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Anti-Sleep Alarm

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Abstract: *Expertise advancement has always been a great boon to human life that helps in developing many systems, which adds comfort, safety, advancement, and so on in every field right from agriculture to industries. One of such area is to have an automatic system for detecting the driver sleepiness condition, which will alarm the driver to stop driving. Many systems are available in this area for warning the driver of his drowsiness for safety of drivers. This paper is a survey of driver sleepiness classification that will help us understand different techniques that can be employed to make this alert system more accurate thereby increasing the rate at which drowsiness detection can be done. This paper also introduces how modern technology like Machine learning and IoT can also be used to enhance the performance of driver sleepiness detection which will avoid accidents and ensure read safety.*

Keywords: Neural Network, Machine learning, Driver Drowsiness, Driver Sleepiness, Accident Detection System

I. INTRODUCTION

Conferring to the survey of world health organization, every year about 1.25 million people are killed in road accidents and most of these people are from age set 15-29. The percentage of crashes caused due to drowsiness is about 10-20%In many cases drivers are aware of sleepiness but still they continue to drive.9 To stop drivers from driving in the sleepy conditions many smart sleepiness warning systems has been designed and some of them are already in market, unfortunately quantification of sleepiness is still an issue and the exact measure of drowsiness has yet to found. Now-a-days, many schemes are available in market like navigation systems, warning alarm systems etc. to make driver's work easy. But still Driver sleepiness is one of the major reasons of traffic accidents. Drowsiness reasons more road accidents than drink-driving. It is a serious highway safety problem which leads to health injuries, deaths and economic losses. If drivers could be signalled before they became too sleepy to drive safely, some of the crashes could be avoided. Drowsiness detection systems is yet not that effective due to `not considering the individual differences. Based on the kind of data used, sleepiness detection systems can be differentiated as of invasive and non-intrusive methods. Different parameters for Sleepiness detection systems are - vehicle grounded events, behavioural measures and physiological measures. Vehicle based information like steering position and deviation of lane positioning can be used for sleepiness detection and are already present in modern vehicles but warning generated are often inaccurate and unreliable. Behavioural information like eye closure, eye blink, yawning and head postures can also be used but recognition of head positioning or eye blinks or other features extraction using camera is still hard and clumsy especially due to changing light conditions. Physiological signals like ECG, EEG, and EOG also can be helpful and accurate for sleepiness detection but again is clumsy and difficult

Vehicle Based Measures:

Vehicle based experiments can be used to capture driver drowsiness. The two widely used measures are Steering Wheel Movement and Deviation of Lane Positionin

Steering Wheel Movement (SWM):

It is restrained with the help of steering angle sensor and is widely used to measure the degree of drowsiness in drivers. The steering behavior of the driver is monitored and measured by mounting an angle sensor on the steering column. When the amount of micro-corrections on the steering wheel seems to reduce as compared to normal driving it seems

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drowsy, Most of the vehicle industries like Nissan and Renault, have adopted SWMs but it works in very limited situations.

Standard Deviation of Lane Position (SDLP):

It is one more measure using which the level of driver sleepiness can be outlined. In field experimentations the position of lane is followed with the assistance of an exterior camera. In swift, many studies have concluded that vehicle based measures are not specific to drowsiness because deviation of lane can be caused by any type of impaired driving, including driving under the influence of alcohol or other drugs, especially depressants.

Eye-closure :

Location of the exact position of the eye is difficult due to many factors like effect of lighting, facial expression and facial shadowing. Different measures may be obtained with percentage of eyelid closure, maximum closure duration, blink frequency, average opening level of the eyes, opening velocity, closing velocity of eye and an effective driver sleepiness detection model can be designed that can work under varying unconstraint and luminance atmosphere. If face position is obtained, location of the eye can be made much more accurate.

We can use the method of eye detection in L*a*b colour space [6]that easily differs between the face and non-face portion. This method is not robust to pose variation. But we can use this disability as an advantage in distraction detection system. If the eye portion is not found we may assume that the driver is not looking forward and this can be categorized in distraction state and must warn the driver.

