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Drowsy Driver Warning for Accident-Avoidance System Using Image Processing

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Abstract: ***Driver in-alertness is an important cause for most accident related to the vehicles basis of the system to possibly reduce the accidents related to driver's drowsiness. The purpose of such a system is to perform detection of driver fatigue. By placing the camera inside the car, we can monitor the face of the driver and look for the eye-movements which indicate that the driver is no longer in condition to driver is no longer in condition to drive. In such a case, a warning signal should be issued. This paper describes how to find and track the eyes. We also describe a method that can determine if the eyes are open or closed. The main criterion of this system is that it must be highly non-intrusive and it should start when the ignition is turned on without having at the driver initiate the system. Nor should the driver be responsible for providing any feedback to the system. The system must also operate regardless of the texture and the color of the face. It must also be able to handle diverse condition such as changes in light, shadows, reflections etc. In given paper a drowsy driver warning system using image processing as well as accelerometer is proposed.***

Keywords: Drowsy, system, fatigue, template matching.

I. INTRODUCTION

The innovations in the automobile industry over the last hundred years have made our vehicles more powerful, easier to drive and control safer more energy efficient, and more environmentally friendly. Majority of the accidents caused today by cars are mainly due to the driver fatigue. Driving for a long period of time causes excessive fatigue and tiredness which in turn makes the driver sleepy or loose awareness. With the rapid increase in the number of accidents seems to be increasing day to day. Therefore a need arises to design a system that keeps the driver focused on the road. Data on road accidents in India are collected by Transport Research Wing of Ministry of Road Transport & Highways.

The aim of this project is to develop a prototype of drowsy driver warning system. Our whole focus and concentration will be placed on designing the system that will accurately monitor the open and closed state of the driver's eye in real time. By constantly monitoring the eyes, it can be seen that the symptoms of driver fatigue can be detected early enough to avoid an accident. This detection can be done using a sequence of images of eyes as well as face and head movement. The observation of eye movements and its edges for the detection will be used. Devices to detect when drivers are falling asleep and to provide warnings to alert them of the risk, or even control the vehicle's movement, have been the subject to much research and development. Driver fatigue is a serious problem resulting in many thousands of road accidents each year. It is not currently possible to calculate the exact number of sleep related accidents because of the difficulties in detecting whether fatigue was a factor and in assessing the level of fatigue.

A. Objectives Of The Study

The objectives of this project are

1) Developing algorithm and simulation for face and facial feature detection.
2) Developing algorithm and simulation for yawning and closed eyes status detection.
3) Developing algorithm and simulation for fatigue detection using information and results obtained in objective (ii).

B. Scope of the study

The scopes that need to be proposed in this project are:

1) The image can be processed accurately in day light only.
2) Since fatigue level will be detected from facial expressions, hence user must face towards the camera.
3) The project will detect the fatigue level of user on software bases only.
4) Even if one factor (eye) is covered by spectacles, the system will be able to detect fatigue from the other uncover factor (mouth).
5) Facial features (eyes and mouth) must not be covered simultaneously.
6) The project might give different results if the driver is suffering from illness.

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C. Problem Statement

Currently available driver drowsiness detection systems usually fall into two categories:

1) Very expensive systems, limited to specific high-end car models; and
2) Fordable solutions that lack robustness. Our work is focused on implementing a drowsiness detection system that tries to bridge the gap between them by balancing or ability and availability with functionality. An analysis of current and previous work in the field of drowsiness detection emphasize the difficulty and complexity of the problem due to three essential challenges that need to be tackled, namely: reliability, accuracy and speed. The aim of our approach is to overcome these challenges by building a mobile, real-time, dynamic, adaptive system that leverages, whenever possible, readily available computer vision tools.

II. METHODOLOGY

The function of the system can be broadly divided into eye detection dth, and straight lines running through the right and left outer edges of the face. In a binary image, the eye becomes collection of black pixels, along with the eyebrows, nostrils, mouth and other facial features. These collections of black pixels are recognized on the basis of a labeling operation, and the position of each eye is extracted by judging the area of each label along with its aspect ratio and relative coordinate positions in the facial image. Through this process of detecting each vertical eye position, the central coordinates of each eye are recognized. The coordinates serve as references for defining the areas of eye presence.

A. Eye Tracking

A function for tracking the positions of the eye is an important capability for achieving high-speed processing because it eliminates the need to process every frame in order to detect each eye position from the entire facial image. This function consists of a subordinate for updating the areas of eye presence and recognizing when tracking becomes impossible. The basic concept of eye tracking is to update the area of eye presence, in which an eye search is made in the following frame, according to the central coordinates of the eye in the previous frame. The updating process involves defining an arc of eye presence on the basis of the coordinates (xk, yk) at the point of intersection of center lines running through the Feret's diameter of the detected eye. The area thus becomes the area of eye presence in which the system searches for the eye in the image data of the next frame. This process of using information on eye position to define the eye position for obtaining the next facial image data makes it possible to track the position of the eye. As it is clear from this description, the size of the area of eye position changes. If the eyes are tracked correctly, their degree of openness will always vary within certain specified range for each individual driver.

