Smart Vision Glasses (Project Report)

Problem Statement

Challenge for the Visually Impaired:
Visually impaired individuals face significant difficulties in performing daily tasks such as reading, navigating safely,recognising traffic signs while travelling , recognizing people, and responding to emergencies. Available aids are either too expensive, have limited functionality, or lack the integration of advanced technology like AI to provide real-time assistance.

Why *Assistive Glasses for Visually Impaired* is the Solution:
Assistive glasses for the Visually Impaired provide a comprehensive, affordable, and AI-driven solution by addressing multiple challenges in a single device. It empowers visually impaired individuals to live more independently with features like reading mode , walking mode and SOS emergency mode .

Novelty of the Idea

Unique Aspects of *Assistive Glasses for the Visually Impaired*:

- **Multifunctionality in One Device:** Combines multiple features into one wearable solution, whereas most existing tools focus on just one aspect.
- **SOS Alerts:** Includes emergency communication, which is usually overlooked by other products.
- **Avoids Braille learning for reading**: Users can read directly using computer vision techniques without the need for Braille language.
- **Personalization:** Supports text reading in multiple languages .

Rationale for Taking Up the Project

The rationale for taking up the *Assistive glasses for the Visually Impaired* project is driven by the need to enhance the quality of life for visually impaired individuals.According to survey we conducted from Navjyot Andhjan Mandal Ahmedabad we found various problems that people with vision impairments face in performing their everyday tasks without any assistance . These limitations often lead to reduced independence and increased dependency on caregivers. With advancements in AI and machine learning technologies, it is now possible to design assistive devices that can provide real-time support, improve autonomy, and enhance safety for the blind community.

Hence we decided to make a project which revolutionaries the lifestyle of blind people by bridging the gap between technological innovations and accessibility by integrating AI-based vision and audio assistance. By utilising wearable hardware such as glasses fitted with a camera and audio earphones, the system aims to provide visually impaired individuals with a more interactive, intelligent, and responsive solution for everyday life. The key features, such as reading mode , walking mode and SOS emergency mode which ensure that the user can experience an improved sense of safety and independence.

Objective of the Project

The *Assistive Glasses for the Visually Impaired* project aims to develop a multi-functional wearable device designed to aid visually impaired individuals in navigating their environment and managing daily tasks. The key objectives include:

1. **Real-Time assistive support to visually impaired people** : Utilise AI and computer vision technologies to provide assistive support in their regular activities.
2. **SOS Mode:** If the user becomes lost, helpless, or disoriented, the SOS mode can be triggered manually by the user, or automatically by the system based on patterns such as prolonged inactivity or signs of disorientation. Once activated, the system sends the user's location and an emergency message to their designated contact, ensuring they can be located and assisted promptly.
3. **User-Friendly and Language-Compatible Audio Feedback**: Convert detected text, faces, currency, and environmental cues into audio feedback in the user's preferred language, enhancing accessibility across different regions.

This feature-rich project aims to provide visually impaired individuals with greater autonomy, safety, and convenience in their everyday lives.

Project Description Modewise

Reading Mode:

Features:

- Face recognition, currency detection, and reading handwritten or printed text to audio.

Algorithms:

- **Face Recognition:** Convolutional Neural Networks (CNN), and using transfer learning from models like OpenCV's face recognition or MobileNetV2.
- **Text-to-Audio Conversion:** OCR (Optical Character Recognition) using Tesseract, paired with Text-to-Speech (TTS) APIs.
- **Currency Detection:** Custom-trained CNN models for identifying different currencies.

Walking Mode:

Features:

- Walking mode is specifically tailored to cater ultimate walking assistance to users, making it solely sufficient to aid them with the gift of non dependent lifestyle in very critical conditions like walking on "Indian" roads like avoiding possible obstacles , traffic light recognition .

Algorithms:

- Uses transfer learning from models like YOLO , Mobilenet,VGG16 which triggers audio based feedback.

SOS Emergency mode :

Features:

- The user manually triggers SOS, sending GPS location and emergency alerts to a designated contact.

Algorithms:

- Button-triggered system for sending alerts and location via GSM.

Methodology detailing stepwise activities and sub-activities:

Phase 1: Research and identification of problem

- Research 3D printing materials suitable for lightweight glasses.
- Collect various features necessary for blind people from Navjyot Andhjan mandal Ahmedabad.
- Read Research papers for implementing different modes.

Phase 2: Design Hardware Architecture

- Using CAD Software create a design for the glasses frame that accommodates the camera, buttons, and wiring.
- Decide on button placement for switching between Reading and Walking modes.
- Finalise the 3D design and specifications for printing.
- Print a prototype frame to check fit and durability.

Phase 3: Software Development

Reading mode :

- Currency Detection.
- Handwritten Text Recognition.
- Face Recognition.

Walking mode :

- Pedestrian /Obstacle Detection/traffic light recognition .
- Obstacle Feedback System using audio that provides distance-based warning to the user.

Phase 4: SOS Emergency System

- GSM Module Integration
- Emergency Call Activation.

Phase 5: Audio Feedback Integration

- Integration of audio feedback for Both Reading and Walking modes.
- Mode switching Functionality between reading and walking mode.

Phase 6: Prototype Development

- Assemble components such as the camera, GSM module, NVIDIA Jetson Nano, and buttons.

Phase 7: Testing

- Testing to check the accuracy and correction of errors.

Phase 8: Documentation & Patent Filing

Work Flow :

Gantt Chart (Month Wise):

Task	**Month 1**	**Month 2**	**Month 3**
Research & Planning	🟩		
Design Hardware Architecture	🟩		
Develop Reading Mode			
Currency Detection	🟩		
Handwritten Text Recognition	🟩 🟩		

Face Recognition		🟩	
Develop Walking Mode			
Pedestrian/ Obstacle detection/traffic light recognition		🟩	
Obstacle feedback system		🟩	
Sos Emergency System mode		🟩	
Integrated Audio Feedback system		🟩	
Prototype Development			🟩
Testing & Refinement			🟩
Documentation & Patent Filing			🟩