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An Identification Framework to Determine Drowsy Drivers and Help in the Prevention of Road Accidents

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Abstract*: There is less concentration to a possibly risky driving conduct - driving with fatigue. There has been a progression of innovation overtime to help drivers. In this paper, we propose a framework to check consciousness of a driver whether the person is an abled condition to drive. In this model, the individual's face is recorded by a camera with face detection, and segmentation to segment eye and mouth features accurately. We utilize the discovery of face eyes and mouth and apply behavioral measures, for example, eye conclusion and yawning to recognize the tiredness of the driver. The spotlight set on planning a framework that will precisely screen the eye developments. This check can identify sufficiently early to evade road accidents.

Keywords: Drowsiness, Eye blink, Fatigue detection, Image Retrieval.

I. INTRODUCTION

Reliably various individuals lose their lives in perspective of auto crashes the world over. Incredibly, Iran positions first on the planet to the degree street fatalities and reliably roughly thirty thousand of individual family lose their lives in these occasions. The bit of the human factor in mischances can't be discounted; According to national encounters, in 90 to 95 percent of auto collisions in Iran, human factor expect an essential part .At the moment that all is said in done, the driver deficiency addresses 25 percent of calamities and around 60 percent of street mishaps result in death or bona fide hurt. We all in all can be the setback of apathy while driving, basically after the too brief night rest, balanced physical condition or in the midst of long voyages. The impression of rest diminishes the driver's level of deliberateness conveying unsafe conditions and extends the probability of an occasion of disasters. In an examination by the National Transportation Research Institute (NTRI) in which 107 subjective car accidents had been picked, exhaustion spoke to 58% all things considered. An essential driver of shortcoming is eagerness or lack of sleep. Unrehearsed frameworks were the vital structures to develop the customized course in automobiles. A recognizable weakness of these systems is that their responses to natural changes aren't consistent.

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It is especially essential in driving where time is a fundamental factor in driver's decision.

On the other hand, another technique to check the driver shortcoming is watching the physical condition and outward appearances of the drivers, which remote sensor frameworks can't process and transmit this information with adequate precision. The speed with which features may be evaluated does not acceptably compensate for their number, in any case. Subsequently, the dissent area structure uses a variety of the learning figuring AdaBoost to both select the best features and to get ready classifiers that usage them. The system figures out how to use information got for the parallel variation of the image to find the edges of the face, which restricts the domain of where the eyes may exist. When the face an area is found, the eyes are found by enrolling the even midpoints in the locale. Considering the discovering that eye zones in the face show unfathomable power changes, the eyes are arranged by finding the basic power changes in the face. When the eyes are found, evaluating the partitions between the power changes in the eye an area choose if the eyes are open or close.

In spite of the way that the driver's security is improving in road and vehicle plan, the total number of honest to goodness mishaps is until now growing. Most of these mischances results from shortcomings of the driver's thought. Tiredness recognizable proof ought to be conceivable in various courses in light of the results.

II. PROPOSED SYSTEM

The proposed framework is an enhancement from the current framework's that are as of now present in certifiable applications (as made reference to in figure 2.1). The framework contains 3 unique modules through which our Driver lazy motor predicts if the client is feeling sluggish or not.

Beforehand the proposed framework could just portion the mouth (yawning) and were costly frameworks because of the utilization of a great deal of sensors. The framework our group has executed will distinguish facial cues, head tilt, and confront division. The identification will occur on the edges that will computed through the camera present in the vehicle. Each casing will be figured for each case and a precise expectation of the condition of the driver will assist the framework with implementing some type of security.

Here the proposed framework incorporates three modules they are as per the following:

- Frame Decomposition

- Frame Analysis
    - Eye Detection
    - Yawning Detection
    - Head tilt Detection
- Decision Making

A. Frame Decomposition

This module deteriorates the camera into edge by-outline reference continuously to compute the distinctions in the principal picture and the last picture to distinguish an adjustment in facial conduct of the driver. Consistently 14.91 edges are send to the analyser to identify any given weakness for that second and afterward the analyser examinations the earlier second to recognize any exhaustion between the two seconds, if the weariness is more prominent than the limit weariness that has been set, (through different measurable assessments which will be refreshed each month) at that point the framework will verify that the driver is in a condition of weakness. On the off chance that the weariness is not as much as edge weakness, at that point the framework will establish that the driver isn't in the condition of exhaustion. These edges must be figured in a totally extraordinary module so the processing power required by the analyser isn't hampered.

