IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

# Voice Navigation and Live Location Tracking for Visually Impaired People

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***Abstract***: Our eyes play an important role in our day-to-day life. It is the most valuable gift we have. But still, some people lag this ability to visualize the surrounding things. Therefore, this paper presents an idea of developing a system i.e, NavGuide, that can assist the visually impaired people in their everyday activities. The device comprises an Arduino with an ultrasonic sensor, flame sensor, fall detection, and buzzer. Under emergency condition alert SMS is sent to the caretakers. Through this module, they could be easily tracked.

***Index Terms*** **- Arduino Mega, GSM, GPS, Assistive technology, Visually Impaired People (VIP), navigation, fire and ultrasonic sensors.**

## I. INTRODUCTION

Vision plays an important role in gaining knowledge of the surrounding environment. Vision loss makes it difficult to live a normal life. Visual impaired can include a person who has lost his ability to see completely or it includes a person who is suffering from a partial vision loss [1]. The estimated number of people impaired in the world is 285 million; 39 million are blind, and 246 having a low vision. Visually Impaired People are people with less or no ability to read [5]. Thus, the visually impaired people required the support of some people in their day-to-day activities. Some people usually use a white cane or guide dog for their assistance. However, they are limited because they do not guarantee saving blind people from risks. Guide dogs can guide the people about the obstacles, and give the right way to travel. But sometimes due to a misconception, it will be dangerous for the people. At the same time, the White cane can detect only obstacles up to knee-level. Hence, the user cannot detect raised obstacles and it will detect only at the distance of 1 m from the user, giving little time to take any preventive actions. Thus, the proposed NavGuide is an electronic device that assists in giving simplified information about the surroundings of the user.

## II. CHALLENGES FACED

Real-time challenges faced by visually impaired people in daily life are listed as below,

1. Traveling around places without disturbing others.
2. Traffic signal crossing and rail crossings.
3. Difficulty in identifying obstacles in the path.
4. Depending on others for day to day tasks like searching for things, navigating from one place to another outdoor.
5. Many times blind people do not know about their own location. Difficulty in tracking blind people by the caretakers.

## III. RELATED WORK

The idea to help visually impaired started with a walking cane that evolved to become a smart walking stick that uses Infra-Red (IR) or Ultra Violet (UV) sensors for the detection of obstacles [2]. Some works related to technologies that are helpful for visually impaired people are discussed below. A Smart assistive device that consists of Smart glasses and Smart shoes. In this device, the shoe is used to detect the obstacle distance and alert the user regarding it by the audio output. The system converts the text to braille which is stored in the memory for further processing to make it readable for blind people [1]. The main disadvantage of this device is cost-effective.

The current navigation system for visually impaired people focus on travelling from one place to another but only in indoor [7]. The Smart cane cause vibration and alert to the user with the help of the ultrasonic sensor. The vibration causes discomfort to the blind people. Assistive technology constructed using an embedded system creates a logical map of the surroundings and provides audio feedback to the user.

## IV. PROPOSED SYSTEM

Navigation for blind people is possible only with the help of others or by using assistive devices. Related to the location, movement and obstacle information, security is much needed for users[3]. To overcome the daily challenges faced by visually impaired people, we proposed a NavGuide system which is based on priority information about the surrounding environment. This information is provided to the user using audio feedback. The system assists in finding obstacles in the path. It also guides fire and water on the floor. The system is implemented to increase the mobility of visually impaired people in various environments [6]. The block diagram of the proposed system is as given below

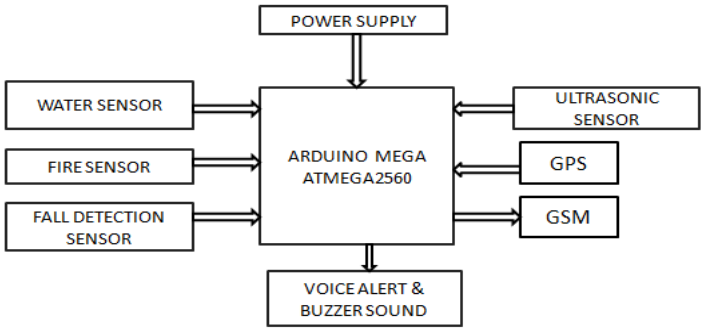


**Fig.1** Block Diagram of Proposed System

## V. DEVICE REQUIREMENTS

All the device requirements including both hardware and software components are listed below,

