Futuristic Driving Safety System

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FUTURISTIC DRIVING SAFETY SYSTEM

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***Abstract*—A lot of road accidents happen every day that consume a lot of lives. Many safety measures have been taken by the governments by introducing rules and regulations for road safety. If the mistake happens by the driver of the vehicle, the situation is out of rules and regulatory terms of the government because of human error. One of the main causes for road accidents is drowsiness or sleepiness of the driver. To detect the drowsiness and sleepiness of a driver in the vehicle, a real-life automated system is necessary which can alert him and warn him before any misconduct happens on the road. An automated system can help the situation to be improved.**

Keywords—Facial landmark detection, Eye Aspect Ratio, Drowsiness, Cruise control, Lane detection, Facial recognition

I. Introduction

The road safety is threatened per-day, throughout the world and one the major reason is drowsiness of the driver of vehicle. A lot of road accidents happen that cause a lot of damage to lives of humans and animals with more and more of economic losses.

Mostly the drivers feel fatigued with lots of tiredness that is known as drowsiness. Lack of concentration even for a few seconds could lead to a greater risk to the lives. Drivers need to be attentive while driving the vehicle all the time.

Avoiding this problem is a necessary cause. Now, we need to develop a system that can detect and alert about the drowsiness or sleepiness of the driver of the vehicle. In case the drowsiness occurs multiple time then a further advanced system is needed to save the situation here. Here, we will be using Per-Clos algorithm on eyes to detect sleepiness. If the drowsiness is repeated more than three times then the cruise control of the car comes to action.

II. Problem Statement

The problem arises due to drowsiness or sleepiness of the driver and that could lead to a serious harm to lives. This problem can be eradicated if the driver is alerted after feeling drowsy and that can be done by using an automated system that can detect the sleepiness and then proceed with suitable precautionary measures that could lead to saving a lot of lives.

The objective here is to create a real time working automated model that will alert the person if he is feeling drowsy and then detecting the correct lane of the road to park vehicle. The automated model takes image for every second or for multiple frames in the video at multiple instants and checks for eye closure and calculates the time for eye closed using per-clos algorithm. The driver will be alerted through a sound alarm if the eyes are detected to be closed for a certain amount of time and proceed to detect the lane of the road. The problem is bigger than it seems and needs to be looked upon.

III. Modular Division

The entire architecture of the system is divided into 4 modules:

A. *Facial Landmark Detection*

The input to the system is taken from the camera and detects the landmarks on the face in the video input. 68 total facial landmarks are detected through the images obtained from video stream. The source code performs this action by using camera attached to the system as input to it. Firstly, the face is detected, and then eyes are identified using 12 landmarks.

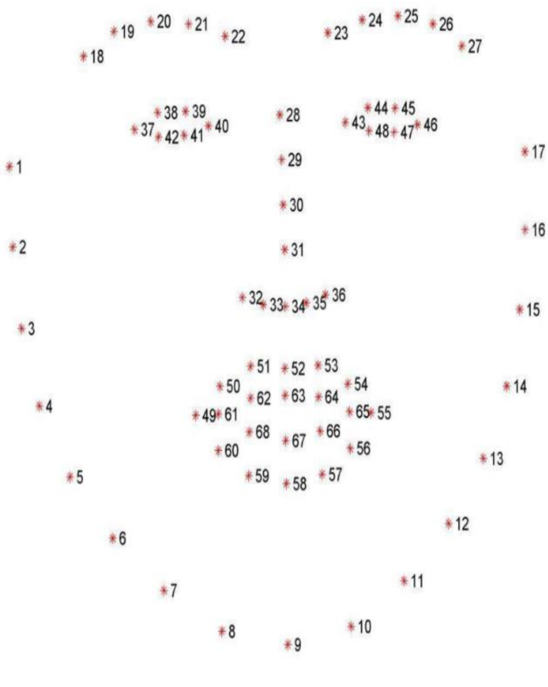

Fig. 1. Facial Landmark Detection

B. Eye Aspect Ratio calculation

Eye Aspect Ratio is calculated by using 6 coordinates for each eye. The algorithm works as it calculates the distance between eye lids vertically. If the distance between eyelids equals zero then the system detects the eye closed and then the time for the eye closed is calculated.

PERCLOS stands for Percentage of Eye Closure and is defined as the calculation of distance between eyelids. In this system the per-clos works as the eye closure is detected when the Eye Aspect Ratio reduces to zero and if remains in the same state for a predefined time then drowsiness is indicated.

