Driver Drowsiness Detection System

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Abstract— Driver fatigue resulting from sleep deprivation or sleep disorders is an important factor in the increasing number of the accidents on today's roads. Driving a vehicle involves coordination of the locomotor system along with the healthy function of the brain. When the driver feels drowsy, it may unsettle the balance and may lead to erratic driving causing potential accidents. The main aim of the driver drowsiness detection system is to design a monitoring system that processes the image to indicate the current driving aptitude of the driver and raise a warning alarm if the driver is fatigued.

Key words: Drowsiness Detection, Feature Extraction, LBP, Yawn Detection, Fatigued

I. INTRODUCTION

Each year hundreds of people lose their lives due to traffic accidents around the world. The role of human factor in accidents cannot be ruled out. According to national statistics in 90 to 95 percent of car accidents, human factor plays a pivotal role. In general, the driver fatigue accounts for 25 percent of accidents and approximately 60 percent of road accidents result in death or serious injury.

Young male drivers, truck drivers, company car drivers and shift workers are the most at risk of falling asleep while driving. However any driver travelling long distances or when they are tired, is at the risk of a sleep related accidents. The early hours of the morning and the middle of the afternoon are the peak times for fatigue accidents and long journeys on monotonous roads, particularly motor-ways, are the most likely to result in a driver falling asleep.

Studies indicate that 8 to 9 hours of extended nocturnal sleep are needed to resolve sleepiness caused by decreased sleep time. Motor vehicle accidents related to fatigue, drowsy driving, and falling asleep at the wheel are particularly common but often underestimated.

In recent years, the use of intelligent systems in cars has developed considerably. These systems use wireless sensor networks to monitor and transmit the condition of the car and the driver. Smart cars which use software techniques to control engine speed, steering, transmission, brake etc. has improved the quality of driving drastically.

On the other hand, another method to check the driver fatigue is monitoring the physical condition and facial expressions of the drivers, which wireless sensor networks are unable to process. In this paper the algorithms for face detection and eye tracking have been developed with almost no restrictions on the background. We developed a system that localizes and track the eyes and head movements of the driver in order to detect drowsiness.

II. SYSTEM IMPLEMENTATION

Implementation is the stage of the project when the theoretical design is turned into a working system. Thus it can be considered as the critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective.

The implementation stage involves careful planning, investigation of the existing system, designing of methods to achieve change over and evaluation of change over methods. Here the proposed system includes three modules which are as follows:-

- Segmentation of face
- Detection of eyes condition
- Yawning detection

III. ALGORITHM STUDY

A. Object Detection

Haar-like features are digital image features used in object recognition. They owe their name to their intuitive similarity with Haar wavelets and were used in the first real-time face detector. A Haar-like feature considers adjacent rectangular regions at a specific location in a detection window, sums up the pixel intensities in each region and calculates the difference between these sums. This difference is then used to categorize subsections of an image. In the detection phase a window of the target size is moved over the input image, and for each subsection of the image the Haar-like feature is calculated. This difference is then compared to a learned threshold that separates non-objects from objects.

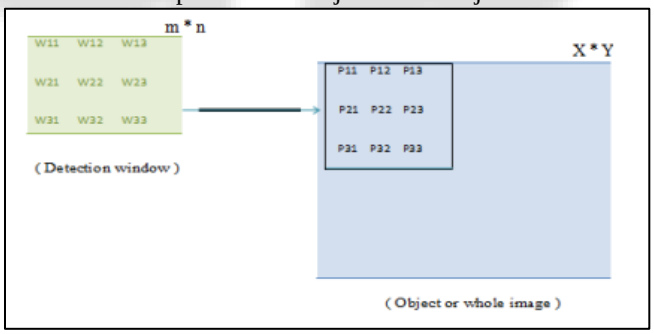

Fig. 1: Hear Features

B. Eye Detection

Important factor which helps detect driver fatigue is the state of eyes, i.e. whether they are open or closed. In the state of fatigue, eyelid muscles subconsciously attempt to accelerate the process of going to sleep. Using this property, determining whether eyes are open or closed is done by relying on the difference of brightness intensity of the pupil in the image and its symmetry. An eye template is used to detect eye region from face image. The template is matched with eye region using cross correlation technique. The method does not require any complex mathematical calculation and prior knowledge about the eye. It is a simple method and can easily be implemented by hardware.

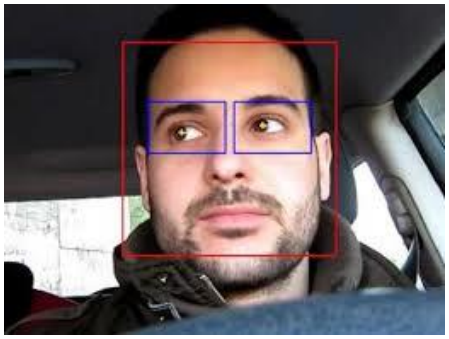

Fig. 2: Eye Detection

C. Yawning Detection

In this paper the other sign of fatigue during driving, which is manifested in a person's face, is frequent yawning that is due to body reflexes when a person is exhausted and about to fall asleep. An efficient technique is needed that is able to display the changes in face configuration and detect the yawning. Among clustering methods used in segmentation of various parts of the image, the mean-based clustering or K-means was utilized. It is a partitioning method that treats observations in data as objects having locations and distances from each other. It partitions the objects into K mutually exclusive clusters, such that objects within each cluster are as close to each other as possible, and as far from objects in other clusters as possible. Each cluster is characterized by its centroid, or centre point.

