AI-Powered Based Blind And Visually Impaired System For Smart Glass

RathnaV[1], SubashreeK[2], Yogeshwari D[3], Mrs. R. Archana[4]
[1, 2, 3, 4] Dept of CSE
[1, 2, 3, 4] Dhanalakshmi Srinivasan Engineering College, Perambalur.

Abstract- *Visual impairment poses significant challenges to the daily lives and mobility of millions of people worldwide. In this context, smart assistive technologies have gained momentum in improving the independence and quality of life for the blind and visually impaired. They are having difficulty navigating their everyday lives because they are unable to detect impediments in their environment, and one of their biggest challenges is identifying people. Other than automation, object detection is used in a variety of applications that have yet to be fully explored. This project includes one such application that employs detection to assist visually impaired individuals in identifying items ahead of them for safe navigation, as well as a face recognition system with aural output that may help visually impaired people recognize known and unfamiliar people and currency identification(Denomination). Speakers would provide them with voice-based assistance. We used a deep learning-based Convolutional Neural Network (CNN) to identify and recognize humans and objects in the environment in this study. The Faster Region Convolution Neural Network technique processes and classifies the picture taken by the camera. The audio jockey receives the detected picture as an audio input. As a result, this model aids visually impaired persons in a more comfortable manner than white canes.*

Keywords- Deep Learning, Faster Region-Convolutional Neural Network, Smart Glass, Image and Object Recognition

I. INTRODUCTION

This project aims to transform the lives of visually impaired individuals by leveraging artificial intelligence, computer vision, and machine learning. We are developing an advanced assistive system that combines object detection, face recognition, and currency identification to promote greater independence. The system will use deep learning algorithms to detect and recognize objects, people, and currency, providing real-time audio feedback to users. This will help visually impaired individuals better understand and interact with their surroundings. By enabling greater mobility and confidence, the project seeks to empower users to live more independently and engage more fully in society. Through the power of AI, we aim to create a more inclusive and accessible world for all.

- **Existing system – Non-Vision**

A Kinect-Based Navigation System

The system described Kinect sensors carried in a backpack, shoulder bag by the user.

Smart Cane

Simultaneous locating and mapping technology found in Google's Project Tango.

Moovit

It's offers guidance on the public transport network, managing schedule in real time

- **Existing system – Vision Based System**

Histogram of Oriented Gradients (HOG)

That is utilized to detect objects and face in image processing and computer vision

Single Shot Detector (SSD)

It is a method for detecting objects in images using a single deep neural network.

II. LITERATURE SURVEY

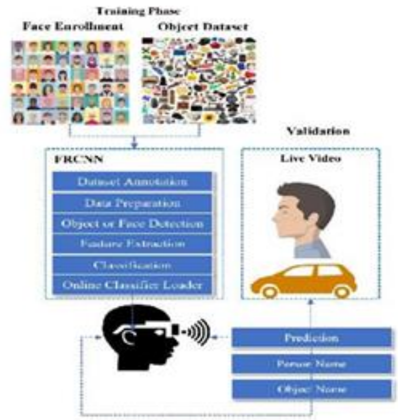
- <u>A Hybrid Algorithm for Face Detection to Avoid Racial Inequity Due to Dark Skin</u>- However, the human face is vulnerable to multiple variations like age, light effects, and expressions of the face, while capturing images and image quality/resolution. These variations act as the challenge for face recognition techniques to yield accurate results. In facial recognition, color acts as a major variant. Classification of human skin color helps to identify a person's skin tone achieved by definition of skin region. This technique has simplified detection rules and helps in generating much faster classifiers

- Exposing Fake Faces Through Deep Neural Networks Combining Content and Trace Feature Extractors - With the breakthrough of computer vision and deep learning, there has been a surge of realistic looking fake face media manipulated by AI such as Deepfake or Face2Face that manipulate facial identities or expressions.
- Object Detection in Thermal Spectrum for Advanced Driver-Assistance Systems- Thermal cameras can be used for object detection in both day and night-time environmental conditions. Since it is invariant to illumination changes, occlusions, and shadows it provides improved situational awareness.
- YOLO-FIRI: Improved YOLOv5 for Infrared Image Object Detection - To infrared image object detection using a one-stage region-free object detector YOLO-FIR. The designed feature extraction network extends and iterates the shallow CSP module, which uses an improved attention module.
- Learning Domain-Invariant Discriminative Features for Heterogeneous Face Recognition - To a novel framework for heterogeneous face recognition (HFR), integrating domain-level and class-level alignment in one unified network using domain-invariant discriminative features (DIDF) method.
- REFPN - FCOS: one-stage object detection for Feature learning and accurate localization - Combines Receptive Field Pyramid Network (RFPN) and Fully Convolutional One Stage (FCOS) object detection for enhanced feature learning and accurate localization. May struggle with small objects, require careful balance between feature learning and localization, and be sensitive to hyperparameter tuning and training data quality.
- YOLO - ACN: focusing on small target and occluded object detection- Enhances YOLO algorithm with Attention and Contextual (ACN) modules to improve detection of small and occluded objects.

III. PROPOSED SYSTEM

- Smart Glass designed to recognizing faces and objects for visually impaired people.
- The Faster R-CNN model uses perform the object detection and classification.
- A trained assistant who provides spoken feedback about what you are looking at.
- Detects and classifies different denominations of currency to assist in financial transactions.
- Uses Faster R-CNN to detect and classify objects such as furniture, vehicles, and street signs.

System Architecture



IV. MODULES

1. Smart Glass

- In this module we design a AI powered smart glass
- with an integrated camera which helps the user capture images.
- These images are sent for processing to proprietary
- FRCNN machine learning models which are deployed on smart glasses.
- Once the images are processed, the speech response
- is sent to the Smart glass, which the user hears via the built-in speaker on the glass.
- Smart Glass is designed as AI glasses for the blind
- and visually-impaired.