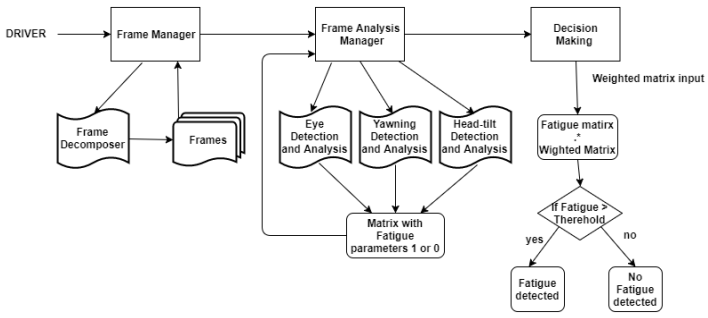

Fig. 1. Flowchart of the proposed System

B. Frame analysis

This module will analyse the data of the frame, it will analyse the pixels to produce a set of useful data which will help in our goal to check the state of the driver. There are three components to this module namely -:

- Eye Detection
- Yawning Detection
- Head-tilt Detection

Eye-Detection

This segment checks for the development of the eye of the driver. This development dissects if the driver is in a condition of exhaustion or not. It will initially distinguish the eyes of the driver; at that point it will regard the skin surface as foundation of the individual and eyes as the closer view. As indicated by numerous parameters like term for which the eyes where shut or the recurrence by which the eyes were shut. Counting such parameters, we endeavor to discover the distinctions for which the framework identifies that district of eye was fundamentally diminished in the resulting outline. It is a useful parameter and the one with a more prominent weightage in basic leadership process on the grounds that a driver if the eyes are shut the driver is certainly feeling sleepy.

Yawning-Detection

This segment identifies for the development of the mouth of the driver. The development examines if the driver is in a condition of exhaustion or not. It will identify the mouth of the driver. It will regard your skin as foundation and your mouth as closer view. As per numerous parameters that would be executed for the exactness of the model like span for which his mouth was open and at what recurrence it was open, considering these models framework will ascertain the contrasts between two casings for which the frontal area is expanded altogether. It is useful parameter and will play one of the real jobs amid basic leadership process.

Head-tilt Detection

The part recognizes the development for the development of the leader of the driver. The development investigates if the driver is in a condition of weariness or not. It will distinguish the essence of the driver. It will regard your face as closer view and your seat as foundation. As indicated by may parameters that would help make this model precise like span for which the head is brought down or the recurrence at which it is done, considering these variables framework will figure the distinction between two casings and will send an alarm to basic leadership if the foundation is altogether expanded.

C. Decision Making

This module will enable us to compute if the ebb and flow condition of the driver is tired or typical. Through the arrangement of important information got through the past procedure it will assess the driver's ebb and flow state.

The information is given to basic leadership demonstrate for which weights have been given to every single part and every last parameter. The information we get is as 1 for weakness recognized and 0 for no exhaustion identified. A network is kept up for the quantity of parameters relating to their specific segments, with the assistance of this framework we apply weights on another lattice and afterward duplicate these two grids regularly as in A.*B where An and B are grids. We accomplish a last network, the combined total of the components if more prominent than the limit of weakness then the exhaustion will be recognized and on the off chance that it is less at that point no weariness will be distinguished.

