.      Buzzer
4.      GSM AND GPS
5.      Obstacle sensor
6.      Water level sensor
7.      Manhole sensor
8.      RF Module
9.      LCD
10.     HEART BEAT SENSOR
11.     TEMPARATURE SENSOR
12.     BUTTON PANIC

1.      Regulated Power Supply(RPS) :
Power supply is a supply of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.A power supply may include a power distribution system as well as primary or secondary sources of energy such as
•       Conversion of one form of electrical power to another desired form and voltage, typically involving
converting AC line voltage to a well-regulated lower-
voltage DC for electronic devices. Low voltage, low power DC power supply units are commonly integrated with the devices they supply, such as computers and household
electronics.
•       Batteries.
•       Chemical fuel cells and other forms of energy storage systems.
•       Solar power.
•       Generators or alternators.

2.      Arduino MEGA 2560:

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything neede d to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC - to-DC adapter or battery to get started. The Mega 2560 board is compatible with most shields designed for the Uno and the former boards Duemilanove or Diecimila.The Mega 2560 is an update to the Arduino Mega, which it replaces

Features:

| | | |
|---|---|---|
| Microcontroller | ATMega2560 | wireless networks, similar to a mobile phone. A GSM Subscriber Identity Module (SIM) card, and basically phone for a computer. Such a modem can even be |
| Operating Voltage | 5V | phone that the computer uses for GSM network cap Traditional modems are attached to computers connections to other computer systems. A GSM m |
| Input Voltage (recommended) | 7-12V | similar fashion, except that it sends and receives waves rather than a telephone line. This type of external device connected via a Universal Serial Bu |
| Input Voltage (limit) | 6-20V | serial cable. More commonly, however, it is a smal directly into the USB port or card slot on a compute It is widely used mobile communication system in |
| Digital I/O Pins | 54 | an open and digital cellular technology used for t voice and data services operates at the 850MHz, 9 and 1900MHz frequency bands. **Features** |
| Analog Input Pins | 16 | • Improved spectrum efficiency |

| | |
|---|---|
| DC Current per I/O Pin | 20 mA |
| DC Current for 3.3V Pin | 50 mA |
| Flash Memory | 256 KB |
| SRAM | 8 KB |
| EEPROM | 4 KB |
| Clock Speed | 16 MHz |

3.      Buzzer

Basically, the sound source of a piezoelectric sound component is a piezoelectric diaphragm. A piezoelectric diaphragm consists of a piezoelectric ceramic plate which has electrodes on both sides and a metal plate (brass or stainless steel, etc.). A piezoelectric ceramic plate is attached to a metal plate with adhesives. Applying D.C. voltage between electrodes of a piezoelectric diaphragm causes mechanical distortion due to the piezoelectric effect. For a misshaped piezoelectric element, the distortion of the piezoelectric element expands in a radial direction. And the piezoelectric diaphragm bends toward the direction. The metal plate bonded to the piezoelectric element does not expand. Conversely, when the piezoelectric element shrinks, the piezoelectric diaphragm bends in the direction Thus, when AC voltage is applied across electrodes, the bending is repeated, producing sound waves in the air.To interface a buzzer the standard transistor interfacing circuit is used. Note that if a different power supply is used for the buzzer, the 0V rails of each power supply must be connected to provide a common reference.If a battery is used as the power supply, it is worth remembering that piezo

sounders draw much less current than buzzers. Buzzers also just have one 'tone',whereas a piezo sounder is able to create sounds of many different tones.

To switch on buzzer -high 1 To switch off buzzer -low 1.

4.        GSM &GPS

GSM :

Global System for Mobile Communications (GSM) modems are specialized types of modems that operate over subscription based

modem accepts a acts like a mobile

a dedicated mobile abilities.

to allow dial-up odem operates in a data through radio modem may be an s (USB) cable or a l device that plugs

or laptop.the world. GSM is ansmitting mobile 00MHz, 1800MHz

•        International roaming
•        Compatibility with integrated services digital network (ISDN)
•        Support for new services.
•        SIM phonebook management
•        Fixed dialing number (FDN)
•        Real time clock with alarm management
•        High-quality speech
•        Uses encryption to make phone calls more secure
•        Short message service (SMS)

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves.

A GSM modem can be an external device or a PC Card / PCMCIA Card. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop computer. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate.

In addition to the standard AT commands, GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards. With the extended AT commands, you can do things like:

•        Reading, writing and deleting SMS messages.
•        Sending SMS messages.
•        Monitoring the signal strength.
•        Monitoring the charging status and charge level of the battery.
•        Reading, writing and searching phone book entries.

