

# Design and Development of Blind Navigation System using GSM and IR Sensor

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**Abstract:** Blindness means lack of visibility. Blindness can be partial or complete. Partial blindness means limited vision. Where complete blindness means one cannot see anything or does not see light. In this paper we have proposed to make a navigation unit for visually challenged persons that is fixed in a walking stick and acts as an Electronic eye for the Blind person so that he/she can move freely and safely. There are so many smart sticks available using ultrasonic, RFID etc. but they have some drawbacks. In this paper we propose a Blind unit that will be helpful for both indoor and outdoor purpose since it has IR sensor for detecting obstacle and it has GSM feature so that the visually impaired person can communicate with customer care unit and can make calls to the near and dear ones. It has a Bluetooth wireless headset also. When the blind person gets an obstacle or reaches the destination appropriate message can be heard over the headset.

**Keywords:** Blindness, Navigation Unit, Electronic Eye, IR Sensor, GSM

## I. INTRODUCTION

A report by World Health Organization (WHO) stated that globally it is estimated that approximately 1.3 billion people live with some form of distance or near vision impairment[1]. With regards to distance vision, 188.5 million have mild vision impairment, 217 million have moderate to severe vision impairment, and 36 million people are blind. Globally, the leading causes of vision impairment are cataract, glaucoma, corneal opacity, trachoma etc. Interestingly India is now home to the world's largest number of blind people. Of the 36 million people across the globe who are blind, over 15 million are from India [2].

It is extremely difficult for visually challenged people to move or live without help. Mobility aids like walking sticks or guide dogs are still very much in use[3]. White cane are also used to guide them during moving. Although it might be helpful, it does not guarantee saving blind people from risks. These traditional ways can be used for low level obstacle detection only.

Electronic Travel Aids (ETAs) devices have been introduced recently for the blind people. ETAs are devices that contain sensors which alert the blind about obstacles existence through vibration and sound [4], [5]. Such devices increase the self-confidence of the blind person as they provide the necessary help to the blind to move in unfamiliar environment. Several visual aids have been developed[6],[7]. There are devices that might protect him hitting obstacles like those using ultrasonic sensor like K sonar [8], Ultra cane [9], Mini-guide [10], Palmsonar [11], Ultra-Body-Guard [12], laser devices like C-5 laser cane [13].

The above mentioned devices that are based on ultrasonic sensor or laser light receives reflected waves, and produces either an audio or tactile stimulus in response to nearby objects. The intensity of the sound and tactile vibration is proportional to the distance of the pointed object. As a result many important problems are frequently cited: Firstly, ultrasonic devices have big size, high weight, and high power consumption. Laser has a very narrow spectrum so it collects information about very narrow area.

Secondly, solution based on sound confusing and difficult to understand [16] as well as solution based on tactile stimulation as mentioned by [17].

The paper is organized in the following manner. Section II gives a technical overview of the components to be used in system implementation. Section III describes the proposed system. Section IV concludes the paper with a discussion on the scope for research in this domain.

**II. TECHNICAL SPECIFICATIONS**

In this paper our proposed system is composed of numerous components which are described as follows. Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

**Specification:**

- Microcontroller: ATmega328P
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- In/out Voltage (limit): 6-20V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- PWM Digital I/O Pins: 6
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB (ATmega328P) of which 0.5 KB used by bootloader
- SRAM: 2 KB (ATmega328P)
- EEPROM: 1 KB (ATmega328P)
- Clock Speed: 16 MHz
- LED\_BUILTIN: 13
- Length: 68.6 mm
- Width: 58.4 mm
- Weight: 25 g

HC-05 module is an easy to use Bluetooth serial port protocol module, designed for transparent wireless serial connection set up. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR(Enhanced Data Rate) 3 mbps modulation with complete 2.4 GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with adaptive frequency hopping feature (AFH). It has the footprint as small as 12.7mmx27mm.

**Technical Specifications:**

- Serial Bluetooth module for Arduino and other microcontrollers
- Operating Voltage: 4V to 6V (Typically +5V)
- Operating Current: 30mA
- Range: <100m
- Works with Serial communication (USART) and TTL compatible
- Follows IEEE 802.15.1 standardized protocol
- Uses Frequency-Hopping Spread spectrum (FHSS)
- Can operate in Master, Slave or Master/Slave mode
- Can be easily interfaced with Laptop or Mobile phones with Bluetooth
- Supported baud rate: 9600,19200,38400,57600,115200,230400,460800.

GSM module is used to establish communication between a computer and a GSM system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. GSM MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM network. It requires aSIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification. A GSM MODEM can perform the following operations:

1. Receive, send or delete SMS messages in a SIM.
2. Read, add, search phonebook entries of the SIM.
3. Make, Receive, or reject a voice call.

The SIM900 is a complete Quad-band GSM solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900 delivers GSM 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption.

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received.

**Hardware Description:**

- LM358 IC 2 IR transmitter and receiver pair.
- Resistors of the range of kilo ohms.
- Variable resistors.
- LED (Light Emitting Diode).

**III. SYSTEM MODEL**

The proposed system provides the following features:

- A blind stick not more than 400 rupees.
- A cheap, low power consuming, user friendly IR sensor.
- GSM module to connect with the customer care unit and with the near and dear ones when needed.
- Bluetooth head set for guidance.

The system model is shown in figure 1 below.

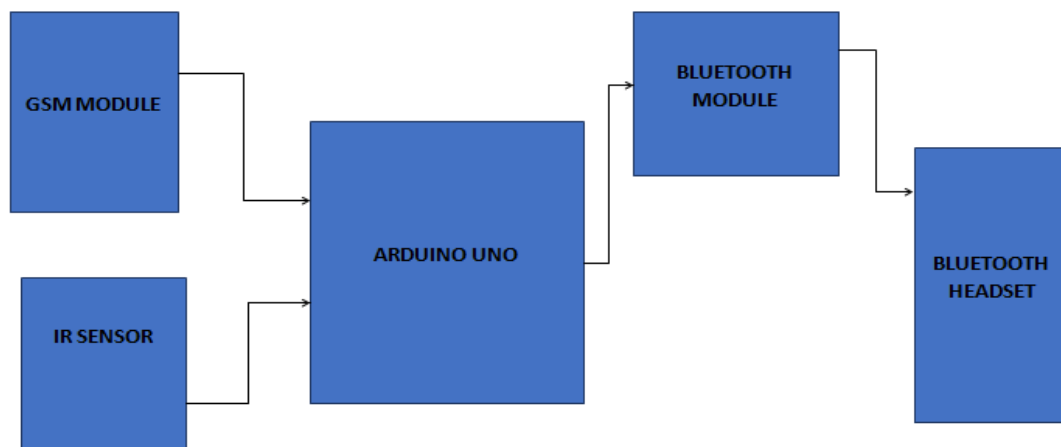


Figure 1: Block Diagram of proposed System

In this paper our proposed system provides the blind with multiple facilities. It detects obstacles in his path and produce appropriate alert to save him from hitting objects. The infrared sensors are used in this paper because they are small, low power consuming and have specific spectrum. Using this navigation module, a blind person can safely negotiate obstacles.

**IV. CONCLUSION**

In this paper, a solution is proposed to help blind to move safely and detect obstacles in their path. Solution was composed of a foldable stick with a pair of IR sensors mounted on it. An earphone was also connected to the system to alert the blind with speech warning message about the detected obstacles. Along with that there is a GSM module to make a call to near ones in emergency. This proposed model has an eminent future prospect as well. We can incorporate GPRS technology to this model and customer care unit can be set up regionally to assist blind persons, thus making the whole system more efficient.

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