Fig. 3: Normal Mouth Detection

Fig. 4: Yawning Detection

IV. FINAL OUTCOMES

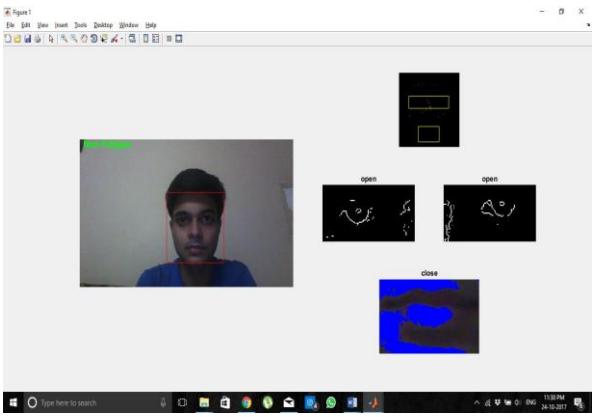

Fig. 5: Snapshot for driver Non-Fatigue

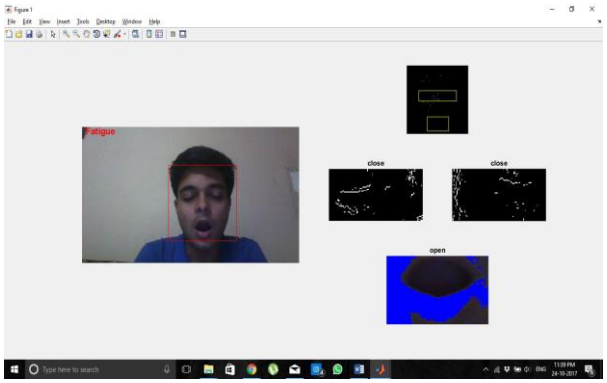

Fig. 6: Snapshot for driver Fatigue

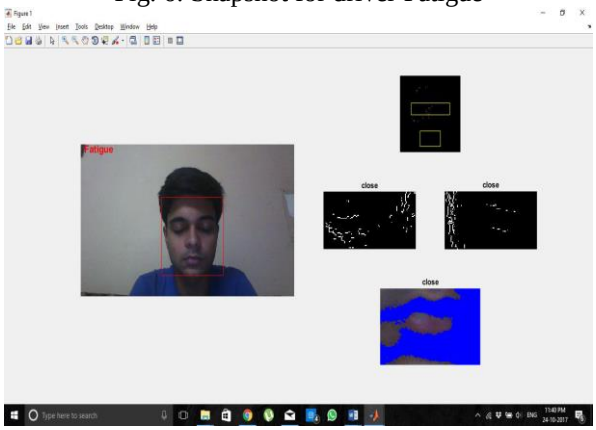

Fig. 7: Snapshot for driver Fatigue

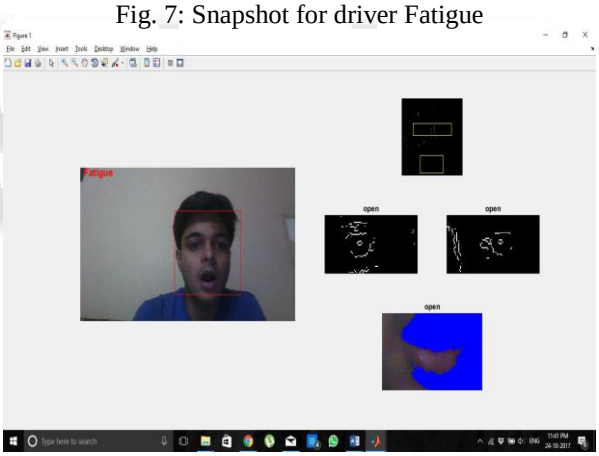

Fig. 8: Snapshot for driver Fatigue

V. COMPARATIVE STUDY

A. Comparison with AdaBoost Algorithm

AdaBoost algorithm is a machine learning algorithm that uses the weighted sum of other learning algorithms also known as "weak classifiers" to represent the final output of the boosted classifier.

On comparison with Viola Jones Algorithm, AdaBoost shows a slower training time as at each iteration step the algorithm tests all features on all examples. Viola Jones on the other hand has an uncompetitive high detection speed while retaining high detection accuracy.

B. Comparison with Neural Network Based Filter

The Neural Network based approach examines small windows of an image and decides if each window contains a

face. The system arbitrates between several networks to improve performance over a single network.

The Neural Network based methodology is quite complex with the accuracy rate not being as high as those achieved by Viola Jones algorithm.

VI. CONCLUSION

After reviewing multiple techniques used for drowsiness detection, we can conclude that these techniques are suitable according to the given driving and vehicle conditions. We developed a system that localizes and tracks the eyes and head movements of the driver along with the mouth region in order to detect drowsiness. If the eyes are closed for too long or the person is yawning, a warning signal will be given in the form of buzzer. The project has been made successful using Image Processing techniques which are much simpler and user friendly and thus present us with an immense amount of research opportunities.

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