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Driver Drowsiness Detection for Safety Assistance Using OT and Machine Learning

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Abstract - One of the leading incidents and accidents worldwide is driver weariness. One of the most reliable methods of determining driver weariness is to recognize the driver's tiredness. The goal of this project is to create a working prototype of a sleepiness detection technique. This device monitors the drivers face and sounds a warning if he or she appears to be tired. The program is a great surveillance system that isn't obtrusive. The objective is to improve the motorist's wellbeing without becoming intrusive. The motorist's eye blink is observed in this research. When a motorist's eyes are closed for an infinite length of duration, the driver is considered drowsy and an alert is raised. This has already been programmed for the recognition of facial characteristics, OpenCV was used with the face landmark detection model.

1. INTRODUCTION

1.1 Introduction

Transit systems play a vital part in anthropogenic sources in our daily lives. Road things like this can happen to anybody at time for a plethora of ways, but the majority of them are prompted by drowsy driving. Tiredness is caused by inadequate of extra sleep, and causes excessive on lengthy flights. Driver vigilance will be reduced as a result of these circumstances, resulting in dangerous conditions and an increased hazard. As a result, the majority of accidents occur every year all across the country [1]. Emerging innovations can play an essential part in offering a solution to the issue in just this technologically advanced day.

According to a study from the national American Academy of sleep medicine in the United States, 100000 deaths are caused each year by driver tiredness. Similarly, a study found that being up for 24 hour increases tiredness [2].

As a result, in order to strengthen the protection of automobiles, continuous surveillance of the mechanical force's status and important input (e.g., alerts or safeguard automated operations) have to be included. Fortunately, a variety of technologies, such as distributed pressure sensors, eye cameras, and wearable technology for detecting crucial data, are now available to address these issues. [3]-[4]

Because although existing information devices will provide information on the driver's body position, the user's natural mechanism, or his rhythm, the collection of different indicators of surrounding vehicles has been the most significant and safe, especially in motor vehicle contexts where the cars and trucks mandated are more scary than limited cars. In contrast, two major factors in system components should really be considered: driver enjoyment and dependability.

Multiple monitoring systems and data sensing combining had to be linked with the challenge of preventing single failures or misleading device results in order to allow a typical driving behavior and avoid discomfort or maybe affecting the activities performed merely in case of emergency to boot. The numerous device platforms in the vehicle automation system, in fact, represent the means by which the automobile interacts with the environment and with the driver to assure a high degree of safety and to improve overall comfort throughout the journey. Typically, these systems connect with one another using standard automotive bus protocols.

The regulator access networking (CAN), a well-known traditional serial bus transceiver with time quality and effective cognitive irresponsibility used in many sorts of cars, is the one employed for this technology.

Based on two parameters, this research suggests a novel approach for identifying tiredness in people. The first step is to use the phone to film facial and ocular characteristics, as well as to recognize winking and set a limit value for the lower limit of eye closures. Furthermore, an Arduino component is employed, which is connected with viscoelastic detectors to calculate driver hand pressure on the steering column in real time putting a given threshold. The results of both procedures are combined to make a final conclusion and warn the driver.

1.2 Problem Statement

By focusing on the driver's visual attention, an application solution is meant to prevent innumerable accidents caused by fatigued drivers' behavioral and cognitive alterations. In terms of monitoring the severity of impact effects during car crashes, data of the position must be kept in order to take supporting action.

2. Literature Survey

Previous studies for decreasing traffic fatalities due to tiredness assessment and prevention alertness solutions based on the available information are notifiable inside the existing literature.

Are using OpenCV [11] modules, Davidson et al. [9] created a basic system that uses the Har Mathematical programmed to detect objects and face features [10]. Utilizing figures come, the eye location is retrieved from the obtained image. Then they locate the eyelid to determine the degree of ocular closure.

A. Paola [13] devised a method that used an infrared camera to detect signs of driver fatigue. An artificial software for investigating and pursuing the rightmost lane has been built using the creation of bright elements. When tiredness is recognized, the system sends an alarm notification to the driver.

To detect the facial region, C Kumar [16] employed the Adaptive threshold approach. Discovering facial traits and important points like hair and a probable face center creates the location of concentration. For appropriate eye detection, feature extraction and K - means are applied. Then, using non-linear SVM, a collection of shape options is generated and developed to influence the attention's position.

Climate difficulties (temperature change, poor road circumstances), genetic and morphological concerns (exhaustion, age) are all elements that influence operator driving effectiveness and attitude [19]. Factors such as alcohol, narcotics, cigarettes, and irregular work shifts, as well as vehicle-related difficulties (bad condition, old vehicle) All of these things will have a greater impact on each individual's driving force.

