IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE)
e-ISSN: 2278-1676,p-ISSN: 2320-3331, Volume 14, Issue 5 Ser. II (Sep. – Oct. 2019), PP 12-16
www.iosrjournals.org

Smart Blind Cane With Alarm Kit And Location Sharing System

Bansari Deb Majumder[1], Atmadip Dey[2], Abhishek Bhamha[3], Arka Majumdar[2]
[1](Teacher-In charge, Dept. of Electronics and Instrumentation Engineering, Narula Institute of technology, Kolkata)
([2]Student, Dept. of Electronics and Instrumentation Engineering, Narula Institute of technology, Kolkata)
([3]Senior Associate, Tata Consultancy services, Mumbai)
Corresponding Author: Bansari Deb Majumder1

Abstract: *To provide a better and safe independent experience to blind people in their daily lives, suffering with ophthalmological diseases, an attempt has been made to develop an Arduino based multi-sensor driven blind helper stick. This stick can guide the visually challenged people to move around freely using the ultrasonic sensor and proximity sensor integrated with it by detecting necessary obstacles or dead-end present around and alerting them with the alarm unit consisting of vibrator and buzzer attached in the stick. Also, a GSM module is present that sends a message with current location to a preset number when triggered with a button by the user.*

Keywords: *Arduino UNO, Blind stick, Infrared proximity sensor, Ultrasonic sensor, GSM kit*

Date of Submission: 07-10-2019 Date of acceptance: 23-10-2019

I. Introduction

In modern era the latest machines, advanced industries and smart devices starting from cell phones, refrigerators, electric appliances like light and fan depend big time on sensors. Sensors are devices that help us measure physical parameters. The data received from these sensors helps the devices for better understanding of the surroundings and thus resulting in better performance. The sensitivity of these sensors is very important as the accurate results depend on the accuracy and efficiency of these sensors. Similarly, for human beings the sensory organs act as the sensors. And all the above-mentioned conditions are also valid for these organs. The sensory organs are our way to interact with and understand the surroundings. Humans have five sensory organs eyes, nose, ears, tongue which help to see, smell, hear, taste and touch respectively. Eyes are the most important sense organ as we perceive up to 80 percent of all the impressions through sight. Eyes can also act as replacement for any other sense organ but the reverse is not possible or rather very difficult to achieve.

It is very important to maintain and take care of our eyesight so as to continue to connect with outside world and stay aware of everything around us. According to WHO as of 2018 approximately 1.3 billion people live with some kind of vision impairment and around 36 million people are blind. The majority of such people with vision impairment are over 50 years of age. India has around 12 million blind people which makes it home to 1/3 of the world's blind populace. Survey show that in every 5 seconds a person goes blind in the world and for children it counts to every 1 minute. So, the need for modern technology to build devices which will support such people at a very young age rises so that they can also move around independently. Thus, the proposed system comes as a perfect fit. A very common instrument stick has been modified into a smart device that will posses' all-in-one applications for a person to move around with it. With various sensors and other electronic devices, it can guide the needy on their way by detecting obstacles and sending prior warning to avoid accidents.

Two types of proximity sensors have been used to detect objects. The system depends on the placement of these sensors which also amplifies its efficiency. The stick can detect object in all 3 sides front and sideways simultaneously. The microcontroller has been programmed to refresh the data received from the sensors at minimum time gaps which allows it to process more data. This system also constitutes of an alarm unit consisting of a switch and GSM kit which will help the user to inform a preset number to know the exact location of the former in case of an emergency. The user in turn can feel nearby objects with vibration and buzzer sound which are trigger units working based on data from sensors.

The main objective of the project is obstacle detection. Various attempts have been made to develop such a device before with different approaches. Assistor sticks have been developed that work on image processing and echolocation system using image sensors, ultrasonic sensors and servo motor, all being manipulated by Mobile applications [1]. Attempts have been made to DTMF devices which include multiple sensors to accumulate and work for the betterment of the blind and deaf [2]. Some work has also been done to design an Artificial Navigation System with adjustable sensitivity-based approach towards obstacle detection [3]. Zigbee has also been used to develop Obstacle Information System for line follower [4]. Most works have been done using Ultrasonic sensors with various microcontrollers. [5] [6] The approaches are very much based

on Proximity sensors. Some research has also been done to design better quality sensors. [7]. SOS systems also can be used as navigation tools integrated with a helper cane. [8]

The entire proposed system has been defined explicitly in the following sections along with components used and the results we have achieved by simulation on NI LabView.

