Location Sharing and Obstacle Alert for Blind

Rajesh Yedluri[1] Rama Krishna Somulavari[2] Manish Chowdary Veeravalli[3] Kaleshavali Shaik[4] Sunil Babu Melingi[5]
[1,2,3,4]Student [5]Associate Professor
[1,2,3,4,5]Department of Electronics & Communication Engineering
[1,2,3,4,5]VVIT, Guntur, Andhra Pradesh, India

Abstract— Now-a-days there are many types of aids to the blind people in order to make their life easier. Blind people may face problems in some or the other way i.e. whenever they get lost in any place or met with an accident. To overcome such problems we turned up with a smart technical solution which helps the blind people to get identified easily to sense the obstacles in a smart manner. Blind stick consists of an Ultrasonic sensor, a GPS module and a GSM module. The sensor is used to indicate the person that obstacles are ahead of him. GPS module is used to indicate the location where as a GSM module is used for smart communication. This system is intended to provide overall measures and real-time assistance via GPS. The system consists of Ultrasonic sensor, GPS module, GSM 900 Module and Vibratory circuit (speakers or head phones). This project aims at the development of an Electronic Travelling Aid (ETA) kit to help the blind people to find obstacle free path. This ETA is fixed to the stick of the blind people. When the object is detected near to the blind person's stick, it alerts them with the help of vibratory circuit.

Key words: Blind People, Arduino, GSM, GPS, ETA

I. INTRODUCTION

Visual impairment can limit people's ability to perform everyday tasks and can affect their quality of life and ability to interact with the surrounding world. Blindness, the most severe form of visual impairment, can reduce people's ability to perform daily tasks, and move about unaided. Good quality rehabilitation allows people with different degrees of visual impairment to fully profit from life, achieve their goals and be active and productive in today's society. Ample efforts have been made to aid the blind by innovating and improving technologies. One of the major factors in developing these technical aids is the compatibility with the user. Other feature of these products should be the durability.

The users might not be able to charge the system. So, appropriate measure should be taken for it. To aid visually impaired and to provide a compact and complete solution, a blind stick can be developed which will include a GPS system, obstacle detection mechanism and an audio module, so that the stick can instruct the directions to the user. The obstacle detection mechanism is combined with navigation and location detection using GPS-GSM and an audio module with Bluetooth transceiver to provide a better solution than the already existing solutions.

The technologies we plan to use are sonar technology, GPS navigation, GSM network, voice recognition and notification. Sonar technology is used for obstacle detection. The principle of the system works in the way that the detector sends and receives a signal. Upon the reception of the signal, the distance is calculated using the time it took for the signal to reflect back. It is a simple procedure which works with the properties of electromagnetic waves. This is mainly used to find distances in various fields.

II. RELATED WORK

Existing paper works and solutions related to GPS-GSM, and Obstacle detection reveal that, so far, all these technologies have been implemented individually but not integrated for the cause of the blind.

In sonar technology, sound propagations is used to navigate, detect objects on or under the surface of the water, such as other vessels. Active sonar is emitting pulses of sounds and listening for echoes. This is the mechanism we will be working with. This is primarily used for acoustic location tracking. Ultrasonic sensors are very well used for sensing applications in the areas of engineering, physics and medicine. Smart walking stick for visually impaired [1] incorporates artificial vision and object detection integrated with GPS to enable the user to know about the environment for efficient navigation. Although it is an advanced technology, lack of voice recognition to input the destination is a disadvantage to this system.

Obstacle Detection in Unfamiliar Indoor Environments [2] comprises of a Kinect unit, a Tablet PC, a microcontroller, IMU sensors, and vibration actuators. These vibrators minimize the reliance on audio instructions for avoiding obstacles. It can also guide the blind to reach a desired destination (office/room/elevator) within an unfamiliar building with the help of RGB camera of Kinect unit, 2-D printed codes, a compass sensor for orienting the user towards the next direction of movement, and synthesized audio instructions. The system is heavily equipped and needs complex and heavy computations and processing which lead to rise in costs and energy consumption. Enhancement of smart cane [3] talks about a method which uses a smart cane to detect and notify obstacles.

