Accident Prevention By Eye-Gaze Tracking Using Imaging Constraints

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Abstract: This paper comes as a response to the fact that, more and more accidents are caused by people who fall asleep at the wheels. Eye tracking is one of the most important aspects in driver assistance systems, tracking an eye plays a major role as eyes hold more information about gaze, attention and fatigue level of drivers. This plays a vital role in the ADAS systems. The number of times the driver blinks will be taken into account for identification of the driver's drowsiness. The direction of where the driver is looking will be estimated according to the location of the driver's eye gaze. The developed algorithm was implemented using Open-CV in order to create a portable system. This system is designed with alarm indication to wake up the driver on the wheels using the buzzer and the vibrator attached to the steering wheel. If the person is inebriated, the vehicle would stop.

Keywords: fatigue, inebriated, soberness, ADAS, drowsiness, Open-CV

I. INTRODUCTION

A report by WHO (World Health Organization) shows that about 1.56 million people die as a result of road accident around the world[1]. The US National Highway Traffic Safety Administration (NHTSA) estimated that fatigue driving was a factor in 2.2-2.6 percent of total fatal crashes annually during the period through 2009-2013[2]. There are many studies related to the advance driver assistance system. However most researches focuses on collision avoidance and drug intake. There are less developed systems for monitoring status of driver. In this paper, the status of driver is measured through eye gaze tracking[1]. This paper has used Open-CV (Open Source Computer Vision) Library to incorporate Image Processing into a wide variety of coding languages. It has C++, C, and Python interfaces running on Windows, Linux, Android and Mac. In the existing system, there are no effective methods to identify or to monitor the driver's fatigue or sleep level. Most of the tragic accidents in highways are occurring mainly due to the drowsiness of drivers. In existing systems, the alcohol meter is used to test driver's status while driving. But it is used to test only the person who is inebriated and it can't control the driver's sleep or fatigue related accidents. There are no techniques used to find the concentration of human while driving[4]. Object Detection using Haar cascade classifiers based approach is effective object detection. This approach is based on machine learning where a cascade function is trained with a number of positive images and negative images[7]. Then the trained images are used to detect other images which are captured in real-time. The image detection here is used with face detection, especially with eyes. Initially, the classifier is trained with a large number of positive image and negative image by using the algorithm.

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Then it is necessary to extract features from it. The lack of concentration of drivers are also lead to accidents, the eye images are detected even when not facing with wind shield and talking to next person for a long time. Then the driver is alerted while driving.

II CAUSE OF ACCIDENTS

Distracted drivers are the main cause of accidents. Distracted drivers are the ones whose attention gets diverted from the road due to mobile phones, conversing with the person beside. They get distracted even by the roadside fights or any other political meetings[13]. By concentrating on these issues the drivers collide with other vehicles. Distracted driving result in horrific accident. Our research work presents the idea to keep the drivers alert without getting distracted. A driver's state of vigilance can also be characterized by indirect vehicle behavior lateral position, steering wheel movement time to line crossing[3].

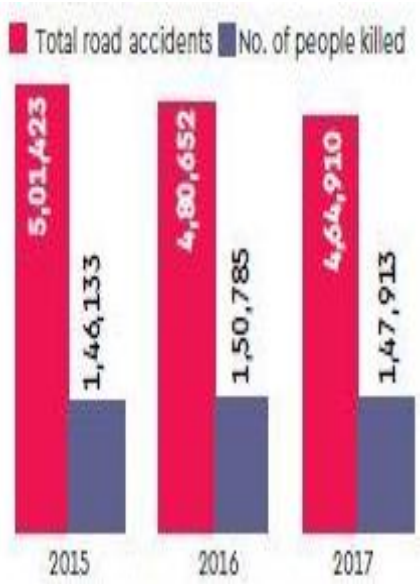

***Figure 1**.Statistics of road accidents*

III EXISTING SYSTEM

In existing system, there is a lack of techniques to sense fatigue level of drivers. This leads to drowsiness of the

driver, it may eventually make the driver to sleep during driving which may lead to major accidents in highways especially during night time. Alcohol meter is used to test only the person who is inebriated and it can't control the driver's sleep or fatigue related accidents[11]. If the driver is talking with the person sitting nearby which leads to diversion while driving and this also will lead to many accidents[10].