2. Object Detection and Face Recognition

2.1 Face Enrollment

- This module begins by registering a few frontal face of Blind persons friends, family or other know person.
- These templates then become the reference for evaluating and registering the templates for the other poses: tilting up/down, moving closer/further, and turning left/right.
- Frames are extracted from video input**.**

3. Object and Face Identification

- Capturing the object or face image from the Smart Glass Camera, the image is given to face detection module.
- This module detects the image regions which are likely to be human.

- The face detection using Region Proposal Network (RPN), face image is given as input to the feature extraction module to find the key features that will be used for classification.
- The face image is then classified as either known or unknown

4. Prediction

- In this module the matching process is done with trained classified result and test Live Camera Captured Classified file.
- Hamming Distance is used to calculate the difference according to the result the prediction accuracy will be displayed.
- Audio output.
- If a data is triggered during processing, voice synthesis is used to alert the user, generating, for example, “stop,” if there is an obstacle in the way. Saying that Hi Ramesh.

5. Performance Analysis

- In this module we able to find the performance of our system using SENSITIVITY, SPECIFICITY AND ACCURACY of Data in the datasets are divided into two classes not pedestrian (the negative class) and pedestrian (the positive class).
- Sensitivity, specificity, and accuracy are calculated using the True positive (TP), true negative (TN), false negative (FN), and false positive (FP).
- TP is the number of positive cases that are classified as positive.

V. IMPLEMENTATION

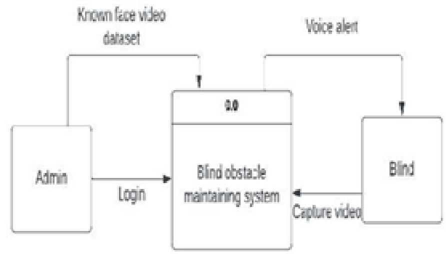
Hardware Requirements

- Processors: Intel® Core™ i5 processor 4300M at 2.60 GHz or 2.59 GHz (1 socket, 2 cores, 2 threads per core), 8 GB of DRAM.
- Disk space: 320 GB.
- Operating systems: Windows® 10, macOS*, and Linux*.

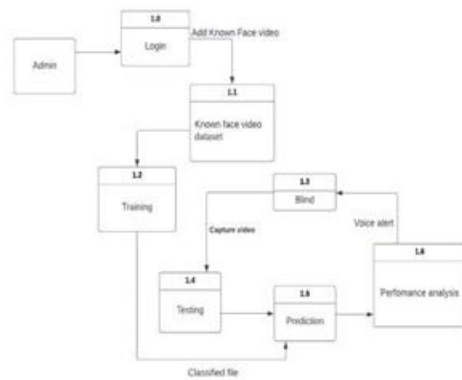
Software Requirements

- Server Side : Python 3.7.4(64-bit) or (32-bit)
- Client Side : HTML, CSS, Bootstrap
- IDE : Flask 1.1.1
- Back end : MySQL 5.
- Server :Wamp Server 2i
- DL DLL: TensorFlow, Pandas, Si Kit Learn

Data flow diagram – Level 0



Data flow diagram – Level 1



Data flow diagram – Level 2

VI. CONCLUSION

- The device presented here is a smart glass that incorporates the functionality of a machine vision and obstacle detection and recognition sensor.
- It can be conveniently advertised and made accessible to the visually disabled population.

- Let the visually impaired people can interact more closely with the people around them, without fear of being blurred and uncertain.

REFERENCES

[1] H. Kim, J. Park, K. Lee, "Lightweight AI Models for Wearable Assistive Devices," IEEE Internet of Things Journal, vol. 10, no. 5, pp. 2301-2312, 2024.
[2] H. Kim, J. Park, K. Lee, "AI-Powered Assistive Devices for the Blind: A Review of Recent Advances," IEEE Sensors Journal, vol. 23, no. 7, pp. 11234-11250, 2024.
[3] C. Chen, A. Kapoor, X. Yu, et al., "Real-Time Object Detection and Navigation System for Visually Impaired People," IEEE Transactions on Neural Systems and Rehabilitation Engineering, vol. 31, pp. 456-468, 2023.
[4] M. Zhang, T. Wang, Y. Li, "Lightweight Object Detection Model for Wearable AI Devices," IEEE Internet of Things Journal, vol. 10, no. 5, pp. 2301-2312, 2023.
[5] M. Ramesh, S. K. Gupta, "Smart Vision Glasses for Blind Using AI and IoT," International Conference on Advanced Computing and Communication Systems (ICACCS), pp. 1-6, 2023.
[6] A. Dosovitskiy, L. Beyer, A. Kolesnikov, et al., "An Image is Worth 16x16 Words: Transformers for Image Recognition at Scale," International Conference on Learning Representations (ICLR), 2021.
[7] Z. Liu, H. Mao, C. Wu, et al., "Swin Transformer: Hierarchical Vision Transformer Using Shifted Windows," International Conference on Computer Vision (ICCV), pp. 10012-10022, 2021.
[8] X. Chen, L. Zhang, Y. Zhou, "An AI-Enabled Smart Glasses System for the Blind," IEEE Transactions on Biomedical Engineering, vol. 68, no. 5, pp. 1934-1943, 2021.
[9] R. Wang, Q. Liu, P. Wang, et al., "Deep Learning-Based Assistive Technologies for Visually Impaired People: A Survey," IEEE Access, vol. 9, pp. 127487-127503, 2021.
[10] J. Redmon, A. Farhadi, "YOLOv4: Optimal Speed and Accuracy of Object Detection," arXiv preprint arXiv:2004.10934, 2020.