Driver Drowsiness Classification Based on Eye Blink and Head Movement Features Using the k-NN Algorithm

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ABSTRACT: The number of cars has increased exponentially during the past ten years. However, there has also been a direct correlation between this increase and accidents involving driving. According to research, a large number of these collisions are caused by drivers who are either preoccupied or who become tired during extended drives. Numerous image processing-based methods have been developed to identify a driver's level of exhaustion and drowsiness. These methods aren't always the greatest, though, as some could produce accurate yet incorrect forecasts.The EAR (Eye Aspect Ratio) Algorithm will be used in this study to develop a system that will determine whether or not the driver is feeling sleepy based on a live visual feed. Additionally, the system will notify the inattentive motorist of any potential collision utilizing Internet of Things sensors.

KEYWORDS: EAR (Eye Aspect Ratio), Image Recognition, Machine Learning, IoT

I. INTRODUCTION

This work implements a driver drowsiness detection method based on the driver's iris visibility, which determines the driver's condition of eyes. The device will alert the driver if it detects that they are tired and their eyes stay open or closed for longer than is normal or if they are not looking directly ahead. The system can determine the condition of the eyes both with and without normal glasses.Until now, commercial cars lacked a system like this to actively stop drivers from becoming distracted while operating a vehicle, thus averting potential collisions or accidents.

A branch of machine learning called image recognition places a strong emphasis on the interpretation of visual data, such as images and videos. Instantaneous visual data processing enables the system to respond quickly, and by utilizing cutting-edge technology, processing speeds are also increased.

RELATED WORK

Some efforts have been reported in the literature on the development of the not-intrusive monitoring drowsiness systems based on the vision.

1) Belal Alshaqaqi, Abdullah Salem, Baquhaizel developed a Vision based system for Driver Drowsiness Detection. In this paper, a module for Advanced Driver Assistance System (ADAS) is presented to reduce the number of accidents due to drivers fatigue and hence increase the transportation safety; also this system deals with automatic driver drowsiness detection based on visual information and Artificial Intelligence. The methods used for these tasks are: skin color for face detection, symmetry for eye localization, also the state of eye is given by the Hough transform for circles. The driver state are measured by calculating PERCLOS (percentage of eye closure) which stands for frequency of closure of eye.

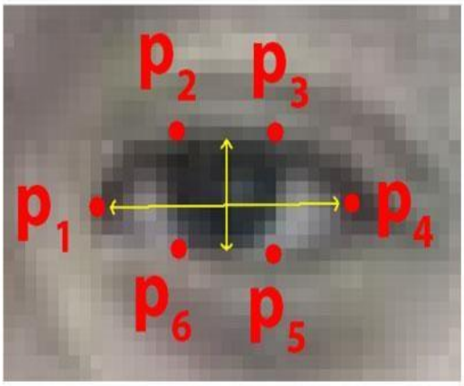
2) Mohammad Amin Assari, Mohammad Rahmati developed Driver Drowsiness Detection using Face Expression Recognition. In this proposed system, the sequence of images that have been acquired by the proposed hardware are then injected as input to the system. The facial components including eyebrow, eye and mouth is extracted on the face detected initially. It was heavily based on IR sensitive camera and IR sensors to detect the various facial structures even in low light conditions.

3) Maninder Kahlon and Subramaniam Ganesan created Driver Drowsiness Detection System Based on Binary Eyes Image Data. In this paper, driver drowsiness detection algorithm based on the state of eyes of the driver which is determined by his iris visibility has been implemented. After capturing an image rectangular eyes area was adjusted to

reduce the noise. RGB to Gray scale and finally to Binary image conversion is with a suitable threshold value. A median filter was used to reduce the noise and then the image was smoothened. The drowsiness detection is done based on the conditions like Black to White pixels ratio, number of pixels in the column greater than the threshold value and eye’s shape.

