Survey on Driver Drowsiness Detection System

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Abstract— the most significant causes of road accidents are drowsiness and fatigue. the drowsiness of the driver is one of the feasible ways of measuring driver fatigue. The main purpose of this system is to prevent accidents, save lives and vehicle.Numerous methods have been developed to detect the level of drowsiness, techniques based on image processing. We have perused 8 survey papers in which we found out image processing and machine learning to be viable and which produces results effectively keeping in mind as to how those unwanted dysfunctionalities can be minimized in the future.
If the drivers' eyes remain closed for more than a certain period of time, the driver is said to be drowsy and an alarm is sounded.with the help of OpenCV that uses the Haar Cascade library for the detection of facial features.

Keywords— Face Recognition, Driver Drowsiness, EAR, Haar Cascade Classifier, OpenCv.

1. Introduction

Road accidents are normally caused by the drivers carelessness.However, injuries are also caused by drowsiness and exhaustion. The amount of casualties caused by them is rising year by year. It is also important to minimise the number of accidents caused by drowsiness and fatigue.To minimise the number of collisions, researchers around the world are developing several approaches to accurately detect drowsiness on the driver's face. Accidents can be monitored with the aid of this device as it can sense a person's drowsiness and also alert the driver and can control accidents.The system can sense drowsiness within a period of around two or three seconds.The driver is alerted by real-life warnings. Various characteristics, such as visual, non-visual and vehicular, are recommended for identification. Visual characteristics are taken directly from the driver's face and are captured by a camera.Non-visual characteristics are impulses that emerge from the driver's body that are used to obtain certain signals, in which case a special sensor is connected to the driver's body. Vehicle features can be achieved by observing the behavior of the driver as well as the vehicle while driving. But the first suggestion is to create a dataset of facial expression because it can predict drowsiness and exhaustion.The second concept is to merge visual, non-visual and vehicle elements into one for improved identification. And the last one is the

development of wearable hardware, such as smartwatches for easy-to-use and user-friendly drowsiness detection.

2. Literature Survey

A. Behavioral Approach

Susheelamma K H and Smriti Gururaj describe Haar Cascade Algorithm, which is used in this paper. They have also explained how Raspberry Pi is used. OpenCV is also used for face recognition and detection.[1].

J.Rooban Roy says the Internet of Things based system which uses Raspberry Pi. ML- Machine Learning is applied for eye detection and region classification[2].

Nora Kamarudin, Nur Anida Jumadil Describes, In this system has four main steps for determining an object namely an integral image, Haar-like feature ,Cascade Classifier and AdaBoost learning. First step is the detection of the face, Haar features are the important part of the Haar Cascade Classifier. The Haar cascade features are mainly used to determine the occurrence of features in the image[4].

According to Sukrit Mehta, Sharad Dadhich, Sahil Gumber, Arpita Jadhav Bhatt EAR (Ear Aspect Ratio) is used to compute the values. Dlib library is used to detect facial landmarks. Based on the value, detection is carried out and alarm buzzes. Eye Closure Ratio to detect driver's drowsiness is based on adaptive thresholding. Machine learning algorithms have been taken on to test the efficacy of the system approach. Algorithms used in this paper effectiveness are Random Forest Classification and SVM[6].

According to J.Rooban Roy, S.Sibi and V.Gowri in An IOT Based Alarm System in Car for Traffic, Alcohol and Drowsiness Detection and Accident Prevention alcohol sensor is used for alcohol detection. IC and Node MCU are also used. If the person did consume alcohol waves are detected and sent to IC. Eye Detection is done using machine learning algorithms. Esp8266 microcontroller performs operation related to detection of the obstacles on the way. A seat belt sensor is also installed. If the sensor

doesn't sense the seat belt locked it sends waves to the to the IC thus reminding the driver to wear it [2]

B. Physiological Approach

According to J.Rooban Roy, S.Sibi and V.Gowri in An IOT Based Alarm System in Car for Traffic, Alcohol and Drowsiness Detection and Accident Prevention alcohol sensor is used for alcohol detection. IC and Node MCU are also used. If the person did consume alcohol waves are detected and sent to IC. Eye Detection is done using machine learning algorithms. Esp8266 microcontroller performs operation related to detection of the obstacles on the way. A seat belt sensor is also installed. If the sensor doesn't sense the seat belt locked it sends waves to the to the IC thus reminding the driver to wear it [2]

In Embedded based drowsiness detection using EEG signals P Kingston Stanley, Jaya prahash T,Sibin Lal S,P Vijay Daniel describes how Hypovigilance is estimated through EEG system using BCI (Brain-computer interface) ,it's a process which prompts an alarm to alert the drowsy driver[3].

