



# International Journal of Innovative Research in Computer and Communication Engineering

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# AI Powered Assistance System for Visually Impaired

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**ABSTRACT:** Safe navigation remains a major challenge for visually impaired individuals, particularly in indoor environments where obstacles such as furniture, equipment, and people may obstruct movement. Conventional mobility aids such as white canes provide only limited tactile feedback and do not offer information about the surrounding environment before physical contact occurs.

This project presents an AI Powered Navigation Assistance System for Visually Impaired that utilizes computer vision techniques to detect obstacles and provide voice guidance. The system processes real-time visual input from a camera and applies an object detection model to identify objects present in the environment. Detected objects are analyzed to determine whether they lie within the user's path of movement, and relevant voice alerts are generated using a text-to-speech module.

The system has been implemented using Python and the YOLOv8n object detection model for real-time detection and audio feedback. In addition, a mobile application interface developed using Android Studio with Gemini API integration has been designed to illustrate how the system can be extended to smartphone-based accessibility.

Experimental observations demonstrate that the system can successfully identify obstacles and generate appropriate audio guidance. The mobile application component further demonstrates the feasibility of integrating the navigation assistance functionality into mobile devices.

The proposed system highlights the potential of combining artificial intelligence, computer vision, and mobile technologies to enhance accessibility and independent mobility for visually impaired users.

## I. INTRODUCTION

Navigation within unfamiliar or obstacle-rich environments presents significant challenges for visually impaired individuals. Indoor spaces such as corridors, classrooms, offices, and public facilities contain numerous objects that may obstruct movement and increase the risk of collisions.

Traditional mobility aids such as white canes are widely used to detect obstacles through physical contact. While these tools provide essential support, they do not provide information about the type or location of obstacles before contact occurs.

Recent developments in **Artificial Intelligence and Computer Vision** have enabled systems that can analyze visual information and recognize objects in real time. Deep learning-based object detection models have demonstrated high accuracy in identifying multiple objects within images and video streams.

By combining computer vision with audio feedback mechanisms, it is possible to develop assistive systems that provide real-time information about the surrounding environment. Such systems can significantly improve situational awareness and mobility for visually impaired users.



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This project proposes an **AI Powered Navigation Assistance System** that detects obstacles using a camera and provides voice-based guidance to help users navigate safely. The system identifies objects present in the environment, analyzes their position relative to the user's path, and generates appropriate audio alerts.

To explore accessibility through portable devices, a **mobile application interface has also been developed using Android Studio**, demonstrating how the navigation assistance functionality can be integrated with smartphone platforms.

### II. PROBLEM STATEMENT

Visually impaired individuals often experience difficulty navigating indoor environments due to the presence of obstacles that cannot be easily detected without assistance. Although traditional aids provide some level of support, they do not offer detailed information about the surrounding environment.

Existing computer vision systems can detect objects in images or video streams; however, directly announcing all detected objects may result in excessive or irrelevant information. This can reduce the effectiveness of the system for navigation assistance.

Therefore, there is a need for an intelligent system that can detect objects, analyze their relevance to the user's movement path, and provide concise and meaningful voice guidance in real time.

### III. OBJECTIVES OF THE PROJECT

The main objectives of this project are:

- To develop an AI-based navigation assistance system for visually impaired users.
- To detect common obstacles such as people, furniture, doors, and electronic devices.
- To determine whether detected objects lie in the user's forward movement path.
- To estimate the approximate distance of obstacles (far, near, very close).
- To provide meaningful voice guidance instead of continuous object announcements.
- To explore integration of the navigation assistance system with mobile application interfaces.

### IV. LITERATURE REVIEW

Recent research has explored the use of artificial intelligence and computer vision to develop assistive technologies that improve mobility for visually impaired individuals.

Keerthiga V., Anne P.S., and Bhavani G. introduced VisionSpeak, a system that combines object detection with voice assistance to help visually impaired users understand their surroundings. The system detects nearby objects using computer vision techniques and converts the detected information into audio feedback. This approach allows users to receive real-time information about obstacles in their environment, improving awareness and navigation safety.

