# SMART NAVIGATION ASSIST FOR VISUALLY IMPAIRED AND DIFFERENTLY ABLED

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***Abstract:*** The objective of this project is to provide an efficient navigation assist to overcome the limitations of conventional methods employed for the differently abled and visually impaired. This is achieved by employing sensors like MEMS accelerometer, Obstacle detection sensor. Use of ultrasound based ranging enhances the horizontal and vertical range of the obstacle detection. Also, with a simple twist of wrist, the wheelchair can be moved in the desired direction. Bluetooth module is also used to control the wheel chair by smart phone with the help of a specially designed application. Special three-wheel structure is used which helps the wheel chair climb pavements or staircases. The person sitting on the wheel chair himself can move it through gesture controlled mechanism providing independent mobility for the visually challenged and differently abled as well.

***Key words*- Ultrasonic sensor, obstacle detection, MEMS accelerometer, gesture control, Bluetooth, staircase climbing.**

## I. INTRODUCTION

Many smart devices have come up for the past two decades to help the blind people with obstacle detection. Sensors like obstacle detection sensor have been integrated with the conventional cane, making it a 'Smart cane'. Smart cane managed to enhance the obstacle detection range making the travel of the blind people less risky. However, it also has certain limitations in some cases. The major difficulty arises when the blind person is old or cannot walk on his own (physical disability). In such case, the person may be bed ridden and often require a wheelchair to navigate from one place to other or an escort. But, the person being blind, wheel chair may often collide with the obstacles. The operation of the wheel chair by the person himself is strenuous task. There are Smart wheel chair systems which use joystick or tactile screen and even voice recognition based controlling. Moreover, these wheel chairs cannot be moved upstairs/downstairs or onto small pavements on road without lifting it up. Lifting up the person along with the wheel chair is again a difficult task. All these limitations of the conventional systems can be overcome in this by combining altogether the obstacle detection, gesture control, Bluetooth control and staircase climbing mechanisms into a single project.

## II. BLOCK DIAGRAM

The figure shows block diagram of the proposed system. It consists of a battery, MEMS sensor, Bluetooth module, Ultrasonic obstacle detection sensors, Fall detection sensor, Relay, Motors, Switch, Buzzer and Arduino UNO. The entire circuit is supplied with power from a 12V Battery. Arduino is connected to a power bank for its power supply. When the battery is connected to the power supply circuit, the system initializes. The Relay circuit acts as a low current amplifier to provide large current that is required for the operation of the motors. The motors used in this project are 60rpm DC motors.

If the Bluetooth module is receiving any commands from the paired smart phone, the Arduino is programmed to prefer the Bluetooth to MEMS commands. In the other case, where there is no command received from the Bluetooth, Arduino takes the input from the MEMS sensor and carries out the operation according to the previously dumped program. Simultaneously, code written also determines the distance of an obstacle from the wheelchair. The control mechanisms are carried out as written until the distance of the obstacle from the wheelchair is safe. If any obstacle comes closer or is at a deadly distance, both the control mechanisms cease and the wheelchair automatically stops. The operation is resumed when the obstacle moves far beyond the deadly range.