The number of SMS messages that can be processed by a GSM modem per minute is very low -- only about six to ten SMS messages per minute.
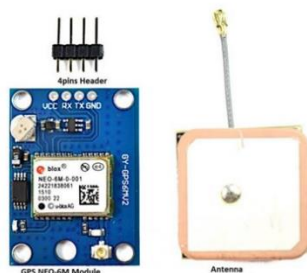
GPS:



Fig: GPS Module

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 broadcast signals from space that are used by GPS receivers to provide three- dimensional location (latitude, longitude, and altitude) plus the time.

• To determine position locations; for example, you need to radio a helicopter pilot the coordinates of your position location so the pilot can pick you up.

• To navigate from one location to another; for example, you need to travel from a lookout to the fire perimeter.

• To create digitized maps; for example, you are assigned to plot the fire perimeter and hot spots. To determine distance between two points or how far you are from another location.

5.      Obstacle Sensor

This "ECHO" Ultrasonic Distance Sensor from Rhydolabz is an amazing product that provides very short (2CM) to long-range (4M) detection and ranging. The sensor provides precise, stable non-contact distance measurements from 2cm to 4 meters with very high accuracy. Its compact size, higher range and easy usability make it a handy sensor for distance measurement and mapping. The board can easily be interfaced to microcontrollers where the triggering and measurement can be done using one I/O pin. The sensor transmits an ultrasonic wave and produces an output pulse that corresponds to the time required for the burst echo to return to the sensor. By measuring the echo pulse width, the distance to target can easily be calculated.

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:

Echo Sensor Features:
1.      Professional EMI/RFI Complaint PCB Layout Design for Noise Reduction
2.      Range : 2 cm to 4 m
3.      Accurate and Stable range data
4.      Data loss in Error zone eliminated
5.      Modulation at 40 KHz
6.      Mounting holes provided on the circuit board
7.      Triggered externally by supplying a pulse to the signal pin
8.      5V DC Supply voltage
9.      Current - < 20mA
10 .Bidirectional TTL pulse interface on a single I/O pin can co mmunicate with 5 V TTL or 3.3V CMOS microcontrollers
11.     Echo pulse: positive TTL pulse, 87 ^s minimum to 30 ms maximum(PWM)
12.     On Board Burst LED Indicator shows measurement in progress
13.     3-pin header makes it easy to connect using a servo extension cable, no soldering required

Water Level Sensor:

Level sensors detect the level of substances that flow, including liquids, slurries, granular materials, and powders. All such substances flow to become essentially level in their containers (or other physical boundaries) because of gravity. The substance to be measured can be inside a container or can be in its natural form (e.g. a river or a lake). The level measurement can be either continuous or point values. Continuous level sensors measure level within a specified range and determine the exact amount of substance in a certain place, while point-level sensors only indicate whether the substance is above or below the sensing point. Generally the latter detect levels that are excessively high or low.

There are many physical and application variables that affect the selection of the optimal level monitoring method for industrial and commercial processes. The selection criteria include the physical: phase (liquid, solid or slurry), temperature, pressure or vacuum, chemistry, dielectric constant of medium, density (specific gravity) of medium, agitation, acoustical or electrical noise, vibration, mechanical shock, tank or bin size and shape. Also important are the application constraints: price, accuracy, appearance, response rate, ease of calibration or programming, physical size and mounting of the instrument, monitoring or control of continuous or discrete (point) levels.

This article discusses level sensing from the perspective of the phase of the material - solid, liquid, and slurry-type - and how their physical and electrical properties may affect the performance of the sensor.

Manhole Sensor(IR sensor):

Various types of infrared based applications are available in the market. The circuit for infrared based applications is designed along with the transmitter and receiver sections i.e. we can't use it for other application. But the infrared communication project which we have done here can be used in any application just by replacing the application at the place of infrared LED in the circuit diagram of infrared communication. By using this project we can design infrared based applications easily. The entire circuit consists of two sections named as

1.      Transmitter section and
2.      Receiver section
1.      Transmitter section:

The transmitter section consists of a 555 timer IC functioning in astable mode. It is wired as shown in figure. The output from astable mode is fed to an IR LED via resistor which limits its operating current. Infrared LED in the transmitter section emits IR radiation which is focused by a plastic lens (optics) in to a narrow beam.

