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# DRIVER DROWSINESS DETECTION SYSTEM

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**Abstract**: Recently, techniques for reducing the effects of drowsiness have to be developed because of the danger it poses while driving. Driver fatigue and distractions can cause a lack of alertness, which can lead to driver inattention. Driver distraction happens when something or someone diverts attention from the task of driving. Driver sleepiness, in contrast to driver distraction, lacks a cause and is instead characterized by a gradual loss of focus on the road and other vehicles.

**Keywords:** Drowsiness, OpenCV, Dlib, facial features, video processing

## I. INTRODUCTION

Road accidents are one of the primary causes of untimely deaths nowadays. The way people manage their time has undergone significant change in the present. As a result, the human body's normal sleep cycle has been compromised. Humans typically feel sleepy at any moment of the day because of little sleep and erratic sleep cycles. People may find it challenging to do tasks like driving, which call for a healthy and fully functional state of mind and body, due to these bad work-life balance issues. One of the main factors contributing to traffic accidents today is sleepiness. About 40% of traffic accidents are caused byfatigued drivers who fall asleep behind the wheel, according to the Central Road Research Institute (CRRI). If the motorist is warned in time, a number of unfortunate events can be prevented. Most frequently, drivers would become inattentive and have unlucky collisions. The driver's weariness and drowsiness are to blame for this decline in attention. When the motorist is on his or her own, the scenario becomes exceedingly hazardous. Accidental microsleeps are the root cause of the decline in attentiveness. One of the biggest causes of poor road safety, severe injuries, economic losses, and even fatalities is drowsiness or exhaustion. Collectively, these circumstances raise the possibility of traffic collisions. Several unfortunate occurrences can beprevented by using a computer to detect weariness automatically. The driver's status is regularly analyzed by the sleepiness detection systems, which issue alerts before any unfavorable events occur.

Recent estimates estimate that accidents connected to fatigue are responsible for 1,200 deaths and 76,000 injuries per year. It is evident that there are over 2,400 traffic accidents annually, resulting in one fatality every four hours. According to estimates, drowsy driving accounts for about 20% of car accidents involving fatalities for the driver. It was discovered that increased fatigue causes a rapid decline in driving performance, which causes more than 20% of all vehicle accidents. Less concentration causes the driver to get distracted, which increases the risk of a traffic accident. Because of the greater speeds at which they occur, the distraction, and the fact that the driver was unable to take any avoiding action—not even brake—before the accident, drowsiness-related incidents have all the makings of being more serious. An important test for accident prevention systems is the development of improvements for detecting or preventing driver fatigue. Strategies must be developed to counteract the effects of tiredness due to the danger it poses while driving. The body and activities of a person change slightly as they lose awareness due to fatigue. We are able to measure tiredness efficiently thanks to these side effects and factors.

Machine learning techniques have been utilized to forecast a driver's state and emotions in order to provide information that would improve road safety, in addition to research and development on autonomous vehicle technology. In addition to more obvious factors like gender, age, and years of driving experience, a driver's health can also be inferred from their facial expressions, bio signals, and driving habits. Recent advances in machine learning-based video processing have made it possible to evaluate images captured by cameras with great precision. Therefore, variables that reflect face features have been created based on the association between facial features and a driver's drowsy state. In this paper, we proposed a method for extracting detailed features of the eyes, the mouth, and positions of the head using OpenCV and Dlib library in order to estimate a driver's level of drowsiness.

## II. LITERATURE REVIEW

According to a National Highway Traffic Safety Administration survey, 56,000 car accidents in the United States in 1996 were thought to be caused by sleep deprivation. According to a 2007 survey, weariness was the primary contributing cause in 18% of accidents. Up to 20% of serious traffic accidents in Britain were brought on by weariness. In a similar vein, a survey conducted by the Road and Traffic Authority indicates that 20% of traffic accidents in 2007 were caused as a result of exhaustion. Drowsy driving accidents were avoided and managed while the car was out of control. Using the driver's eye blinkis the phrase used here to indicate that the motorist is tired.