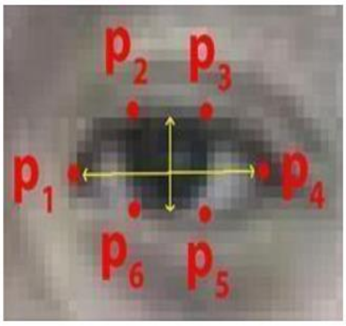

Fig.2. Per-Clos Algorithm

Eye Aspect Ratio = (L + M) / (2.N)

where,

the distance between the point (p_2, p_6) is L

the distance between the point (p_3, p_5) is M

the distance between the point (p_1, p_4) is N

C. Drowsiness detection

If eyes remain closed in multiple frames captured from the video input, then system will detect the drowsiness. If the eyes are closed for multiple frames of the video input and that calculates to 2-3 seconds, then the driver of the vehicle is considered to be drowsy by the system. The per-clos algorithm is used to detect the drowsiness in this project. If the driver of the vehicle is detected drowsy for 3 times consecutively, then the video input to the system is switched to the camera on the top of the vehicle.

D. Lane Detection of the Road

The basic principle here used is named Top view image transformation that transforms the camera view mounted on top of the vehicle into a virtual postion with a top view angle. The real image of the road is turned into binary image firstly to be used in Hough algorithm that leads to further calculations. The Hough algorithm contibutes into hough transformation that works as it searches for the lines on the road using its equation. The hough transformation has a necessity to choose the longest straight line from the lines detected on the road. Two coordinates are taken out of the longest line detected from the road and they work as starting point (x1,y1) and ending point (x2,y2).

The equation of straight line model for road linear detection is stated below:

$$b = \frac{(y2-y1)}{(x2-x1)},$$

$$a = y1 - \frac{(y2 - y1)}{(x2 - x1)} * x1$$

In the equation above, ‘b’ is the slope of the linear detection model. The parameters calculated above ‘a’ and ‘b’ are to be used again in curved line detection that is also part of lane detection.

Below is the flowchart for the lane detection

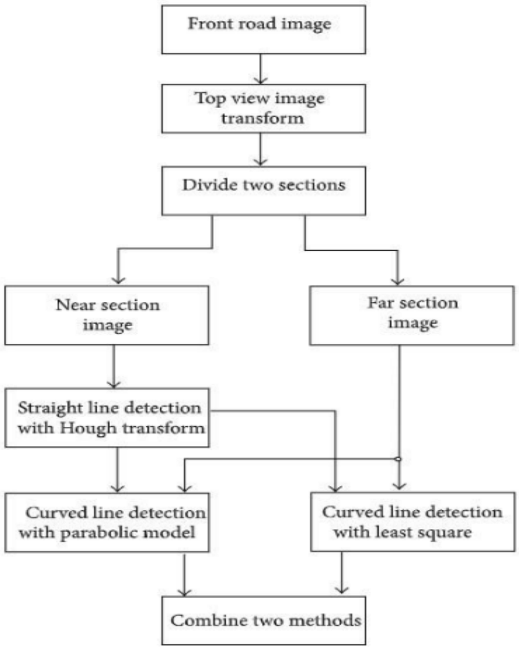

Fig.3. Hough Transformation Flowchart

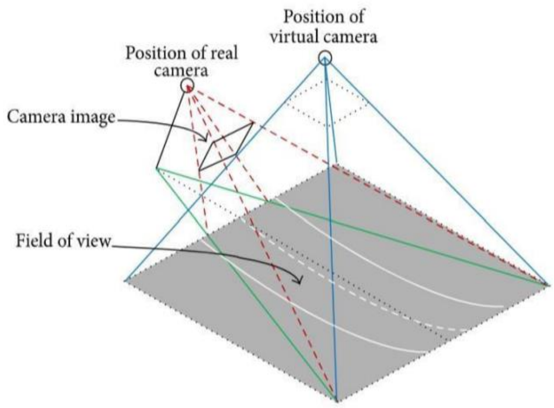

Fig.4. Top View of Image Transformation

Fig. 2.2.5.2 Binary image of top view

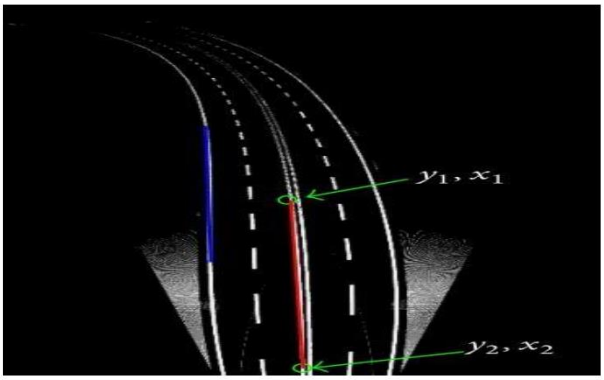

Fig.2.2.5.3 Hough trasnsformed image

IV. PROPOSED SYSTEM

The proposed system will be used to detect drowsiness and detecting the lane of road to park the vehicle as a safety measure. The proposed system captures images using the webcam stream mounted on top of the vehicle and after capturing, it detects the facial landmarks through face detection technique. It uses facial landmark detection technique to pick out the 12 coordinates of the eyes detected.

