International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 13 Issue: 03 | Mar 2026 www.irjet.net p-ISSN: 2395-0072

Smart Specs: Smart Glasses For Visually Impaired.

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Abstract - *The AI-powered accessibility application presented is designed to assist visually impaired individuals in understanding and navigating their surroundings more independently. The system combines modern technologies such as artificial intelligence, computer vision, and voice interaction to create a simple and accessible platform. By integrating multiple assistive features in a single application, the project aims to make daily activities easier and safer for users who rely on auditory guidance instead of visual information.*

The application includes a Smart Camera module that detects objects and describes the surrounding environment in real time using AI-based image recognition. It provides voice feedback so that users can understand what is around them. In addition, a Voice Navigation module allows users to search for destinations and receive step-by-step navigation through voice commands. An integrated AI Assistant helps users interact with the system, ask questions, and access different features of the application easily.

Overall, the system focuses on improving accessibility and independence for visually impaired individuals by providing intelligent guidance and assistance. By combining AI technologies with a user-friendly interface and voice-based interaction, the application helps users navigate environments more confidently. This project demonstrates how modern technology can be used to create practical solutions that enhance mobility, awareness, and quality of life for people with visual impairments.

Key Words: **artificial intelligence, accessibility, object detection, voice navigation, assistive technology**

1. INTRODUCTION

Introducing an intelligent solution designed to improve accessibility and independence for visually impaired individuals, our AI-powered application combines modern technologies to create a smart and supportive digital companion. The system is developed to help users better understand their surroundings, navigate unfamiliar environments, and interact with technology more easily. By integrating artificial intelligence, computer vision, and voice interaction, the application aims to simplify everyday activities and reduce the challenges faced by people with visual impairments. Designed with accessibility and usability in mind, the system focuses on creating a seamless and userfriendly experience. It also incorporates safety-focused features such as an SOS emergency option that can provide quick assistance in critical situations. By combining intelligent technologies with an accessible interface, this project aims to empower visually impaired users to move more confidently, stay aware of their surroundings, and interact with the digital world in a more independent and secure way.

2. LITERATURE REVIEW

The research in this paper explores the growing role of artificial intelligence–based assistive technologies in improving accessibility and independence for visually impaired individuals. Existing studies highlight how advancements in computer vision, speech recognition, and mobile technologies have significantly improved the ability of assistive systems to support people with visual disabilities in their daily lives. Researchers emphasize that tools such as object detection, voice navigation, and intelligent assistants can help users better understand their surroundings, navigate unfamiliar environments, and access information more efficiently. These technologies aim to reduce dependence on others and promote greater confidence and mobility among visually impaired users.

Many studies focus on the effectiveness of computer vision systems in recognizing objects, obstacles, and environmental elements in real time. By converting visual information into audio descriptions, these systems allow users to receive immediate feedback about their surroundings. Research has shown that integrating voice-

based interaction into assistive applications enhances usability and accessibility, as visually impaired users can control the system through simple voice commands instead of relying on touch-based interfaces. In addition, the inclusion of AI-driven assistants has been found to improve user interaction with digital systems by enabling natural communication and providing guidance when accessing application features.

Furthermore, several researchers highlight the importance of user-centered design in the development of assistive technologies. A well-designed interface with clear voice feedback, simple navigation, and minimal visual complexity significantly improves user engagement and satisfaction. Studies also discuss the importance of safety-focused features, such as emergency assistance systems, which allow users to quickly contact support during critical situations. These features increase the reliability and trustworthiness of accessibility applications, especially when used in real-world environments.

Recent research also emphasizes the potential of integrating multiple assistive functionalities within a single platform. Instead of relying on separate applications for navigation, object recognition, and assistance, modern solutions aim to provide a unified system that simplifies user interaction. By combining technologies such as artificial intelligence, computer vision, and speech processing, these systems can deliver a more seamless and efficient user experience. This integration helps visually impaired individuals perform everyday tasks such as identifying objects, navigating streets, or interacting with digital services more independently.

Additionally, accessibility research highlights the importance of making assistive technologies widely available through smartphones and web-based platforms. Mobile devices provide a convenient and cost-effective solution for deploying AI-powered accessibility tools, allowing users to access assistance anytime and anywhere. Studies suggest that applications designed for smartphones have higher adoption rates due to their portability, familiarity, and ease of use. As a result, many modern accessibility systems focus on developing mobile-friendly solutions that integrate intelligent features without requiring specialized hardware.