These incidents happened because the driver was drowsy and could not control the car when he or she awoke. The eye blink closure rate allowed for the detection of sleepiness. The technology will beep signal if the driver is in a drowsy state.

One of the proposed techniques is to keep an eye on how the car is moving to spot the driver's tiredness. However, this approach has drawbacks because the findings depend on the kind of vehicle and the state of the road. Processing the driver's electrocardiogram (ECG) readings is another technique. Due to the requirement that ECG probes be permanently attached to thedriver's body, this method also has drawbacks. The motorist would be bothered by that. Few studies have attempted to measure the driver's eye blink rate as a measure of their level of weariness. Many studies have developed approaches based on a combination of projection and the geometry characteristics of the iris and pupil for the successful identification of eye blink rate.

On the "Support Vector Machine" (SVM) classifier, certain works are also based. To determine the condition of the eye, the SVM classifier is employed. The Gabor filter and SVM classifier were used to extract ocular characteristics. The developers of the aforementioned methods employed a few circumstances that made identifying the eye state challenging The device, which incorporates an eye fixed blink sensor to live the driver's blink rate and an adaptive speed controller built with a stepper motorto produce accurate throttle location, recognizes the driver's signs of driver weariness. Technology advancements give us some hope that we are able to, a minimum of partially, avoid these. during this study, accidents are measured and controlled using IR and alcohol sensors. To capture video footage of the motive force, it uses remotely placed charge-coupled devices cameras with active infrared illuminators. to see the driver's level of weariness, a range of visual cues that generally indicate an individual's level of awareness were extracted in real-time and systematically merged. The used visual cues identify eyelid, gaze, and head motions. To characterize human exhaustion and calculate fatigue supported visual cues, a probabilistic model was created. An accurate description of exhaustion is obtained by the simultaneous use of visual clues and their methodical arrangement. this method was validated using human test subjects from various ethnic backgrounds, both with and without glasses, and under various lighting circumstances. it had been discovered to be trustworthy and accurate in describing weariness.

The Supervised Descent Approach (SDM), which tracks some face landmarks to extract a crop of regions of interest (ROI) (the driver's ear region), is employed by the pc vision-based method to assess whether a driver is holding a mobile phone near his or her ears. The ROIs are wont to extract features, and classifiers that have already been trained are wont to identify phone usage. Near real-time operation is feasible for the system. Yang's method involves sending high-pitched beeps through the car's sound system, using Bluetooth to attach devices, and using phone-based software to record and interpret sound signals. we will tell whether the driving force (or another passenger within the car) is on the phone by calculating the situation of the telephone using the beeps. The proposal's categorization accuracy was quite 90%. This method allows for hands-free operation, however it's brand and package dependent, and therefore the driver must continuously enable the program.

Another proposal identifies the behaviors of a distracted driver related to text messaging. The approach uses a cellular phone programmed to record any typing done (pressing and releasing any key). An analysis may be performed to verify distractions through these records. Experiments were finished six participants used the mobile phone as passenger and driver what distinct patterns of typing frequency were shown in each situation. the driving force cannot reply the text messaging with a mean frequency of two press keys by the second. This constraint detects the driving force in 99% of cases, but it works with offline processing.

The system may be applied to others equipment, i.e, the GPS.

Another system presents for detecting and parsing the movement of the driver’s head. It uses the optical flow of the driver’s image. The detected movements are compared with a predefined set of relevant movements of the automotive environment. Thesystem observes the time spent which the driving force is looking within the same direction. If the time spent is longer than a predefined interval of your time, the distraction is observed. The system’s accuracy during a real environment is 86%. The approach finds the driving force distraction level for observing objects outside of the vehicle. A fusion of two computer vision systems is employed.

The first one detects the driver’s field of view (inside of the vehicle) and therefore the other detects the movement (outside)by using the salience map (the outside movements what must attract the driver’s attention).

