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CAMERA-BASED DRIVER DROWSINESS DETECTOR

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Abstract - *The significant causes of road accidents are occurred due to Drowsiness and Fatigue of drivers. We aim to reduce the number of accidents due to driver Drowsiness hence will increase transportation safety. This System will Live Monitor the Driver Facial Expression using Image Processing and Based on the Drowsiness or frequent Yawning it will Notify the driver to take a break and if driver do not take a break, then it will generate an Alert Signal such as Turning on the Music Player, Turning on Vibration Motor of Driver Seat and turning on Hazard lights which will indicate other drivers that this driver is feeling drowsy. The entire system is implemented using Raspberry-Pi.*

***Key Words*: Drowsiness Detection, Image Processing, Facial Detection, Yawning, Hazard Lights.**

1. INTRODUCTION

The purpose of this project is to devise a way to alert drowsy drivers in the act of driving. One of the causes of car accidents comes from the drowsiness of the driver. As we know in India the total number of road accidents is increased by 1.8 percent from 1,89,400 in 2018 to 2,01,205 in 2020. The road accident data analysis of 2020 reveals that about 1374 accidents and 400 deaths take place every day on Indian roads.

So, our objective is to develop a system for drowsiness detection. The focus will be placed on designing a system that will accurately monitor the open or closed state of the driver's eyes in real-time. Also, to get the Yawning Count of the driver and accordingly give an alert signal to Driver. The components require for this project are Raspberry Pi 4B, Raspberry Pi 4B Camera, LED's, Vibration Motors. System targets to detect the driver fatigue through analyzing various parameters (data) such as Aspect Ratio of Eyes to detect

whether the Eyes are Closed or Opened and also the Aspect Ratio of Lips to detect the Yawning and keep count of Yawning, captured through Camera taking inputs from drivers Facial Expression. A Driver is said to be sleepy if his /her eyes are closed for more than 10secs and yawning continuously. So, as soon as the Drowsiness is detected the Alert signal will be generated by the micro-controller and can be forwarded to the alert system, which will Turn ON the Music Player, Vibration of Seat Produce by vibration motor, and alerting the other drivers by giving proper indication signs by Hazard Lights. The Camera will be installed at top of the Speedometer Dashboard which will Capture the Frames.

2. LITERATURE SURVEY

In 2006, Matthew Smith, Gerald Witt, Harry Zhang describes the Methodology which uses **Brain Wave Sensor** which was Brain Computer Interface (BCI). The Limitation was it was not Robust or Compatible and also the cost of the project was High.

In 2009, Frank A. Haight described **Detection of Drowsiness Using Blinking Technique,** the methodology used was Detecting blinks using piezoelectric adhesive disk attached to canthus of eyes but, it was not suitable due to sensor attached to face/eyes it was so intrusive.

In 2011, S. Cotter described the Methodology in which the **System Records eye movements via corneal reflection technique** but the there was some Drawback, this was unsuitable due to need for headset so this was highly intrusive

In June 2012, A. Cheng described **'Driver Drowsiness Recognition Based on Computer Vision Technology'**. They presented a nonintrusive drowsiness recognition method using eye-tracking and image processing. A robust eye detection algorithm is introduced to address the problems caused by changes in illumination and driver posture. Six measures are calculated with percentage of eyelid closure, maximum closure duration, blink frequency, average opening level of the eyes

In 2015, Adrian Rosebrock described **Driver Drowsiness Detection Using Image Processing and Facial Landmarks.** They used Python Library OpenCV to Detect the Face and used Haar Cascade Classifier file for detection of eyes, and they measured Eye Aspect Ratio and with the help of EAR they detected Drowsiness and Fatigue. If the eye aspect ratio indicates that the eyes have been closed for a sufficiently longed enough amount of time, it will send Alert signal and notify the driver.

3. BLOCK DAIGRAM

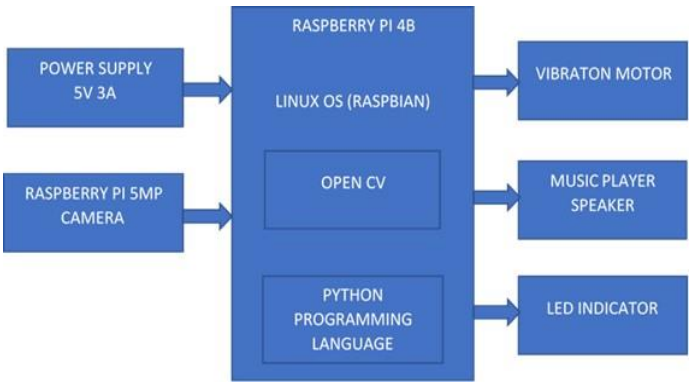

Fig -1: Block Diagram

4. METHODOLOGY

This project consists of Raspberry Pi 4B, Raspberry Pi 4 Camera, LED's, Vibration Motors. System targets to detect the driver fatigue through analyzing various parameters (data) coming from the Camera taking inputs from drivers Facial Expression.