R. Gawande, Shraddha P. Mankar, D. Sankhala, N. Watpal, and S. Vispute proposed an Android-based object detection system for visually impaired individuals. Their system utilizes smartphone cameras to capture environmental images and applies object detection algorithms to identify obstacles. The detected objects are communicated to the user through voice alerts, demonstrating the potential of mobile devices as accessible assistive tools.

Another study by Yogesh M. and Dr. Madhu H.K. presented AI Eyes, a real-time assistive mobile application designed to support visually impaired people using object detection. The system employs deep learning models to analyze camera input and identify objects present in the environment. Voice instructions are then generated to guide users during navigation.

These studies demonstrate that integrating deep learning-based object detection, real-time image processing, and audio feedback mechanisms can significantly enhance assistive navigation systems. Building upon these concepts, the proposed system focuses on detecting obstacles in real time and providing voice-based navigation assistance while also exploring integration with mobile application interfaces.



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### V. PROPOSED SYSTEM

The proposed system is an AI Powered Navigation Assistance System for Visually Impaired designed to help users detect obstacles and navigate indoor environments more safely. The system utilizes computer vision and artificial intelligence techniques to analyze real-time visual input and provide voice-based guidance.

The system captures live video through a camera and processes the input frames using a deep learning-based object detection model. The YOLOv8n model is used to identify objects present in the environment and generate bounding boxes with classification labels. This enables the system to recognize common indoor obstacles such as people, chairs, tables, and other objects.

After detecting objects, the system analyzes their position relative to the user's direction of movement. Objects that lie within the potential movement path are identified as relevant obstacles. Based on this analysis, the system generates appropriate audio alerts that inform the user about the presence and type of obstacle.

A text-to-speech module is used to convert the generated messages into voice output, allowing the user to receive real-time navigation assistance. This helps visually impaired individuals become more aware of obstacles in their surroundings and move more safely.

In addition to the core navigation system, a mobile application interface developed using Android Studio with Gemini API integration has been designed to demonstrate how the system can be accessed through smartphone platforms. The mobile application provides an interface through which users can interact with the navigation assistance system and access its functionality in a portable environment.

By combining object detection, spatial analysis, and voice feedback, the proposed system aims to provide an effective and accessible navigation assistance solution for visually impaired users. The system focuses on delivering clear and relevant guidance so that users receive meaningful information without unnecessary audio interruptions. This approach improves usability and supports safer navigation in indoor environments.

### VI. SYSTEM ARCHITECTURE

The system architecture defines the workflow of the proposed navigation assistance system, which converts real-time visual input into voice guidance for the user.

The system starts with the camera input module, which captures live video from the surroundings. The video is divided into frames and processed in the image preprocessing stage to improve quality and prepare it for analysis.

Each frame is then passed to the YOLOv8n object detection model, which identifies objects and generates bounding boxes along with classification labels.

The detected objects are analyzed in the obstacle analysis module, where their position and distance relative to the user are determined. Objects in the user's path are considered potential obstacles.

The decision processing module evaluates these obstacles and generates appropriate navigation instructions such as warnings or directional guidance.

These instructions are converted into speech using a text-to-speech module, and the final voice output is delivered to the user in real time.

A mobile application developed using Android Studio provides an interface for user interaction, while integration with Gemini API enhances intelligent decision-making and system performance.