Over the last decade, there are various studies done associated with drowsiness detection and drunk driving. Features

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employing a driver’s Visual characteristics, Physiological and Driving- behaviour based studies are conducted each having theirown advantages for drowsiness detection and by using sensors for drunk driving detection. A survey that has a comprehensive insight into the well-established techniques for driver inattention monitoring and introduces the employment ofmost up-to-date and futuristic solutions exploiting mobile technologies like smartphones and wearable devices. The studies were categorized into two groups: driver drowsiness and distraction. A comprehensive compilation, used features, classificationmethods, accuracy rates, system parameters, and environmental details, was represented. A similar approach was also taken for the methods used for the detection of driver distraction. a visible analysis of Eye State and Head Pose (HP) for continuousmonitoring of alertness of a vehicle driver. The proposed scheme used visual features like Eye Index (EI), Pupil Activity (PA),and HP to extract critical information on non-alertness of the motive force . A system is meant and implemented an automatic system, using computer vision, which runs on a computationally limited embedded smart camera platform to detect yawning. Implementation of the Viola–Jones algorithm for face and mouth detections and, use of a back-projection theory for measuring both the speed and also the amount of the changes within the mouth, to detect yawning together with the histogram of the grey scale image.

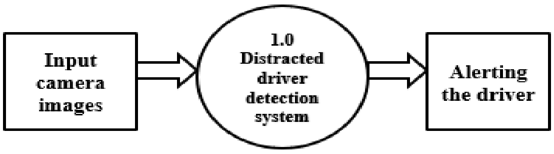
A warning alarm was also sounded if driver fatigue was believed to achieve an outlined threshold. And presented an efficient driver‘s drowsiness detection system, by using yawning detection. The consideration of eye detection and mouth detection was done, detecting the driver‘s face using YCbCr method. After that, eyes and mouth positions by using HAAR features. Lastly yawning detection performed by using mouth geometric features.There has been conducted the research in an exceedingly relatively simpler way. They claim the sleep onset is that the most crucial consequence of fatigued driving, separate the difficulty of sleep onset from the worldwide analysis of the physiological condition of fatigue, and take eyes opening and shutting as cues of sleep onset. they need used vision-based system to observe the eyes conditions so as to detect fatigue in driving. Lee et al. have used two fixed cameras to capture the driver‘s sight line and also the driving lane path for the aim of driving pattern and standing recognition.

They calculate the correlation coefficients among them to monitorthe driving status and patterns. These methods all need one or more cameras to be installed in the vehicle and just in front of the driver. It will cause certain potential safety hazard to the driver

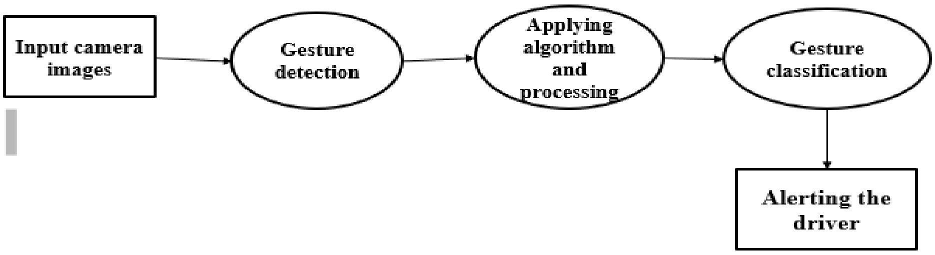
## III. METHODOLOGY

After choosing a location, people often look to the left or right side of the road when they begin to drive. However, as time goes on and a motorist grows weary, their blinking frequency reduces. Drivers who blink less frequently risk having their heads fall forward and closing their eyes unintentionally. These temporal behaviors are continuously observable. As a result, changes in a driver's state can be determined by analyzing the temporal variations of face features.

Results are achieved in this area by utilizing both software and hardware platforms to identify driver intoxication and sleepiness. In addition to eye and head motions, an additional visual cue that may be used to determine how sleepy someone is their eyes and faces. Making a real-time application with computer vision is a highly difficult endeavor that requires a robustprocessing machine. Computer vision is created using open source software called OpenCV. C, C++, Python, and Java programming language extensions all support OpenCV. When a driver shows signs of sleepiness or exhaustion, a GSM message will be sent, and the buzzer will be activated until the car owner sends a GSM-positive message. The suggested system's fundamental block diagram is seen in Fig. 1. A cascade function is trained using a large number of positive and negative images in the Haar Feature based Cascade Classifier technique, which uses a positive image to detect the facial regionand eye region. A detector and a trainer are both included in Open CV. To create a user-



Level-0 Diagram



Level-1 Diagram

defined object classifier, use the open CV. The constructed object classifier is saved as an extension.xml file and can be utilized later in the programming process. In this article, we also employ clever operator edge detection to pinpoint the precise coordinates of the ocular region. Here, a cellphone ring detector is being utilized to identify instances of cell phone use while driving and to alert the motorist to the dangers of doing so.