T.Edison, K.Ulaga priya says the drowsiness detection method was developed that used a mobile device camera. In order to test a model in proper-time, used wearable EEG mechanism that consists of a bluetooth-enabled EEG headband.[7]

C.Vehicular Approach

In Driver Drowsiness Detection Based on Time Series Analysis of Steering Wheel Angular Velocity Gao Zhenhai, Le DinhDat, Hu Hongyu describes the driving behaviour under fatigue is evaluated, followed by the assessment of the time-detection window; and then, the data series Angular velocity of the steering wheel in time detection The window will be selected as the detection function. If it is detected the function meets the constraint of magnitude and uncertainty. Constraint in the time window.[8]

D. Hybrid Approach

In Prediction of drowsy driver detection by using soft computing technique, T.Edison, K.Ulaga priya, A.Saritha

provides the application of multifaceted convolution networks. Softmax Layer classifier is used and trained. Here after image acquisition meaningful information is collected using mathematical operations. A hybrid technique is used for detection. A neutral based system is used for determining the amount of fatigue. Deep learning is used to detect driver drowsiness.[7]

2.1 Summary of Related Work

The summary of methods, advantages and accuracy used in literature is given in Table.

Papers	Methods	Advantages	Limitation
Drowsiness detection of drivers using iot image processing and machine learning techniques.[1]	Opencv picture handling Raspberry Pi	Recognize Mishaps, Alerts Medical Clinics and	The system fails if light is falling directly on the camera.
An IOT Based Alarm System in Car for Traffic, Alcohol and Drowsiness Detection and Accident Prevention.[2]	mySQL JSP CSS Raspberry Pi	Non-Meddlesome And prompts Warning On time	System is very costly and is implemented only in very expensive vehicles.
Embedded based drowsiness detection using EEG.[3]	EEG Signal BCI(brain-Computer interface)	Drivers Safety is Assured Through EEG headband	Inability to Detect driver Eye closure
Implementation of Haar Cascade Classifier and Eye Aspect	Image Processing and Machine Learning	Less complex as compared to others.	Face & eyes won't be detected In glasses or shades

Ratio for Driver Drowsiness Detection Using Raspberry Pi.[4]			
Drowsy Driver Warning System Using Image Processing.[5]	Image Processing	It can be non-intrusive by using optical sensors of video cameras to monitor changes.	In summer it may lead to perspiration on sensors, diminishing their ability to monitor accurately.
Real-Time Driver Drowsiness Detection System Using Eye Aspect Ratio and Eye Closure Ratio, Amity University.[6]	Image Proce-ssing and Machine Learning	The findings Indicate that it operates under all lighting conditions.	Invasive and may distract drivers, need costly sensors.
Prediction of Drowsy Driver Detection by using Soft Computing Technique.[7]	Soft Computing	Feasible for practical drowsiness detection system.	MATLAB, the software consumes a lot of time to Process videos.
Driver Drowsiness Detection Based on Time Series Analysis of Steering Wheel Angular Velocity, Jilin University.[8]	Calculating angular velocity using steering wheel.	Reflects the Driver's Movements immediately enhances the accuracy of recognition of drowsiness.	Affected by external facto such as the g metric Condition of roads and Weather

Table 1 Summary of literature survey

3. Conclusion

The systematic analysis offers descriptions of behavioural, and physiological parameters dependent on drowsiness detection techniques. Some methods are explained in depth and their strengths and weaknesses are debated. Behavioural techniques include algorithms like Haar Cascade and Random Forest. Apart from this Machine Learning techniques are used for eye and face detection. Raspberry Pi, Buzzer and Cameras are the main hardwares used in this behavioural techniques. One of the papers describes different types of sensors used such as IC, Esp8266, Node MCU and other microcontrollers. A seat belt sensor is also installed which sends waves to the IC when the seat belt is not identified as locked and sends warning to the driver. Psychological based techniques like ECG and EEG give us accurate and fast results but are not feasible because they use hardware sensors and wires which should be connected to the drivers. One of the hybrid methods uses both psychological and Deep Learning Techniques. Neural based systems are used for determining the amount of fatigue. Here drowsiness is detected using deep learning. However, Haar Cascade is commonly used algorithm which provides good accuracy and derives results in less time period.

4. Future Scope

The system can be interfaced with vehicle airbag systems that alert vehicle occupants from getting injured.This can also be improved by adding a camera to the controller module that captures the accident spot and shares its location which makes the tracking easier. By analyzing the collected data we are going to find why accidents occur and provide ways to reduce the road accidents in future.In future, this model can be reached out to give alert before dozing by computing the heart beat measure without physical unsettling influence i.e., non nosy technique utilizing changed ECG strategies.

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