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Hardware Based Driver Drowsiness Detection System

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Abstract: *Most of the road accidents occurred at the night are caused because of a sleepy or semi-conscious driver. This leads to risking the life of passengers and traffic. In road travel drivers are the most responsible part of the traffic, they are not just responsible for their own life but also for passengers and fellow traffic as well. So, to make sure that there are no such accidents we need a reliable system within the car itself to make sure the driver is not sleepy or at least he/she should be aware of his/her fatigue before risking the life of passengers. So to overcome these problems we are making a system called Driver drowsiness detection system. It will be a safety technology that will prevent accidents that are caused by drivers who fell asleep while driving or felt unconscious. In this system, we will be using Open CV for gathering the live feed of the driver's face and converting the data from the feed into a two-dimensional array using facial landmarks. Then the local binary pattern will compare the template data set and the data set from the live feed and will determine whether the eyes are closed or not. The buzzer will alert the driver by triggering the alarm or waking him up to prevent accidents.*

Keywords: OpenCV, Facial Landmark, Local Binary Pattern, Buzzer

I. Introduction

Major studies have suggested that around 10-20% of all road accidents are fatigue-related. Drowsy driving can be extremely dangerous, a lot of accidents are related to the driver falling asleep while driving and subsequently losing control of the vehicle. However, Initial signs of fatigue and drowsiness can be detected before a critical situation arises. So we made a hardware system called Driver Drowsiness Detection System. It is a car safety technology that helps to prevent accidents caused by drivers getting drowsy. This system aims to locate, track and analyze the driver's eyes which helps in increasing traffic safety and reduction of traffic accidents utilizing new technologies. It is important to use new technologies to design and develop such systems that are capable of monitoring drivers and measuring the level of attention the driver gives in the complete driving process.

In this paper, we aim to design and develop a hardware system using computer vision because it is the most feasible and appropriate technology available to deal with this problem. In addition to that, we are using some software and hardware for implementation. We booted up Linux operating system into our raspberry pi-4 as an operating system to implement our system, camera module to capture images, memory card for storing data. Also, we are using the pycharm compiler to compile the python code which we run on Linux operating system.

II. Implementation

The driver is always the one to carry the responsibility of passengers. So to avoid at least one of the major reasons for accidents we are making a hardware system called Driver Drowsiness Detection System. For implementation, we used some software and hardware.

As a base of our hardware system, we used RasberryPi-4 which is nothing but a single chip computer about the size of a deck of cards. We installed raspbian-os which is a Linux distro. We used a terminal to run python code. To get the live feed, we installed the pycam module.

To capture the feed from the pycam module we are using OpenCV then to analyze we are using Keras's deep learning libraries. Then we provided a template known as Cascade in a .xml file format which will only be used to compare. The

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algorithms we used are PCA (principal component analysis), facial landmark recognition and local binary pattern to convert the feed from pycam into two-dimensional array. The fig1. Showing how the algorithms we are implementing in our system. Then this array will be compared with the cascade.xml using Numpy. To make sure that the system gets notified every time the user closes his eyes the facial landmark are monitored in real-time and whenever two array rows are merged the system will detect it as eyes closed state and for the duration the eyes are closed the system will start counting the frames in terms of scores. Whenever the score reaches a certain limit, the buzzer will be triggered. The buzzer will continue to trigger until the score reaches back to its normal value, the score will start declining as soon as the driver opens his eyes. The score will depend on the frames per second and the resolution of the camera.

The following figure shows how (Principal Component Analysis, Facial Landmark, Linear Binary Pattern) this algorithms are working in this system.