II. Methods And Materials

2.1 Methodology

2.1.1 Hardware Section

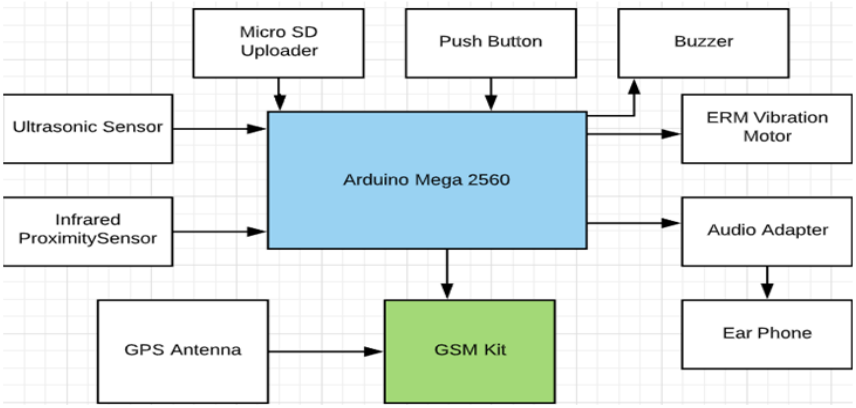

Figure 1: Block diagram of the proposed system

The proposed system is an embodiment of many advanced sensors and other electronic modules which combined together, synchronized give critical decisions based on the real-time data collected by the input devices. At first, each of the three sets of Ultrasonic and Infrared proximity sensors planted facing the front and sideways start reading data from the same sides. The sensors thus detect objects in three directions and send it to the microcontroller Arduino Mega. The microcontroller then compares the distance of the objects with a preset standard distance and decides if it is dangerous for the user or not. If the object is found to be within 30 cm from the sensor, Arduino triggers the vibrator in the handle of the user and also sets an alarm from the buzzer. These stays triggered till the distance further decreases or the user keeps moving towards the obstacle. As soon as the user stops moving the alarm stops.

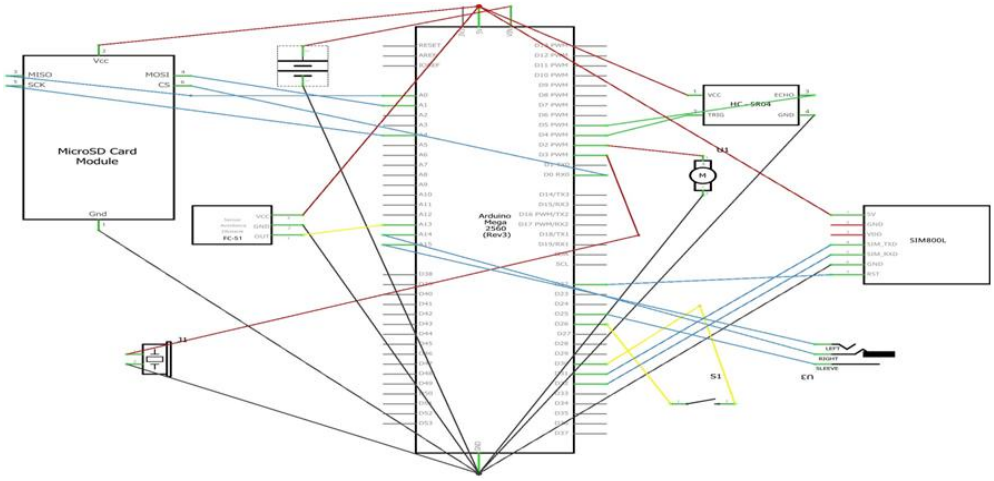

Figure 2: Schematic diagram of the system

The Arduino is interfaced with an SD Card Uploader – Breakout Board. In this storage device the various commands are stored which warn the user about the placement of the obstacle. This adds special status to the entire alarm unit. The user thus can be more cautious while walking. A 3.5 mm headphone jack is present in the stick handle which is also interfaced with Arduino. The voice commands can be heard if a headphone is attached to this jack. The jack is connected to the microcontroller through an audio adapter. All the voice commands are stored in .wav format compatible with the microcontroller itself. The Arduino keeps track of the particular set of sensors detecting obstacles and selects the set audio file for that direction. All the voice commands are set for separate situations. Lastly a final stage of safety is added. It consists of a GSM kit, a GPS

antenna and a pushbutton. When the user needs to contact their backup one can simply push the button. The push button will trigger a signal from Arduino to GSM module. The GSM module upon receiving the activation signal will send a text message to an assigned number with the current location coordinates. The GPS antenna can be interfaced with the GSM kit and programmed to record locations and encrypt that into the text messaging program to further the cause.

