Drowsy Detection and Alarming System (DroDeASys)

Hrishikesh B. Juvale, Anant S. Mahajan, Ashwin A Bhagwat, Vishal T Badiger, *Research Scholars*,

Ganesh D. Bhutkar, Priyadarshan S. Dhabe, Manikrao L. Dhore, *Assistant Professors*

Abstract— **The paper discusses the Drowsy Detection & Alarming System that has been developed, using a non-intrusive approach. The system is basically developed to detect drivers dozing at the wheel at night time driving. The system uses a small infra-red night vision 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 discusses the algorithms that have been used to detect drowsiness. The decision whether the driver is dozing or not is taken depending on whether the eyes are open for a specific number of frames. If the eyes are found to be closed for a certain number of consecutive frames then the driver is alerted with an alarm.**

Index Terms— **Alarm, Detection, Driver Drowsiness, Fatigue.**

1 Introduction

Driver fatigue is a significant factor in a large number of vehicle accidents. The development of technologies for detecting or preventing drowsiness at the wheel is a major challenge in the field of accident avoidance systems. By monitoring the eyes, it is believed that the symptoms of driver fatigue can be detected early enough to avoid a car accident. Detection of fatigue involves a sequence of images of a face, and the observation of eye movements and blink patterns.

The eye detection algorithm as well as the drowsy detection procedure has been implemented using a self developed algorithm. The system is developed using image processing fundamentals. The focus of the system is on accurately determining the open or closed state of the eyes. Depending on the state of the eyes it can be said whether the driver is alert or not.

To achieve the result we have used the clustering & slope detection algorithms. The images of the drivers face are acquired from the infra-red night vision camera. The infra red camera illuminates the drivers face at night time. The images obtained are converted to binary images first & then clusters on those images are found out. The slope detection algorithm is used to make the former algorithm more accurate in detecting the state of the eyes. It calculates the slope between each of the clusters & keeps on discarding the clusters as long as we don't get the right clusters as the pupils of the eyes.

This paper discusses these algorithms as well as the flow of the system in greater detail in the following sections.

2 Block Diagram

The block diagram shown in Figure 1 describes the dynamic flow of the system wherein a new image/frame is extracted pre-processed, processed and post processed to determine whether the state of drowsiness is reached. If this state is reached then an alert is given to the driver and the process continues until all frames are processed.

Manuscript received April 26, 2007. This work was supported in part by the U.S. Department of Commerce under Grant BS123456 (sponsor and financial support acknowledgment goes here). Paper titles should be written in uppercase and lowercase letters, not all uppercase. Avoid writing long formulas with subscripts in the title; short formulas that identify the elements are fine (e.g., "Nd–Fe–B"). Do not write "(Invited)" in the title. Full names of authors are preferred in the author field, but are not required. Put a space between authors' initials.

H. B. Juvale was a student of Vishwakarma Institute of Technology, Pune – 411037, India. He is now with Cybage Software Pvt.Ltd. (corresponding author to provide phone: 91-20-25469928; e-mail: hrishikeshjuvale@gmail.com).

A. S. Mahajan, was a student of Vishwakarma Institute of Technology, Pune – 411037, India. He is now with Accenture. (e-mail: anant_mahajan99@yahoo.com).

A. A. Bhagwat was a student of Vishwakarma Institute of Technology, Pune – 411037, India. (e-mail: ashwin.bhagwat@yahoo.com).

V. T. Badiger was a student of Vishwakarma Institute of Technology, Pune – 411037, India. He is now with Wipro Technologies. (e-mail: .com).

Prof. G. D. Bhutkar is an assistant professor in Vishwakarma Institute of Technology, Pune – 411037, India. (e-mail: ganesh.bhutkar@vit.edu).

Prof. P. S. Dhabe is an assistant professor in Vishwakarma Institute of Technology, Pune – 411037, India. (e-mail: priyadarshan.dhabe@vit.edu).

Prof. M. L. Dhore is the H.O.D. of Computer Engg. Dept. in Vishwakarma Institute of Technology, Pune – 411037, India. (e-mail: hodcomp@vit.edu).

