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Facial Expression Based Driver Monitoring and Accident Detection System

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Abstract:- Many of the road accidents happens due to driver drowsiness and in order reduce the number of accidents caused by driver fatigue we propose a system for monitoring drivers by detecting drowsiness symptoms using image processing techniques and pulse sensing mechanism. The system also includes a method for rapid detection of accidents using accelerometer. For detecting drowsiness the proposed method make use of the facial expression of the driver and pressure applied by the driver on the steering wheel while driving. And the driver is alerted if drowsiness is detected. In case of accidents, the system reports the vehicle location and details to emergency contacts for faster rescue.

Keywords:- *Accident Detection, Driver Drowsiness, Accident Monitoring.*

I. INTRODUCTION

In India, traffic accidents kill more than 150,000 people every year, that's about 400 fatalities a day. The major motivation behind the project work is to develop a monitoring system for driver to detect fatigue and drowsiness. Our aim is to reduce the number of accidents by developing a system for detecting vehicle accidents by identifying driver drowsiness. The system is developed in environments like raspberry pi, matlab and opencv and makes use of the technologies like IoT and Image processing. This product can be used as an aid to reduce the number of road accidents and related fatalities.

The proposed system for prediction and detection of accidents, predicts accidents using driver drowsiness by recognizing facial features and pulse rate of the driver. An additional pulse sensor is also used to detect the drowsiness. Machine learning algorithm is used to decide whether driver is showing drowsiness symptoms or not. By detecting the drowsiness, the driver is alerted with an alarm. Accident is detected using impact sensor data. . In case of accidents the alert is sent to the emergency contacts

II. RELATED WORKS

To detect drowsiness symptoms Belal et al. [1] developed a driver's eye sleep recognition system. An Advanced Driver Assistance System (ADAS) module was provided to reduce the number of accidents caused by driver fatigue and thus to improve the safety of travel and transport. The method was based on measuring the Facial Landmark and Eye Aspect Ratio scheme.

An automatic Smart Accident Detection(ASAD) was developed by Asad et al.[2] to detect accidents and report such accidents in a timely manner. The system has an auto-detection unit that immediately notifies Emergency Contact via a text message whens an instant change in acceleration, rotation and impact force was detected at the end of the vehicle.

Wei Zhang et al. [3] introduced a non-intrusive approach for detecting drowsiness using eye tracking and image processing. A sophisticated eye recognition system was implemented to address problems caused by changes in lighting and driver attitude. The six tests used to determine drowsiness are PERCLOS, MCD, BF, AOL, OV of the eyes and CV of the eyes. Tey Han et al. [4] Introduced Vehicle collision detection (VCD) system that requires on-board sensors such as GPS, accelerometer and linear acceleration. GPS is used to calculate the speed of the vehicle while the accelerometer is used to calculate the speed force.Combine the two sensors to determine a state of an incident, i.e. the extent of potential accidents. A smartphone like a small computer with a mobile application is used to introduce the Human Machine Interaction Program using Android operating system [5].

Rahim et al. [6] proposed an idea of detecting the driver drowsiness by taking his pulse rate using pulse sensors.In humans the pulse rate will lower from the normal rate when he/she has a drowsiness tendency. Another system was introduced to detect the drowsiness using pulse rate by the help of Pho- toplethysmography sensor [7].This system used the processing unit Arduino Nano and Odroid XU4 and

has an LCD for displaying the output.And another technology used to detect the pulse rate for drowsiness detection is ECG sensor [8].

Vehicle collision detection (VCD) system introduced by Tey Han et al.[4] requires on-board sensors such as GPS, accelerometer and linear acceleration. GPS is used to calculate the speed of the vehicle while the accelerometer is used to calculate the speed force.Combine the two sensors to determine a state of an incident, i.e. the extent of potential accidents. [9]The camera inside the vehicle will transmit the real time video which is used to see the current situation of passengers.

In this work we propose a driver monitoring system that detects drowsiness by detecting eye blinks and measuring pulse rate. The driver is alerted in case of drowsiness detection. It also includes an accident detection module that detects the accident and report vehicle location and details to emergency contacts. Section II describes the proposed system followed by conclusion in section III.

III. THE PROPOSED SYSTEM

This section, describes the proposed system to detects driver drowsiness and report to emergency contacts in the case of accident. Here two different functionalities are combined together to a single product. Drowsiness alerting and accident detection are combined together as it is necessary in the current scenario. The overall system architecture is shown in fig 1.

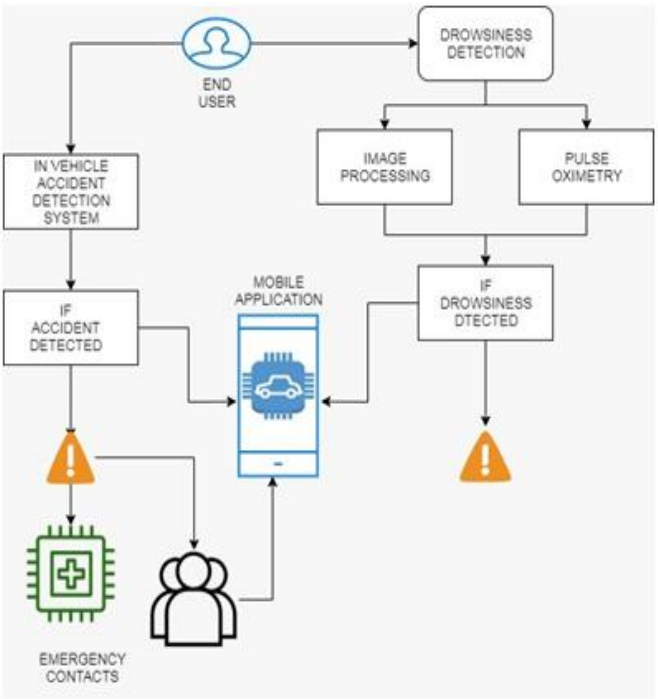

Fig. 1:- system architecture of proposed system

A. Drowsiness Detection

1) *Detecting eye blinks:* Eye blinks can be detected by referencing significant facial landmarks. The Eye aspect ratio (EAR) is a constant value when the eye is open, but when the eye is closed rapidly falls to zero. Eye blinks of the person are obvious.