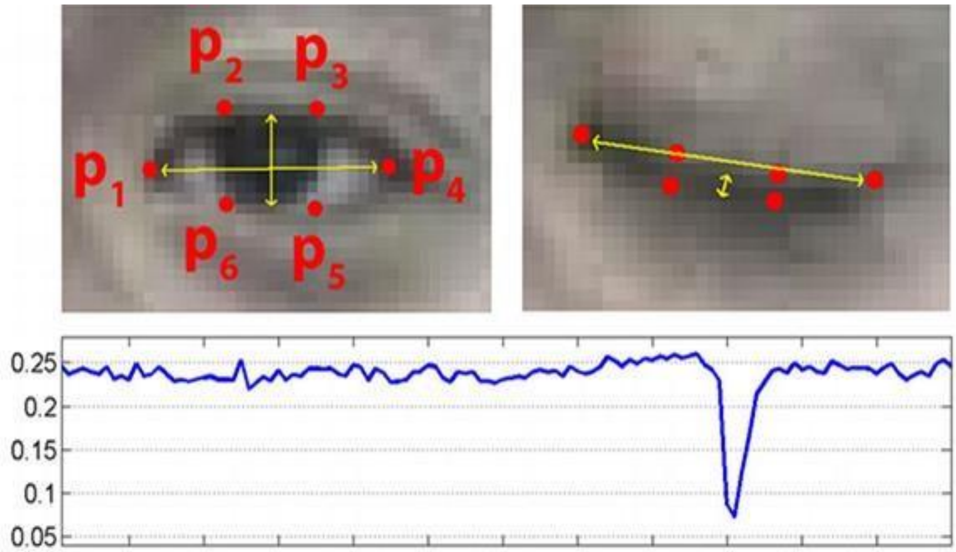
II. PROPOSED ALGORITHM

A computer vision system that can automatically detect driver's drowsiness in a real time video stream and then play an alarm if the driver appears to be drowsy. This system will work independently along with collision detection sensor and GSM module for emergency contacts and alert.



*EAR (Eye Aspect Ratio)*Fig 1.1

Each eye is represented by 6 (x, y)-coordinates, starting at the left-corner of the eye (as if you were looking at the person)and then working clockwise around the eye:
It checks 20 consecutive frames and if the Eye Aspect ratio is less than 0.25, Alert is generated.



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

Fig 1.2

This will detect if driver is feeling drowsy and then will give an alarm to alert the driver and take necessary action.Additional features of the system include GSM module to alert the emergency contacts of driver regarding any unfortunate possibility.A distance/proximity sensor will also alert the driver in regarding any possible collision in case the driver is not paying attention.(Fig 1.2)

