DRUNK AND DROWSY DETECTION OF DRIVERS USING ARTIFICIAL INTELLIGENCE

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***Abstract* -** This paper gives a complete method for drunk and drowsy detection of the driver using CVT of facial landmark detection and motion detection. The driver's constant real-time video feed is perceived with the help of a smartphone camera. Eye blinking is analyzed for drunkenness. Simultaneously the system checks the body and the head movements using the differential imaging technique, which operates in real-time. A severity score indicating the fitness to drive is generated cumulatively using both methods. The driver is notified with the sound of an alarm if the results are positive based on a threshold value of the severity score.

Key Words: Computer vision, Motion detection, Face Detection, EAR

1. INTRODUCTION

Drunk and drowsy driving are the principal sources of road accidents across the sphere. Klauer et al. [1] have found that drowsiness growths the possibility of an accident up to six times, which is further compounded due to hours of darkness conditions or in situations without prior enough sleep [2]. It is a well-known fact that the effect of alcohol is one of the major sources of condensed vehicular control and increased threat of accidents. Many studies have recognized that the risks of road accidents, injury or death growth exponentially under the effect of alcohol [3]. In Europe itself, there is an estimation of 10,000 expiries each year because of drunk driving [4]. Alcohol-impaired driving accidents subsidize to about 31% of all traffic casualties in the USA [5]. In China, Li et al. found that about 34.1% of all road accidents were alcohol-related [6]. All of these studies indicate grave human spaces and preventable causes of death, which can be prevented by proper observing and warning technology. Therefore, it is crucial to advance a complete system to nonstop monitor a person's physical and facemask movements and to alert them at critical moments to avoid road [17] and [18]; techniques using a stereo camera [18] and [19]. Some of these techniques have also been converted into commercial products such as Smart Eye [18], Seeing Machines DSS [19], Smart Eye Pro [18] and Seeing Machines Face API [19]. However, these profitable products are still limited to precise environments and require laborious standardization methods. Thus, there is a long way to go before a dependable and healthy commercial product is built in this category.

2. PROPOSED WORK

The proposed work targets both the detection of drowsiness and reduced vehicular control due to stupor induced by the influence of alcohol and even sleep deprivation, simultaneously and provides a solution which detects and reports such conditions in real-time.

The main system flow diagram is shown in Fig. 1. The input to the system is a video feed captured by a simple smartphone camera attached in a position to get a continuous video feed of the head and upper body of the driver. This feed is processed frame by frame, by the system. Drowsiness is detected by the blink patterns of the eyes, using facial landmark detectors [20], which provide a precise method for estimation of eye-opening using a single scalar metric called Eye Aspect Ratio (EAR). Simultaneously, an analysis to detect head and body movements of the driver is performed, to ascertain whether he/she is potentially under the influence of alcohol or sleepy or both.

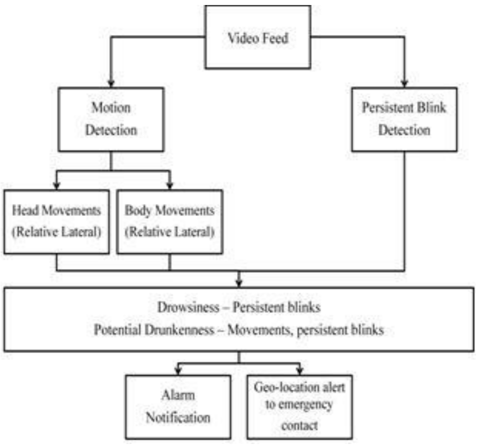

Fig. 2.1: Driving fitness detection- system flow diagram

3. SYSTEM ARCHITECTURE

The design pattern that is followed is **observer, pattern** which is a software design pattern in which an object, called the **subject**, maintains a list of its dependents, called **observers**, and notifies them automatically of any state changes, usually by calling one of their methods.