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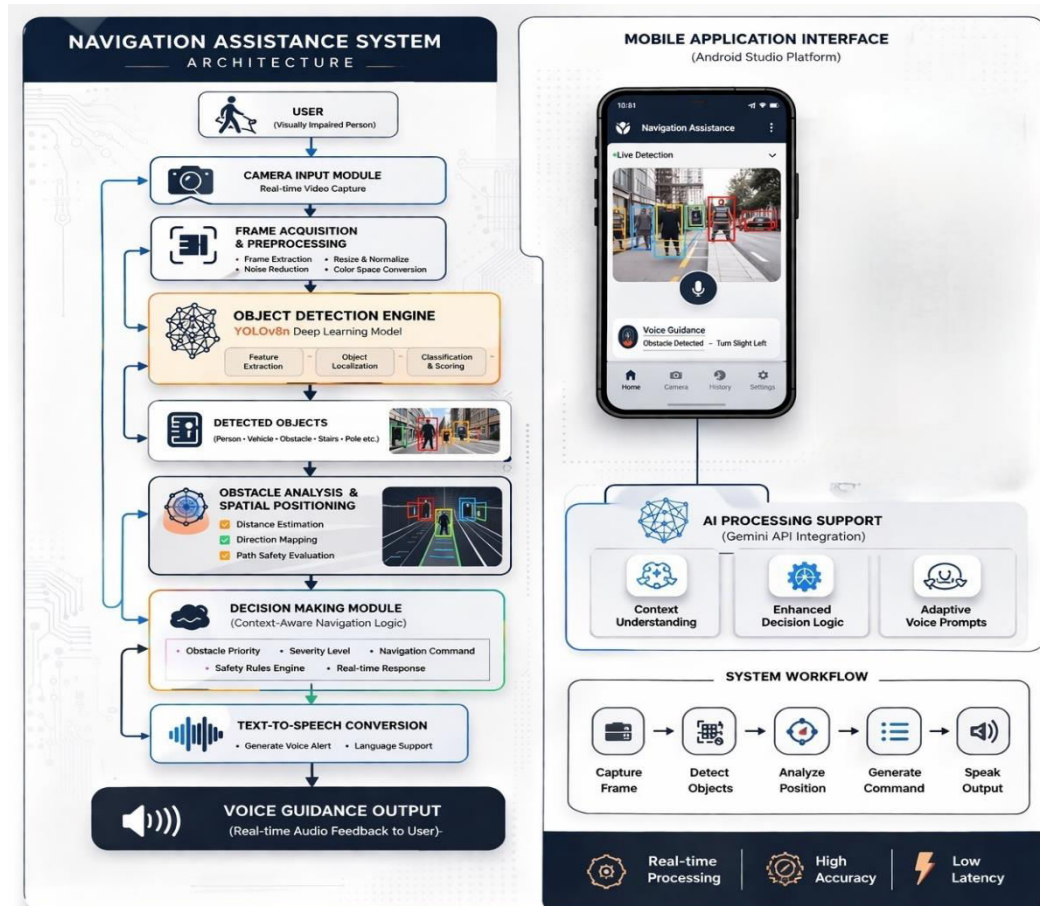


Figure: System Architecture of AI-Based Navigation System and Mobile Application Interface

## VII. METHODOLOGY

The methodology of the proposed navigation assistance system describes the process through which visual information from the environment is analyzed and converted into audio guidance for the user. The system integrates real-time image acquisition, deep learning-based object detection, spatial analysis, and speech output to assist safe navigation.

### Step 1: Environment Capture

The process begins with capturing real-time visual input using a camera device. The camera continuously records the surrounding environment and provides a live video stream for further analysis.

### Step 2: Frame Extraction

The video stream is divided into individual frames. These frames serve as input for the computer vision processing stage and allow the system to analyze the environment continuously.

### Step 3: Object Detection

Each frame is processed using the YOLOv8n object detection model. The model identifies objects in the scene and generates bounding boxes with classification labels for items such as people, chairs, tables, and other obstacles.

### Step 4: Object Position Analysis

After detection, the system evaluates the spatial location of the identified objects. Their positions are analyzed to determine whether they lie within the user's potential direction of movement.

### Step 5: Obstacle Identification

Objects located within the likely movement path are treated as relevant obstacles. This filtering ensures that only important obstacles are considered for navigation assistance.



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### Step 6: Guidance Message Generation

Based on the detected obstacle and its position, the system generates a short guidance message describing the obstacle for the user.

