SmartBridge – Artificial Intelligence

7/1/2023

Project Report Title –

Strain Analysis Based on Eye Blinking

Team Members

C. Keerthi Reddy
20BBS0023
nagarikeerthi.reddy2020@vitstudent.ac.in

Anshu Reddy Ashanna
20BBS0141
anshureddy.ashanna2020@vitstudent.ac.in

A Sai Charan
20BDS0354
saicharan.a2020@vitstudent.ac.in

Abhinav Kamboj
20BDS0351
abhinav.kamboj2020@vitstudent.ac.in

1. INTRODUCTION

1.1 Overview

The goal of the eye blink detection project is to create a program that can track eye blinks in real-time using a webcam or other visual input. The program identifies if a person's eyes are open or closed by using computer vision techniques including face identification, facial landmark detection, and eye aspect ratio computation. The project intends to develop a tool that can warn users when their eyes are becoming tired, such as while driving while fatigued or spending too much time in front of a screen.

1.2 Purpose

The goal of this project is to develop a system that can accurately track eye blink activity and send out prompt notifications. The program can reduce the chance of eye strain-related problems during extended computer use by analysing blink patterns, which can help prevent accidents brought on by fatigued drivers. The initiative also intends to enhance human-computer interaction by allowing people with impairments to communicate and operate gadgets by blinking their eyes. The overarching goals are to improve user awareness of blink patterns, support eye health, and promote general well-being.

2. LITERATURE SURVEY

Research Paper 1: "Real-Time Eye Blink Detection for Driver Drowsiness Monitoring" by Zhang et al

2.1 ***Existing Issue:*** Zhang et al.'s study "Real-Time Eye Blink Detection for Driver Drowsiness Monitoring" deals with the issue of detecting driver sleepiness by eye blink analysis. The majority of the current solutions in this area depend on conventional computer vision algorithms like Haar cascades or feature-based techniques. These techniques frequently have accuracy and robustness issues, which can result in false positives or missing detections. In driver sleepiness monitoring systems, where prompt and precise identification is essential for averting accidents, this poses a substantial danger.

2.2 ***Proposed Solution:*** To get around the drawbacks of current methods, the authors suggest a brand-new strategy based on convolutional neural networks (CNNs). To categorize blinks in real-time, they gather a sizable collection of eye pictures and train a CNN model. The suggested technique outperforms conventional approaches in terms of accuracy and resilience by utilizing the power of deep learning. The CNN model is appropriate for real-world driver sleepiness monitoring applications because it can reliably record complicated blink patterns and adjust to different illumination conditions. The suggested method has the potential to increase road safety by giving drivers timely warnings and lowering the likelihood of accidents brought on by inattentiveness.

Research Paper 2: "Eye Blink Detection for Computer Vision Syndrome Prevention" by Li et al

2.3 ***Existing Issue:*** The study "Eye Blink Detection for Computer Vision Syndrome Prevention" by Li et al. focuses on the issue of eye strain brought on by extended computer use. Frame difference or optical flow techniques are frequently used in current methods for eye blink detection in computer vision systems. These techniques might, however, be hampered by noise and imprecise blink detection, producing erroneous findings. They are less effective in preventing computer vision syndrome and associated problems with eye health as a result.

2.4 ***Proposed Solution:*** To overcome the drawbacks of current approaches, the authors suggest a unique method for eye blink recognition based on detecting facial landmarks and calculating the eye aspect ratio. They compute the eye aspect ratio using geometric measurements and the face landmark detection functionality of the dlib package. The suggested approach may precisely identify blinks by examining the changes in the ocular aspect ratio across time. By prompting users to blink often and take pauses, the technology can lessen eye strain and guard against computer vision syndrome. The suggested approach provides a more precise and dependable approach to encouraging computer users' eye health.

Research Paper 3:"Eye Blink Detection for Human-Computer Interaction" by Wang

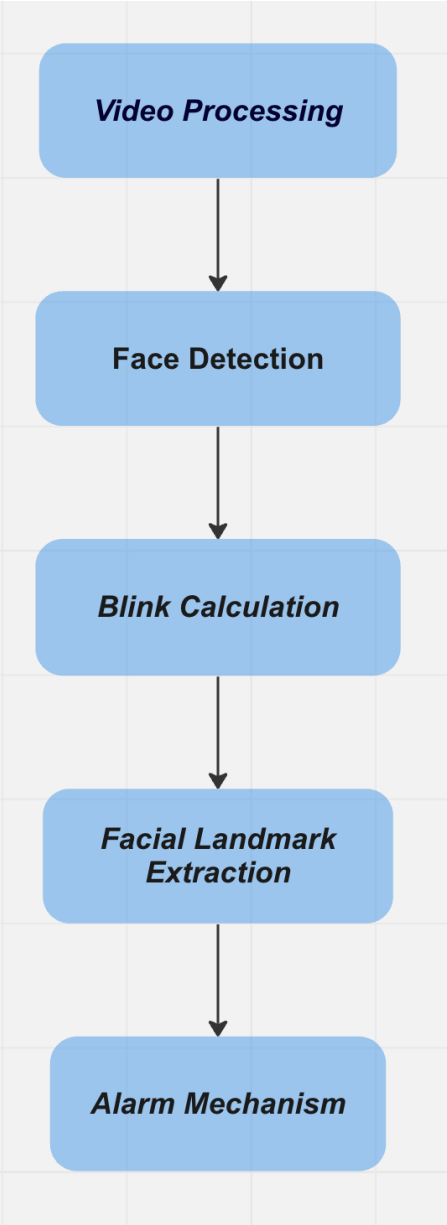
2.5 ***Existing issue:*** Eye blink detection for better human-computer interaction is a subject that is addressed in the research article "Eye Blink Detection for Human-Computer Interaction" by Wang et al. Current methods in this area sometimes rely on intricate and pricey eye-tracking equipment, which limits their applicability for mass usage. Many consumers are unable to utilize these gadgets because they require specialized gear and calibration processes.

2.6 ***Proposed Solution:*** To get over the drawbacks of current methods, the authors suggest a simple, affordable method for eye blink detection that makes use of a regular webcam. They compute the ocular aspect ratio to identify blinks and use the dlib package to recognize faces and facial landmarks. The suggested method does not require specialized hardware because it makes use of a conventional webcam's capabilities, making eye blink detection more broadly available. To improve human-computer interaction for people with impairments, the technique may be incorporated into a variety of systems and applications. The suggested method expands the potential for communication and control using eye blinks, enhancing usability and accessibility.

