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AI-Powered Object Detection for the Visually Impaired (AODVI)

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Abstract: *Visually impaired individuals face daily challenges in navigating safely through their surroundings. Traditional aids such as white canes and guide dogs offer limited support, as they only detect physical obstacles but cannot provide detailed contextual information. Without proper assistance, visually impaired people are at risk of accidents, dependency, and reduced independence. This project proposes the development of AI-Powered Object Detection for the Visually Impaired (AODVI), a system that integrates real-time object detection, location awareness, and voice-based feedback. The system captures video using a camera, processes it using lightweight deep learning algorithms (such as YOLOv8-Nano or MobileNet SSD), and identifies obstacles or objects in the path of the user. Detected objects and navigation information are then communicated via audio output, allowing users to move independently and safely*

Keywords*:* Image Processing, Machine learning, Visually Impaired, Object Detection, YOLO

I. INTRODUCTION

The Technology for navigation of the blind is not sufficiently accessible devices rely heavily on infrastructure requirements. Without vision it can be challenging for visually im-paired persons to navigate through rooms or different road paths .The main aim to develop the project is to help the visually impaired people and to detect the obstacles to detect the road traffic signs. The blind persons life become easier and they can go anywhere where they wants without anyone helps .They can walk alone through street they does not need anyone to assist them they can handle their self correctly. The preventing users from dangerous location our aim is to collected from environment (cameras, sensors, scanners, etc) and transmitted to the users to the audio format.

1.1 Background

- Object detection is an important application of artificial intelligence and computer vision. It helps identify and recognize objects present in the surrounding environment. In today's digital world, smartphones are widely used, but visually impaired people and elderly users face difficulty in operating them.
- This project focuses on developing an Object Detection system using a Voice-Based Android Application. The system allows users to detect real-world objects through a mobile camera and receive audio feedback. YOLOv8 algorithm is used for real-time object detection, making the system fast and accurate.

1.2 Additional Technical Approaches:

• Android application development using Android Studio.
• Programming languages: Java / Kotlin.
• Speech-to-Text for user voice commands.
• Text-to-Speech for audio responses.
• YOLOv8 algorithm for object detection.
• TensorFlow Lite for model deployment.

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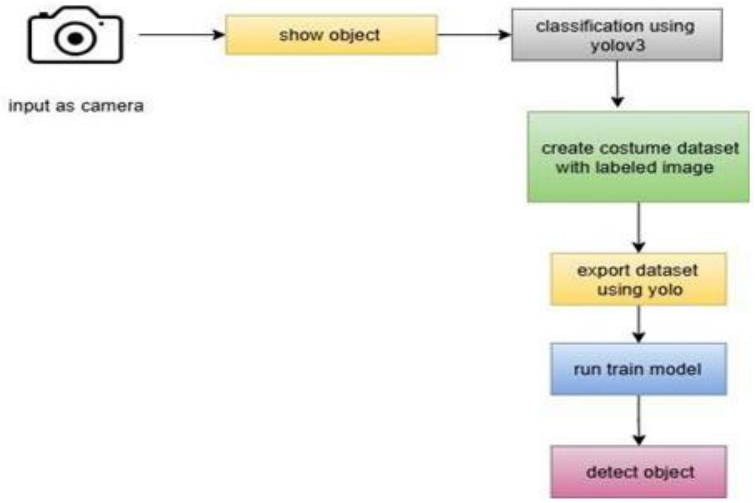
- GPS for location tracking.
- Accessibility services for WhatsApp control.
- API integration for weather updates.

II. REASON FOR DEVELOPING THIS SYSTEM

- To help visually impaired users identify surrounding objects.
- To provide hands-free mobile operation.
- To improve safety through emergency calling features.
- To reduce dependency on others.
- To implement AI-based real-time detection.
- To enhance accessibility using voice technology.

2.1 System Architecture



1. Object Detection – A camera captures live video which is processed by lightweight AI models such as YOLOv8-Nano or MobileNet+SSD. These algorithms detect objects like vehicles, pedestrians, poles, and doors in real time. Distance estimation techniques approximate how far the object is from the user.
2. Location Awareness – A GPS module provides real-time location data. This can be used for navigation guidance (e.g., road crossing, bus stop detection) and also for emergency communication where the user's location can be shared with caregivers.
3. Voice-Based Output – A Text-to-Speech (TTS) system converts the detected object and location information into spoken alerts. For example, "Car approaching from the right, 3 meters away." Multilingual support ensures accessibility for diverse users.

2.2 Algorithms

For efficient implementation, selection of algorithms is the most crucial part. Thus, different object detection algorithms like R-CNN, Fast R-CNN and YOLO are compared.

R-CNN [5] uses a region based proposed method. RCNN does not take the whole image, instead, it takes the part of the image that has a higher chance of containing the object. The training time of the network is very large. Moreover, it cannot be used in real time as its speed is very slow, it takes 47 seconds for each image to get detected.

The speed and accuracy of Fast R-CNN [6] are better than R-CNN [5]. In fast R-CNN[5], there is no need to feed 2000 regions every time to the convolution layer; instead, it is passed only once per image which provides a convolutional feature map.

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In this system, the YOLO (You Only Look Once) algorithm is used which is the best fit for Realtime detection applications. YOLO, when compared to different detection algorithms, works differently. The YOLO algorithm takes the entire image(frame) in a single instance and processes it. The feature that makes YOLO stand out from other algorithms is its excellent processing speed where it can process 45 frames per second.

III. LITERATURE SURVEY

Sr. No.	Title	Name of Journal	Publication year	Remark
1	Real-Time Object Detection for Visually Challenged People	Proceedings of the International Conference on Intelligent Computing and Control Systems (ICICCS 2020) IEEE Xplore Part Number:CFP20K74-ART; ISBN: 978-1-7281-4876-2	2020	Image Processing, Machine learning, Visually Impaired, Object Detection, YOLO.
2	Object Detection and Distance Estimation Tool for Blind People Using Convolutional Methods with Stereovision	2019 International Symposium on Electronics and Smart Devices	2019	Blind, Centroid, Convolution Neural Network

IV. FUTURE DIRECTIONS

This device can perform different task during the development of the algorithm. These device is more suitable if it is possible to get higher frame per second of the system. Further modifications to enhance the performance of the system will be added.

V. OBJECTIVES

- Measuring distance of object from camera .
- Measuring dimensions of an object from known distance .
- Measuring dimensions of an object from unknown distance.
- Using artificial intelligence and the YOLOv3 Algorithm, detect an object and measure its distance and dimensions.

VI. ADVANTAGES

The proposed work is to change the visual world into an audio world by notifying the blind people about the objects in their path.

This will help visually impaired people to navigate independently without any external assistance just by using the real-time object detection system.

VII. CONCLUSION

An effective real-time object measurement approach is suggested for industrial systems in the proposed system. Computer vision is employed in the system that is being supplied to find, gauge, and measure items. In a real-time movie, the system is able to recognise and measure items. The size of each object is determined after it has been identified using the YOLOv3 Algorithm for Object Detection.

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