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Estimation of Driver's Level of Drowsiness and Alcohol Intoxication using Arduino

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Abstract - *Driver Drowsiness System in today's` modern world transportation is necessary for the aspect of safety, we will be making a drowsiness detecting device. An endless number of individuals drive on the highway day and night. Cabbies, transport drivers, truck drivers and individuals travelling significant distance experience the ill effects of lack of rest. Because of which it turns out to be exceptionally hazardous to drive when feeling lethargic. Most of mishaps occur because of the drowsiness of the driver. So, to prevent these accidents we will build a system using Python, OpenCV and Arduino which will alert the driver when he feels sleepy.*

This study also highlights that these solutions and studies focus on solving any one problem and not most of the problems in general. For this reason, there must be a common system which can give solution for most of the problems mentioned here. Anon-intrusive system which can solve all these problems.

Key Words*: *Driver Drowsiness Detection System, OpenCV, Arduino.

1. INTRODUCTION

Drowsiness is the state of feeling tired or sleepy. We all can be a victim of drowsiness while driving, due to too many short night sleeps, tired physical condition or during long journeys. Driver fatigue affects the driving ability of many drivers in the following 3 ways:

1) It impairs coordination.

2) It causes longer reaction times and delays the reflex action of our central nervous system.

3) It impairs judgment.

The number of accidents as a result of drowsiness is increasing day by day. Recent statistics estimate that annually 76,000 injuries and 1200 deaths can be attributed to drowsiness related crashes. The advancement of technology in detecting the drowsiness of the driver is a noteworthy challenge as it can help reduce the probability of accidents taking place resulting in decrease in the death and injuries caused due to drowsy driving. Considering the hazards, drowsiness presents on the road, it is necessary to develop and efficient system which can work under low light environment and with better and faster speed. Nowadays the driver safety in the car is one of the most wanted system to avoid accidents.

Our objective of the project is to ensure the safety system. In this manner, a system which can keep a check of driver's condition for drowsiness and alert the driver before it's too late. For this we need a system which will focus on the open or closed state of driver's eyes as by monitoring the state of the eyes detection of drowsiness is easy. Detection in real-time is the major challenge in the field of accident prevention system. The purpose of this study is to provide a real-time monitoring system using video processing, face/eye detection techniques. This system deals with automatic driver drowsiness detection based on visual information. Our system will capture the video through camera and after processing, it will alert the driver based on the results. This system has overcome few of the limitations of the existing systems. Our System will not only alert the driver but also the co-passengers with a loud alarm and the vehicles behind with an alert message with the help of a LCD display attached to the back of the vehicle to slow down or stop.

Table 1: Effect of Alcohol on Highway Safety [1]

Blood Alcohol Content (BAC) Level in g/100ml	Effect
0.02 to 0.04	Progressive Deterioration
0.04 to 0.05	Important involvement in the accident
0.02 to 0.04	Dominant Accident Factor
0.02 to 0.04	At BAC 0.01g/100ml, accident risks 7-25 times

India reported the highest number of road accidents in 2013, According to a new estimate by the World Health Organization, close to 1,05,725 people died as a result of traffic crashes in 2013. 77.5 percent of overall road accidents are caused by negligence of drivers. According

to figures in Europe, 10 percent-20 percent of all traffic incidents occurred because of driver fatigue [2].

Driver exhaustion and sleepiness represent 25 per cent of all accidents. Statistics show driver lack of attention is a huge issue for road accidents worldwide. Driver lack of attention may be due to his / her lack of emphasis on secondary activities. Stress behavior by drivers can be the reason the accidents are caused by lack of attention. These crashes occur only from midnight until 6 am [3].

A combined solution should be provided in order to effectively identify and solve all the factors that can cause accidents. The system should be a non-intrusive system which can be installed in automobiles and will be able to solve most of the factors which lead to accidents.

2. LITERATURE SURVEY

A few efforts have been accounted for in the improvement of the system to identify the drowsiness dependent on different elements like head movements, pulse changeability, grip quality and development of the guiding wheel against the way markings out and about [4]. A drowsy driver discovery system has been created to focus on the eyes of driver and determine the drowsiness. Drowsiness recognition strategies, as per the boundaries utilized for location is separated into two segments for example intrusive method and a non-intrusive method. The fundamental contrast of these two techniques is that in the intrusive strategy, an instrument associated with the driver and afterward the estimation of the instrument is recorded and checked. In any case, intrusive methodology has high accuracy, which is relative to driver inconvenience, so this technique is once in a while utilized. [5]. The system has the ability to pick whether the driver's eyes are opened or shut. Exactly when the eyes are close for a truly significant time- frame, an warning sign is given to driver.

