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Bionic Eye Model to Provide Vision or Restore Sight for Blindness Using Vision Transformer

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ABSTRACT: Visual implants are intended to produce an artificial vision leading to some levels of functional vision restoration. It uses 60 microelectrodes implanted in the retina and can improve the quality of life of visually impaired people by making them experience light even if they were in the dark for many years. Due to the limited number of microelectrodes of existing visual system stimulator, the artificial vision they permit has very low resolution. Many researchers have worked on improving the artificial vision created with low resolution implants by using image processing and machine vision algorithms.

I. INTRODUCTION

The project has a wide scope in terms of enhancing artificial vision for visually impaired individuals, it is important to acknowledge and address the potential limitations to ensure the effectiveness and ethical use of the system.

Scope of the Project

- **Enhanced Artificial Vision:** The primary scope of the project is to develop an advanced visual implants web app that leverages machine learning and image processing techniques to enhance artificial vision for visually impaired individuals.
- **Real-time Assistance:** The app will provide real-time assistance to visually impaired users by analyzing live video feeds, recognizing faces, predicting emotions, estimating distances, and identifying objects in their surroundings.
- **User-Friendly Interface:** The project aims to develop a user-friendly interface that is accessible and easy to navigate for both visually impaired users and administrators.
- **Training and Dataset Management:** Administrators will have the ability to train and manage datasets within the system, enabling continuous improvement of BlindNet models for better accuracy and performance.
- **Accessibility Features:** The system will include accessibility features such as audio output and text-to-speech functionality to ensure that visually impaired users can easily interact with the system.

II. LITERATURE SURVEY

2.1. A Hybrid Algorithm for Face Detection to Avoid Racial Inequity Due to Dark Skin

Authors: Muhammad, Syed Sarmad Abbas, Adnan Abid, Saim Rasheed
Year: 2021

Objective:

The aim of this project is to face detection systems for people with dark skin using a hybrid algorithm based on Gaussian and Explicit rule model.

Methodology:

There has been significant development in the facial recognition technology during past few decades. This technology has been widely used by different organizations and governments for defense, security, and surveillance projects.

Merits:

- Its accuracy is high.
- It is efficient and time consuming is low.

Demerits:

- The accuracy is very low to detect people with dark skin.
- To detect the variation among the skin tone within races has been considered as major challenge for all skin modelling techniques.

2.2. Exposing Fake Faces Through Deep Neural Networks Combining Content and Trace Feature Extractors

Authors: Eunji Kim, Sungzoon Cho

Year:2021

Objective:

The aim of this project is to expose fake face media forensics using a hybrid face forensics framework based on a convolutional neural network (CNN).

Methodology:

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. The fake faces were mostly created for fun, but abuse has caused social unrest. For example, some celebrities have become victims of fake pornography made by DeepFake. There are also growing concerns about fake political speech videos created by Face2Face

Merits:

- Highest accuracy at various video compression levels when compared to the baseline models, confirming its robustness.
- It effectively learns the different characteristics of fake manipulation methods.

Demerits:

- It is less effective.
- Accuracy is low.

III. PROPOSED SYSTEM**• Artificial Vision Build and Train**

In the initial phase of Artificial Vision Build and Train, the project focuses on assembling a diverse dataset, gathering images relevant to face recognition, gender prediction, age estimation, and emotion prediction.

• Vision Prediction System using Vision Transformer

In the Vision Prediction System using Vision Transformer, real-time video is captured through a device-mounted camera, serving as input for subsequent analysis by the Vision Transformer. This technology predicts whether individuals in the user's vicinity are known or unknown, extracting features and enhancing spatial awareness.

3.1.1. Advantages

- Enhances artificial vision for better clarity.
- Promotes greater independence for visually impaired users.
- Integrates real-time image processing for swift and dynamic analyses of live video feeds.
- Audio output ensures effective information delivery.
- Handles diverse tasks, from face recognition to object detection.

- Provides timely information for better situational awareness.

IV. MODULES

Visual Implant Firmware

The Visual Implants Web App is designed to empower visually impaired individuals by leveraging cutting-edge technology. On the front end, user interfaces are crafted for simplicity, employing HTML templates and Flask-Bootstrap for accessibility.

End User Interface

Live Video Module: This feature captures and streams real-time video through the user's glasses, with the Image Processing Module enhancing visual clarity on the live feed.

