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AUTOMATED FRAMEWORK FOR VISION BASED DRIVER FATIGUE DETECTION BY USING MULTI-MODEL FUSION SCHEME

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ABSTRACT: *In recent years, traffic accidents caused by fatigue driving have increased significantly. Fatigue during long-time driving threatens the safety of drivers and transportation. This project describes a modern approach which will detect driver fatigue considering the fatigue state. Viola Jones Algorithm is used for facial features detection. Primary attention is given to faster detection and processing of data. Driver's drowsiness will be detected by checking whether the eyes are closed over some particular consecutive frames. If the closing of eyes that the driver is drowsy then a mail will be send to higher officer. Different techniques are used in driver-fatigue monitoring systems. The first category includes intrusive techniques, which are mostly based on monitoring biomedical signals, and therefore require physical contact with the driver. The second category includes non-intrusive techniques based on visual assessment of driver's bio-behavior from face images. The third category includes methods based on driver's performance, which monitor vehicle behaviors such as moving course, steering angle, speed, braking, etc. The one real time application is drowsiness detection based on facial detection and expressions such as drowsy driver detection in order to prevent the accidents on road. Face and eyes behaviors based facial video analysis or drowsiness detection for the drivers is the scope of our aim. The SMS sends to the authorized person through the GSM.*

Keyword: Fatigue Detection, Behavior, Eye Detection, Monitoring.

INTRODUCTION:

One of the major reasons for road accidents now a days is due to driver fatigue. Be it long distant travelling or drunk driving drowsy state leads to risky cracks which are dangerous to lives as well. To overcome such accidents some method has to be developed that is practicable to all vehicle drivers . Sleepiness during driving is a major cause for road accidents. Most people thought that drunken driving is the serious cause of accidents and unaware of drowsy driving which is just fatal. It also deteriorates vigilance, concentration and alertness so that the ability to perform different consciousness-based activities (such as driving) is impaired, decreases awareness, reduces judgment and increases the risk of crashing. Road accidents caused due to driver exhaustion is more serious and leads to death other than drunken driving and rush driving accidents due to drowsiness is more crucial because the driver is loss the awareness which leads to serious injuries or death. Not only are the people traveling in vehicles the victims. The pedestrians will also get affected. Drowsiness and non-alertness of the drivers are the major causes of traffic accidents, especially for drivers of large vehicles (such as cars, buses and heavy trucks) due to long driving periods and lack of sleeping, so for these reasons there is a need to develop a system to do a function in term of decreasing the accidents. A vision-based drowsiness and non-alertness detection system for the drivers monitoring, which is easy and flexible for positioning in all kinds of vehicles. The system consists of modules of face detection, eyes detection, eye openness/close estimation, and drowsiness/alertness measure percentage of eye close and facial appearance. The main function of the drowsiness detection systems is to track and detect the feature points and the facial behaviors of the people then find the drowsiness from those behaviours so that the systems can be applied in many fields.

LITERATURE REVIEW:

The paper[1] presents a driver-monitoring systems that contains both drowsiness detection method and distraction detection method. It consists of face-detection, head orientation– estimation, eye-detection, eye-state–detection, drowsiness-detection, and distraction-detection steps. The distraction and drowsiness are determined from the head pose of a driver. The driver-drowsiness level is measured as PERCLOS, which is the percentage of eye closure time during a certain time interval. Similarly, the distraction level is measured as PERLOOK, which is the percentage of time spent not looking ahead during a certain time interval. Here the computational cost of system can be decreased and also eye-detection errors and the consequent false alarms for drowsiness are decreased.

The paper[2] proposes a method for monitoring driver safety levels using a data fusion approach based on several discrete data types: eye features, bio-signal variation, in-vehicle temperature, and vehicle speed. A fake incoming call warning service alerts the driver if his or her safety level is suspiciously compromised. Realistic testing of the system demonstrates the everyday benefits of multiple features and their fusion in providing a more authentic and effective driver safety monitoring. Even though existing drowsiness monitoring systems perform well, they have limitations in terms of their approach. For instance, methodology that uses facial features requires a long moving-averaged window to track slow changes in a driver's vigilance. In the case of bio-signal processing, existing techniques require that sensors

be attached to the human body to obtain vital signs. This could distract the driver and cause discomfort.

Factors contributing to drowsiness related accidents

Researchers have identified many factors that can be attributed to the causes of drowsiness-related accidents. Factors that influence driver fatigue/drowsiness include greater daytime sleepiness, less sleep, more difficult schedules, more hours of work, a driver's age, driver experience, cumulative sleep debt, the presence of a sleep disorder and the time of day of the accident.

