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# REAL TIME OBJECT DETECTION AND CLASSIFICATION using yolo

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**ABSTRACT_** Technology plays a vital role in daily life, especially for individuals with visual impairments. Navigation in unfamiliar environments poses a significant challenge, making assistive systems essential. This study introduces a blind navigation system using a Raspberry Pi and the YOLO (You Only Look Once) object detection algorithm. YOLO enables real-time detection of objects in images and videos with high accuracy. The system consists of a Raspberry Pi connected to a camera module, which uses YOLO to detect objects in the user's surroundings. Identified objects are conveyed to the user via text-to-speech and vibration feedback, indicating direction and distance. Capable of recognizing various obstacles like doors and stairs, the system is lightweight, portable, and powered by a rechargeable battery. A simple one-button interface initiates detection, and the system's sensitivity can be customized to suit user needs.

## 1.INTRODUCTION

### 1.1 Visual Impairment

The International Classification of Diseases 11 (2018) classifies vision impairment into two groups: distance and near presenting vision impairment.
Distance vision impairment:

Mild – visual acuity worse than 6/12 to 6/18
Moderate – visual acuity worse than 6/18 to 6/60
Severe – visual acuity worse than 6/60 to 3/60
Blindness – visual acuity worse than 3/60
Near vision impairment:

Near visual acuity worse than N6 or M.08 at 40cm. A person’s experience of vision impairment varies depending upon many different factors. This includes, for example, the availability of prevention and treatment interventions, access to vision rehabilitation (including assistive products such as spectacles or white canes), and whether the person experiences problems with inaccessible buildings, transport, and information.

### 1.2 Prevalence

Globally, at least 2.2 billion people have a near or distance vision impairment. In at least 1 billion – or almost half – of these cases, vision impairment could have been prevented or has yet to be addressed.
This 1 billion people include those with moderate or severe distance vision impairment or blindness due to unaddressed refractive error (88.4 million), cataract (94 million), age-related macular degeneration (8 million), glaucoma (7.7 million), diabetic retinopathy (3.9 million) , as well as near vision impairment caused by unaddressed presbyopia (826 million) .
In terms of regional differences, the prevalence of distance vision impairment in low- and

middle-income regions is estimated to be four times higher than in high-income regions (1). With regard to near vision, rates of unaddressed near vision impairment are estimated to be greater than 80% in western, eastern and central sub-Saharan Africa, while comparative rates in high-income regions of North America, Australasia, Western Europe, and of Asia-Pacific are reported to be lower than 10%..

Population growth and ageing are expected to increase the risk that more people acquire vision impairment.

## 2.LITERATURE SURVEY

**2.1 Woojin Chung, "Integrated navigation system for indoor service robots in large-scale environments"** It contains architecture of navigation system, the development of crucial navigation algorithms like map, path planning, and localization, and planning scheme such as fault handling. This system provides some advantages that are 1) A range sensor based generalized scheme of navigation without modification of the environment. 2) Intelligent navigation-related components. 3) Framework supporting the selection of multiple behaviors and fault handling schemes [9]

**2.2 Denis Tudor, Lidia Dobrescu, Drago Dobrescu, "Ultrasonic Electronic System for Blind People Navigation"** This system presents a new electronic system using an ATmega328P microcontroller, two ultrasonic sensors and vibrating motors as a helping solution for blind people navigation. In order to determine the distance, HC-SR04 ultrasonic sensors are used. The HC-SR04 ultrasonic sensor uses sonar A short ultrasonic pulse is transmitted at the initial time, echoed by an object [10].

**2.3 Kanchan M. Varpe, M.P. Wankhade," Visually Impaired Assistive System"**which focuses on independent portability of blind people who travel in an unfamiliar environment without any manual assistance. System include on the server side zigbee transceiver for wireless conversation, RFID reader with an integrated microcontroller, zigbee transmitter and TTS for playing information to user. The VIAS can be used by visually impaired or blind users at the system implemented environment such as organization campus which can be school, college, hospitals, shopping mart, bus stands, etc [14].

**2.4 Aladrén, G. López-Nicolás, Luis Puig, and Josechu J. Guerrero" Navigation Assistance for the Visually Impaired Using RGB-D Sensor With Range Expansion"**, In this paper, a new system for NAVI is presented based on visual and range information. Rather of using multiple sensors, we choose one device, a consumer RGB-D camera, and take advantage of both range and visual information. In appropriate, the combination of depth information with image intensities, resulting in the robust expansion of the range-based floor segmentation. Our system detects the main structural elements of the scene using range data [15].