### Step 7: Speech Output

The generated message is converted into audible instructions using a Text-to-Speech (TTS) module, providing immediate feedback to the user.

### Step 8: Mobile Interface Integration

A mobile application interface developed using Android Studio demonstrates how the navigation assistance functionality can be integrated with smartphone platforms and accessed through voice-enabled interaction.

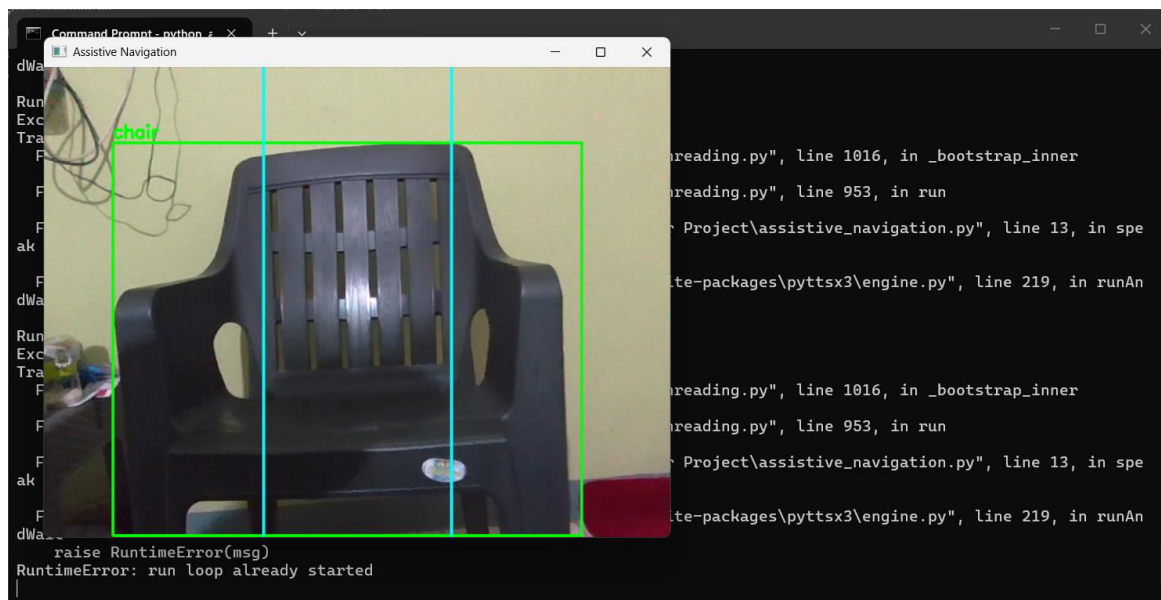
Through this sequence of image processing, object detection, and audio guidance, the system assists visually impaired users in identifying obstacles and navigating their surroundings more safely.

## VII. RESULTS

The developed system was evaluated to observe its ability to detect obstacles and provide audio guidance. The object detection model successfully identified common indoor objects such as people, chairs, tables, and electronic devices from real-time visual input. The system analyzed the location of detected objects and generated voice alerts when obstacles were present within the user's movement path.

The observations indicate that the system is capable of performing real-time object detection and providing useful navigation guidance.

