A Mini Project Report on

DROWSINESS DETECTION SYSTEM

Submitted in partial fulfilment for the degree of Bachelor of Technology in Computer Science and Technology

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CERTIFICATE

This is to certify that **Bhakti Dwivedi, Simran Gupta,Vaishnavi Kadam** has successfully completed minor project work on **Drowsiness Detection System** in the partial fulfillment for the bachelor's degree in **Computer Science and Technology** during the year 2022-23 as prescribed by SNDT Women's University.

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EXAMINAR 1

EXAMINAR 2

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0.1 ABSTRACT

The word "drowsiness" refers to the feeling of being sleepy or drowsy. A person who is drowsy could feel worn out or lethargic and struggle to stay awake. Those who are sleepy tend to be less vigilant and may even nod off, but they can still be awakened.

The primary goal of drowsiness detection systems is to prevent accidents caused by driver fatigue, which is a major cause of road accidents worldwide. These systems have been widely adopted by the automotive industry and are now integrated into many modern vehicles. They are also used in other industries, such as aviation and transportation, where driver alertness is critical to safety.

Drowsiness detection systems are needed to detect and alert users. This report proposes a model of detecting the user's drowsiness using the Convolution Neural Networks (CNN). This report proposes an efficient method for drowsiness detection by two phases: facial features detection and eye tracking. A light-weight, real time user's drowsiness detection system is developed and implemented. The implementation of this system is mainly towards drivers, students and security guards.

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Chapter 1

INTRODUCTION

Nowadays Driver fatigue is a major factor in a large number of vehicle accidents. Recent statistics estimate that annually 1,200 deaths and 76,000 injuries can be attributed to fatigue related crashes. The development of technologies for detecting and avoiding drowsiness at the wheel is a major challenge in the field of accident-avoidance systems. Because of the hazard that drowsiness presents on the road, methods need to be developed for counteracting its effects.

Drowsiness detection is a safety technology that can prevent accidents that are caused by drivers who fell asleep while driving. Not only limited to the drivers, this system can also be used by watchmen as they fall asleep and various mishaps take place. Students, while studying, often fall asleep. This system will help them stay alert and focus on their studies. The system will detect the early symptoms of drowsiness before the user has fully lost all attentiveness and warn the user that they are no longer capable of operating the vehicle safely or are lacking in their task.

This project "drowsiness detection" is based on concepts of artificial intelligence and lies in the fields of computer vision and machine learning. The algorithms used in the project are based on deep learning concepts. Computer vision is the field of artificial intelligence that enables systems and computers to obtain information from digital images, videos or any other visual inputs. A neural network with three or more layers is a neural network, and deep learning is a subset of machine learning. Although they fall far short of being able to match the human brain's capabilities, these neural networks make an effort to mimic its activity and enable it to "learn" from massive amounts of data.

For the first part of the aim, we will use a famous facial detection algo-

rithm, the Viola Jones algorithm. It has two steps, training and detection. The image is first converted into grayscale as that format has less data to process. The algorithm detects the face on grayscale and is then converted into coloured. It outlines a box, searches for a face within the box - or more like it searches for Haar-like features. After the above process we move on to the extraction of the facial region which we execute using the Convolution Neural Network (CNN) algorithm. The CNN algorithm is a particularly constructed algorithm in deep learning based in the domain of computer vision that can take in an input image, assign importance (weights and biases) to objects, and differentiate one from another.

1.1 Problem Statement

While engaging in tasks that require constant concentration, like driving a car, studying online being drowsy might be risky. Driving when sleepy increases drowsiness, which increases the risk of accidents. The main challenge is detecting the user's condition and deciding whether or not they are drowsy. The primary idea of this project is to create a deep learning-based alert system i.e. drowsiness detection system. The objective is to create a tool that can accurately assess whether or not a user is sleepy. The concept majorly impacts the automotive industry, improving driving safety and reducing the number of fatalities brought on by drowsy driving.

In this project, we aim to design and develop a web based application where the user can start the detection by clicking on the Start button.

By using this system the user can detect their state of drowsiness and prevent from accidents/distractions.