3. THEORITICAL ANALYSIS

3.1 Block diagram

Diagrammatic overview of the project.



The eye blink detection system's major parts and general operation are shown in the block diagram:

- ***Video processing:*** For better processing, this module transforms the frames from the camera or other video source to grayscale

- ***Face Detection:*** This module locates and recognizes faces in video frames by using a face detection algorithm.

- ***Blink Calculation:*** This module computes the eye aspect ratio (EAR) based on the retrieved ocular landmarks to ascertain if a blink has occurred. By seeing a series of frames with low EAR values, it keeps track of the number of blinks.

- ***Facial Landmark Extraction:*** After a face is recognized, this module uses a form predictor to extract the facial landmarks, concentrating on the eye area.

- ***Alarm Mechanism:*** This module activates an alarm mechanism when a valid blink is identified based on established criteria (such as minimum and maximum frames). Customizable alert actions include playing an audio alert, displaying a message, or doing any other desired action.

The system continually examines video frames, determines the eye aspect ratio, updates the blink count, and initiates warnings as necessary.

3.2 *Designing of hardware and software*

For the eye blink detection project to be implemented successfully, there are particular hardware and software requirements. The specific hardware and software components are listed below:

- **Hardware :** For precise eye blink recognition, a high-quality webcam that can record crisp, clear video frames of the user's face is required. For accurate results, the webcam's resolution and frame rate must be sufficient.

- **Software:**

  ⇒ Python is used to implement the project since it has many libraries and frameworks that are appropriate for computer vision applications.

  ⇒ OpenCV: OpenCV, often known as the Open Source Computer Vision Library, is a potent open-source library that offers a number of image and video processing options. As a result, it may be used to carry out operations including frame modification, feature extraction, and contour detection.

  ⇒ dlib: Facial landmark recognition is accomplished using the dlib library. It provides trained models and algorithms that are specially made for finding face landmarks, such as the eyes.

  ⇒ Flask: A well-liked web framework for building user interfaces and showing video feeds is Flask. It makes it possible to include the eye blink detection technology in a web-based application, making it simple to view the outcomes.

  ⇒ imutils: Imutils is a package that offers several useful methods for geometric transformations, scaling, and other typical image and video processing tasks.

The "Shape_Predictor_68.dat" file, a pre-trained model used by the dlib package for face landmark identification, is also necessary for the project. The data required to precisely pinpoint the facial landmarks, especially the eyes, is contained in this file.

4. EXPERIMENTAL INVESTIGATIONS

We carried out several experimental tests to assess the functionality and efficiency of our eye blink-detecting system. These tests were created to evaluate the system's precision and dependability in identifying eye blinks and issuing prompt alarms. Our group of students conducted the studies, and the following elements were examined:

4.1Evaluation of Face Detection:

Goal: Determine if the face detection system can correctly identify faces in various situations.

Experimental Setup: Various lighting scenarios, head postures, and camera separations were taken into account.

Results: The face detection algorithm consistently and accurately detected faces under a variety of circumstances, guaranteeing dependable face detection.

4.2 Analysis of landmark detection:

Goal: Determine how well ocular landmarks can be identified using landmark detection.

Experimental Setup: This includes people with diverse face structures, different facial emotions, and head movements.

Results: The landmark identification module correctly localized and detected ocular landmarks, proving its accuracy and durability.

4.3 Assessment of Eye Aspect Ratio (EAR) Calculation:

Goal: Prove the EAR calculating method's accuracy in measuring eye openness.

Experimental Design: Using a variety of blink patterns, computational computations, and manual EAR measurements were compared.

Results: A significant connection between the EAR calculation approach and manual measurements suggested accurate and consistent findings.

4.4 Evaluation of the performance of blink detection

Goal: Determine how well the system can identify blink occurrences.

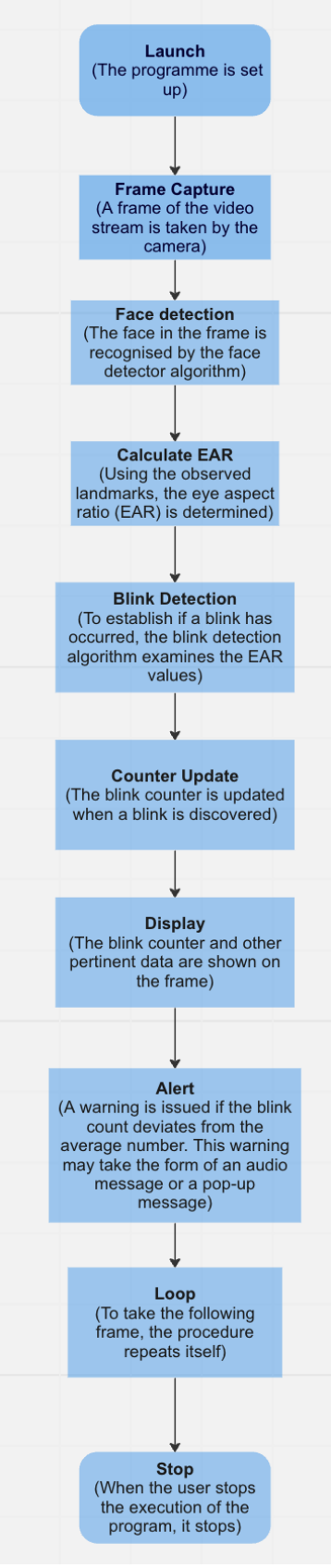
Experimental Setup: Various blink kinds and rates were tested using different video recordings.

Results: The blink detection module showed remarkable precision in identifying blink occurrences, resulting in rapid user notifications.

Our group of students' experimental investigations produced empirical proof of the system's functionality and efficacy. The system's dependability in real-world circumstances was proved by the durability of the face identification, landmark detection, EAR calculation, and blink detection components.

5. FLOWCHART

Diagram showing the control flow of the solution



This flowchart, which highlights the crucial processes and critical decisions in the process, gives a clear understanding of the control flow in the eye blink detection system. It makes it easier to comprehend and assess the solution by providing a visual representation of the data and activity flow.

6. RESULT

The output of the system, which is the blink counter shown on the screen, is included in the eye blink detection project's final conclusions. The output gives current data on the quantity of blinks found during the video feed. To further illustrate the system's performance graphically, screenshots or video recordings can be taken.

