

## Artificial Vision for Blind Person

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**Abstract** – “Artificial Vision for Blind Person” presents an ultrasonic waist belt which provides an electronic navigation for visually impaired and blind person. The system consists of ultrasonic sensors, Arduino Uno, Bluetooth module, Vibration motor and smartphone. Ultrasonic waist belt detects obstacles in front, bottom, left and right directions using a network of ultrasonic sensors. To inform the person about detected obstacle and its distance, the information from ultrasonic waist belt is passed to the mobile application which then alerts the user through voice instructions. The main objective is to provide a cost effective & efficient navigation system that allows blind individuals to get directed throughout their journey independently.

**Key Words:** Artificial Vision, Ultrasonic Sensor, Voice Alert, Obstacle Detection, Blind Person.

### 1. INTRODUCTION

The World Health Organization (WHO) states that more than 40 million folks are completely blind and 314 millions have some quite visual disorder. These people have to be dependent on others for navigation. To solve this problem, there must be a system that helps blind person to accomplish the movement. It is necessary to have innovative ways to leverage the capability of a system to seek individuals and objects. To make them comfortable in environment, they should have information of objects and obstacles ahead of them and that conjointly makes the navigation simple. There are some systems available like RFID based intelligent walking stick [1], IR stick [8], ultrasonic sensor based systems [4] and ultrasonic spectacles [5]. These systems based on device which produces ultrasonic sound and receives reflected pulses, according to which it produces vibration in response to that. These solutions are less effective as they do not provide better navigation to blind individuals.

The aim of this system is to overcome drawbacks of earlier systems by designing and implementing ultrasonic waist belt with a voice-based alert for the blind individuals to provide higher obstacle detection and avoidance. The ultrasonic waist belt has four ultrasonic sensors at front, right side, left side and bottom that covers the maximum area to detect obstacle in vary. If the obstacles are detected by the system then information regarding obstacle is provided to a blind

person with the help of voice feedback.

### 2. METHODOLOGY

The proposed system makes use of ultrasonic sensors to continuously send digital signals to microprocessor. From duration of transmitting and receiving pulses, distance is get calculated and if obstacle is detected within particular range, it gives a voice alert to the blind person. The range of ultrasonic sensor is between 3cm to 300cm. Ultrasonic sensors has ultrasound waves which has a frequency above normal human hearing i.e. 20KHz and the range of human hearing is between 20Hz to 20KHz.

The distance is calculated using following formula:

$$\text{Distance} = (\text{travel\_time} / 2) * \text{speed\_of\_sound}$$

The system uses Arduino Uno R3 is a microcontroller board supported by ATmega328. HC-05 module is a straightforward to use Bluetooth module, designed for clear wireless serial association setup. HC-05 Bluetooth module acts as bridge between Arduino Uno and mobile application.

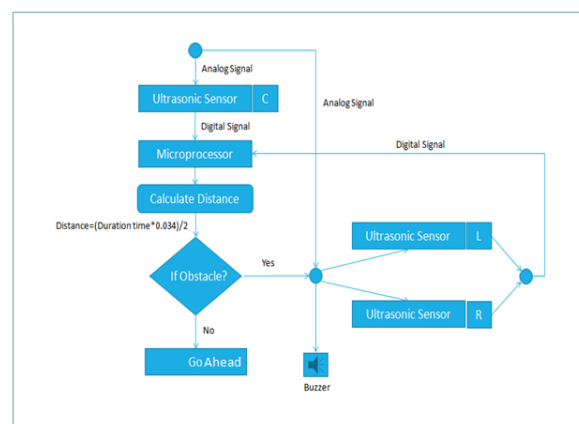


Fig 1. Dataflow Diagram

### 3. PROPOSED SYSTEM

The System is divided into two parts –

- i) Hardware
- ii) Software.

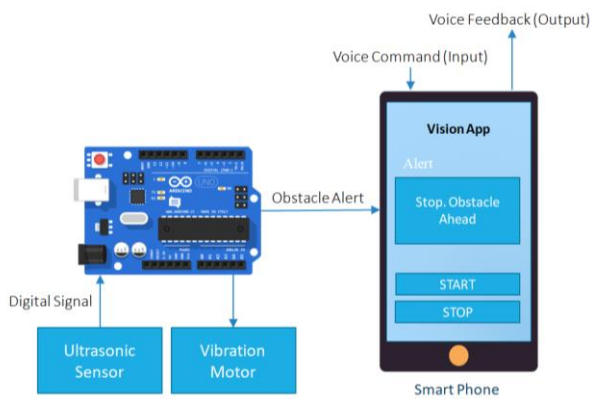


Fig 2. Architecture Diagram

- i) **Hardware** – It includes Arduino-UNO connected with Ultrasonic sensor and vibration motor. Ultrasonic sensor will help blind to detect intercepting obstacle which then alerts by using vibration motor.
- ii) **Software** – An integrated android application which will provide voice alert to blind person.