Overall, the literature indicates that AI-powered assistive applications have the potential to significantly improve the quality of life for visually impaired individuals. By enabling real-time environmental awareness, voice-based navigation, and intelligent assistance, these technologies promote greater independence and safety. However, researchers also suggest that further improvements are needed to enhance accuracy, reliability, and usability in diverse environments. Continued research and development in artificial intelligence and accessibility design will play a crucial role in creating more effective assistive systems for visually impaired users in the future.

3. SYSTEM DESIGN

Overview:
The system design for the AI-powered accessibility application focuses on creating a reliable and user-friendly platform that assists visually impaired individuals in understanding their surroundings and navigating environments more independently. The application is built with multiple integrated modules that work together to provide intelligent assistance through artificial intelligence, computer vision, and voice interaction. These modules include the Smart Camera module for object detection, Voice Navigation for route guidance, an AI Assistant for user interaction, and an SOS emergency feature for safety support. All these components operate within a unified system to provide real-time assistance and improve the accessibility experience for users.

At the core of the system is the AI-based image recognition module, which processes visual input from the device camera to detect objects and analyze the surrounding environment. The system uses computer vision techniques to identify objects and convert this information into audio feedback, allowing users to understand what is present around them without relying on visual cues. The Voice Navigation module allows users to search for locations and receive step-by-step directions using voice commands, making it easier for visually impaired individuals to move safely and confidently in different environments. The integrated AI Assistant further enhances usability by allowing users to communicate with the system naturally and access different features through voice interaction.

The system is designed with accessibility and simplicity as key priorities, ensuring that users can easily interact with the application without complex navigation or visual dependency. Safety is also an important part of the design, which is why the application includes an SOS emergency feature that allows users to quickly request help during critical situations. The interface is kept minimal and intuitive so that users can easily access important features when needed.

To ensure smooth performance and reliability, the system is developed using a modular architecture, allowing different components to operate independently while still working together within the application. This approach makes the system easier to maintain, update, and expand in the future. Security and data privacy are also considered during development, ensuring that user interactions and location data are handled responsibly.

Overall, the system is designed to provide a practical and scalable assistive solution that improves independence and situational awareness for visually impaired individuals. By combining artificial intelligence, voice-based interaction, and real-time environmental recognition, the application demonstrates how modern technology can be used to build inclusive solutions that enhance accessibility and support individuals with visual impairments in their everyday lives.

4. FUNCTIONALITY OF THE SYSTEM/FLOWCHART

The AI-powered accessibility application is designed to assist visually impaired individuals by providing intelligent features that help them understand their surroundings, navigate environments, and interact with technology more easily. The system integrates multiple functionalities that work together to deliver real-time assistance and improve accessibility.

One of the primary functions of the system is object detection through the Smart Camera module. Using computer vision and artificial intelligence, the application analyzes images captured from the device camera and identifies objects present in the surroundings. Once an object is detected, the system converts the information into audio feedback, allowing the user to understand what is around them without needing visual input. This feature helps users identify obstacles, everyday objects, and environmental elements in real time.

Another important functionality is voice-based navigation. The system allows users to search for destinations and receive step-by-step directions using voice commands. By integrating navigation services with voice interaction, the application provides clear audio instructions that help users travel safely and reach their desired locations more easily. This feature reduces the challenges visually impaired individuals often face when moving through unfamiliar environments.

The system also includes an AI Assistant that enables users to interact with the application through natural voice communication. Users can ask questions, request assistance, or access different features of the application using simple voice commands. This functionality makes the system more accessible and eliminates the need for complex visual interfaces.

In addition, the application provides an SOS emergency feature designed to improve user safety. In emergency situations, users can activate the SOS function to quickly send alerts or request assistance. This ensures that help can be reached when the user is in a critical situation, increasing confidence and security while using the system.

Overall, the system combines object recognition, voice navigation, intelligent assistance, and emergency support to create a comprehensive accessibility solution. By integrating these functionalities into a single platform, the application helps visually impaired individuals perform daily tasks more independently while improving their awareness, mobility, and safety.