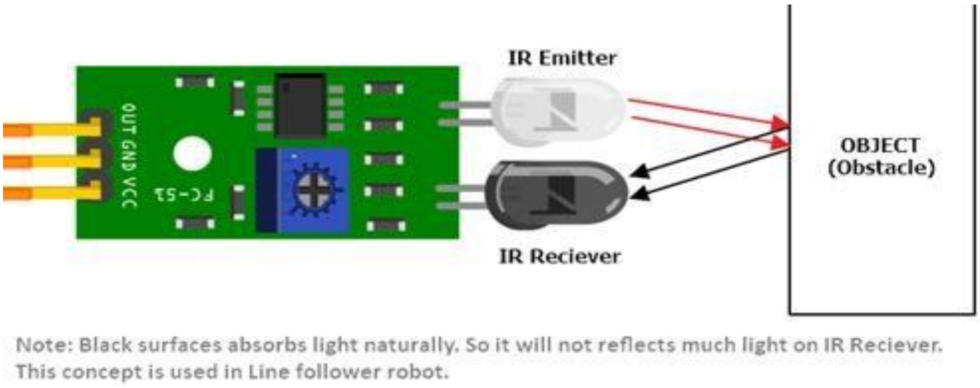
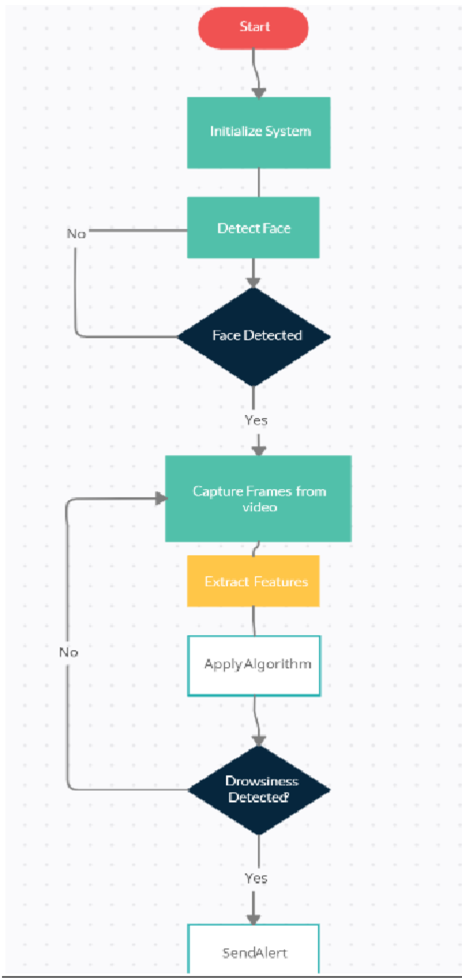


Fig1.3

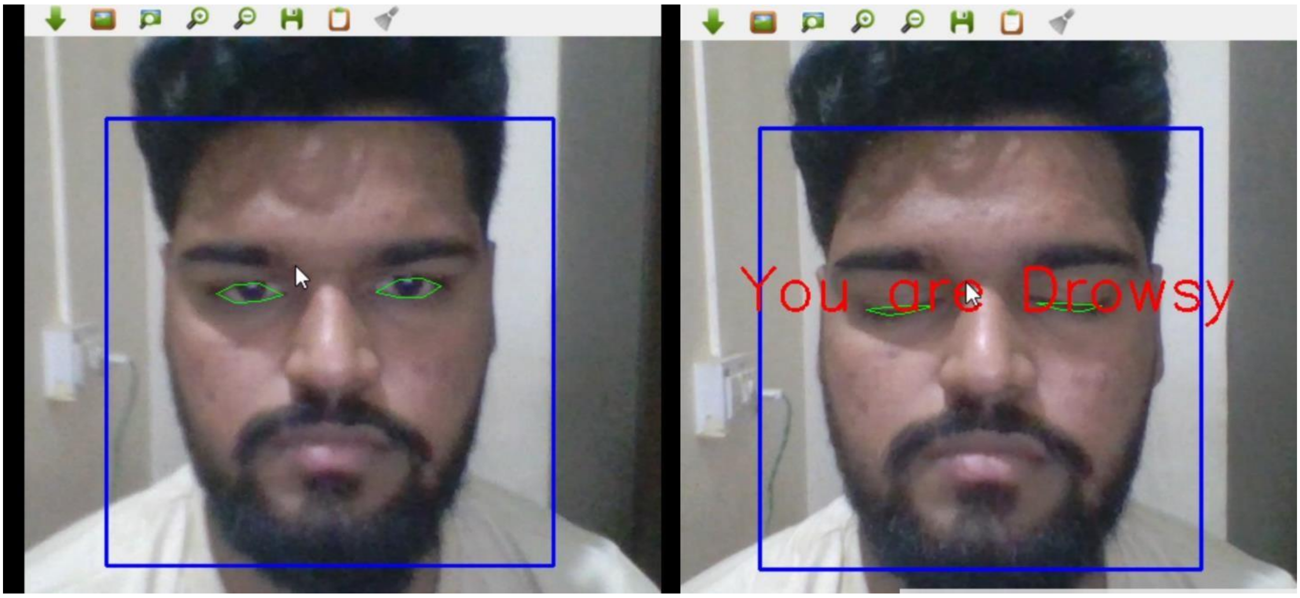
The collision sensor will give an alert in case of any sudden obstruction in front of the vehicle while driving. This will bring the driver to an alert position and will nudge him to take necessary precautions.

