



# Development of Sophisticated Smart Blind Stick Using GSM and GPS

K. C. T. Swamy<sup>(✉)</sup>, Boya Uday Kumar, N. Usha Kiran, P. Shankar Goud, Y. Sai Vamshi, and N. Akhil Yadav

G. Pullaiah College of Engineering and Technology, Kurnool 518 452, India  
kctswamy@gmail.com

**Abstract.** Original idea of our paper/project is to develop a blind stick that can be multi-functional and helpful for blind people in their daily usage. Usually in most of the scenarios, blind-people use their hands for seeking help, and most of the people who are blind are literally dependent for guidance. This dependence and helplessness makes blind people not being progressive in their respective fields and ultimately it is leading to the depression of blind people. Normal sugarcane blind sticks don't even recognize the snugs or stumbling blocks present in nearby areas of blind people and as a result people end up in getting accidents. Therefore, in our paper, sophisticated smart blind stick's been designed, developed to help the blind people and provide them an obstacle-free path. This project consists of an ultra-sonic sensor fixed to the user's stick. This ultrasonic sensor helps in detecting the obstacles which are there on the path of the blind people. If the sensor detects the obstacle, then the outputs like buzzer and vibration motor gets triggered as per program dumped in the Arduino UNO, and as a result the user will get to know the obstacles and act accordingly. This way they will be free from the little accidents that are caused due to the obstacles in front of them. Additionally, GSM and GPS are also added to help blind people in navigation and aid them from dangerous accidents. GPS module helps in navigation. GSMs are useful in transferring/sending the SMS of live location to the guardians of the blind people and the control room as well. Thus, our sophisticated smart blind stick helps the blind people to walk without any fears and it is a smart electronic. Therefore, this device will be the perfect answer for overcoming the fears and troubles of visually impaired people.

**Keywords:** Arduino UNO · Ultrasonic Sensor · GSM Module · GPS Module

## 1 Introduction

Vision impairment is a sort of impairment where someone's eyesight is reduced to a level that it can't even be corrected to the usual level. Therefore, full correction is almost impossible with the help of glasses, contact lenses, medication or the vision surgery. In the present scenario 2.3 billion populations are facing the vision impairment which might be near or far distance impairment. Half of these cases which is a cumbersome of 1.1 billion people face very severe distance impairment or blindness. There are many strategies

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which are been followed in the market in order to deal with the vision impairment problems such as vision rehabilitation, guiding dogs, personal trainers and helpers, white sugar canes normal blind sticks. A recent trend has been a lot of research that focused on the design of smart sticks. Manikanta et al. [1] used an Arduino NANO with an ultrasonic sensor and buzzer to detect the deterrent force. Pratik et al. [2] used a Raspberry Pi microcontroller to control ultrasonic and infrared sensors to detect obstacles. Wall MI et al. [3] operated a smart stick pic16f877, a microcontroller, and an ultrasonic sensor for detecting snags, and tasked them for sending signals to the ISD1932 recorder/playback and this recorder and speaker associate is proposed. Additionally, Mohad Helmy et al. [4] used different software called MPLAB for programming an ultrasonic sensor and microcontroller to detect tripping blocks. Ayatt Nada et al. [5] integrated water sensor that detects the presence of water regardless of water level. Its use is to alert the user to the presence of water. Ashraf Anwar et al. [6] integrated thermal sensors with ultrasonic and water sensors. Later Vipual et al. [7] used an ultrasonic sensor, humidity sensor with a microcontroller. When the sensor identifies the snugs/deterrents, the microcontroller sends a signal to buzzer to warn the user. Roland et al. [8] integrated all sensors and confirmed the accuracy of the system in terms of results. Vinay et al. [9] used his GORE in the design and also developed a Radio Frequency Identification (RFID) operating in the low frequency band. Manikandan et al. [10] integrated all sensors and his RFID module into a microcontroller and confirmed that the system worked accurately. All these strategies are slight high in price and less effective in reality. Vision rehabilitation is very costly, guiding dogs are not so effective in reality, personal trainers and helpers are costly, and white sugar cane sticks are very less effective in the current scenario. So, this paper contains an effective alternative to all these problems- sophisticated smart blind stick using GSM and GPS modules. Here we have integrated ultrasonic, LDR sensors and added GSM and GPS modules for knowing the location of the person in hazardous situation.