A. ARDUINO MEGA:

An Arduino Mega board consists of an Atmel Atmega 8-bit AVR microcontroller with components that allows incorporation into other circuits for interfacing and facilitate programming [8]. This board has 54 digital IP/OP pins in which 15 pins are used for PWM(Pulse Width Modulation), 16 analog input pins four serial ports, USB port, power jack, a reset button and a ISCP header. It is powered by 5v power supply.

B. ATMEGA2560:

It is a high-performance, low-power microchip which is based on 8-bit AVR RISC and it combines 4KB EEPROM, 256KB ISP flash memory, 8KB SRAM, real time counter and byte oriented 2-wire serial interface.

C. ULTRASONIC SENSOR:

The ultrasonic sensor uses ultrasonic sound waves to measure the distance between the objects and the user. It detects an obstacle in the range of50 cm and in the directions right, left, and front. The distance can be calculated by,

Distance, L = ½*TC

Where T – Time taken by the sound wave to travel back and forth between obstacle and sensor

C – Speed of the sound

½ denotes that either time traveled from obstacle to sensor or from sensor to the obstacle is needed for the calculation.

If the obstacle is detected, voice alert is given to the user using speaker.

D. FLAME SENSOR:

The flame sensor is used to detect the fire at the range of 60 degrees. It is sensitivity adjustable and works in the range of 3.3v-5v.This sensor is based on the YG1006 sensor which is high sensitive and high speed NPN silicon

E. FALL DETECTION SENSOR:

A fall detection sensor detects and differentiates the acceleration of human body actions from the regular motion. It is an electro-mechanical device that measures acceleration forces. This sensor is interfaced with 3.3v or 5v microcontroller. It can measure the static and dynamic acceleration resulting from motion.

F. WATER SENSOR:

This sensor detects the presence of water simply by using two conducting wires which when comes in contact with the water, it conducts, circuit becomes closed loop and sensor indicates this to microcontroller board.

G. GPS MODULE:

GPS provides anyone with continuous timing and positioning information in the world [9]. The latitude and longitude are determined using trilateration method. The function of the 12 visible satellites is to transmit information back to earth

ground stations over radio frequency range from 1.1 to 1.5 GHz. GPS satellite have atomic clocks on board to keep accurate time.

H. GSM MODULE:

GSM is mainly used for mobile network in the world[10]. GSM is a mobile system that divides a 200 kHz channel into 8 25 kHz time-slots and provides basic to advanced voice and data services. GSM operates on 900 MHz and 1800 MHz mobile communication bands.

## VI. METHODOLOGY

The basic methodology of our proposed system is based on an ultrasonic sensor, flame sensor, water sensor, fall detection sensor, GPS, and GSM module. All the sensors and modules are interfaced using the Arduino MEGA microcontroller board which is based on the Atmega2560 microcontroller.

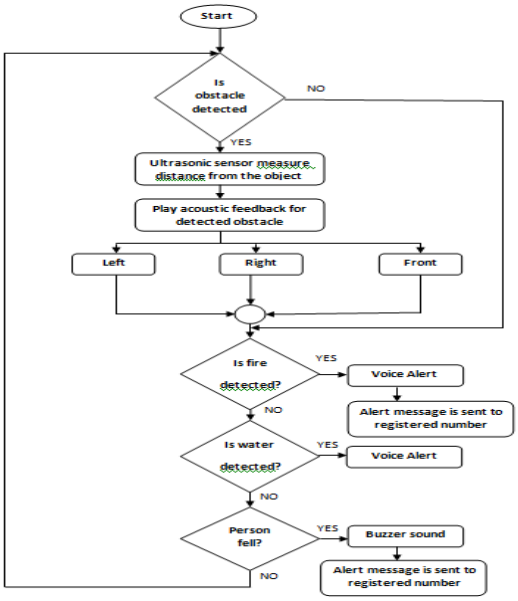


**Fig.2** Flow Chart

If the fire is detected or if the person fell, alert SMS with live location(latitude, longitude) of the user is sent to the caretaker using GSM (Global System for Mobile Communication). The live location of the user can be tracked by the caretaker using GPS (Global Positioning System) module.