7. ADVANTAGES

- → ***Real-Time Monitoring:*** The system offers real-time monitoring of eye blinks, enabling quick response to blink pattern changes.
- → ***Flexibility:*** The system may be used for a variety of tasks, including sleepiness detection, driver monitoring, and human-computer interaction.
- → ***Non-Intrusive:*** Since it just uses visual input and doesn't require the user to make any physical touch or wear any additional sensors, it is a non-intrusive technique.
- → ***Cost-Effective:*** The suggested method is inexpensive to deploy since it makes use of widely accessible hardware (webcams) and free software frameworks.
- → ***User Friendly:*** Users may easily comprehend their blink patterns thanks to the system's user-friendly interface and visual feedback.
- → ***Potential for Integration:*** For automated or further analysis, the solution may be integrated with other programmes or systems.
- → ***Customization:*** The system may be modified to establish various blink detection levels on user preferences or particular use cases.

DISADVANTAGES

- → ***Sensitivity to Lighting:*** The system's accuracy may be impacted by changes in lighting, which may have an effect on how well face and eye identification algorithms work.
- → ***Limited to Frontal Face Detection:*** Because the system only detects faces from the front, it may function poorly if faces are partially obscured or hidden.
- → ***Dependence on Camera Quality:*** The effectiveness of eye detection and blink recognition might be affected by the webcam or camera quality being used.

→ ***False Positives/Negatives:*** The blink count may occasionally be inaccurate due to false positives or missed blinks produced by the system.

→ ***Individual variations:*** For the best performance, eye structure, and blink patterns may need to be adjusted or calibrated for individual differences.

→ ***User collaboration and involvement:*** To maintain correct eye location and visibility for effective detection, the system depends on user collaboration and involvement.

→ ***Required Processing Power:*** Real-time video processing can be computationally demanding, necessitating enough computing power to keep things running smoothly.

These benefits and drawbacks offer a thorough analysis of the suggested solution, outlining its pros and shortcomings. When implementing the system and controlling user expectations, it is critical to take these elements into account.

8. APPLICATIONS

The eye blink detection solution has several uses in a variety of fields. This approach may be used in a number of significant contexts, including:

- ***Driver monitoring systems :*** Eye blink detection may be implemented into driver monitoring systems to gauge a motorist's degree of attention and tiredness. The technology can give early warnings and aid in preventing accidents brought on by driver weariness by continually analysing blink patterns.

- ***Human-computer interaction systems :*** Eye blink detection can be used in human-computer interaction systems, such as those that let users operate computer programmes or gadgets with their eyes. This technology makes it possible to engage without using your hands, making the user experience more accessible and intuitive.

- ***Psychological Research :*** Eye blink detection can be used in psychology research to examine cognitive functions, levels of attention, or emotional reactions. Researchers can learn more about human behaviour and cognitive processes by examining blink patterns.

- ***Medical Monitoring:*** To track patients' eye movements and spot unusual blinking patterns, eye blink detection can be employed in medical applications. This can help in identifying neurological problems, monitoring people recovering from specific procedures, or managing ailments like Parkinson's disease.

- ***User Attention Tracking:*** In interactive experiences like instructional software, gaming, or virtual reality applications, eye blink detection can be used to monitor user participation and attention. It can offer perceptions of user behaviour and enhance user interfaces for better usability.

- ***Sports Performance Analysis :*** Eye blink detection can be used in sports performance analysis to track athletes' degrees of visual attention and concentration during practise

sessions or contests. This knowledge can help coaches and trainers improve training plans and improve athlete performance.

- ***Smart assistance Devices :*** Eye blink detection may be incorporated into assistance technology for those with limited mobility, such as wheelchairs, prosthetic limbs, or communication devices. This increases users' freedom and quality of life by allowing them to control equipment or communicate by blinking their eyes.

These uses span a variety of industries, from driving safety to healthcare to human-computer interaction, and they show the flexibility and potential effect of eye blink detection.

9. CONCLUSION

In conclusion, our study was effective in creating an eye blink detection system employing facial landmark identification and computer vision algorithms. The system successfully proved its capability to detect blinks, compute the eye aspect ratio, and precisely track eye movements in real-time video streams. The technology could determine the user's blink frequency and gauge their degree of awareness by examining the blink patterns.

The research met its goal of developing an eye blink detector and showing its potential use in a variety of fields. It may be used in driver monitoring systems to avoid accidents brought on by fatigued drivers, improve human-computer interactions, promote intelligent assistive devices, help psychological research, and analyse athletic performance.

Overall, the eye blink detection system performed admirably, providing insightful data about user eye behaviour. It acts as a basis for additional developments and applications in the area of computer vision and HCI.

10. FUTURE SCOPE

Although the existing eye blink detection system has produced encouraging results, there are still several areas that might use development and improvement.

- ***Robustness and Adaptability:*** The system's adaptability to various lighting scenarios, head rotations, and face changes may be improved. To manage occlusions, partial facial views, and differences in eye appearance, the system may be made more effective.
- ***Real-time Performance:*** Additional optimization may be made to raise computational effectiveness and realize real-time performance on low-power gadgets. This would make it possible for the system to be installed on platforms with limited resources, such as embedded devices and cell phones.
- ***Multi-person Tracking:*** Extend the system to handle several faces at once and precisely monitor each person's eye movements. When numerous users or subjects need to be observed at once, this would be quite helpful.

- ***Integration with Other Modalities:*** Investigate the integration of eye blink detection with other physiological or biometric modalities, such as heart rate monitoring or facial

expression recognition. The user's physical and mental condition could be better understood as a result of this.

- ***Deep Learning Approaches:*** Investigate the use of deep learning methods for detecting eye blinks, such as convolutional neural networks (CNNs) or recurrent neural networks (RNNs). These methods have shown encouraging outcomes in comparable challenges and may enhance the system's generalization and accuracy skills.

- ***Extended Applications:*** Explore further fields and applications where eye blink detection may be used, such as security systems, emotion identification, interactions in virtual reality, and neuromarketing studies.

By addressing these potential areas for development, the eye blink detection system may be improved to provide even more precise and adaptable performance, creating new opportunities for its use in a variety of disciplines.

