Driver Monitoring System

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Abstract: *Road accidents are veritably common each over the world. It's due to the lack of attention of drivers. Data on business accidents state that driver's mistake is the major reason of loss and detriment on roads all over the world every day. In this design we described a module for intelligent driver monitoring system to drop the extent of similar losses which can automatically detects the driver's distraction. As the distracted driving has been concerned as a unproductive aspect in numerous accidents, thus a real- time driver monitoring system can help business accidents effectively. So, we're enforcing this real- time system to cover the motorist's knowledge by noticing the parameter of drowsiness & alcohol using python libraries and MQ3 detector independently which will identify facial expressions and alcohol consumed by the motorist and warn him.*

Keywords: Driver Monitoring , Face Recognition, OpenCV, Dlib, Drowsiness Detection

I. INTRODUCTION

Drowsiness/ fatigue can be caused by numerous reasons similar as overworking, lack of sleep, alcohol consumption. it may lead accidents. When the driver is drowsy the alertness is veritably low so in this paper we've designed a tackle to cover the driver's drowsiness. The camera will cover the element of the face that's our eyes and it'll measure the eye aspect ratio grounded on the value we can determine drowsiness and produce an alert using buzzer and wobbling the seat.

In India the alcohol consumption rate is veritably high. In last 12 years, 76446 people died in 20,11,405 road accidents nationwide due to consumption of alcohol. The motorist who drinks alcohol is in the state of confusion, he she looses the knowledge and capability of proper driving and quick judgment which leads to death and severe accidents. It not only take lives of the driver but also passengers and people involved in the accident die due to severe injuries.

In order to help it we've designed a driver monitoring system which can detect alcohol consumption in the driver before driving. The driver should give his/ her sample of breath grounded on the smell we can conclude if the he has consumed alcohol or not, if the alcohol consumption is detected he wil not be able to start the vehicle.

II. LITERATURE SURVEY

This survey is done to comprehend the need and prerequisite of the general population, and to do as similar, we went through different sites and applications and looked for the fundamental data. Grounded on these data, we made an inspection that helped us get new studies and make different arrangements for our task. We reached the decision that there's a need of similar application and felt that there's a decent extent of progress in this field too. Driver monitoring systems (DMS) are gaining increasing attention in the field of automotive safety. These systems utilize various sensors, such as cameras and buzzers, to monitor the driver's behavior, attention, and physiological state to enhance road safety. In this literature review, we will focus on DMS based on cameras and buzzers.Buzzers or auditory cues are often integrated into DMS to alert the driver when their behaviour deviates from safe driving. These auditory cues can be designed to vary in intensity or frequency to convey different levels of urgency. For example, a study by Hjalmdahl et al. (2018) used a combination of visual and auditory alerts to alert the driver when they exhibited signs of drowsiness[1]. The auditory alerts, in the form of a low-frequency buzzer, were found to effectively improve the driver's response time to the visual alerts and help prevent drowsy driving. In addition, some studies have explored the integration of cameras[13] and buzzers in DMS to provide a comprehensive approach to driver monitoring. For instance, a study by Li et al. (2018) proposed a DMS that utilized a camera to detect facial features and a buzzer to provide real-time auditory alerts for different driving behaviours, such as drowsiness, distraction, and aggressive driving[2]. The combined system demonstrated improved accuracy and effectiveness in detecting multiple driver states and providing timely warnings. Overall, the literature suggests that DMS based on cameras and buzzers can effectively monitor the driver's behaviour and state, and provide timely alerts to help prevent accidents caused by drowsy, distracted, or inattentive driving[5]. However, further research is needed to optimize the performance of these systems in different driving conditions, consider driver preferences and acceptability, and address potential limitations, such as false positives or negatives, privacy concerns, and system reliability[8][11].

III. PROPOSED METHODS

A Driver Monitoring System is a real-time system that monitors the facial expressions of the driver. Driver monitoring systems aim to enhance driver safety, reduce accidents, and improve overall road safety.Here are some proposed methods on Driver Monitoring System.

