ISSN No:-2456 –2165

Complete Study and Control Schemes on Road Accidents Caused Due to Drowsiness

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Abstract:-This paper brings out a proper solution for detecting the drowsy state of the driver. Being fatigue, drowsy and feeling sleepy are identified to be the major reasons for road accidents now a days. Since this factor is unavoidable, the only way is to alert the person once he feels drowsy. To alert the driver, various detection systems were designed, considering various parameters. These factors arrive at a conclusion that various factors are found to be compromising, leading to accidents. Drowsiness is a silent killer and now it is becoming a need of the hour to bring out solutions for this issue.

Keywords:-Driver Drowsiness, Electrooculography, Electroencephalography, Karolinska Sleepinessscale, Auto Regressive Integrated Moving Average

I. INTRODUCTION

Road accidents are becoming a major factor threatening human lives. Many reasons are behind this unavoidable problem. One of the worst causes is the sleeping state, which is found to be an unavoidable factor. This factor cannot be stopped but can be alerted when drowsy state is reached. Research reports warn us with alarming increase in the rate of road accidents every year. National Highway Traffic Safety Administration has reported 71,000 crashes, 45,000 injuries and 800 deaths due to drowsiness in 2013.

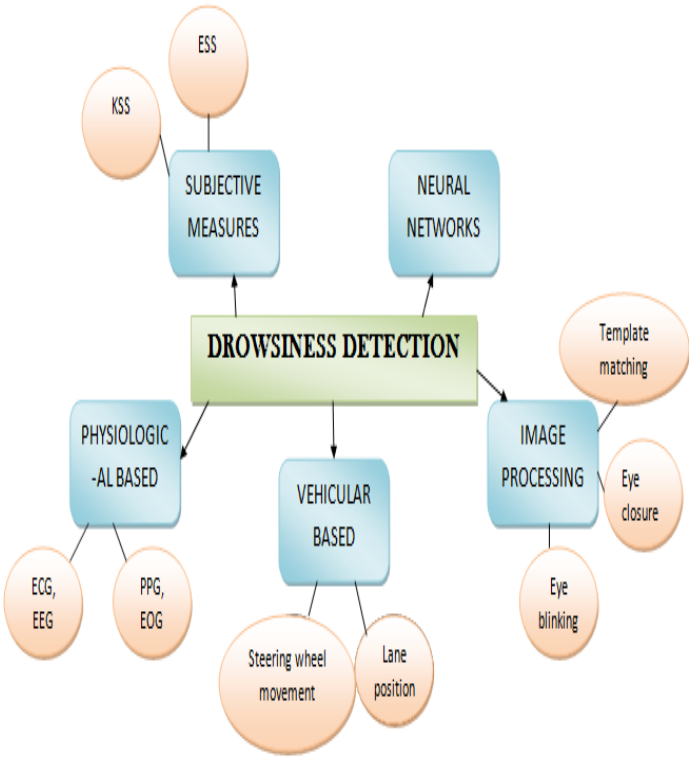
Global Road Safety reported that 1,41,525 people were killed and approximately 5,00,000 were injured in India because of road crashes in 2015. As per the recent reports, the country recorded at least 4,80,653 accidents in 2016, leading to 1,50,786 deaths. The above statistics suggests that 413 people died everyday in 1,318 road accidents. Furthermore, the data reveals that a minimum of 16 deaths occurred in road accidents every hour. The Times of India has nearly 800 reports of accidents due to driver drowsiness. With respect to the above statistics and the seriousness of the problem, many different systems were proposed to alert the driver and pull him out of his drowsy state. Those methods had several drawbacks and were found to be difficult to implement practically.

II. DRIVER DROWSY

Sleep deprived driving is also known as tired driving or fatigue driving is the operation of a motor vehicle while being cognitively impaired by a lack of sleep. The four major effects are namely: distortion in coordination, takes longer time to react, reduction in judgement, reduces the ability to remember things.

III. LITERATURE SURVEY

A survey was done among different proposed methods to obtain a clear vision about the problems stated.



IV. PHYSIOLOGICAL METHODS

In physiological methods, the subject is tested for drowsiness using biological signals. Various biological signals involve Signals from brain termed as EEG, ECG the electrical activity of the heart beat and EOG the signals from eyes.