Chapter 2

Literature Survey

2.1 Technical Papers

A literature survey, also known as a literature review, is an essential part of research that involves a comprehensive analysis and synthesis of previously published research on a specific topic. The purpose of a literature survey is to identify gaps in knowledge, assess the state of research, and provide a foundation for further research.

Throughout the research phase, we looked on to various research papers and articles citing about drowsiness detection system. Amongst all wee selected 6 papers for the success-full completion of this project. The Research Paper No. 3 is the base of this project, as it used Machine Learning techniques and deep learning for training the model. All the research papers were very insightful and helped us in the proper understanding of the problem and creating an effective solution for it.With the help of research papers we were able to design the architecture of our model. The following table provides an overview of this Literature survey:

No.	Paper Name,Author(s),Year of Publishment	Methodology and Technologies	Observations/Findings and Remarks
1	Driver drowsiness detection using ANN image processing Vesselenyi, T., Moca, S., Rus, A., Mitran, T., Tătaru, B. Year: 2017	This paper has 3 types of methods that are used for detecting drowsiness of drivers using ANN image processing. They are: driver image analysis, EOG signal processing and EEG. It is related to pictures captured during driving and analysing the driver 's eyes that are opened or closed or half-opened.	The classification success rate was increased with the training of the respective networks. Cropping of images and down sampling is not possible for image processing.
2	Fatigue state detection based on multi-index fusion and state recognition network Y. Ji, S. Wang, Y. Zhao, J. Wei, and Y. Lu Year: 2019	This paper has built a drowsy situation recognition-based technique. Firstly, the human face will be detected using MTCNN (multitask convolutional neural network). Some open-source libraries were used for locating the facial points with help of DLIB that is used to extract the drowsiness symptoms.	This technique has a 93 percent average accuracy rate in identifying essential facial features. Creating an information fusion model and gathering different types of information is challenging.

3	Comparative Analysis of Driver Drowsiness Detection using Machine Learning Techniques Neha Bhondve, Ashutosh Dalvi, Vinit Dhande, Neerav Bhamare, Prof. Shikha Pachouly Year: 2019	The system uses images for detection of drowsiness using machine learning. Metrics such as eye closure analysis, eye blink rate are considered. A model will be constructed using CNN and a dataset containing the images of the driver. This dataset will contain both drowsy as well as non-drowsy images. Once the model is trained, the system will start capturing images of the driver while driving.	This technique has a 95.18 percent average accuracy rate in identifying essential eye features and is also reliable and accurate. The result can be affected by the lighting conditions and presence of sunglasses /spectacles can interrupt the functioning.
4	Real-Time Fatigue Detection System using Computer Vision Rishika Tiwari, Drashti Patel, Shruti Pandey, Prof. Rushikesh Nikam Year: 2020	The system works on Computer vision. It has been proposed using Image Processing and Machine Learning. It focuses mainly on facial expressions. It has 5 stages - Face detection, Facial landmark detection, Feature extraction, Eye closure status, Lip opening status for yawn detection.	The results are accurate and reliable for detection of eyes and mouth. It extracts and detects the features in real-time.System provides a 90.88 percent average accuracy rate. There are chances some frames will be missed and not fulfil in real- time category.

5	Real-time driver drowsiness detection system based on convolutional neural network. Hashemi, M., Mirrashid, A., Beheshti Shirazi, A. Year: 2020	This system holds a stream of frames in its initial phase. Coming to the pre-processing unit, the system landmarks facial points to access ROI in the image. And the eye region is selected. And that will be input to the FDNN network which classifies whether the person is drowsy or not.	FDNN, VGG-16, VGG-19 gives an accuracy of 98.15percent,95.45percent and 94.96percent respectively. The parameters extracted with good performance will require larger datasets using more hidden layers of deeper networks.
6	Intelligent Driver Drowsiness Detection for Traffic Safety Based on Multi CNN Deep Model and Facial Subsampling. M. Ahmed, S. Masood, M. Ahmad, and A. A.A. El-Lati Year: 2021	An ensemble model is proposed which consists of two modules that will feature extraction of eyes along with mouth samples that were taken with MTCNN from face pictures and the result of the system determines if the driver is drowsy or not.	Precision, sensitivity, and F1 scores are 97.38percent, 97.54percent, 99.2percent, and 97.46percent,respectively, for the overall training. Face detection is not always possible for working with maximum accuracy on all samples of input and also there are some chances of missing frames that can contain important data.