## IV. IMPLEMENTATION

### Domain and Architecture

1) Convolutional Neural Network Deep learning may be a subset of machine learning which teaches machines to try and do what humans are naturally born with: learn by example. Though the technology is usually considered a collection of algorithms which 'mimics the brain', a more appropriate description would be a group of algorithms which 'learns in layers. It involves learning through layers that enable a computer to develop a hierarchy of complicated concepts from simpler concepts. Deep learning is that the central technology behind plenty of high-end innovations like driverless cars, voice control in devices like tablets, smartphones,hands-free speakers etc and lots of more. It's offering results which weren't possible before or perhaps with traditional machine learning techniques. Majority of the deep learning methods utilize neural network architectures and that's why deep learning models are widely called deep neural networks similarly. A deep learning process consists of two key phases — training and inferring. The training phase are often considered as a process of labelling huge amounts of information and identifying their matching characteristics. Here, the system compares those characteristics and memorizes them to return up with correct conclusions when it encounters similar data next time. During the inferring phase, the model makes conclusions and labels unexposed data with the assistance of the knowledge it gained previously. During the training of deep learning models, professionals use large sets of labelled data along with neural network architectures which learn features from the information directly without the requirement for feature extraction done manually.

### Advantages of Deep Learning

1. Feature Generation Automation Deep learning algorithms can generate new features from among a limited number located within the training dataset without additional human intervention. this suggests deep learning can perform complex tasks that always require extensive feature engineering. For businesses, this implies faster application or technology rollouts that deliver superior accuracy.
2. Works Well with Unstructured Data one in every of the largest draws of deep learning is its ability to figure with unstructured data. within the business context, this becomes particularly relevant after you consider that the bulk of business data is unstructured. Text, images, and voice are a number of the foremost common data formats that companies use. Classical ML algorithms are limited in their ability to research unstructured data, meaning this wealth of data often goes untapped. And here's where deep learning promises to form the foremost impact. Training deep learning networks with unstructured data and appropriatelabeling can help businesses optimize virtually every function from marketing and sales to finance.
3. Better Self-Learning Capabilities The multiple layers in deep neural networks allow models to become more efficient at learningcomplex features and performing more intensive computational tasks, i.e., execute many complex operations simultaneously. It outshines machine learning in machine perception tasks (aka the power to form sense of inputs like images, sounds, and video sort of a human would) that involve unstructured datasets. this can be thanks to deep learning algorithms' ability to eventually learn from its own errors. It can verify the accuracy of its predictions/outputs and make necessary adjustments. On the opposite hand, classical machine learning models require varying degrees of human intervention to work out the accuracy of output.

What's more? Deep learning's performance is directly proportional to the amount of coaching datasets. So, the larger the datasets, the more accuracy.

4. Supports Parallel and Distributed Algorithms A typical neural network or deep learning model takes days to find out the parameters that outline the model. Parallel and distributed algorithms address this pain point by allowing deep learning models tobe trained much faster. Models will be trained using local training (use one machine to coach the model), with GPUs, or a mixture of both. However, the sheer volume of the training datasets involved could mean that storing it during a single machine becomes impossible. And that's where data parallelism comes in. With data or the model, itself being distributed across multiple machines, training is more practical. Parallel and distributed algorithms allow deep learning models to be trained at scale. as an example, if you were to coach a model on one computer, it could take up to 10 days to run through all the info. On the opposite hand, parallel algorithms may be distributed across multiple systems/computers to finish the training in but daily. looking on the quantity of your training dataset and GPU computing power, you may use as few as two or three computers to over 20 computers to complete the training within each day