11. BIBILOGRAPHY

→ Rahman, M. Sirshar and A. Khan, "Real time drowsiness detection using eye blink monitoring," 2015 National Software Engineering Conference (NSEC), Rawalpindi, Pakistan, 2015, pp. 1-7, doi: 10.1109/NSEC.2015.7396336. https://ieeexplore.ieee.org/document/7396336

→ Nahar, Lutfun & Palit, Ria & Kafil, Aymun & Mukti, Zinnia & Akter, Shamima. (2019). Real Time Driver Drowsiness Monitoring System by Eye Tracking Using Mean ShiftAlgorithm. 10.1109/ICAEE48663.2019.8975593. https://www.researchgate.net/publication/338169533_Real_Time_Driver_Drowsiness_Monitoring_System_by_Eye_Tracking_Using_Mean_Shift_Algorithm

→ B. R. Ibrahim et al., "Embedded System for Eye Blink Detection Using Machine Learning Technique," 2021 1st Babylon International Conference on Information Technology and Science (BICITS), Babil, Iraq, 2021, pp. 58-62, doi: 10.1109/BICITS51482.2021.9509908. https://ieeexplore.ieee.org/abstract/document/9509908

12. APPENDIX

Code:

```
import datetime
import cv2
import dlib
import gtts
from imutils import face_utils
from scipy.spatial import distance as dist
from winotify import Notification,audio
from playsound import playsound
import random
import tkinter as tk
from  tkinter import ttk
#-------------------------------------
def popupmsg(msg):
    popup = tk.Tk()
    popup.wm_title("Urgent")
```

```
    style = ttk.Style(popup)
    style.theme_use('classic')
    style.configure('Test.TLabel', background='aqua')
    label = ttk.Label(popup, text=msg, style='Test.TLabel')
    label.pack(side="top", fill="x", pady=10)
    B1 = ttk.Button(popup, text="Okay", command=popup.destroy)
    B1.pack()
    popup.mainloop()
def eye_aspect_ratio(eye):

    A=dist.euclidean(eye[1],eye[5])
    B=dist.euclidean(eye[2],eye[4])
    C=dist.euclidean(eye[0],eye[3])
    ear=(A+B)/(2.0*C)
    return ear
def Calc_Ear(frame,gray):
    (lStart, lEnd) = face_utils.FACIAL_LANDMARKS_IDXS["left_eye"]
    (rStart, rEnd) = face_utils.FACIAL_LANDMARKS_IDXS["right_eye"]

    rects = detector(gray, 0)

    # loop over the face detections
    for rect in rects:
        # determine the facial landmarks for the face region, then
        # convert the facial landmark (x, y)-coordinates to a NumPy
        # array
        shape = predictor(gray, rect)
        shape = face_utils.shape_to_np(shape)

        # extract the left and right eye coordinates, then use the
        # coordinates to compute the eye aspect ratio for both eyes
        leftEye = shape[lStart:lEnd]
        rightEye = shape[rStart:rEnd]
        leftEAR = eye_aspect_ratio(leftEye)
        rightEAR = eye_aspect_ratio(rightEye)

        # average the eye aspect ratio together for both eyes
        #  Since eye blinking is performed by both eyes synchronously, the EAR of
both eyes is averaged.
        ear = (leftEAR + rightEAR) / 2.0

        # compute the convex hull for the left and right eye, then
        # visualize each of the eyes
        leftEyeHull = cv2.convexHull(leftEye)
        rightEyeHull = cv2.convexHull(rightEye)
        cv2.drawContours(frame, [leftEyeHull], -1, (0, 255, 0), 1)
        cv2.drawContours(frame, [rightEyeHull], -1, (0, 255, 0), 1)

        return ear
timediff=datetime.datetime.now()
def time_interval_passed():
    global timediff
    time_delta=datetime.datetime.now()-timediff
    seconds_passed=time_delta.total_seconds()
    if(seconds_passed>=20):
        timediff=datetime.datetime.now()
        return True
def NotifyLess():
    speech = gtts.gTTS("Hi You are Blinking Less than an Average Guy Blinks in a
Minute...So just Blink Up")
    sp2 = gtts.gTTS("I Think You are In Sleep or Not Attentive to Work So Either
WakeUp From Sleep Or Blinkup")
    sp2.save("output3.mp3")
    speech.save("output2.mp3")
    playsound("output2.mp3")
    playsound("output3.mp3")
    popupmsg("I Think You are In Sleep or Not Attentive to Work So Either WakeUp
```

```
From Sleep Or Blinkup")
    benefits = [
        "Blinking keeps our eyes hydrated, preventing dryness and promoting optimal
visual clarity.",
        "Through blinking, we naturally remove dust particles and debris,
maintaining a clean and clear line of sight.",
        "Blinking is an essential part of eye hygiene, flushing out irritants and
keeping our eyes comfortable.",
        "With each blink, we promote proper tear film distribution, ensuring
efficient lubrication of our eyes.",
        "Blinking helps to reduce eye strain and eye fatigue, allowing us to sustain
focus for longer periods.",
        "The act of blinking refreshes our eyes, revitalizing our visual perception
and enhancing our awareness.",
        "By blinking, we prevent the eyes from becoming dry and itchy, providing
relief and promoting comfort.",
        "Blinking is a natural mechanism that helps to regulate the brightness of
the light we perceive.",
        "Through blinking, we maintain the integrity of our cornea, protecting it
from potential damage or abrasions.",
        "Blinking is like a gentle reset button for our eyes, restoring their
balance and promoting visual well-being.",
        "With every blink, we ensure a continuous supply of oxygen to our eyes,
supporting their overall health.",
        "Blinking helps to reduce eye irritation and redness, keeping our eyes
looking fresh and vibrant.",
        "The act of blinking provides a brief pause in our visual journey, allowing
us to appreciate the beauty around us.",
        "Through blinking, we promote the natural production and flow of tears,
contributing to eye health.",
        "Blinking is a natural reflex that helps to prevent the eyes from becoming
dry and uncomfortable.",
        "With each blink, we protect our eyes from potential infections by washing
away harmful microorganisms.",
        "Blinking helps to regulate the amount of light that enters our eyes,
preventing overexposure and discomfort.",
        "The act of blinking gives our eyes a momentary break, reducing eye strain
and promoting relaxation.",
        "Through blinking, we improve the overall comfort and well-being of our
eyes, enhancing our quality of life.",
        "Blinking is an essential part of maintaining healthy vision, ensuring
optimal eye function throughout the day.",
        "With every blink, we promote the even distribution of tears, preventing dry
spots and maintaining clarity.",
        "Blinking acts as a natural defense mechanism, protecting our eyes from
foreign objects and potential injuries.",
        "The act of blinking helps to regulate the moisture levels in our eyes,
preventing dryness and irritation.",
        "Through blinking, we prevent the buildup of eye mucus, maintaining a clear
and comfortable visual experience.",
        "Blinking is like a gentle massage for our eyes, relieving tension and
promoting relaxation.",
        "With each blink, we create a protective barrier that shields our eyes from
harmful environmental factors.",
        "Blinking helps to prevent eye fatigue and supports our ability to maintain
focus and concentration.",
        "The act of blinking ensures that our eyes receive a constant supply of
nutrients, promoting their vitality.",