The notification is done to the user with the help of his smart phone. The sensors in the cane detect the distance between both the user and the obstacle. It also uses a gsm module in the system to track his location. It also uses a trivial accelerometer to detect uneven topologies. This helps a great lot to avoid accidents. Only limitation is that every user should be equipped with a smartphone because the data from the sensors are collected by the phone. These data is then transferred to the user by the help of an earphone. Design and development of secure navigation system for visually impaired people [4] is an infrared based detecting system and it announces obstacles in the user's path. This system also gives the necessary guidelines for the user to avoid the obstacles. This notification is done by vitro-tactile or sound feedback. In this system, a light weight sensor is

attached to a head cap so that the user is informed about the obstacles near to the head area.

This provides an advantage over the simple walking stick. Obstacle detection gadget for visually impaired people [5] obstacle detection system proposed is based on infrared and the output is provided by buzzers and vibrators. This system is used for indoor obstacle detection. Enhanced independence free path detector to blind people using gsm has been proposed in [6]. Infrared technology is used for shoulder width field view from knee to head level. This significantly increases the field of view, but the infrared rays are easily shielded which reduces the efficiency and effectiveness of the system. Blind Aid using Radio Frequency Identification (RFID) and Ultrasonic sensors [7] uses RFID technology and ultrasonic sensors to help in improved navigation, but RFID has its own constraints like interference and complexity due to RFID tagging of every object in the vicinity.

III. PROPOSED MODEL

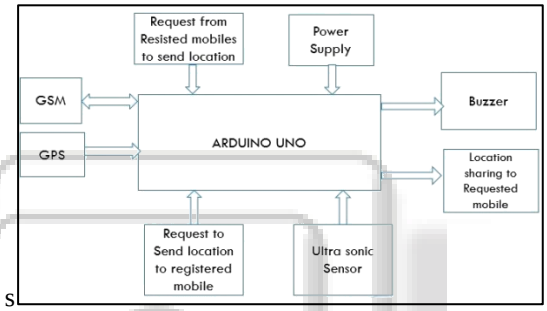


Fig. 1: Block Diagram of the system

The Fig illustrates the architecture of the blind stick, which depicts the various technologies and technological standards that are used. The Arduino Uno collects the data from the different modules interfaced to it, such as the GPS module upon being triggered by the Arduino Uno by receiving SMS from GSM module. The GSM module is used as an interface to send the data received by the Arduino Uno via SMS to a mobile. The GSM module functions as a trigger for the Arduino Uno to request data from its various modules connected to it. If an SMS text with specified keyword is sent to request the current location or GPS coordinates is sent to the GSM module via the user's phone, then the GSM module triggers the Arduino Uno to request the current GPS coordinates.

IV. COMPONENTS

A. Hardware Components

1) Arduino UNO:

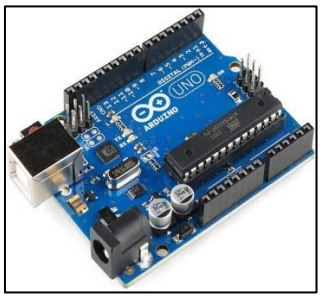


Fig. 2: Arduino Uno

The Arduino UNO receives data from different modules and analysis the data and customises the data in a user understandable format. For the moment the design is not made compact, since the main focus now has been to show that this concept of blind stick would be highly impactful for blind people. The blind stick runs on a battery or any external source. In order to minimize power consumption, the blind stick has been programmed to provide GPS and other information only by accessing the switch.

2) GPS Module:

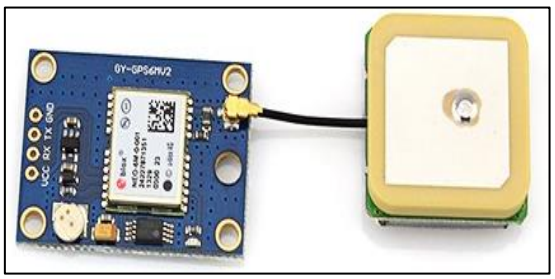


Fig. 3: GPS location Sensor

For determining the real time location of the child NEO6MV2 GPS module has been used which communicates with the Arduino Uno through a 9600 bps software serial interface. The connections between the Arduino Uno and the GPS module established like the connections with GSM module. It has a low power consumption and small size, which is very compact. The GPS module output comprises of standard string information which is governed by the National Marine Electronics Association (NMEA) protocol. Once the SMS trigger text "LOCATION" is sent from the cell phone of the user, this text is received by the GSM which in turn triggers the Arduino Uno to execute the GPS code to fetch the current, accurate location of the GPS module. The location output received from the GPS module is in the following format:

