Real-Time Driver Vigilance Monitoring System

Sakshi y. Hiwanj, Prof. Varsha Bendre
VLSI and Embedded System, Pimpri Chinchwad College of Engineering, Pune, India

Abstract **-** The ever-increasing number of vehicle crashes has become a serious problem concern to society due to a diminished driver's vigilance. Driver fatigue causes to diminished abilities of perception, recognition and vehicle control which poses hazard to their own and others lives. Survey shows that leading causes of accidents are driver drowsiness, distraction and alcohol consumption of driver. With the growing traffic, this problem will further deteriorate. The main aim of this project is to develop a system to detect drowsiness of a driver based on eye detection in digital image by using Viola and Jones algorithm and accordingly generate vibrations and alarm. The main components of the system consist of a camera, a specially designed hardware system, Raspberry Pi for real-time image processing interfacing with camera module which detect drowsiness and drunken driver and generate alarm and vibration to warn driver either according to status of eyes or consumption level of alcohol. The proposed system possibly helps to reduce number of accidents in today's traffic.

Keywords **-** *Raspberry pi , alcohol detection, drowsiness , haar features , image processing.*

I. INTRODUCTION

Driver drowsiness is a significant factor in a large number of vehicle crashesh. Recent statistics calculate approximately that annually 1,200 deaths and 76,000 injuries are found to be due to fatigue. In today's era one of the important goals of the intelligent transportation systems (ITS) are improvement of public safety and the reduction of accidents. Driver fatigue and distraction is one of the most important factors in accidents. Drowsiness reduces driver perception and decision-making capability to control the vehicle. Driver is fatigued and steering performance is deteriorated because of driving for a long period of time which leads to unawareness of driver**.** Symptoms of drowsiness seem mostly after having lunch and dinner. In addition, drug addiction, drinking alcohol and using hypnotic medicines can lead to loss of consciousness. Driving drowsy slows your response time, decreases consciousness, and impairs judgment, just like drugs or alcohol, driving drowsy can contribute to a fatal collision. [1]

Generally, the driver drowsiness and lack of concentration are reasons of about 20% of the crashes and 30% of fatal crashes. Therefore a need arises to design a vigilance system to known the driver's level of vigilance and alerting a driver when he is distracted due to fatigue is essential to prevent accident. By detecting face and monitoring eyes, it is believed that the symptoms of driver fatigue can be detected early enough to avoid a fatal collision. Detection of fatigue involves the observation of eye movements and blink patterns in a sequence of images of a face.

Fatigue/distraction detection approaches can be divide into three categories:

- Approaches based on bioelectric signals such as ECG and EEG
- Approaches based on steering motion
- Approaches based on driver face monitoring

The first type measures biological indicators such as heart and pulse rate, brain waves. These techniques have the best detection accuracy but they require physical contact with the driver. They are intrusive. The second type measures vehicle behaviors like lateral position, speed and turning angle. These approaches can be implemented non-intrusively, but they have numerous limitations such as the type of vehicle, driver skill and driving conditions. In addition, it requires particular equipment and can be costly. The third type is face analysis. as the individual face is dynamic and has a high degree of unevenness, in computer vision study face detection is considered to be a complex problem. As one of the salient features of the human being face, individual eyes play an important role in visage identification and facial expression analysis. In fact eyes can be considered salient and relatively stable feature on the face in comparison with other facial features. Therefore, when we identify facial features, it is advantageous to identify eyes before the recognition of other facial features. The location of other facial features can be estimated using the eye location. In addition, the size, the location and the image-plane rotation of face in the image can be normalized by only the position of both eyes [1].

Block diagram of overall system is shown in figure 1. Based on Acquisition of video from the camera that is in front of driver perform real-time processing of an incoming video stream in order to infer the drivers level of drowsiness if the drowsiness is detected then the output is send to the alarm system and alarm is activated.

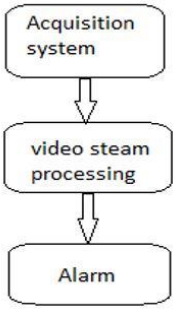

Fig.1. Block diagram of system

II. FACE DETECTION ALGORITHM

The proposed system, at first detects faces in the video stream coming from the camera. So we have to select a Face Detection Algorithm suitable for the application.

Face Detection Techniques

Face detection techniques have been researched for years and much progress has been done. Most of the face detection methods focus on detecting frontal faces with good lighting conditions. These methods can be categorized into four types: feature invariant, knowledge-based, appearance-based and template matching.