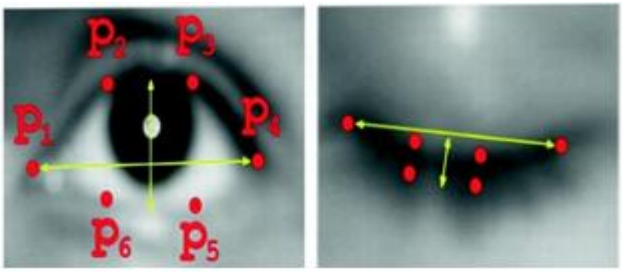

Fig. 2. eye blink detection

The threshold value for EAR is set as 0.3.When the camera is in ON condition the system will process the camera input frame by frame. Frame counter value is set as 48.And,if the value of EAR falls less than 0.3 in consequent 48 frames the alert will be given to the driver.

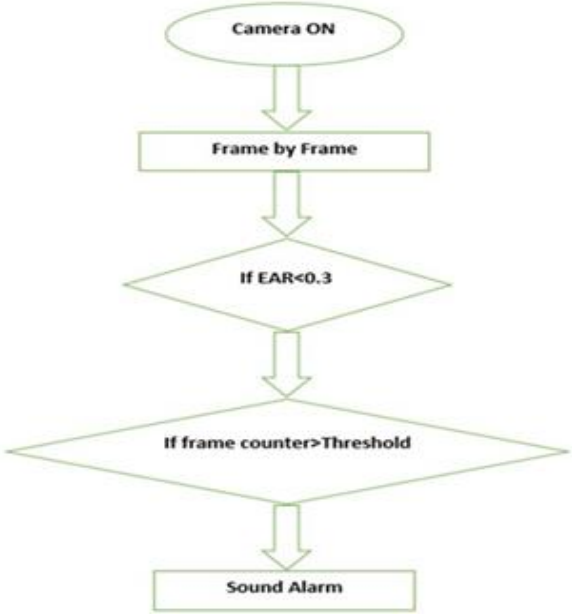

Fig. 3. Dataflow diagram for eyeblink detection

2) *Using Pulse Sensor:* Pulse sensor can be used to calcu- late the beats per minute, which can be used to distinguish whether a driver is showing drowsiness symptoms or not. This sensor can be placed on the steering wheel. The normal pulse rate of males are 75 to 100BPM.But in the case of drowsiness this rate will lower to 50 to 65BPM.In females also the pulse rate will lower in the case of drowsiness as given in TABLE I. This is a secondary method to be used to detect drowsiness.

TYPES OF STAGES	MALE	FEMALE
NORMAL	75BPM<BPM<100BPM	70BPM<BPM<95BPM
DROWSINESS	50BPM<BPM<65BPM	45BPM<BPM<63BPM

TABLE I PULSE RATE IN BEATS PER MINUTE

$$EAR = \frac{||P2 - P6|| + ||P3 - P5||}{2||P1 - P4||} \quad (1)$$

B. ACCIDENT DETECTION

Accident is detected primarily using an accelerometer. It detects physical changes like tilt, tap and shake. It includes a net- work module and GPS module. Location is fetched using GPS module and send in case of emergency using GSM module. In the case of accident detection, GPS data is fetched and sent over GSM module. Accident is detected using Impact sensor. Accident alert is send using the mobile application.

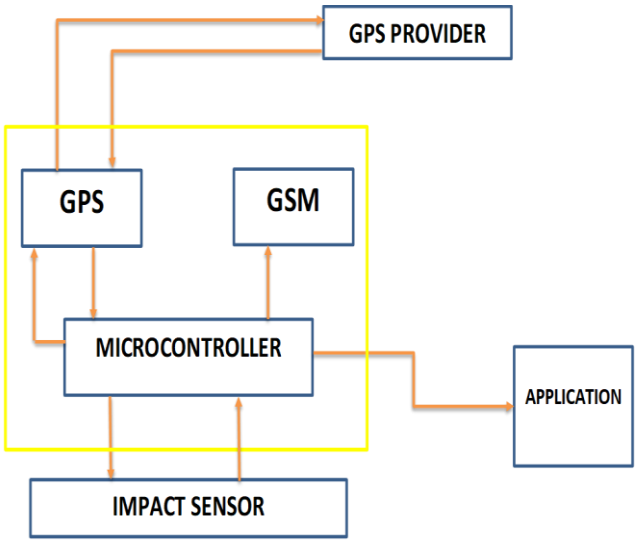

Fig. 4. Dataflow diagram for accident detection

C. APPLICATION

The user interface of the project includes a mobile applica- tion. The application communicates with the microcontroller, using Bluetooth. It continuously communicates with the mobile application. Driver can connect with our system using this mobile application by turning on the Bluetooth. Drowsiness alert can be done through this application. Accident detection alert can be send to required contacts also using this interface.

IV. CONCLUSION

In the current scenario where the number of accidents are increasing out of which a significant number of accidents are due to drowsiness, the proposed system which can detect accidents and avoid them by driver drowsiness detection. It is more accurate because this system doesn't always depend on image processing instead it co-ordinates different sensor data to achieve its goal. Similarly in the case of accident detection, this can also proportionally decrease the death by helping them send out emergency services in time.

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