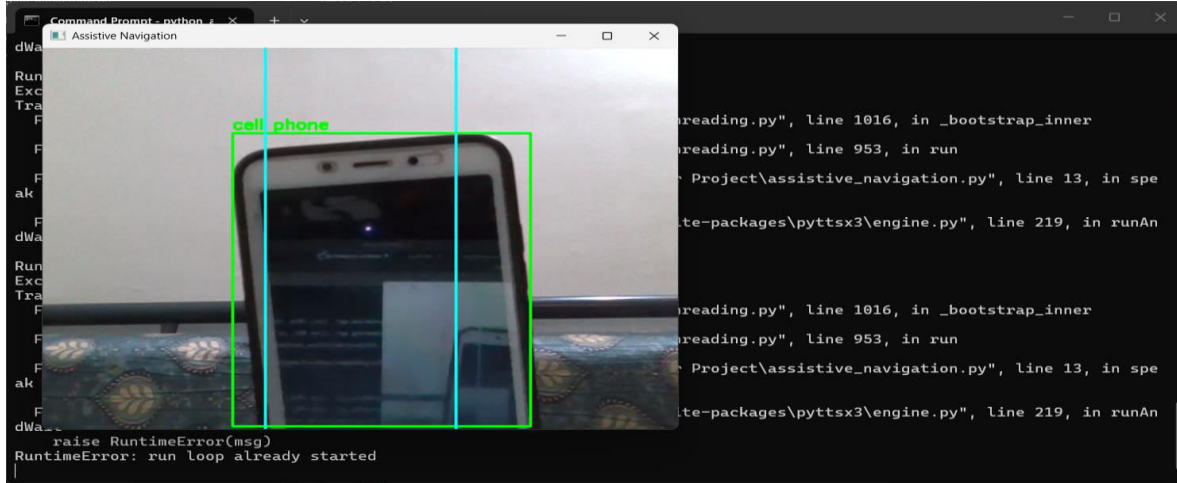
Results of real-time object detection outputs, bounding box detection and object classification, voice guidance responses generated by the system –



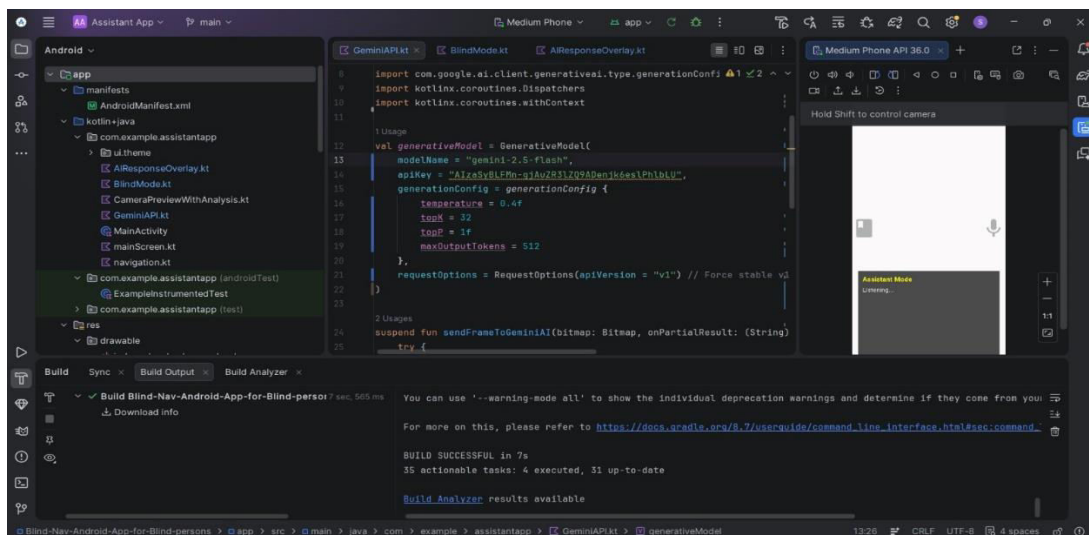
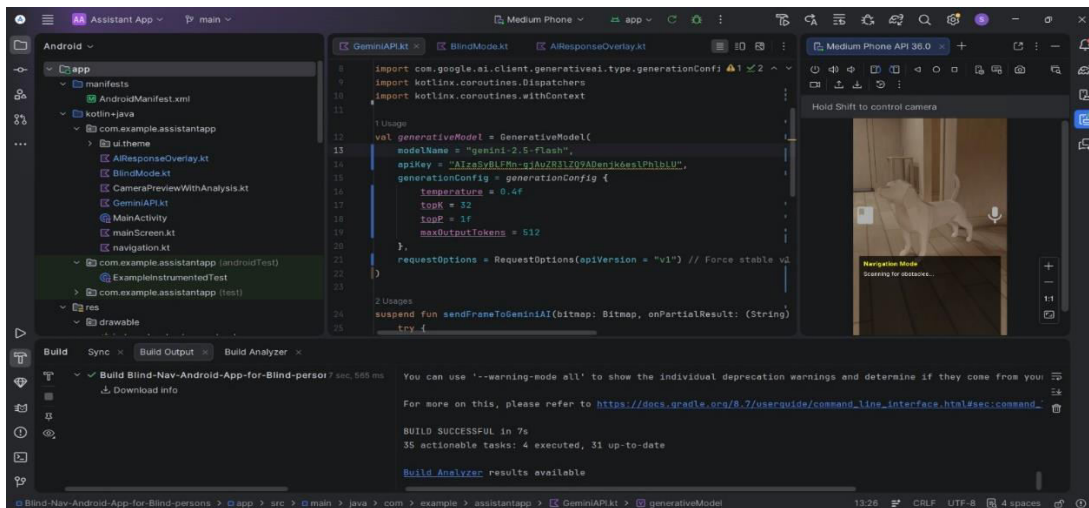