D. Proposed Algorithm

1. Module 1
    a. Frames are calculated at 14.91 frames/second and a dimension of 646x366.
    b. For every second
        i. Convert image to gray scale.
        ii. Send set of images x to Module 2.
    c. End for loop
2. Module 2
    a. All the components are evaluated in this stage.
    b. For every x frame received.
        i. Find Eye(x) detection, Yawning(x) detection, Head-tilt(x) detection.
        ii. If frame not x(0): then Eye(x)-Eye(x-1) and Yawning(x)-Yawning(x-1) and Head-tilt(x)-Head-tilt(x-1).
        iii. Else: do nothing
        iv. Apply the parameters to all the components and if any fatigue is still detected mark 1 corresponding to component-parameter relationship. A matrix will be formed which we can call matrix V.
    c. End Loop

3. Module 3
    a. Weight matrix → W (We will input this matrix)
    b. Apply W.*V operation on the matrices and store the data in matrix F.
    c. C_SUM (Cumulative sum) (F) → e
    d. If e > fatigue_threshold: Driver Drowsy
    e. Else: no fatigue detected

III. IMPLEMENTATION AND ANALYSIS

The above project requires both hardware and software components. The first hardware component that is required is the Bluetooth chip which is found embedded in all modern smartphones and is easily compatible with the car in transferring of data and the detection of drowsiness of the driver. The other hardware components that is required for the implementation is the GPS Module and Micro OS so that in case of an emergency, an immediate location can be sent to the nearest hospital and fire station. The software that is essential for the implementation of the project is the Dashboard with the GUI (as shown in figure 2) which showcases the camera which observes the driver and determines the how sleepy the driver is. Another embedded software component which is needed is the customized MATLAB with a very few libraries so that the proper detection of the edges of the eyes and other facial cues can be determined.

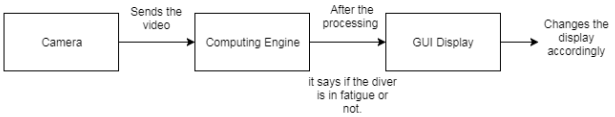

Fig. 2. Implementation Flowchart

A. Backend-Working

Snapshot of implementation for our modules have been provided to show the working of the computing environment, it depicts how the given engine analyses a given frame to provide us with results (as shown in figure 6)

Face Detection

Used for Head-tilt detection component, treating face as foreground and area except the face as background.

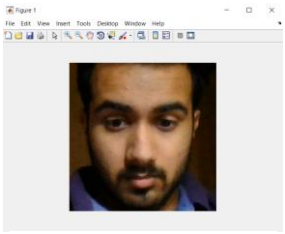

Fig. 3. Face Detection

If for the subsequent frames the background increases it will specify it as fatigue in head-lowering conditions.

Eye-Detection

Used for Eye-Detection component, treating eyes as the foreground and skin as background as shown in figure 4 and 5. It will calculate frame-by-frame detection for any changes in the foreground or the background of the image.

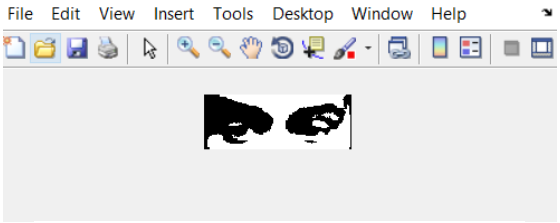

Fig. 4. Eye Detection – Frame by Frame

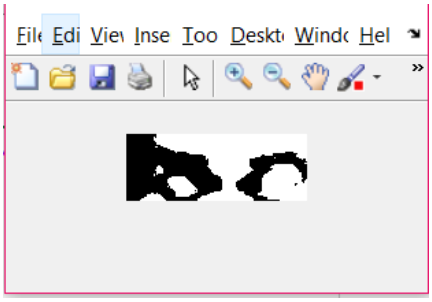

Fig. 5. Eye Closed - Detection

Decision Making

The final result is obatained by multiplying fatigue matrix with weighted matrix to obtain cummulative sum of fatigue which determines the result. Then the message " Fatigue Detected" is displayed in the Matlab Screen hence indicating that the driver is drowsy and he should immeadiately stop to prevent an accident. The mesaage also further gets integrated with the dashboard UI and helps display the message on the screen of the car.

```
t =

    45


ans =

FATIGUE DETECTED


ans =
```

c	15
counter	30
counter1	3125
counter2	1119
Eyes	48x129 uint8
eyespercenta...	58.6563
eyespercenta...	50.4683
face	184x184x3 uint8
FDetect	1x1 CascadeObje...
final	2
height	38
i	39

