Truck Driver Safety Assistance

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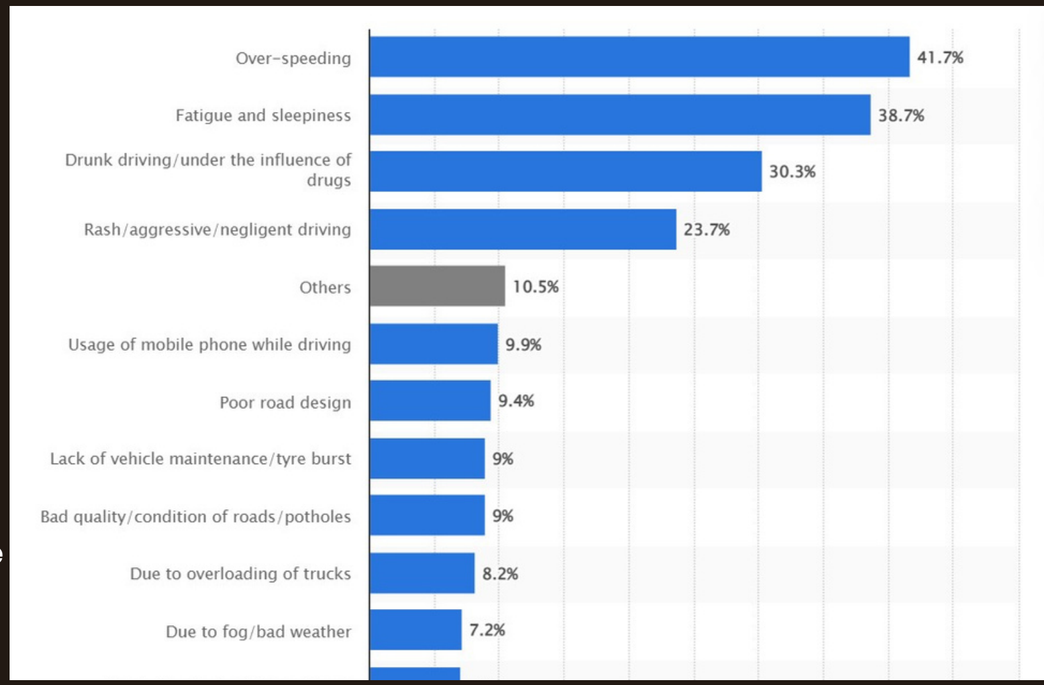
Introduction

- Eye closure and body posture are two instances of fatigue-related real-time hazardous behaviours or mental activity In light of this, we can either track changes in physiological signals like brain waves, eye blinking and heart rate to track tiredness or accommodate for bodily changes like sagging posture, the way the driver's head is cocked, and the state of their eyes.
- Although more accurate, the earlier method is unrealistic since super sensitive electrodes would it must be linked directly to the driver's body, which might irritate and distract the
- driver. Additionally, prolonged driving would cause perspiration on the sensors, reducing their effectiveness to precisely observe. The second method uses a video camera to evaluate physical changes, such as open or closed eyelids to detect weariness. This method is well suited for use in real-world driving situations because it is non-intrusive. Micro sleeps, which are brief periods of sleep lasting 2 to 3 seconds, are another reliable sign of exhaustion. Therefore, a timely warning is given when a driver's eyes are continuously monitored for signs of sleepiness.

Problem Statement

- Our main Problem is accidents due to drowsiness.The shortage of drivers in the market led to over burdening of truck drivers with long working hours by the fleet owners, which caused fatigue and reduced the resting time.According to a survey on the status of truck drivers in India, over-speeding was stated as the major cause for road crashes by the truck drivers as of February 2020. Fatigue and sleepiness was stated as the second major reason for road accidents among 38 percent of truck drivers in the south Asian country.
- According to the stats of National Highway Traffic Safety Administration (NHTSA),there were 795 fatalities from drowsy driving related crashes in 2017. NHTSA estimates fatigue-related crashes resulting in injury or death cost society $109 billion annually, not including property damage.
- Exhausted drivers who doze off at the wheel are responsible for about 40% of road accidents, says a study by the Central Road Research Institute (CRRI) on the 300-km Agra-Lucknow Expressway.
- The National Highway Safety Administration estimates that drowsy driving results in 1,550 deaths, 71,000 injuries and more than 100,000 accidents per year.
- Driver weariness was selected as the top priority CMV by highway safety, which included many drivers. safety concern As a result, current FHWA-sponsored human factors research is dominated by the fatigue issue on the safety of CMV driving.
- The project's goal is to identify driver drowsiness and alert them when necessary so accidents can be avoided.
- The concept directly impacts the automotive industry, improving driving safety and reducing the number of fatalities in crashes brought on by drowsy driving.



