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A Survey on e-Sarthi: Your Safety our Concern

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Abstract: The majority of road accidents happen because of driver behavior and fault. Vehicle accidents not only cause death and injuries, but they are also reasons for financial losses and low productivity. The careless behavior of the driver also puts other drivers at risk. Driver drowsiness and have become important factors in accidents. So there is a need for the system that detects the drowsiness of the driver and alerts him. This paper gives a survey of the techniques used by the researcher for detecting driver's behavior in real-time while driving and abstract view of the proposed system that we are going to implement to analyze the driver's behavior by detecting drowsiness and yawning.
Keywords: Drowsiness Detection, Yawning Detection, HAAR Classifier, Face Detection, Alerting, Driver Status Notification, Image Processing.

I. INTRODUCTION

Drowsiness[1][2][3] is a human characteristic that can have grave and fatal consequences if not considered and acted upon especially on roads while driving. It is a major contributor to highway crashes. Drowsiness is defined as the state of feeling sleepy [1]. Drowsiness reduces reaction time, decreases alertness, and weakens judgment. The driver can't focus on the primary task of driving which may enhance the likelihood of crash occurrence. With the ever-growing traffic conditions, this problem will further be increased. Figure a1 shows the exact condition of Driver Drowsiness.

The National Highway Traffic Safety Administration (NHTSA) [3] estimates that approximately 20 % of crashes are mainly due to driver fatigue [2] [5]. Every year nearly a million people die and are injured as a result of road traffic crashes. These deaths and injuries have an immeasurable impact on families and communities as they tragically and irrevocably change people's lives. In addition to the huge emotional toll, these injuries cause considerable economic loss to casualties, their families and nations as a whole. It will be necessary for next-generation smart vehicles, to develop advanced driver specific active/ passive safety systems. Important to analyze on-road, real traffic naturalistic driving data for all possible driving variations in different manoeuvres. Many efforts have been made recently to ensure driver safety and to decrease car accidents.

The main aim of this project is to recognize the attentiveness of the driver in driving. In case the driver is found to be yawning or sleeping from driving, then the constant sound is played to alert him. Continuously evaluate driving performance.

II. LITERATURE SURVEY

Varsha.E et al. [3] present " Computer Vision System for Driver Fatigue Detection ", in this system can actively monitor driver vigilance level and alert the driver to any insecure driving condition. In that drowsiness detection of the driver is based on violations algorithm for face and eye detection. The implementation is done with a video camera, Raspberry Pi hardware, and open-source computer vision library (Open CV) and Microsoft visual studio.

Lorraine Saju, et al.[4], proposed "Driver Behavior Analysis Using Non - Invasive sensors", a system that uses an ARM 7(LPC2129) controller as the main control unit and CAN bus a car. ARM 7 is used to obtain high performance. The CAN bus usage helps in high-speed communication in control networks and also supports to share data among all nodes which result in enhancing their collaborative work.

The system also helps to identify ECG, eye blink and alcohol consumption by the driver.

Saeid.fazli and Parisa. Esfahani, [5] focuses on eye states tracking. Images are captured using a camera and used for tracking as the input of the proposed method. In the first step, we use color space for drivers' face detection and crop the face from the background. Further, the area of the eyes is calculated and crop image from this region. The top and bottom coordinates of the eyes are located using retrench the face pixels from this area and canny operator for edge detection. In the last step, we count then several white and black pixels and compare the distance between these coordinates for recognition of the driver's fatigue.

A.N.Shewale et al.[6] designed a system that will monitor the open or closed state of drivers' eyes in real-time. The video camera is placed on a car desk in front of the driver for monitoring the eyes state of the driver. This system, in turn, detects the drowsiness of the driver. The system uses the Viola-Jones method which detects objects in the images i.e. identification of the face and eye localization is done by Haar-like features. If eyes remain closed for the successive frames, the system indicates a "drowsy driver".

Shewata Maralappanavar, Reenakumari Behera, Uma Mudenagudi et al. [7] uses the viola jones algorithm for face detection and eye regions are detected as left and right regions. It needs a positive image and a negative image to train classifier. The accuracy obtained for the gaze direction was around 75%. It was tested on different conditions for frontal images.

John H. L et al. [8] used machine learning classification algorithms such as hidden Markov models proven to be beneficial in predicting driver actions.