2.      Receiver section:

The receiver section consists of a silicon phototransistor to convert the infrared radiation to an electric current. It responds only to the rapidly pulsing signal created by the transmitter, and filters out slowly changing infrared radiation from ambient light. The receiver section comprises an infrared receiver module, and a led indicator. When the signals are interrupted, the IR Led goes off after a few seconds depending upon the value of RC combination.

We can increase the distance between the IR transmitter and receiver just by placing the lens between them. After connecting the IR transmitter and receiver circuit, we can get the output by applying 6V Power supply to the circuit. We can use this circuit with any application very simply. For example a buzzer circuit is placed at the output of IR circuit, when the signals are interrupted, the buzzer produces sound. Both the transmitter and receiver parts can be mounted on a single bread board or PCB. The infrared receiver must be placed behind the IR Led to avoid false indication due to infrared leakage. An object moving nearby actually reflects the IR rays emitted by the IR Led.

Radio Frequency Module:

RF Transmitter:

The function of a radio frequency (RF) transmitter is to modulate, up convert, and amplify signals for transmission into free space. An RF transmitter generally includes a modulator that modulates an input signal and a radio frequency power amplifier that is coupled to the modulator to amplify the modulated input signal. The radio frequency power amplifier is coupled to an antenna that transmits the amplified modulated input signal. The RF transmitter used in our project is TWS-434A. This RF transmitter transmits data in the frequency range of 433.92 MHz with a range of approximately 400 foot (open area) outdoors. Indoors, the range is approximately 200 foot, and will go through most walls. TWS-434A has features which includes small in size, low power consumption i.e. 8mW and operate from 1.5 to 12 Volts- DC, excellent for applications requiring short-range RF signal. Data to be send is Amplitude modulation with the carrier RF signal.
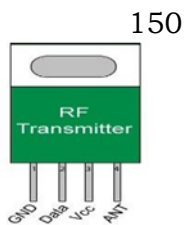
Fig. RF TRANSMITTER

Pin Description of Transmitter
•       Pin 1: Ground (-5v)
•       Pin2: Input pin for data from encoder
•       Pin3: Supply (+5v)
•       Pin 4: Pin for external RF antenna

RF Receiver:

The RF receiver receives an RF signal, converts the RF signal to an IF signal, and then converts the IF signal to a base band signal, which it then provides to the base band processor. As is also known, RF transceivers typically include sensitive components susceptible to noise and interference with one another and with external sources. The RF receiver is coupled to the antenna and includes a low noise amplifier, one or more intermediate frequency stages, a filtering stage, and a data recovery stage. The low noise amplifier receives an inbound RF signal via the antenna and amplifies it. The RF receiver used is RWS-434. This RF receiver receives RF signal which is in the frequency of 434.92 MHz and has a sensitivity of 3uV. The RWS- 434 receiver operates from 4.5 to 5.5 volts-DC, and has both linear and digital outputs and its tunable to match the frequency of the transmitter unit.
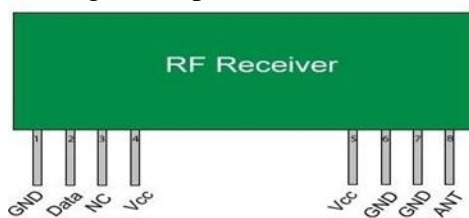


Fig. RF RECEIVER

Pin Description of Receiver
•       Pin1: Ground (-5v)
•       Pin2: Output Pin For Digital Data Recieved
•       Pin 3: Output Pin For Analog Data Recieved
•       Pin4: Supply (+5v)
•       Pin5: Supply (+5v)
•       Pin6: Ground (-5v)
•       Pin7: Ground (-5v)
Pin 8: Pin For External RF Antenna

LCD:

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.
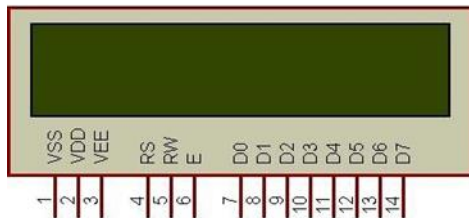
Fig. 16x2 LCD

Heart Beat Sensor:

Heartbeat sensor. It is a noninvasive type biomedical sensor which works on Principle of Infrared light propagation through Human Blood. It gives a digital Pulse output (+5V) every time a Heart Beats. It works on +5 volt DC supply. Heart beat sensor gives digital Pulse outputs of heat beat when a finger is placed on it. When the heart beat is detected, the output beat LED flashes in union with each heartbeat. This digital output can be connected to microcontroller directly to measure the Beats per Minute ( BPM) rate. Analog output can be used to show waveform of heart beats. It works on the principle of Light modulation by blood flow due to heart beat through finger at each pulse.