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Results of Mobile application interface screens-





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### VIII. CONCLUSION

The AI Powered Navigation Assistance System demonstrates how artificial intelligence and computer vision technologies can be utilized to support visually impaired individuals during navigation.

By analyzing real-time visual input and generating voice alerts, the system helps users become more aware of obstacles present in their surroundings. The use of the YOLOv8n object detection model enables efficient real-time recognition of objects within indoor environments.

The additional development of a mobile application interface illustrates how the navigation assistance functionality can be integrated into portable devices, thereby increasing accessibility and convenience for users.

Overall, the project highlights the potential of AI-based vision systems in developing effective assistive technologies that improve mobility and independence for visually impaired individuals.

### IX. FUTURE SCOPE

Future work can focus on extending the system into a fully integrated mobile platform that enables real-time navigation assistance directly through smartphones.

Further improvements may include the incorporation of GPS-based outdoor navigation, enhanced distance estimation techniques, and multilingual voice guidance to support a wider range of users.

Integration with wearable technologies such as smart glasses or wireless audio devices could provide a more seamless and hands-free navigation experience.

With continued advancements in artificial intelligence and mobile computing, the proposed system has the potential to evolve into a practical assistive solution for visually impaired individuals.

### REFERENCES

- [1] Mrs. Keerthiga.V, Anne P.S, Bhavani. G, "VISIONSPEAK: Object Detection and Voice Assistance for Visually Impaired People," *International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE)*, 2025. DOI: 10.17148/IJARCCE.2025.14479. Available: <https://ijarcce.com/wp-content/uploads/2025/05/IJARCCE.2025.14479.pdf>
- [2] R. Gawande, Shraddha P. Mankar, D. Sankhala, N. Watpal, S. Vispute, "Android Based Object Detection System for Visually Impaired," *International Journal for Research in Applied Science & Engineering Technology (IJRASET)*, 2024. DOI: <https://doi.org/10.22214/ijraset.2024.58593>. Available: <https://www.ijraset.com/best-journal/android-based-object-detection-system-for-visually-impaired-587>
- [3] Yogesh M, Dr. Madhu H.K., "AI Eyes: A Real-Time Assistive Mobile Application for Visually Impaired People Using Object Detection," *International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE)*, 2026. DOI: 10.17148/IJARCCE.2026.151132. Available: <https://ijarcce.com/wp-content/uploads/2026/01/IJARCCE.2026.151132-ai.pdf>
- [4] J. Redmon, S. Divvala, R. Girshick, and A. Farhadi, "You Only Look Once: Unified, Real-Time Object Detection," *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2016.
- [5] Glenn Jocher et al., "YOLOv8: Ultralytics Object Detection Model," *Ultralytics Documentation*, 2023. Available: <https://docs.ultralytics.com/>



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