

# A Survey on Advance Walking Stick for Blind Assistance using IoT

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**Abstract:** This project presents a design and implementation of smart walking stick that helps the blind people to travel individually. The proposed hardware system consists of Arduino Nano, Ultra sonic sensor, voice playback module, GPS receiver module and the GSM. The Detection of obstacles is done using an Ultra sonic sensor. The Ultra sonic sensor detects the presence of an obstacle in front of it and passes the data to Arduino Nano. The Arduino Nano process the data received and calculates whether the obstacle is close enough or not. The processed data is fed to the voice playback module which provides voice assistance to the blind person through a speaker in order to avoid the collision between the obstacles. To make more useful the stick is also mounted with the moisture sensor that detects and alerts the blind if any moisture content is present to avoid slippery paths. The GPS receiver has been used for safety purpose to track location of the user. If the blind people need any help, then they can trigger an emergency button which is mounted on the stick then the GSM will send the location information to the predefined contact numbers within 2 minutes. This whole setup will be mounted on the stick. All effort is being made to make this stick is to be cheaper as well as easy to use. With all these features the blind people can boost up their navigation ability and not to depend on anyone while walking in unknown places.

**Keywords:** Arduino; Ultra sensor; GSM; GPS; Microcontroller; voice playback module.

## 1. Introduction

Blindness may be caused due to temporary or permanent injury to any portion of the eye, the optic nerve, or the area of the brain responsible for vision can lead to blindness. Visually challenged people facing many problems in their everyday life, often have a difficult time to navigate outside the environment. The crucial physical disability is that the Visual Impairment. The blind people have to face many problems in their everyday life. The worst problem is that detecting object in front of them in order to step ahead. Worldwide, between 300 million and 400 million people are visually challenged due to various causes According to world Health Organization (WHO), about 36 million are blind. Earlier blind people were totally depended on coached dogs and white canes to move independently in unknown areas. Products developed for the visually impaired have specially concentrated on communication tools such as reading machines and stamping printers for Blinds. Many Navigation aids apart from the cane have still to be

implemented in such a way that leading to their approval by the visually challenged community. The number of people visually challenged from infectious diseases has prevented in the last twenty years according to global estimates work. In a constant technically developing world many electronic devices are came into exist which reduces the problems facing by people who are with disability [3]. A simple system has been planned and developed which help the blinds to move independently.

## 2. Objective

Many researchers studied the problems facing by the blind people to navigate around the known environment and most of the scholars designed the new technologies to provide a smart navigation stick to roam around the known places. This makes that the blind person can move only to the specified places. Taking this into consideration the walking stick is developed for blind people to navigate independently and its objectives are as follows:

### A. Object detection

Ultra-sonic sensor which is called as object detection sensor is used to avoid the collision between the objects and the blind person, to make the blind person more convenient to move independently water sensor which helps in identifying moisture content to avoid slippery paths.

### B. Voice feedback upon object detection:

To give notification about the presence of an obstacle, a voice alert is produced through headphones or speaker by voice playback module in order to avoid the collision between the blind person and obstacles. Location finding and emergency unit: Emergency switch has to be implement to send location SMS to the predefined number using GPS and GSM module in order to save the blind person from danger. The entire system is designed to be small and easy to use hence it should be cost effective.

## 3. Methodology

The Figure1 shows the block diagram of the proposed system consists of various hardware devices which are mounted on the board for the operation of the walking stick. The devices are Arduino Nano which is Microcontroller, IR proximity sensor,

voice playback module, GSM modem, GPS module, LCD display. The brief descriptions of all the hardware components are as follows:

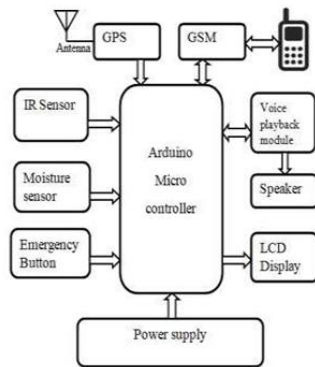


Fig. 1. Block diagram of proposed system

#### A. ATmega328 Microcontroller

All the components used in this project are interfaced with the ATmega328 Microcontroller manufactured by Atmel belongs to the Mega AVR (Advanced Virtual RISC) series which processes the signals coming from different components or sensors. It is a chip mounted on the Arduino Nano Board. It is open source hardware as well as software hence this is very similar to the computer. It gives 8 bits of data and has 38KB flash memory with read and write functionalities it also has EEPROM (Electrically Erasable Programmable Read-only Memory) that enable to store data even though the power supply is not supplied. It is low power consumption with Advanced RISC Architecture. It has peripheral features that provide two 8-bit and one 16-bit timer with a separate oscillator. It also provides 23 general purpose I/O lines, 32 general purpose working registers.

#### B. Ultra-sonic sensor

The Ultra sonic sensor is an object detection sensor which contains a pair of transmitter LED and receiver photodiode. The transmitter continuously emits infrared radiations, when the signals hit by an object some of the rays reflected and is received by the photodiode. The received continuous signals are fed to the positive input of comparator op-amp IC LM358 and are compared with the reference voltage at the other input. When the strength of the transmitter led is high, more energy will be received by the photodiode, the voltage across the photodiode drops, and the voltage across the positive input gets higher than the negative input of the comparator, then the output becomes high and led turns ON which indicates the presence of an object. Similarly, when there is emission of IR rays towards photodiode then the output of comparator is LOW and led turns OFF which indicates the absence of an object.

#### C. Moisture sensor

The moisture sensor is a straightforward moisture discovery circuit which consists of two probes those allow the current to

pass through the soil and then it gets the resistance value to measure the moisture content. Its output turns out to be high when input is low that is the reason it is known as inverter IC. At the point when there is no moisture in soil probe 1 of IC7404 turns out to be low a result of this yield stick 2 goes high. At the point when adequate measure of water is there then it will wind up damp and stick 1 of IC7404 goes high which make stick 2 of IC7404 low.

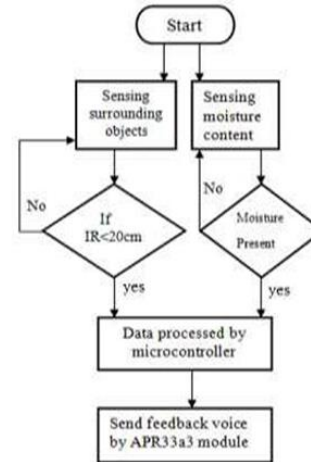


Fig. 2. Flow of object detection and voice segment

#### D. GPS module

GPS stands for Global Positioning system which provides location information to the GPS receiver anywhere in the Globe. It is a universal radio navigation system established by the U.S Department of Defence (DOD) to give information about the location for military application. A signal from one or more radio navigation aids enables a person to compute their position. Hence we are using GPS module in this project to get the location information of blind person.

#### E. GSM Module

GSM acronym stands for Global System for Mobile communication which is acts as communication link between the blind person and to any person whose contact number linked to a GSM system. In this project we are using SIM900 GSM module built with dual Band GSM/GPRS engine-SIM900A which works on frequencies of 850/900/1800/1900MHz. This module can be connected to the microcontroller which allows the GSM module to communicate with the mobile network by sending or receiving messages. In this project the GSM is used to send a SMS about location information to the parents using an extended AT command set. The location message will be sent through the module by connecting Tx, Rx and GND with the microcontroller. When an emergency switch is pressed by the blind person the location message will be sent to the predefined contact number.

#### F. LCD Display

Liquid Crystal Display is used in this project for displaying outputs of each module controlled by the microcontroller. We

are using 16x2 LCD that able to write 16 characters in 2 rows. It helps to identify and remove errors module wise in case of system get failure.