- Knowledge-based methods use human-coded set of laws to represent facial features, such as two symmetric eyes, a nose in the middle and a mouth below the nose.
- Feature invariant methods try to find facial features which are invariant to pose, lighting condition or rotation. Skin colours, edges and shapes fall into this category.
- Template matching methods calculate the correlation between a trial image and pre-selected facial templates.
- Appearance-based methods espouse machine learning techniques to extort discriminative features from a pre-labelled training set.

An approach used to detect objects in general, applicable to human faces as well as presented through Viola-Jones. This scheme proved to detect objects tremendously speedily and is analogous to the best real time face detection systems. Viola and Jones (2004)[11] presented a new image representation in their research called Integral Image which allows fast calculation of image features to be used by their detection algorithm. The first stage of this algorithm is a new image representation called an integral image that allows for very fast feature estimation. a set of features which are reminiscent of Haar Basis functions (use related filters which are more complex than Haar filters). The integral image representation introduces in order to compute harr like features very quickly at many scales for images. The integral image can be computed from an image using a few operations per pixel. Once evaluated, any one of these Harr-like features can be evaluated at any scale or location in steady moment [11].

The second stage is an algorithm based on AdaBoost which is trained against the related object class to select a smallest set of features to represent the object. This algorithm is a process for constructing a classifier by choosing a small number of important features using AdaBoost. Inside every image subwindow the entire number of Harr-like features is very huge, far bigger than the number of pixels. The learning method must eliminate a large majority of the available features in order to guarantee rapid classification, and focus on a minute set of significant features. Feature selection is achieved through a simple variation of the AdaBoost procedure: the weak learner is constrained so that each weak classifier returned can depend on only a single feature [11]. As a result each stage of the boosting method, which chooses a new weak classifier, can be seen as a feature selection method. AdaBoost provides an efficient learning algorithm and strong bounds on generalization performance [11].Viola and Jones used features extracted from the training set and AdaBoost algorithm to select the finest feature set and constructing the ultimate classifier which comprises the minority stages.

The third stage of this algorithm is a scheme for combining successively more complex classifiers in a cascade structure which spectacularly increases the speed of the detector by focusing concentration on promising regions of the image. The concept behind focus of attention approaches is that it is frequently possible to quickly determine where in an image an object might occur [11]. More multifarious processing is reserved only for these promising regions. The key appraise of such an approach is the "false negative" rate of the attentional method. It must be the case that either all, or almost all, object instances are chosen by the attentional filter.[11] The same viola and Jones algorithm used for detecting eyes.

III. METHODOLOGY

The detail proposed system consists of following blocks

- **Camera:** Video camera is device used to monitor driver face. Video camera detects face and eye movement of the driver in form of image. The obtained information is then passed to processor for further processing.

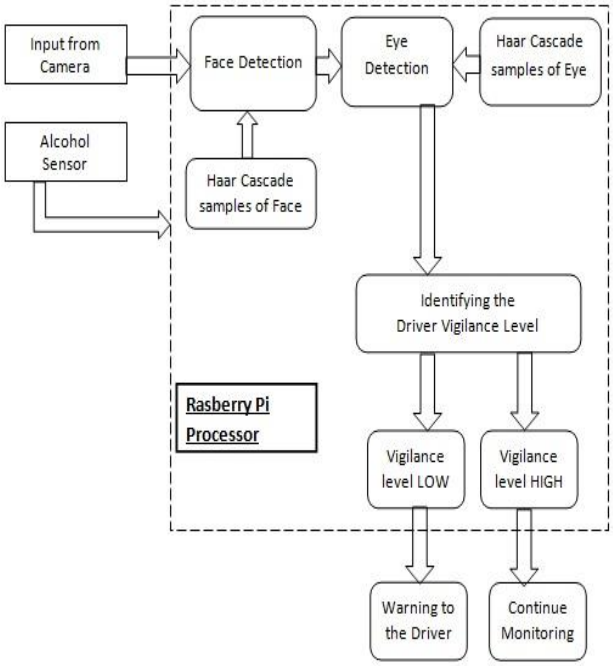

Fig.2. proposed block diagram

- **Alcohol sensor:** Alcohol sensor is used to detect whether the driver is alcoholic or not. The alcohol parameters are then digitized and forwarded to processor for further processing.
- **Processing unit:** The processing unit of the raspberry-pi takes the input image from the video camera and Alcohol sensor; according to the program code stored it detects face and generates necessary signals for vibrator or alarm if any drowsiness or alcohol parameters are beyond the normal level.
- **Image Acquisition:** A video camera along with an array of Infrared LEDs is mounted in front of the driver to continuously capture the video of the driver.
- **Face Detection:** A robust Face detection module detects the driver's face region to monitor it further. The face detection algorithm is based on Viola-Jones face detection approach.
- **Eyes Detection:** Driver's eyes are detected by using HAAR Classifier based eyes detection module.
- **Driver Vigilance Level Decision :** Depending on the state of the driver as determined in previous blocks, the vigilance level or alertness of driver is determined and an

alarm or vibration is generated if the alertness of the driver is very low.