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## REQUIREMENT PLANNINGTOOLS

1) Anaconda Spyder Anaconda Navigator could be a desktop graphical computer programme (GUI) included in Anaconda®
distribution that permits you to launch applications and simply manage condo packages, environments, and channels without using command-line commands. Navigator can seek for packages on Anaconda Cloud or in an exceedingly local Anaconda Repository. so as to run, many scientific packages depend upon specific versions of other packages. Data scientists often use multiple versions of the many packages and use multiple environments to separate these different versions. The command-line program condo is botha package manager and an environment manager. This helps data scientists make sure that each version of every package has all the dependencies it requires and works correctly. Navigator is a straightforward, point-andclick thanks to work with packages and environments with no need to type condo commands in a very terminal window. It is accustomed find the packages required, installthem in an environment, run the packages, and update them – all inside Navigator. Spyder may be a powerful scientific environment written in Python, for Python, and designed by and for scientists, engineers and data analysts. It features a novel combination of the advanced editing, analysis, debugging, and profiling functionality of a comprehensive development tool with the information exploration, interactive execution, deep inspection, and delightful visualization capabilities of a scientific package. Furthermore, Spyder offers built-in integration with many popular scientific packages, including NumPy, SciPy, Pandas, I Python, QtConsole, Matplotlib, SymPy, and more [18].

2) VS Code The Visual Studio integrated development environment could be a creative pad that you just can use to edit, debug, and build code, then publish an app. An integrated development environment (IDE) may be a feature-rich program that may be used for several aspects of software development. Over and above the quality editor and debugger that almost all IDEs provide, Visual Studio includes compilers, code completion tools, graphical designers, and plenty of more features to ease the software development process. Visual Studio offers a set of tools that enable you to simply create cloud-enabled applications powered by Microsoft Azure which may be wont to configure, build, debug, package, and deploy applications and services on Microsoft Azure directly from the IDE [19].

## LIBRARIES

1) keras keras is an open-source neural-network library written in Python. it's capable of running on top of TensorFlow, Microsoft Cognitive Toolkit, R, Theano, or PlaidML. Designed to enable fast experimentation with deep neural networks, it focuses on being user-friendly, modular, and extensible. it had been developed as a part of the effort of project ONEIROS (Open-ended Neuro- Electronic Intelligent Robot Operating System), and its primary author and maintainer is François Chollet, a Google engineer. Chollet is also the author of the XCeption deep neural network model. Keras allows users to productize deep models on smartphones (iOS and Android), on the web, or on the Java Virtual Machine. It also allows use of distributed training of deep- learning models on clusters of Graphics processing units (GPU) and tensor processing units (TPU) principally in conjunction with CUDA [20].
Advantages of keras

➢ Large Community Support: There are plenty of AI communities that use Keras for his or her Deep Learning framework. Many of them publish their codes additionally tutorial to the final public.

➢ Have multiple Backends: you'll be able to choose TensorFlow, CNTK, and Theano as your backend with keras. you'll be able to choose a special backend for various projects looking on your needs. Each backend has its own unique advantage. ➢ Cross- Platform and simple Model Deployment: With a spread of supported devices and platforms, you'll deploy keras on any device like

1. iOS with CoreML
2. Android with TensorFlow Android,
3. Applications program with .js support
4. Cloud engine
5. Raspberry Pi

➢ Multi GPUs Support: you'll train keras with on one GPU or use multiple GPUs directly. Because keras includes a built-in support for data parallelism so it can process large volumes of knowledge and speed up the time needed to coach it.

2) OpenCV opencv-python may be a library of Python bindings designed to unravel computer vision problems. Python could be a general-purpose programing language started by Guido van Rossum that became extremely popular very quickly, mainly thanks to its simplicity and code readability. It enables the programmer to specific ideas in fewer lines of code without reducing readability. Compared to languages like C/C++, Python is slower. That said, Python will be easily extended with C/C++, which allows us to jotdown computationally intensive code in C/C++ and make Python wrappers that may be used as Python modules. this provides us two advantages: first, the code is as fast because the

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original C/C++ code (since it's the particular C++ code working in background) and second, it easier to code in Python than C/C++. OpenCV-Python may be a Python wrapper for the first opencv C++ implementation [21].
opencv includes a modular structure, which implies that the package includes several shared or static libraries. the subsequent modules are available:

➢ Core functionality (core) - a compact module defining basic data structures, including the dense multi-dimensional array Mat and basic functions employed by all other modules.