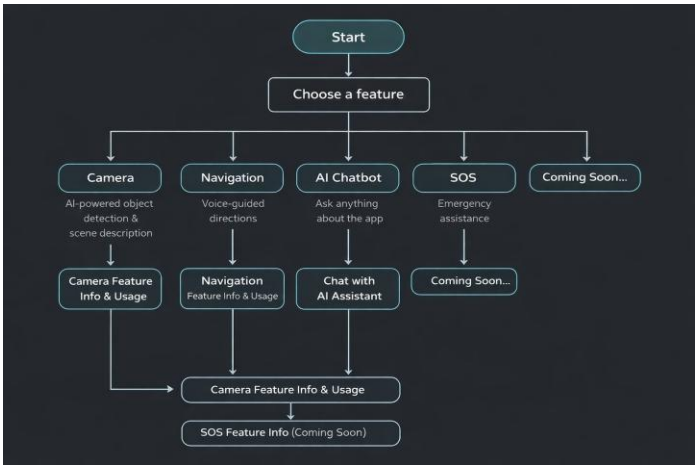

Fig -1: Functionality System

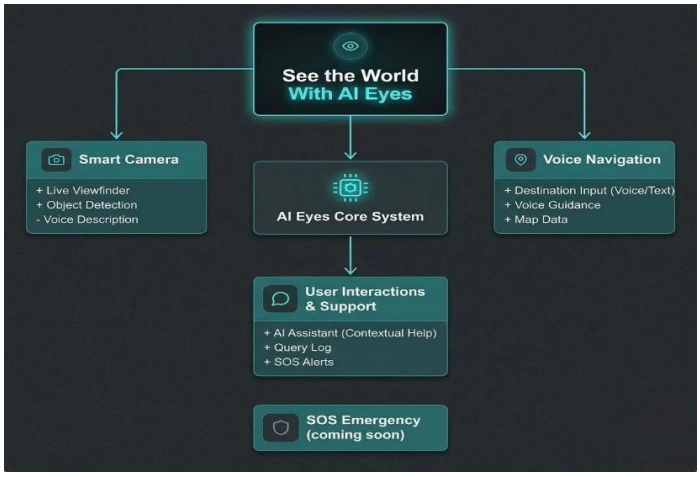

Fig -2: Flowchart

5. DATABASE DESIGN

The database design for the AI-powered accessibility system is structured to efficiently store and manage the data required for the application to function smoothly. The system uses a relational database to organize information related to users, detected objects, navigation requests, and emergency contacts. This structured approach ensures that the application can process and retrieve information quickly while maintaining data accuracy and reliability.

At the core of the database is the User table, which stores basic information about users of the application. This table includes fields such as user_id, username, email, password, and profile details. The user_id acts as the primary key and uniquely identifies each user in the system. Passwords are stored using encryption techniques to maintain user security and privacy. This table allows the system to manage user authentication, login, and profile management efficiently.

The system also includes a Detected Objects table, which records information about objects identified through the Smart Camera module. This table contains fields such as object_id, object_name, detection_time, and user_id. The object_id serves as the primary key, while the user_id acts as a foreign key that links detected objects to the user who initiated the detection process. This helps maintain a record of detected items and improves system functionality when analyzing user interactions.

Another important table is the Navigation History table, which stores details of navigation requests made by users. It includes fields such as navigation_id, destination, start_location, date, and user_id. The navigation_id acts as the primary key, while the user_id links the navigation request to a specific user. This table helps track navigation activities and supports better analysis of user movement patterns within the application.

For safety purposes, the database also contains an Emergency Contacts table. This table stores information about emergency contacts that can be used when the SOS feature is activated. It includes fields such as contact_id, contact_name, phone_number, and user_id. The contact_id is the primary key, and user_id acts as a foreign key linking contacts to the respective user. This ensures that the system can quickly access the correct contact details during emergency situations. To maintain efficient performance, indexing techniques are applied to frequently used fields such as user_id, detection_time, and destination. This improves query speed when retrieving or processing data. The database is also designed to be flexible and scalable, allowing new tables or attributes to be added easily if additional features are introduced in the future.

In conclusion, the database design for the AI-powered accessibility system provides a structured and reliable foundation for storing and managing application data. By organizing information related to users, object detection, navigation activities, and emergency contacts, the database supports the smooth functioning of the system while ensuring data security, efficiency, and future scalability.

6. PROBLEM STATEMENT

The problem addressed in this project focuses on the difficulties faced by visually impaired individuals when performing everyday tasks such as recognizing objects, navigating unfamiliar environments, and accessing important information independently. Traditional navigation and assistance methods often rely on human support, guide dogs, or basic tools like walking sticks, which may not always provide sufficient information about the surrounding environment. As a result, visually impaired individuals often face challenges in understanding obstacles, identifying objects, and moving safely in public or unfamiliar spaces. Although some assistive technologies exist, many of them are either expensive, limited in functionality, or require specialized hardware that is not easily accessible to everyone. In many cases, available solutions focus only on a single feature, such as navigation or object recognition, without providing a comprehensive system that supports multiple aspects of daily life. Additionally, some systems lack intuitive interfaces and voice-based interaction, making them difficult for visually impaired users to operate effectively.