Objectives

- It has been suggested that fatigue warning systems (FWS) be used as a specific countermeasure to lessen collisions brought on by driver drowsiness. When crucial levels of drowsiness are reached, these devices alert the driver.
- They use a number of approaches to detect driver drowsiness while operating a vehicle. However, it is still difficult to identify driver weariness using reliable, unobtrusive, and objective measurements. Lane departure, steering wheel movement, ocular or facial traits may all be used as detection methods. Of course, drivers also have a responsibility to follow speed limits, work-permitting limits, and rest-period regulations.
- Additionally, those in the chain of command are required to take reasonable action to avoid situations that could result in driver weariness or speed limit violations. It delivers in-depth details regarding physiological parameters like alertness, driving performance, and drivers' subjective states.

Literary Review

01 Design of a Vehicle Driver Drowsiness Detection System through Image Processing using Matlab

02 Detecting Driver Drowsiness Based on Sensors: A Review

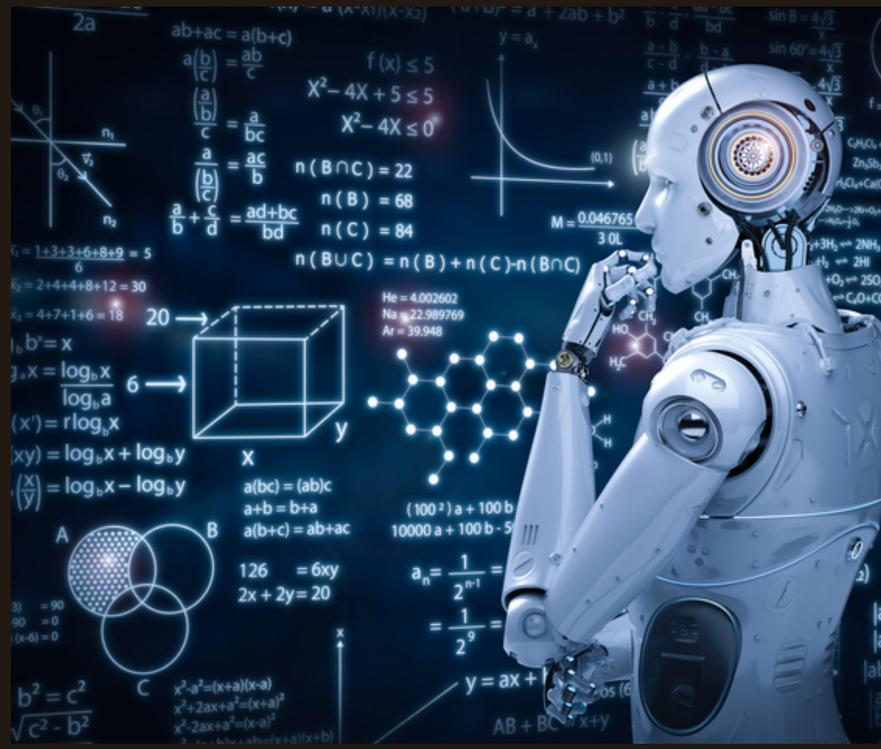
03 DRIVER DROWSINESS DETECTION SYSTEM

04 Driver Drowsiness Detection using Eye-Closeness Detection

05 Driver Drowsiness Detection

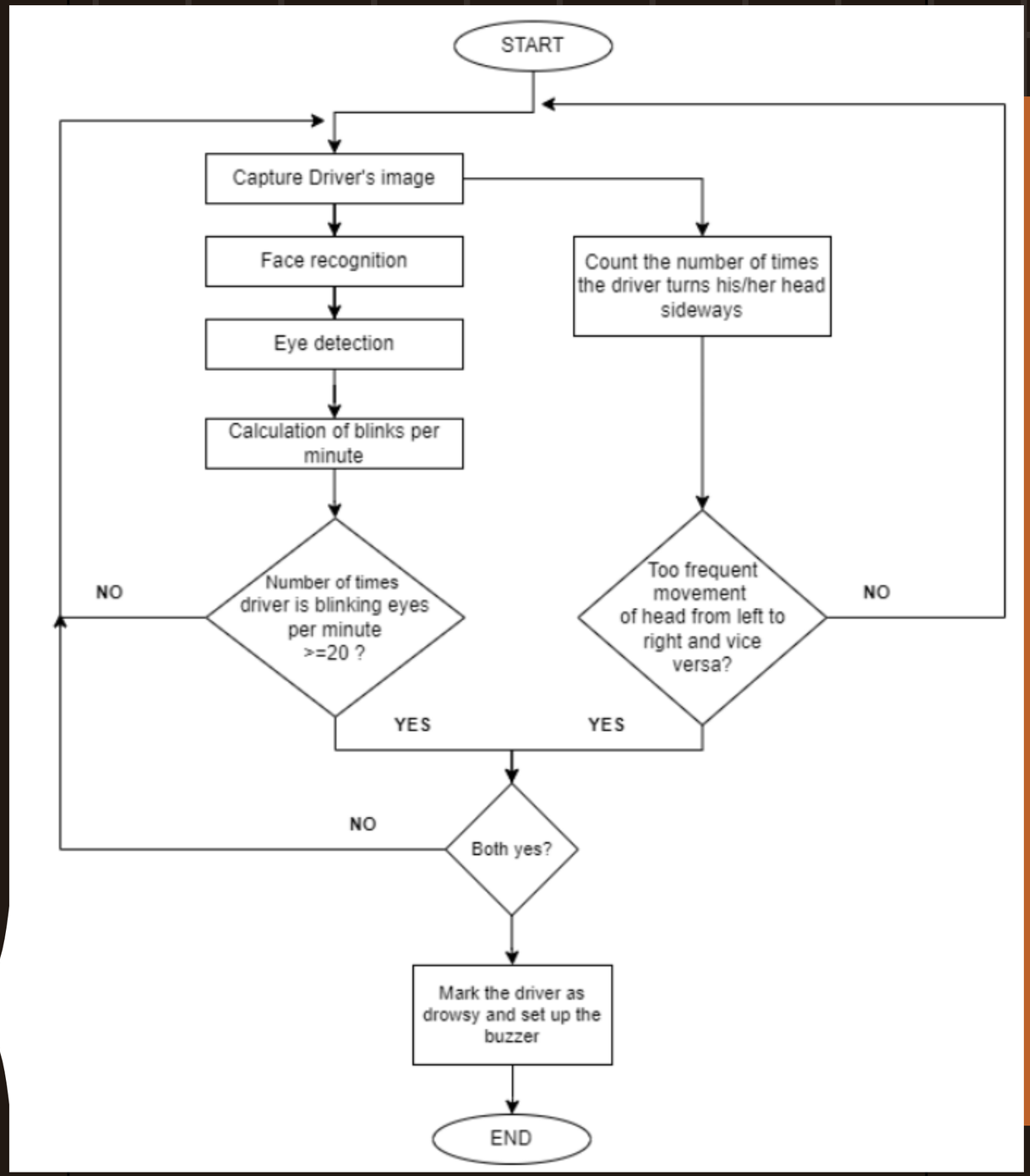
Future Scope

- Future research may concentrate on how to assess weariness using external aspects like vehicle states, sleeping patterns, weather, mechanical data, etc. Highway safety is seriously threatened by driver drowsiness, which is especially problematic for drivers of commercial vehicles.
- This major safety concern is a result of 24-hour operations, high annual mileage, exposure to difficult environmental conditions, and rigorous work schedules. One important step in a series of preventive steps required to address this issue is to monitor the driver's level of alertness and drowsiness and give feedback on their state so they may take appropriate action. Currently, the camera's zoom or direction cannot be changed while it is in use. Future effort may be to automatically zoom in on the eyeballs once they are localized.



