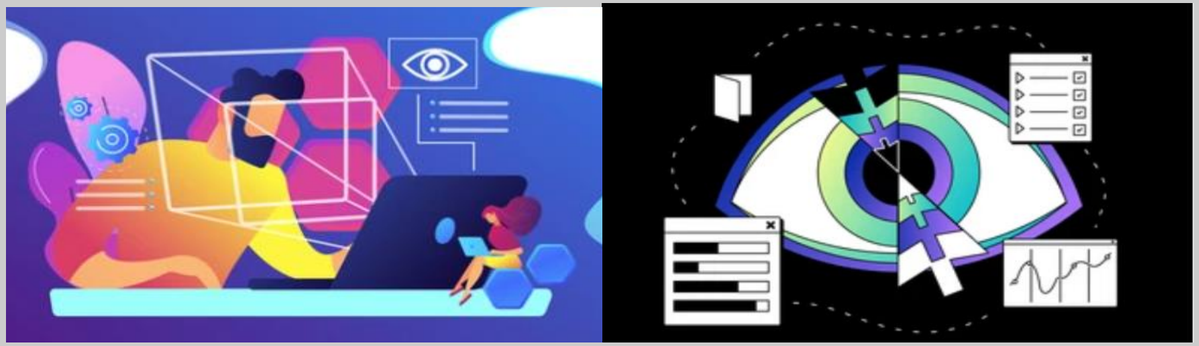
EYENAV



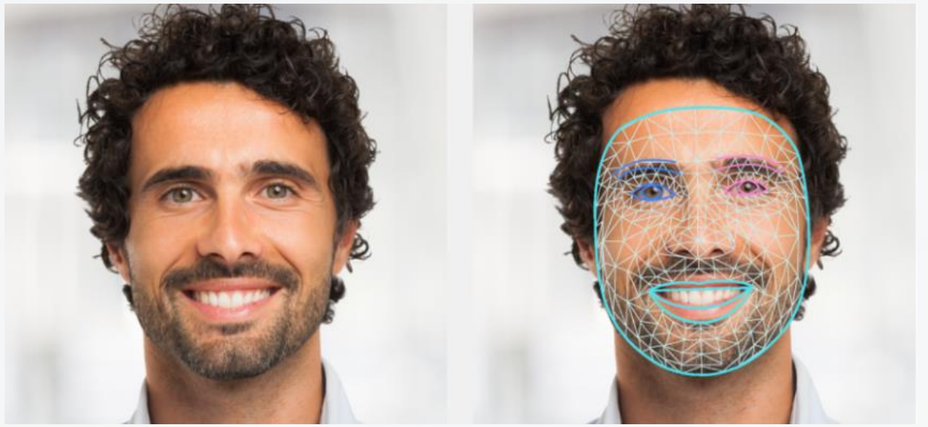
ENHANCING HEALTHCARE ACCESSIBILITY WITH EYE-CONTROL COMMUNICATION

PROBLEM STATEMENT

- Paralyzed individuals and those recovering from accidents often experience severe communication challenges and social isolation due to their physical limitations.
- These limitations can be the result of various medical conditions, accidents, or traumatic injuries.
- Their ability to convey essential needs is profoundly restricted.
- Traditional healthcare communication systems, which predominantly rely on verbal or physical interactions, are ill-suited to accommodate their unique requirements.
- This mismatch creates a noticeable gap in patient-centered care, as these individuals struggle to engage effectively with healthcare professionals.

PROJECT INTRODUCTION

- In response to this critical need, EyeNav was developed , a solution designed to ensure accessibility for all, regardless of physical limitations. The primary goal of this project is to empower individuals dealing with limited mobility due to illness, accidents, or paralysis.
- EyeNav provides a user-friendly interface equipped with intuitive buttons for fundamental needs such as "Food," "Water," "Medicines," and "Help."
- What sets EyeNav apart is its innovative approach to communication.
- Users can effortlessly express their requirements by merely blinking their eyes, initiating a voice communication feature that relays their needs to caregivers.



OBJECTIVES

OUR VISION : A MORE INCLUSIVE HEALTHCARE

Objective 1

Empower individuals dealing with restricted mobility due to illness, accidents, or paralysis.