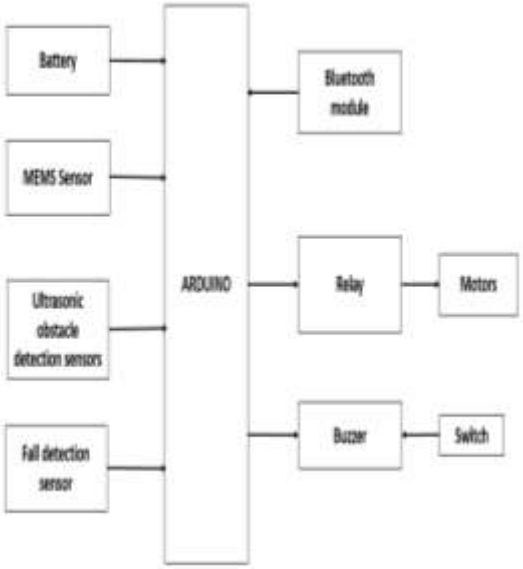


**Fig 3.2: Block diagram**

## III. FLOWCHART

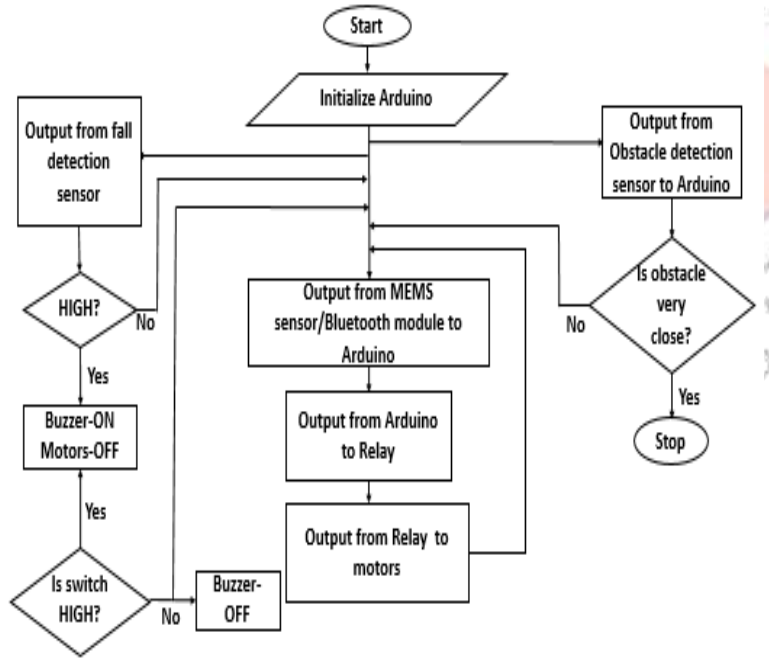


**Fig 3.2: Flowchart**

The operation of the proposed system is shown in the above flowchart. When the supply is given to the Arduino, all the components are initialized. Either of the gesture control or controlling via Bluetooth are carried out in parallel with the obstacle detection mechanism. The fall detection sensor is used in order to detect falling of the wheelchair. When the wheelchair falls down, an output is generated from the vibration sensor, and a buzzer gets ON and continues to be ON until the chair is lifted up and is switched OFF.

## IV. METHODOLOGY

### 4.1 Ultrasonic sensor


**Fig 4.1 HC- SR04**

The obstacle detection sensor is used in this project in order to calculate the distance of the obstacle from the wheelchair. The transmitter continuously transmits the ultrasonic waves. When any obstacle comes in the path of the waves, the waves hit the object and are reflected back. The reflected waves are captured by the Receiver. Based on the time elapsed between the transmission and reception of the ultrasonic waves, the distance of the obstacle from the wheelchair is calculated.

### 4.2 MEMS Accelerometer

Output information from accelerometer is voltage which depends on movement or tilt of sensor in space. The MEMS sensor is employed here for detecting the gesture of the person holding it. Depending on the gesture (tilt of the accelerometer in space), the movement of the wheel chair is determined.


**Fig: MMA 7361**

### 4.3 Bluetooth module

**Fig: HC-05**

Bluetooth module is used in order to control the wheel chair using a smart phone. The idea behind using a Bluetooth module is that even if a person accompanies the disabled, he could control the movement of the chair using his smart phone with the help of a specially designed application reducing the physical strain to the maximum extent.

## IV. RESULTS AND DISCUSSION

### 4.1 Results

The following are the results observed:

1. Movement of the wheelchair based on the gestures.
2. Staircase climbing with the help of three-wheel structure.
3. Halt in rotation of wheels when an obstacle is at a deadly distance.

### 4.2 Conclusion

Ultrasonic obstacle detection has paved way for numerous number of applications in the field of Embedded systems. One of the major areas of its application is navigation assist for the visually impaired people. Many difficulties like going upstairs / downstairs, collisions with vehicles or other obstacles on road while moving faced by the visually impaired people having trouble to walk which may be due to age factor or due to physical disability are overcome with the help of this navigation aid.

### 4.3 Future work

1. Pits or potholes in the path can also be detected by placing more number of obstacle detection sensors at various parts of the vehicle.
2. Preventing the vehicle from falling can be made by using angle detection sensors.
3. Obstacle detection mechanism can be used in vehicles travelling on road to avoid the accidents and to avoid any collisions in low light as well.
4. GPS and many other sensors can be integrated.

## V. ACKNOWLEDGMENT

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