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Estimate and Analyze Safety Driving of Cars using Raspberry-Pi

Pravin Shivhare[1], Shrushti Kawale[2], Anjali Manohar[3], Neha Rawate[4], Sweta Raut[5]
[1, 2, 3, 4]*Students,* [5]*Project Guide, Computer Science and Engineering Department, Nagpur Institute of Technology, Rashtrasant Tukadoji Maharaj Nagpur University*

Abstract: ***An important application of machine vision and image process may be a driver drowsiness detection system, thanks to its high importance to beat the road fatalities. In recent years there are several analyses comes reportable within the literature during this field; this is often as a result of which the increasing rate of road accidents worldwide therefore by victimization such quite techniques we can cut back the speed of accidents. As, life is the most precious gift of nature, we have tend to should shield it in any manner thus, it's the simplest way the accidents on the road which might conjointly avoid collision and reduce traffic also, during this paper, not like standard sleepiness detection strategies, that area unit supported the attention states alone, we tend used facial expressions to sight sleepiness. The system has been tested and enforced in exceedingly real surroundings. The drowsiness detection system would alter to spot the face of the driving force, which might ceaselessly monitor the facial features of the driving force and analyze its expression and acknowledge a scenario wherever the driving force is dozing off and so sends an alert message on the user screen. Thus, the main uses of machine vision, image process, computer science will be brought into the system that uses the raspberry-pi hardware therefore on utterly analyze, monitor and sight the blinking of an eye and may with success manage the reduction of road fatalities.***

Keywords: ASM-Active Shape Model, AAM-Active Appearance Model, BN-Bayesian Network, FACS-Facial Action Coding, LBP-Local Binary Patterns, NN-Neural Network, HMV-Hidden Markov Model, SVM-Support Vector Machine.

I. INTRODUCTION

Majority of accidents that occur daily during which nearly around 1.3 million individuals die per annum. Most of those accidents square measure caused by the distraction or the sleepiness (drowsiness) of the motive force. Construction of high-speed road roads had diminished the margin of error for the motive force. The infinite or sizable amount of individuals drive the vehicle for long-distance on a daily basis and night on the road. Lack of sleep or distractions just like the phone call, talking with the traveler/passenger, etc. might cause the associate accident; to stop and minimize the chances of such accidents we tend to propose a system that alerts the motive force by appalling them if the motive force gets distracted or feels drowsy. Facial landmarks detection is employed with facilitate of image process of pictures of the face captured exploitation the camera, for detection of distraction or temporary state within the driver. This whole system is deployed on transportable hardware which might be simply put in within the automotive to be used.

II. CONCEPTUAL FRAMEWORK

A. Objective

The major objective and cause of presenting this project is to minimize and reduce the number of road accidents, with the increasing rate of road fatalities in accidents caused due to the human faults is creating a buzz these days thus to overcome and avoid such reasons we must carefully ensure and find a way to prevent human safety while driving vehicles.

B. Technology

1) Python 2.7
2) Raspberry-pi hardware

C. Characteristics

1) Detection of drowsiness of driver through eye blink and facial detection.
2) Audio feedback system to alert and alarm the driver in case of sleepiness.
3) Provides high accuracy in low light as well.

D. Technologies Used Previously

There are different kinds of techniques and various technologies that have been used so far for the examination and evaluation of drowsiness detection. The first one is based on the examination and continuous supervision within the vehicle, in which it continuously monitors the steering wheel position, lane position and pressure on the acceleration pedal. The second one is based on behavioral, in which it continuously monitors the blinking frequency of eye, eye closure, and head pose. The third one is based on physiological, which checks heart rate and brain activity by ECG (Electrocardiogram), EEG, EOG (Electrooculography) and EMG(Electromyogram). There are four major extreme factors that give rise to the fatigue level in the driver. These are sleep, work, time of day and physical state. According to our body clock, we can do most of the work during day time and take rest (sleep) at night. Consider a case in which a driver works for a complete day without taking rest and drives the car during the night without taking rest then, the human body clock affects him. Next is the work. The type of exertion (light/heavy) also influences on car driver at night. Because of heavy work, he comes to a state at which the body reaches the fatigue and wants rest. If he does not take proper rest and travels car then the car driver becomes drowsy(sleepy).

The medical reason for drowsiness also varies. The lethargy of a car driver depends on the secretions in the body. Body emissions also affect the activities of a person. There are mainly two different types of activities in our body namely sympathetic and parasympathetic. Sympathetic activities are controlled by adrenalin emission. And parasympathetic activities are controlled by acetylcholine emission. When adrenalin secretion in the body is maximum at that time, the opening area of the eye is maximum means the person is attentive. Similarly, when acetylcholine secretion is maximum at that time, the opening area of the eye is minimum means the person is snoozing. Whenever, the driver gets exhaustion at that time, the acetylcholine emission in the body is at it's extreme, due to this iris part of the eye is restricted and the pupil gets dilated.