Examine a driver laziness watching and early caution system, which utilizes AI strategies, considering vehicle telemetry data. The proposed framework can ensure safe driving by consistent checking of driving pattern [6]. A response for driver observing and occasion acknowledgment subject to 3-D information from a range camera is presented. The system merges 2-D and 3-D techniques to give head pose estimation and zones of intrigue recognizable proof

Zhu et al.[7], suggested an proposal to reduce the risk of injuries. This paper used two cameras to capture the driver's facial expression, eye response, head rotation and stance, facial gestures to achieve driver somnolence later this much work in this field was completed.

Albu et al.[8] later identified a scenario in which sleeping while driving is the most extreme driver fatigue consequence and also identified the physiologicalcondition of drowsiness, tracking the closure of the eye. Toassess the drowsiness in driving they use many other approaches to detect the fatigue and track the eye condition.

Lee et al.[9] calculated driving status by using two cameras one used to capture driver views and the other used to monitor the direction while driving for driving pattern and status recognition purposes. We use photos to track the drivers and constantly monitor the vehicle.

3. PROBLEM STATEMENT

A. Objectives

- Input video stream for faces
- Apply facial landmark detection and extract the eye regions
- Compute eye aspect ratio to determine if the eyes are closed. If the eyes have been closed for a sufficiently long enough amount of time, sound an alarm to wake up the driver.
- Using Arduino Uno board to demonstrate alcohol detection and obstacle detection.

4. METHODOLOGY

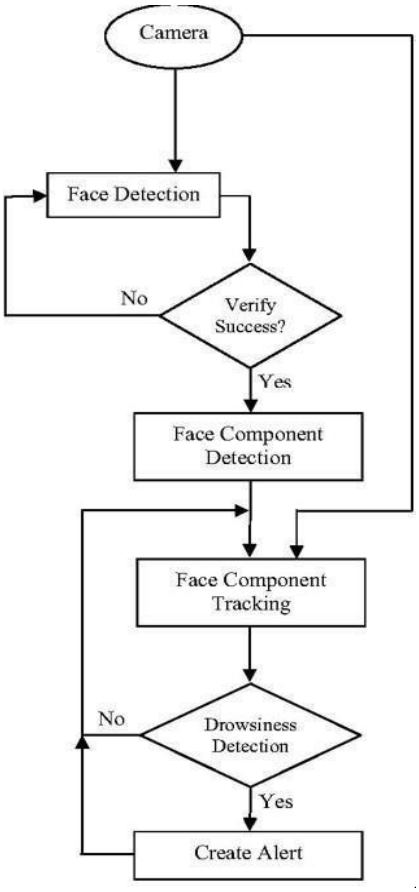

Fig.1 Flow chart for Driver Drowsiness Detection System

- The algorithm uses Dlib library (A toolkit for making real world machine learning and data analysis applications) for the face detection and eye detection.
- Develop program for face detection using OpenCV to determine positive and negative samples.
- If a face is found, we apply facial landmark detection and extract the eye regions.
- Develop program for Eye Detection with the help of Dlib library, Cmake library and numpylibrary.
- First, the video retrieves an image frame from the camera.
- The algorithm detects the face in the pre-processed image by using facial landmarks produced by Dlib library.
- In the detected face region, the algorithm finds the face landmark.
- The facial landmarks produced by Dlib is an indexable list.
- To detect eye region, the correct array slices from the set of face landmarks is detected.
- Using EAR (eye aspectratio) to determine whether the eyes of the driver are closed or not while driving.
- If the eye aspect ratio indicates that the eyes have been closed for a sufficiently long enough amount of time, we'll sound an alarm to wake up the driver.
- Set the EAR threshold = 0.25.
- Compute the eye aspect ratio (EAR) of both the eyes.
- Check to see if the eye aspect ratio is below the

  "blink/closed" eye threshold.
- If it is, we increment COUNTER, the total number of consecutive frames where the person has had their eyes closed.
- Developing an efficient system for the driver drowsiness detection using Arduino to display the suggestions for the driver.
- Using the PySerial module to link Arduino with python. ZIGBEE module which is used to read and write serial data to Arduino.
- If the counter is greater than 50, alarm sounds and

  "You're Drowsy" is displayed on the screen.

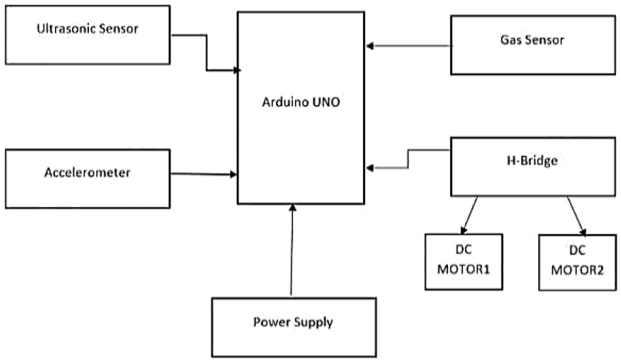

Fig.2 Architecture of Arduino-Uno board setup

Eye aspect ratio:

Unlike traditional image processing methods for computing blinks which typically involve some combination of Eye localization threshold to find the whites of the eyes.