Table 2.1: Literature Survey

2.2 EXISTING SYSTEM

Drowsiness detection systems are designed to monitor a driver's level of attentiveness to prevent accidents caused by driver fatigue or drowsiness. There are several existing systems of drowsiness detection that use various technologies to detect the signs of driver fatigue. Some of the common technologies used in drowsiness detection systems include:

1. Eye-Tracking Systems: Eye-tracking systems are used to detect signs of drowsiness by tracking eye movements. These systems use cameras and sensors to track the frequency and duration of eye closure, eye blink rate, and eye movement patterns. If a driver's eye-closure duration is longer than a predetermined threshold, the system will issue an alert to wake the driver up.

2. Steering Wheel Sensors: Steering wheel sensors can detect a driver's level of attentiveness by measuring steering wheel movements. These sensors monitor the driver's grip on the steering wheel and detect any changes in the driver's grip, such as a decrease in pressure. If the system detects that the driver's grip on the steering wheel has decreased, it will send an alert to the driver.

3. Facial Expression Analysis: Facial expression analysis systems use cameras to analyze facial features, such as mouth movement and head posture, to detect signs of drowsiness. If a driver's mouth is consistently open or their head is drooping, the system can issue an alert.

4. EEG (Electroencephalogram) Systems: EEG systems measure brain activity to detect changes in a driver's level of alertness. These systems use electrodes attached to the driver's scalp to monitor the brain's electrical activity. These systems measure brainwave patterns to determine if a driver is experiencing drowsiness or fatigue.

5. Smartphone-Based Systems: Some drowsiness detection systems use smartphones to detect signs of drowsiness. These systems use smartphone sensors to detect the driver's head position, motion, and facial expressions. If the system detects signs of drowsiness, it can issue an alert.

6. Heart Rate Monitors: Some drowsiness detection systems use heart rate monitors to detect any signs of drowsiness. These systems monitor the driver's heart rate and detect any changes in the heart rate, such as a decrease in the heart rate. If the system detects that the driver's heart rate has decreased, it will send an alert to the driver.

Chapter 3

PROPOSED SYSTEM

The proposed system for drowsiness detection consists of various steps using deep learning libraries and use of convolution networks. The details of each step are provided below:

Step 1: In the first step, the video is extracted through webcam using OpenCV and then the video is divided into frames.

Step 2: Process of conversion of image to grayscale has been held for faster processing using open CV. After converting into grayscale,region of interest is calculated i.e., Face.

Step 3: Use the ROI to find the eyes and feed them to the classifier. The technique for detecting eyes is the same as for detecting ears. HaarCascade classifier is used in left and right eyes.

Step 4: The CNN classifier will determine whether or not the eyes are open. The eye status is predicted using a CNN classifier to feed the image into the model.

Step 5: If eyes are closed beyond the score 15 then system will sound an alarm using the play sound library to alert the driver, else more frames to process.

3.1 Workflow of Project

The camera in front the driver is started, then the current frame is extracted and the face is detected. After detection of face, eyes are being monitored continuously. The system calculates the score and then compares it. If the score increases and gets above 16, the model takes the decision to alert by alarming.