IV PROPOSED SYSTEM

In this paper new ideas proposed based on the Advance Driver Assistance System (ADAS),to prevent accidents and save life. This paper proposes an effective system to prevent accident due to fatigue and soberness related problems using eye gaze tracking algorithms used in advanced image processing technique. It focus on the ADAS technology which is used in the automobile industries.It uses OpenCV to track the image of the person (driver) especially the eyes. Local binary pattern related algorithms are used to sense the state of the eyes i.e., open and close of eye lid. A camera will be faced in front to monitor the image and state of the diver[8]. If the eye lid is closed for prolonged period of time, then the buzzer and a vibrator fixed on the steering wheel is used to alert the driver to wake him up while he is driving. This can prevent the major accidents in the highways due to the sleep and drowsiness related problems[9]. It can also track the driver if he is not looking at the wind shield and chatting with the person sitting next to him without concentrating on driving. The following methodologies included for the better driving assistance.

A.SCLERA RECOGNITION:

There are many findings related to the Sclera recognition, which has received attention recently due to the distinctive features extracted from blood vessels within the sclera. In this way there are many such findings. Sclera blood veins have been investigated recently as a biometric trait which can be used in a recognition system[4]. In the recent time, new approach is used for sclera recognition like; The blood vessel structure of the sclera is unique to each person, and it can be remotely obtained non- intrusively in the visible wavelengths[5]. Hence based on the sclera vascular patterns researches have been done.

***Figure 2**. Eye Recognition*

It captures the facial expressions and focuses on the retina movement. It is programmed with Haar cascade Algorithm and also it is capable of capturing images during night.

B.VIGILANCE SYSTEM

The vigilance is referred to as alert to danger. A piezoelectric sensor device uses the piezoelectric effect for measuring and convert them in to electrical signals. It measures the force, acceleration and pressure. These sensors have considered has multipurpose tool for the measurement of various processes. They are used for process control and also for research and development activities in different industries. In this paper piezoelectric sensors are used to provide the necessary jerk to the driver for providing alert from accidents.

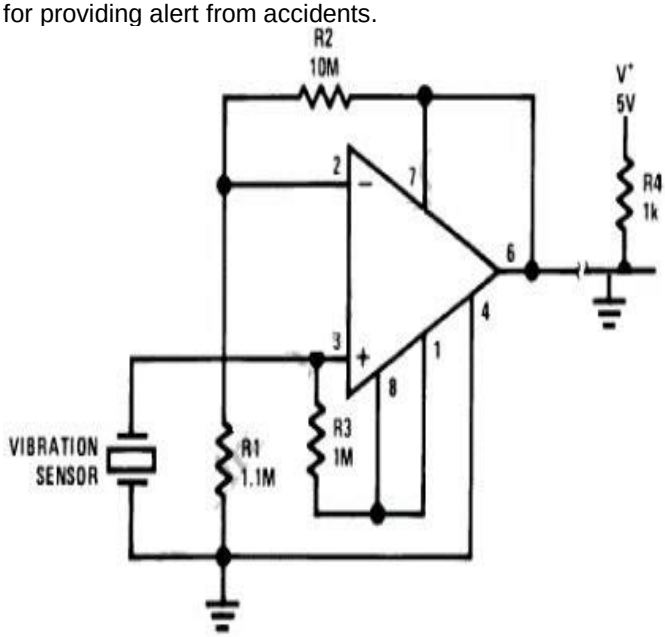

***Figure 3**. Vibrator*

C.ALERT ACTION

There is an another alert given to the driver through a buzzer. A buzzer is an electronic signaling device, used mostly in vehicles and household appliances for alert purpose. It connects the switch or a sensor to a control unit and determines the actions done and it usually alerts by producing a buzzing ,beep sound or illuminate a light.Thereby the user is alerted to take appropriate actions according to the state. This is programmed with a voice message in their desired language for easy understanding purpose