- **Computer Vision-Based Approach:** This method involves using computer vision techniques to analyze visual cues from the driver's face and eyes. Cameras mounted in the vehicle can capture images or video of the driver's face, and then algorithms can be applied to track facial landmarks, detect facial expressions, and analyze eye movements to determine the driver's attention, gaze direction, and blink rate
- **Real-Time Alerting System:** Once the driver monitoring system detects an unsafe behavior, such as drowsiness or distraction, a real-time alerting system can be triggered to provide warnings to the driver. Alerts can be delivered through visual cues, such as LED lights on the dashboard, auditory cues, such as beeps or voice prompts, or haptic cues, such as vibrations on the steering wheel or seat. The alerting system should be designed to be effective and non-intrusive, so as not to distract the driver further.
- **Privacy and Security Considerations:** Privacy and security are critical considerations in a driver monitoring system. Proper measures should be in place to protect the driver's personal information and ensure data security. Compliance with relevant privacy regulations and standards, such as General Data Protection Regulation (GDPR) or Health Insurance Portability and Accountability Act (HIPAA), should be ensured.
- **Alcohol Sensor Integration**: An alcohol sensor, such as a semiconductor-based breathalyzer sensor or an infrared spectroscopy-based sensor, would be integrated into the vehicle's interior in a strategic location, such as near the steering wheel or in the driver's seat. The sensor would be designed to accurately and reliably detect the presence of alcohol in the driver's breath.

These are some proposed methods for a driver monitoring system. The specific implementation would depend on factors such as the target audience, the intended use case, and the available resources and technology. It's important to thoroughly evaluate and validate the proposed methods to ensure their accuracy, reliability, and safety in real-world driving scenarios.

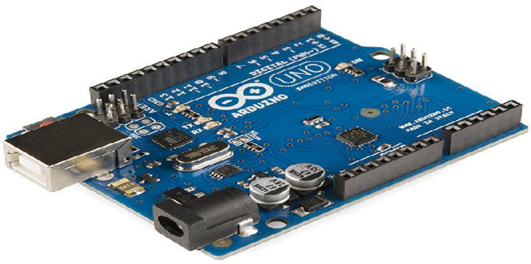
Here are some python libraries that were used in our project:

- **dlib:**This is a popular C++ library for machine learning and computer vision, which also provides a Python API for facial detection and facial landmark detection. It includes pre-trained models for detecting facial landmarks, which are used in the code to detect the landmarks of the eyes and calculate the eye aspect ratio (EAR) and mouth aspect ratio (MAR).
- **Numpy:**This is a popular numerical computing library for Python that provides support for large, multi-dimensional arrays and matrices, along with a large collection of mathematical functions for performing various numerical operations. In the code, it is used for calculating the mean of the facial landmarks, which is used in the calculation of the mouth aspect ratio (MAR).
- **imutils.face_utils:**This library is also part of the **imutils** package and provides utility functions for facial landmark detection. It defines functions for extracting facial landmarks from facial regions, such as eyes, nose,

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Impact Factor: 7.301
Volume 3, Issue 3, April 2023

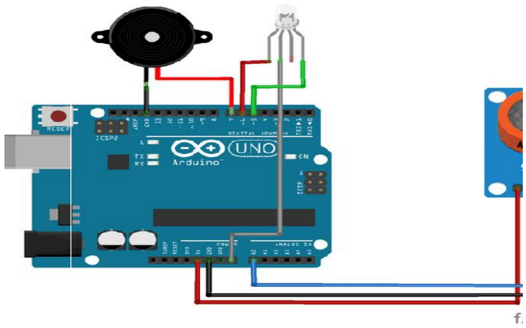
and mouth, using the facial landmark detector provided by **dlib**. In the code, it is used to extract the coordinates of the eye landmarks from the detected face region.

- **scipy.spatial.distance**: This library is part of the SciPy ecosystem, which is a collection of open-source scientific computing tools for Python. Thescipy. spatial.distancemodule provides various functions for calculating distances between points or arrays of points in n-dimensional space. In the code, it is used to calculate the Euclidean distance between two sets of coordinates representing the landmarks of the eyes, which is used in the calculation of the eye aspect ratio (EAR).