The human transcription faults can potentially hinder the development of algorithms for advanced safety systems and lead to performance degradations. To take advantage of the fast-growing smartphone applications market and integrate telematics services and recent activities have resulted in a mobile platform that contributes to vehicle naturalistic driving studies and voice-based human-machine interfaces.

The author of [9] uses the algorithm of integral projection to determine the positions. In horizontal integral projection, peaks are the vertical coordinates of the eyelid; troughs are vertical coordinates of the canthus. Finally, gaze direction is estimated according to the position of the pupil in normal state eye and head posture.

Christopher Cabrall, et al. [10] gives Non-intrusive eye-tracking measures that estimate driver conditions (i.e., distraction, drowsiness, and cognitive overload) automatically to trigger manual-to-automation ToC and serve as a driver readiness verification during automation- to-manual Toe.

The system can detect gaze situation, gaze inconsistency, eyelid opening, as well as external environmental complexity from the driving scene to facilitate ToC in automated driving.

Luis M. Bergasa et al. [12] gives the system that merges, via an artificial intelligence algorithm, data from on-board driver monitoring sensors such as an eyelid camera and a steering grip sensor with driver performance data from lane tracking sensor, gas/brake and steering wheel positioning. The system works vigorously at night.

This paper [13] used six classes describing the basic directions of gaze like Up, Center and Up, Down, Center and Down, Left, Right. Subsequently, for every class, an independent GMM is trained using the EM algorithm, which conveys the gaze categorization possibility in the mentioned classes.

Multi-camera head poses estimation including facial landmark detection algorithms [14], camera placement and selection procedure is done. The system analyses for a gaze zone estimation show very promising results in significant improvement overhead pose alone system.

Eyosiyas et. al. [15] described 'Driver Drowsiness Detection through \HMM based Dynamic Modeling'. Where the study of the facial expression of the driver through the Hidden Markov Model (HMM) based dynamic modeling to detect drowsiness is done. They have implemented the algorithm using a simulated driving setup.

III.PROBLEM STATEMENT

To implement a system i.e. "e- Sarthi: Your Safety Our Concern" for identifying some of the causes of driver drowsiness and evaluate driving performance to avoid road accidents.

IV.OBJECTIVES

A. To provide automated alert system for driver.
B. To identify alertness in driving. If the driver is found to be yawning or sleeping from driving, then continuous alert is given.
C. To analyse the drivers driving skill.
D. For continuous evaluation of driving performance.

V. MOTIVATION

The majority of road accidents happen because of driver behaviour and fault. Vehicle accidents not only cause death and injuries, but they are also reasons of financial losses and low productivity. The careless behaviour of the driver they also put other drivers at risk. Driver drowsiness has become important factors in accidents.

To avoid this issue, we are implementing a system to monitor driver behaviours in real time, which can reduce fatalities, injuries and road accidents. To measure driver drowsiness behaviour.

The system can be monitored and highly useful in reducing road accidents.

