Driver Drowsiness Detection System for Accident Prevention

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Abstract – *Drowsiness is one of the main reasons that causes accidents, most of the times driver become drowsy when driver is sleep deprived, drinking alcohol, stress, bad posture while driving, sleep disorders and many more. Proposed system consists of image-based drowsiness detection using driver eyes and mouth, along with continuous alcohol consumption detection. When eye closed for above a certain duration then it can be considered as driver in drowsy condition. Also, yawning denotes the tendency to drowsiness. As mentioned before that alcohol consumption is also a reason for road accidents by making driver into the drowsy state. Alcohol presence is continuously monitored using sensors and whenever alcohol detects vehicle engine needs to shut down to avoid accidents.*

***Key Words*: Drowsiness, Alcohol, Driver, Eye, Yawning, Sensors.**

1. INTRODUCTION

Driver drowsiness detection and alcohol detection are useful tools to avoid the possibility of leading to accidents. Proposed system can be placed in electric vehicles (but not limited to) because speed of the vehicle will be controlled easily whenever drowsiness and alcohol presence detected. Drowsiness is detected by monitoring facial features over a camera which pointing towards the driver. Using machine learning driver's face is converted into 68 salient points. It includes both mouth and eye coordinates, by detecting and analysing these eye points, drowsiness detection is possible. Whenever the driver feels drowsy, there will be chances their eyes get closed. By detecting the eyes are closed for a certain duration indicates driver might be in drowsy state. When drowsiness detected vehicle speed will be reduced automatically and alert produced to wake the driver. Continuous alcohol detection will be useful to avoid accidents due to drink and drive, whenever the alcohol presence above allowed level then vehicle will be stopped.

1.1 Drowsiness detection

Using a camera driver face activity will be continuously monitored in real time. Using software libraries such as dlib, OpenCv and numpy are used for face recognition, eye and mouth coordinates identification. Parameters like Eye Aspect Ratio (EAR) and Mouth Aspect Ratio (MAR) are derived from equations with respect to the coordinate values. EAR and MAR values are variable based on the facial expressions. Whenever eye is closed EAR value is lesser and when eye is open EAR value will be high. A threshold EAR value is used to determine whether eyes are shut or open. If EAR value consecutively below threshold value then system assumes that driver is in drowsy state and alerts the driver and vehicle speed is reduced.

Yawning can be detected using MAR values, like the EAR, a threshold MAR is used to detect the yawning. Whenever the MAR value is below threshold MAR then mouth is closed, MAR value above threshold value indicates that the mouth of the driver is opened. The threshold MAR will be picked to ensure the talking of the driver is not mis-triggered as yawning.

1.2 Alcohol Detection

Alcohol consumption of the driver will be detected by using a MQ3 sensor. If driver consumed alcohol, then alcohol level inside the vehicle will be higher than a threshold value. When alcohol consumption detected, then the vehicle immediately stops to avoid risk of accident.

2. SYSTEM DESIGN

System consists of camera, image processing part , alcohol detection part, speed controller and alert generator. Camera is used to continuously monitors the face activity of the driver. The image processing part estimate the EAR and MAR values to determine drowsiness. Along with drowsiness detection alcohol level inside the vehicle is determined using gas sensor. Speed controller is provided to vary the speed of electric vehicle when drowsiness or alcohol presence is determined.

Eye coordinates are determined during image processing and each eye is represented by 6 distinct points. EAR value is calculated using these eye coordinates values, see figure 1. In case the EAR value is less than the threshold value for consecutive frames then system detects that the driver is drowsy. Similarly based on the mouth coordinates MAR value is determined. The MAR value above threshold MAR is defined to be yawning condition. An Alert generating system gives audible warning signal to driver when drowsiness detected by system.