Consequently, if the value found by the system falls outside the range, it judges that the eyes are not being tracked correctly. The process of detecting the position of each eye from the entire facial image is then executed once more.

B. Judgment Whether the eye are open/Closed

We constructed a template consisting of two circles, one inside the other. A good match would result in many dark pixels in the area inside the inner circle, and many bright pixels in the area between the two circles. We track the eye by looking for the darkest pixel in the predicted region And thus the driver can be warned if found in drowsy state.function, comprising the first half of the preprocessing routine, and a drowsiness detection function, comprising the second half.After inputting a facial image, preprocessing is performed to binarize the image and remove noise, which makes it possible for the image to be accepted by the image processor. The maximum width of the face is then detected so that the right and left edges of the face can be identified. After that the vertical position of each eye is detected independently within an area defined by the center line of the face width and lines running through the outermost points of the face. On that basis, the area in whic h each eye is present is determined. Once the areas of eye presence have been defined, they can be updated by tracking the movement of the eyes. The degree of eye openness is output simultaneously with the establishment or updating of the areas of eye presence . That value is used in judging whether the eyes are open or closed and also in judging whether the eyes have been detected correctly or not. If the system judges that the eyes have not been detected correctly, the routine returns to the detection of the entire face.

The following explains the eye detection procedure in the order of the processing operations.

1) *Preprocessing:* The preprocessing operations include the binarization of a facial image to increase the processing speed and conserve memory capacity and noise removal. The image processor developed for this drowsiness warning system performs the expansion and contraction operation on the white pixels and processing for noise removal is performed on the small black pixels of the facial images. After the binarization, the noise removal procedure involves an expansion processing method

combined with the use of a median filter. These preprocessing operations are sufficient to support detection of the vertical positions of the eyes. However, following identification of the eye positions, the size of the eyes must be converted back to the original image format at the time the degree of eye openness is output. To facilitate that, data contraction is performed in the latter stage of preprocessing.

2) *Face width Detection:* The maximum width of the driver's face must be detected in order to determine the lateral positions of the areas in which the eyes are present. Face width is detected by judging the continuity of white pixels and the pattern of change in pixel number. On that basis, the outer edges of the face are recognized and determined.
3) *Detection of Vertical eye Positions:* Each vertical eye position is detected independently within an area demarcated by the center line of the face, which is found from the face width, and straight lines running through the right and left outer edges of the face. In a binary image, the eye becomes collection of black pixels, along with the eyebrows, nostrils, mouth and other facial features. These collections of black pixels are recognized on the basis of a labeling operation, and the position of each eye is extracted by judging the area of each label along with its aspect ratio and relative coordinate positions in the facial image. Through this process of detecting each vertical eye position, the central coordinates of each eye are recognized. The coordinates serve as references for defining the areas of eye presence.
4) *Eye Tracking:* A function for tracking the positions of the eye is an important capability for achieving high-speed processing because it eliminates the need to process every frame in order to detect each eye position from the entire facial image. This function consists of a subordinate for updating the areas of eye presence and recognizing when tracking becomes impossible. The basic concept of eye tracking is to update the area of eye presence, in which an eye search is made in the following frame, according to the central coordinates of the eye in the previous frame. The updating process involves defining an arc of eye presence on the basis of the coordinates (xk, yk) at the point of intersection of center lines running through the Feret's diameter of the detected eye. The area thus becomes the area of eye presence in which the system searches for the eye in the image data of the next frame. This process of using information on eye position to define the eye position for obtaining the next facial image data makes it possible to track the position of the eye. As it is clear from this description, the size of the area of eye position changes. If the eyes are tracked correctly, their degree of openness will always vary within certain specified range for each individual driver. Consequently, if the value found by the system falls outside the range, it judges that the eyes are not being tracked correctly. The process of detecting the position of each eye from the entire facial image is then executed once more.
5) *Judgment whether the eye are open/closed:* We constructed a template consisting of two circles, one inside the other. A good match would result in many dark pixels in the area inside the inner circle, and many bright pixels in the area between the two circles. We track the eye by looking for the darkest pixel in the predicted region And thus the driver can be warned if found in drowsy state.

III. ADVANTAGES

The drowsy driver system detects drowsiness and fatigue prior to the driver falling asleep. The warnings can begin as the driver becomes fatigue and intensify as the system detects increasing drowsiness to avoid endanger himself and/or others.

Other technologies, such as those that detect head motion, do not warn the driver of drowsiness and fatigue until the driver has fallen asleep and possibly lost control of the vehicle. The ideal system should begin to warn the driver's drowsiness early before fatigue significantly impairs driving ability. Other benefits include

An approximate reduction in fuel consumption of 15 percent.

Improved traffic flow.

Increased safety and More comfortable working conditions for drivers.

