WWJMRD 2017; 3(9): 6-9
www.wwjmrd.com
International Journal
Peer Reviewed Journal
Refereed Journal
Indexed Journal
UGC Approved Journal
Impact Factor MJIF: 4.25
e-ISSN: 2454-6615

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A Review on Driver Fatigue Detection System

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Abstract
Driver Fatigue is usually caused by four main factors: sleep, work, time of day, and physical. Usually individuals try and do a lot of in a very day and that they lose precious sleep thanks to this. Usually by taking caffein or alternative stimulants individuals still stay up. The dearth of sleep builds up over variety of days and also the next issue that happens is that the body finally collapses and also the person falls asleep. Time of day factors will usually have an effect on the body. The human brain is trained to suppose there are times the body ought to be asleep. These issues are resolved with the assistance of SVM and another technique.

Keywords: Driver Fatigue, IR, EOG, ECG & EEG etc.

Introduction
Fatigue, somnolence and somnolence area unit typically used synonymously in driving state description [1]. Involving multiple human factors, it's two-dimensional in nature that researchers have found troublesome to outline over past decades [2]–[5]. Despite the anomaly encompassing fatigue, it's a crucial issue for driving safety. Studies have shown that fatigue is one amongst the leading conducive factors in traffic accidents worldwide [6]. it's notably crucial for activity drivers, like drivers of buses and serious trucks, thanks to the very fact that they will need to beat up a protracted length of the driving task, throughout the height somnolence periods (i.e., 2:00 A.M. to 6:00 A.M. and 2:00 P.M. to 4:00 P.M.), and below monotonous or dissatisfaction operating conditions [7], [8]. Analysis to observe driver somnolence is classified into 3 categories: 1) vehicle-based approaches, 2) behavior-based approaches, and 3) physiological-signal based mostly approaches (see [7], [9] for an honest review). In physiological approaches, the physiological signals from a body, like EEG (EEG) for brain activity, electrooculogram (EOG) for eye movement, and cardiogram (ECG) for pulse rate, area unit evaluated to observe driver somnolence [10]–[5]. Recent studies show that the strategies victimization physiological signals (specially the graphical record signal) can do higher responsibility and accuracy of driver somnolence detection compared to alternative strategies [6]. However, the intrusive nature of measure physiological signals will hinder driving, particularly for prolonged driving periods. Vehicle based mostly approaches collect signal knowledge from sensors in vehicles to judge driver's performance. These strategies monitor the variations of handwheel angle, lane
Position, speed, acceleration, and braking to predict the motive force fatigue [7]–[2-1]. It's convenient to gather vehicle signals. However, these approaches could be too slow to observe driver somnolence [7]. Behavior-based approaches depend upon vision analysis to watch driver's behavior, together with eye-closure, eye-blinking, yawning, head pose, hand gesture, etc., through a camera directed to driver's face [2]–[7]. The motive force is alerted if a somnolence symptom is detected. The vision-based systems on behavior analysis area unit enticing to automobile industries since they area unit and non-intrusive to the motive force and therefore the measures are effective and reliable to predict driver fatigue [8]. A drowsy driver displays variety of symptoms, together with frequent eye-closure, speedy and constant blinking, cernuous or swinging head, and frequent yawning [9]. Within the last decade, varied vision systems are developed to observe such behaviors of somnolence for driving safety. Most of the present systems need the installation of a camera directly toward the driver's face to capture high-resolution face pictures, and a few of them use specifically

designed infra-red (IR) cameras [3], [10] or stereo cameras. The vision algorithms area unit designed for high-resolution front-view face and eye pictures (e.g., the peak of the face is over hour of image height in input pictures over 640 × 480 pixels). This configuration isn't applicable for buses and enormous vehicles. A bus largely incorporates a massive front glass window to let the motive force have a wide-field-view of scene for safe driving since it's a lot of wider than cars. Putting a camera on the front glass window isn't sensible, which additionally blocks the drivers' read. If the camera is put in on the frame round the window, the camera isn't ready to capture the frontal read of driver's face, in order that existing vision algorithms aren't applicable [9].