Features:
• Operating voltage: 5V DC
• Output pattern: Pulsating DC Works on IR sensor principle
• Suitable for measuring the pulse rate easily
• Easy to operate.

Temperature Sensor :

Temperature is the most-measured process variable in industrial automation. Most commonly, a temperature sensor is used to convert temperature value to an electrical value. Temperature Sensors are the key to read temperatures correctly and to control temperature in industrials applications.

A large distinction can be made between temperature sensor types. Sensors differ a lot in properties such as contact-way, temperature range, calibrating method and sensing element. The temperature sensors contain a sensing element enclosed in housings of plastic or metal. With the help of conditioning circuits, the sensor will reflect the change of environmental temperature.

Temperature Sensor (LM35)
Pin Definition
The definition of gray-scale sensor pin is
1. Signal Output
2. GND
3. Power

Features Of Temperature Sensor
• Calibrated directly in Celsius (centigrade)
• 0.50 C Ensured accuracy (at +250 C)
• Suitable for remote applications
• Operate from 4 to 30 V
• Low cost due to wafer-level trimming
Specifications
• Type: Analog
• Sensitivity: 10mV per degree Celcius
• Functional range: 0 degree Celsius to 100 degree Celsius

Software Components:

Arduino IDE:

Arduino microcontrollers are programmed using software.The platform is known as Arduino Integrated Development Environment (IDE). It provides an easy-to-use interface that allows you to create, collect and upload code to Arduino devices. Here are a few cross-platform features and details compatibility with Arduino IDE. Many users can use Arduino IDE because it is available for Windows, macOS and Linux. User-friendly interface. The user-friendly interface of IDEja#039; making it suitable for both beginners and experienced developers. Code Editor: This code editor facilitates the writing and reading of code by offering features like syntax highlighting, code completion, and auto-indentation. Integrated Examples Many built-in examples in the Arduino IDE assist users in learning how to use various Arduino libraries and functionalities. Manager of the Library Manager in the Arduino IDE makes it simple for users to install and maintain libraries for different sensors, modules, and parts. Monitor in Serial One of the IDEand#039;s tools for facilitating communication between the Arduino board and the computer is the Serial Monitor. It is frequently used for Arduino output monitoring and debugging. Manager of the Board the process of adding support for various Arduino-compatible boards is made simpler by the Board Manager. From a list, users can choose the exact Arduino board theyand#039;re using. Simple Code Upload With just one click, users of the IDE can upload their code to the Arduino board. It seamlessly manages the uploading and compilation process. Integrated Support Links to the Arduino website and useful documentation are provided by the IDE, offering resources for learning and troubleshooting. Accessible Source The source code for the Arduino IDE is open-source and available for customization. This transparency promotes improvements and contributions from the community.

REQUIRED LIBRARIES:

The     library is an extension of the standard Liquid Crystal library for Arduino, specifically designed to work with LCD displays that communicate using the I2C protocol. This library simplifies the process of interfacing with I2C-enabled LCD displays, reducing the number of wires needed for connection.

2.Wire

The            library in Arduino is used for I2C communication. I2C, which stands for Inter-Integrated Circuit, is a serial communication protocol that allows multiple devices to communicate with each other using only two wires: one for data (SDA - Serial Data) and one for clock (SCL - Serial Clock). The library     simplifies     the     implementation     of     I2C communication in Arduino sketches

3.

Unlike the hardware serial ports (e.g., Serial, Serial1) that are typically used for communication with a computer or other

Conclusion:

In conclusion,Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested.

Future Scope:

Our proposed project first uses ultrasonic sensors to detect obstacles ahead using ultrasonic waves. On sensing obstacles the sensor passes this data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close enough. If the obstacle is not that close the circuit does nothing. If the obstacle is close the microcontroller sends a signal to sound a speaker. It also detects and sounds a different buzzer if it detects water and alerts the blind. The system has one more advanced feature integrated to help blind find their stick if they forget where they kept it.. Pressing the remote

button sounds a buzzer on the stick which helps the blind person to find their stick. Thus this system allows for obstacle detection as well as finding stick if misplaced by visually disabled people.