        "Through blinking, we enhance the efficiency of our tear drainage system,
maintaining optimal eye health.",
        "Blinking serves as a natural reflex that helps to prevent the eyes from
becoming dry and irritated.",
        "With every blink, we allow our eyes to rest and recover, reducing strain
and promoting visual comfort.",
        "Blinking is a natural mechanism that helps to protect the delicate tissues
of our eyes from damage.",
        "The act of blinking helps to prevent the evaporation of tears, keeping our
```

```
eyes moist and comfortable.",
        "Through blinking, we improve the stability of our tear film, ensuring a
smooth and clear visual experience."]
    toast = Notification(app_id="Strain Alert",
                         title="Hey Man! You Are Blinking Less than the Average Guy
Blinks in a Minute",
                         msg=benefits[random.randrange(0, len(benefits))],
                         duration="long",
                         icon='C:/Users/saic3/PycharmProjects/flaskProject/Pic.jpg')
    toast.set_audio(audio.LoopingAlarm2, loop=True)
    toast.add_actions(label="Just Blink Up!! Man Learn More About Blinking",
                      launch="https://www.spindeleye.com/blog/2017/03/the-
importance-of-blinking/")
    toast.show()
def NotifyMore():
    speech = gtts.gTTS(
        "Hi You are Blinking More than an Average Guy Blinks in a Minute...Looks
Like Stressed.. So I Advise You To Take Some Rest")
    speech.save("output1.mp3")
    playsound("output1.mp3")
    popupmsg("Take Rest For a While")
    disadvantages = [
        "Blinking can momentarily disrupt our focus and attention.",
        "Excessive blinking can be a sign of eye strain or fatigue.",
        "Frequent blinking may be associated with nervousness or anxiety.",
        "Rapid blinking can cause eye irritation and redness.",
        "Blinking can interrupt our visual perception, especially during critical
moments.",
        "Prolonged periods of blinking can lead to missed visual information.",
        "Blinking may cause temporary blurring of vision.",
        "In certain situations, excessive blinking can be distracting to others.",
        "Frequent blinking can be a symptom of certain medical conditions or
allergies.",
        "Blinking may contribute to a feeling of eye dryness or discomfort.",
        "Intense blinking can disrupt eye contact during social interactions.",
        "Rapid blinking can cause mascara or eye makeup to smudge.",
        "Excessive blinking may be perceived as a sign of nervousness or
dishonesty.",
        "Blinking can temporarily obscure our view, especially when driving or
operating machinery.",
        "Frequent blinking can be a result of digital eye strain from prolonged
screen use.",
        "Rapid blinking may lead to eye fatigue and tiredness.",
        "Intense blinking can cause temporary sensitivity to light.",
        "Frequent blinking can interfere with concentration and productivity.",
        "Excessive blinking can draw unnecessary attention to the eyes.",
        "Blinking can momentarily interrupt the continuity of visual information
during activities such as reading or studying.",
        "Rapid blinking can create a sense of visual instability or inconsistency.",
        "Frequent blinking can be a result of eye allergies or irritants in the
environment.",
        "Blinking may cause temporary interruption of eye contact during important
conversations.",
        "Excessive blinking can contribute to a sense of eye strain or eye
heaviness.",
        "Intense blinking can disrupt the application of eye drops or contact
lenses.",
        "Frequent blinking can be a symptom of certain eye disorders or
conditions.",
        "Blinking can temporarily obstruct our view during precise tasks, such as
threading a needle.",
        "Rapid blinking can cause eye makeup to smudge or smear.",
        "Excessive blinking can create a sense of self-consciousness or discomfort
in social settings.",
        "Blinking may disrupt the flow of visual information during activities such
as watching a movie or playing a video game.",
        "Frequent blinking can lead to temporary loss of visual continuity or
```

```
smoothness.",
        "Intense blinking can cause temporary eye strain or eye fatigue.",
        "Blinking can temporarily obstruct our view of important details or
objects.",
        "Excessive blinking can contribute to a sense of eye dryness or itchiness.",
        "Rapid blinking may create a sense of visual distraction or distortion.",
        "Frequent blinking can interfere with the effectiveness of eye-tracking
technologies.",
        "Blinking can momentarily interrupt the accuracy of eye measurements during
eye exams.",
        "Intense blinking can disrupt the visibility of subtle facial expressions.",
        "Excessive blinking can lead to a sense of self-consciousness or
embarrassment.",
        "Blinking may cause temporary interruption of visual continuity during
activities such as playing sports or driving.",
        "Frequent blinking can be a result of exposure to bright lights or glare.",
        "Rapid blinking can cause temporary changes in visual perception, such as
flickering or dimming.",
        "Excessive blinking can contribute to a feeling of eye strain or eye
tiredness.",
        "Blinking may cause temporary interruption of eye contact during important
presentations or public speaking.",
        "Intense blinking can disrupt the application of eye makeup or cosmetic
products.",
        "Frequent blinking can be a symptom of dry eye syndrome or other ocular
surface disorders.",
        "Blinking can momentarily obstruct our view of fast-moving objects or
events."
    ]
    toast = Notification(app_id="Strain Alerter(Desktop-Version)",
                         title="Hey Man! You Are Blinking More than the Average Guy
Blinks in a Minute",
                         msg=disadvantages[random.randrange(0, len(disadvantages))],
                         duration="long",
                         icon='C:/Users/saic3/PycharmProjects/flaskProject/Pic.jpg')
    toast.set_audio(audio.LoopingAlarm6, loop=True)
    toast.add_actions(label="Just Blink Up!! You Might Be Suffering With Some More
Stress So Try To Get Assistance",
                      launch="https://www.healthline.com/health/eye-health/eye-
blinking")
    toast.show()

#-------------------------------------------

#Defining All Static Variables for Capturing and Detection
detector=dlib.get_frontal_face_detector()
predictor=dlib.shape_predictor('Shape_Predictor_68.dat')
Capture=cv2.VideoCapture(0)
Counter=0
totalBlinks=0
EYE_AR_THRESH=0.22
EYE_FRAMES_MIN=2
EYE_FRAMES_MAX=5
EYE_THRESH=10

#-------------------------------------------------------------------------------------
-
#The Main Loop
while True:
    ret,frame=Capture.read()
    gray=cv2.cvtColor(frame,cv2.COLOR_RGB2GRAY)
    #Defining Constraint's For Blinking
    if(time_interval_passed()):
        if(totalBlinks<12):
            NotifyLess()
            totalBlinks=0
        elif(totalBlinks>36):
```