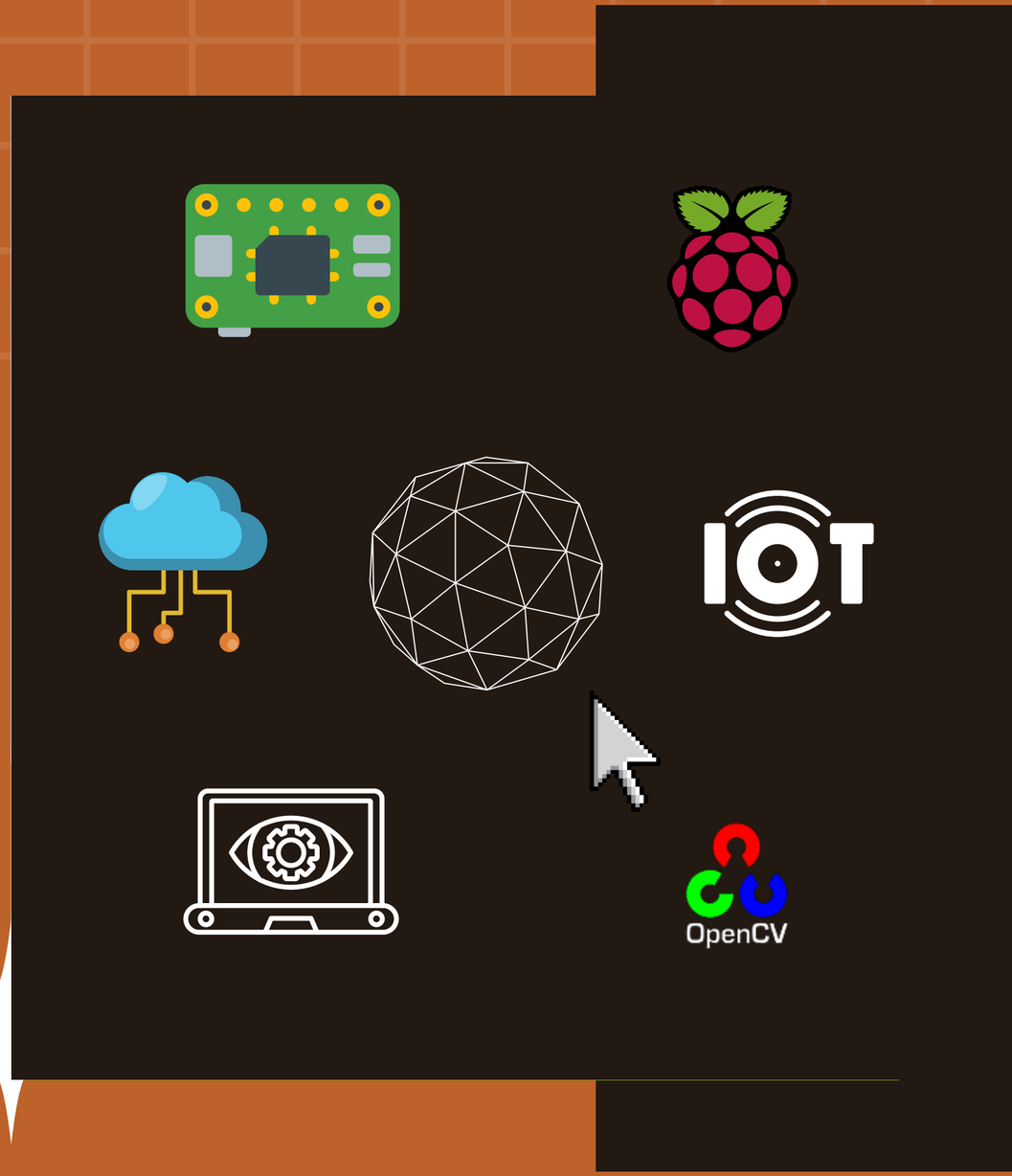
Flow Chart & Algorithm

- Camera clicks the photo of driver
- Face is detected
- Eyes are detected from the face, to see whether they’re open or closed.
- Movement of head is also monitored
- If movement is too frequent and eyes are found close, then the device will set off the alarm.
- Else, the device will continue to do its work