III.IMPLEMENTATION

For implementing this technique we have to first install python (GUI), Python-2.7 and the libraries including OpenCV which would eventually capture the image of the driver driving the car i.e. video streaming or continuous supervision and recording of the driver is done this recording or the monitoring is then displayed on the Raspberry-Pi Hardware using Raspbian OS. In case when a driver is found into a condition where he/she is found to be closing the eye blob that is if a system fails to detect the eye blob of the driver for a particular span of time then the alarm is generated into the car so as to alert and awake the drowsy driver, again if the driver is still into this condition our system would be able to identify and recognize the area into which the driver is driving and stop the car and send an e-mail to a nearby traffic police headquarter.

This can be implemented by using:-

1) OpenCV library in Python
2) Harcasscade files
a) Harcasscade_eyeblinkdetector
b) Harcaascade_facedetector

There are three different methodologies that are used for detecting driver drowsiness and also avoiding the road fatalities due to human faults.

A. Vehicle-Based Approach

It is one of the techniques used to find out driver lethargy. This technique continuously monitors the position of the lane/street onto which the driver is driving, it also closely monitors the vehicle steering wheel position and pressure on the acceleration pedal. If it violates the normal threshold or the constant values that are the fixed numbers according to the country, then there are chances that the driver has either reached the extreme level of fatigue or is in a drowsiness state.

B. Physiological Based Approach

In this method, we constantly observe pulse rate, heart rate and brain activity information. ECG is used to analyze the variation in heart rate and also identify different conditions for drowsiness. EEG is used to determine the different electrical activities of the brain. In order to decide the brain activities, electrodes are placed around the scalp of the car driver. These electrodes sense the voltages produced in the brain cortex. These voltages contain three regularities related to alpha, beta and gamma waves. These regularities can be further processed to calculate drowsiness and different sleep stages.

C. Behavioural Based Approach

This methodology includes yawning (opening area of mouth), eye closing, eye blinking rate and head pose. This can be done by placing a camera in the obverse of the car driver. The camera unceasingly captures images of the car driver. The car driver's image is further processed for identifying the drowsiness of the driver.

Our proposed system comprises of open-source 5-megapixel Raspbian-Pi camera for capturing real-time images of a car driver, driving the car for further dispensation on that image, we need to refer the image to Raspberry-pi system board. The Raspberry-pi system is installed with Raspbian OS and Python packages for Open CV (Computer Vision). Haar_casscade features are used to calculate the required part of the eye (pupil and iris). Additionally, the Hough transform is used for edge detection of pupil and iris. Pupil and Iris area is estimated and then it compares with the threshold value. If it exceeds the threshold value then the driver drowsiness condition is detected then the alarm is been raised and indicated by the buzzer. The buzzer is directly coupled to the PIC 16F controller and the PIC controller in sequence interfaced with the Raspberry-pi system board. This would alert the driver and thus prevents the accident.

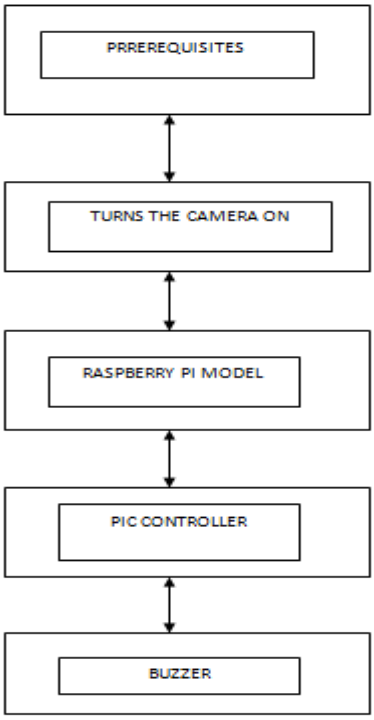

Fig1: Procedural Block Diagram

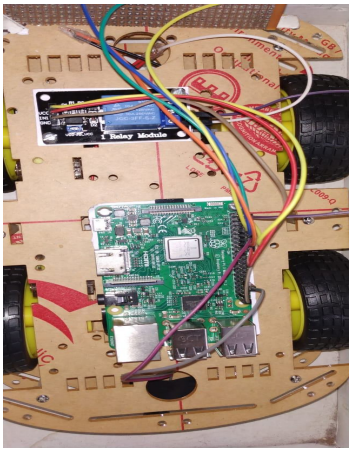

Fig2: Hardware Setup

D. Figures and Tables

Sr.no	Figure no.	Figure name.	Location.
1	Fig1	Procedural Block Diagram	Implementation
2	Fig2	Hardware Setup	Implementation
3	Fig3	Eye Detection	Results and Discussions

IV. RESULTS AND DISCUSSIONS

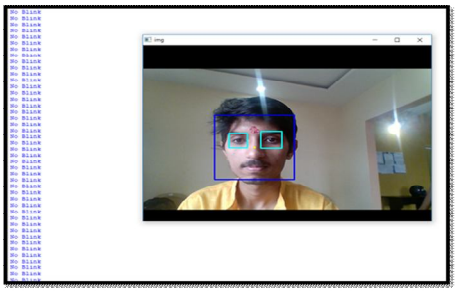

Fig3: Eye Detection

The Major objective and cause behind this project were to minimize the accidents that occur due to human faults of Anxiety and drowsiness. To achieve the project objective many logics and algorithms were used to detect the facial eye expression of the driver that ultimately controls the state of the vehicle depending on the results of the face of the driver getting to the system.