Choosing whether the white territory of the eyes disappears for a satisfactory time period which is indicating a glimmer. The eye perspective extent is fairly a significantly progressively dazzling course of action that remembers an amazingly fundamental calculation subordinate for the extent of partitions between facial places of interest of the eyes. This procedure for eye gleam ID is speedy, capable, and easy to complete.

The eye aspect ratio work is used to calculate the extent of divisions between the vertical eye places of interest and the partitions between the even eye achievements. The appearance estimation of the eye edge extent will associate with consistent when the eye is open. The value will at that point quick reduce towards zero during a squint. In case the eye is closed, the eye perspective extent will again remain generally consistent, yet will be significantly humbler than the extent when the eye is open.

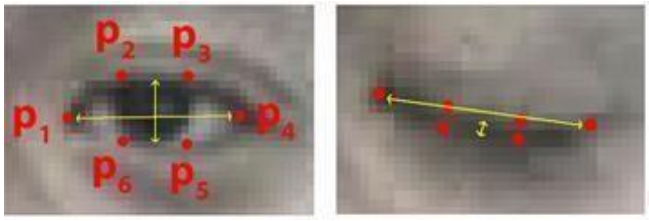

Fig. 3 *Left:* Visualization of eye landmarks when the eye is open. *Right:* Eye landmarks when the eye is closed.

We observe, that the eye aspect ratio is constant, then drops quickly to zero, then again increases, indicating a blink. In our drowsiness detector system, we'll be analyzing the eye aspect ratio to see if the value falls and does not increase back again to constant, this implies that the person has closed their eyes for a sufficient amount of time to sound the alarm.

The formula used for calculation of EAR is as follows:

$$\mathrm{EAR} = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

EAR algorithm:

Step 1: Use the Detected Eye region from the algorithm.

Step 2: Compute the Eye Aspect Ratio to determine if the eyes are closed.

Step 3: If EAR satisfies the drowsy condition then move to step 5.

Step 4: If EAR is normal then go to Step 1.

Step 5: Sound Alarm. A. Work Done

- Develop program for face detection using OpenCV to determine positive and negative samples.
- If a face is found, we apply facial landmark detection and extract the eye regions.
- Develop program for Eye Detection with the help of Dlib , Cmake and numpylibrary.
- Using EAR (eye aspect ratio) to determine whether the eyes of the driver are closed or not while driving.
- If the eye aspect ratio demonstrates that the eyes have been shut for an adequately long enough measure of time, we'll sound an alert to awaken the driver.
- Set the EAR Limit=0.25.
- Compute the eye aspect ratio (EAR) of both the eyes.
- Check to check whether the eye aspect ratio is beneath the "flicker/shut" eye edge.
- If it is, we increase COUNTER, the absolute number of continuous edges where the individual hashad their eyes shut.
- If the the counter reads more than 50, alert sounds and "You're Drowsy" is shown on the screen
- Using ZIGBEE module which is utilized for wireless communication toArduino.
- Using UV sensor for obstacle detection and Accelerometer for accident detection i.e by checking the orientation of the car with respect to X-Y plane Testing and implementation of System by measuring the accuracy and robustness of the system

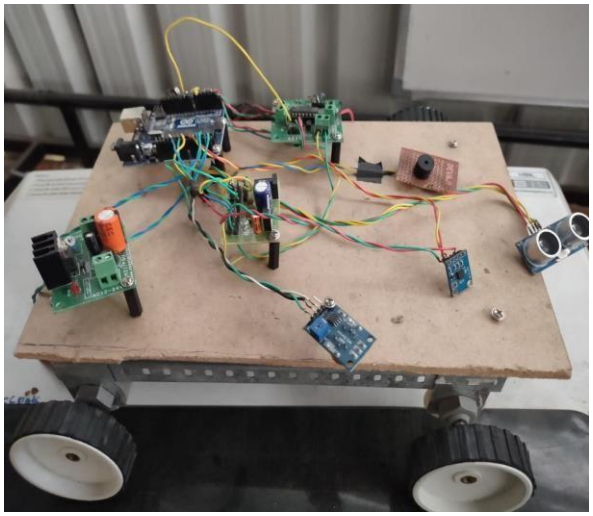

Fig.4 Final Setup of Robot Car for demonstrating Drowsiness detection and Alcohol Intoxication

5. CONCLUSION

The suggested alert-alarm system is effective in detecting the real-time drowsiness, it can effortlessly detect the twitch of an eye and drowsiness, the algorithm used for processing provides an intrusion-free solution independent of age or gender, usage of alcohol detectors will reduce the accidents pertaining to those issues, therefore this system as a unit will act as a great facilitator in preventing the road mishaps due to drowsiness and alcohol intoxication and act as a preventive device.

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