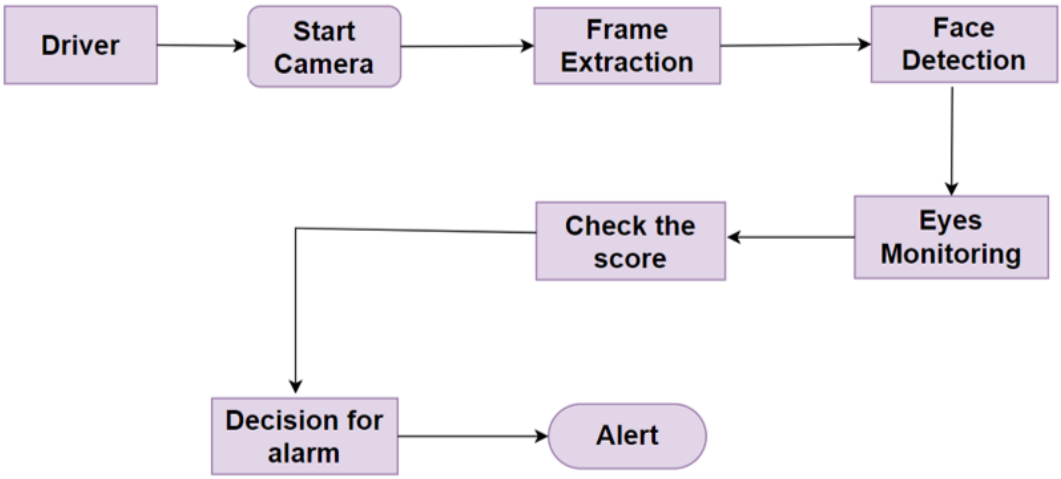

Figure 3.1: Workflow

Chapter 4

ARCHITECTURE OVERVIEW

There exists a CNN Module which is been trained and fed with dataset of eye's images i.e open and closed eyes The flow of the system is: The camera detects the face and sets a frame and then the eyes are been tracked continuously. If the CNN classifier detects drowsiness (i.e closed eyes) it then alerts by alarming the driver, and if not the camera tracks continuously and repeats the same process.

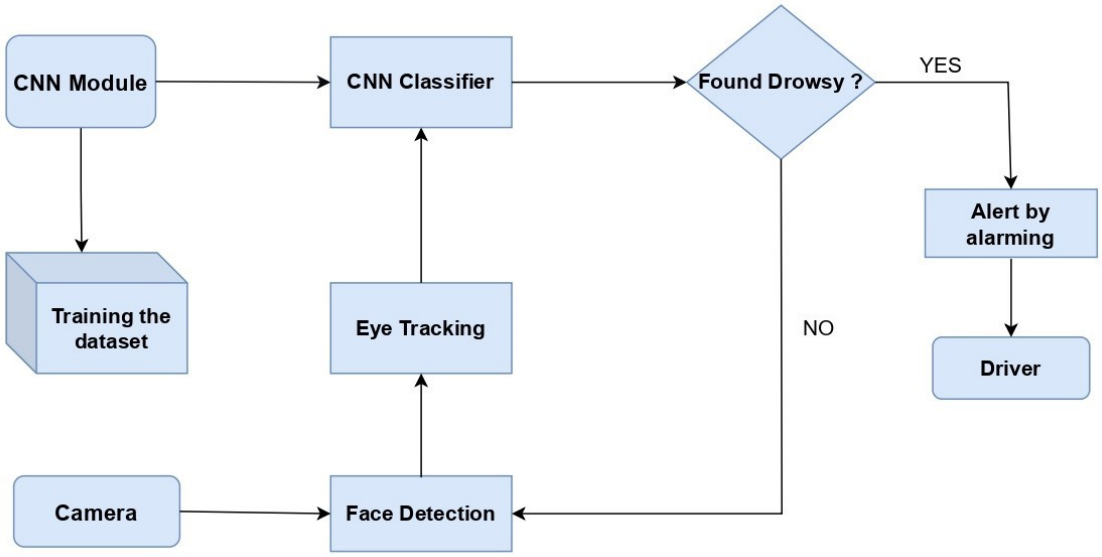

Figure 4.1: Architecture

Chapter 5

HARDWARE AND SOFTWARE REQUIREMENT

5.1 Hardware Specification

- System Processor: Pentium IV processor or higher.
- RAM: Minimum 64 MB primary memory.
- Hard disk: Minimum 1 GB hard disk space.
- Display: SVGA Monitor
- Key board: Windows compatible.
- Web Camera.