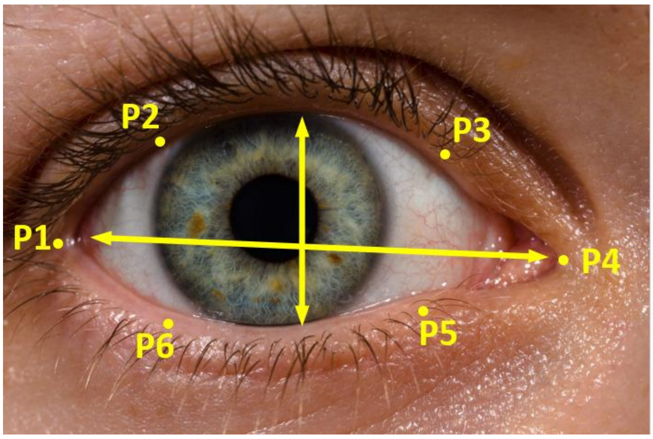

Fig -1: Eye Coordinates

EAR value is determined by,

EAR = (P2– P6) + (P3–P5) / 2 *(P1–P4)

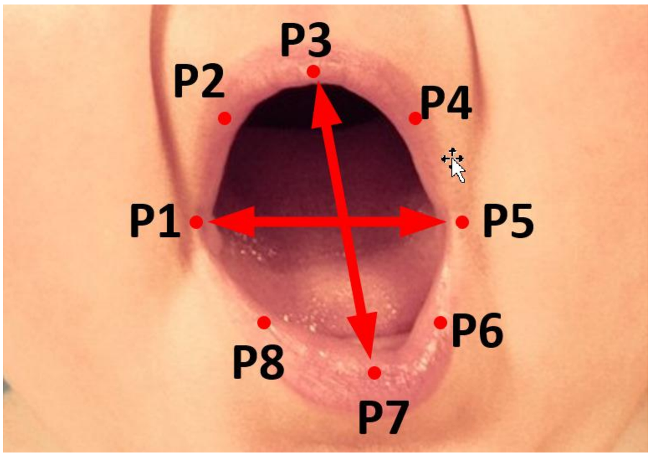

Fig -2: Mouth coordinates

Also Mouth Aspect Ratio (MAR) is determined by,

MAR= (|| P2-P8 ||+|| P3-P7 ||+|| P4 - P6 ||) / 2 (||P1-P5||)

2.1 Existing System

System captures real time feed of the driver while driving and using Haar cascade algorithm face can be recognized. From the outline of face, eye and mouth will be detected. Each frame of the camera feed is used to measure EAR . With optimized algorithm eye shut due to sleepiness is detected. All other unintentional events like blinking of eye will not be considered by the system as drowsiness event. In other words, it is assumed to be driver is in drowsy condition, so false detection will be avoided. After detecting drowsy state of driver alert signal is passed from the signal to alert the driver.

System workflow is given below.

Step 1: Start

Step 2: Camera Initialization by the IPU

Step 3: Camera starts to fetch images

Step 3: Detecting facial landmarks

Step 4: Detecting eye Coordinates

Step 5: Finding EAR value

Step 6: Comparing with threshold values

Step 7: If drowsiness event detected, alert is produced

Step 8: Else, continue monitoring

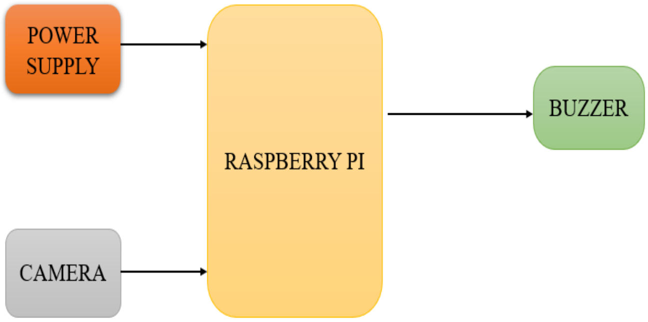

Fig -3 : Block diagram of existing system

2.2 Proposed System

Along with driver drowsiness detection using EAR, new system consists of Yawn detection, Alcohol detection and vehicle speed control. Yawn detection is done by using MAR threshold value, if the MAR value is over a predefined threshold, then it is assumed that driver is yawning. Alcohol consumption monitoring runs continuously to determine the weather driver consumed alcohol or not. If system detects the alcohol consumption event, then the vehicle immediately get stopped to prevent him/her continue driving. Whenever drowsiness state of driver determined then vehicle speed reduces automatically to halt along with audible alert