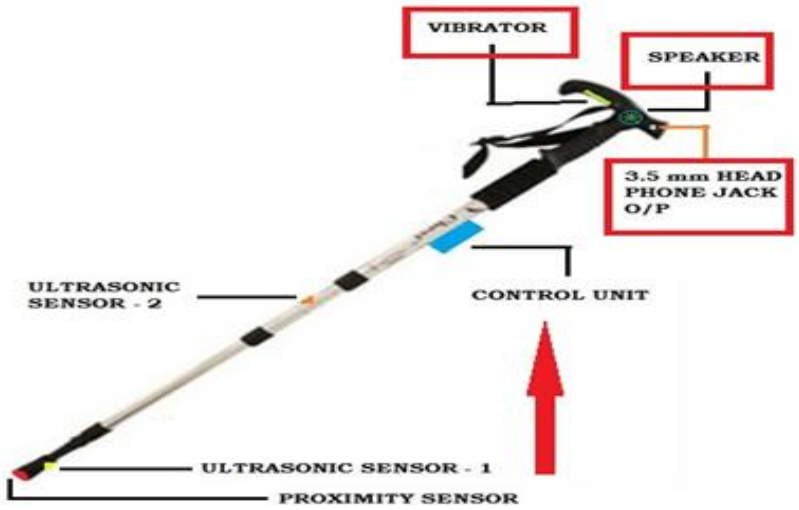

Figure 3: Hardware design of the proposed system

2.1.2 Software Section

In the software section we mainly use Arduino Idle to program the Arduino interfaced input and output devices namely the Ultrasonic and IR proximity sensors, the GSM kit, etc. At first, the Arduino selects the sensors showing deviations from mainstream values. Each set is accessed by the Arduino after a set delay time. When an abnormality of data is detected the Arduino at first triggers the pins connected to the buzzer and vibrator to HIGH. The condition is set such that until the particular sensor set gives constant data ideally it stays high. When values are constant a voice message is heard by the user through the earpiece as to the side where obstacle is detected. The user thereby changes his path slightly to avoid any accident. In the prototype developed we set took a set distance of 12 cm. from the sensor used two Ultrasonic and 1 IR Proximity sensor.

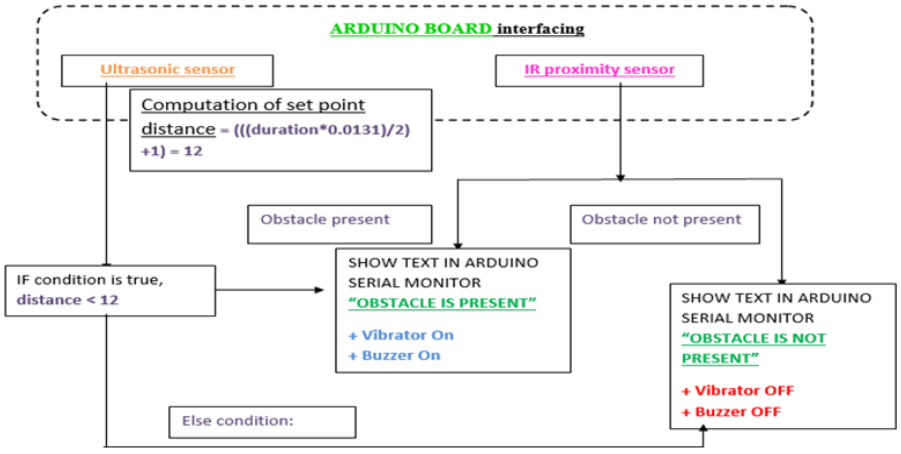

Figure 4: Block diagram of algorithm used

2.2 Materials

2.2.1 Arduino Mega 2560

The Arduino Mega 2560 kit is one of the most powerful microcontroller boards of the Arduino family having 54 digital pins with 15 of those having an option to be used as PWM pins and 16 analog pins. The Arduino is the most important part of this project as it is the head to all the different systems integrated in this device. Among the main functions of Arduino, it can synchronize other devices interfaced with it. It is based on the ATmega 2560 chip.