Objective 2

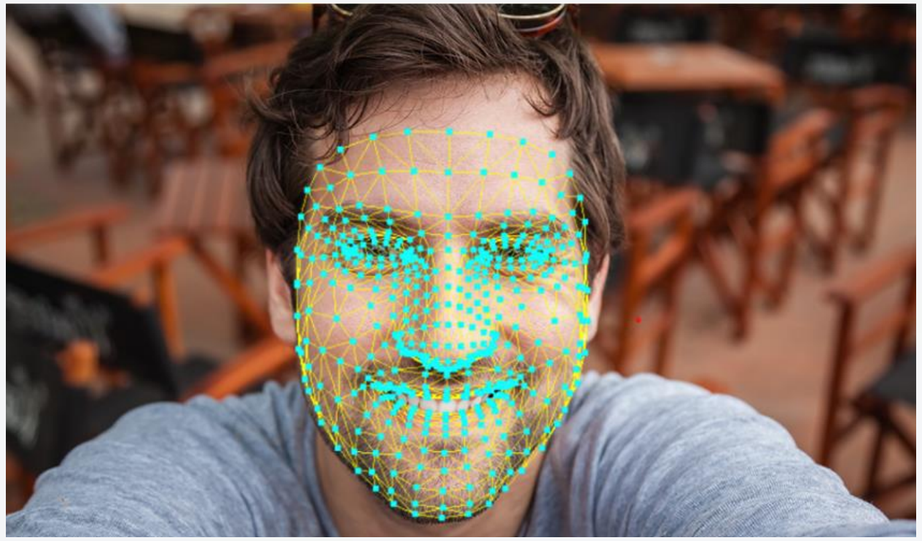
Provide individuals with disabilities a means to interact with a graphical user interface (UI) and effectively communicate their healthcare needs.

Objective 3

Enable users to effortlessly request essential services such as food, water, medication, or general assistance, prioritizing their comfort and well-being.

INNOVATION

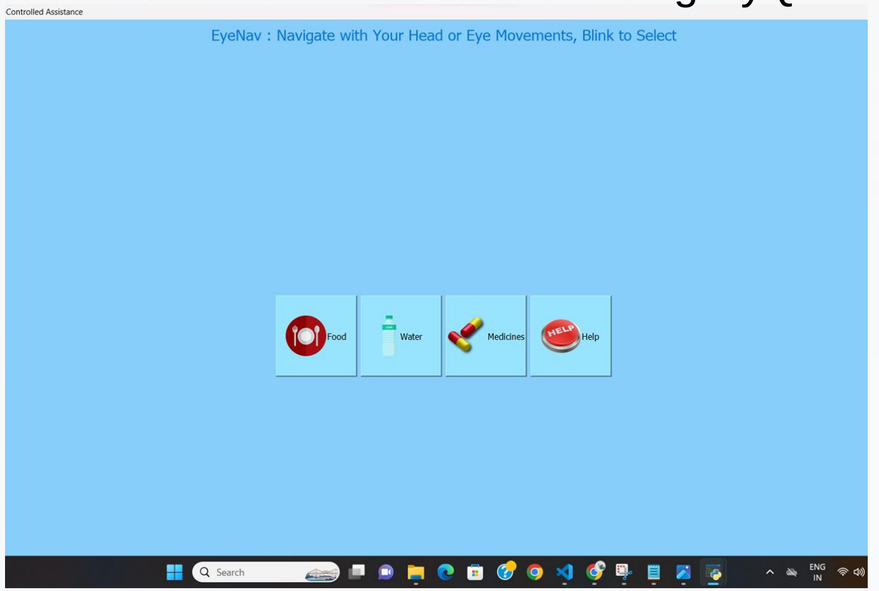
Facial Landmarks Using Mediapipe



- Use of eye-tracking technology for limited mobility users to navigate the application's user interface and communicate needs.

- Bridging the gap between users and the digital world by translating subtle eye cues into cursor control and button clicks.