Another major challenge is the lack of real-time environmental awareness and emergency support within many existing assistive systems. Without immediate feedback about surrounding objects or obstacles, visually impaired individuals may face safety risks when moving through crowded or unfamiliar areas. Similarly, the absence of quick emergency communication features can make it difficult for users to seek help during critical situations.

Furthermore, many existing solutions do not fully utilize the capabilities of modern technologies such as artificial intelligence, computer vision, and voice recognition to provide an integrated accessibility experience. The lack of a unified platform that combines object detection, voice navigation, intelligent assistance, and safety features limits the effectiveness of assistive applications designed for visually impaired individuals.

Therefore, there is a clear need for a smart and accessible system that can provide real-time assistance, improve environmental awareness, and support safe navigation. The proposed AI-powered accessibility application aims to address these challenges by integrating object detection, voice navigation, AI-based assistance, and emergency support within a single platform. By leveraging modern AI technologies and designing the system with accessibility in mind, the project seeks to enhance independence, safety, and quality of life for visually impaired users.

7. ADVANATGES

The AI-powered accessibility system offers several advantages for visually impaired individuals by providing intelligent assistance that improves independence, safety, and daily mobility. One of the major benefits of the system is its real-time object detection capability through the Smart Camera module. By using artificial intelligence and computer vision, the system can identify objects and obstacles in the surrounding environment and convert this information into audio feedback. This allows visually impaired users to better understand their surroundings without relying on visual input, making everyday activities safer and more manageable. Another significant advantage of the system is the voice-based navigation feature, which enables users to search for destinations and receive step-by-step directions using simple voice commands. This functionality reduces the difficulty that visually impaired individuals often face when traveling in unfamiliar areas. By providing clear audio instructions, the system helps users move more confidently and reach their desired locations without requiring constant assistance from others.