Tech Stack

- Internet of Things:
- Computer Vision
- OpenCV
- Raspberry Pi
- Cloud Platform



Conclusion

- Drowsiness impairs mental awareness, making it more difficult for someone to drive safely and raising the possibility that a mistake could result in fatalities or serious injuries. It has also been demonstrated to diminish consciousness, slow reaction speed, and impede judgement. Truck drivers are particularly vulnerable to sleepy driving accidents due to long hours behind the wheel and boring road conditions. It is a difficult and complex challenge to successfully manage driver drowsiness in the commercial motor vehicle sector.
- This method will be useful in reducing many accidents because driver fatigue contributes to a significant number of traffic accidents. This will assist save money and lessen personal suffering by averting many accidents.
- The device will use a camera to track the driver's eyes, and by creating an algorithm, we can identify signs of driver drowsiness early enough to prevent an accident. Therefore, this project will be useful in anticipating driver fatigue and will provide a warning output in the form of sound with a frequency range of 50 to 60 Hz.

Thank You!

Abstract

The primary goal of this research is to create a non-intrusive system that can recognize driver weariness and send a timely warning. This method will help prevent many accidents because driver fatigue contributes to a significant number of traffic accidents. Through the use of a camera, this system will track the drivers` eyes, and by creating an algorithm, we can identify signs of driver drowsiness early enough to prevent an accident. Therefore, this research will aid in the early detection of driver fatigue and provide warning output in the form of sound and seat belt vibration, with a frequency range of 50 to 60 Hz. Additionally, the alert will be manually turned off rather than automatically.

For this reason, the warning will be turned off using a deactivation switch. A Warning signal is issued in the form of text or a red color circle if all three input variables indicate a potential for weariness at the same time. This will provide a clear sign of exhaustion or drowsiness, which may then be utilized to record the performance of the driver.

PAPER 1: Design of a Vehicle Driver Drowsiness Detection System through Image Processing using Matlab

Introduction

Feeling drowsy during long drives when your main focus is on the road all the time is a very common problem. This leads to some serious accidents caused on the roads, mostly truck and bus drivers are sleep deprived, because of their odd working hours. Some of the common identified factors causing this problem are: less than 8 hours sleep, no appropriate sleeping environment, no work schedule.

Summary

The drowsiness in a driver can be observed by many facial changes which are: blinking of eye, moving head from side to side, and yawning. The most dominating factor considered here is blinking of eyes. A normal person blinks 15 times a minute while a drowsy person blinks 21 times approximately. Using the eye-detection code in MATLAB, the number of blinks are calculated in a time period after processing the image and making a matrix of the image.

All this work is done by a laptop and based on the set target of the software, in case of more than a specific number of blinks, an alarm will be triggered in order to inform the driver about staying focussed or to take a rest.

Conclusion

Inadequate rest and sleep schedules in drivers causes drowsiness during driving. Drowsiness can be detected by some major factors that are noticeable like: blinking of eyes, yawning and moving head from side to side. Here, blinking of eyes was considered the dominating factor out of all and the project is based on it. Drowsiness during driving can cause accidents and hence should be taken care of.

Paper 2: Detecting Driver Drowsiness Based on Sensors: A Review

Introduction

- Drowsiness during driving has been a very common issue, which causes a large number of accidents on the road. Most accidents are caused in night time or during afternoons on
- high-speed highways, where mostly the driver is male (aged 18-25 years) and is alone in
- the vehicles with no traffic. This is the ideal condition to feel drowsy.
- To detect the drowsiness, the following three approaches are used and compared: vehicle-based measures, behavioral measures, and physiological measures.