User Interface For Patients Using PyQt5



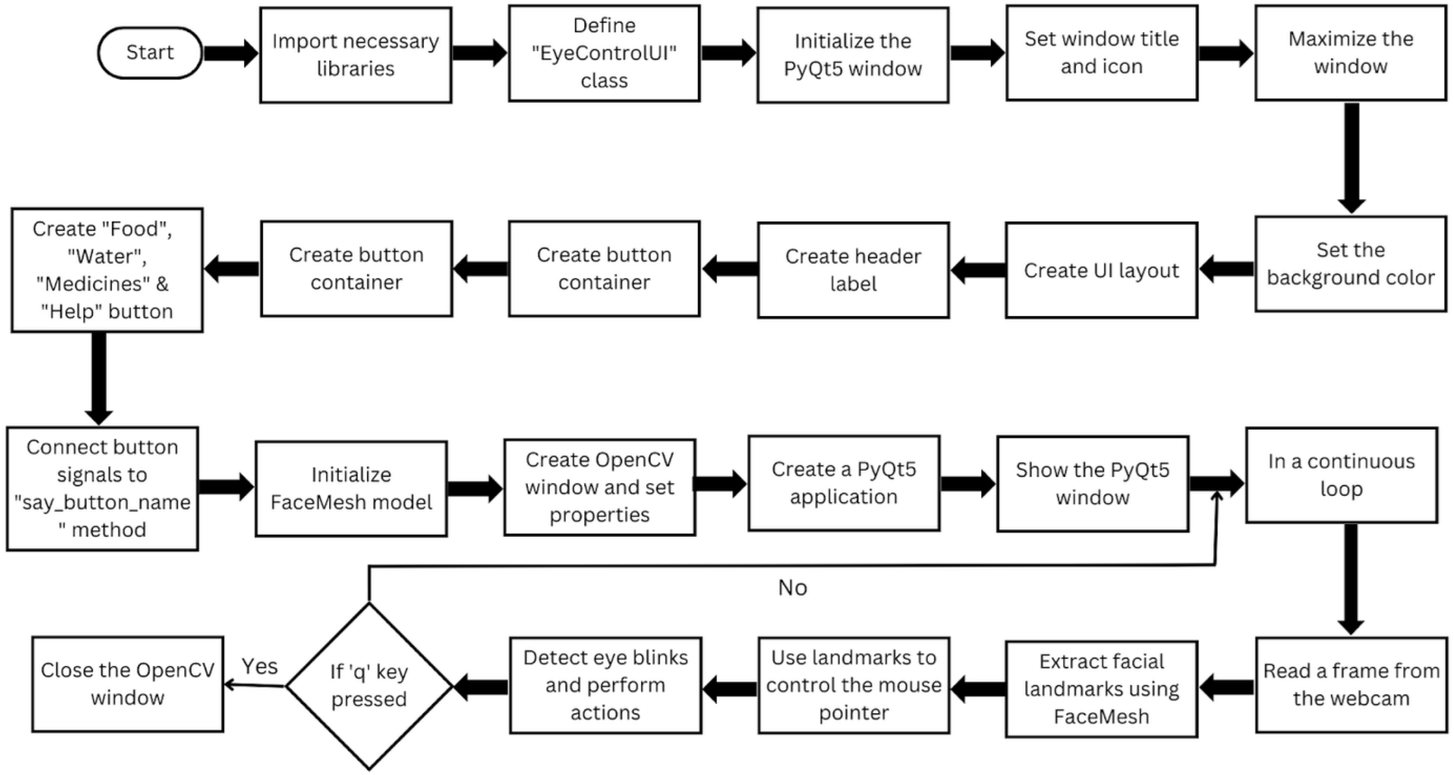
- Empowering users to request essential services promptly (e.g., food, water, medication, general assistance).

- Streamlining communication in healthcare settings, leading to improved overall quality of care and reduced workload for healthcare professionals.

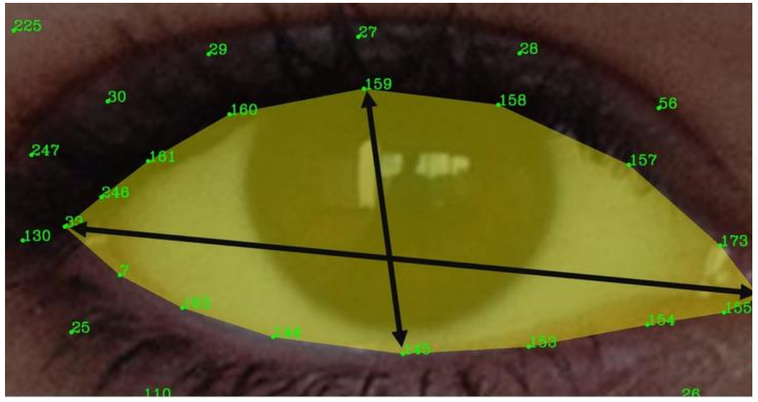
ALGORITHM

- Import necessary tools for computer control and UI creation.
- Design a user-friendly window with buttons: "Food," "Water," "Medicines," and "Help."
- Clicking a button generates a voice message to communicate the need.
- Use the computer's webcam to detect a user's face in the video feed.
- Detect eye and head movements through facial landmarks.
- Control the computer's mouse cursor based on eye and head movements.
- Trigger actions (e.g., mouse click) when specific conditions (e.g., eye blink) are met.
- Display the webcam's video feed in a window on the computer screen.
- Enable hands-free interaction with the computer.