Various studies have been conducted to determine driver fatigue using objective and subjective measurements. Objective assessments are linked to administering questionnaires to drivers [20]. There are certain disadvantages to this strategy, such as the fact that the evaluation is done on the day of the vehicle event, and that driver drowsiness-related difficulties are not factored into the equation during the driving job [21].

Approaches like muscle tiredness different implications testing procedures have argued a substantial role in identifying driver weariness physiologically for nearly two decades. SEMG has been utilized as a foundation by a number of different scientists [23] [4] [24] to investigate fatigue in a variety of vehicles, including cars, 2 different, and large vehicles. The change in electromyography technique was linked to muscles metabolic reactions, which can result in serious weariness in drivers.

3. OVERVIEW OF THESYSTEM

3.1 Existing System

A low-intrusive drowsiness detection system using field-programmable gate array (FPGA) has been designed by Vita bile. This system focuses on bright pupils of eyes which are detected by IR sensor light source embedded in a vehicle. Due to this visual effect, the retinas identified up to 90%, which helps to find drivers' eyes for analyzing drowsiness through a number of frames for avoiding serious mishaps.

authors implemented a real-time system to track human eyes using cyclone II FPGA.

3.1.1 Disadvantages of Existing System

To develop this system a hardware kit is required which required more space in cars.
Processing time is high compare to only software applications.

3.2 Proposed System

The framework developed here is intended to reduce the number of accidents caused by tired drivers. Driver weariness is now a common cause of traffic accidents all around the world. As a result, these tasks should be necessary to manage the autonomous installation of an intelligent alert or alertness in an automobile, which is one of the platform's goals. Face expression and eye blinking are assessed to determine the vehicle's state in order to analyses different behavior or graphical representations attitudes. The purpose of the eye blink is to identify the driver's tiredness. Without even any effects of fatigue, an EAR's criterion value is greater than 0.25. Whenever a driver stops working autonomously, the EAR limit value drops below the specified value range. The frequency of video sequence of the vehicle's glazed eyes is represented by a predefined threshold of sleepy blinking sample. If the number of total measuring frames exceeds the limit of the predefined threshold, the operator is considered drowsy.

Advantages of Proposed System

- ✓ This method will detect problem before any chances of accident accord and inform driver and other passengers by raising alarm.
- ✓ In this OpenCV based machine learning techniques are used for automatic detection of drowsiness.
- ✓ Time taken for processing and detection is less compare to hardware methods.

3.3 Proposed System Design

In this project work, I used five modules and each module has own functions, such as:

1. Design Overview
2. Face Detection
3. Histogram oriented gradient
4. Eyes Detection

3.3.1 Design Overview

The main proposed design for Driver Fatigue Monitoring is to record an image from one webcam and precisely evaluate the status of driver through processing data. In order to make this possible, the necessary software must be gathered. Python machine learning are implemented in this research, as well as a camera. The computer vision and face land mark detection models along with OPENCV modules, are used to detect faces and eyes.

3.3.2 Face Detection

For detecting faces of user from live camera face land mark detection model are used Driver Fatigue Monitoring necessitates both software and hardware, including IOT that user can access from other location and communicate information to software, as well as a camera that detects the face and eyes and processes the frequency of eye movements. Various methodologies are used in this research, which are detailed in this document.

3.3.3 Histogram Oriented Gradient

The HOG method can be used to pre - process the images, which includes image resizing and color standardization. In this research, the HOG model is used to calculate efficiency characteristics from the photograph of the operator and retrieve Input images from the illustration structures, giving the specific region of eyes.

3.3.4 Eye Detection

Following the capture and preparation of the vehicle's image, the following step is to compute the driver's tiredness using the flashing eye movement rate. For each picture, scores are computed, and alterations in the blinked rate are compared to the predefined threshold. Shape land mark model is used, which is effective for facial recognition and can provide eyeball detection results, is used to successfully identify eye movement rate.