Predicted Result Module: Utilizing object detection, facial recognition, and distance estimation, this module offers valuable insights into the surroundings, including the number of people, their identities, emotions, and approximate distances.

Audio Output Module: Designed for accessibility, this module converts predicted results into spoken information, employing text-to-speech capabilities. It provides auditory cues for users, including feedback on system status and voice-based navigation for user controls. The combination of live video, predicted results, and accessible audio output ensures a comprehensive and user-friendly experience for individuals with visual impairments.

Artificial Vision Build and Train

- **Dataset Collection**

The initial step in building an artificial vision model involves the comprehensive collection of a diverse dataset. This dataset should encompass images relevant to face recognition, gender prediction, age estimation, and emotion prediction. Ensuring diversity in age, gender, and emotions within the dataset is crucial for robust model training. To create a robust dataset for Face Recognition, Gender Prediction, Age Estimation, and Emotion Prediction, a systematic approach involving live video capture and frame extraction is employed.

- **Live Video Capture**

Utilize a camera or webcam to capture live video footage. This ensures that the dataset reflects real-world scenarios, providing diverse and dynamic facial expressions.

From the extracted frames, manually or automatically annotate the faces to create a labeled dataset. Ensure diversity in lighting conditions, angles, and facial expressions to enhance the model's robustness.

- **Classification**

To unify face recognition, gender prediction, age estimation, and emotion prediction into a cohesive framework, a Convolutional Neural Network (CNN) architecture is employed. This CNN is trained on the integrated dataset, encompassing diverse tasks and ensuring effective classification across multiple dimensions.

- **Build and Train the Model**

The final stage involves building and training the integrated model. The dataset is split into training and testing sets, and the model is iteratively trained. Parameters are adjusted to optimize performance, ensuring that the model effectively captures the intricate relationships within the data.

Vision Prediction System

- **Live Video Analysis**

The system begins by capturing a live video feed through a camera mounted on the user's device. This real-time video serves as the input for the Video Vision Transformer, a sophisticated model capable of efficiently analysing visual information and extracting meaningful features.

- **Predict Know or Unknown for the Blind**

The extracted features are then compared with the trained model to predict whether individuals in the user's vicinity are known or unknown. This comparison helps the system determine the familiarity of people, aiding the visually impaired user in recognizing acquaintances.