Algorithm implemented For Creating The Application



Landmark Points For Detecting Position Of The Eyeball

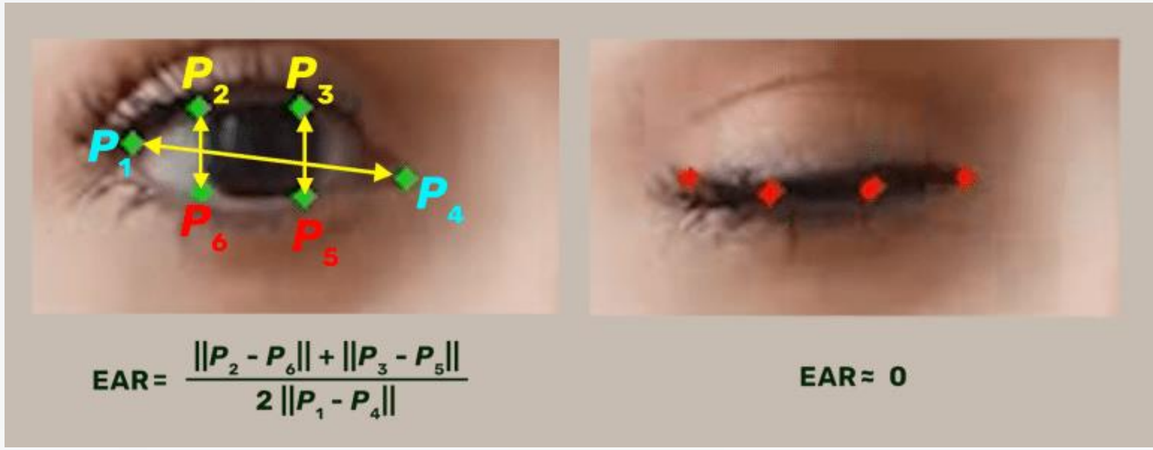


METHODOLOGY

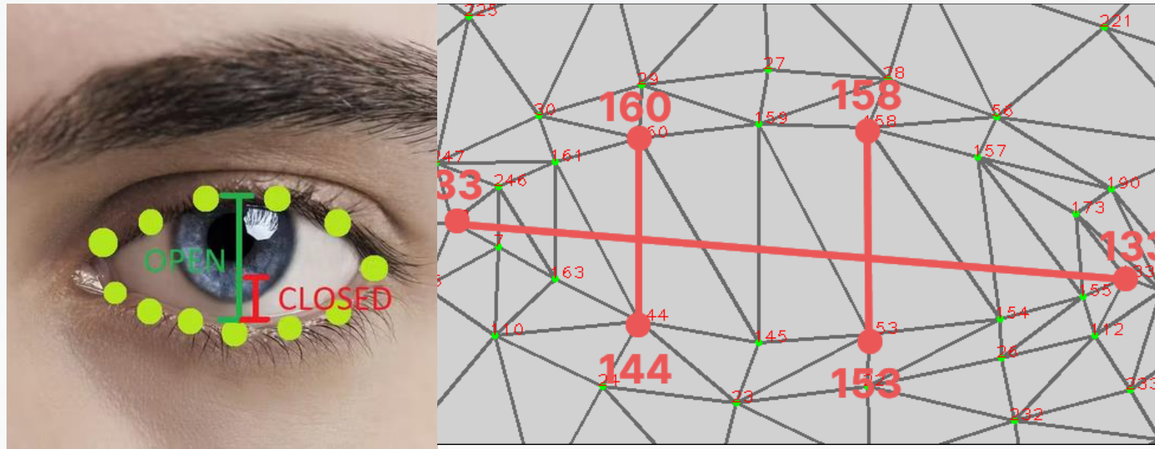
Brief Overview

- Precise eye tracking via Mediapipe was utilized for eye movement and blink detection.
- FaceMesh model tracks eye movements for precise cursor control.
- pyttsx3 was used for seamless text-to-speech communication of user needs.
- User-friendly PyQt5 GUI was created with intuitive buttons for common requirements.
- EyeControlUI class was defined to create an interface with specific need buttons for vocal communication.
- Continuous visual feedback is provided for an intuitive user experience.
- Python code integrated OpenCV, Mediapipe, pyautogui, and PyQt5 for technical backbone.