V. CONCLUSIONS

Thus by using a drowsiness detection system that detects the drowsiness of the driver which can be used to prevent accidents that occurs due to human faults of drowsing while driving the car.

Thus, we have successfully interfaced with the Raspberry-Pi camera with the processor. The Raspberry-Pi camera is properly initialized and video and images are captured. Image is further used for Har_cascade eye detector, feature extractions. Har_cascade Face region, Eye region and Open eye region is calculated. A delay is set for the warning buzzer if the driver is drowsing alarm starts blowing, trying to warn the driver to stop the vehicle. If yet the driver continues to drive the vehicle automatically gets stop and parking indicators get starts indicating alert to other vehicle drivers. An alert Email gets generated to the nearest police station on a safer side so as to manage and take further actions.

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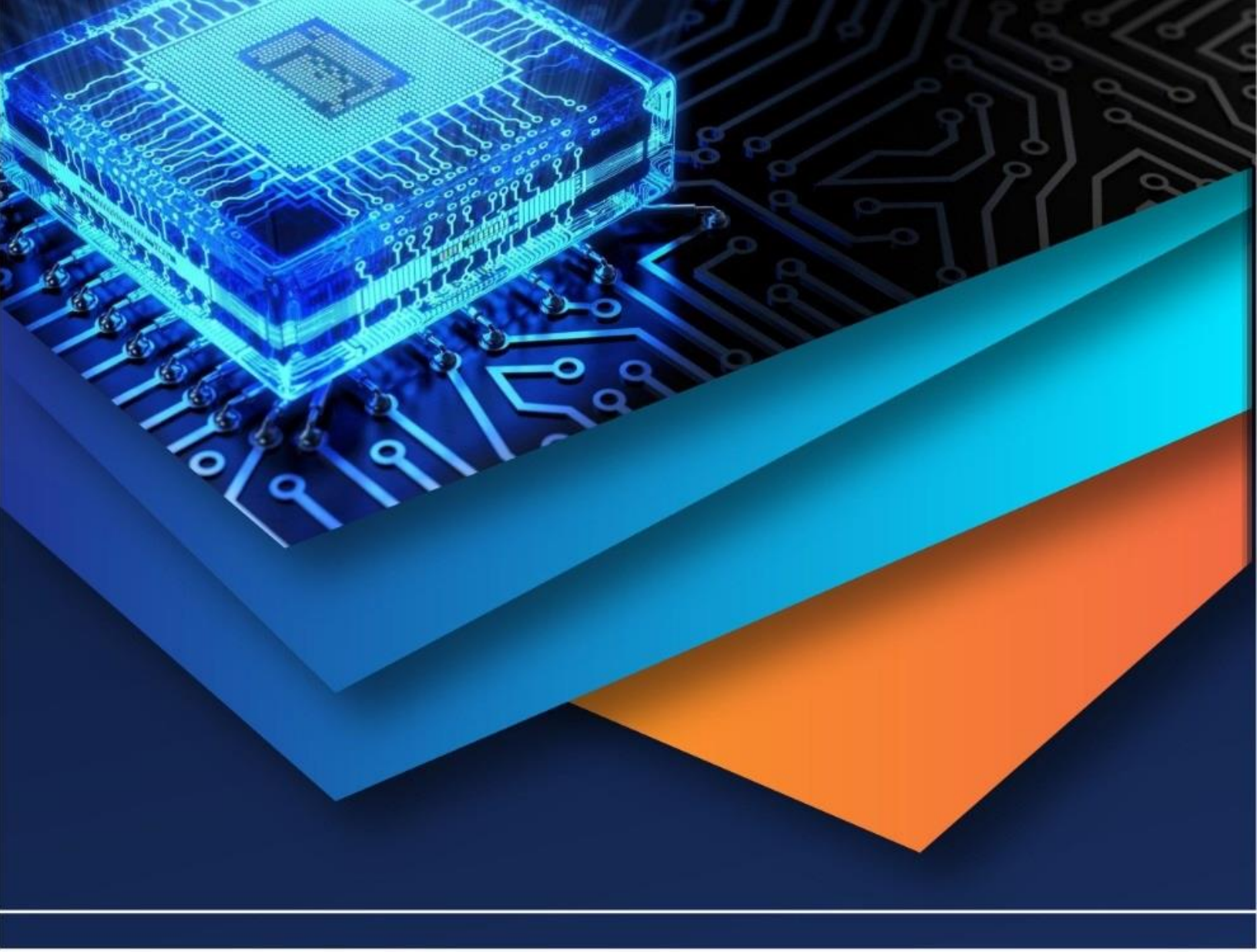

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