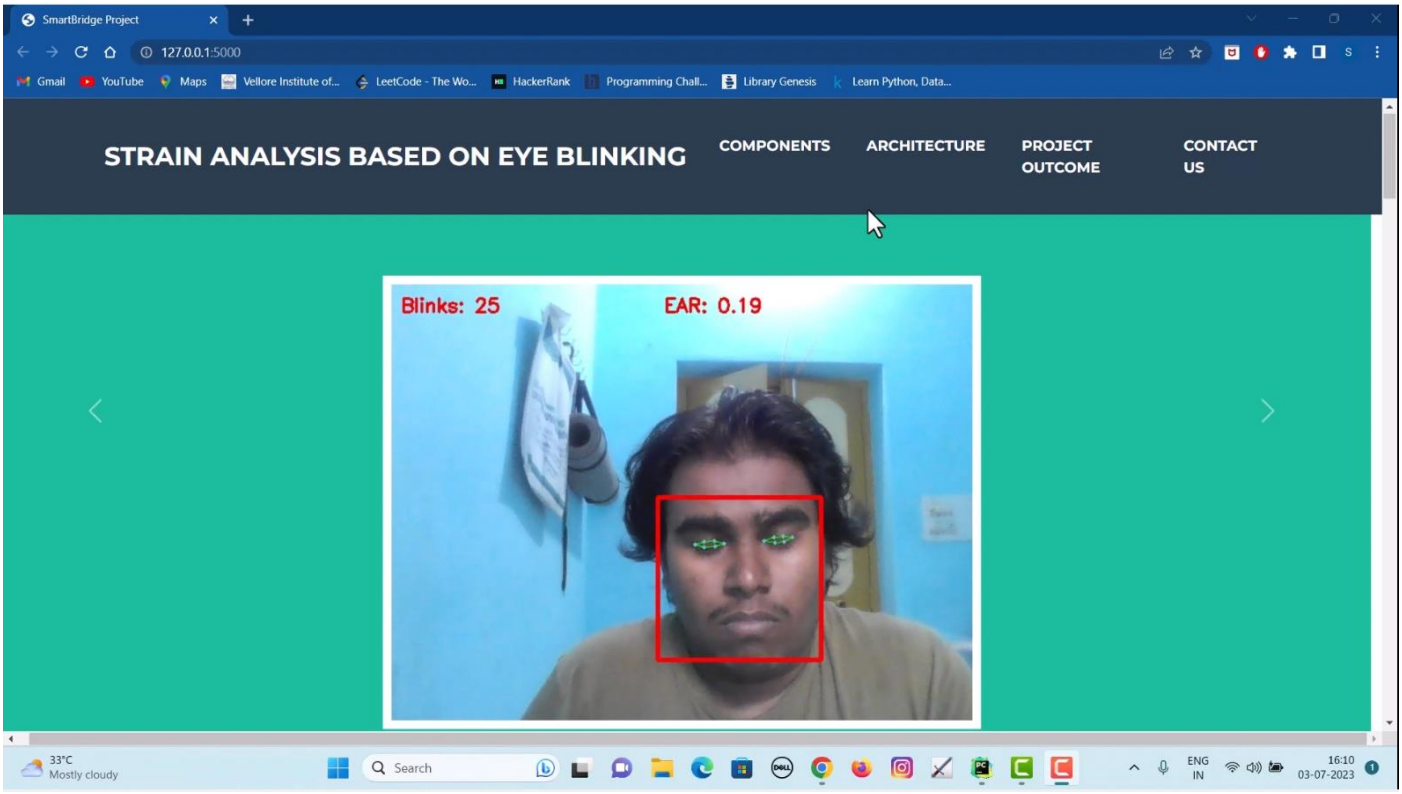
```
            NotifyMore()
            totalBlinks=0
        totalBlinks=0
    EAR=Calc_Ear(frame,gray)
    if EAR is not None:
        if EAR<EYE_AR_THRESH:
            Counter+=1
        else:
            if Counter>=EYE_FRAMES_MIN and Counter<=EYE_FRAMES_MAX:
                totalBlinks+=1
            Counter=0
        cv2.putText(frame,"Blinks:
{}".format(totalBlinks),(10,30),cv2.FONT_HERSHEY_SIMPLEX,0.7,(0,0,255),2)
        cv2.putText(frame,"EAR:
{:.2f}".format(EAR),(300,30),cv2.FONT_HERSHEY_SIMPLEX,0.7,(0,0,255),2)
    cv2.imshow("Frame",frame)
    if cv2.waitKey(1)==ord('q'):
        break
Capture.release()
cv2.destroyAllWindows()
```