Eye Aspect Ratio (EAR)



Vertical Distance Between The Upper & Lower Eye Landmarks



METHODOLOGY

UI Setup : A user interface (UI) using PyQt5 was created, which consists of four buttons for "Food," "Water," "Medicines," and "Help." This UI can be navigated using eye movements and blinks.

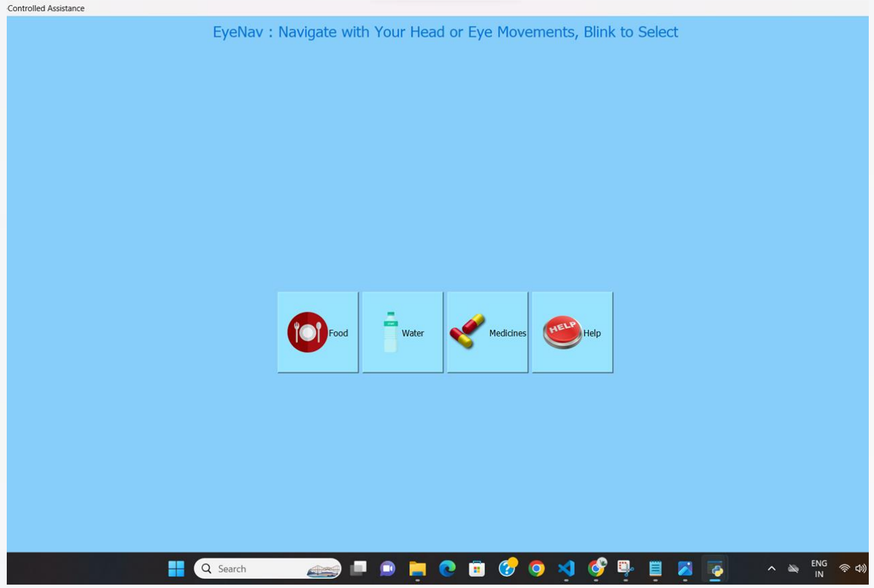
FaceMesh Initialization : The MediaPipe FaceMesh model was initialized to detect facial landmarks, including eye landmarks, to track the user's eye movements.

Custom Window Setup : A custom OpenCV window named "Eye Controlled Mouse" was created for displaying the webcam feed.

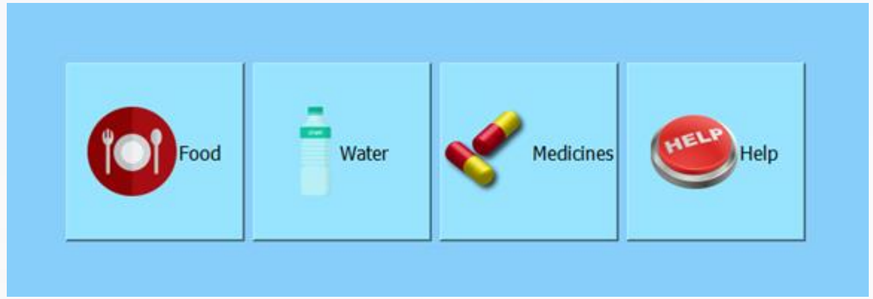
Main Loop :

- Frames are captured continuously from the webcam.
- The captured frames are flipped horizontally to match the user's perspective.
- The MediaPipe FaceMesh model processes the frames to detect facial landmarks, including eye landmarks.