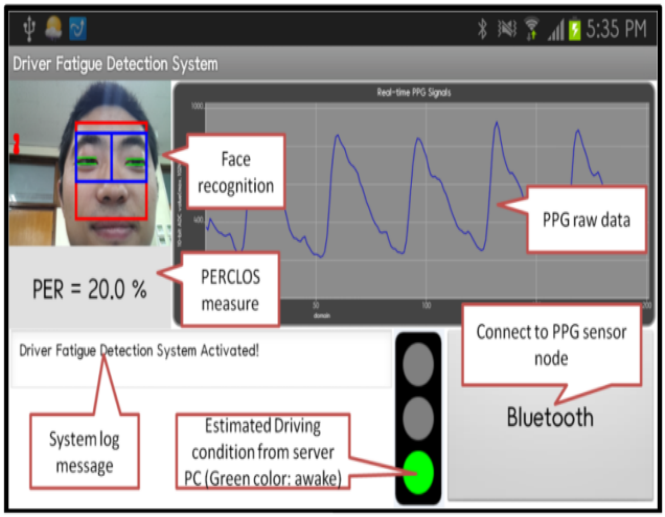
The paper[1]discusses the driver fatigue which is an important problem worldwide and its detection in a effective manner ha major significance over public health. The method employs feature extraction using a single EEG. Four different entropies are measured and deployed for the analyses of original EEG signal. The highest accuracy is upto 95%. The combinations of the channel, features are classified based on the subject. It is subject specific. The accuracy of fuzzy entropy is far greater than other features. On comparing the features of various channels each is very different.

The paper[2] is aimed at using signals from eye which constitutes the technique of Electrooculography. Eye blinking of an individual appears to be that driving factor in this paper. This is obtained by using skin electrodes which are further amplified and programmed to user's needs in a smart phone using Arduino. In order to reduce mistakes from computation, ARIMA (Auto Regressive Integrated Moving Average) modules were developed to predict the future evolution of the obtained data.

The paper[3]proposes a method in which drowsiness is detected using electrooculography and the electrocardiography. Drowsiness of the driver has become a major cause of property damage, several accidents and has gained attention over years. The study measures the difference between the alert and drowsy state and a conclusion is obtained by testing 22 healthy individuals. Features extracted include heart rate and its variability. The ratio of high frequency and low frequency is considered. The features of ECG and EOG are combined and acceptable level of 80% accuracy is achieved. The proposed method is expected to be comfortable to wear and accurate (80%) results are obtained.

V. IMAGE PROCESSING TECHNIQUE

Image processing is a technique to perform certain operations on an image, to get an improved image or to obtain certain useful information from it. In this type, images are processed and outputs are obtained in the form of either images or other forms of data. Here image represents that of eye, mouth and head movements.



The paper[4] gives an idea of using different techniques like image processing, and artificial neural network together for detecting drowsiness. Template matching, eye blinking and yawning are considered as key parameters in image processing. Template matching involves the state of eye in which if the driver closes his eyes for a particular period of time, an alarm is generated. Eye closure duration is measure under eye blinking. A large vertical mouth opening is assumed to be modelled under yawning technique. A helmet with electrodes in it is used for these measurements. The difference in the rays emitted in the brain different ranges of signals is obtained which are subjected to further analysis. A collection of neurons are used to detect the drowsiness using artificial neural network technology. Thus different techniques are suitable for different situations.

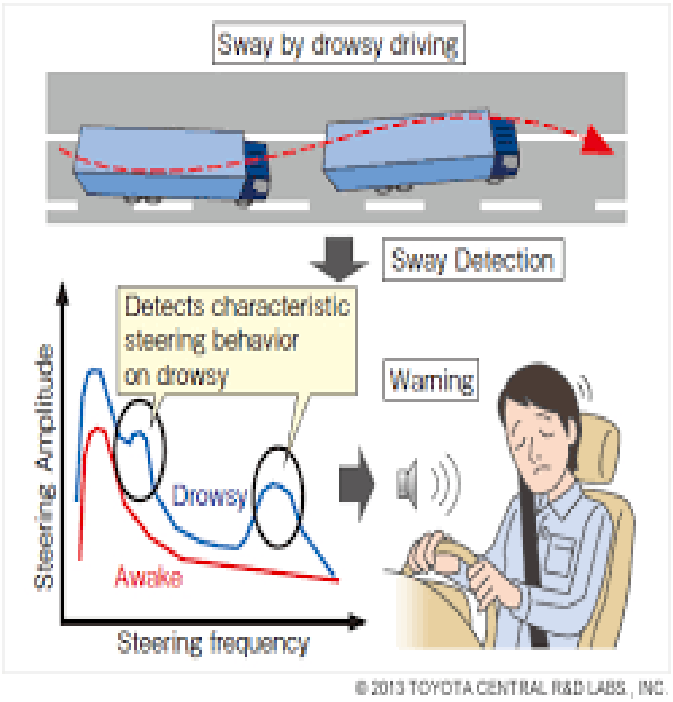
The paper[5] introduces RDDDS technique which is based on the condition of the eye. Real time Driver Drowsiness Detection System uses a web camera which captures a video. The resolution is about six mega pixels in minimum. The alarm is setup with speakers. Camera settings, video frames, face detection, eye detection are used for checking the open and closed conditions of the eyes. The threshold value is obtained by binarising both the eyes. The alarm is triggered when the system is encountered with closed eyes for five consecutive frames. The alert signal extends upto next five frames