Driver Drowsiness Detection System (DDDS) has the potential to greatly reduce road accidents in the large commercial vehicle sector where driver fatigue is a significant risk and in turn to provide major benefits to road transportation companies in terms of cost savings and improved safety and reliability.

IV. EXEPECTED OUTCOME AND FUTURE SCOPE

A. *Expected Outcome*

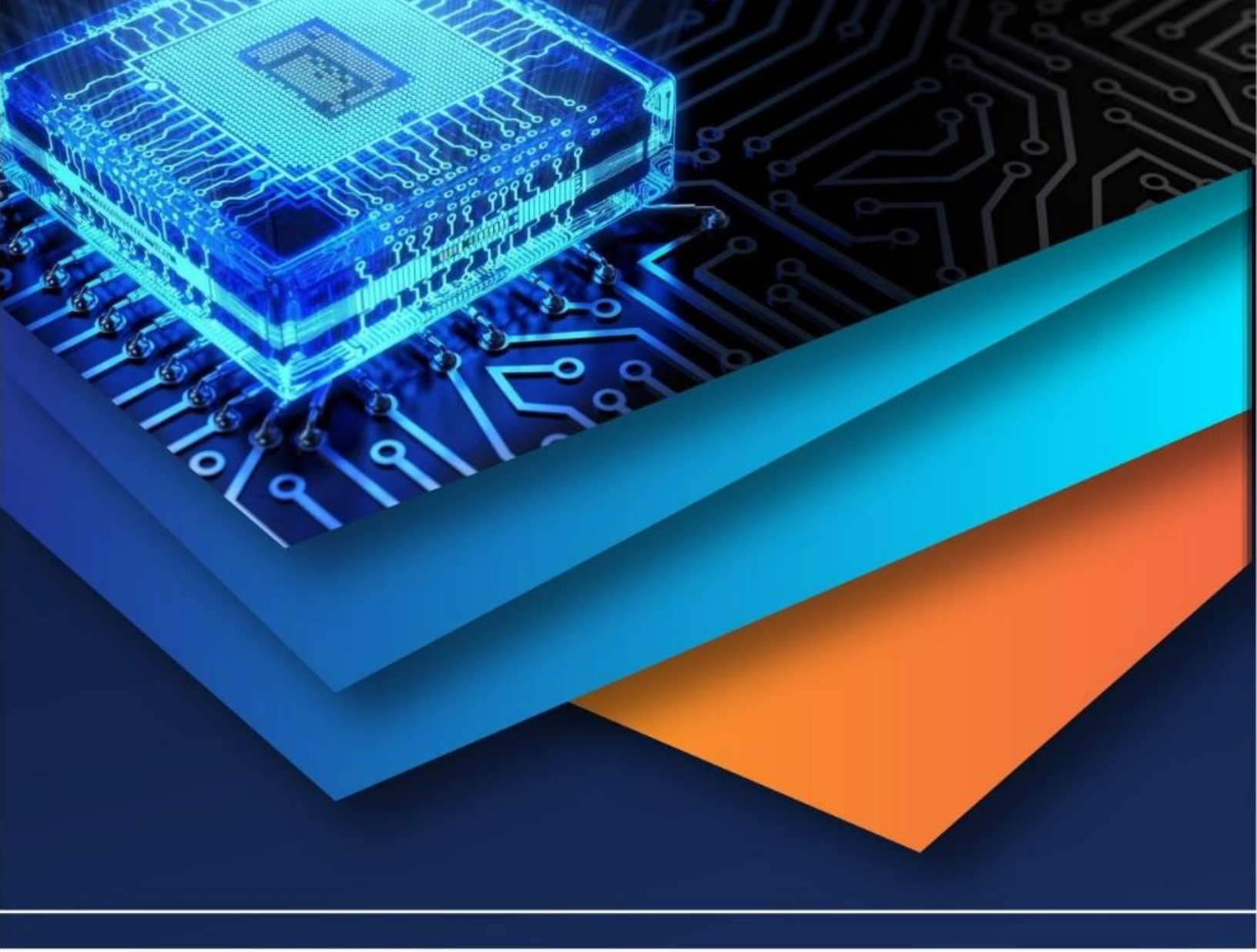
We can be checked the driver is sleep or not. When the person's face is captured by the camera first it will extract the background and foreground classes then for the extracted face part segmentation. By observing the eye and mouth state it will check for driver fatigue. Here we can observe that eye is opened and mouth is closed so there is no sign of fatigue will be detect. Hence Alarm is not generated.

B. Future Works

As we know there is always a scope for further improvement same thing will be applicable over here. There is vast scope for this system of drowsiness detection. As there are several signs by which we can say the person is feeling drowsy. To detect the drowsiness several alternatives are available like eye detection, Iris detection, pupil detection, and Eye detection. Out of these options proposed system uses eyes behavior for drowsiness detection. For making the system more strong and efficient one can check the two different behavior together so chances of false identification may reduce. This system can be introduced in an organization like security system, Toll collection counters, importantly at check post.

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