5.2 Software Requirements

- Operating System : Windows 7 or above
- Programming language: Python
- Python Libraries: OpenCV, PlaySound, Keras, TensorFlow,PyGame
- Frontend: Html, CSS
- Framework: Flask
- Tool: Jupyter Notebook,VsCode

Chapter 6

IMPLEMENTATION OF PROJECT

6.1 User Interface

We have created a user interface for the users to provide smooth and friendly access to the system.

The user first visits the webapp, where a he sees a beautiful page displaying the start button for detection and a quote written with a marquee, "You sneeze, It Beeps!", this is shown in Interface Screenshot below.

Once the user clicks on the"Start" button on the interface, the camera starts and ultimately the eyes tracking begins.

6.2 Model Training

Step 1: Data Collection - Data is collected using a camera that captures the driver's facial features, etc. A dataset is collected of images or videos of drivers exhibiting both drowsy and alert states. This dataset is obtained from Kaggle, by collecting data through surveys or experiments.

Step 2: Data Preprocessing - The dataset is pre-processed by resizing the images to a standard size, converting them to grayscale, and normalizing the pixel values.The collected data is normalized and prepared for input into the CNN model.

Step 3: Training Set and Validation Set Split - Splitting the pre-processed dataset into a training set and validation set. The training set will be used to train the CNN, while the validation set will be used to validate the model's performance during training.

Step 4: CNN Model - The CNN model is trained on the preprocessed data to detect patterns in the driver's facial features and eye movements

that are indicative of drowsiness. The model consists of several convolutional layers, pooling layers, and fully connected layers.

Step 5: Training the Model - The CNN model is trained using the training set by optimizing the model parameters with a suitable loss function and backpropagation algorithm. The validation set is used to monitor the model's performance and prevent overfitting.

Step 6: Testing - The trained CNN model is tested and validated on new data to evaluate its performance. The performance metrics used depend on the specific requirements of the system, and includes accuracy, precision, recall, and F1 score.

Step 7: Implementation - Once the model is validated, it is integrated into the drowsiness detection system. The system continuously monitors the driver's facial features and eye movements, and uses the CNN model to detect drowsiness in real-time. If the driver is detected as being drowsy, the system would alert the driver and potentially take action to prevent an accident, by sounding an alarm.

6.3 Main Program Explanation

We use OpenCV to take images from a webcam and these images given to a deep learning algorithm that can tell whether someone's eyes are closed or opened. In this case, we are looking for the persons face and eyes.

Step 1: Image is taken as input from camera - We'll use a camera to capture photographs as input. But, in order to gain access to the webcam, we created an endless loop that captures each frame. We employ the cv2 method given by OpenCV.

Step 2: Create a ROI by detecting a face in the picture - To segment the face in the captured image, we first converted it to gray scale because, the OpenCV object detection algorithm only accepts grayscale images as input. To detect the objects, we don't need colour detail. We use the Haar cascade classifier to detect the face. The classifier face = cv2.Cas is set with this section. for (x,y,w,h)infaces,we use cv2.rectangle(frame, (x,y), (x+w, y+h), (100,255,100), 1

Step 3: Use the ROI to find the eyes and feed them to the classifier - The technique for detecting eyes is the same as for detecting ears. Cascade classifier is used in left and right eyes. Then, use

$\text{left}_eye = leye.detectMultiScale(gray)todetecttheeyes.$

We extracted only the details of eyes from the captured image. This can be done by first removing the eye's boundary box and then using this code to remove the eye image from the picture. $l_eye = frame[y : y + h, x : x + w]$.

This information is given to CNN, which decides whether the eyes are closed or not. The right eye also detected in the above manner.

Step 4 – The classifier will determine whether or not the eyes are open - The eye status is predicted using a CNN classifier to feed the image into the model, since the model requires the proper measurements to begin with. We begin by converting the colour picture to grayscale.

$r_eye = cv2.cvtColor(r_eye, cv2.COLOR_BGR2GRAY)$.

Then, since the model is trained on images with a resolution of 24*24 pixels, We resize the image to 24*24pixels. cv2.resize (r_eye, (24, 24)).