- **Arduino Uno**: Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started

3.1 Arduino Circuit Diagram



- **MQ3 Sensor:** MQ3 sensor is an alcohol sensor that senses the alcohol which is present in the surrounding environment. There is a SNo2 element inside the sensor, which is low in conductivity in the clean air, and its conductivity increases when alcohol is sensed. It has good sensitivity to alcohol and less sensitivity to gasoline Typically there are 4 pins 1. ao-analog output 2. do-digital output 3. GND-ground 4. VCC This sensor works on 5v. The potentiometer used to set the limited value for the MQ3 sensor and limited value is 25 mg. when it reaches above the limited value it gives an alert to the driver and locks the ignition of the engine. Then the information is given to the concerned person.

MQ3 Sensor

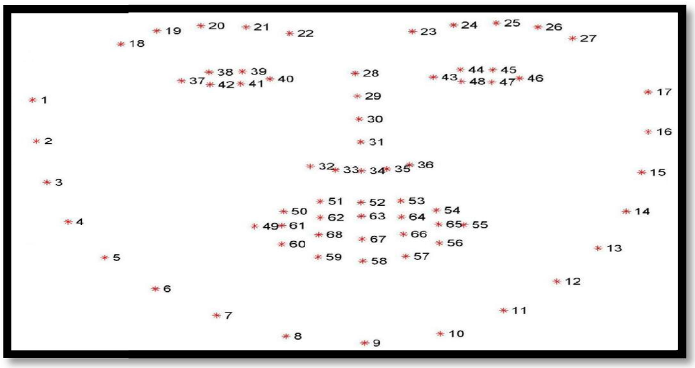
IV. METHODOLOGY

Landing Videotape

The use of the OpenCV module is to capture the real- time video using a webcam which acts as an input for further processing

Finding Facial Landmarks

Using Python libraries like CV2 and Dlib we coded the program to detect the drowsiness of eyes and yawn . After recognizing hand it'll detect 68 points as shown in the figure.



Getting the landmarks for eyes

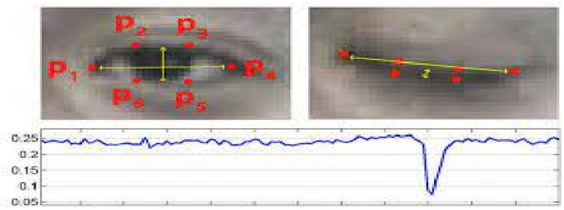
Using the landmarks from above figure we can detect the person's eyes from his/her face and then further detect if he/she drowsy or not.

Getting the landmarks for mouth

Using the landmarks from above figure we can detect the person's mouth from his/her face and then further detect if he/she yawns.

Using Eye Aspect Ratio (EAR)

By using the EAR formula we can calculate distance between eyelids and identify if the eyes are closed.
We first assign a threshold value and then calculate the distance between eyelids, now if the distance is less than the assigned threshold value then eyes are considered to be closed.



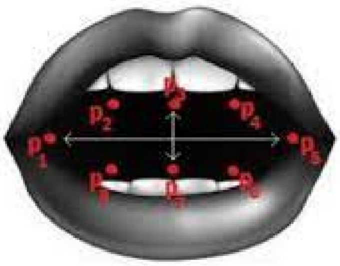
$$EAR = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

Using Mouth Aspect Ratio (MAR)

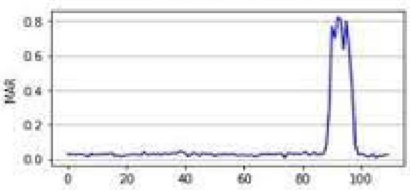
Using this formula we can calculate distance between both the lips. In this case, if the distance between lips is greater than assigned threshold value than we can conclude that driver is yawning.

