Smart Vehicle Accident Prevention System

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Abstract - *This paper describes a real-time accident prevention system with using eye blink and fatigue detection. Here camera is interfaced by using MATLAB image processing to acquire real-time frames of driver. It features a robust, reliable and accurate technique to detect driver's drowsiness by monitoring the eye movements and the abrupt sleepiness. The vehicle responds by vibrations in the steering wheel, setting off the alarm and gradually stops the vehicle whenever necessary. The whole process is observed on real time MATLAB image processing.*

***Index Terms— Driver's Drowsiness, Real-time, Image Processing, Eye-blink detection, fatigue*.**

1. INTRODUCTION

Accidents are exaggerating at a large pace, and various technologies are being used to prevent them .In context to this scenario, driver's drowsiness is one of the many factors responsible for shortcomings. There are various researches going on for the detection of driver's drowsiness and various studies have been made. Driver's drowsiness is being neglected and is not considered as a major cause for accidents. But according to the National Sleep Foundation's 2005 Sleep in America poll, 60% of adult drivers(about 168 million people) have driven a vehicle while feeling drowsy in past years, and more than 1/3rd (37% of 103 million people)of them have actually fallen asleep at the wheel . The National Highway Traffic Administration [1] conservatively estimates that 100,000 police reported crashes are the direct result of driver fatigue each year. This results in an estimated 1550 deaths, 71,000 injuries and $12.5bilion in monetary losses. In order to reduce the number of accidents many efforts have been acknowledged for developing an effective safety system.

With increasing rate of vehicles on the road; accidents are also increasing which are caused due to various reasons, among which driver's drowsiness [2] during long hours of continuous driving is one of the major issues. We can categorize driver's drowsiness by the following actions: (i) Sensing of physical attributes, (ii) Vehicle's response, (iii) Observing driver's response [3]. Sensing of physical attributes of driver[5] is the most accurate and reliable technique which can be implemented in following ways: (i) Measuring physiological signals such as heart rate, yawning, and eye blinking, (ii) And measuring physical movements such as driver's head movement and eye status. In Vehicle response: Vehicle responds to the drivers drowsiness in following ways:(i)vibration in the steering wheel, (ii)alarm goes off after vibration, (iii)parking lights goes off after alarm, (iv)speed of car slows down and eventually stops. Observing driver's response: Driver's response [4] are being recorded continuously into frames and stored. Accordingly the action is been taken on the level of drowsiness.

In this paper, the safety of the persons who are sitting in the car are provided by detection of eye movement and posture of the driver during driving, this detected data are proceed by using real time image processing in MATLAB software. The camera is mounted on the rear mirror of the car and is turned on as soon as engine of the vehicle starts, then the detection of the driver's eyes takes place. There is continuous tracking of the eye movement and close time of the eye is noted accordingly as shown in the Figure.1. The face segmentation [6] of the driver is done accordingly tracking the yawn and eye movement along with opening and closing of mouth. As long as the closing time of eye is less than 5 seconds there is no alert but when the closing time of eye exceeds 5 seconds there is an alert. The steering vibrates with the help of vibrator circuitry attached below the steering and buzzer is turned on to wake the driver as shown in the Figure2. [7][8].

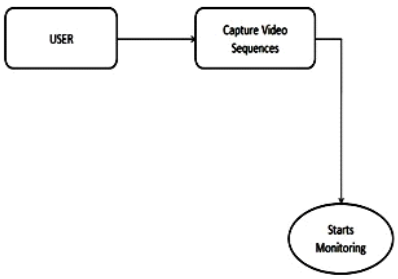

Figure1: Continuous frames are captured when the vehicle starts

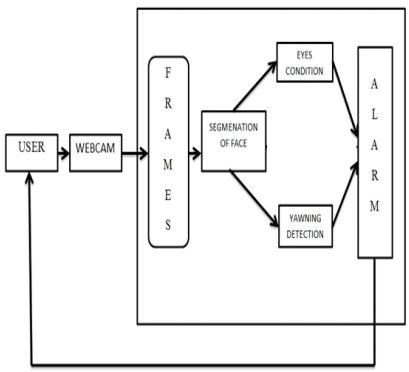

Figure2: Frames are observed in following sections (i) segmentation of face, (ii) eyes condition, (iii) yawning detection.

2. DESIGN COMPONENT

This technique is more useful because of various advantages such as Reduction in accidents, Maintain traffic management by avoiding traffic jams, and Real time image processing more feasible and compatible than IR sensors. The following components are used Arduino Uno Board USB Arduino A000073, Vibrator, Quantum QHM495LM 25MP Point Web Camera and Piezoelectric Buzzer Alarm 5V. The flow diagram of proposed design is shown in Figure3.

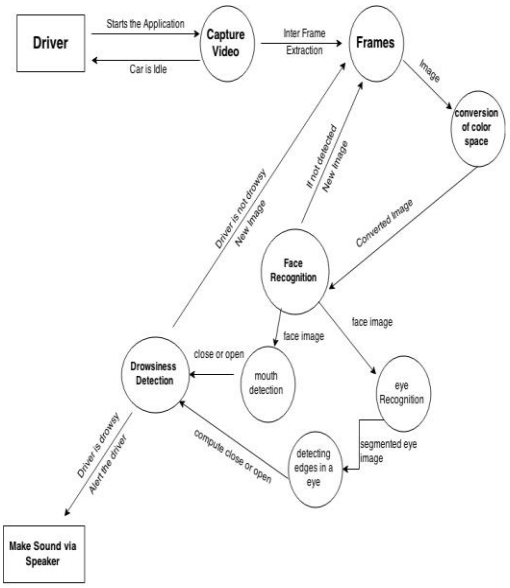

Figure3: Flowchart and working of the system.