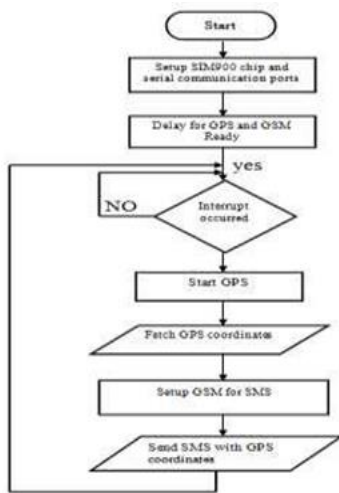


Fig. 3. Flow of location finding and emergency segment.

### G. Emergency Switch

The Switch is provided to use when the user is in Danger. The location information sent to the parents by GSM when an Emergency Switch is pressed by the user.

## 4. Result

### A. Object detection

Objects may be present on the lower surface in the route of the blind or high level objects in front of him. A variety of objects at varying distances and heights are placed, and later the sensor is linked to oscilloscope to know the received signal variation. We get result as no signal; Figure 4 shows the graph of Received signals in Ultra sonic sensor which are (1) No object (2) Object in front of the blind.

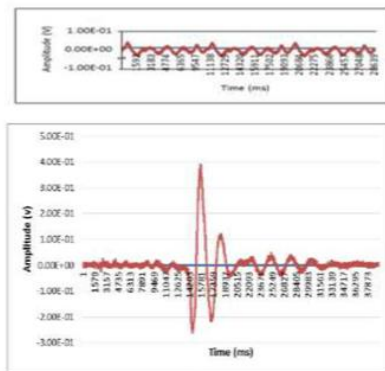


Fig. 4. Ultrasonic sensor object detection (1) No object (2) object in front of the blind.

### B. Voice feedback upon obstacle detection

We also checked the voice notification using the voice playback warning module and it is able to provide the correct

instruction to the user through speaker and the obtained data is listed

### C. Location finding and emergency unit

The emergency button used in the smart walking stick to send the location message to the preset contact number. An experiment was conducted to test whether the GSM is able to trigger through switch. To make GSM to be trigger the microcontroller has to detect the interrupt for once. The rising edge and falling edge type of interrupt is used on the Arduino Nano microcontroller. To generate one of several rising and falling edges a de-bouncing circuit was considered which uses capacitor and resistor. The circuit generates high voltage when the button is pressed due to discharging of capacitor. A smooth falling edge is created when the button is released therefore the microcontroller finds only one falling edge which allows the emergency button to execute properly and thus it functioned as expected.

When the authorized person clicks on the link received as SMS, the location will be accessed on the Google map thereby the parents can track the blinds destination that will show the exact position where the blind person is located as shown in the above Figure 6. Thus the location retrieves from the server and providing safety system for the blind person is achieved.

### D. Complete prototype representation of walking stick

The figure 7 shows the complete designed prototype representation of walking stick. It reduces not too dependent on the other family members. It is simple and easy to use. It helps in avoiding minor collisions and thus provides the more safety. Voice play back module provides alert about the objects through speaker. Emergency button is provided which activates GPS and GSM to sends location information to the parents if the blind person is in danger. Shows complete result description of each component.

## 5. Conclusion

The main goal of our research is to provide a smart walking stick to the blinds to navigate around the environment without any interaction with sighted people and that should be very cost effective and ease of use. The hardware implemented using Arduino Nano hence the system is small in size also comfortable to carry along. The voice playback module is comfortable to give instructions by using any language so that the system can be used by worldwide. The GPS and GSM modules are successfully operated above model with operating gsm/gps alerts also and voice also.

## 6. Future scope

The system can be modified by adding flame detector sensor to alert them to escape from the fire accidents. The principles of radar can be used to detect the long ranging target objects. By identifying the colour of tablet box a blind person can intake the tablet for his health issues this can be achieved by

implementing the Colour recognition sensor technique so that the medication problem for visually impaired can be avoid.

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