➢ Image Processing (imgproc) - a picture processing module that has linear and non-linear image filtering, geometrical image transformations (resize, affine and perspective warping, generic table-based remapping), color space conversion, histograms, andso on.

➢ Video Analysis (video) - a video analysis module that features motion estimation, background subtraction, and object tracking algorithms.

➢ Camera Calibration and 3D Reconstruction (calib3d) - basic multiple-view geometry algorithms, single and stereo camera calibration, object pose estimation, stereo correspondence algorithms, and elements of 3D reconstruction.

➢ 2D Features Framework (features2d) - salient feature detectors, descriptors, and descriptor matchers.

➢ Object Detection (objdetect) - detection of objects and instances of the predefined classes (for example, faces, eyes, mugs, people, cars, and so on).

➢ High-level GUI (highgui) - an easy-to-use interface to simple UI capabilities.

➢ Video I/O (videoio) - an easy-to-use interface to video capturing and video codecs.

3) Comparison Between opencv and Matlab

➢ Speed Since, MATLAB is fabricated from java which successively is fabricated from C. Therefore, when a code is scripted and run on MATLAB, the pc initializes by interpreting the code and converting it into java and so finally executes the script.
Whereas, open CV uses c/c++ library functions. Which directly provides the pc with the machine language code and hence helps infaster execution. Using OpenCV ends up in more utilization of your time and resources in image processing and fewer in interpreting.

➢ Portability As OpenCV runs on C, therefore any device which runs on C can run OpenCV. It can toil well with Windows, mackintosh or Linux.

➢ Cost MATLAB is far costlier than OpenCV. MATLAB costs around USD2150 whereas, OpenCV is freed from cost. Even the bottom MATALAB is dear because it has commercial, single user License. And OpenCV could be a BSD license so it's freed from cost [22].

4) numpy could be a Python package. It stands for 'Numerical Python'. it's a library consisting of multidimensional array objects and a group of routines for processing of array. Numeric, the ancestor of numpy, was developed by Jim Hugunin. Another package.
Numarray was also developed, having some additional functionalities. In 2005, Travis Oliphant created numpy package by incorporating the features of Numarray into Numeric package. There are many contributors to the present open source project. Using NumPy, a developer can perform Mathematical and logical operations on arrays, Fourier transforms and routines for shape manipulation and Operations associated with algebra.

5) dlib Dlib may be a general-purpose cross-platform software library written within the programing language C++. Its design is heavily influenced by ideas from design by contract and component-based software engineering. Thus, it is, first and foremost, a collection of independent software components. it's open-source software released under a lift Software License. It contains software components for managing networking, threads, graphical user interfaces, data structures, algebra, machine learning, imageprocessing, data processing, XML and text parsing, numerical optimization, Bayesian networks, and lots of other tasks [25].

6) pyenchant pyenchant may be a spellchecking library for Python, supported the superb Enchant library. Enchant is employed to test the spelling of words and suggest corrections for words that are miss-spelled. It can use many popular spellchecking packages to perform this task, including ispell, aspell and MySpell. it's quite flexible at
handling multiple dictionaries and multiple languages. PyEnchant combines all the functionality of the underlying Enchant library with the flexibleness of Python and a pleasant “Pythonic” object-oriented interface. It also aims to supply some higher-level functionality than is offered within the C API [26].

7) pyttsx3 it's a text-to-speech conversion library in Python. Unlike alternative libraries, it works offline, and is compatible with both Python 2 and three.

8) The requests library is that the de facto standard for creating HTTP requests in Python. It abstracts the complexities of creating requests behind a fine looking, simple API in order that you'll specialize in interacting with services and consuming data in your application. Requests allow you to send HTTP/1.1 requests. you'll be able to add headers, form data, multi-part files, and parameters with simple Python dictionaries, and access the response data within the same way [27].