Fig. 6. Command Window

B. Frontend-Working

Initial Dashboard

The following image contains the dashboard of the vehicle. It consists of all the information which is typically present in most vehicles. It consists of the speedometer, the odometer, the amount of fuel reserves for the car and some additional features such as the weather, forecast and a basic built in GPS System to indicate direction and replicate maps. This screen will serve as the UI for driver and will help in aid of an emergency. (Figure 7)

Fig. 7. User Interface for Dashboard System

Dashboard after the detection of fatigue

After the detection of the driver being incapacitated or deemed incapable of driving a vehicle by the Viola Jones Algorithm, the dashboard will portray an alert message and the screen will turn red, indicating danger (as exhibited in figure 8) The dashboard will also simultaneously decrease the speed of the vehicle to reduce any kind of danger and will make sure that all the safety features of the vehicles are deployed.

Fig. 8. User Interface – Alert state

Emergency Protocols which appear after the detection of a drowsy driver

Emergency Calling - As soon as the speed of a car falls below a threshold value and the driver appears to be incapable of driving a car, a phone call is immediately made to the hospital and the emergency contact of the person.

Emergency Message - An emergency message is sent to the nearest hospital, so that in case of an injury it is easy to locate the car and the right medication and ambulance can be brought in adequate time

Emergency Location - Location is sent to the police immediately so as to make sure that the car is found as quickly as possible and that the person involved in an accident is able to make it to healthcare as quickly as possible as shown in the below figure 9

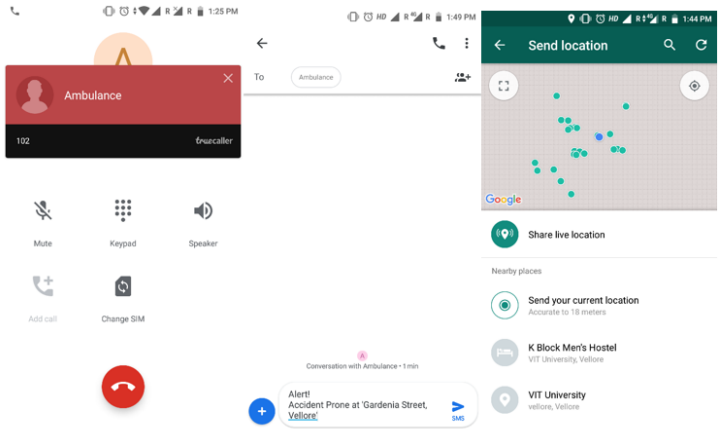

Fig. 9. (a) Emergency Calling (b) Emergency Message (c) Emergency Location

The final result obtained will be if the driver is feeling drowsy or not. The command window will be displaying FATIGUE DETECTED.

Fig. 10 Command Window

IV. CONCLUSION

In this paper, we exhibited the origination and usage of a framework for recognizing driver sluggishness in light of vision that plans to caution the driver in the event that he is in a sleepy state. We proposed the dynamic way to deal with a facial following of genuine outward appearances. The precision enhancements come from dynamic detecting, which enables us to powerfully recognize understudies and the head movement; a blend of the K separating with the make a beeline for precisely anticipate the highlights areas. Not exclusively does this enhance the following pace by expelling the need to re-recognize questions in each casing, however, it enhances the vigor too, as the notable highlights are stronger than the Viola-Jones identification system to the pivot and photometric changes. The calculation doesn't work for the general population laying down with eyes open. The calculation is kept an eye on around fifteen recordings of around 5-10 seconds. The calculation gives the right answer on around 25 recordings that make it around 83.33% exact. This model that has been implemented can be further improved and made more accurate by involving Machine Learning, we can incorporate the details of physical health and can do data analysis on the piece of the data being produced each time fatigue is detected, it can find similar patterns and can suggest ways to improve and lower the level of drowsiness, it can predict through previously available data that at what time the person usually feels lazy and would increase level of cautions in the system. This could improve the accuracy of the model which will be implemented and will help decrease accidents due to fatigue.

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