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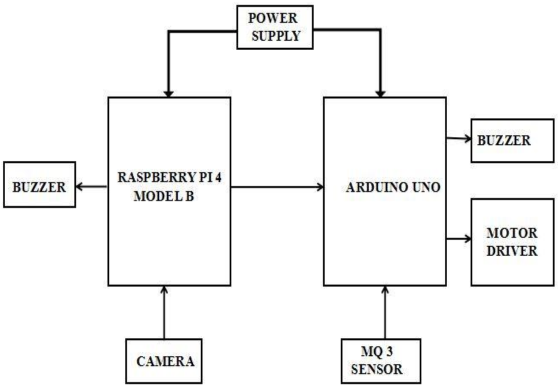

Fig -4: Block Diagram of Proposed System

Raspberry pi is used for image processing of the real time feed from the camera. Separate Arduino UNO is used for alcohol detection part, for reducing load of Raspberry Pi, during prototyping phase. With better software optimization, the functions of Arduino can be shift into Raspberry Pi platform, thus removing Arduino altogether from system. This optimization is part of the future scope. MQ3 sensor used as the alcohol sensor here and Motor Driver indicates vehicle speed controller, both are controlled and monitored by the Arduino. Buzzers are provided to indicate alcohol presence and drowsiness.

As future enhancement this system can adopt to autopilot related automation in electric vehicles. i.e., whenever the driver in drowsy condition then EV shift to autopilot mode automatically. IR based Night vision camera is an alternative over normal camera for efficient functioning of system during night time with zero cabin light.

2.3 Results

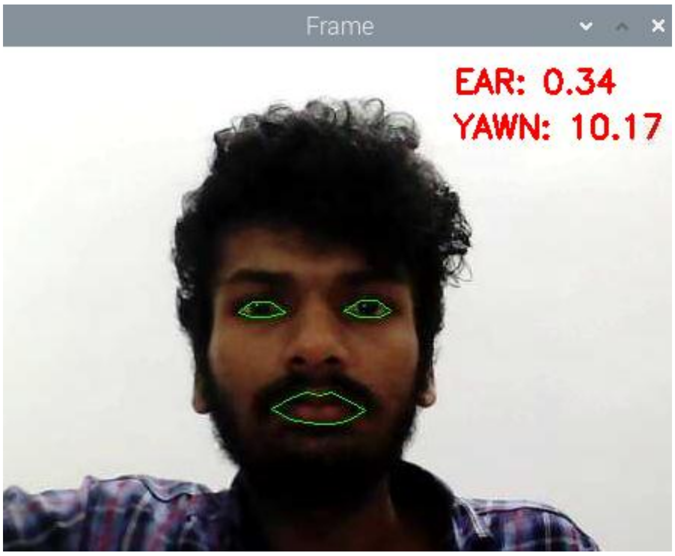

Fig -5: Normal Condition

Fig -6: Yawn Detection

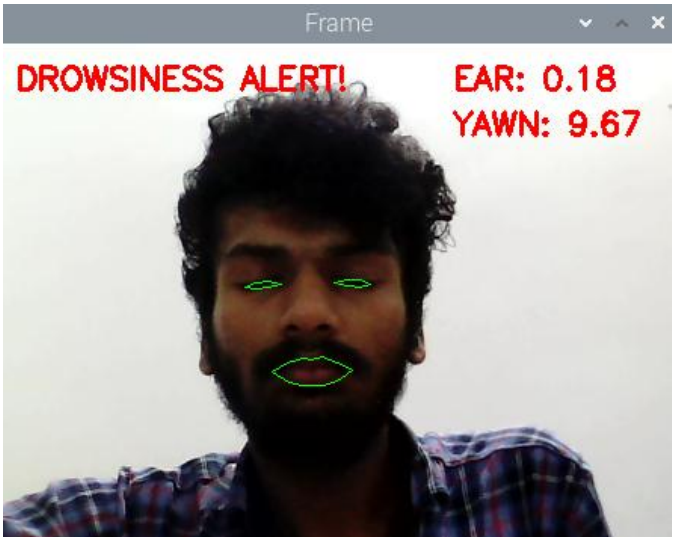

Fig -7: Drowsiness Detection

3. CONCLUSIONS

Currently Driver drowsiness system is majorly enabled on high end cars, which makes the advantage of this safety to not reach common man. With proposed project the safety can be bring to on all types of vehicles with less cost, which make the technology accessible. While monitoring is in progress the risky situations like microsleep & drowsiness are proactively identified and accidents can be avoided. Alcohol level of the driver is monitored to avoid driving while the driver is intoxicated. By doing this many accidents can be prevented and gives safety to driver, passengers and pedestrians.

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