V. EXPERIMENT AND RESULTS

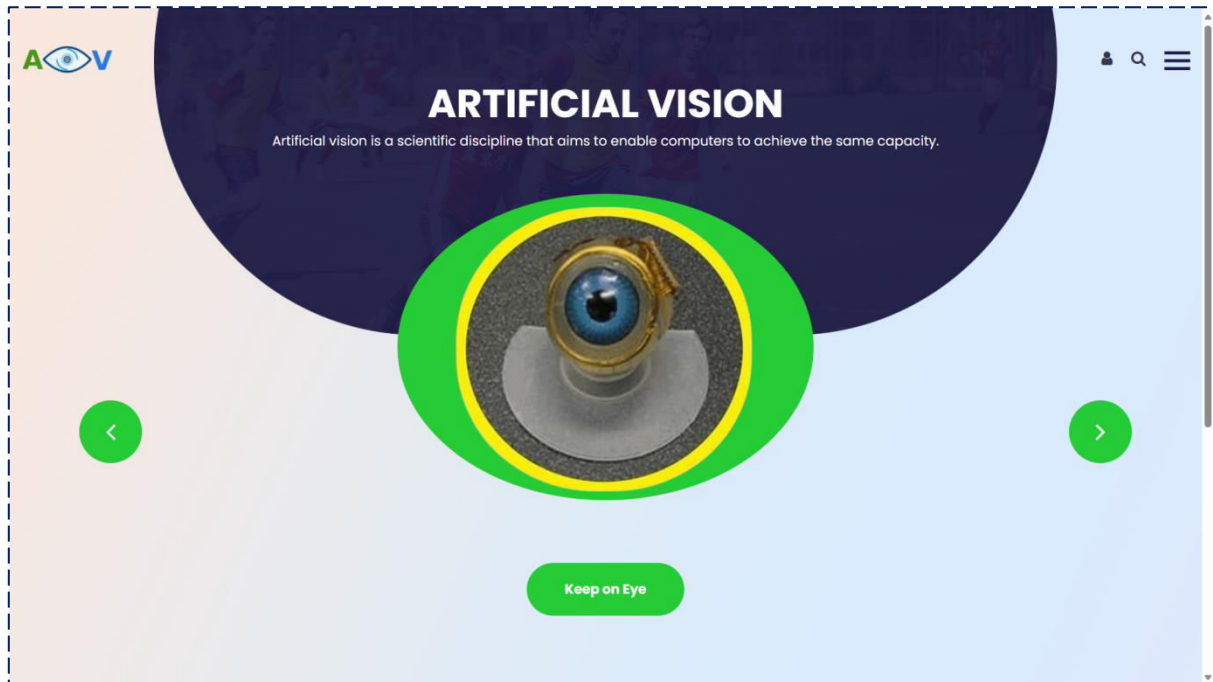


FIGURE NO.1 HOME PAGE

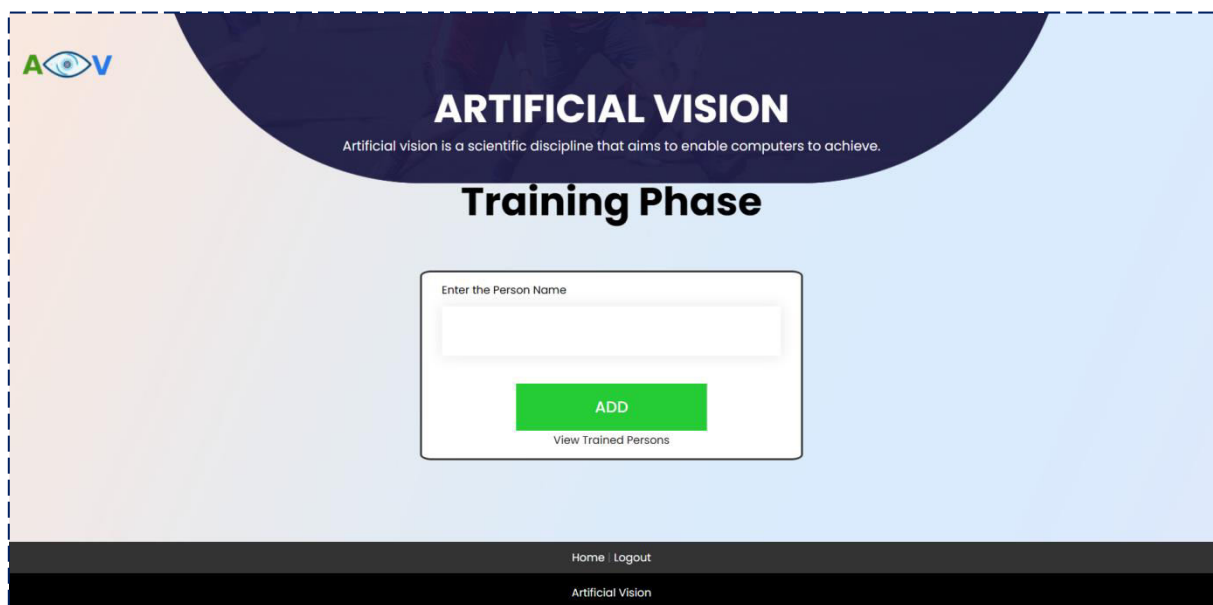


FIGURE NO. 2 TRAINING PHASE

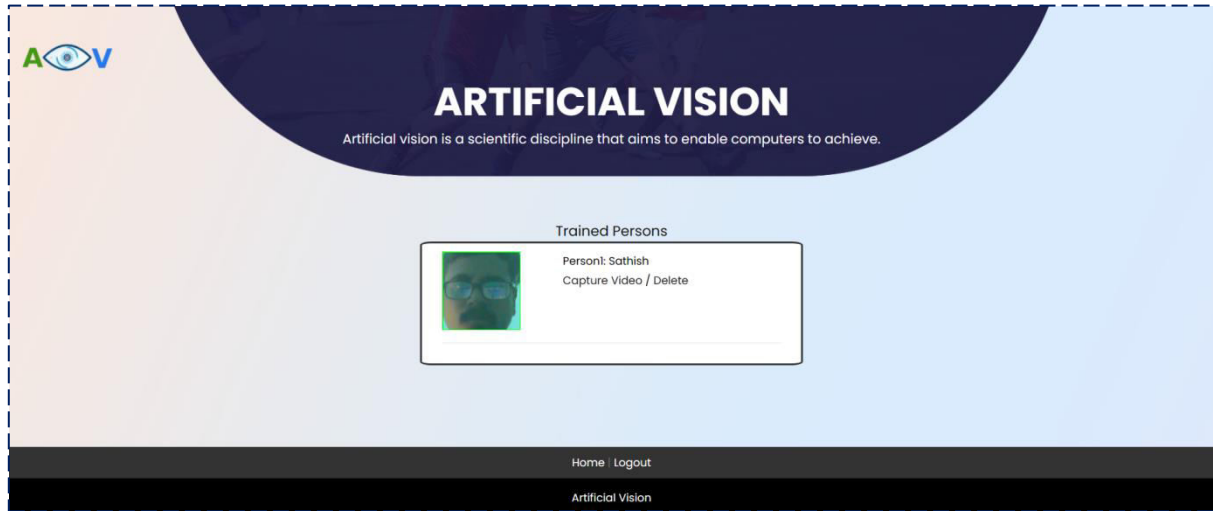


FIGURE NO.3 TRAINED PERSON

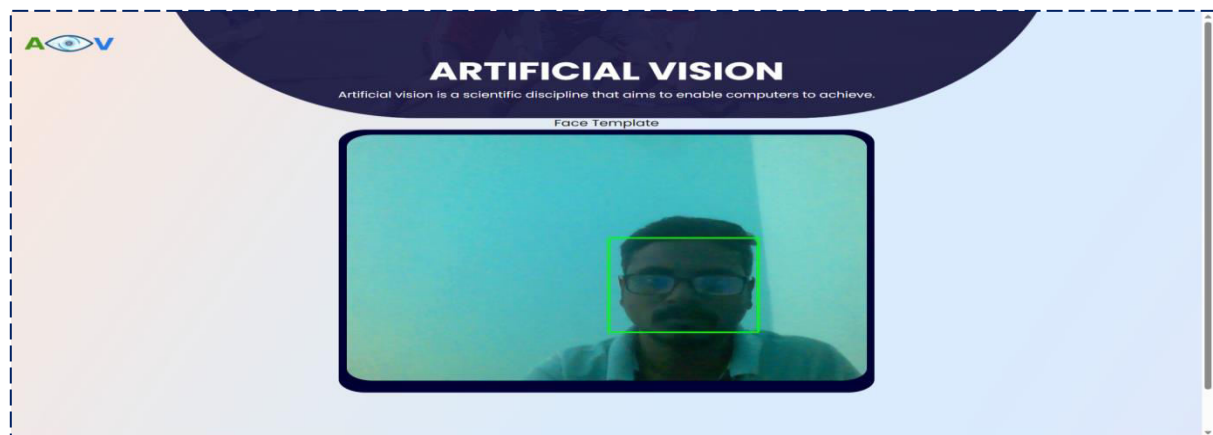


FIGURE NO. 4 TRAINING FACE TEMPLATE