This system ensures the safe driving of vehicles of any kind. The System will alert the driver if the driver is found to be sleepy or tired. The System can also be further improved by adding other sensors so that more data will be there to work on like for example alcohol sensor to detect alcoholic drivers this kind of system will safeguard the vehicles like school bus etc. where the passengers are wholly dependent on the driver for their safety.

Also, existing systems are not that cost-effective but a system like this could be. Working of the system is, in real-time it continuously monitors the EAR (Eye Aspect Ratio) and head position and the state of the eyelid to decide on alerting the driver about his fatigue and suggesting him/her to take rest. Driver is said to be sleepy if his/her eyes are closed more than 10secs and yawning continuously.

5. FLOWCHART

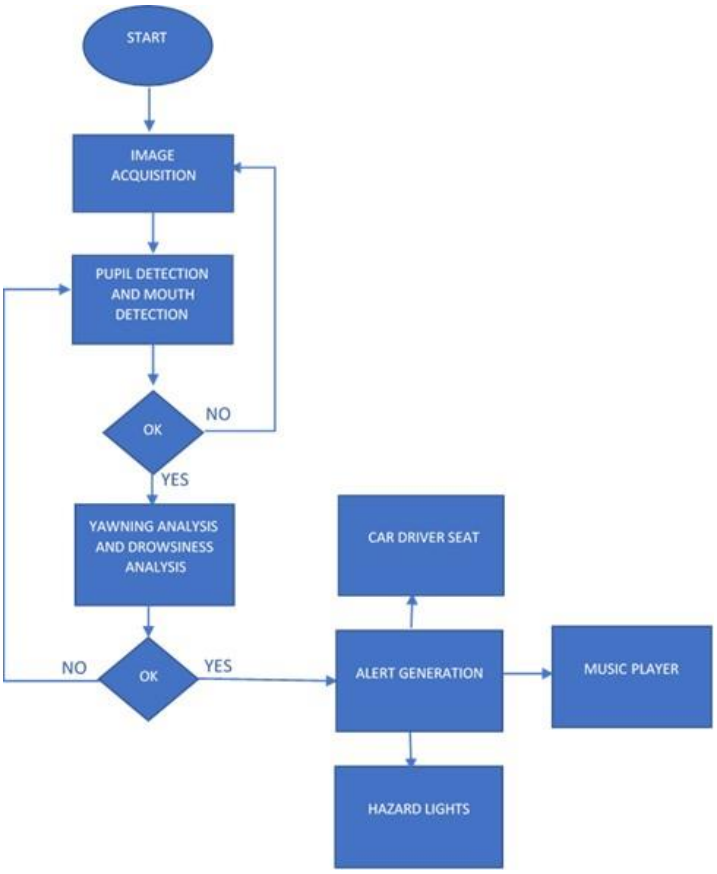

Fig -2: Flowchart

6. ALGORITHM

1. Start Vehicle
2. Raspberry Initialize and Raspberry Camera Initialize
3. Image Processing Using Open CV
4. Pupil Detection and Mouth Detection

i. If no jump to 3

5. Check for Drowsiness and Yawning Detection

i. If no Jump to 4

ii. If yes Alert Generation

6. Alert Generation

i. Turn on Music Player and Play Songs

ii. Blink Indicator of Vehicle (Hazard Lights)

iii. Turn on Vibration Motor

7. Repeat Step 4

7. EXPERIMENT AND RESULT

7.1 Result 1

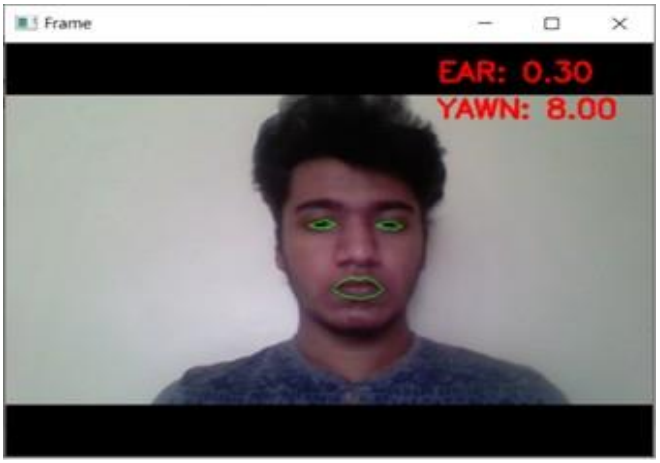

Fig -3: Experiment 1

This is Experimental Result where Eyes and Mouth are detected using Image processing, the Eye Aspect ratio gets calculated and displayed, this is the ideal state where the peer does not feel Drowsiness and it's not Yawing, So the EAR is 0.30 So, there is no any alert signal generated. Yawn factor is the distance between the upper lip and lower lip at the ideal state it is 8.00 and if Yawning occurs the value of the Yawn factor get exceeds 8.00.