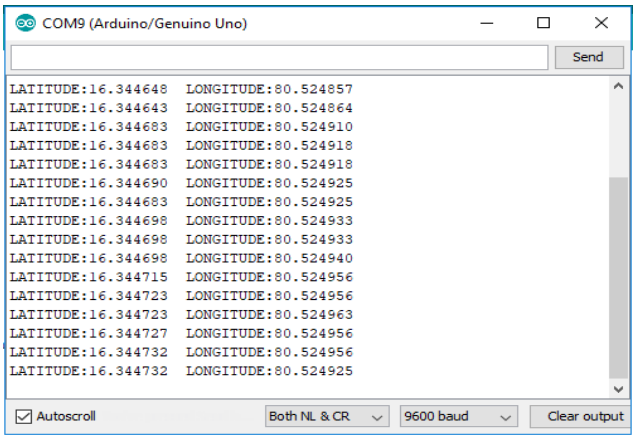


Fig. 4: Output received GPS location sensor

The latitude and longitude coordinates received are stored in variables called "latitude" and "longitude," which are then called upon when the SMS text received on the GSM module matches with the keyword "LOCATION". Once the SMS trigger text "LOCATION" is sent from the Smartphone of the user, this text is received by the Arduino GSM Shield which in turn triggers the Arduino Uno to execute the GPS code to fetch the current, accurate location of the GPS module. The location output string received from the GPS module is in the following format:

$GPRMC,220516,A,5133.82,N,00042.24,W,173.8,231.8,130694,004.2,W*70
1 2 3 4 5 6 7 8 9 10 11 12

1.	220516	Time Stamp
2.	A	validity A-ok, V-invalid
3.	5133.82	current Latitude
4.	N	North/South
5.	00042.24	current Longitude
6.	W	East/West
7.	173.8	Speed in knots
8.	231.8	True course
9.	130694	Date Stamp
10.	004.2	Variation
11.	W	East/West
12.	*70	checksum

3) GSM Module:

GSM/GPRS Modem-RS232 is built with Dual Band GSM/GPRS engine- SIM900A, works on frequencies 900/ 1800 MHz. The Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip (MAX232). The baud rate is configurable from 9600-115200 through AT command. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface. The on-board Regulated Power supply allows you to connect wide range unregulated power supply. Using this modem, you can make audio calls, SMS, Read SMS, attend the incoming calls and internet etc. through simple AT commands.

Fig. 5: GSM Module

It transfers the information over to the user via SMS. Arduino provides GSM libraries for GSM module as well which allows the GSM module to make/receive a call, send/receive SMS and act as a client/server. The GSM module receives 5V power supply directly from the 5V pin connection at the Arduino Uno 5V. The serial communication between the Arduino Uno and GSM module is performed between the serial pins 0,1. The Arduino has been programmed to receive SMS text messages from the caretaker's cell phone via GSM module. It also sends the location in the form of message through GSM module when blind person activates the switch on stick.

4) Buzzer:

Fig. 6: DS18B20

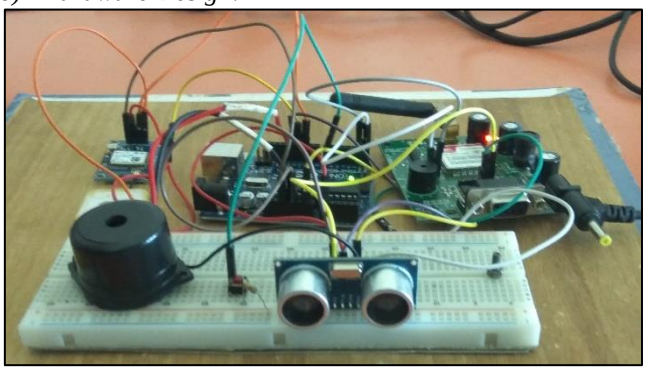
A buzzer is an audio signaling device which may be mechanical, electromechanical or piezo electric. When an obstacle is detected within the range of the ultrasonic sensor then a beep sound is generated through the buzzer continuously until the obstacle is in range. This buzzer is connected to the arduino through pin 13 and the other pin grounded.