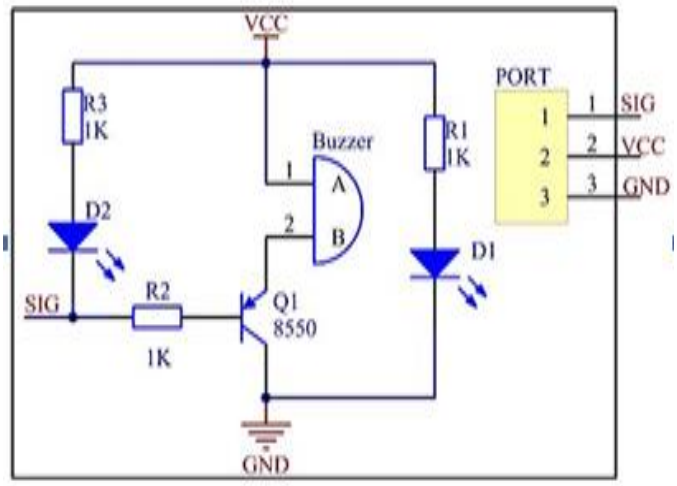

***Figure 4**. Buzzer*

D. TRANSMITTER-RECEIVER

A universal asynchronous receiver/transmitter is a type of computer hardware that performs receive or transmit opeation and also translates data between parallel forms and serial forms.

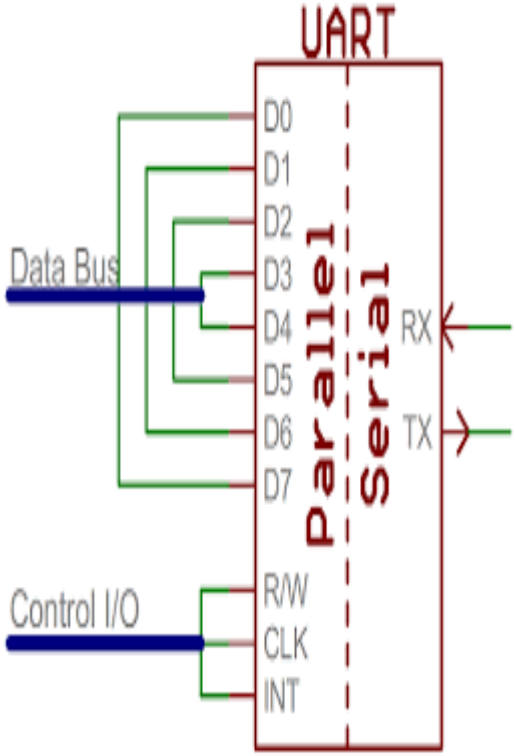

***Figure 5**. UART*

UARTs are commonly used in along with various other communication standards such as EIA, RS-232 etc. In this paper UART have been used in conjunction with the Open-CV.

V. ALGORITHM

In this paper Haar Cascade algorithm is used . It is an Object Detection with Haar feature-based cascade classifiers. It is also an effective object detection method.