FACE AND EYES DETECTOR:

The Viola–Jones object detection framework is the first object detection framework to provide competitive object detection rates in real-time .Although it can be trained to detect a variety of object classes, it was motivated primarily by the difficult of face detection. Cascade Object Detector API of viola-jones algorithm from MATLAB is used to detect the face from the image. Once face is detected, within the face to detect the eyes we use another Cascade Object Detector for eyes. Then these extracted eyes are sent to SVM.

EYE STATE DETECTION

Detection of the eye state (closed/open) is very important in order to be able to detect the changes of the driver eye, which is a key drowsiness indicator. Different approaches have been proposed to address the problem of blink detection. The average duration of an eye blink is 0.5 to 0.6 seconds with a frequency varying from once every 3 seconds up to several a tenth of a second . The blink rate can be affected by several external stimuli like fatigue.

Different algorithm have been used to detect the blinks in an eye with template matching being one of them, according to on online database is developed that contains some images of the eyes indifferent states. The real-time images obtained from the cameras are developed into a template that is correlated with the images in the database. A correlation threshold that indicates an open eye is established. Blinks are detected using a time that is triggered each time the correlation scores falls below the set threshold. A correlation score that lies between -1 and 1 indicate the parallel levels with scores close to 0 indicating low similarity and score close to 1 indicate a close match to the open eye template.

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EXPERIMENTAL SETUP

The experiments were conducted using car driving game simulator, all the data was recorded and logged and then these data were used as inputs to Matlab programs which attempted to discriminate between normal and abnormal driving. After trying several algorithms we eventually used a Support Vector Machine (SVM). The basic block diagram for the Support Vector Machine classification system. It shows the experimental method used to examine the driver drowsiness detection. There are two main components that were used during the classification process.

• Distance to lane boundary (m) - using Matlab vision technique

The support vector system will analyze the data and then process it using the algorithm that has been set. The system will alert the driver if the system detects that the driver in the drowsiness state.

Viola Jones Algorithm are used in videos of moving objects, one need not apply object detection to each frame. Instead, one can use tracking algorithms like the KLT algorithm to detect salient features within the detection bounding boxes and track their movement between frames. Not only does this improve tracking speed by eliminating the need to re-detect objects in each frame, but it improves the robustness as well, as the salient features are more resilient than the Viola-Jones detection framework to rotation and photometric changes.

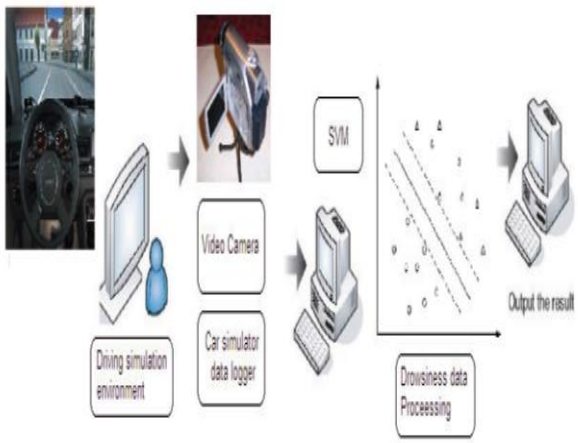

Fig:1 Research Test-Bed System Components

PERCLOS a parameter used to widely used to display the drowsiness of a driver, it is defined as the proposition of frames in which the driver's eyes are closed over a certain period

$$\text{PERCLOS}[k] = \left(\frac{\sum_{k-n+1}^{n}}{n}\right) * 100$$

where PERCLOS [K] is the PERCLOS value in the kth frame and n is a window size and the total number of frames within the period measuring PERCLOS. Blink[i] is a single binary value that represents the status of the eye at ith frame. Blink[i] is "0" when the eye is open and "1" when the eye is closed (Jaeik Jo, 2014).