The paper[6]addressesa detection technique in which PPG bio-signals by using multimodal head supports. PPG sensors are placed on the head such that it touches the user's ear lobe. Thus pulse of the person is measured. Sympathetic and parasympathetic nerve activities that influence heart rate is analyzed using R-R interval analysis. Thus LF and HF frequency ranges were determined. They range from 0.04 to 0.15 hertz and 0.15 to 0.4 hertz respectively. They mark the sympathetic and parasympathetic nerve activities. The difference in the states of the person i.e the drowsy state and normal state was obtained by conducting virtual driving

VI. VEHICULAR METHODS AND SUBJECTIVE METHODS

Driver drowsiness can also be detected using two factors namely vehicular and subjective measures. Vehicular methods depend on the lane position, movement of steering wheel and pressure on the steering wheel. Subjective methods of assessing physical activity depend on our own perception. Skills can be appraised by objective or subjective measurements. Objective performance measures

The technology in this paper [7] is with respect to vehicle based measurements, behavior based measurements and major subjective measures like Epworth Sleepiness Scale(ESS) and Karolinska Sleepiness Scale(KSS). These subjective methods are based on individual estimation of a person's drowsy state. A set of short questionnaire was prepared and the driver was asked to rate his prospect of drowsiness in various situations. The score so obtained revealed the sleepiness level of the individual. For instance if the score is higher the sleepiness is also higher. This concludes the ESS method. KSS method has nine graded rating scale which is based on a self-assessment to measure drowsiness. In certain cases both the methods are fused and taken into consideration.



VII. BEHAVIORAL METHODS

One of the methods in detecting driver drowsiness is Behavioural measures in which some of the tests and methods used to gain information about a subject.

This paper[8]proposes a drowsy driving detection based on several parameters such as eye activity measures, inclination

of driver's head, sagging posture, heart beat rate, skin electric potential and EEG. Since it is a multi -source information fusion method, it promotes high accuracy and reliability of fatigue determination. According to this paper the detection methods of drowsy driving with wireless sensor network is defined in four categories like, drowsiness detection based on driver's physiological signals where EEG and ECG are used; drowsiness detection based on driver's physiological response characteristics where the blink information of driver's eyes i.e., PERCOLIS and the nodding movement of driver is considered; drowsiness detection based on driver's operating behaviour where steering wheel and peddling operation is considered; drowsiness detection based on vehicle's lane tracking an lane deviation information where a camera is fixed on the vehicle, pointing towards the road ahead. The camera monitors the lane tracking according to image processing algorithms. This paper analyses and compares the various current drowsy driving detection technologies.

The paper [9] presents methods for detecting drivers drowsiness using indicators based on physical and driving performance. All these indicators are forced to obtain the result. In this real time drowsiness is focused instead of long time sleep/awake prediction. An optimised indicator is used and simulated. They are based on performance skills. The fusion of indicators is evaluated using neural networks and is optimized. The evaluations of indicators are studied during different driving sessions. The main conclusions are obtained and best combinations are concluded and results are obtained.

In this paper[10] the driver's drowsiness is continuously monitored by observing the eye state and movements and the DIP algorithm. They are based on the micro sleeps. These last for two to three seconds and they are a good indicator of fatigue state. Thus by monitoring the eyes continuously using a camera the sleepy state of the driver is detected and a warning is provided. The hardware for the above is developed based on image processing and controllers. In addition to the alarm the speed of the vehicle is also reduced. With this ultrasonic sensor is used to detect the obstacle's distance from the vehicle and the speed is controlled.

VIII. CONCLUSION

Millions of people die due to road accidents each year. Major road accidents are caused due to the distraction of the driver. The distraction is mainly caused due to the driver fatigue. The driver can be alerted in many ways whenever he is being distracted. Different methods of driver's drowsiness detection study and the above survey is conducted to reduce road accidents. There is an at most need to detect the drowsiness of the driver. This survey helps us to choose a most suitable method to detect the driver drowsiness and to alert them.

IX. RESULT

From the above survey, it has been observed that, none of the methods gave maximum accuracy and few methods were found to be complex. In order to increase the accuracy more than one method can be fused and results can be obtained.

X. FUTURE WORK

Our further work incorporates three different methods which are being considered and fused. These include sweat gland activity which is measured using Galvanic Skin Response (GSR) sensor, Eye potential during drowsiness using Electrooculography (EoG) and in addition a pressure sensor on the accelerator is placed to identify drowsiness of the driver. This method is expected to give accuracy level which is greater than the above methods.

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