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VI. PROPOSED SYSTEM

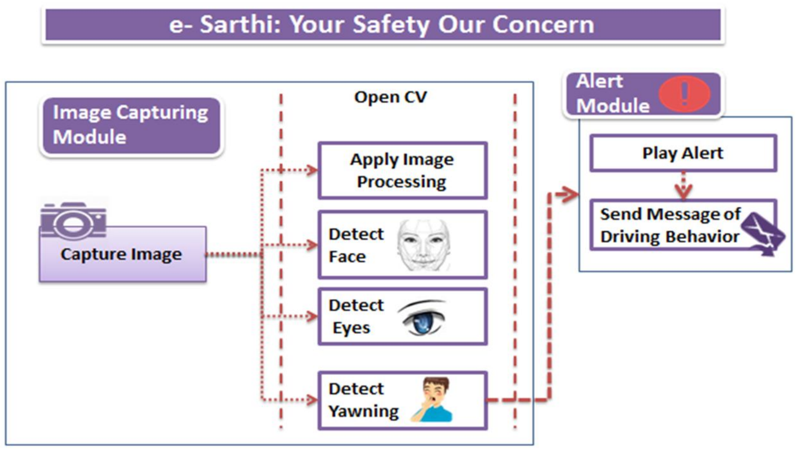

Figure 1: System Architecture

A. System Explanation

1) *Capture Image:* The camera continuously captures the driver image. Capturing of images is done using Open CV and Java module. The image captured is coloured image. The input image to the system is 640*480 pixels.
2) *Detect Eyes:* Haar cascade is used to detect eye and face from the captured image. If a closed eye is detected then an attentive is made to driver. The image is sent every 2-3 seconds to the system.
3) *Detect Yawning:* Haar cascade is used to detect face from the captured image. Yawing is detected from the face image using eye, nose, and mouth order. i.e. if eyes are closed and mouth is open then the driver is Yawing. So alert is given to the driver.
4) *Detect Drowsiness from Driving:* Project's primary aim is to identify alertness in driving. If the driver is found to be yawning or sleeping or drowsy from driving, then continuous alert is given.
5) *Play Alert, and Notify Admin:* In case the driver is finding to be drowsy, then continuous alert is given to the driver and SMS is send to the admin.

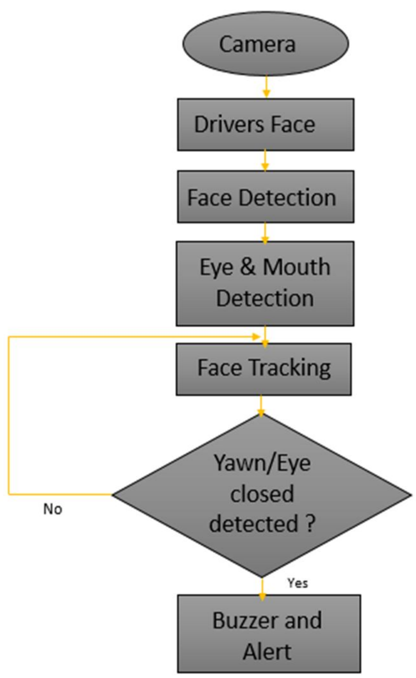

Figure 2: System Working Flowchart

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VII. ALGORITHMS

A. Grayscaling

The first algorithm in the working of the system is Grayscaling algorithm. This algorithm is useful in converting the input RGB image into Grayscale format. The resultant Grayscale colour value is the resultant of the sum of the R, G, B divided by fancy mathematical number. Below are the three basic process followed by grayscale algorithm:

1) Get the red, green, and blue values of a pixel
2) Use fancy math to turn those numbers into a single gray value
3) Replace the original red, green, and blue values with the new gray value.

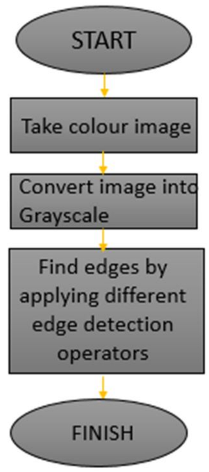

Figure 3: Grayscaling Algorithm Flowchart

VIII. THRESHOLDING ALGORITHM

Image thresholding is a simple and active, technique of separating an image into a foreground and background. This image analysis method is a kind of image segmentation that separates objects by altering grayscale images into binary images. For each pixel, a similar threshold value is used. If the pixel value is lesser than the threshold, it is set to 0, else it is set to a maximum value. The **cv.threshold** function is used to apply the thresholding. The first argument is the source image, which must be a grayscale image. The second argument is the threshold value which is used to categorize the pixel values. The third argument is the maximum value which is allocated to pixel values beyond the threshold.

