DETECTING THE DROWSINESS OF THE DRIVERS USING IMAGE PROCESSING

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Abstract

Image processing facilitates enhancing raw images or extracting essential information from them for various applications. The major reason for most of the road accidents according to enforcement officers patrolling the highways and major roads is the presence of sleep-deprived drivers who contribute to 40% of the road accidents. During long drives, there are circumstances that lead to accidents due to the sleepiness of the driver. To avoid sleepiness of the driver being a cause of the accident, we can provide a solution by detecting the drowsiness of the driver and providing an alert. Eye prediction is done by checking if the person's eyes are closed in order to identify if the person is falling asleep. By monitoring the state of the human eyes, the signs of driver fatigue can be detected and the alert can be given early enough to prevent a possible road accident. The drowsiness detection system manages to alert the driver if the eyes of the driver are being kept closed for more than a certain amount of time by triggering a set of warning sounds. We can drop the number of road accidents caused by the driver's fatigue by implementing this type of system on a large-scale, thus saving countless lives.

1. INTRODUCTION

Driver drowsiness detection is a safety technology which prevents accidents when the driver tends to get drowsy. One of the significant factors in a large number of vehicle accidents is the driver's fatigue. The development of technologies for detecting or preventing drowsiness is a major help in the field of accident avoidance systems. Inattention of the driver might be the result of a lack of alertness when driving due to driver drowsiness and distraction. Based on the research in other countries, it can be seen that driver fatigue is a serious problem. [1]

The main objective is to develop a prototype of a warning system for a drowsy driver. Our whole concentration and focus will be placed on designing the system that will accurately monitor the open and closed state of the driver's eye in real time. It can be seen that the symptoms of driver fatigue can be detected early enough to avoid an accident by constantly monitoring the eyes. This detection can be done by continuously monitoring the eye states using the camera attached on the dashboard, and by marking some points at the eyes and calculating the Eye Aspect Ratio. If the eyes have been closed for a certain amount of time, we'll assume that they are starting to doze off and play an alarm to wake them up and grab their attention. [2]

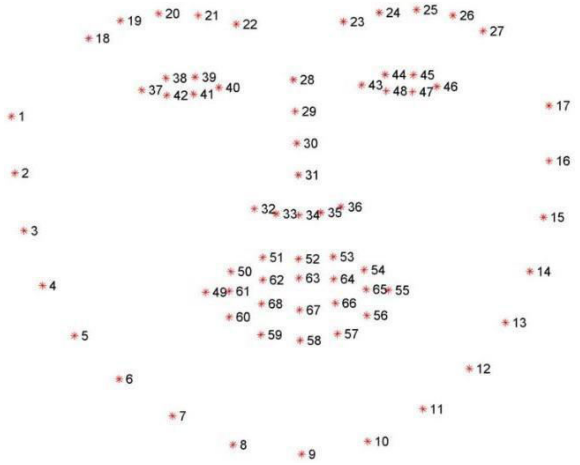

Fig.1. Facial landmarks set detected by dlib

The above image represents the 68-landmark detector data which helps to detect the eye points to calculate the Eye Aspect Ratio. This paper proposes a computer vision based driver drowsiness system, use

of OpenCV in image processing, interfacing of webcam to OpenCV, dlib, and Python and developing alertness systems using the status of the eyelid to alert the driver accordingly by providing an alarm.

The observation of the movements of the eye and its edges will be used for the detection. The drowsiness detector will even be able to work in a variety of conditions, including direct sunlight when driving on the road and low lighting while in the concrete parking garage.

2. SYSTEM DEVELOPMENT

2.1 Computational Analysis Matching

The dashboard mounted camera is used to monitor the eyes of the driver in real time to detect drowsiness. The camera will be connected to the laptop and will send the frames.

The captured image is sent to the processor for image processing. It converts the received image to digital signal using OpenCV. The digital signal is transmitted from the transmitter to the receiver. Both the transmitter and the receiver are then paired up.

2.2 Drowsiness Detection Design

We should predict the landmarks of important regions in the detected face. Once the landmarks are predicted, we use only the eye landmarks to determine the Eye Aspect Ratio(EAR) to check if a person is drowsy.

6 *(x, y)*-coordinates represent each eye, starting at the left-corner of the eye and then working clockwise around the remainder of the region. [3]-[5]