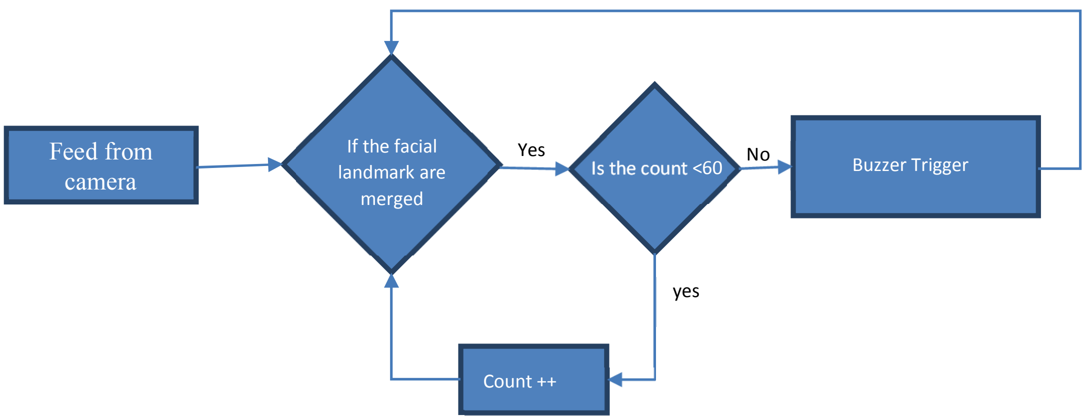

Figure 1: Algorithm Flowchart

As our system is score based it will detect drowsiness on score based. We have set a certain limit of frames in our system to check, if it is going beyond then the buzzer will alert the driver by triggering the alarm. As soon as the driver opens his/her eyes, the score start to declining.

You can see in Fig 2. The driver is in active state and his score is 0 but as he is feeling unconscious or going in inactive state, the score is increasing in Fig 3. When it reaches to 30 frames or exceeding it, the system gives warning as ‘Sleepy Driver Alert’ and intiate the buzzer in Fig 4. As soon as the driver opens his eyes it will go to cooldown stage and score starts to decrease and again reaches 0.

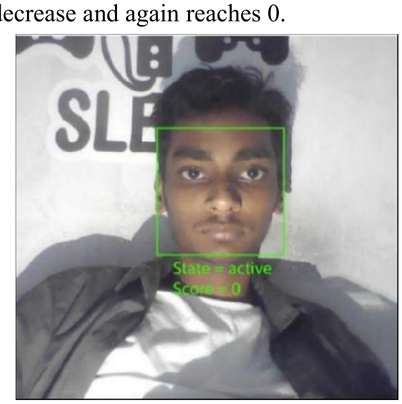

Fig 2. The active state of driver

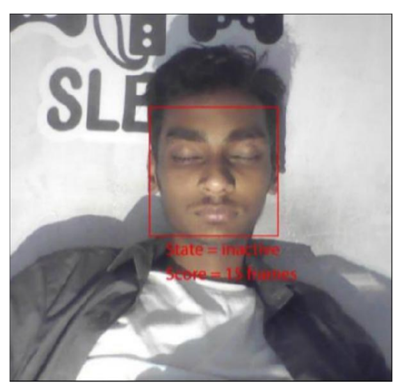

Fig 3. The inactive state of driver

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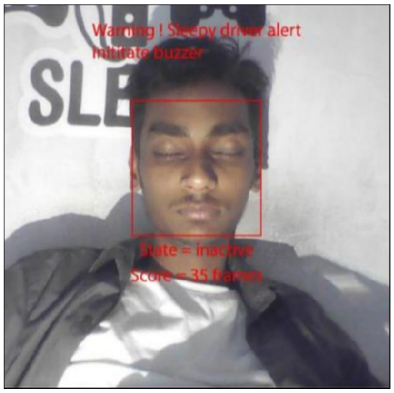

Fig 4. Trigger state when frames score exceeds 30

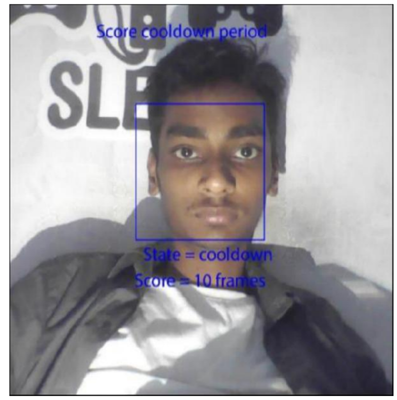

Fig 5. Cooldown stage when driver wake up and score starts to decrease

III. APPLICATIONS

- Automatic eye blink detection
- Helps avoid accidents
- Can be used in car, trucks, school bus, vans etc

IV. CONCLUSION

The drowsiness detection system has a minimum intrusive approach for monitoring the drowsiness of the driver which is based on computer vision techniques installed in real-world vehicles and capable of handling real operations. It detects fatigue of a driver and the eye movements as the driver's eyes are closed or not beforehand to prevent an accident that may take place because of the sleepy or unconscious driver. The buzzer was triggered at the most accurate point where the score reaches 30 frames and the efficiency can also be calculated from glasses as well as bare eyes. The score starts to decline as soon as the eyes are open. Hence the drowsiness detection with optimum efficiency is achieved.

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