User Interface



Buttons On The UI For Conveying Needs



METHODOLOGY

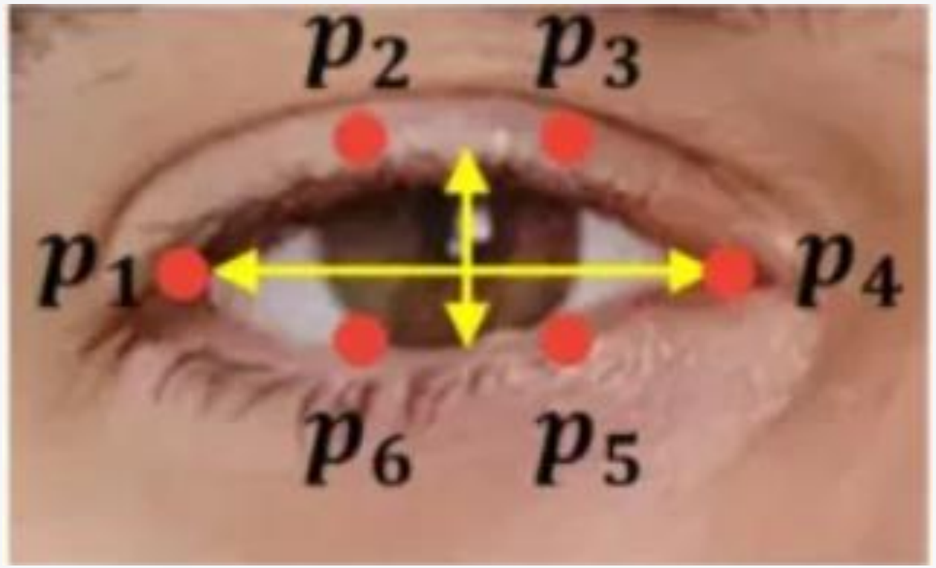
Eye Tracking and Cursor Control :

- Landmarks related to the user's eyes were extracted, particularly points corresponding to the corners of the eyes.
- The positions of the eye landmarks were mapped to screen coordinates, allowing the cursor to follow the movement of the user's eyes.
- The PyAutoGUI library was used to control the cursor position.

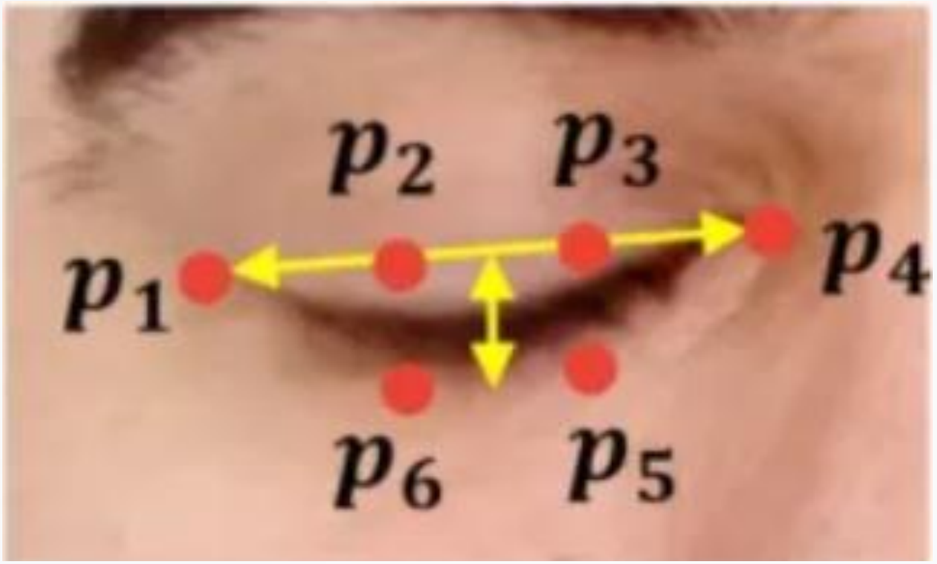
Blink Detection :

- Eye Aspect Ratio (EAR) was utilized to detect blinks.
- EAR is a measure of the eye's openness.
- A minimum EAR value (MINIMUM_EAR) was set above which the eyes are considered open, and below which they are considered closed.
- This parameter can be adjusted based on specific requirements and scenarios.
- Consecutive frames in which the EAR is below MINIMUM_EAR were tracked.
- Low EAR value indicates blinking of the user’s eyes.

Open Eye Will Have More EAR



Close Eye Will Have Less EAR



METHODOLOGY

Mouse Clicks On Blinks :

- The vertical distance between the upper and lower eye landmarks is continuously monitored.
- When this distance is very small (a blink is detected), it initiates a mouse click on the button where the cursor is, using PyAutoGUI's click() function.