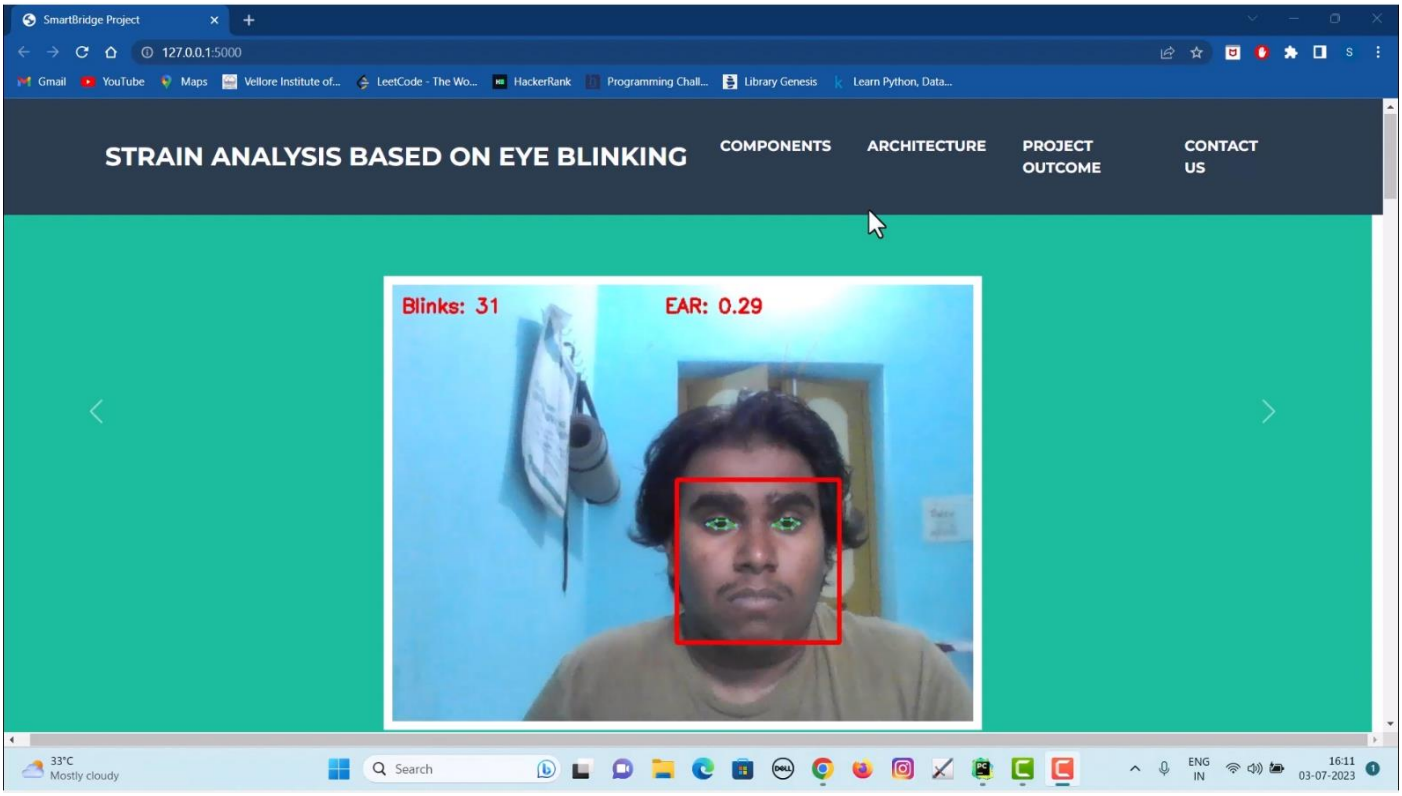
ScreenShots:

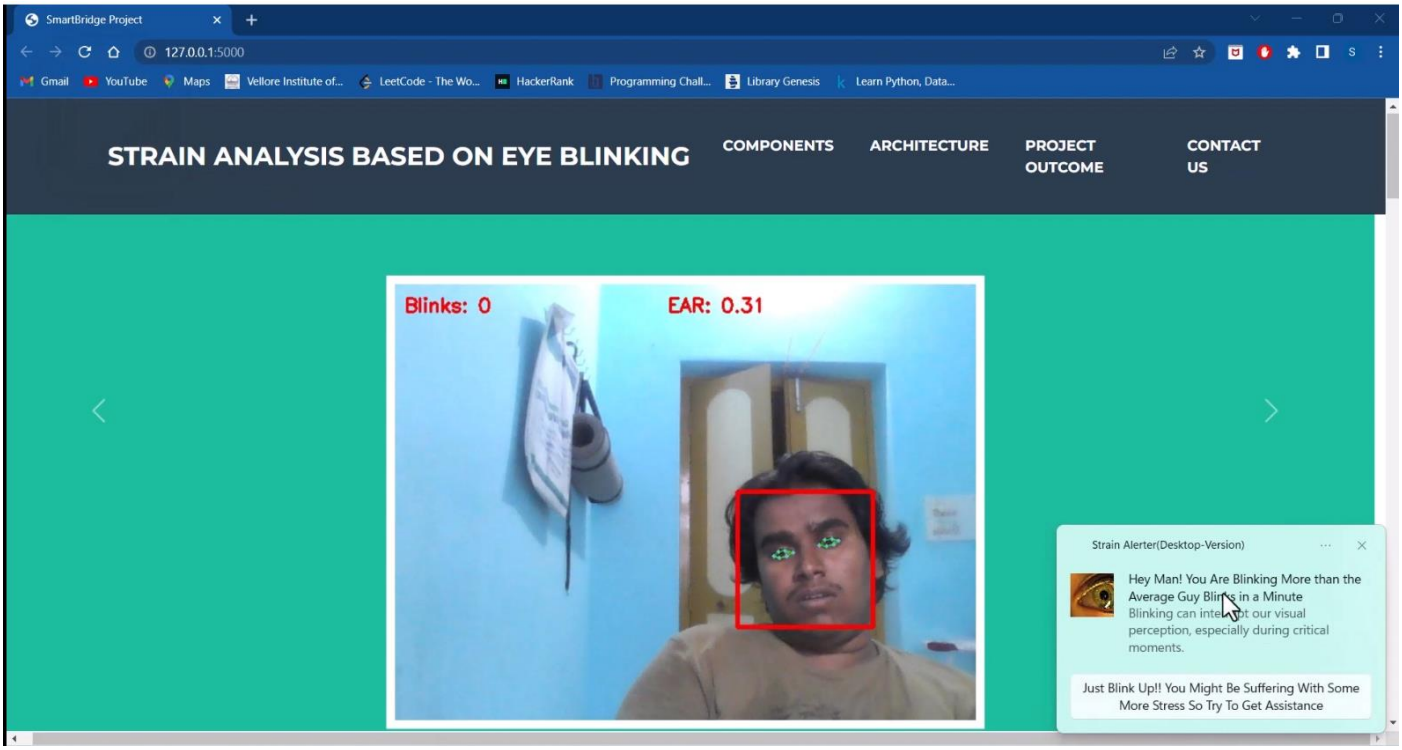
```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\saic3> cd D:\
PS D:\> cd '.\Strain Analysis Based On Eye Blinking\'
PS D:\Strain Analysis Based On Eye Blinking> python -m venv ./venv
PS D:\Strain Analysis Based On Eye Blinking> pip install --upgrade pip
Requirement already satisfied: pip in c:\users\saic3\appdata\local\programs\python\python311\lib\site-packages (23.1.2)
PS D:\Strain Analysis Based On Eye Blinking> pip install --upgrade setuptools wheel
Requirement already satisfied: setuptools in c:\users\saic3\appdata\local\programs\python\python311\lib\site-packages (68.0.0)
Requirement already satisfied: wheel in c:\users\saic3\appdata\local\programs\python\python311\lib\site-packages (0.40.0)
PS D:\Strain Analysis Based On Eye Blinking> pip install -r requirements.txt
```