IV. EXPERIMENTAL RESULTS

Fig.3 Alertness detected with raspberry pi

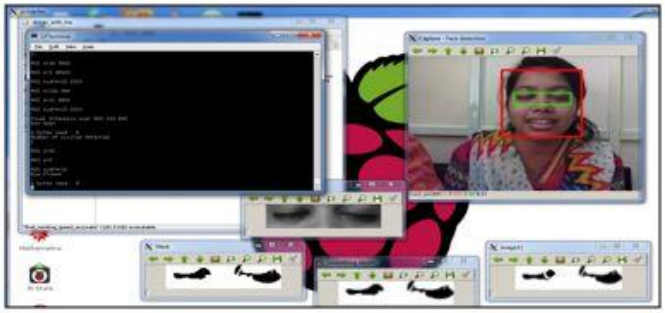

Fig.4 drowsiness detected with raspberry pi

Fig.3 and fig. 4 shows hardware result implementation which detect alertness as well as drowsiness of driver accurately accordingly generate alarm and vibration to alert driver. Analysis of proposed system taken place on 10 persons out which system detect drowsiness of 8 persons shown in table.1, 2 persons drowsiness not detected. From table we can see that system accuracy is about 80%. For alcohol detection we have use cough syrup which detects alcohol present. Fig.5 and Fig.6 shows alcohol values in normal as well as in detected condition.

TABLE.1 RESULT ANALYSIS

No. of tests	Drowsiness detected	Drowsiness not detected	Accuracy
10 different persons	8	2	80%
5 times same person	4	1	90%

Fig. 5 Normal value of alcohol sensor

Fig. 6 Alcohol detected

V. CONCLUSION

Hardware result shows that drowsiness of driver is detected with accuracy in real time by using face and eye detection. Drowsiness of driver detected on Raspberry Pi and driver get alert by alarm and vibration when driver is drowsy or consume alcohol. From analysis results we can conclude that system accurately detect drowsiness about 80%.

VI. REFERENCES

[1] Sakshi hiwanj, Prof. varsha bendre, "Real Time Driver Vigilance System", A R DIGITECH, International Journal of Engineering, Education and Technology(ARDIJEET) ISSN 2320-883X,VOLUME 3 ISSUE 2,01/04/2015

[2] Mohamad-Hoseyn Sigari ,Muhammad-Reza Pourshahabi, Mohsen Soryani and Mahmood Fathy " A Review on Driver Face Monitoring Systems for Fatigue and Distraction Detection" International Journal of Advanced Science and Technology, 2014.

[3] G.Senthilkumar, K.Gopalakrishnan, V. Sathish Kumar "EMBEDDED IMAGE CAPTURING SYSTEM USING RASPBERRY PI SYSTEM" International Journal of Emerging Trends & Technology in Computer Science (IJETTCS) 2014.

[4] Muhammad Fahad Khan and Farhan Aadil "Efficient Car Alarming System for Fatigue Detection during Driving" International Journal of Innovation, Management and Technology, Vol. 3, No. 4, August 2012.

[5] Singh Himani Parmar, Mehul Jajal, Yadav Priyanka Brijbhan " Drowsy Driver Warning System Using Image Processing" INTERNATIONAL JOURNAL OF ENGINEERING DEVELOPMENT AND RESEARCH .

[6] A.V. Desai, M.A. Haque "Vigilance monitoring for operator safety: A simulation study on highway driving" Journal of Safety Research 2006.

[7] Luis M. Bergasa, Jesus Nuevo, Miguel A. Sotelo, Manuel Vhzquez "Real-Time System for Monitoring Driver Vigilance" IEEE Intelligent Vehicles Symposium 2004.

[8] Paul Viola, Michael Jones "Rapid Object Detection using a Boosted Cascade of Simple Features" ACCEPTED CONFERENCE ON COMPUTER VI SI ON AND PATTERN RECOGNI TI ON 2001.

[9] www.raspberrypi.org