#### 4. REQUIREMENTS

Following would be the technical requirement to develop our system:

- **Software:**
  - Operating System- windows 10 (64 bit)
  - IDE – Arduino, Android Studio 3.1.3
  - Languages- Java 8, Python 3.6.6
- **Hardware:**
  - Ultrasonic Sensor HC-SR04
  - Arduino UNO R3
  - Vibration Motor
  - Bluetooth HC-05
  - Smart Phone (With Android Version More Than 4.1)

#### 5. RESULT AND DISCUSSION

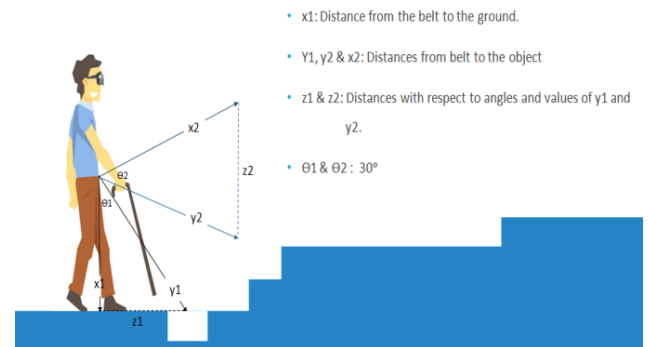


Fig 3. Working of Ultrasonic Waist Belt

Result part of ultrasonic waist belt presents two important cases. Those are:

##### 5.1. Result of Ultrasonic Waist Belt (Obstacle Detected in Front Less Than 1 meter)

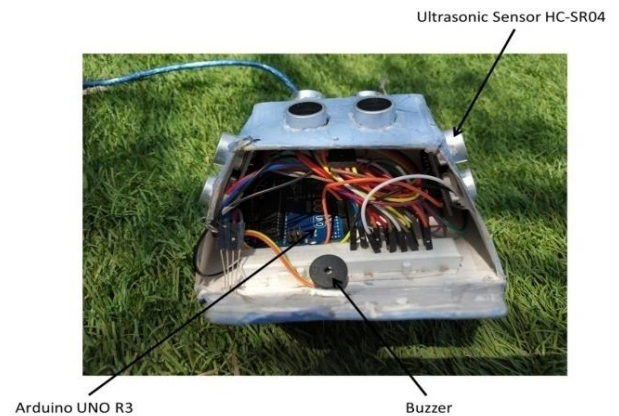


Fig 4. Ultrasonic Waist Belt

Ultrasonic Waist Belt first checks for the presence of an obstacle in front. When any obstacle gets detected within 1 meter in front direction, the ultrasonic waist belt checks for either way.

##### 5.1.2. Way at Left

If there is an obstacle detected in front within 1 meter, the belt tries to find out any way at left or right direction. If any obstacle gets detected within 1 meter in the right direction but there is no obstacle in the left then the belt gives a result to turn left.

##### 5.1.3. Way at Right

After detecting an obstacle in front, if any obstacle gets detected within 1 meter in left direction but there is no obstacle in the right direction then the belt suggests turning right.

#### 5.1.4. Way at Both Directions

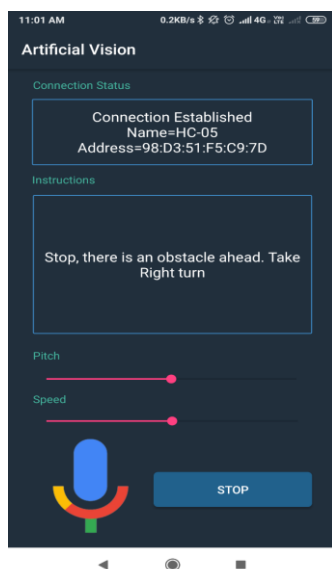
If an obstacle is detected in front but there is no obstacle on both left as well as right direction then belt gives clearance to move in any of the left or right direction.

#### 5.1.5. No Way to Go

After detecting an obstacle in front, if there is no way in both left and right direction then ultrasonic waist belt gives result showing no way to go.

#### 5.2. Result of android application

When an obstacle is detected by ultrasonic waist belt, the distance of obstacle is sent from belt to android application. Then the person will be able to get notified with the voice alert including preferable direction where a blind person can move.



**Fig 5. Artificial Vision Andorid Application (For voice Alert)**

### 6. FUTURE SCOPE

#### 6.1. Navigation

##### 6.1.1. Outdoor Navigation

To get navigated, a blind will give voice command of destination and then will be able to get pronounced navigation.

##### 6.1.2. Indoor Navigation

To get navigated within the workplace and track assets in the workplace, beacon device (Bluetooth Low Bandwidth device) will continuously transmit single radio signal in one direction & if bluetooth pairable device will come in beacon range, current location will get inform as programmed in beacon.

#### 6.2. Object & Face Recognition

##### 6.2.1. Object Recognition

Using ORB algorithm (i.e. Oriented FAST & Rotated BRIEF algorithm) a smart phone camera can recognize object in front of it.

##### 6.2.2. Face Recognition

The algorithm like LBPH (Local Binary Patterns Histogram) will be useful for face recognition.

### 7. CONCLUSION

Many blind people have trouble maintaining a proper circadian rhythm due to the lack of visual input to their brains. There is a need to have a navigation system that allows blind individuals to get directed throughout their journey independently and inform them of where their current position may be. The main focus of the system is to detect and avoid obstacles in the path by using ultrasonic sensors. After detecting an obstacle, a blind person gets navigated by voice alert. To detect an obstacle in the path, we have implemented our first module using ultrasonic sensors. Sensors are mounted on the belt, which will detect an obstacle either in front, left, or right. As well as when an obstacle is detected, the module will suggest the correct direction to move.

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