5. Algorithm /Architecture

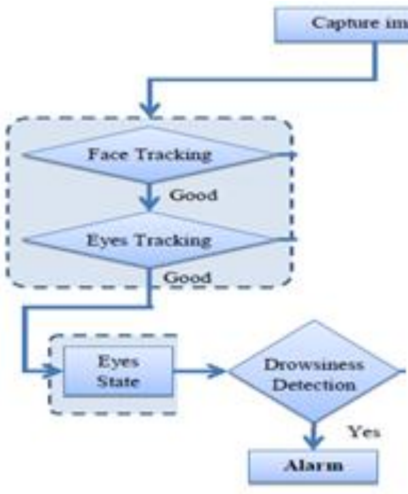

Fig 1: Frame work of Driver Drowsiness Detection

A.HOG Algorithm for Detecting face and compute convex hull

Algorithm: Drowsiness Detection

Input: Hand wheel Pressure and Face detection from camera

Output: Detect Driver Drowsiness

Begin

1. Initialize dlib's face detector (HOG-based) and then create the Facial landmark predictor
2. Grab the indexes of the facial landmarks for the left and right eye, respectively
3. Start the video stream thread
4. Loop over frames from the video stream
5. Detect faces in the gray scale frame
6. Convert the facial landmark (x, y)-coordinates
7. Extract the left and right eye coordinates
8. Compute the convex hull for the left and right eye
9. Check to see if the eye aspect ratio is below the blink
10. Threshold, and if so, increment the blink frame counter
11. If the eyes were closed for a sufficient number send data to Arduino
12. Take pressure readings from hand wheel and send to Arduino
13. Check if both values are above threshold then start alarm.

End

6. EVALUATION RESULTS

A. *Dataset:*

The data set was compiled from a streaming video footage of people operating cars. User characteristics are gathered via a web cam, as well as live monitoring of visual attention, which are used as inputting data for making decisions. The shape predictive land landmark will be used to double-check user information.

B. *Evaluation metric:*

Whenever the person is not driving, yet his or her eyelids are shut and reopened then values are calculated, but when the user is going to drive when out and about, the software's efficiency is checked using both eyeball fluttering values. Only the warning is put to on condition if indeed the eye blink readings are both over the predefined threshold; otherwise, the set an alarm to off mode. The false frequency and high detection are recognized, and their numbers are computed. High rates occur when the alarm is not turned on. Clear and straightforward occur when the alarm is turned on eye blink level are met.

C. *Table and Analysis:*

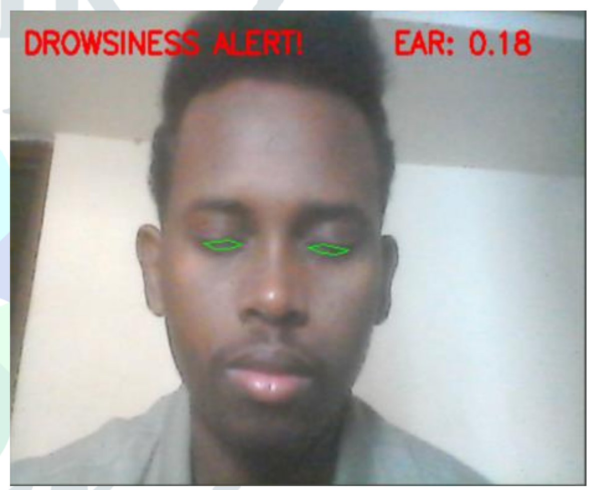

Fig: 2 Drowsiness Detected with Alert message

Various samples with various accuracies were taken and a table plotted for them.

Input	Eye blink accuracy for only eyes	Eye blink accuracy for face and eyes	Drowsiness accuracy for only eyes	Drowsiness accuracy for face and eyes
Sample 1	100%	100%	100%	100%
Sample 2	100%	95%	100%	100%
Sample 3	95%	95%	100%	100%
Sample 4	95%	100%	100%	100%
Sample 5	65%	45%	50%	33%
Sample 6	100%	100%	100%	100%
Sample 7	90%	95%	100%	100%
Sample 8	100%	100%	100%	100%
Total	93.125%	91.25%	93.75%	91.6%

7. CONCLUSION

✓ This study presents a reliable approach to detect operator tiredness and an accident damage (consequence) mechanism in the current era. In most cases, this strategy integrates two separate components into a single integrated solution. However, existing technologies are based on psychology or transportation approaches to recognize driver fatigue, and the seriousness of the accident is also determined independently, and such a methodology is highly intrusive and completely turns on the external surroundings. As a result, the suggested method is used to develop a nonintrusive technique for assessing the driver's sleepiness in relation to the intensity of a collision caused by braking or a mistake.

Future Enhancement

✓ Whenever an actual driver drowsiness warning system detects that a driver's exhaustion level has above a specified threshold, the car must immediately slow down. It is recommended that a scale formation driver drowsiness monitoring system be used on a threshold sleepiness level. It constantly monitors the driver's state of fatigue, and when that level surpasses a particular threshold, a signal is provided that regulates the car's mechanical brake pads.

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