For better convergence, the date is normalized, $r_eye = r_eye/255$.

The model is loaded. Now, each eye is predicted with the proposed model, lpred=model.predict$_classes(l_eye)$.

If lpred[0] = 1, it means that eyes are open, if lpred[0] = 0 then, it means that eyes are closed.

Step 5: The score is essentially a number that we'll use to figure out how long the individual has been closed-eyed - As a consequence, if both eyes are closed, we will begin to raise the score, but if both eyes are open, we will decrease the score. We're using the cv2.putText() function to draw the result on the screen, which displays the status of the person. cv2.putTxt(frame,"Open",(10,height20), font,1,(255,255,255),1,cv2.LINE$_AA$).

A criterion is established, for example, if the score exceeds 15, it indicates that the person's eyes have been closed for an extended amount of time. Then the alarm turned on.

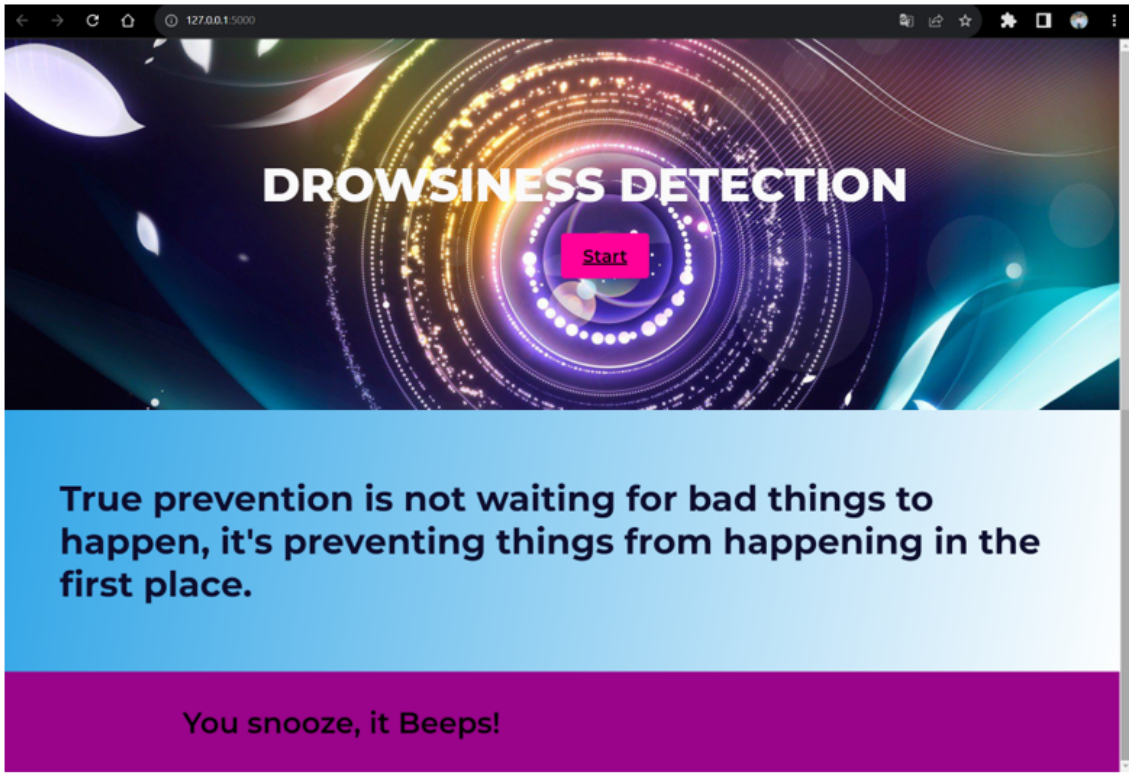

Figure 6.1: User Interface

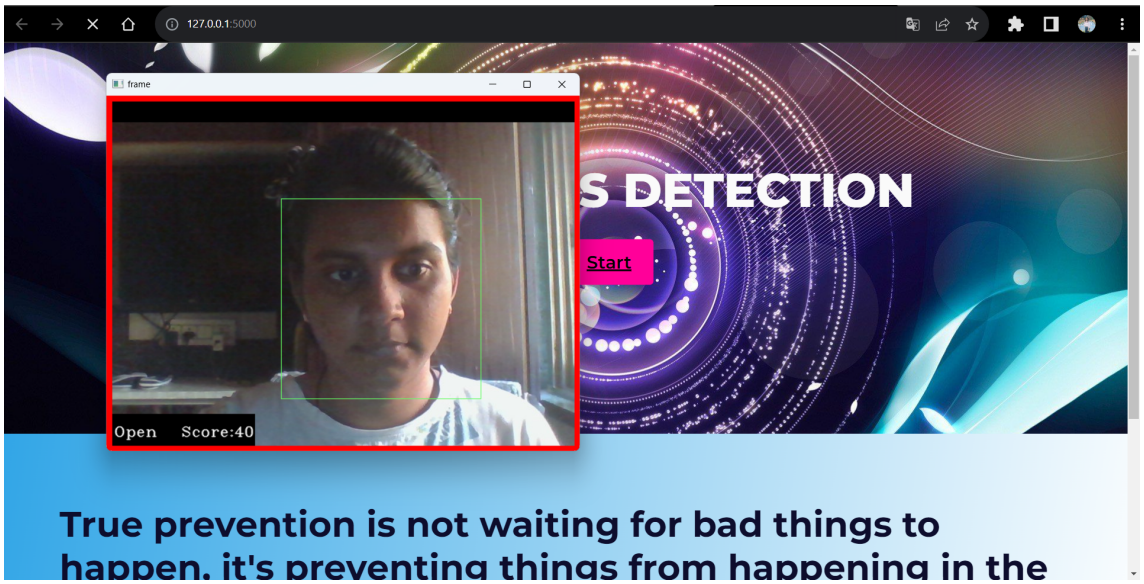

Figure 6.2: Detection Screenshot

Chapter 7

Conclusion and Future Scope

7.1 Conclusion

Drowsiness detection systems are an important technology for promoting safety and preventing accidents caused by drowsiness. These systems use various sensors and algorithms to detect signs of drowsiness such as changes in eye movement and blinking patterns, changes in head posture.

Overall, drowsiness detection systems have shown promising results in detecting drowsiness and alerting users to take a break or change their working behavior. They have the potential to significantly reduce the number of accidents caused by drowsy driving, which is a major contributor to road accidents worldwide.

However, it is important to note that drowsiness detection systems are not foolproof and may not detect all instances of drowsiness or fatigue. Additionally, these systems may be affected by various factors such as lighting conditions, weather, and individual differences in behavior.