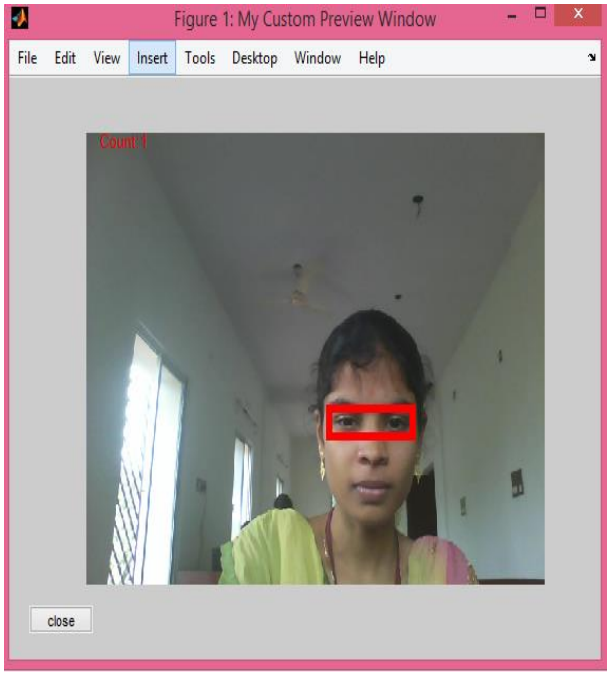

Fig:2 Normal state of the driver

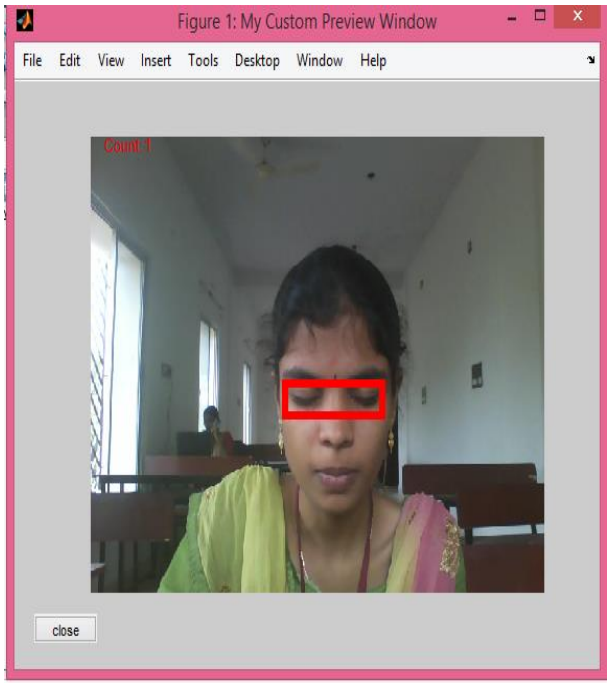

Fig:3 Fatigue is detected in below image

The average eye closure and opening speed (AECS) is another a drowsiness indicator based on the eyelid analysis, when a person is drowsy, the eyes closes/opens slowly due to either tiredness of muscles or slower cognitive processing .Eye closure duration (ECD) is defined as the mean duration of clusters over a definite period, where a cluster is set of continuous frames in which the eyes are closed

$$\mathrm{ECD[k]} = \sum_{i=1}^{p} duration\,[C[k-n]+1)/p$$

Where duration[i] is the number of continuous closed eye frames in ith cluster, n is the total number of frames within the period measuring ECD, p is the total number of clusters in the most recent n frames, and C[k[is the total number of clusters in 0 to k frames.

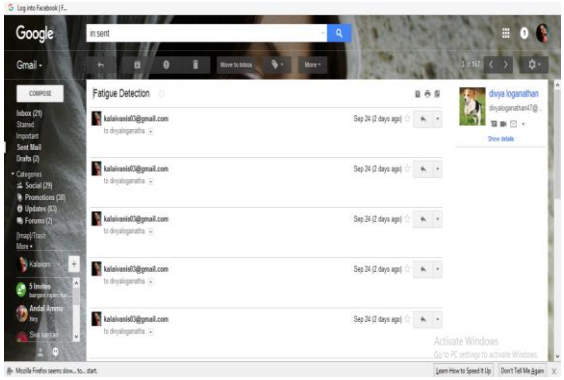

Fig:4 Mail sent to the higher Authority

CONCLUSION

The proposed method easily detects the blinks and the drowsiness as success rate is high because independent haar classifier are used for left eye and right eye. The Driver without the eye glasses eyes blinks were detected more accurate than the driver with eye glasses. Viola Jones face detector has proven to be fastest and most accurate among the face detectors. This system also tried to overcome the shortcomings of earlier developed fatigue detection system. In this technique the fatigue will be detected immediately and also shows current status of driver. It provides new enhancement in technology. The system can be very useful an efficient to avoid accident and can save people life. It can make the world a much better and safe place to live. The remote monitoring system based on SMS and GSM was implemented. Based on the total design of the system, the hardware and software designed. In this paper, the GSM network is a medium for transmitting the remote signal. This includes two parts that are the monitoring center and the remote monitoring station. The monitoring centers consist of a computer and communication module of GSM. The most restrict can be faced this framework is the quality of the video due to different light conditions and motions blur while driving. In future work, the system will be extended to do the function as independent system with more accuracy and without the need for computer intervention during implementation.

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