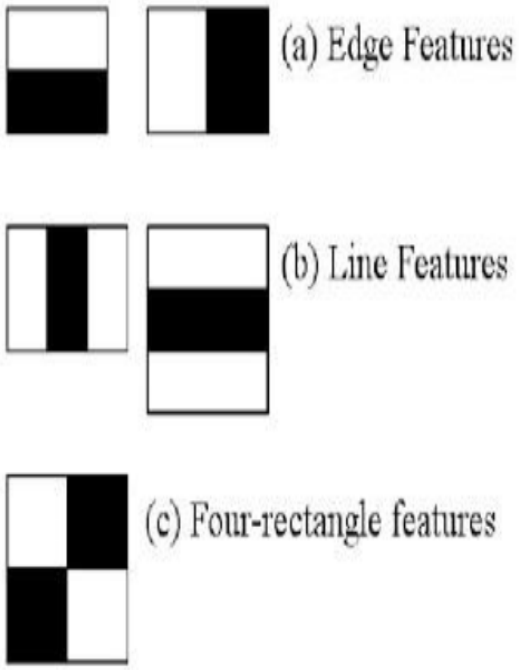

***Figure 6.** Representing Haar features*

This approach is based on machine learning in which a cascade function is trained with more number of positive and negative images. The first feature choosen focuses on the property the region where eye is focused will be darker whrn compared to the resgions of nose and eyes. The second feature is based on the property that the eyes are darker when compared to nose bridge. But the same property when applied to cheeks region or any other region on the face then it will be irrelevant. To overcome this , it is achieved by using the technology Adaboost. While focusing on image, first it is important to check whether the images which has been focused in a window is a face or any other irrelevant images. If it is not a face then it can be rejected without any further processing. By this the time wasted in analyzing unwanted images which has been focused in window can be avoided and there can be more time for checking a possible region in face. The concept of Cascade of Classifiers is introduced to deal with this . For the image which have been focussed in windows various features in thousands can be applied. Instead using all features it is possible to group the features and it can be classified and applied with different stages for different image captured in different windows. If the stage is less the features will be less and vice versa. If a window fails in the first stage itself it is not necessary to apply remaining features on it, so it can be discarded without further reference. If it passes in first stage the next stage can be applied to continue the process. There are various thousands of features with 38 stages with 1, 10, 25, 25 and 50 features in first five stages. (Among the above features there is a possibility of Two features can ve actually obtained as the best features with the Adaboost). In an an average, 10 features out of various thousands of

features are evaluated per sub-window. This is an simple intuitive explanation of how the face detection of Viola-Jones works. Computer vision is a field of informatics, which teaches computers to see. It is a way computers gather and interpret visual information from the surrounding environment .Usually the image is first processed on a lower level to enhance picture quality, for example remove noise. Then the picture is processed on a higher level, for example detecting patterns and shapes, and thereby trying to determine, what is in the picture.[6] In Haar Cascade Algorithm, Cascade classifier class defined for object detection. In an input image it t Detects objects with different sizes. Then the detected objects are returned as a list of rectangles.

- Read the image.
- Load Face cascade (CascadeClassifier > load)
- Detect faces (detectMultiScale)
- Draw circles on the detected faces (ellipse)
- Show the result.

VI.PERFORMANCE MECHANISM

In this paper the components are developed and used in two different areas; one in the windshield of the vehicle and the other in the steering wheel of the vehicle.

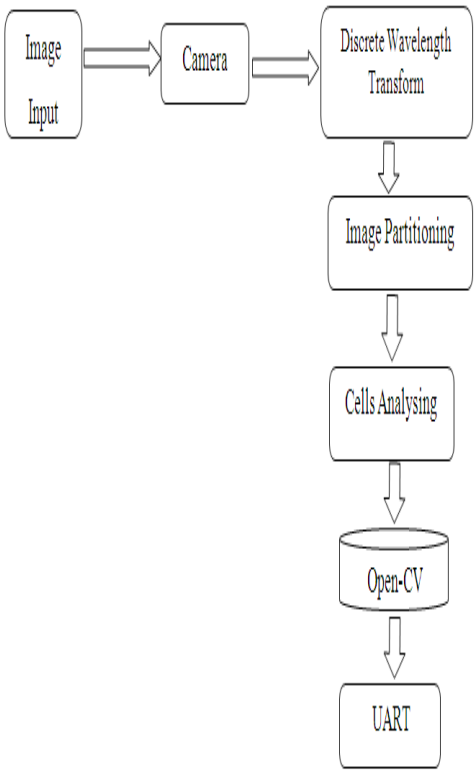

***Figure 7**.Wind shield*

Initially the images are captured using the camera attached in the wind-shield. Through this the images are recorded automatically once the vehicle starts. The recorded images are partitioned and they are stored in the Open-CV. The total number of blinks and the facial expression of the driver are taken into account. Through this accounted expression the fatigue level of the driver is detected.