## 2 Related Work

The work in this paper presents our structured plan and the execution of an Arduino-ultrasonic sensor-GSM-GPS-based blind stick for a disabled individual. An ultrasonic sensor module is used for the impediment or obstacle discovery in the way of visually impaired individual, and a buzzer is utilized to alert the users or to make the individual cautions. The complete proposed framework is been implemented on the Arduino UNO board. Blind people use white sugar cane sticks to help in the obstruction identification. They (daze people) also tend to use guide canines (guide dogs) for guiding them and all these methods are ineffective. So, we are making a new, versatile, effective, straight forward and less expensive framework that will permit the visually impaired people to walk through the natural and new conditions without any guidance of guides. The frameworks also include the integration of LDR sensor to detect the presence of light in the surroundings. And additionally, framework is designed with GPS [11–14] module to track the position of the blind user, and GSM module is integrated to send a message to their guardians, friends, control room when the user feels like he/she is in danger.

In this work, we have introduced a sophisticated smart electronic stick for visually challenged people. Our sophisticated smart sugar stick comprises of Ultrasonic sensor, LDR sensor. These sensors are executed and programmed using a microcontroller (Arduino UNO). Our stick can detect the obstacles which lie in the range of 2m from the blind people. Our project and paper aim to provide a very affordable, reliable, sophisticated smart cane which would help the visually challenged people to navigate very freely. In the annals of the world history, people have been suffering from many disabilities that are related to vision. So, the main purpose and the objective of our paper is based on encountering the disabilities of blindness by designing the microcontroller based electronic hardware that can corroborate the visually impaired user to detect the obstacles in front of them.

### 3 Proposed Method

After going through all the previous versions of blind sticks, we have made so many extensions and came to a conclusion and to put it in a nutshell: The main working of our stick is detecting an obstacle or gadgets for blind people. Our stick design consists of an external battery and it provides a 6V force supply to the entire circuit. Ultrasonic sensors are used in the circuit for detecting the obstacles. In order to decide the distance of an obstacle or object, compute the distance between the obstacle using,  $[Distance] = Speed * Time$ .

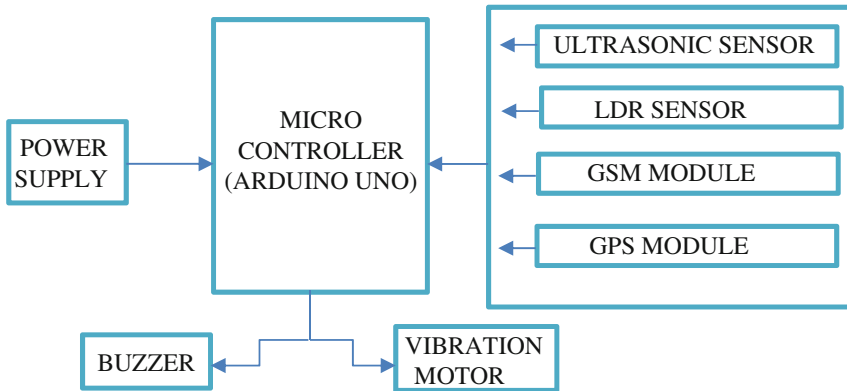
Speed of the object going through air is around 341m/s. Time is determined between the obstacle and getting back the message. Distance travelled by the signal is double, so it is divided by two, therefore:  $[Distance] = *Distance/2$ .

We have integrated two ultrasonic sensors, one at the bottom, other at the middle of the stick with 30cm, 50cm range detection respectively. And LDR sensor is also added to detect the presence of light in the atmosphere. Also, external switch is connected for triggering. Buzzer and Vibrator are also integrated for alert system. Therefore, when sensors detect an obstacle, then buzzer will ring and parallelly vibration motor will start vibrating the stick. Thus, user will be alerted and then act accordingly.

Apart from these sensors, we have used GSM and GPS modules to make the stick so sophisticated and smart with the advancement in the features. GPS is utilized for knowing the coordinated of the location of the user and the location will be sent as message if at all the user triggers the switch in case of dangerous situations. GSM module is integrated to send the message of the location to the guardians/friends and control room in case of hazardous situations. GPS module would always keep on updating the location, while GSM module would turn on after triggering of the external switch. Thus, message of the coordinates would only be sent only when triggered on external switch (Fig. 1).

#### **Arduino UNO**

The ATmega328p microcontroller is termed as Arduino UNO board. It contains USB port for communication with laptops. Arduino UNO has input-output pins for interaction with the outside environment. USB cables are used to connect the Arduino with laptops and the dumping of programs is done through these cables. The software used to write the code is Arduino IDE.



