

# “AI Guidance System for Blind Peoples”

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**Abstract** - In today's world, Artificial Intelligence is offering a wide range of solutions for any problem. This paper represents an “AI guidance system for blind peoples”. This system is an interdisciplinary approach of Deep Learning and IoT. Our device is in the shape of a pair of eyeglasses for giving these people guidance efficiently and safely. As compared to the existing system this system is fast and accurate by using the YOLO algorithm for object detection from image frame or video provided by the camera and separate module of Ultrasonic sensor and IR sensor for obstacle detection. Also for guiding person we are using Natural language processing for voice commanding the system and getting awareness in form of voice. This system can help to detect staircases, text from anywhere, person, digs, hips, vehicles, doors, obstacles, and currency which will help blind people to be independent.

**Key Words:** Artificial Intelligence, Deep Learning, IoT, YOLO Algorithm, Object detection, Ultrasonic sensor, IR sensor, Natural Language Processing.

## 1. INTRODUCTION

Visually challenged people (VCP) struggle in their everyday life and have major difficulties in participating in cultural, tourist, family, and other types of outdoor activities especially those which are in unfamiliar surroundings. The World Health Organization (WHO) said that 3% of our population is visually challenged. Visually blind people usually use white canes or guide dogs for help for detecting obstacles over the past years. Guide dog phases difficulty in finding out obstacle situated above his height and white cane fails in the case of hanging objects. Also, this solution does not describe the obstacle. We are trying to overcome these problems in our AI system.

This system uses an interdisciplinary approach of Deep Learning and IoT. In this system, we have used an ultrasonic sensor and IR sensor integrated with Arduino UNO R3 as a separate module to detect obstacles. Also, we built a CNN model using the YOLO algorithm to detect various objects like vehicles, people, stairs, doors, digs, and hips using video frames obtained by the camera. We had built a natural language processing module for commanding our system. Also voice output regarding obstacles and other instructions. In this system, we used raspberry pie as the main computer.

We are going to place our system in wearable glasses. Unlike previous systems, our system is fast and accurate to detect objects because of the YOLO algorithm. It operates in real-time and does not need the internet to operate as we are using it on CPU to operate. An impaired person can wear this system and command this system for finding the things like a person, vehicle, stairs, door, and text using voice command. This system recognizes these commands and gives a desirable output invoice. Also while traveling, it detects objects and obstacles and notifies about it to the user using voice output.

This paper focuses on the following points:

Section II gives information about the related works involved in the AI guidance system for blind peoples. The proposed smart guiding glasses system design is presented in Section III. Finally, we have made some conclusions in Section IV.

## 2. RELATED WORK

### 2.1 Survey of Previous Work

**Table -1:** limitations of previous work

| Sr. no | Real-time working | Accurac y | Speed | In / outdoor | Ref. |
|--------|-------------------|-----------|-------|--------------|------|
| 1.     | yes               | less      | less  | indoor       | [6]  |
| 2.     | yes               | less      | less  | indoor       | [2]  |
| 3.     | no                | high      | less  | both         | [5]  |
| 4.     | yes               | less      | less  | both         | [8]  |

By reference to the above-mentioned attributes, we can conclude that previous systems have some drawbacks. To overcome these drawbacks we created one system. Some of the previous systems are based on the internet so for operating them you must have a network connected to them. Because of it, these systems become dependent on ground

stations such as an internet-based environment (cloud). Some of these systems are only virtually tested but fails in the real world.

Other drawbacks of previous systems:

- The previous systems are big in size and costly.
- Previous systems operate in a very short range.
- Some of these systems do not operate in real-time.
- They require internet connectivity to work if the connection breaks it fails to operate.
- Most of these systems only work indoor.
- Previous systems are less accurate and slow.

## 2.2 Problem Description

Blind people face many challenges in everyday life from reading a book to walk on the street. Many tools are available in the market to face these challenges, but they are not sufficient. Vision is the most important thing in anyone's life, without it visually challenged people need an assistant to carry on work daily. In this paper, we have discussed the challenges faced by blind people and tried to provide a solution to them for working everyday life.

## 3. PROPOSED SYSTEM

### 3.1 Hardware Architecture

It consists of the following components:

- **Raspberry Pi 3 :**



The Raspberry Pi is a low-cost, portable, single-board computer. Depending on the user requirements it can be customized. We used Raspberry Pi for image and video processing, natural language processing. It supports various programming languages like C++, python, and java. The Raspberry Pi has a wide range of possibilities to do with it to

create digital projects. We also used it as the main computer for our system.

- **Arduino UNO R3 :**



Arduino is an open-source electronics platform used with sensors to process sensing tasks. Arduino boards can read inputs from various sensors. It uses various languages.

- **IR sensor :**



IR sensors are small microchips with a photocell that are designed to either emit or receive infrared light and in some cases sensor does both. They are used in the detection of remote objects. This system uses the IR sensor to detect an object at a certain distance. This is possible through using a pair of IR sensors (Transmitter and Receiver), the transmitter emits IR and the receiver receives the light bounced back from the object.