## 3.PROPOSED SYSTEM

Constantly changing, the field of technology has become something we depend on for many facets of our everyday life. For those with vision problems, technology has become a vital instrument for offering more independence and access. Navigation is one field where technology may greatly influence. Especially in unknown settings, those with visual disabilities may find navigation difficult. Thus, creating a blind navigation system to assist people in negotiating unknown areas would be quite useful. This study presents a blind navigation system based on a Raspberry Pi and the YOLO (You Only Look Once) object identification method. A computer vision method called object detection lets computers find and identify items in video or picture. With amazing precision and speed, YOLO is a real-time object identification system able to identify items in movies and photos. By processing the whole image with one neural network, the YOLO algorithm can identify objects quite quickly. Ranging from simple to complex, many projects may be done on the low-cost, credit card-sized computer known as the Raspberry Pi. Its cheapness and adaptability make it a common option for DIY electronics projects. The suggested blind navigation system is a camera module linked to a Raspberry Pi. Objects in the field of vision of the camera are detected by the system using the YOLO algorithm. The YOLO algorithm finds items in the image produced by the camera. The system then orally informs the user of the object locations using text-to-speech technology. The technology can also offer vibrating feedback to show the object's distance and direction. The technique can be used to find a variety of items, including doorways, stairs, and obstacles. Designed to be portable and lightweight, the system allows users to carry it with them everywhere. A rechargeable battery powers the system; its user interface is straightforward and uncomplicated. Comprising one button, the user interface starts the object detecting procedure. The system is also meant to be configurable so that users may change the object detecting system's sensitivity to fit their requirements.

**3.1 Model of Process**

The following procedures can be used to implement object detection and classification on Raspberry Pi with audio output:

1. Put together the hardware elements: Building the Object detection system will require a Raspberry Pi board, a microSD card, a Pi camera module, and a USB speaker or headphone connector. Configure the Pi camera module and attach it to the Raspberry Pi board.

2. Download the most recent version of the Raspberry Pi OS and set it up on the microSD card. Install the necessary software, including Python libraries and a camera module, as well as a text-to-speech (TTS) library for the audio output.

3. The Pi camera module will be utilised to photograph the surrounding area. Capture photos using Python code and process them to get information about the existence of doors, stairs, and other barriers. Provide audio output for the user using the TTS library, hence informing them of the distance to obstacles and directions to go around them

4. Combine distance computations with audio output: Integrate the audio output with the distance calculations using Python code so the system may produce audio cues depending on the user's location and the surrounding environment. Test the system to make sure it offers dependable and accurate navigational support to visually impaired users.

5. All things considered, constructing Object detection System using Raspberry Pi with audio output calls for hardware component assembly, operating system and necessary software installation, image capture and processing, TTS library audio output generation, audio output integration with distance computations, and system testing. Such a system can offer useful navigation support to visually impaired people with diligent implementation and testing.

