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A PATH FOR HORIZING YOUR INNOVATIVE WORK

REVIEW ON PREDICTION OF DRIVER FATIGUE

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Abstract: In today's life, probability of accidents is increased due to driver's fatigue condition. In this paper, we present methodology for detecting a fatigue in real time environment as well as try to improve accuracy of existing system. We exploit the physiological properties and appearance of eyes as well as head/eye motion dynamic with the help of various algorithms. Various visual cues that typically characterize the level of alertness of a person are extracted in real time and systematically combined to infer the fatigue level of the driver. The simultaneous use of multiple visual cues and their systematic combination yields a much more robust and accurate fatigue characterization than using a single visual cue. We also proposed a methodology which validated under real-life fatigue conditions with human subjects of different ethnic backgrounds, genders, and ages; with/without glasses; and under different illumination conditions.

Keywords: NHTSA, RBC, IR

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INTRODUCTION

The ever-increasing number of traffic accidents in the United States that are due to a diminished driver's vigilance level has become a problem of serious concern to society. Drivers with a diminished vigilance level suffer from a marked decline in their perception, recognition, and vehicle-control abilities and, therefore, pose a serious danger to their own life and the lives of other people. Statistics show that a leading cause of fatal or injury-causing traffic accidents is due to drivers with a diminished vigilance level. In the trucking industry, 57% of fatal truck accidents are due to driver fatigue. It is the number one cause of heavy truck crashes. Seventy percent of American drivers report driving fatigued. The National Highway Traffic Safety Administration (NHTSA) estimates that there are 100000 crashes that are caused by drowsy drivers and result in more than 1500 fatalities and 71 000 injuries each year in U.S. With the ever-growing traffic conditions, this problem will further increase. For this reason, developing system that actively monitoring a driver's level of vigilance and alerting the driver of any insecure driving conditions is essential for accident prevention, Mathematical models of alertness dynamics joined with ambulatory technologies:

1) These technologies use mathematical models to predict operator alertness and performance at different times based on interactions of sleep, Circadian, and related temporal antecedents of fatigue.
2) Vehicle-based performance technologies: These technologies detect the behavior of the driver by monitoring the transportation hardware systems under the control of the driver, such as driver's steering wheel movements, acceleration, braking, and gear changing .

1. LITERATURE SURVEY

2.1 Techniques for Detecting Drowsy Drivers

Possible techniques for detecting drowsiness of drivers can be generally divided into the following categories like: sensing of physiological characteristics, sensing of driver operation, sensing of vehicle response, monitoring the response of driver.

2.1.1 Monitoring Physiological Characteristics

Among these methods, the techniques that are best, based on accuracy are the ones based on human physiological phenomena [8]. This technique is implemented in two ways: measuring changes in physiological signals, such as brain waves, heart rate, and eye blinking; and measuring physical changes such as sagging posture, leaning of the driver's head and the open/closed states of the eyes [8]. The first technique, while most accurate, is not realistic, since sensing electrodes would have to be attached directly onto the driver's body, and hence be annoying and distracting to the driver. In addition, long time driving would result in perspiration on the sensors, diminishing their ability to monitor accurately. The second technique is well suited for real world driving conditions since it can be non-intrusive by using optical sensors of video cameras to detect changes.

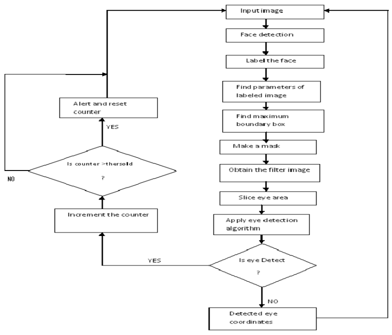
2.2 Face detection:

Traditionally the face detection task can be implemented with two very distinct approaches. These approaches are feature-based and image based. Image based approach makes use of any information that the actual image can provide, such as color ranges, intensities. Feature –based approach uses information obtained from particular set of features corresponding to a given image, such as edges, pixel -pixel relative positioning, points of interest. Most of the existing face detection algorithms work with gray images [2]

Human face perception is currently an active research area in the computer vision community. Locating and tracking human faces is a prerequisite for face recognition and/or facial expressions analysis, although it is often assumed that a normalized face image is available. In order to locate a human face, the system needs to capture an image using a camera and process the image, search the image for important features and then use these features to determine the location of the face. For detecting face there are various algorithms including skin color based algorithms. [2][4]

3. LIMITATIONS OF EXISTING SYSTEM:

With 60% accuracy, it is obvious that there are limitations to the system.



- The most significant limitation is that it will not work with people who have very dark skin. This is apparent, since the core of the algorithm behind the system is based on binarization. For dark skinned people, binarization doesn't work.
- Another limitation is that there cannot be any reflective objects behind the person. The more uniform the background is, the more robust the system becomes. For testing, rapid head movement was not allowed. This may be acceptable, since it can be equivalent to simulating a tired person. For small head movements, the system rarely loses track of the eyes. When the head is turned too much sideways there were some false alarms.
- The system has problems when the person is wearing eyeglasses. Localizing the eyes is not a problem, but determining whether the eyes are opened or closed is a problem.

2. PROPOSED WORK:

The existing system has 60% of accuracy with that we are going to design the Drowsy Person Detection System. Each design decision will be presented and rationalized, and sufficient detail will be given to allow the reader to examine each element in its entirety.