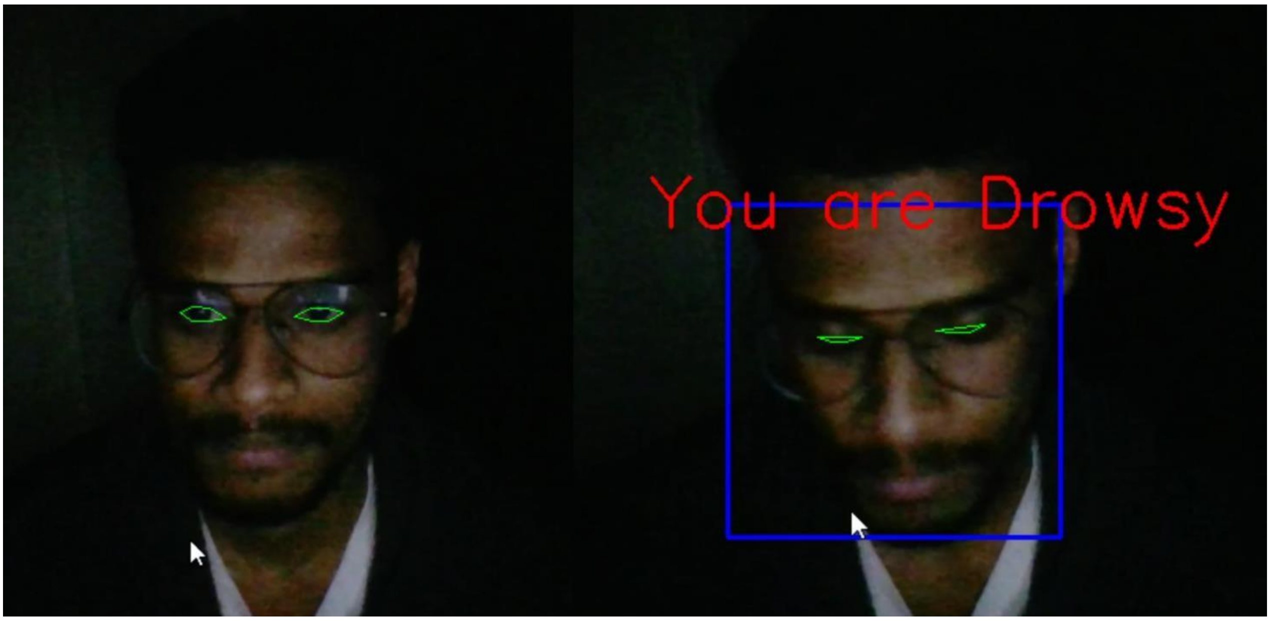
<u>System Flow Diagram</u>



III. SIMULATION AND RESULTS

The simulation studies involve testing the system in both day light and low light conditions.
As shown below the face of the driver is accurately detected and the drowsiness is identified.





From the above test results it is clear that the system will be highly accurate even if the driver is wearing glasses and even work in low light conditions.

IV. CONCLUSION AND FUTURE WORK

This study suggests a novel method for identifying driver fatigue. A mechanism that warns the driver in the event of a potential collision is also present. The employed technique yields excellent accuracy and runs more quickly than other sophisticated algorithms that have been used in the past. Previous methods might make judgments based on characteristics such as blink rate and eye closure. In order to determine if the individual was sleepy or not, we took the eye aspect ratio into consideration. In the event of an accident, the proximity

sensor will notify the driver.

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