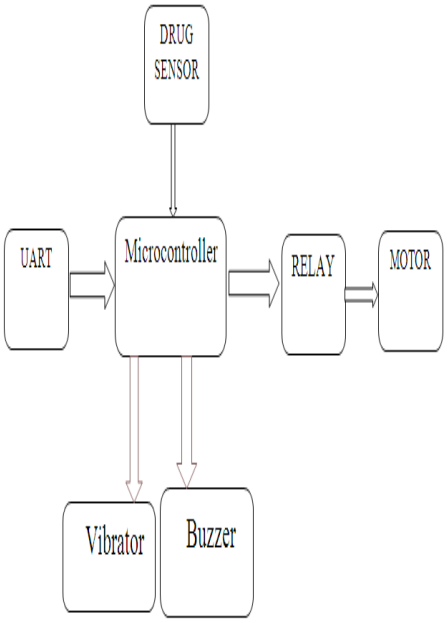

***Figure 8.** Steering wheel set-up*

For example-If there is no eye retina movement or eyes are closed for few seconds then that determines that the driver is mentally absent or asleep respectively. In such way, the device is programmed. The drivers are kept alert through-out the distance travelled. If the drivers have inebriated then the vehicle would stop/not start automatically. Additional component are desgined using the drug sensor for the safety purpose.

VII. RESULTS

This paper is an effective way to conceive an active eye-tracking based system, which focuses on the drowsiness detection amongst fatigue related deficiencies in driving. By implementing this paper the road accidents can be controlled. Open Source Computer Vision is a software library which consists of programming functions mainly used in formatting real–time computer systems[6]. The open-CV is used in this proposed system as a database to store the total number of blinks of eyes. Open-CV tracks the eye image of the drivers. In the database the open state and closed state of the drivers are noted and saved for further analysis. Local binary pattern algorithms are used in this paper to identify the closed state of eye of an driver. If the eye lid is in closed state continously for some period of time, the information will be send to steering wheel section, then the driver is alerted with an buzzer and vibrator which is fixed in the steering of the vehicle.This alert helps him to wake up while driving the vehicle. The major road accidents are occurring mainly due to the lack of concentration during driving. This can be avoided and the proposed helps to reduce the road accidents and road safety improvement.

VIII. CONCLUSION

In this paper, necessary experiments are done to prevent accidents. Fatigue monitoring systems can be developed to make it useful for technology purpose. Machine learning object detection algorithm Haar Cascade is used in this paper to identify objects in an image. In this paper an effective sytem is proposed to prevent accidents that occurs in roads due to the fatigue and drowsiness of drivers. In proposed system eye gaze tracking algorithms are used, if eye lid of the driver is in closed state for some long period then the buzzer alert the driver and wake him up. With this accidents in due to sleep related problem of driver can be avoided. The proposed system also alerts the driver with buzzer if he is not looking at wind shield or chatting with the persons while driving by capturing his eye status. By this major accidents in highways due to the lack of concentration of driver can be avoided. The future enhancement can be done by adding the neuro-sky equipment. This neuro-sky equipment is used to detect brainwaves and determine the fatigue level of the drivers. This method can also help in preventing accidents in highway [1]. In the researches the person's brainwaves vary according to time and environments. Detecting those brain waves the alert messages can be given to the drivers using an application.

IX. REFERENCES

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