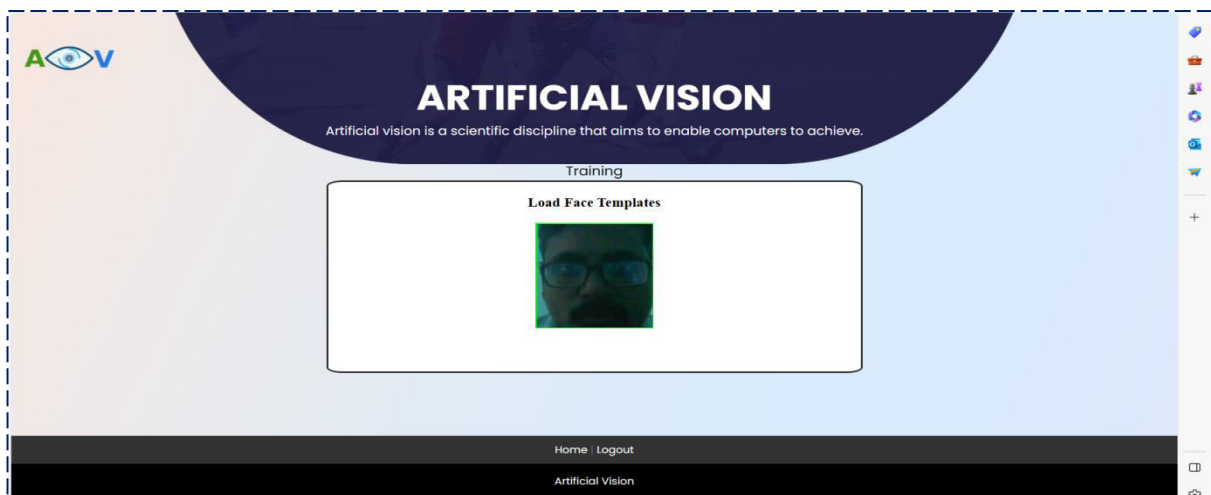


FIGURE NO. 5 LOAD FACE TEMPLATES

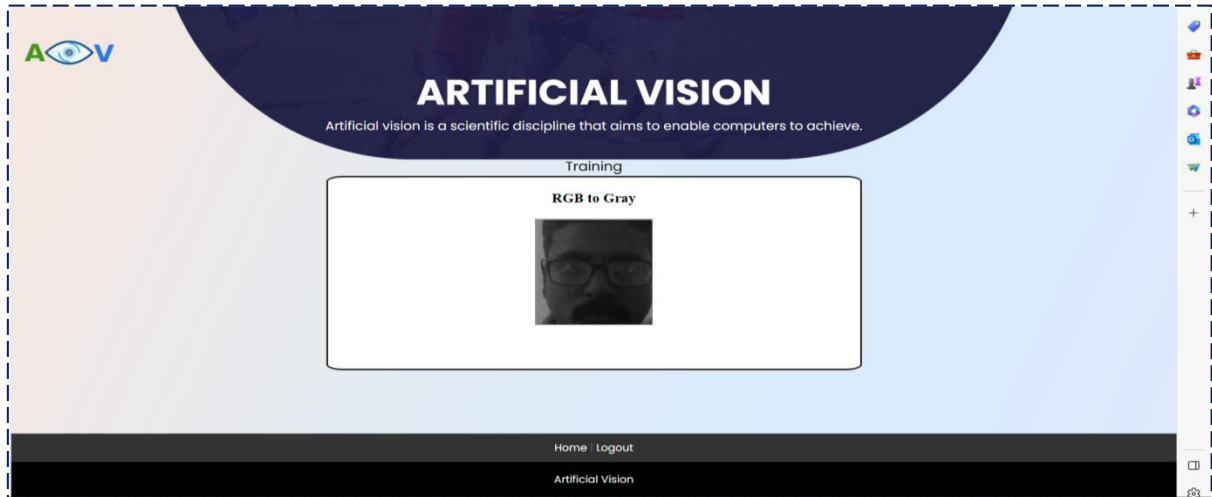


FIGURE NO. 6 TRAINING RCB TO GRAY

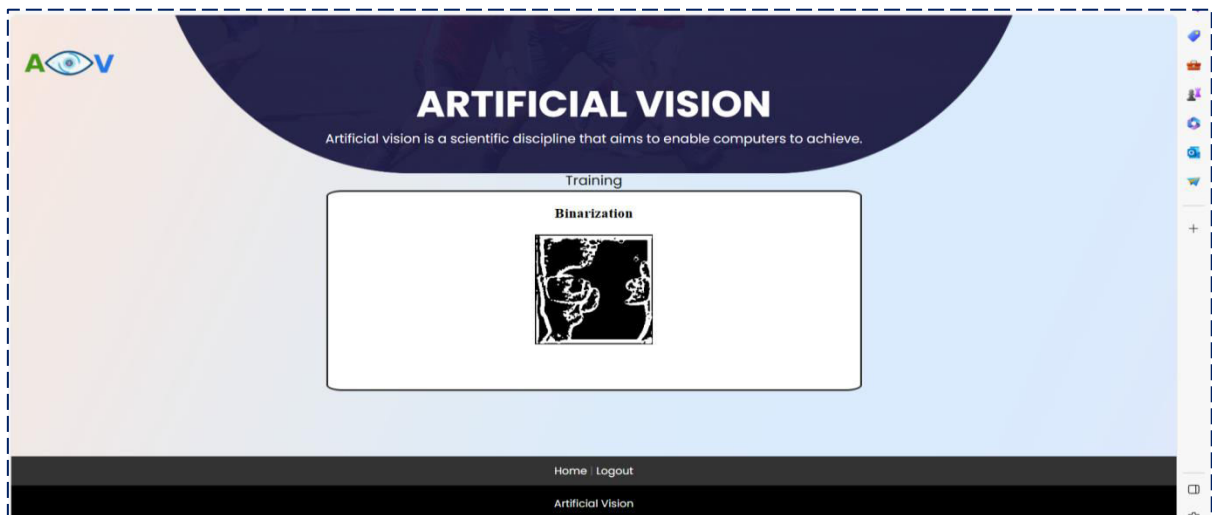


FIGURE NO. 7 BINARIZATION

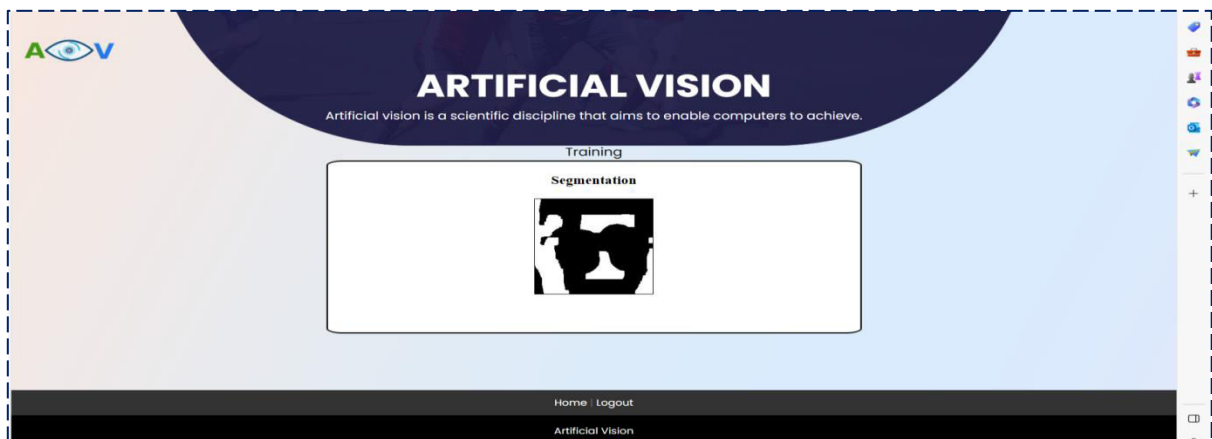


FIGURE NO. 8 SEGMENTATION

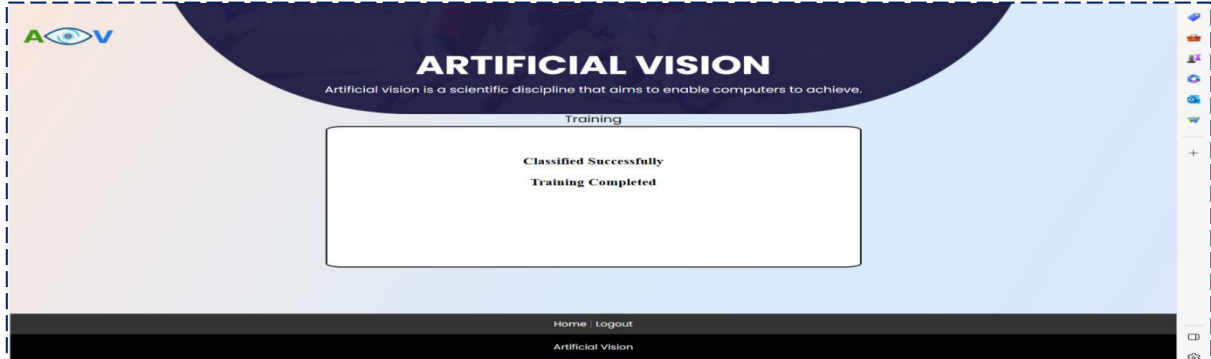