Summary

- In this research, the simulator of a car is used with the drowsy driver in order to maintain the safety of the driver. The drowsiness can be caused by: lack of sleep, time of the day and increase in duration of driving hours. All these factors were considered while performing experiments in the simulator. KSS drowsiness scale (1-9) was used to measure the amount of drowsiness where 1 is ideal condition and 9 is the most dangerous condition to drive.
- In vehicle based approach, Steering Wheel movement and standard deviation of lane positioning was used.
- In behavioral measure, blinking of eyes, movement of head from side to side and yawning was considered.
- In Physiological measures, various body signals like ECG, EMG, etc were used.

Conclusion

- Upon comparing all the methods, the most dominant and reliable was the Physiological method as it predicted drowsiness most accurately. The other method, that is the behavioral measure used the computer vision approach which is not very good at times due to the camera positioning and poor lighting conditions at night. However Physiological methods can also be probed to be invasive in the long run, which needs to be taken care of during driving to make the driver comfortable.
- It is also important to consider that these results are based upon simulated setup and not on real-time conditions.

Paper 3: DRIVER DROWSINESS DETECTION SYSTEM

Introduction

- Drowsiness causes a large number of accidents every year and it isn’t a self solving issue.In this research paper, a ADAS system is developed that is based on the image processing and identifies the blinking of eyes as a common factor to measure the drowsiness of the driver. These tests were performed on real drivers on the road. Several other approaches are also considered during these tests.

Summary

- An algorithm to detect the state of an eye is implemented in this research paper. It is based on the Digital Signal Processor (DSP). Steps that follow are Face detection -> Eyes localization -> Eyes tracking -> Eyes state -> Driver state.
- In case the driver's eyes are found close for more than 5 consecutive frames, this means the driver is drowsy and an alarm is triggered.

Conclusion

- In this project, the drowsiness is detected and informed if found.
- It is done via the IR camera that possesses the ability to see in low light conditions also. Hough Transform for Circles is used for the decision of the eyes states.
- Results are very accurate with a very low false-positive rate, which means the design is good and implementable.
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Paper 4: Driver Drowsiness Detection using Eye-Closeness Detection

Introduction

- Car accidents are a major problem in this developing world. One of the most commonly identified driver-error is accidents caused due to drowsiness of the driver. In this research paper, the authors have worked to improve the eye closeness detection system developed by Volkswagen in their cars. The most common issues faced in the vehicle were: Lighting conditions, driver wearing eyeglasses, and dark skin tone.
- These issues are tackled in the research paper.

Summary

- Raspberry pi 3 along with Raspberry camera module was used to capture the image.
- The following methods were followed to get the proper eye closeness of the driver:Face Detection (Haar Cascade Classifier -> Region of Interest -> Eye Detection -> Eye closeness detection -> Geometrical rotation). Here, geometrical rotation is used to deal with the limitation of the Haar Cascade classifier and to get the tilt of the head of the driver.

Conclusion

- Raspberry pi 3 was the cheapest option that was used and that can be further improved for faster calculations. The algorithm was first implemented to the photos captured by the mobile phones and then it was uploaded to Raspberry pi 3. It showed an accuracy of 99.85% based on the sample data which was quite good.
- Although for real-world applications, more improvements are needed.

Paper 5: Driver Drowsiness Detection

Introduction

- All over the world, drowsiness has been a significant problem causing horrible accidents. There have been many proposed approaches to solve this issue, some being wearables and external hardware's, that in term reduces the comfort of the driver while driving. In this method, the author has proposed an experimental setup that has 2 factors to detect the drowsiness- eye blinking and hand-pressure exerted on the steering wheel.
- Used hardware is Arduino UNO and software is OpenCV and HOG.

Summary

- Data was collected while normal driving and analyzed. According to which a threshold value is set by the author which tells that whenever the eye blinking is above a specific rate and the pressure exerted on the steering wheel is less than a threshold value, an alarm will trigger itself, warning the user to focus on the road, in other case, the alarm will stay off.

Conclusion

- When compared to other methods and techniques where both the approaches (eye blinking and hand-pressure) were not being used together, it was found that this approach gives the correct result for around 96% of the time about the driver being drowsy. This is the highest among all the approaches.Only limitation is the hardware that is a little invasive in nature.