7.2 Result 2

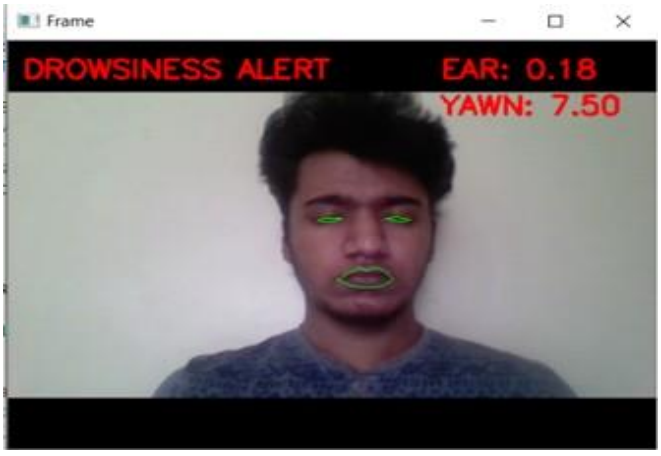

Fig -4: Experiment 2

This is Experimental Result where Eyes were closed for more than 10 secs so, there was a notification on the screen "Drowsiness Alert" and an alert signal was generated and was being passed to alert systems such as Music Player and Vibration Motor. The Eye Aspect Ratio is calculated at every frame per second so if the value of EAR is less than 20 in 10 consecutive frames it results in Drowsiness or Fatigue, which means the peer is feeling drowsy.

7.3 Result 3

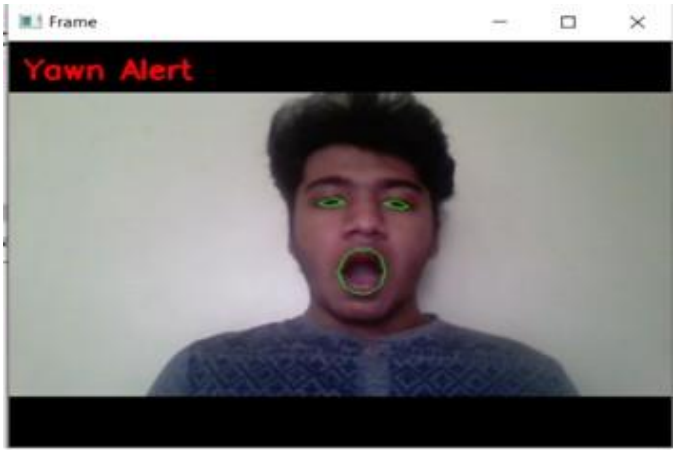

Fig -5: Experiment 3

This is Experimental Result where the peer is Yawning and so there is a notification that "Yawn Alert" and an alert signal was generated to alert the system that is Music Player and warn the peer to "Please Take a Break". Yawning alert is generated when Yawn Factor calculate the distance between the upper lip and lower lip and if this yawn factor exceeds more than 20 the yawn counter gets increment by 1 so if the peer is frequently yawning the yawn counter gets incremented and if this yawn counter value exceeds 5 then a notification displayed and an alert signal is generated. The yawn factor is also calculated at every frame.

8. OBSERVATION TABLE

SR. NO	OBSERAVTION	EAR AND YAWING FACTOR	RESULT
1	Eyes Open and Not Yawning	EAR >=28.0 Yawning Factor <= 8.0	Ideal State
2	Eyes Closed and Not Yawning	EAR < 20.0 Yawning Factor <=8.0	Drowsiness Alert (Sleeping State)
3	Eyes Open and Yawning	EAR >=28.0 Yawning Factor > 8.0	Yawn Alert (Yawning State)

9. ADVANTAGES OF PROPOSED SYSTEM

- Reduction in road accidents will be one of the main advantages.
- An efficient system to detect user attentiveness based on fatigue.
- Easy implementation due to readily available hardware and software.

- Light Weight Code, Simple Method Uses Eye Aspect Ratio and Mouth Movement while yawning.

10. APPLICATION OF PROPOSED SYSTEM

- This system can be implemented in different types of vehicles such as Cars, Trucks etc.
- This project can be integrated with a car so that automatic speed control can be imparted if the driver is found sleeping.
- This System Can be used to Monitor Employee's Tiredness During Work Hours.

11. CONCLUSIONS

This project tries to look at the emerging technologies and deter- mine the best approaches in trying to prevent the number one cause of fatal vehicle crashes.

This System will Live Monitor the Driver Facial Expression and Based on the Drowsiness or frequent Yawning it will Notify the Driver to take a break and If Driver Don't take a break, then it will Generate an Alert Signal such as Turning on the Music Player, Turning on Vibration Motor of Driver Seat and Turning on Hazard lights which will indicate other drivers that this driver is feeling drowsy

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