SmartBridge Project
127.0.0.1:5000
Gmail
YouTube
Maps
Vellore Institute of...
LeetCode - The Wo...
HackerRank
Programming Chall...
Library Genesis
Learn Python, Data...
STRAIN ANALYSIS BASED ON EYE BLINKING
COMPONENTS
ARCHITECTURE
PROJECT OUTCOME
CONTACT US
Blinks: 25
EAR: 0.19
33°C
Mostly cloudy
Search
ENG
IN
16:10
03-07-2023


SmartBridge Project
127.0.0.1:5000
Gmail
YouTube
Maps
Vellore Institute of...
LeetCode - The Wo...
HackerRank
Programming Chall...
Library Genesis
Learn Python, Data...
STRAIN ANALYSIS BASED ON EYE BLINKING
COMPONENTS
ARCHITECTURE
PROJECT OUTCOME
CONTACT US
Blinks: 31
EAR: 0.29
33°C
Mostly cloudy
Search
ENG
IN
16:11
03-07-2023

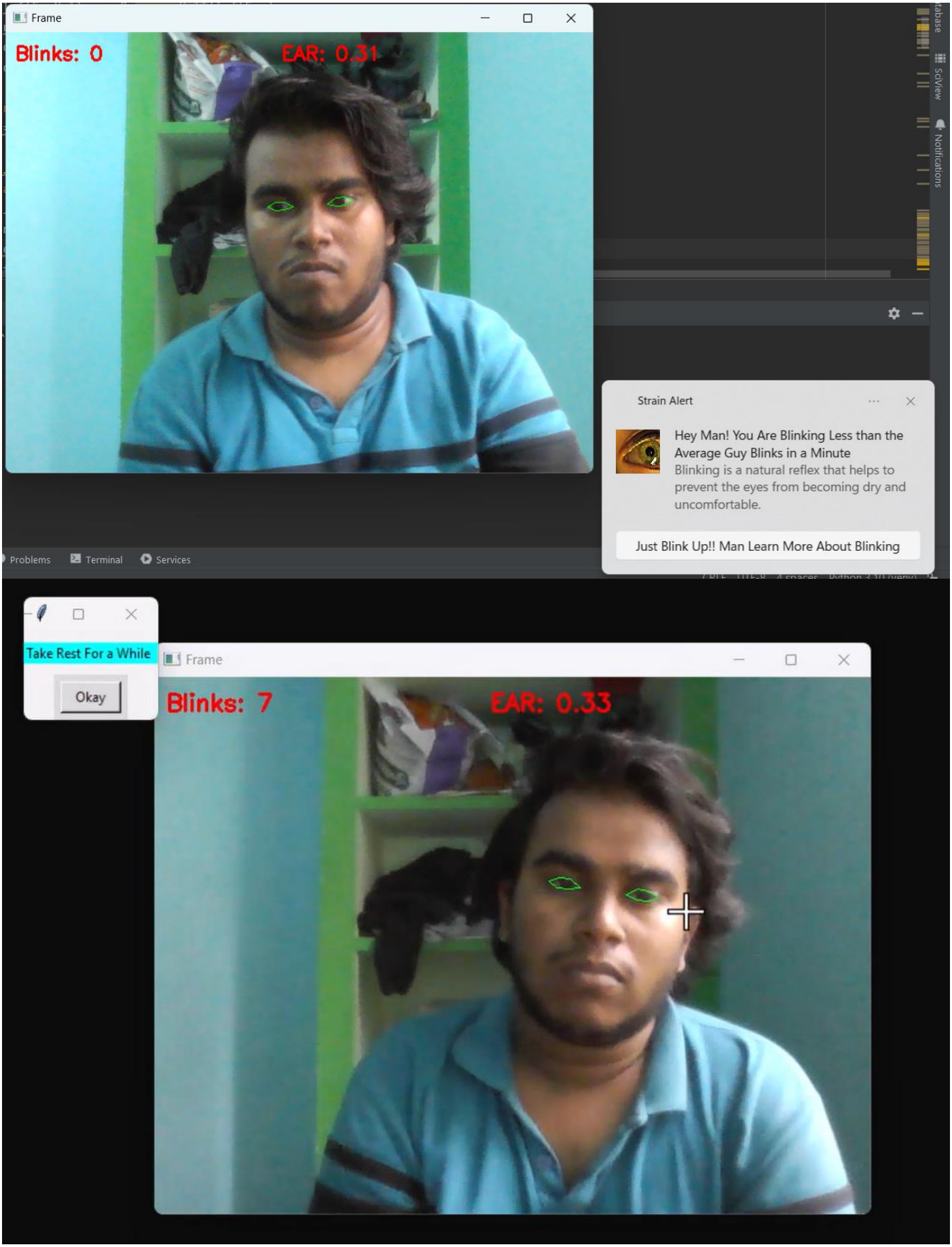

SmartBridge Project
127.0.0.1:5000
Gmail
YouTube
Maps
Vellore Institute of...
LeetCode - The Wo...
HackerRank
Programming Chall...
Library Genesis
Learn Python, Data...
STRAIN ANALYSIS BASED ON EYE BLINKING
COMPONENTS
ARCHITECTURE
PROJECT OUTCOME
CONTACT US
Blinks: 0
EAR: 0.31
Strain Alerter(Desktop-Version)
Hey Man! You Are Blinking More than the Average Guy Blinks in a Minute
Blinking can interrupt our visual perception, especially during critical moments.
Just Blink Up!! You Might Be Suffering With Some More Stress So Try To Get Assistance

STRAIN ANALYSIS BASED ON EYE BLINKING

COMPONENTS ARCHITECTURE PROJECT OUTCOME CONTACT US

LIVE-VIDEO-CAPTURE

LIVE-VIDEO-CAPTURE


Frame
Blinks: 0
EAR: 0.31
Strain Alert
Hey Man! You Are Blinking Less than the Average Guy Blinks in a Minute
Blinking is a natural reflex that helps to prevent the eyes from becoming dry and uncomfortable.
Just Blink Up!! Man Learn More About Blinking
Problems
Terminal
Services
Take Rest For a While
Okay
Frame
Blinks: 7
EAR: 0.33

```
PS D:\Strain Analysis Based On Eye Blinking> python app_eye.py
```