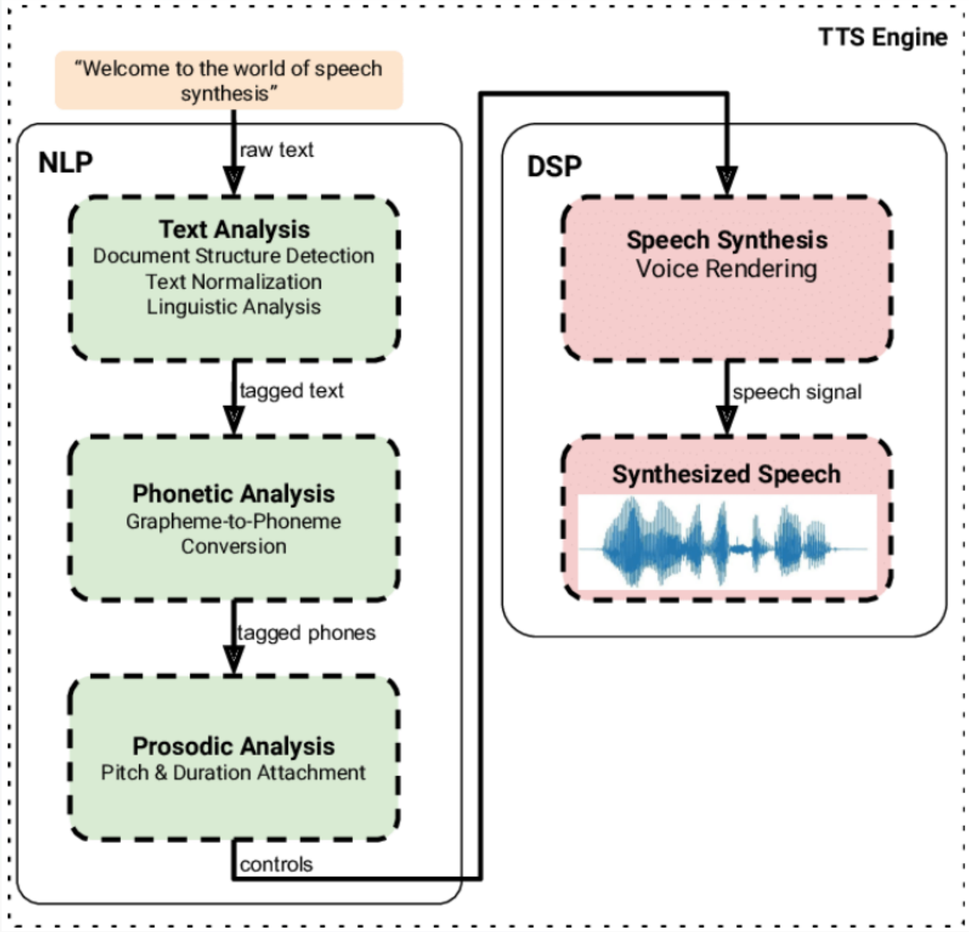
Display and User Interaction :

- The processed frame, including the cursor position and blink status, is displayed in the "Eye Controlled Mouse" OpenCV window and the UI.
- The user can press the 'q' key to exit the program.

Text-to-Speech :

- When the user clicks one of the buttons in the UI, a text-to-speech engine (Pyttsx3) reads aloud the button's text to assist the user in communicating their needs.

Text To Speech System Architecture



RESULTS

- The EyeNav project successfully addresses complex challenges confronted by patients in healthcare facilities and individuals with medical conditions.
- Precise eye tracking with the Mediapipe library ensures accurate monitoring of eye movements and blink detection.
- Seamless speech generation enables effective communication of user needs.
- The user-friendly GUI enhances accessibility through easy selections with eye movements and blinks.

CONCLUSIONS & FUTURE ENHANCEMENTS

EyeNav provides a comprehensive solution for those with limited mobility and medical conditions.

Integration of cutting-edge technologies significantly improves healthcare communication and users' quality of life.

Future prospects include customized adaptations to cater to individual patient requirements.

Advanced facial expression analysis with Mediapipe aids caregiver understanding and enhances pain management by monitoring emotional states, fatigue, and pain levels through facial landmarks.

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THANK YOU

Together, we can truly transform lives with EyeNav.

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