The eye is detected using facial recognition method and it is used to calculate eye closure time for the drowsiness detection. Using Per-clos algorithm the state of the eye is detected whether eyes are closed or open. If the eyes are found to be closed for a predefined period of time then the system detects drowsiness and starts further process to alert the driver.

If the driver is found drowsy for 3 times by the system that also sounds the alarm three times, then the system will start detecting lanes of the road by using digital image processing using Hough algorithm and the cruise control of the vehicle will do further safety procedure that will park the vehicle in the leftmost lane that is considered the safest to park in India.

The program for the system will flow by process to process. The programming is done using python 3 programming language because it contains a pre-trained face recognition function which is efficient enough. The program flowchart is shown below:

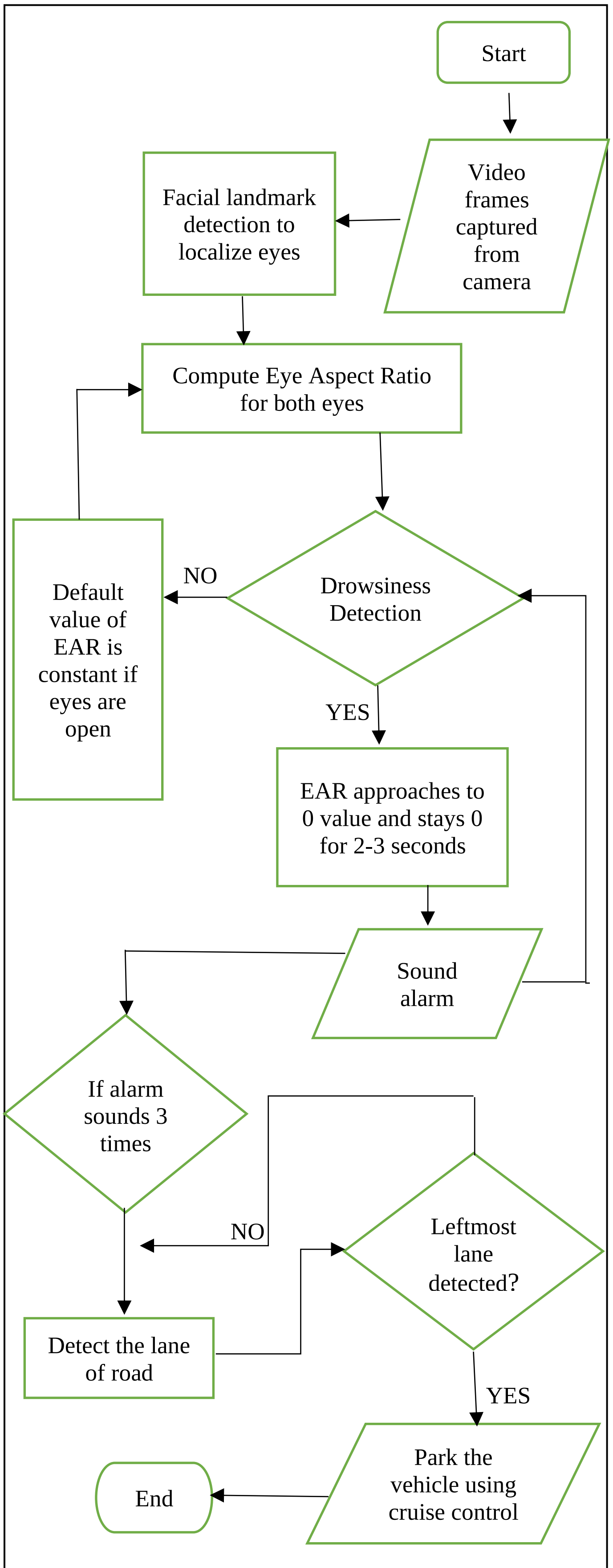

Fig.5. Flowchart of Proposed System

V. CONCLUSION AND FUTUREWORK

Conclusion- An automated system was developed that helps in detecting the drowsiness of the driver in a vehicle. A continuous video stream from webcam is fed as input to the system installed inside the vehicle. The eye closure is detected using per-clos algorithm and that helps in detecting drowsiness of the driver. If the driver is detected drowsy for 3 consecutive times by closing his eyes for a specific amount of time all three times, then the system will detect the lane of the road using another camera placed on the top of the vehicle. Binary image transformation of the real image of the road is provided to the hough transformation as input for the calculation of the parameters of the road. Once the leftmost lane of the road is detected, the cruise control of
the vehicle will automatically park it for the safety of driver.

Futurework- The work can be extended by programming the cruise control of the vehicle through an electronic chipset to assume the control of the steering to park the vehicle automatically on the safest lane of the road. Further work can be done so that we can use the system efficiently using InfaRed webcam that will enable the visibility even in night. InfraRed webcam does not need light of daytime to work and that will make the system suitable to work in the night where there is low visibility.

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