FIGURE NO. 9 TRAINING COMPLETED

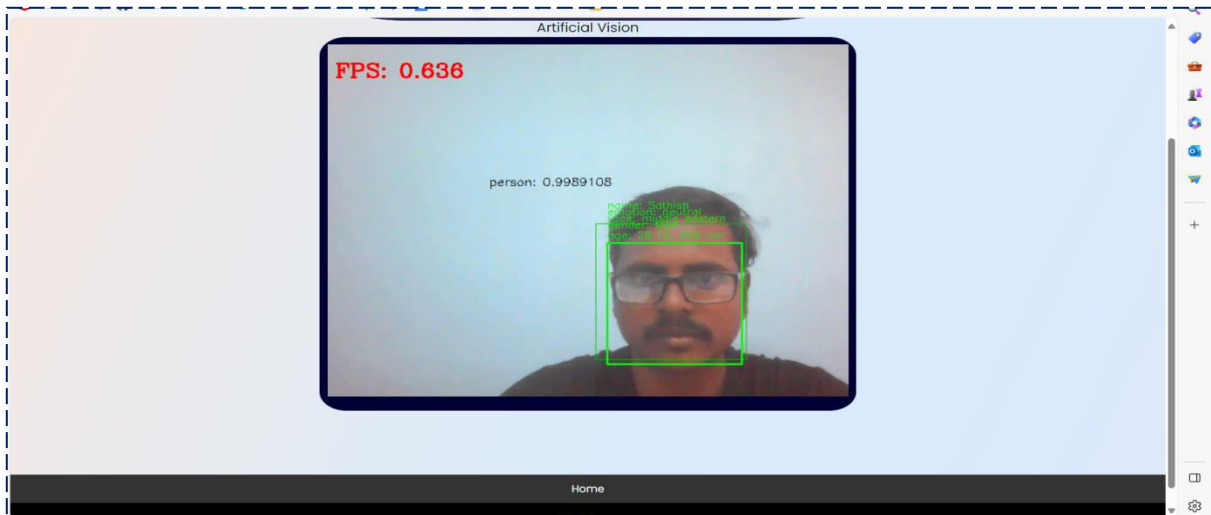


FIGURE NO. 10 ARTIFICIAL VISION FACE DETECTION

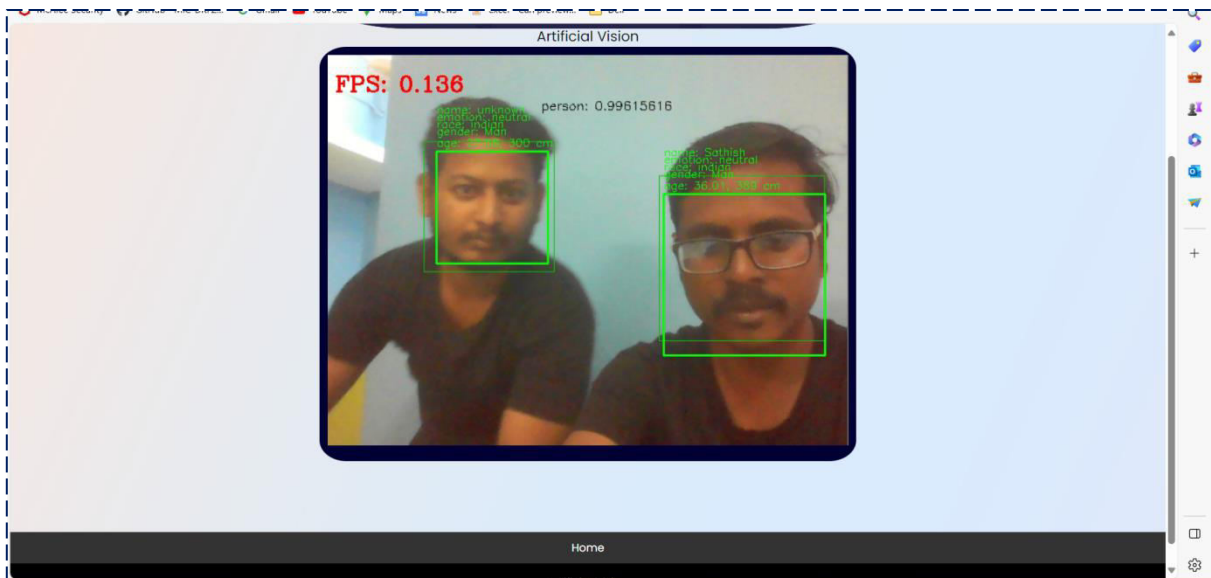


FIGURE NO. 11 FACE DETECTION TWO PERSON

VI. CONCLUSION

In conclusion, the project aims to revolutionize the artificial vision experience for visually impaired individuals by integrating advanced technologies and innovative approaches. Through the implementation of Vision Transformer technology, real-time image processing algorithms, and information extraction techniques, the project endeavors to enhance accessibility, promote independence, and improve the overall quality of life for visually impaired users. By addressing key challenges such as limited access to information, navigation barriers, social interaction limitations, and educational and employment obstacles, the project seeks to empower visually impaired individuals to lead more fulfilling and independent lives.

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