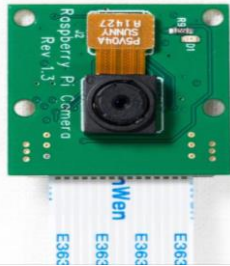
- **Ultrasound sensor :**



An Ultrasound sensor is a device that can measure the distance to an object using sound waves. It transmits the sound wave at a specific frequency and the sensor waits for detection of the reflected wave. By calculating the time interval between emission and receiving, it calculates the distance between an ultrasound sensor and the object. Sometimes, the ultrasound sensor might not detect some objects because sometimes the wave might not reflect back properly to the sensor and it goes somewhere else. In this

situation, the ultrasound sensor will not be able to predict the distance accurately.

• **Camera module :**



This module takes pictures and sends them to the microcontroller i.e. raspberry pi. The frequency of taking images can be altered depending on the program and usage. This module has Sony IMX219 8-megapixel sensor. It can be used also to take high definition videos too.

• **Headset :**



We used a simple one-ear headset with a mic for audio input and output.

**3.2 Description**

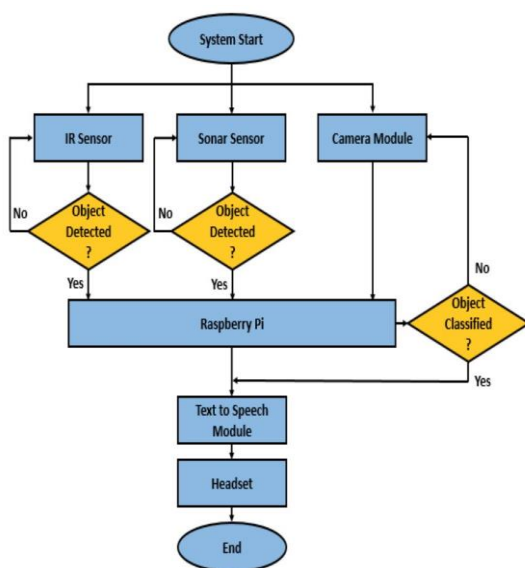


Fig 1. Hardware architecture of AI guidance system for blind people.

In this system, we used an IR sensor, an Ultrasound/sonar sensor integrated with Arduino Uno r3 for obstacle detection from the surrounding. If any object/obstacle came in the range of these sensors sense that object and Arduino send signals to the raspberry pi. Then raspberry pi activates the text to speech module and the user can get voice output. The camera module captures the video frames from the surroundings and sends them to raspberry pi then the programs we designed, it process that frames detect/identify objects from it and notify the user through voice output.

**3.3 Software Architecture**

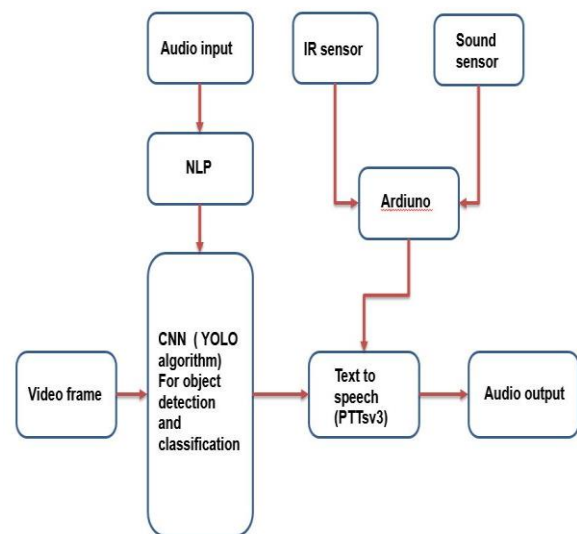


Fig 2. Working of software model

**YOLO Algorithm:**

YOLO (you only look once) algorithm is an algorithm based on regression, instead of selecting the interesting part of an Image, it predicts classes and bounding boxes for the whole image in one run of the Algorithm. YOLO is a clever convolutional neural network (CNN) for doing object detection

**Working:**

When the system starts IR sensor and sound sensor starts sensing the surrounding. Also, the camera module starts capturing video frames. The video frame taken by the camera module gets processed in our program consist of the CNN YOLO algorithm model. We had trained this model to detect various things like staircases, text from anywhere, person, digs, hips, vehicles, doors, obstacles, and currency. If the system finds out anything like that in front of it then our text to speech model starts which gives the output to the user in form of voice. Also concurrently, if the sensor finds out any obstacle from surrounding it activates the text to

speech module to notify the user through the headset. We had built natural language processing which remains active for the user to command system for some task to do like to find some text, object, etc. whenever the user commands the system through the microphone, the NLP starts processing the command and instructs the program to do a specific task.

## CONCLUSIONS

A guidance system for blind peoples will provide ease of traveling for blind people without any support from others. A new AI-based system to control the navigation of a blind person has been proposed with more speed and accuracy. This AI-based system offers a simple electronic guidance system that is configurable and efficient. The system will help blind people to be self-dependent by assisting them in their daily life outdoor or indoor.

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