Working :
hardware,     enables serial   communication between two Arduino boards or between an Arduino and another     WORKING: This smart blind stick provides guidelines to the device using only digital pins. The Arduino allows you to create communication port on digital pins

4.       Adafruit_FONA
library in a software-based serial
blind/deaf and dumb peoples and also provides security from different situations like obstacle, manhole and water. This blind stick detects the obstacles using sensors which are in front of the blind person. This stick monitors the heartbeat ,body temperature and shown in lcd to know the
basic health condition of user.   This device automatically senses the

The library is part of the Adafruit presence of obstacles in its path and helps blind people in deviate their
FONA library, which is designed for Adafruit's FONA series of GSM/GPRS cellular modules. These modules allow Arduino or other microcontroller-based projects to communicate over the cellular network for various applications like sending SMS messages, making phone calls, and connecting to the internet.

Prototype:
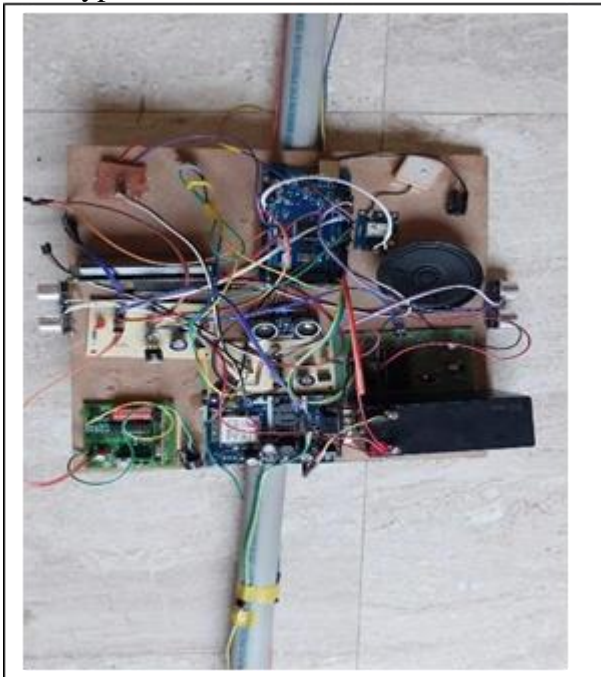


direction of movement through speaker and buzzer alarm. This stick consists of a Microcontroller based control system, Buzzer, water sensor, manhole detection sensor and Obstacle detection Sensor. The obstacle detection mechanism is done by ultrasonic sensor to find the presence of an obstacle in its path. Voice circuit is a system which is capable of storing voices and playing back the stored voices when obstacles, manholes & water are detected. This system eliminates the usage of old alarm systems and makes to configure the alerts through voice. If any manhole or water detected in front of the person then this system immediately gives alert to the person through speaker. This device is designed in such a way that there is no requirement of manual attention towards it except in case of emergency situations. This device is installed with GPS and GSM module for tracking of user. An emergency button is provided in this device, whenever the button is pressed the location details of user are sent to

the preinstalled mobile number. Another button is also provided in this device, which is used to find the stick whenever the stick is misplaced or lost.

Result: By using this project we can design Smart Blind Stick with voice& alarm system and Smart blind walking stick using Arduino can be successfully developed. This paper proposed the design and architecture of a new concept of Smart Stick for blind people. The advantage of the system lies in the fact that it can prove to be a very low cost solution to millions of blind person worldwide.

References:

☐       References: U. Masud, T. Saeed, H. M. Malaikah, F. U. Islam and G. Abbas, "Smart Assistive System for Visually Impaired People Obstruction Avoidance Through Object Detection and Classification," in IEEE Access, vol. 10, pp. 13428- 13441, 2022,

☐       S.Ponnada, S. Yarramalle and M. R. T. V., "A Hybrid Approach for Identification of Manhole and Staircase to Assist Visually Challenged," in IEEE Access, vol. 6, pp. 41013-41022, 2018.

☐       Mukesh Prasad Agrawal, Atma Ram Gupta, "Smart Stick for the Blind and Visually Impaired People", National Institute of Technology Kurukshetra, 2nd International Conference on Inventive Communication and Computational Technologies (ICICCT 2018)

☐              Md. S.Arefi and, T. Mollick, ―Design of an Ultrasonic Distance Meter,‖ International journal of scientific and engineering research Vol. 4, Issue3, March, 2013.

☐       A. Agarwal , D. Kumar and A. Bhardwaj, ― Ultrasonic Stick for Blind,‖ International journal of engineering and computer science, ISSN:2319-7242 Vol. 4, Issue 4, April 2015, pp. 11375-11378.

☐       S.Koley and R. Mishra, ―Voice Operated Outdoor Navigation System for Visually Impaired Persons,‖International journal of engineering trends and technology, Vol.3,Issue 2, 2012