5) Ultrasonic Sensor:

Fig. 7: Ultrasonic Sensor

This is the HC-SR04 ultrasonic ranging sensor. This economical sensor provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm. Each HC-SR04 module includes an ultrasonic transmitter, a receiver and a control circuit. There are only four pins that you need to worry about on the HC-SR04: VCC (Power), Trig (Trigger), Echo (Receive), and GND (Ground).

6) Hardware Design:



7) Software used: Arduino IDE

The Arduino integrated development environment - or Arduino software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and genuino hardware to upload programs and communicate with them. A program written with the ide for Arduino is called a sketch. Sketches are saved on the

development computer as text files with the file extension .ino. Arduino software (IDE) pre-1.0 saved sketches with the extension .pde. The Arduino ide supports the languages c and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the wiring project, which provides many common input and output procedures. The below figures show the software implementation of the above hardware setup.

Fig. 8:

Fig. 9:

Fig. 10:

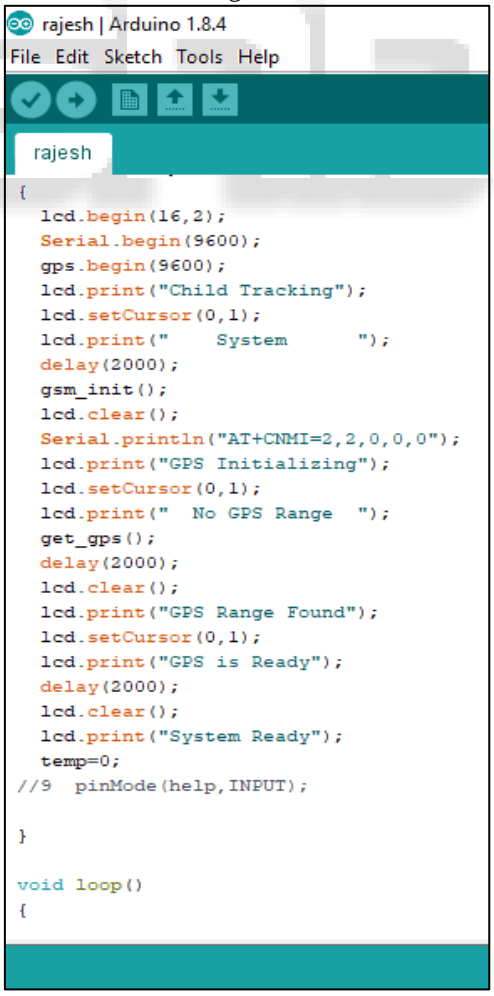


Fig. 11:

V. RESULT

In this section, the experimental tests were performed to determine the various components of the proposed wearable device.

A. GPS Location Sensor

Upon testing the wearable device multiple times with repeated SMS texts. The GPS location sensor was able to respond back with precise latitude and longitude coordinates of the wearable device to the user's Cell phone, which then the user would click on the received Google maps URL which would, in tum, open the G-maps app or any default browser and display location.

