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Alertness Monitoring System: A Review

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Abstract: Experts warn that drivers who neglect to take regular rests when traveling long distances are at a considerable risk of experiencing drowsiness, a condition they frequently fail to detect in time. Sleepy drivers in need of a break are responsible for approximately 25% of significant motorway accidents, according to studies. This means that sleepiness is a bigger cause of road accidents than drunk driving. Attention assist can alert drivers to their present level of weariness and the dangers of inattentiveness and drowsiness throughout a wider speed range.

Keywords—Drowsiness Detection, Eyes Detection, Blink Pattern, Face Detection, LBP, SWM.

I. INTRODUCTION

A automobile safety feature called driver drowsiness detection alerts drivers to impending collisions as they start to become sleepy. According to some studies, weariness may be a factor in 20% of all traffic accidents, and on some routes, it may even account for 50% of them. An important contributing element to a high number of auto accidents is driver weariness. According to recent figures, collisions connected to weariness are thought to be the cause of 1,200 deaths and 76,000 injuries per year. One of the biggest challenges in accident avoidance systems is the development of technology that can identify or prevent driver fatigue. Techniques to mitigate the effects of drowsiness on drivers must be developed because of the danger it poses on the road. Driver fatigue may cause a driver to become less vigilant when driving, which can lead to inattention.. Driver distraction occurs when an object or event draws a person's attention away from the driving task. Unlike driver distraction, driver drowsiness involves no triggering event but, instead, is characterized by a progressive withdrawal of attention from the road and traffic demands. Both driver drowsiness and distraction, however, might have the same effects, i.e., decreased driving performance, longer reaction time, and an increased risk of crash involvement. [1]. "Fig.1", shows the block diagram of overall system. Based on Acquisition of video from the camera that is in front of driver perform real-time processing of an incoming video stream in order to infer the driver's level of fatigue if the drowsiness is Estimated then the output is send to the alarm system and alarm is activated.

II. FACTORS CAUSING DRIVING DROWSINESS

Four primary elements are often responsible for driver fatigue: sleep, work, time of day, and body. People typically try to juggle too much during the day, which prevents them from getting enough sleep. Taking stimulants like caffeine or other substances can make a lot of individuals sleepy. After experiencing insomnia for a few days, the person's body gives out and they go to sleep. The body is often influenced by the time of day. The human brain is wired to believe that the body requires sleep at specific times. These are frequently connected to seeing the sun come up and set. Your body gets the signal to go to sleep from your brain between 2:00 and 6:00 in the morning. The body will eventually suffer from prolonged wakefulness.

III. RELATED STUDY

There are three primary categories for drowsiness detection: (1) vehicle-based; (2) behavioral-based; and (3) physiological-based. The three distinct methods for sleepiness detection are displayed in "Fig. 2". These three factors are what determine if someone is sleepy. A thorough analysis of these measurements will provide light on the current systems, the problems they are having, and the improvements that must be made to create a reliable system.

measures based on vehicles: a variety of parameters, such as lane changes, steering wheel movement, acceleration pedal present

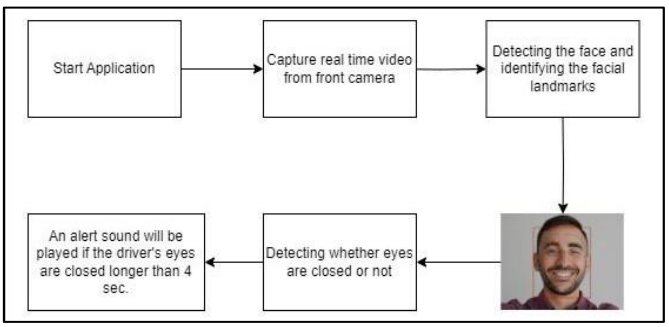
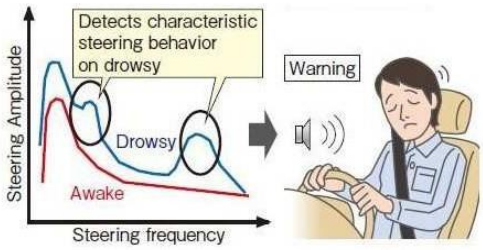


Fig. Block Diagram

Many writers have put forth various methods for drowsiness detection systems; the majority of these methods rely on ECG and vehicle-based techniques.a strong embedded real-time platform to track driver inattention in both daytime and nighttime driving scenarios. This work presents a sleepiness detection technique that combines ocular and brain activity. There is only one electroencephalographic (EEG) channel used to assess brain activity. A technique for tracking driver safety by evaluating fatigue-related data using two different approaches: biosignal processing and eye movement monitoring

IV. DROWSINESS DETECTION TECHNIQUES

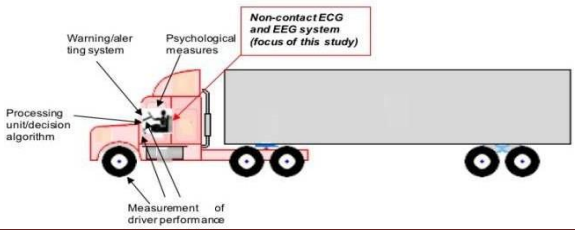
What telltale signs of driver fatigue do drivers give off that can be picked up on by car technologies that aim to prevent or at least warn of it? Research indicates that a variety of technology categories are capable of identifying driver fatigue. Voice recognition is the next in line of these technologies. A person's voice can frequently reveal how worn out they are. The following provides a detailed explanation of the fundamental methods for detecting drowsiness that are most frequently used: • Local Binary Pattern (LBP) • ECG and EEG • Optical



Detection • Steering Wheel Movement (SWM)

Numerous investigators have examined physiological signals. Heart rate (HR) also changes dramatically between wakefulness and fatigue, two other stages of drowsiness. Consequently, heart rate—which is easily ascertained from electrocardiogram signals—can be used to identify drowsiness. Heart rate variability (HRV), whose low frequency (LF) and high frequency (HF) range from 0.04 to 0.15 Hz and 0.14 to 0.4 Hz, has been used by others to gauge drowsiness [12]. The physiological signals are depicted in Figure 3. a sensor system that canbe installed in a car to identify fatigue in the driver.