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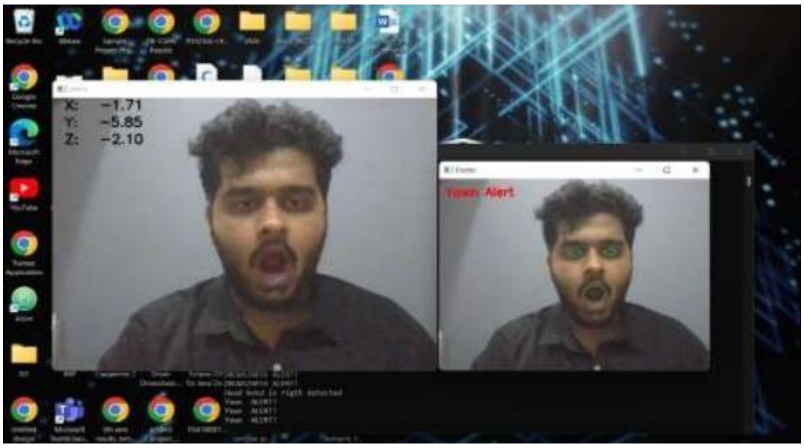
## RESULTS

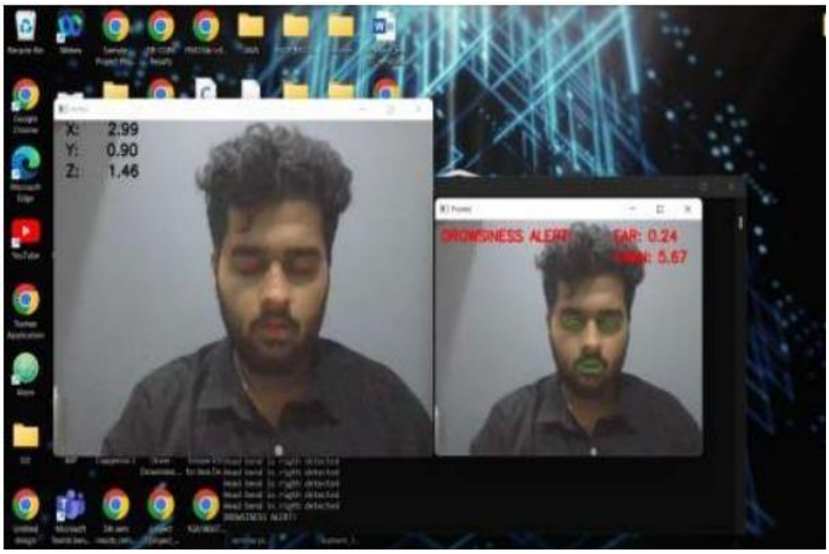


```
X: -1.71
Y: -5.85
Z: -2.10
```

```
Yawn Alert
```

```
DROWSINESS ALERT!
DROWSINESS ALERT!
Head bend in right detected
Yawn ALERT!
Yawn ALERT!
Yawn ALERT!
```

Fig 1. Checking yawning



```
X: 2.99
Y: 0.90
Z: 1.46
```

```
DROWSINESS ALERT      EAR: 0.24
                     YAWN: 5.67
```

```
Head bend in right detected
Head bend in right detected
Head bend in right detected
Head bend in right detected
Head bend in right detected
DROWSINESS ALERT!
```

Fig 2. Detecting when eyes are closed

## V. CONCLUSION

Purpose of our Our project's goal is to assist in finding extremely affordable solutions to problems that arise in daily life. It warns the driver of a vehicle or car anytime the driver becomes tired and shuts his eyes for longer than a second. The accident ratio declines as a result. Therefore, if our project is successfully commercialised, it will contribute to preserving the driver's precious life. The device that can distinguish between normal eye blinking and drowsiness can stop the driver from becoming sleepy while driving. The monitoring system has the ability to determine if the eyes are open or closed. The driver drowsiness system will lessen the likelihood of accidents and ensure both the driver's and the vehicle's safety. Using drowsiness detecting system, driver safety can be implemented in normal cars also.

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