Real-Time Eye and Face Tracking for Monitoring Driver Vigilance

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***Abstract*—A real-time driver-fatigue monitoring system. Camera at the driver's location is used to capture his facial movement. Various visual cues that typically characterize the level of alertness of a person are extracted in real time from the video captured and systematically combined to infer the fatigue level of the driver. The visual cues employed characterize eyelid movement, head movement, and yawning. These visual cues are analyzed by software model to predict the driver's level of alertness. It alerts the driver and the administrator simultaneously, if the driver is found fatigued and continues its operation of monitoring. Our software also validates the user with login credentials and also provides the administrator with log files indicating who have used the system. It is comparatively efficient to a hardware equivalent.**

Keywords— Image processing, eye extraction, SMTP protocol, and programming (MATLAB and .NET).

I. INTRODUCTION

Each year hundreds of people lose their lives due to traffic accidents around the world. A main cause of these accidents is sleeplessness or insomnia. Driver's drowsiness is a major contributing factor in severe road accidents. The National Highway Traffic Safety Administration conservatively estimates that 100,000 police-reported crashes are the direct result of driver fatigue each year. This results in an estimated
1,550 deaths, 71,000 injuries, and $12.5 billion in monetary losses.

Today, to counter this problem we have hardware systems that monitor factors like driver's pulse rate, eye movement and heart rate. These systems though provide accuracy but are not user friendly that is, they are irritating to wear while driving.

To counter this problem and produce a system that is both user friendly and has a significant accuracy than the existing hardware solution we are proposing a software solution.

II. LITERATURE SURVEY

In 2002, Qiang Ji and Xiaojie Yang[4] suggests that active hardware system with the conventional passive appearance- based methods that incorporate face pose into gaze estimation to compensate for head movement.

Anneke Heitmann, Rainer Guttkuhn, Acacia Aguirre, Udo Trutschel [6] uses the head position sensor system and Eye- Gaze system which imposes the challenges for online data interpretation.

Khosro Rezaee, S. Reza Alavi[3] proposed that Real-Time Intelligent Alarm System of Driver Fatigue Based on Video Sequences on the basis of K-means Clustering in 2013 where it has some drawbacks with its performance.

In 2014, Guan-chun Luh suggested a method for Face detection using combination of skin color pixel detection.

III. EXISTING SYSTEM

The necessary hardware and imaging algorithms are developed to simultaneously extract multiple visual cues that typically characterize a person's level of fatigue. The most accurate techniques are based on physiological measures like brain waves, heart rate, pulse rate etc. However, these techniques are intrusive since they require electrodes to be attached to the drivers, causing annoyance to them and these are not fault tolerant.

IV. PROPOSED SYSTEM

The proposed algorithm conducts the detection process by recording the video sequence of the drivers and applies image processing techniques. The system consists of four well- defined phases, namely the face detection, eye tracking, yawning detection and alerting the driver. It also provides user authentication by using user credentials and provides a recorded log of the drivers who used the system.

V. METHODOLOGY

Initially the driver or the person who wants to use the system enters the login credentials (user name and password) given to him by the administrator. The software validates these credentials and authenticates the driver. This part is implemented using .NET framework. If the user is valid, then he will be directed to the MATLAB application where the actual process of monitoring starts.

In MATLAB, the video is captured from the attached webcam of suitable quality. Whatever the video that is recorded by the camera will be fragmented into frames and then into an image, this image will be given as input for face segmentation.

Here we have to detect the face region out of the whole image by selecting an appropriate threshold according to image histogram. Face is our region of interest that is the foreground object and rest is the background object. Here we detect the face using skin segmentation by converting RGB to YCbCr color space. Background and faces can be distinguished by applying maximum and minimum threshold values for both Cb and Cr components. Here, we first detect the face region to minimize the process time and error rate while identifying the eyes and mouth. Next, from the extracted face we identify the eyes and mouth's position.

Eyes are detected using edge detection; edge detection is the process of localizing pixel intensity transitions using SOBEL method. The output of the SOBEL method is a template of the driver's eye which is then used in correlation template matching method to determine the eye state.

Now segmentation of mouth is done, as yawning is also a symptom of fatigue. We detect the mouth region using k-means clustering method. Here the k-means identifies the two lips as two clusters and their centroids are found. If the distance between these centroids is more than the threshold it is considered yawning.

After the output of the above two phases (eye and mouth's state) are processed and evaluated against the specified conditions, if the driver is found fatigue he will be alerted by an alarm and simultaneously a mail will be sent to the registered mail id (admin) using the SMTP protocol that contains an image of the driver's state.

VI. TECHNOLOGIES USED

MATLAB can be used for a range of applications, including signal processing and communications, image and video processing, control and computational biology. More than a million engineers and scientists in industry and academia use MATLAB, the language of technical computing where it has functions for integrating algorithms with external applications and languages such as C, Java and .NET.

.NET Framework provides a large class library named Framework Class Library (FCL) and provides language interoperability. FCL provides user interface, data access, database connectivity, web application development, numeric algorithms, and network communications. Programmers produce software by combining their source code with .NET Framework.

VII. APPLICATIONS

Prevents the driver from falling asleep in long and solo trip and hence it decreases the accidents.

It also validates the user at the time of login.

The admin can use the log files to know who has used the system.

This system can also be used in other situation such as

- Monitoring operators at nuclear plants,
- Pilots of airplanes and
- Security guards.

CONCLUSION

This paper proposes a system that can be used to detect and alert the driver to avoid the accidents caused due to drowsiness of the driver. The high rate of accidents caused by driver's fatigue level justifies the use of the system proposed. High speed data processing and lack of hardware (except camera) distinguishes our proposed system from the existing system.

The development and improvement of this system can save the lives of millions of people annually.

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