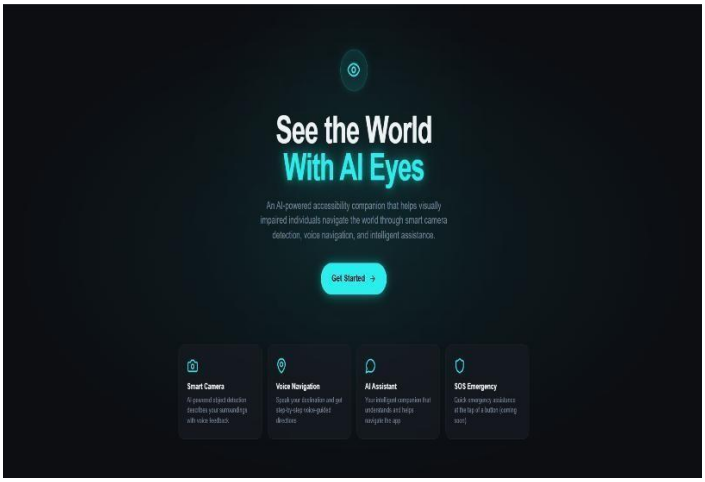

Fig -3: Home Page

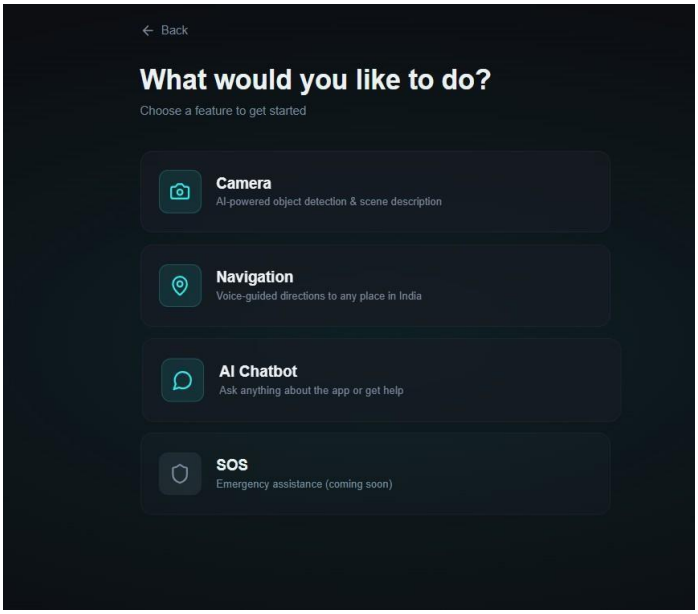

Fig -4: Category Page

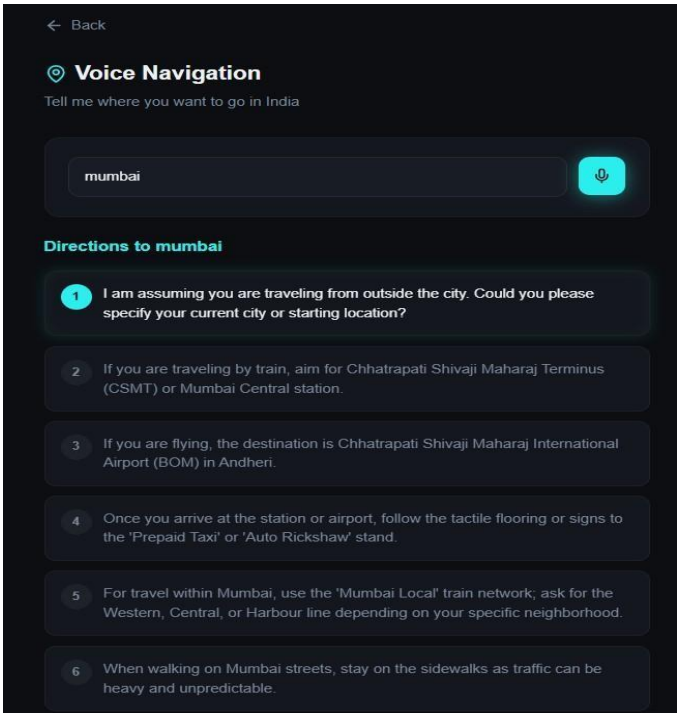

Fig -5: Navigation Page

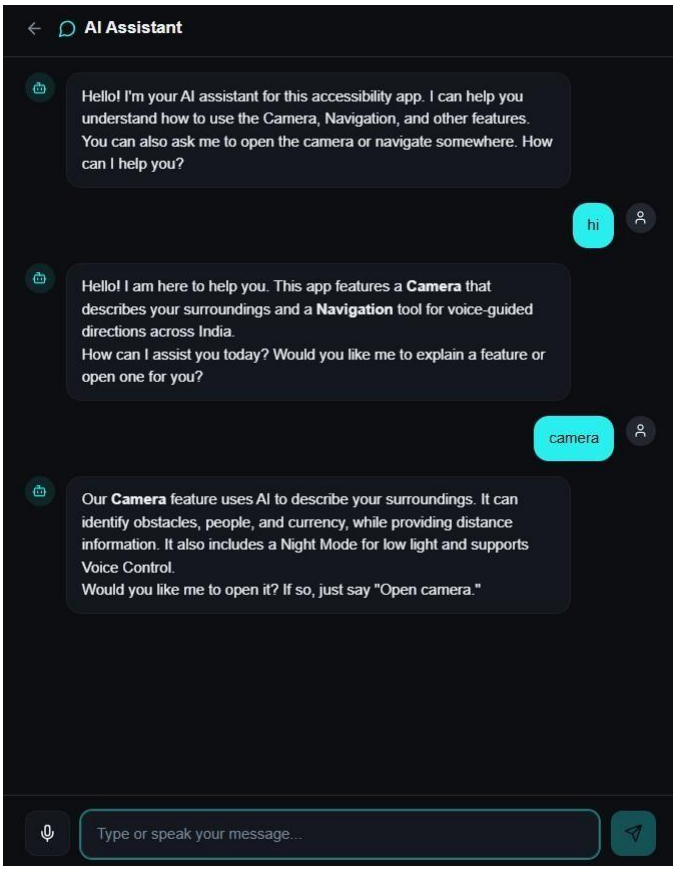

Fig -6: AI Chat-Bot

8. CONCLUSIONS

In conclusion, the AI-powered accessibility system provides a practical and innovative solution to support visually impaired individuals in their daily lives. By integrating technologies such as artificial intelligence, computer vision, and voice interaction, the system helps users better understand their surroundings and navigate environments more independently. Features like the Smart Camera for object detection, Voice Navigation for route guidance, AI Assistant for interaction, and the SOS emergency feature for safety work together to create a comprehensive and accessible platform.

The system enables users to receive real-time audio feedback about their surroundings, helping them identify objects and obstacles more easily. Voice-based interaction simplifies the way users communicate with the application, allowing them to access different features without relying on visual interfaces. Additionally, the navigation feature assists users in reaching their destinations safely by providing clear step-by-step directions. These functionalities significantly reduce the challenges faced by visually impaired individuals while performing everyday activities.

Overall, the AI-powered accessibility system demonstrates how modern technologies can be used to create inclusive and assistive solutions that improve independence and quality of life. By providing intelligent assistance, environmental awareness, and safety support, the system empowers visually impaired individuals to interact with their surroundings more confidently. With further development and integration of advanced AI capabilities, this solution has the potential to become an even more effective tool for improving accessibility in the future.

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