4. RESULT AND DISCUSSION

Earlier researches on this idea were made using IR BASED EYEBLINK SENSOR which included an eye blink sensor mounted on spectacles. These spectacles were made mandatory for the driver while driving which was inconvenient to wear during night journeys. So this technique was not suitable in day time because of IR sensor does not detect the eye moment in sun light. Long drives may result in perspiration on the sensor which will diminish their ability to monitor properly. The figure of eye blink sensor spectacles is shown in Figure4. The idea presented here makes use of REAL TIME IMAGE PROCESSING to monitor the eye blink of the driver. It does not involve any necessary head gear for the driver to wear and is therefore more convenient and reliable.

Figure4: Head gear using IR sensor

The observations are collected at different conditions of the driver drowsiness and discussed in Table1 and Figure. 5(a), 5(b), 5(c). The Result obtained is based on the following parameters: (i) Face Segmentation [4], (ii) Detection of eye blink, (iii) Yawn Detection. The table shows different test cases which describes the working of the system more thoroughly.

Table-1: Different conditions of Drivers Drowsiness

TEST CASE ID	TEST CASE	INPUT	EXPECTED OUTPUT	OBTAINED OUTPUT
TID1	Detecting face	Input frame	Face detected	Segmentation of face
TID2	Detecting eyes	Segmentation of face	Eyes detected	Edges of the eyes
TID3	Detection of mouth	Closed eyes	Detected mouth	Clustered mouth with large hole
TID4	Driver's fatigue condition	Eyes open and Mouth closed	Non-fatigue	No Alarm
TID5	Driver's fatigue condition	Eyes closed and Mouth closed	Fatigue	Alarm generated
TID6	Driver's fatigue condition	Eyes closed and Mouth opened	Fatigue	Alarm generated
TID7	Driver's fatigue condition	Eyes opened and Mouth opened	Fatigue	Alarm generated

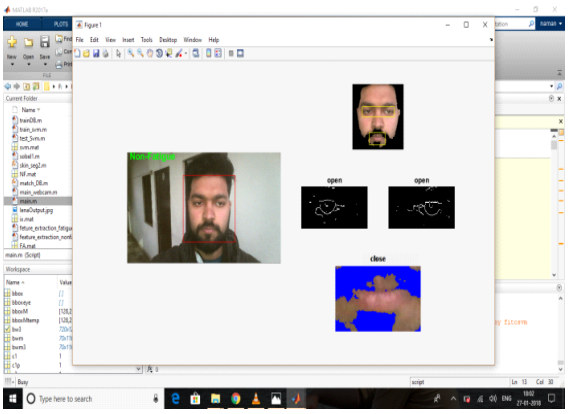

Figure 5(a): Eyes closed and mouth closed (FATIGUE).

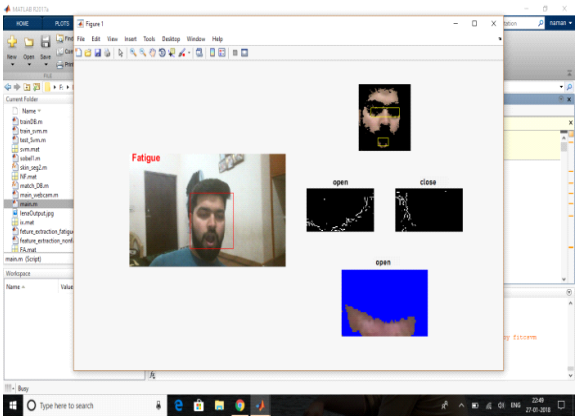

Figure 5(b): Eyes open and mouth closed (NON-FATIGUE)

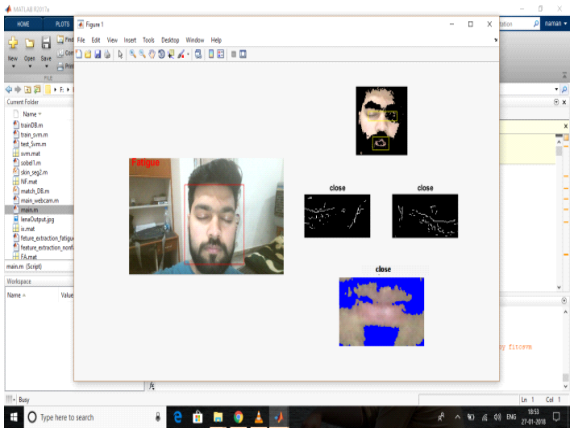

Figure 5(c): eyes open and mouth closed (FATIGUE).

5. CONCLUSION

The system proposed in this paper is acceptable level of performance and an average accuracy of 93.18%. High causality of road accidents is primarily occurred due to human fatigue and justifies the use of this system to alarm drivers at the time of driving. Real-time data processing and high accuracy distinguish this system for the similar systems. Several risky operations can be easily accomplished with this type of system. The proposed system can be used in various applications such as automobiles, nuclear power plants (where continuous monitoring is necessary), Airplanes, Security guard cabins etc.

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