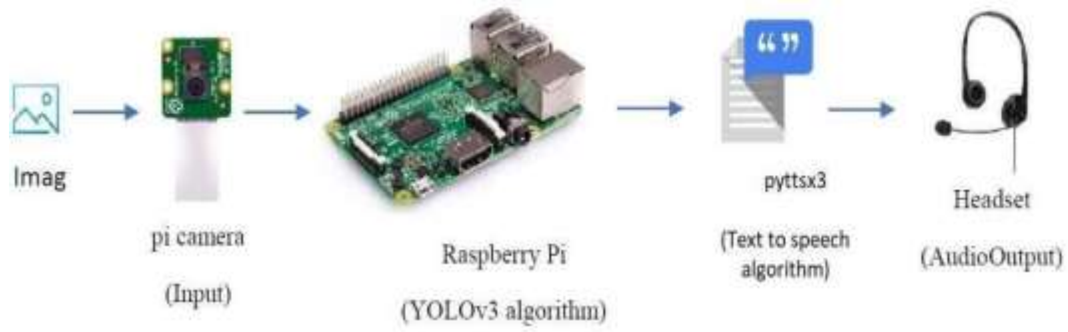


**Fig 1- Hardware Architecture**

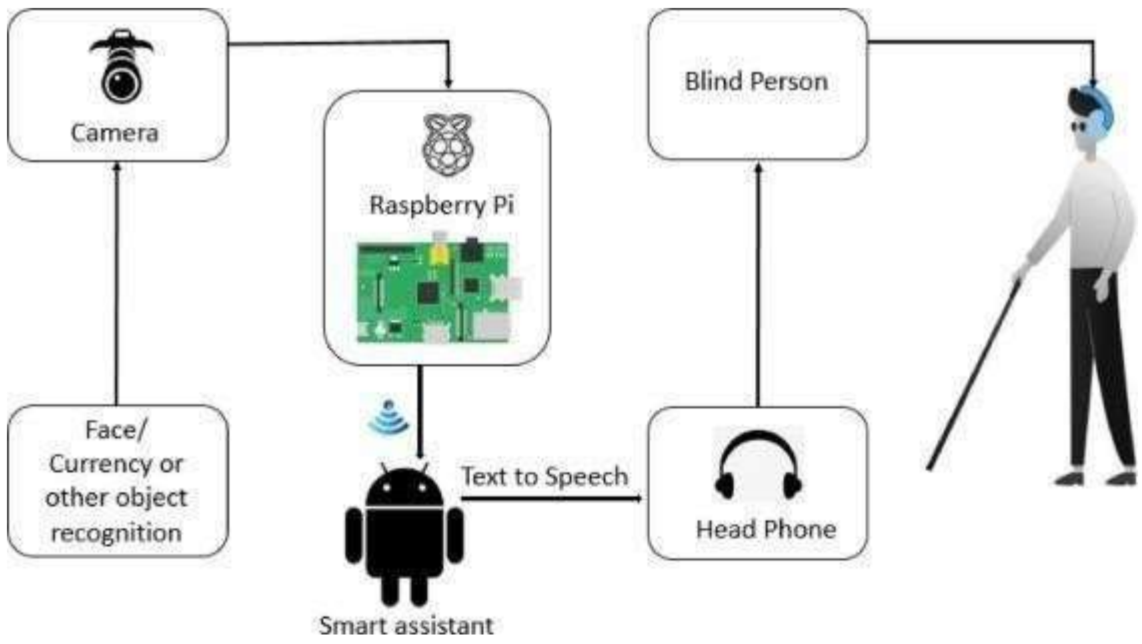


**Fig 2- Process Architecture**

## 4.RESULTS AND DISUSSION

Designed to help blind people negotiate their surroundings, the Object detection and Classification system combining Raspberry Pi with audio output Obstacles are found by the Raspberry Pi-based system via audio output, which then gives the user audible feedback.

Tested in many different environments—indoor and outdoor—the device proved successful in identifying barriers and giving the user audible feedback. Depending on the environment and object size, the system may identify barriers anywhere from 2 cm to 300 cm away.

Real-time clear and succinct audio cues delivered in real-time helped to make the audio output effective in giving user feedback. Different noises were employed to signify the distance and direction of barriers, hence designing the auditory cues to be simple to grasp and interpret.

All things considered, the Object detection and Classification system employing Raspberry Pi with audio output was determined to be useful in helping visually impaired people to negotiate their surroundings. Real-time, clear and simple auditory feedback made the system straightforward to use. Consistent performance across a range of settings and environments showed the system to be dependable as well.

Ultimately, the Object detection and Classification system using Raspberry Pi with audio output is a promising technology that has the potential to increase the mobility and freedom of visually impaired individuals. Although the system has drawbacks, it is a significant advancement in the evolution of assistive technologies for people with impairments.


**Fig 3:Results**

The image consists of two frames demonstrating YOLO-based object detection. In the top image, multiple cats, including a mother and kittens, are detected near a bowl of food, with bounding boxes labeling them as "cat" alongside confidence scores. The FPS (Frames Per Second) value is displayed, indicating real-time performance. The setting appears to be indoors, possibly near a stairway or bicycle wheel. In the bottom image, a young woman with glasses is smiling while sitting on a cushioned bench beside a fluffy white dog, both detected by the model with appropriate bounding boxes. The FPS value is also displayed, and the watermark at the bottom left indicates that the image was captured using a Samsung Galaxy M31. These images effectively showcase YOLO's real-time object detection capabilities for animals and humans in different environments

**5.CONCLUSION**

In conclusion, the Raspberry Pi-based Object detection and Classification system with audio output advances assistive technology for visually impaired people. To help users navigate, the system provides real-time obstacle detection and classification and audible feedback.

Raspberry Pi-based object recognition and classification with audio output provides various advantages over other visually impaired assistive technologies. First and foremost, the system is economical and easy to install with off-the-shelf parts. The system is lightweight and portable, making it suitable for indoor and outdoor use.

The device has been tested indoors and outdoors and has helped visually impaired people navigate. This device is appropriate for persons with poor auditory abilities because its audio feedback is clear and easy to interpret. Easy-to-use controls and excellent aural feedback make the system accessible to users of all technical abilities.

There are various ways to enhance the system despite its benefits. In noisy or irregular settings, the system's ultrasonic sensors may be ineffective. To increase system reliability, more study is needed on alternate sensor types to ultrasonic sensors.

Obstacle detection and classification can be improved. The system can identify and categorise barriers by distance and direction, but it may struggle to classify low-lying or irregular-shaped obstacles. Research is needed to build algorithms that can classify more obstacles, even difficult ones.

The system provides clear, understandable auditory feedback, but it may be improved. Haptic or visual feedback could be added to the system to provide users more cues. Further study is needed to create more natural and understandable audio cues, especially for people with poor auditory ability.

The system's battery life may also limit its efficacy, especially outdoors or for long periods. Research is needed to find alternate power sources to improve system performance and battery life.

Users without significant financial resources should evaluate the system's cost. Further research is needed to lower system cost while retaining effectiveness and reliability.

Object detection and classification must be accessible to a wide range of users, including those with visual and auditory impairments. Research is needed to make systems more accessible to people with severe visual or aural impairments.

In conclusion, Raspberry Pi with audio output could increase vision impaired people's mobility and independence. Although the technology can be enhanced, it already helps visually impaired people.

hindered navigation. With further development, the Raspberry Pi blind navigation support system with audio output could revolutionise assistive technology for visually impaired people and improve their quality of life.

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