The Electroencephalogram (EEG) is the physiological signal most commonly used to measure drowsiness. The EEG signal has various frequency bands, including the delta band (0.5–4 Hz), which corresponds to sleep activity, the theta band (4–8 Hz), which is related to drowsiness, the alpha band (8–13 Hz), which represents relaxation and creativity, and the beta band (13–25 Hz), which corresponds to alertness . A decrease in the power changes in the alpha frequency band and an increase in the theta frequency band indicates .



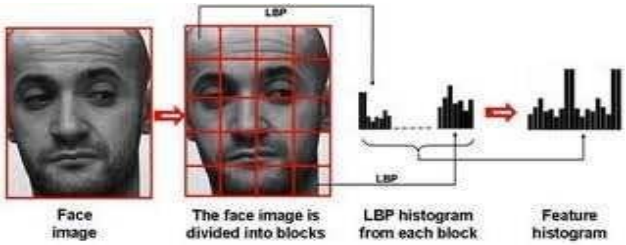


Fig.3. Schematic of Sensing System Integration for Driver Drowsiness Detection and Assistance

A. Local Binary Pattern, or LBP

The domains of computer vision and image processing have shown interest in the local binary model (LBP). Local picture patterns are gathered using LBP, a non-parametric technique, by comparing each pixel to its neighbors Only positive and negative facial expressions, like happiness and sadness, are measured by these machines. The driver's face is detected by the LBP (Local Binary Model), which divides the image into four quadrants before detecting the top and bottom "Figure 4" displays the pictures that LBP takes from a video.

Fig. 4. Local Binary pattern [14]

B. Steering wheel movement

Measured using steering angle sensor and it is a widely used vehicle-based measure for detecting the level of driver drowsiness. Using an angle sensor mounted on the steering column, the driver's steering behaviour is measured. When drowsy, the number of micro-corrections on the steering wheel reduces compared to normal driving. Furlough and Graham found that sleep deprived drivers made fewer steering wheel reversals than normal drivers .To eliminate the effect of lane changes, the researchers considered only small steering wheel movements (between 0.5° and 5°), which are needed to adjust the lateral position within the lane ."Fig.5" shows the SWM based detection. In general, behavior is influenced by driving characteristics (e.g. speed, curve and lane width), driving style (e.g. driving) and driving situation (e.g. relaxed, stressed or tired). The driver constantly evaluates progress and makes small, dynamic changes by slightly turning the steering wheel to accommodate small bumps in the road and overpasses.

Therefore, the driver's fatigue status can be determined according to the small SWM and a warning can be given when necessary. In the simulated environment, a slight crosswind is added to the curve pushing the car to the right side of the road to create a change in side position and force the driver to adjust the SWM. Automobile manufacturers such as Nissan and Renault have adopted SWM, but its functions are quite limited. This is because they work reliably only in certain conditions and also depend on the geometric characteristics of the road and, to a lesser extent, the dynamic characteristics of the car.

C. Optical Sensing

The most common use of optical sensing devices uses infrared or near-infrared LEDs to illuminate driving pupils that are monitored by a camera system. Computer algorithms analyze the frequency and time of facial expressions to determine fatigue. The camera system also monitors face and head position for signs of fatigue, such as yawning and sudden head shaking. The use of optical systems is explained.

D. Blink Based Technology

In this device, the driver's fatigue is detected by measuring the blinking time of the eyes and the closing time of the e yes. Because when the driver feels sleepy, he can easily de tect sleepiness because his eye blinks and eyelids are diffe rent from normal. "Figure 6" shows the darkness of the ey es seen in this system, where the position of the iris and ey es is estimated based on the time tracking condition to esti mate the blinking frequency and eye closing time. [18]. In such a process, a remote camera is used to acquire video a nd then a computer vision system is used to find the positi on of the face, eyes, and eyelid to measure occlusion. [19] We can detect a drowsy driver by moving the eyes closer t ogether and blinking more frequently. Installed in an inco nspicuous corner of the car, such a system would simultan eously monitor any head tilt, eye strain or yawning. The i mage below shows blinking.

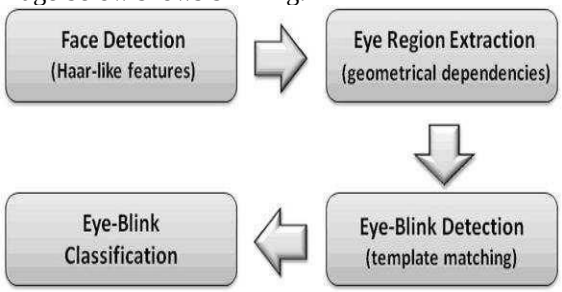


Fig. 6. Scheme of the proposed algorithm for eye-blink detection

V. CONCLUSION

There are various methods of diagnosing driver fatigue as discussed in this article. This article attempts to review the latest technology and determine the best ways to prevent fatal accidents. The number one seller on the market right now is nothing more than a reed switch used to control head tilt. This product is very limited and not very good. The product that BMW produces to recognize the driver's fatigue behavior and integrates into its high-end cars is slightly better, but there is no definitive report that warns the driver. Current business and technology are still in their infancy. New technologies are constantly emerging using different technologies.

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