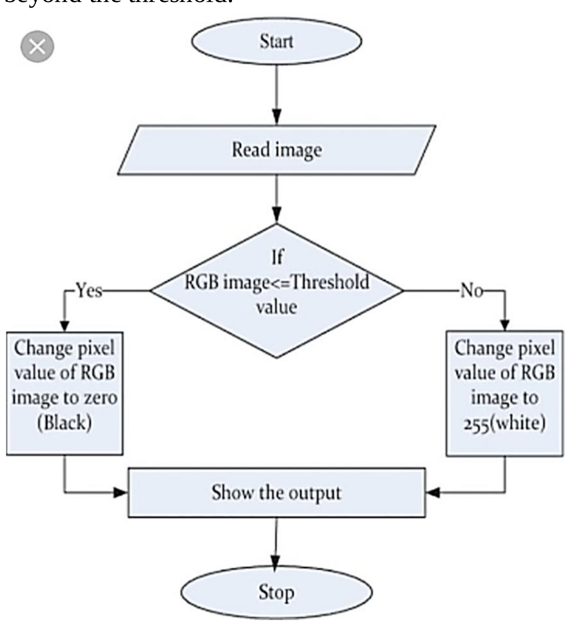

Figure 4: Thresholding Algorithm Flowchart

A. Haar Classifier

1) The Haar classifier algorithm is used here for face detection using some of the facial features. If it is found, the algorithm permits the face candidate to pass to the next stage of recognition. A face candidate is a rectangular segment of the original image called a sub-window. Usually, these sub-windows have a fixed size (typically 24×24 pixels).
2) This Sub-window is often scaled so as to find a different size faces. The algorithm scans the whole image with this window and signifies every individual section of a face. This technique makes the use of an integral image in order to process Haar features of a face candidate in constant time. It uses a cascade of stages which is used to remove non-face candidates rapidly. Every stage contains various different Haar features. Every feature is classified by a Haar feature classifier.
3) The Haar feature classifiers create an output that can then be delivered to the stage comparator. The stage comparator sums the outputs of the Haar feature classifiers and associates this value with a stage threshold to decide if the stage should be passed. If all stages are approved the face candidate is decided to be a face.
4) A Haar feature classifier uses the rectangle integral to estimate the value of a feature. The Haar feature classifier multiplies the weight of every rectangle by its area and the results are added together. Several Haar feature classifiers comprise a stage. A stage comparator sums all the Haar feature classifier results in a stage and compares this summation with a stage threshold. All stage does not have a set number of Haar features. Based on the attributes of the training data different stages can have a changing number of Haar features.
5) This procedure in the algorithm is called feature extraction. Haar Cascade classifier is based on the Haar Wavelet method to analyze pixels in the image into squares by function. This uses "integral image" ideas to compute the "features" detected.

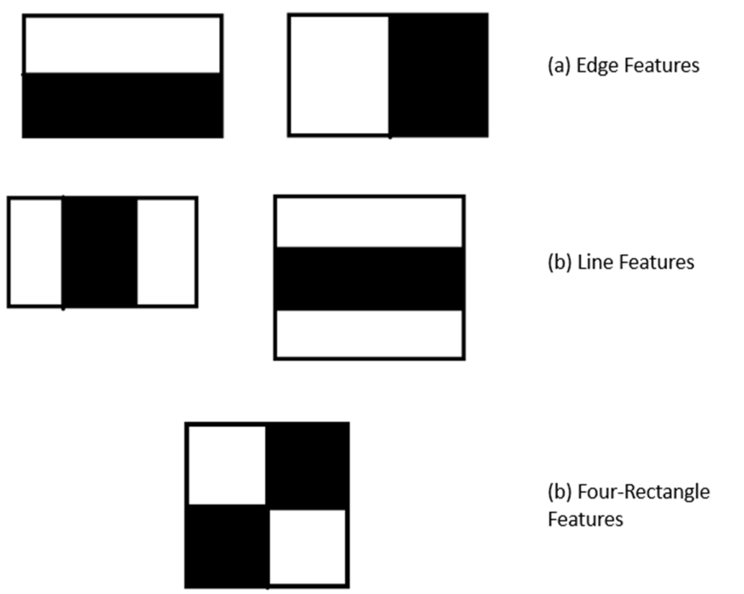

Figure 5: Haar Features

IX. CONCLUSION

About 20% of road accidents occur due to driver fatigue. There are many methods to monitor the driver and thereby alert him/her in case of drowsiness. This survey is conducted to study various methods to detect driver fatigue and to select an appropriate method to detect the causes of driver's drowsiness. To decrease road accidents, there is also a necessity to detect reasons such as sleepiness, fatigue and to alert the driver. This survey supports to select an effective way to decrease road accidents due to driver fatigue.

This project aims at building a safety system for vehicles at a low cost. A real-time system intended to improve the safety and comfort of the vehicle by alerting the driver when the driver feels drowsy at the time of driving. It is one more step towards monitoring driver's behavior automatically to reduce road accidents. This system can detect the causes such as drowsiness, fatigue and alert the driver which is one of the reasons for the majority of road accidents. This will, in turn, provide both securities as well as protection to the vehicle as well as the driver driving the vehicle. The practical implementation of such a type of system can save people's lives. The proposed system helps to automatically detect drowsiness based on the driver's performance.

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