ENVIRONMENT DETECTION FOR BLIND USER

Project Code

EDBP-2025

Project Advisor

Prof. Muhammad Fahad

Project Manager

Dr. Muhammad Ilyas

Project Team

Muhammad Ali Raza Ansari (BSCS51F22S008) — Team Leader
Muhammad Abdullah Zammad (BSCS51F22S036) — Team Member
Muhammad Hassan Javed (BSCS51F22S040) — Team Member

Submitted Date

Oct- 06-2025

Project Supervisor' Signature

Table of Content

1. Abstract

This project introduces a smartphone-based system that uses real-time object recognition and audio feedback to help visually impaired users navigate safely.
The system captures live video through the smartphone camera, detects obstacles using an object detection algorithm, and delivers spoken alerts through earphones or a speaker. Using only built-in smartphone hardware, the system provides an affordable, portable solution for improved spatial awareness and safer navigation.

2. Background and Justification

According to the World Health Organization (WHO) [1], approximately 2.2 billion people worldwide experience vision impairment, emphasizing the need for effective assistive technologies. Traditional aids such as **white canes** and guide dogs help detect nearby obstacles but offer limited environmental awareness and cannot identify surrounding objects [2].

Several Electronic Travel Aids (ETAs), including **SmartCane, Ultra Cane**, and **WeWALK,** use ultrasonic sensors and haptic feedback to assist users [3][4]. Additionally, AI-based wearable devices such as **OrCam,MyEye** and Envision Glasses provide real-time auditory feedback using camera-based systems [5][6]. While these solutions improve mobility, ultrasonic devices cannot distinguish object types, and AI-powered wearables are often expensive and inaccessible.

Therefore, there is a need for a low-cost, portable, and user-friendly solution that utilizes a smartphone camera to detect surrounding objects and provide real-time audio feedback. The proposed system aims to address this gap by offering an affordable assistive tool to enhance environmental awareness for visually impaired individuals.

3. Project Methodology

Phase 1: Requirement Analysis

System requirements are defined for a mobile-based assistive application, focusing on real-time image capture, object detection using computer vision, audio feedback through Text-to-Speech (TTS), and left-to-right directional indication. Performance requirements such as low latency and usability on smartphones are also identified.

Phase 2: Application Development

A mobile application is developed to access the smartphone camera and capture real-time video frames. OpenCV is used for image acquisition and preprocessing to prepare frames for object detection.

Phase 3: Model Integration

A TensorFlow-based computer vision model is trained and integrated into the application to detect objects from the captured images. The model processes each frame in real time to identify surrounding objects efficiently.

Phase 4: Audio and Directional Feedback

Detected objects are converted into speech using a Text-to-Speech (TTS) engine. The system determines the relative position of detected objects within the camera frame and provides basic left or right directional audio feedback.

Phase 5: Testing and Refinement

The application is tested to evaluate detection accuracy, response time, and reliability. Necessary refinements are made to improve performance and user experience.

4. Project Scope

Included:

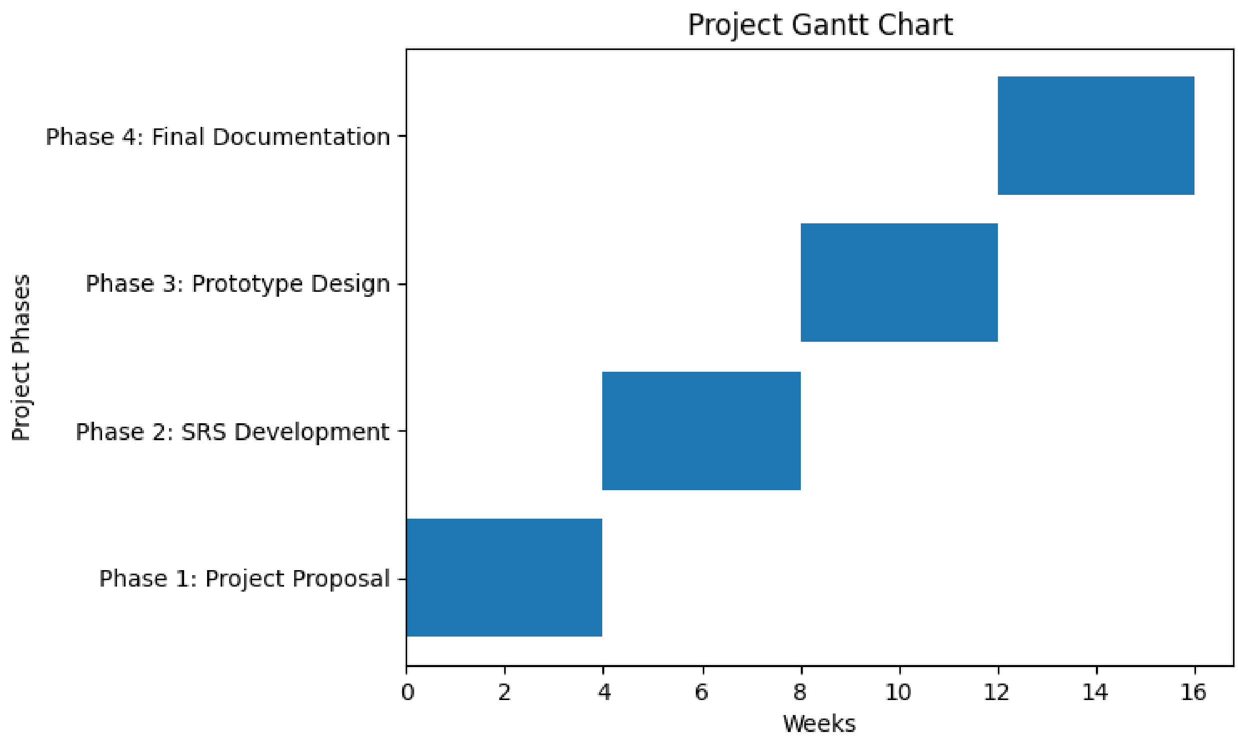
- Real-time object detection using the smartphone camera
- Image preprocessing
- Audio feedback using offline Text-to-Speech (TTS)
- Direction identification (Left, Right)
- Continuous real-time system operation
- Simple and accessible mobile user interface