2.2.2 Ultrasonic Sensor HC-SR04

The principle of the ultrasonic sensor is very similar to that of the RADAR or Sonar Technologies. It consists of three parts the Transmitter, Receiver and the Control Unit. It is connected to the Arduino and a trigger pulse of at least 10us which creates 8 pulses of 40khz sound wave from the transmitter side and the return varied wave is captured by the ECHO side. It has 4 pin which include Gnd, Vcc, trigger pin and echo pin. The echo pin output is picked by the Arduino which is essentially the time for sound waves to travel to the object and return back. Working distance is up to 400 cm.

2.2.3 Infrared Proximity Sensor

This sensor is used to detect objects and hurdles in front of the sensor. The sensor transmits an infrared light from the transmitter led and the reflection from the object is received by the receiver. There is a potentiometer on the sensor whose clockwise rotation increases distance of trigger and counter-clockwise rotation decreases the distance. The output pin goes low when obstacle is detected within working set distance. The receiver is ambient light proof so garbage data is minimum. Range is up to 30 cm.

2.2.4. GSM Kit SIM808

SIM808 is an all-in-one GSM and GPS module which also has features of Bluetooth and can be implemented in IoT. A sim card slot is present at the bottom side where a sim card can be fitted which will basically be the operating number of the module. It can be programmed by interfacing with Arduino to make calls or send text messages. It has different slots for antenna. In this project the GSM and external GPS antenna are fitted to it. It has USB cable jack to connect with a computer.

Other components that have been used are buzzer and Micro SD card holder and audio adapter. For the vibrator we have used Eccentric Rotating Mass (ERM) Vibration Motor. This is basically a motor where an extra weight is attached to one side of the shaft. As a result, when the motor rotates the imbalanced mass creates a vibrational sensation. The same principle is used in the grip of the Blind Stick.

III .Results

An experiment was performed to test the efficiency of the proposed device. A simulation was designed and run on NI LabView to observe the working of the device. Every material used was designed individually with necessary parameter building, manipulation of values, designing the significant algorithm. As output sensing and indication, a led was used. The green light indicates that the user is free to move as the device has not detected any nearby obstacles. Necessary changes were also made depending on the response received by the simulation. A signal processing unit and timer was also included to track response time and smoothen the inputs from sensors.