**Fig. 1.** Block-diagram of proposed method

### Ultrasonic Sensors

HC-SR04 ultrasonic sensor works similar to that of bats, it uses SONAR method to measure the distance between the two objects. Mainly these sensors are used for impediment detection and obstacle detection. Darkness will affect the sensor working and soothing materials like silk detection is little tough for ultrasonic sensor. It has both transmitter and receiver.

### LDR Sensor

LDR is called as a light dependent resistor and it completely depends on light. The main functionality depends on the presence of light. LDR fluctuates depending on the availability of light in the atmosphere. If light is there in the atmosphere, then it remains off, but when light is absent in the atmosphere, then LDR gets turned on, and light will glow.

### Vibration Motor

Vibration motor is used for vibration. These motors mostly work similar to that of mobile phone when the input given is high. Vibration will start once it is connected to a battery and it will off if not connected. These vibrators generate a noticeable vibration effect on the blind stick which alerts the user.

### Buzzer

Buzzer is a little inexpensive part but very effective in terms of work. It produces a beep with high frequency. This buzzer requires power supply. And this battery acquires some 1.3–1.4v of energy from the external battery. It is mostly connected to the switching circuit and it allows it to be turned ON or OFF at preferable intervals.

## 4 Experimental Results

Figure (2) illustrates the suggested design for the circuit diagram of the sophisticated smart blind stick, internal design and integration and the complete structure of the sophisticated smart blind stick.

In 2(a), it's the initial circuit connections and it was taken during the initial stages of our project development. In 2(b), it's the penultimate connections of our circuit on



**Fig. 2.** The proposed blind stick results a) Blind stick initial circuit b) Internal structure of blind stick c) Complete structure of sophisticated smart blind stick d) Message to the guardians when he/she's in danger

the blind stick, and it was taken during the medieval stages of our project development. In 2(c), it's the ultimate final connections of entire circuit on the blind stick. Ultrasonic, LDR sensors, buzzers, and the vibrating motor are integrated on the blind stick. This was taken during the penultimate stages of our project. In 2(d), it's the Screenshot of the message in guardian's phone and it comes from the GSM in the smart stick to the guardian/friend of that blind person. This is the keen result of our project, a message of the location along with the GPS coordinates will be sent to the important contacts/guardians and friends of the user when switch is triggered.

Figure-3(a) consists of a person holding the sophisticated smart blind stick. Figure-3(b) consists of the blind stick detecting the obstacle in front of it using ultrasonic sensors. After detecting the stumbling blocks, alert system is been activated by ringing buzzer and vibrating the vibration motor. Therefore, the person after these alert systems, acts accordingly and gets rid of obstacles.

Figure-3(c) consists of person using our stick for confidently climbing the stairs. Incase if the user feels troublesome, he can press the external switch. This will help in sending the message of the actual location of the user to their guardians/friends. And the buzzer will give continuous beep sound until the user gets help from people. Once the external switch is turned off, then the beep sound will be turned off.

Figure-3(d) consists of person using our stick in night times. Here due to the presence of LDR sensor, it detects the presence of light in surroundings. As the user is using our stick in night times, LDR detects the absence of light and turns on the LED and this light will help ultrasonic sensor in detecting the snugs during night times also. Blind people are been helped in all sort of cases & from all hazardous situations.



**Fig. 3.** a) Person holding it b) Stick detecting the obstacle and ringing the buzzer c) Stick helping the person on stairs d) LDR turning on in the absence of light

## 5 Conclusion

The sophisticated smart blind stick using GSM and GPS has been at last made into a working model which can direct or guide the visually impaired (blind or gaze) people. It intends to fix the problems faced in previous alternatives for guiding the blind people. It mainly focusses on solving the stumbling blocks faced by the blind people. In all scenarios it helps in alerting the user after the detection of the obstacles in the path. In case of extreme dangers, the user can trigger the external switch for sending the message of location coordinates to their guardians/friends and control room. This way the framework and design of the sophisticated smart blind stick takes the action to guarantee the user's security. Thus, our project helps all the visually impaired people around the world and makes them to walk anywhere without any fear. Therefore, our stick eradicates the fear of walking alone in the visually impaired people by properly guiding them. In a nutshell, our sophisticated smart blind stick assists the visually impaired people and handicapped people, along with that our stick helps them to cope up with their lives without any fear of walking. Our stick makes the lives of visually impaired people/gaze people/blind people/handicapped people so simple, simpler, and the simplest by assisting them.

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