Fig. 1: Existing dome camera in the bus and example images of bus drivers captured by the dome cameras in buses. Only an oblique view of low-resolution face images can be captured by the existing dome cameras for normal driving poses. (Images came from open sources of bus service companies with face portions of the drivers being pixelated for keeping anonymity.)[1]

Driver basic cognitive process may well be the results of a scarcity of alertness once driving attributable to driver temporary state and distraction. Driver distraction happens once associate in nursing object or event attracts a person's attention far away from the driving task. Not like driver distraction, driver temporary state involves no triggering event however, instead, is characterised by a progressive withdrawal of attention from the road and traffic demands. each driver temporary state and distraction, however, may need an equivalent effects, i.e., minimized driving performance, longer latency, Associate in Nursing an multiplied risk of crash involvement[11]. Driving may be a complicated task wherever the driving force is accountable of observance the road, taking the proper call on time and at last responding to alternative driver's actions and totally different road conditions. "Fig.1.2", shows the diagram of overall system. supported Acquisition of video from the camera that's ahead of driver perform real-time operation of Associate in Nursing incoming video stream so as to infer the driver's level of fatigue if the temporary state is calculable then the output is send to the warning device and alarm is activated. There area unit several strategies for police work the driving force temporary state. The signs of the driving force temporary state are [12].

- Driver is also yawn oftentimes.
- Driver is unable to stay eyes open.
- The driving force cannot bear in mind driving the previous few miles.
- Drift into the opposite lane or onto the shoulder of the road

Defining Drowsiness

The term "drowsy" is substitutable with asleep, that merely suggests that Associate in Nursing inclination to go to sleep. The stages of sleep is classified as awake, non-rapid eye movement sleep(NREM),and speedy eye movement sleep(REM).The second stage, NREM, is subdived into the subsequent 3 stages. Stage 1: Transition from attentive to asleep (drowsy) stage

1. Light sleep stage
2. Deep sleep

- Factors inflicting Driving sleepiness

Driver Fatigue is commonly caused by four main factors: sleep, work, time of day, and physical. Usually folks try and do abundant during a day and that they lose precious sleep as a result of this. Usually by taking alkaloid or alternative stimulants folks still not blink. The dearth of sleep builds up over variety of days and therefore the next issue that happens is that the body finally collapses and therefore the person falls asleep. Time of day factors will usually have an effect on the body. The human brain is trained to suppose there area unit times the body ought to be asleep. These area unit usually related to seeing the sunrise and sunset. Between the hours of two AM and half-dozen AM, the brain tells the body it ought to be asleep. Extending the time awake can eventually result in the body bally. The ultimate issue may be a person's wholeness. Folks typically area unit on medications that make sleepiness or have physical ailments that cause these problems. Being physically unfit, by being either below or overweight, can cause fatigue. To boot, being showing emotion stressed can cause the body to urge played out faster.

- Connected Study sleepiness detection is divided into 3 main classes

1. Vehicle based mostly
2. Activity based mostly
3. Physiological based mostly. "Fig.2", shows the 3 completely different approaches for sleepiness detection. Sleepiness detection relies on these 3 parameters and in depth review on these measures can give insight on this systems, problems related to them and therefore the enhancements that require to be done to form a sturdy system [7].

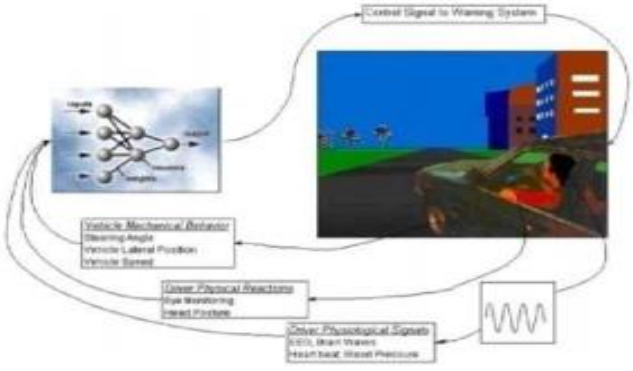

Fig. 2: Different Approaches for Drowsiness Detection and Warnings [2]

Literature Survey

Ralph Oyini Mbouna et al. (2013) have studied visual analysis of eye state and head cause (HP) for continuous observance of alertness of a vehicle driver. Most existing approaches to visual detection of non-alert driving patterns swear either on eye closure or head drooping angles to

work out the driving force somnolence or distraction level. The planned theme uses visual options like eye index (EI), pupil activity (PA), and horsepower to extract essential info on nonalertness of a vehicle driver. EI determines if the attention is open, [*fr1] closed, or closed from the quantitative relation of pupil height and eye height. PA measures the speed of deviation of the pupil center from the attention center over a period. [1]