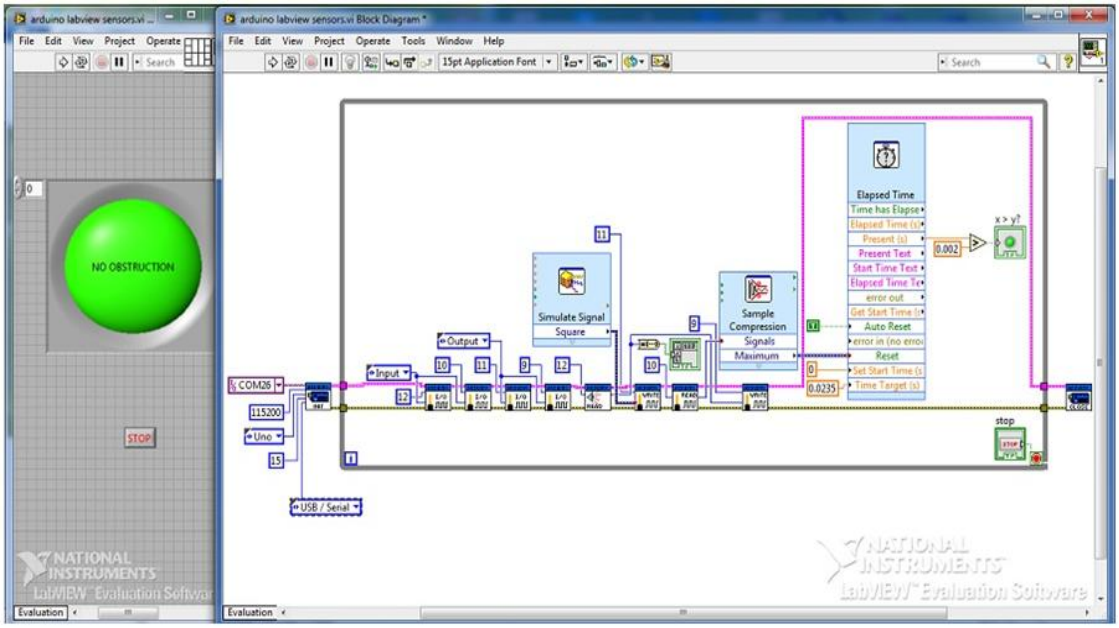

Figure 5: Screenshot of simulation from NI LabView

IV .Conclusion

The proposed system has the capacity to bring ease to a lot of needy people. The stick has been equipped with a lot of technical electronic equipment like the ultrasonic sensor, infrared proximity sensor and GSM kit. The alarm kit consists of the buzzer and vibration motor that create warning signals for the user. The location of the user can also be shared with the GSM kit attached to the device. The stick is a very compact and easy to handle tool. One can easily get accustomed to it through daily use. It is a revolutionary device to bring independence to the blind community. The device also has a horizon of fields to be improved with. A blind person can now move about freely on the road. The device is a small attempt for the betterment of the society.

V .Future Scope

The blind Stick can be developed more with the help of Rashberry Pi and implementing image processing to it. Image Processing can help better identify obstacles. A further development can be made by implementing AI. It will be more convenient for the needy if voice-controlled functions can be developed to it. Also, the current form is prone to limitations while crossing roads or when walking through a very crowded place. This is because the response of the sensors depends on time and distance. With sensors the effectiveness and accuracy may be questioned with time. So more dependable methods need to be implemented. A device as such as this is itself a huge step in the invention of more dependable devices. This can be improved further with more innovation.

References

[1]. Krishnan, Akhilesh & Deepakraj, G & Nishanth, N & Anandkumar, K. (2016). Autonomous walking stick for the blind using echolocation and image processing. 13-16. 10.1109/IC3I.2016.7917927.
[2]. Singh, Akash & Shrivastava, Prasun & Anand, Praveen & Sagar, V. (2015). Medico stick: An ease to blind & deaf 10.1109/ECS.2015.7124825.
[3]. Sen, Arnesh & Sen, Kaustav & Das, Jayoti. (2018). Ultrasonic Blind Stick for Completely Blind People to Avoid Any Kind of Obstacles. 1-4. 10.1109/ICSENS.2018.8589680.
[4]. Kokare, Snehal & Shastri, Rajveer & Kolhar, Shrikrishna. (2018). Line Follower with Obstacle Information System Using ZigBee. 1-5. 10.1109/ICCUBEA.2018.8697470.
[5]. Dey, Naiwrita & Paul, Ankita & Ghosh, Pritha & Mukherjee, Chandrama & De, Rahul & dey, Sohini. (2018). Ultrasonic Sensor Based Smart Blind Stick. 1-4. 10.1109/ICCTCT.2018.8551067.
[6]. Chaurasia, Shashank & Kavitha, K.V.N. (2015). An electronic walking stick for blinds. 2014 International Conference on Information Communication and Embedded Systems, ICICES 2014. 10.1109/ICICES.2014.7033988.
[7]. Kim, Yong & Cho, Soon-Ik & Shin, Dongho & Lee, Jingu & Baek, Kwang-Hyun. (2014). Single Chip Dual Plate Capacitive Proximity Sensor with High Noise Immunity. Sensors Journal, IEEE. 14. 309-310. 10.1109/JSEN.2013.2288251.
[8]. Mohapatra, Saurav & Rout, Sub & Tripathi, Varun & Saxena, Tanish & Karuna, Yepuganti. (2018). Smart Walking Stick for Blind Integrated with SOS Navigation System. 441-447. 10.1109/ICOEI.2018.8553935.
[9]. Purcaru, Dorina & Gordan, Ioan & Purcaru, Anca. (2017). Study, testing and application of proximity sensors for experimental training on measurement systems. 263-266. 10.1109/CarpathianCC.2017.7970408.
[10]. Nada, Ayat & Fakhr, Mahmoud & Seddik, Ahmed. (2015). Assistive Infrared Sensor Based Smart Stick for Blind People. 10.1109/SAI.2015.7237289.

IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) is UGC approved Journal with Sl. No. 4198, Journal no. 45125.

Bansari Deb Majumder. " Smart Blind Cane With Alarm Kit And Location Sharing System." IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) 14.5 (2019): 12-16.