Not Included:

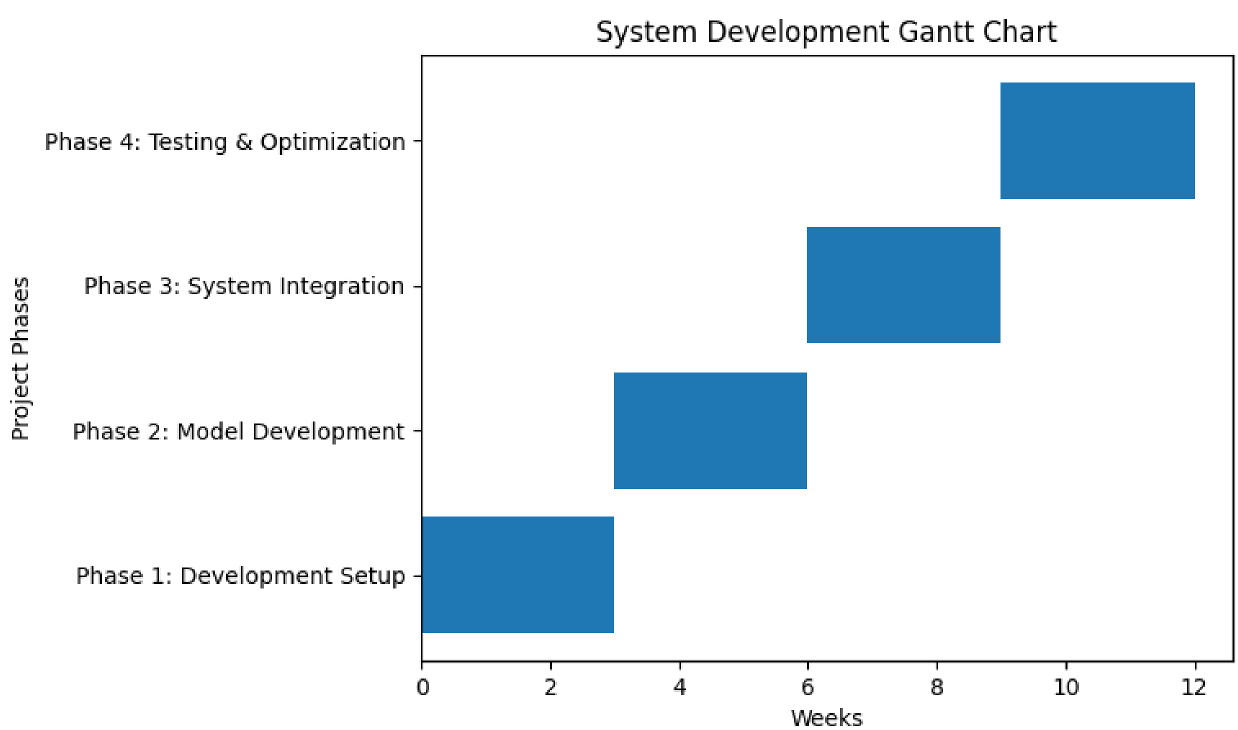
- Distance estimation between the user and objects
- Object size measurement
- Navigation or path planning features
- IoT devices or external hardware integration
- Facial recognition functionality
- Text reading or Optical Character Recognition (OCR)

5. High-Level Project Plan

- **CP1**



- **CP2**



6. References

[1] World Health Organization, "World report on Blindness and vision impairment," Aug. 10, 2023. Available: https://www.who.int/news-room/fact-sheets/detail/blindness-andvisual-impairment

[2] “Guide Dogs vs. White Canes: The Comprehensive Comparison,” CloverNook, Sept. 18, 2020. Available: https://clovernook.org/2020/09/18/guide-dogs-vs-white-canes-thecomprehensive-comparison/

[3] A. Tesfaye, “Enhancing Mobility and Safety: A Smart Walking Cane for Visually Impaired Individuals with Ultrasonic Sensor, Infrared, and GSM Module,” Journal of Computational Science and Data Analytics, 2024. Available: https://journal.aastu.edu.et

[4] “Design of Smart Cane with Integrated Camera Module for Visually Impaired People,” International Journal for Research in Applied Science and Engineering Technology (IJRASET), 2023. Available: https://www.ijraset.com

[5] “Hybrid Approach Using Ultrasonic and Vision-Based Detection for Obstacle Recognition,” International Journal of Engineering and Advanced Technology (IJEAT), vol. 8, no. 4, 2019. Available: https://www.ijeat.org

[6] “Efficacy and Patients’ Satisfaction with the ORCAM MyEye Device Among Visually Impaired People: A Multicenter Study,” *PubMed*, 2024 . Available: https://pubmed.ncbi.nlm.nih.gov/36645535/