## VII. IMPLEMENTATION OF MODEL

The sensors and modules are interfaced with the Arduino board using I/O pins. For obstacle detection, Trig, and Echo pins in the ultrasonic sensors are connected to Arduino.

For fire detection, the flame sensor uses the YG1006 sensor which is an NPN silicon phototransistor. The fall detection sensor has 3 output pins that are connected to the board. It sends output signals when there is a change in the acceleration of the body.

GPS receiver receives the location of the user continuously from the communication satellites. This signal from the satellite is converted using TTL logic by MAX232.GSM transmitter transmits the location of the user in SMS to the caretaker. The water on the floor is detected using water sensor.

Our proposed system is implemented in real time as depicted in the figure given below,

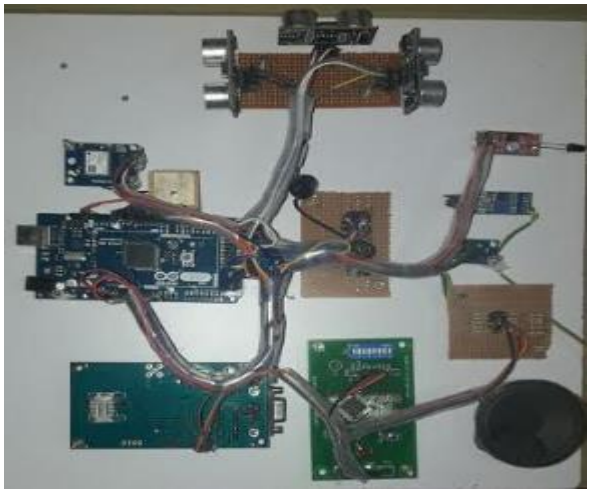

**Fig.3** Hardware Implementation

## VIII. OUTCOME

The results of our system are given as,

The system,

- Detect obstacles in front, right, and left directions and provide audio output to the user.
- Detect water on the floor and fire in 60 degrees range.
- Buzzer sound when the person falls down.
- Send alert SMS with live location of the user to the caretaker in an emergency situation.

The alert SMS which should be sent to the caretaker and live location of the user which is tracked by the caretaker in his/her mobile phone are represented in the following figures,


**Fig.4** Alert Message

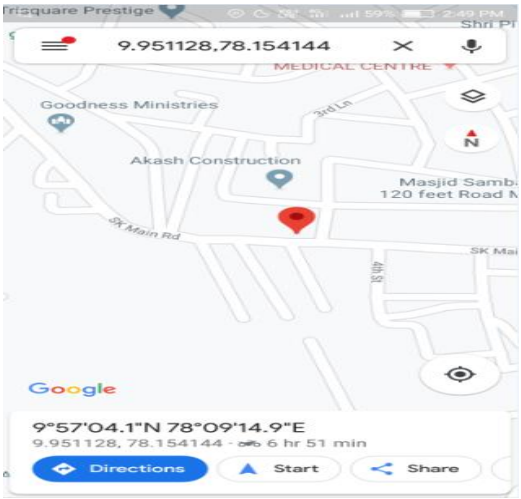


**Fig.5** Location of the Blind People

## IX. CONCLUSION

Our proposed NavGuide system helps blind people in identifying the obstacle-free path and provide security to them. With the help of NavGuide detector, visually impaired people can improve their travel speed, reduce minor collisions, increase safety from downfall, the fire, and an accident as compared to other equipment and, do not lose their way.

The main functions of the presented model are it detects the fire, water, obstacles, and produce audio output to the user. The live location of the user can be tracked by the caretaker under emergency situations using GPS and GSM.

This system provides continues acoustic feedback via a speaker to the visually impaired people which is more beneficial to them while traveling alone. This system is designed to make visually impaired to lead their life independently.

Future enhancement of this system is making the whole device, an automatic by using advanced technologies. Our proposed system can be implemented in shoe for commercial use by the blind people.

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