Therefore, while drowsiness detection systems can be a valuable tool for promoting work safety, they should be used in conjunction with other strategies for preventing drowsy driving and working, such as getting enough sleep, taking breaks during long shifts,etc.

7.2 Future Scope

1. Integration with AI and machine learning: As these systems continue to collect data on drowsiness, they may be able to use AI and machine learning algorithms to improve their accuracy and reliability. This could lead to more effective early warning systems that can alert drivers or workers to take a break before they become too fatigued.

2.Wearable technology: Wearable devices such as smartwatches and fitness trackers could be integrated with drowsiness detection systems, allowing individuals to monitor their own drowsiness levels in real-time. This could be particularly useful for individuals who work in high-risk jobs, such as pilots or truck drivers.

3. Expansion into new industries: As the technology behind drowsiness detection systems continues to improve, we may see these systems being used in new industries, such as construction or manufacturing. This could help to reduce the number of accidents and injuries caused by worker fatigue.

4. Integration with autonomous vehicles: Drowsiness detection systems could play a critical role in ensuring the safety of passengers in autonomous vehicles. These systems could monitor the driver's drowsiness levels and alert the vehicle's control system to take over if the driver becomes too fatigued to drive safely.

5. Personalized alertness training: Drowsiness detection systems can be used to provide personalized alertness training to individuals who are at risk of falling asleep during work or while driving. These systems can provide feedback and suggestions to help individuals improve their alertness and reduce their risk of accidents.

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