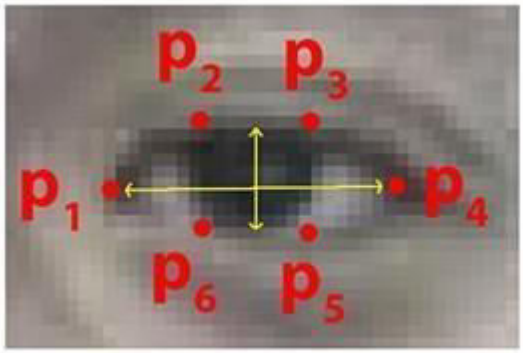

Fig.2. Eye marks when the eye is open

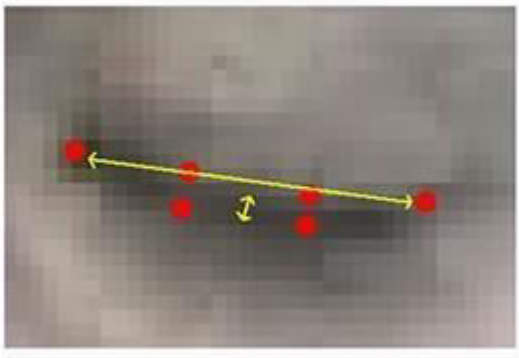

Fig.3. Eye marks when the eye is closed

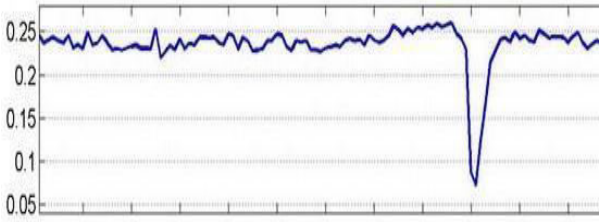

Fig.4. Eye Aspect Ratio plotted over time, the downfall in the aspect ratio graph shows a blink of the driver

It generates the Eye Aspect Ratio(EAR) and if it is less than the normal EAR(0.25) then we will start counting the number of frames the person has closed their eyes for.[6]-[8]

If the number of frames the person has closed their eyes exceeds the maximum allotted frames, then the alarm sound is produced.

The EAR is calculated as,

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

Fig.5. Eye Aspect Ratio Calculation Formula

The distance between the landmarks of the vertical eye is computed in the numerator of this equation while the distance between landmarks of the horizontal eye is computed in the denominator, weighting the denominator appropriately as there is only one set of horizontal points but two sets of vertical points.

It can be seen that, while the eye is open, the eye aspect ratio will remain approximately constant but it will rapidly fall to zero when there is a blink.

Using this simple equation, we can avoid image processing techniques and simply rely on the ratio of eye landmark distances to determine if a person is blinking.[9], [10]

3. ALGORITHMIC STEPS

- First we have used a camera which is setup at a desirable position in a car that looks for faces.
- If the face gets detected, the facial landmark detection task is applied and the region of eyes is extracted.
- Once we get the eye region, we calculate the Eye Aspect Ratio to find out if the eye-lids are down for a substantial amount of time.
- The Eye Aspect Ratio demonstrates that the eyes are shut for a considerably long measure of time or frames, then the alert will sound noisy to wake the driver up.
- For the functionalities of the system and to make it work efficiently we use OpenCv, dlib and Python. [11], [12]

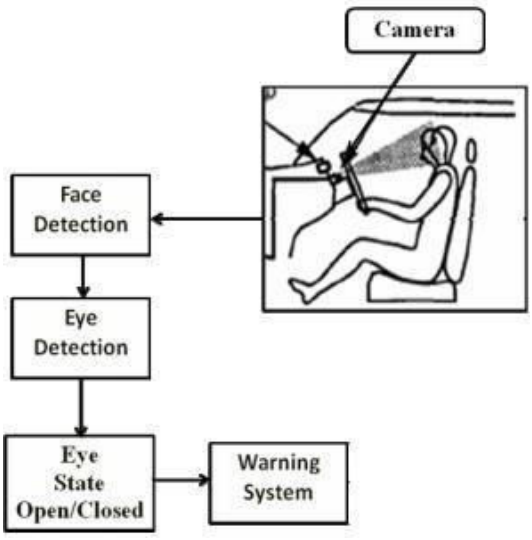

Fig.6. Practical design and working of the system

4. SYSTEM REQUIREMENTS

- Hardware Requirements:
  - Camera
  - Laptop
- Software Requirements:
  - OpenCV
  - Dlib
  - Python

5. CONCLUSION AND FUTURE WORK

The driver abnormality monitoring system developed is capable of detecting drowsiness, reckless behaviour of drivers in a short time. The Drowsiness Detection System developed based on driver's eye closure will be able to differentiate a normal eye blink and drowsiness and detect the drowsiness while driving. The proposed system can help in preventing accidents that occur due to the sleepiness of the driver while driving.

This system functions well even in case of drivers wearing spectacles and even under low light conditions if the camera delivers better output. Essential information about the positions of the head and eyes is obtained through various

self-developed image processing algorithms.

During the monitoring, the system is designed in such a way that it decides if the eyes are opened or closed. When the eyes have been closed for too long, an alert is issued.

This framework can be stretched out further to have abundant security highlights, for example, we can detect the drowsiness using the yarning by calculating the Mouth Aspect Ratio.

If there is a situation where the robbers attempt to attack a moving car the image can be taken and along with the current location it can be sent to the nearest police station.

If there should be an occurrence of an endeavour to robbery, the vehicle's motor doesn't begin or an alarm should be produced. A picture of the burglar is taken in an attempted theft and sent to the owner of the vehicle who can register a case against the thief of the vehicle.[13]-[15]

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