Face Tracking:

The face tracking system has to be accurate to the head movement, head rotating movements, posing variety, and illuminating changes. In order to achieve that goal, many methods exist. We can make use of face detection and object tracking systems together and the merging of both can provide scope for utilization of benefits of both the utilities together. The other method, which is in vogue currently, is Head Position Detection. It merely computes the head tilt angles and when head angle crosses a certain angle, then audio alarm is sent to the driver's ear

Eye Blinking Based Technique:

Eye blinking rate and duration of eye closure is measured to detect driver's drowsiness.

The motive behind this is, when the driver felt sleepy his/her eye blinking and gaze between eyelids are different from normal situations so they easily notice drowsiness. In this eye blinking based drowsiness detection, the position of irises and eye states are monitored or checked over time to estimate eye blinking frequency and eye close duration. System uses a at all placed camera to apprehension video and then to locate the face, eyes and eyelids position system uses computer vision approaches to measure ratio of closure. Using these values one can easily detect drowsiness of driver

Physiological Measures:

Lots of researchers have made use of the physiological signals to detect sleepiness like Electrocardiograph (ECG), Electroencephalograph (EEG) and Electrooculography (EOG).

The value of Heart Rate (HR) varies in different stages of drowsiness, so we can detect the driver's sleepiness using Heart Rate (HR) as alert or sleepy.

This heart rate can be determined by ECG signals which then we can use for drowsiness detection. The physiological signal EEG has frequency bands as delta band (0.5-4 Hz) implies sleep activity, theta band (4-8 Hz) implies drowsiness, alpha band (8-13 Hz) implies relaxation and creativity and beta band (13-25 Hz) implies alertness. The success rate of detecting drowsiness using combination of ECG and EEG is higher than using either signal alone. Some researchers have applied EOG signals to identify sleepiness completed eye movements, the electric potential difference within cornea and retina creates electric field which represents orientation of eye and the produced electric field is the measured EOG signal. Horizontal eye movement can be obtained by putting a disposable Ag-Cl electrode on outer corner of each eye and a third electrode at the centre of forehead for reference. From this we obtain parameters such as

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rapid eye movement (REM) happens when subject is awake and slow eye movement (SEM) takes place when the subject is drowsy

Hybrid Measures:

Artificial Neural Network Based Technique:

In this technique they employ neurons in order to perceive driver's drowsiness.

Humans in fatigue if having certain visual behaviors which can easily be noticed due to a change in facial features including eyes, head, and face.

Easily traceable visual behaviors indicating the level of sleepiness are eyelid movement, gaze, head movement, and facial expression.

To harness this, they created an artificial neural network that could detect sleepiness. This diagram describes the flow how the ANN system can detect drowsiness.9 For this reason, the technique is given that is based on the Steering Wheel Angles (SWA) and Yaw Angles (YA) information in real time driving conditions to capture drivers' fatigue levels. It analyzes the operational features of SWA and YA in several fatigue statuses, followed by the computation of the aporximated entropy (ApEn) features of a small sliding window on time series. It uses a "2-6-6-3" multilevel Back Propagation BP Neural Networks classifier to attain the fatigue detection. Recovered data are segmented and labeled with three stages after concluding expert assessment as "awake", "drowsy" and "very drowsy". This method achieves a total accuracy of 88.02%.9 ANN delivers high precision and efficacy in credentials, that justifies its claim in the identification of driver fatigue. The ANN is a mathematical model that depicts the human brain or behaviours, is non-algorithmic, nonlinear, and self-adaptive system that consists of many computation processing units properly connected. One unit of Neuron can be represented by: $A = f(WP + B)$ where W = weight vector of ANN, B = threshold value vector of network, P = input vector, f = transmission function.

Signal Analysis and Machine Learning:

Signal analysis along with Machine Learning is used to achieve an accurate classifying sleepiness system. Biomathematical model has been proposed in this paper where machine learning framework has been used for feature extraction, Classifier selection and evaluation. Input dataset consist of physiological info like EEG, ECG and EOG signals, from experiments carried out on real road vehicle-based information like lane position, steering, etc. All these different signals are then pre-processed to filter out unfavourable outliers (signals) using zero-phase forward and reverse digital IIR filter. KSS values are used as target values to train the system.

II. CONCLUSION

Various methods for driver drowsiness are discussed in this paper like vehicle-based measure, behavioural measure and physiological measures. Combination of all these methods, a hybrid model, helps to enhance the accuracy of driver sleepiness detection. In addition, adding blink related information or heart rate to steering wheel or seat would greatly improvise the system’s performance.

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