Proposed Flow Diagram:

There are several different algorithms and methods for eye tracking, and monitoring. Most of them in some way relate to features of the eye (typically reflections from the eye) within a video image of the person. The original aim of this paper is to use the retinal reflection (only) as a means to finding the eyes on the face, and then using the absence of this reflection as a way of detecting when the eyes are closed. So various algorithm are discussed below.

4.1 Hough Transform Algorithm:

The Hough transform is a technique of finding any shape in a digital image. It is usually used to find lines and curves or shapes that can be described by a set of parameters. The Hough transform was initially patented as US Patent 3,069,654 in 1962 under the name "Methods and Means for Recognizing Complex Patterns.The simplest form of the transform is the line transform, where lines are the desirable elements sought by the transform. Representing a line in polar form, equation specifies its normal passing through (x, y) drawn from the origin to (ρ, θ) in polar space[6].

$x\cos\theta + y\sin\theta = \rho$

For each point in the (x, y) plane and on the line, the values of ρ and θ are constant. Therefore for a given point in the (x, y) plane we can calculate the lines passing through the point in terms of ρ and θ.

Passing a range of lines at varying angles [0, 2π] and varying θ accordingly it is then possible to calculate the value for ρ. By taking a set of lines through a point and calculating the ρ and θ values for the lines at the point a Hough space can be created.

4.2 Eye Detection and Tracking

Fatigue monitoring starts with extracting visual parameters that typically characterize a person's level of vigilance. This is accomplished via a computer vision system. The system consists of two cameras: one wide-angle camera focusing on the face and another narrow-angle camera focusing on the eyes. The wide-angle camera monitors head movement and facial expression while the narrow-angle camera monitors eyelid and gaze movements. The system starts with eye detection and tracking. The goal of eye detection and tracking is for subsequent eyelid-movement monitoring, gaze determination, facial-orientation estimation, and facial-expression analysis. A robust, accurate, and real-time eye tracker is therefore crucial. In this research, we propose real-time robust methods for eye tracking under variable lighting conditions and facial orientations, based on combining the appearance-based methods and the active infrared (IR) illumination approach. Combining the respective strengths of different complementary techniques and overcoming their shortcomings, the proposed method uses active IR illumination to brighten subject's faces to produce the bright pupil effect. The bright pupil effect and appearance of eyes (statistic distribution based on eye patterns) are utilized simultaneously for eyes' detection and tracking.

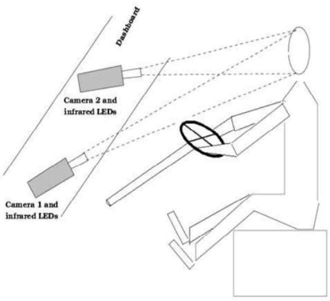


Fig 2 :-Overview of the driver vigilance monitoring system

A. *Image-Acquisition System*

Image understanding of visual behaviors starts with image acquisition. The purpose of image acquisition is to acquire the video images of the driver' s face in real time.

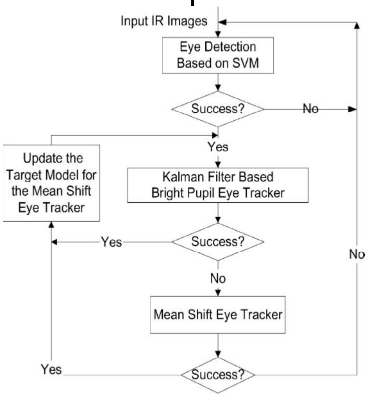


Fig 3:-Flow chart for image acquisition

B. **Eye Detection**

Eye-tracking starts with eyes detection. Eye-detection is accomplished via pupil detection due to the use of active IR illumination.

Specifically, to facilitate pupil detection, we have developed a circuitry to synchronize the inner and outer rings of LEDs with the even and odd fields of the interlaced image, respectively, so that they can be turned on and off alternately. The interlaced input image is deinterlaced via a video decoder, producing the even and odd field images. The detected eyes are then tracked frame to frame.

4.3 Facial-Expression Analysis

Besides eye and head movements, another visual cue that can potentially capture one's level of fatigue is his/her facial expression. In general, people tend to exhibit different facial expressions under different levels of vigilance. The facial expression of a person in fatigue or in the onset of fatigue can usually be characterized by having lagging facial muscles, being expressionless and yawning frequently.

Our recent research has led to the development of a feature-based facial-expression-analysis algorithm. For the fatigue-detection application, in which there are only limited facial expressions, the facial features around the eyes and mouth include enough information to capture these limited expressions. So, in our research, we focus on the facial features around the eyes and mouth. In our method, the multiscale and multiorientation Gabor wavelet is used to represent and detect each facial feature. After detecting each feature in the first frame, a Kalman filter-based method with the eye constraints is proposed to track them.It puts a smooth constraint on the motion of each feature. The eye positions from our eye tracker provide strong and reliable information that gives a rough location of where the face is and how the head moves between two consecutive frames. By combining the head-motion information inferred from the detected eyes with the predicted locations from the Kalman filtering, we can obtain a very accurate and robust prediction of feature locations in the current frame, even under rapid head movement.

3. CONCLUSION

In this paper we proposed a methodology which is going to improve accuracy of existing system. These visual cues characterize eyelid movement, gaze, head movement, and facial expression which help us to find out fatigue condition. So we discussed various algorithms like eye detection, Hough Transform algorithm etc.

With the help of this algorithm and Proposed work we try to improve the accuracy of the existing system and to find out fatigue condition more accurately. We also discussed the limitations like dark skin detection and eyeglass problems and tried to overcome those limitations.

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