Drowsiness Detection System

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Summary

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Significance of the problem

- Fatigue leads to approximately 40% crashes on roads - a toll blamed on poor driving conditions.
- Fatigue is the most common contributor to crashes.

Introduction

What is drowsy driving?

- Falling asleep while driving.
- Not paying attention due to fatigue or lack of sleep.
- Driver drowsiness related accidents have a high fatality rate.
- Driving performance deteriorates with increased drowsiness.

Table 1: Total numbers of traffic crash deaths and serious injuries for Brazil (Source: From National Observatory, which in February 2015 was only able to provide data up to 2012 from DataSUS. The figure for 2013 is from the Ministry of Health[18])

Year	Deaths	Serious Injuries
2013	42,266	
2012	45,751	188,547
2011	44,137	146,322
2010	43,606	149,191
2009	38,116	126,368
2008	38,827	106,408
2007	37,907	108,837
2006	36,808	104,939
2005	36,295	103,022
2004	35,358	95,607
2003	33,315	91,378
2002	32,937	96,165
2001	30,723	97,109
Increase from 2001 to 2012	**49% (37% to 2013)**	**94%**

Objectives

- To take input image through a Web camera.
- To detect face by implementing appropriate algorithms.
- To detect regions of interest.
- To detect eye from region of interest.
- To detect driver drowsiness(if any) by monitoring the eye blink rate.
- To alarm the driver if drowsy.

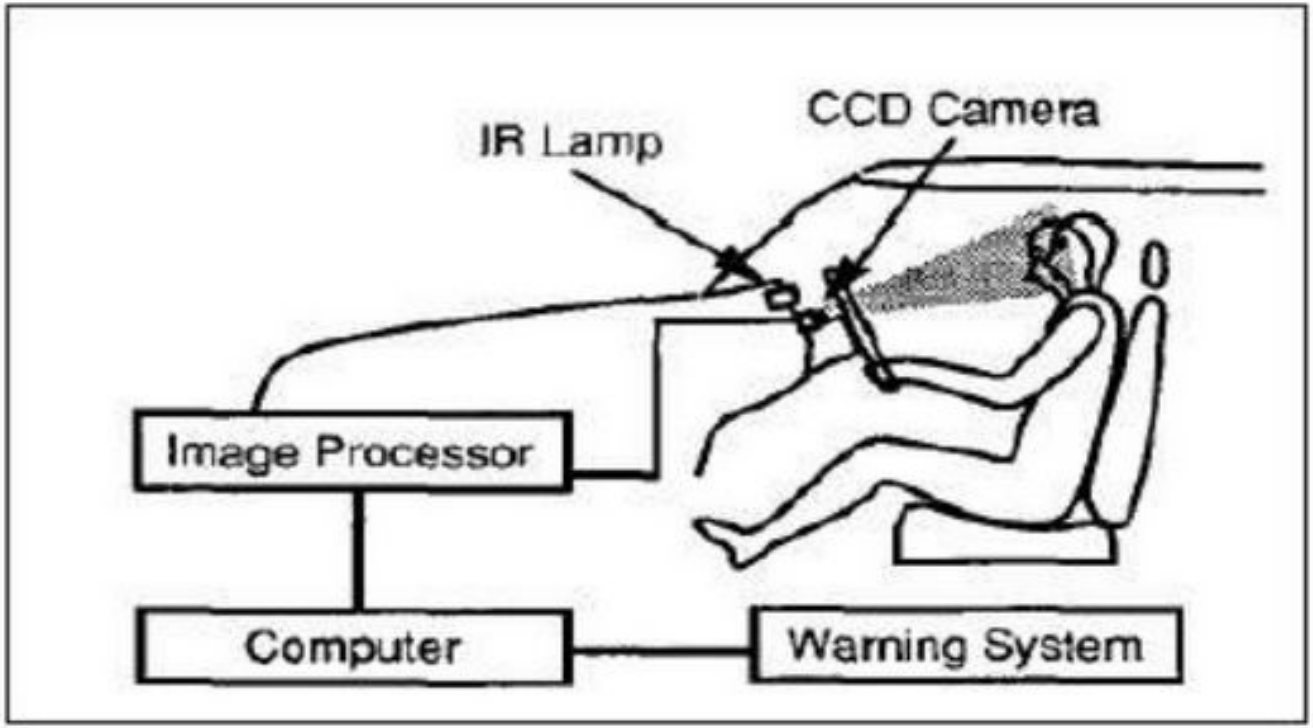
Specifications

- Software specifications
  - Digital image processing using Opencv and Python.
- Hardware specifications
  - Suitable Webcam.