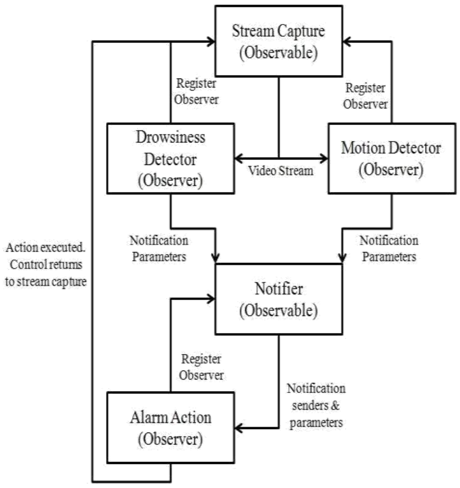

Fig. 3.1: System Architecture diagram

3.1 Steam Capture

This module captures the video from the camera attached in the position to get continuous feed of the head and upper body of the driver. This feed is processed frame by frame, by the system.The Steam capture maintains the dependency list of observer which are drowsy detector and motion detector.

a) Drowsiness Detector: Drowsiness is detected by the blink patterns of the eyes, using facial landmark detectors , which provide a precise method for estimation of eye opening using a single scalar quantity called Eye Aspect Ratio (EAR).

b)Motion Detector : An analysis to detect head and body movements of the driver is performed, to ascertain whether he/she is drunk or sleepy or both. . The lateral movement determines the head tilt angle. When the head angle goes beyond a certain threshold, an unusual behaviour of person is recorded.

3.2 Notifier

This module analyses the results of both of these detectors. When one of them gives confirmation that the driver is either drowsy or drunk or both, the system sounds an alarm, implemented via a voice notification output, to alert the driver.

Drowsiness Flag (D)	Motion Flag (M)	Alert Result
True	True	True
True	False	True
False	True	True
False	False	False

TABLE 1: ALERT MATRIX

The voice alert is sounded continuously until the driver returns back to a state of normalcy and regains control over the vehicle or manually turns it off. The system responds to critical situations of drowsiness and potential loss of vehicle control under the influence of alcohol or drowsiness or both, in real-time, due to negligible computational times of both the real time blink detection and motion detection modules. The alerts are also sounded almost instantly, ensuring accurate and timely alerts to prevent any unfortunate accidents.

4.CONCLUSION

In this paper, we have described a holistic, non-intrusive approach to driving fitness detection, by checking for drowsiness and the loss of vehicle control under the potential influence of alcohol, based on driver visual monitoring, using computer vision techniques of facial landmark detection and motion detection using differential images.

We have also demonstrated that real-time frame based facial landmarks and body motion detectors are precise indicators for estimation of drowsiness and potential drunkenness. These are powerful measures, even for low image resolution and in-the-wild circumstances such as bad illumination, facial expressions, non-frontality etc. The computational cost for the Eye Aspect Ratio of the eye blink and detection of lateral relative motion is found to be negligible, which allows the system to send out alerts in critical situations with rapid response times.

However, the following limitations exist and can be further improved through future discussion and further work.

- We see a limitation in the assumption of a constant blink duration. However, this duration differs from person to person. An adaptive approach can yield better results.
- Nighttime and poor lighting conditions can also potentially impact the performance of real-time blink detection and motion detection algorithms. The usage of approaches which are sensitive and responsive to such conditions can further enhance the system performance.
- Another limitation to this solution is that EAR is estimated for 2D frames which is insensitive to the angle of head orientation. This solution could be further enhanced by defining a 3D EAR, using landmark detectors which estimate a 3D model of the eye landmarks in an image.

- The sending of a geo-location notification to the emergency contact of the driver, their kin or the concerned authorities introduce a requirement of an Internet connection for the system. Apart from this module, the system can function perfectly offline. The introduction of this dependency could be a subject for future discussion, as there could be possible limitations to the proper functioning of this feature in regions of poor connectivity. However, the alarm feature will work even in such situations.

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