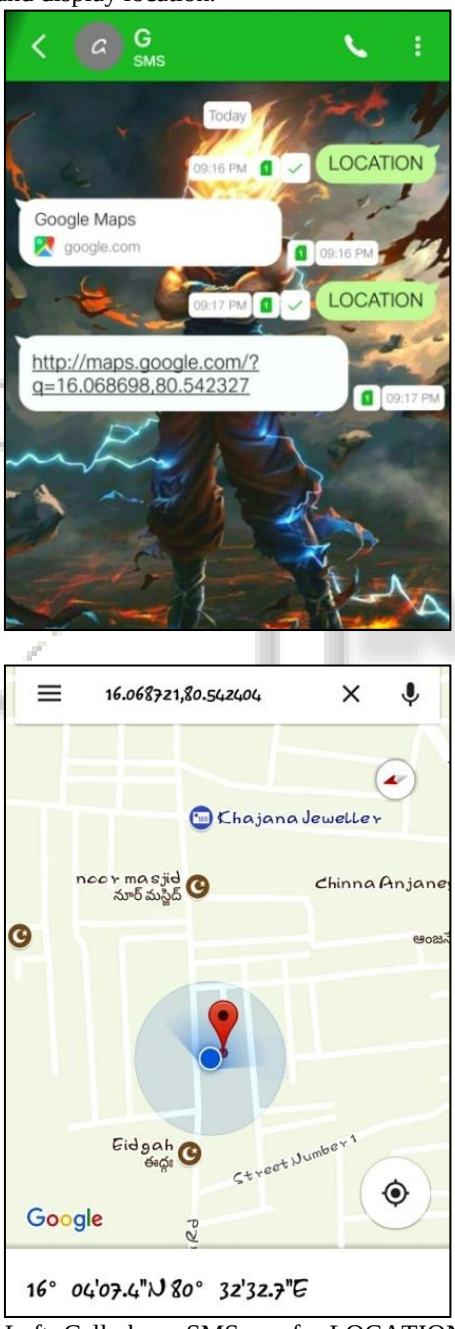


Fig. 12: Left: Cell phone SMS app for LOCATION sensor and Right: Google maps with latitude and longitude coordinates displayed.

In all the scenarios the GPS module was tested, it would respond back to the user's cell phone less than a minute. As shown in the image below, the GPS module (red bubble) was able to show the current location of the wearable with pinpoint accuracy and also show exactly at which side of the building it is present. Whereas for blue dot is showing the wearable to be present on the street, which is marginally off from the exact location.

This marginal miss match in the pin-point location of the wearable can tum out to be fatal in a real life scenario, where the parent may be miss lead to the wrong location of the child. Therefore, NEO6MV2 GPS module proves to be successful in providing the precise location with high accuracy and with a good response time. The only drawback that could be stated was, the GSM module could not interpret multiple valid keywords sent in a single message.

VI. CONCLUSION

We have designed a blind stick with features like obstacle detection and location sharing. This stick helps blind people to identify any obstacles in their way and helps them if they are lost by sending their location to their care takers by clicking a single switch. Care takers can also know the location of the blind people by sending a SMS to the GSM module attached to the stick. We hope this project helps blind people to find their own way without anyone's help.

REFERENCES

[1] Dambhare, Shruti, and A. Sakhare. "Smart stick for Blind: Obstacle Detection, Artificial vision and Realtime assistance via GPS." In 2nd National Conference on Information and Communication Technology (NCICT).2011; 2:31-33.

[2] Al-Shehabi, Monther M., Mustahsan Mir, Abdullah M. Ali, and Ahmed M. Ali. "An Obstacle Detection and Guidance System for Mobility of Visually Impaired in Unfamiliar Indoor Environments." International Journal of Computer and Electrical Engineering. 2014;6(4): 337-341.

[3] Jeslin, J. Gnana, A. Vaishnavi, and J. Nivedha. "Enhancement of Smart Cane To Detect And Notify Obstacles.". International Journal of Engineering Research & Technology (IJERT) 2015;4(2):1-3.

[4] Bhardwaj, Prashant, and Jaspal Singh. "Design and Development of Secure Navigation System for Visually Impaired People." International Journal of Computer Science & Information Technology.2013;5(4): 159-165.

[5] Sudhakar, K., Priyank Saxena, and Sudhanshu Soni. "Obstacle Detection Gadget for Visually Impaired Peoples." International Journal of Emerging Technology and Advanced Engineering.2012;2(12):1-5.

[6] Bharathi, S., A. Ramesh, and S. Vivek. "Effective navigation for visually impaired by wearable obstacle avoidance system." In Computing, Electronics and Electrical Technologies (ICCEET), 2012 International Conference on, IEEE, 2012; 956-958.

[7] Roopsai, V., S. Selvarathinam, and K. G. Varun Krishna. "Blind Aid using Radio Frequency Identification (RFID) and Ultrasonic sensors." International Journal of Computer Science and Electronics Engineering.2013;1(1)-96-100.