Proposed System

- Record video.
- Convert into frames.
- RGB to Grayscale conversion of images.
- Eye localization.
- Thresholding to find the whites of the eyes.
- Determining if the “white” region of the eyes disappears for a period of time (indicating a blink).
- Alert the driver.

Practical set up



Already existing detection systems

- Volvo’s Driver Alert System(DAS).
- Driver drowsiness detection system by BOSCH mobility solutions.
- Drowsiness Alert by MyCarDoesWhat.org

Video

Related work

- Vehicle-Based Drowsy Driver Detection: Current Status and Future Prospects
  - The envisioned vehicle-based driver drowsiness detection system would continuously and unobtrusively monitor driver performance (and “micro-performance” such as minute steering movements) and driver psychophysiological status (in particular eye closure). The system may be programmed to provide an immediate warning signal when drowsiness is detected with high certainty, or, alternatively, to present a verbal secondary task via recorded voice as a second-stage probe of driver status in situations of possible drowsiness.

Related work

- Drowsiness Detection for Drivers Using Computer Vision.
  - This project proposes a non-intrusive approach for detecting drowsiness in drivers, using Computer Vision. The algorithm is coded on OpenCV platform in Linux environment. The parameters considered to detect drowsiness are face and eye detection, blinking, eye closure and gaze. Input is captured and live fed from a camera that supports night vision as well. The algorithm is Haar trained to detect the face and the eye from the incoming frame. Once the eye is detected, further coding is done to track the eye and automatically set a dynamic threshold value. Depending on the values obtained from each of the incoming frames and deviations from the threshold values, eyelid closure/blink/gaze is detected. Warning system is designed to alert the driver. This system renders an efficient solution to road accidents and the cost of developing it into a real time system is also feasible when compared to the cost involved in the manufacture of car.

Related work

- Driver Drowsiness Detection System by Jayasenan J. S 1 , Mrs. Smitha P. S 2(2014).
  - Drowsy Driver Detection System has been developed, using a non-intrusive machine vision based concepts. This system offers a method for driver eye detection, which could be used for observing a driver's fatigue level while he/she is maneuvering a vehicle. The system uses a small monochrome security camera that points directly towards the driver's face and monitors the driver's eyes in order to detect fatigue. In such a case when fatigue is detected, a warning signal is issued to alert the driver. This paper describes the method that has been proposed for finding the eyes, and also for determining if the eyes are open or closed. The system deals with using information obtained for the contour of the image to find the edges of the face, which narrows the area of where the eyes may exist. Once the face area is found, the eyes are found by computing the contour. Once the eyes are located, converting to binary and by counting the bright pixels in the eye area determine whether the eyes are open or closed. The system is also able to detect when the eyes cannot be found, and works under reasonable lighting conditions.

Related work

- Drowsy Driver Warning System Using Image Processing.
  - 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.

Related work

- Driver’s drowsiness detection using eye status to improve the road safety(2013)
  - In recent years, we have used many technologies to detect the drowsiness of a driver in the field of accident avoidance system [1]-[3]. To develop such a system we need to install some hardware components like camera inside the car, which can capture the image of the driver at a fixed interval, and an alarm system, which will alert the driver after detecting his/her level of drowsiness. Now apart from these hardware components, we need a software part also, which can detect the level of drowsiness of the driver and is the main concern of our paper. It is believed that, driver’s fatigue can be easily detected by monitoring the eye status [5] [7], which is either ‘open’ or ‘closed’. In this paper, we develop a drowsiness detection system that will accurately monitor the open or closed state of the driver’s eyes in real-time.

Related work

- Real-Time Eye Blink Detection using Facial Landmarks(2016)

  - A real-time algorithm to detect eye blinks in a video sequence from a standard camera is proposed. Recent landmark detectors, trained on in-the-wild datasets exhibit excellent robustness against a head orientation with respect to a camera, varying illumination and facial expressions. We show that the landmarks are detected precisely enough to reliably estimate the level of the eye opening. The proposed algorithm therefore estimates the landmark positions, extracts a single scalar quantity – eye aspect ratio (EAR) – characterizing the eye opening in each frame. Finally, an SVM classifier detects eye blinks as a pattern of EAR values in a short temporal window. The simple algorithm outperforms the state-of-the-art results on two standard dataset

Deadlines

- 1st week
  - 02/03--09/03-Previous research and proposal submission
- 2nd week
  - 11/03--18/03-Presentation and the commencement of project implementation.
- 3rd week
  - Project update
- 4th week
  -
- 5th week
  -
- 6th week
  - - Final presentation.

Thanks for listening!

Any questions?

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