Mohamad-Hoseyn Sigari et al. (2014) have studied per annum, several automobile accidents owing to driver fatigue and distraction occur round the world and cause several casualties and injuries. Driver face observance systems is one in every of the most approaches for driver fatigue or distraction detection and accident hindrance. These symptoms are typically proportion of lid closure over time (PERCLOS), lid distance, reflex rate, blink speed, gaze direction, eye saccadic movement, yawning, head drooping and head orientation. Then a comprehensive review on driver face observance systems for fatigue and distraction detection is given. [2]

MD. Rafeeq et al. (2014) have studied visual analysis of eye state and head cause (HP) for continuous observance of alertness of a vehicle driver. The planned theme uses visual options like eye index (EI), pupil activity (PA), and horsepower to extract essential info on non-alertness of a vehicle driver. EI determines if the attention is open, [*fr1] closed, or closed from the quantitative relation of pupil height and eye height. PA measures the speed of deviation of the pupil center from the attention center over a period. A support vector machine (SVM) classifies a sequence of video segments into alert or non-alert driving events. [3]

Deepak Ghimire et al. (2015) have studied Driver face observance system will find driver fatigue that is a crucial consider an oversized variety of accidents, victimization pc vision techniques. During this paper they gift a period technique for driver eye state detection. Support vector machine with bar chart of orientation gradient options is employed for classification of state of the eyes as open or closed. If the eye(s) state is detected as closed for a mere quantity of your time the driving force is taken into account to be sleeping associated an alarm are generated. [4]

Harinder Kaur et al.(2015) have studied Drivers WHO don't take regular breaks once driving long distances run a high risk of turning into drowsy a state that they typically fail to acknowledge early enough in keeping with the consultants. Attention assist will warn of inattentiveness associated somnolence in an extended speed vary and advise drivers of their current state of fatigue and also the driving time since the last break, offers adjustable sensitivity and, if a warning is emitted, indicates close service areas within the COMAND navigation system.[5]

Bappaditya Mandal et al. (2016) have studied a vision-based fatigue detection system for driver observance that is simple and versatile for preparation in buses and enormous vehicles. The system consists of modules of head-shoulder detection, face detection, eye detection, eye openness estimation, fusion, somnolence live proportion of lid closure (PERCLOS) estimation, and fatigue level classification. The core innovative techniques ar as follows: 1) associate approach to estimate the continual level of eye openness supported spectral regression; and 2) a fusion formula to estimate the attention state supported adjustive integration on the multimodal detections of each eyes..[6]

Research Gaps

In this analysis work different researchers studied different techniques to perform the driver Fatigue supported strong Visual Analysis of Eye and Face State. Each investigator featured totally different issues which issues are resolved with the assistance of PERCLOS and SVM classifiers. They featured issues like fusion, head-shoulder detection, face detection and non-alertness etc. Same issues are mentioned during this work, rather than this driver face observance systems, 2 main challenges may be considered: (1) "how to live fatigue?" and (2) "how to live concentration?" These issues are the most challenges of a driver face observance system. Of these are issues are coved with the assistance of vision-based fatigue detection system for driver observance, that is simple and versatile for preparation in buses and enormous vehicles and SVM classifiers.

Problem Definition

From the above study of review of literature I have studied the different problems that are as follows:

- The main problem for distraction detection is that if head is forward and eyes look toward the road, the driver does not necessarily pay attention to the road.
- The driver drowsiness detection problem.
- Another problem is the Driver alertness detection during the driving.
- In driver face monitoring systems, two main challenges can be considered: (1) "how to measure fatigue?" and (2) "how to measure concentration?" These problems are the main challenges of a driver face monitoring system.
- Face tracking and increasing system accuracy in detection of fatigue and distraction are considered as other problems.

Conclusion

In this work the different researchers work is reviewed with different types of techniques. Some common problems like for distraction detection is that if head is forward and eyes look toward the road, the driver does not necessarily pay attention to the road are studied. Another problem is Driver alertness detection during the driving. all these problems are resolved in the future with the help of SVM and fatigue of driver based on head-shoulder, face, eye, eye openness estimation, fusion, drowsiness measure percentage of eyelid closure (PERCLOS) estimation, and fatigue level classification**.**

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