DOI: 10.48175/568

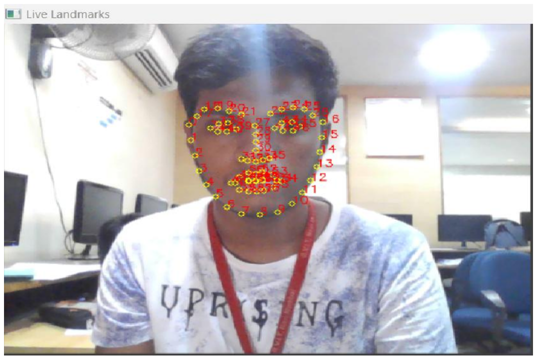
IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Impact Factor: 7.301
Volume 3, Issue 3, April 2023

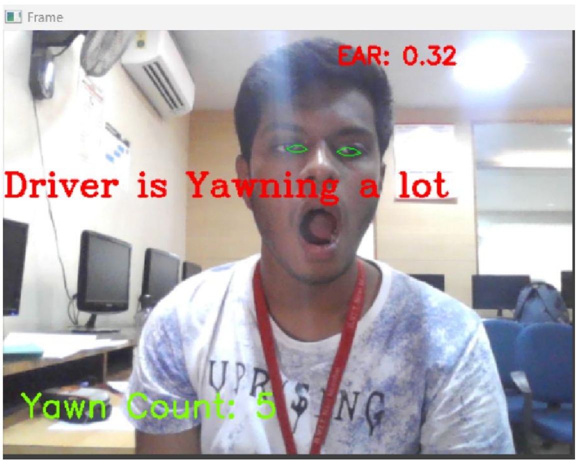


$$MAR = \frac{\|p_2 - p_8\| + \|p_3 - p_7\| + \|p_4 - p_6\|}{2\|p_1 - p_5\|}$$



V. RESULTS





Driver Monitoring System (DMS) is a technology that utilizes various sensors and algorithms to monitor the driver's behavior and state while driving, aiming to improve road safety and driver performance. DMS can detect and analyze a wide range of driver-related information, including eye gaze, facial expressions and alcohol consumption. By monitoring the driver's behavior, DMS can provide real-time feedback, alerts, and intervention to prevent accidents, detect drowsiness or distraction, and enhance driver awareness and engagement.

In our research studies and projects we have explored the use of Driver Monitoring System. Some of the key findings and results from these studies include:

1. **Accident Prevention:** DMS can detect driver drowsiness, distraction, and other risky behaviors in real-time, providing timely alerts and interventions to prevent accidents caused by human error, which is a leading factor in road accidents.
2. **Driver Performance Enhancement:** DMS can provide feedback and coaching to drivers on their driving behavior, helping them to be more attentive, focused, and compliant with traffic rules, thus improving their driving performance and reducing the likelihood of accidents.
3. **Real-time Monitoring:** DMS continuously monitors the driver's behavior in real-time, providing immediate feedback and alerts, which can help in detecting and mitigating unsafe driving behaviors promptly.
4. **Adaptive and Scalable:** DMS can be designed to adapt to different driving scenarios, vehicle types, and driver profiles, making them versatile and scalable for various applications, including passenger cars, commercial vehicles, and specialized driving environments.
5. **Improved Fleet Management:** DMS can be used in fleet management applications to monitor and manage the behavior of professional drivers, helping companies optimize their operations, reduce accidents, and improve the safety of their fleet.
6. **Compliance with Regulations:** DMS can help comply with regulations related to driver safety, such as laws against distracted driving, by providing real-time monitoring and alerts when drivers engage in risky behaviors.

VI. CONCLUSION

This intelligent driver monitoring system is based on computer vision that has been presented in this design. This system uses visual features to assay and to detect driver's eye state and head movement at real time driving situations, like climate, varying background and different facial expressions. The Driver Monitoring System is able of detecting alcohol consumption and drowsiness rightly. The system can separate normal eye blink and drowsiness which can help the driver from entering the sleepy state . The tackle design will make sure that the driver isn't in the drunken state if he/she is in drunken state, the led will blink . It'll also make insure that the driver isn't sleepy and will keep reminding/ waking the driver if he/she is sleepy. We conclude that by designing this system that combines non-intunsive physiological measures with other measures one would directly determine condition of the driver.

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