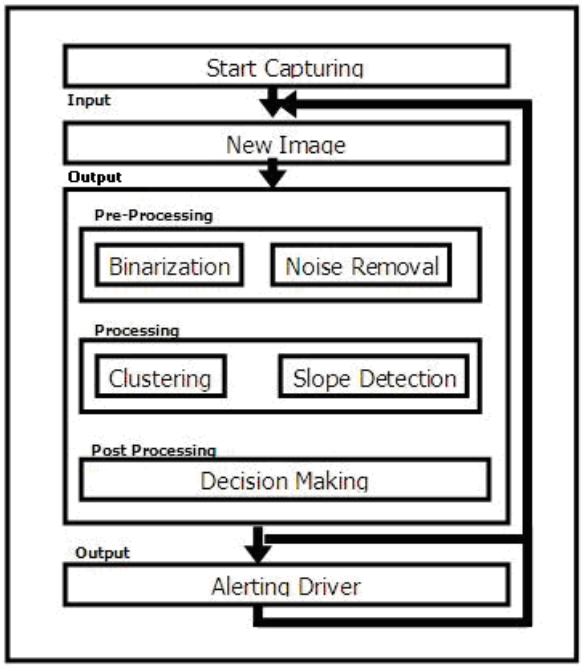

Figure 1 : Block Diagram of DroDeASys.

3 Phases of the System

The system uses a completely software approach & has been broken down into three phases:
1. Pre-processing
2. Processing
3. Post-processing

The processing phase forms the major part of the system & this is where the algorithm to detect the state of the eyes has been implemented.

3.1 Pre-processing

The images acquired from the infra red night vision camera are converted into binary images using a specific threshold. Also the image is enhanced by isolating independent pixels.

3.2 Processing

The binary image is then input to the clustering algorithm wherein clusters are found out within the binary image. Depending on the illumination from the camera at that instant of time & the skin color of the person there will be different number of clusters that will be found each time. Clusters are nothing but the areas of the face which are turned on after applying a specific threshold. Once the clusters are detected the centers of each of the clusters is found out & distance is calculated. We have tested the algorithm on the samples of a number of different people & found out the approximate distance within which the two pupils lie. To detect the eyes the distance is checked between the clusters & if ever the clusters are found to be within that range then the eyes are detected. One problem with this algorithm is that the same distance can be there between a different set of clusters which are really not the eyes.

To accurately detect the eyes the slope detection algorithm is used to calculate the slope between each of the clusters & it discards the clusters till finally the eyes are detected.

If ever the eyes are found then the driver is alert & there is no need of raising an alarm. But if the eyes are not found or are closed for a period of 3 seconds continuously then it is safe to assume that the alertness level has dropped down to certain level & the driver is dozing. In such a case the driver is alerted by raising an alarm.

$$dist = Sqrt((x2 - x1)^2 + (y2 - y1)^2) \quad (1)$$

where, (x1,y1) and (x2,y2) are any two points.

Distance formula

$$Slope = dy / dx \quad (2)$$

Slope formula

3.3 Post Processing

Depending on the state of the eyes found in the previous stage an appropriate decision is made & then displayed on screen.

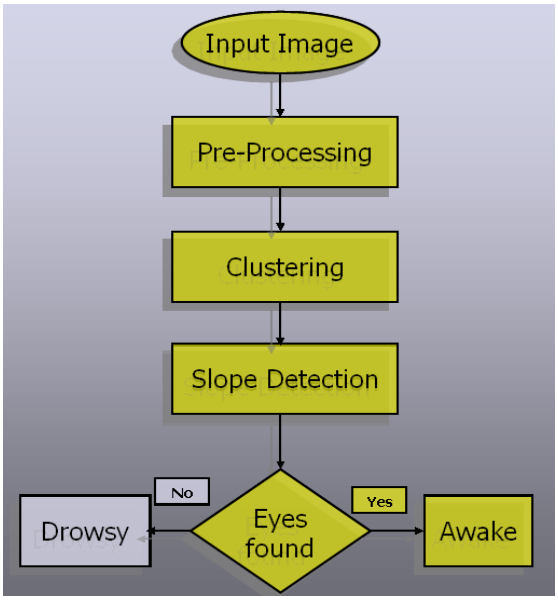

Figure 2 : Flowchart of DroDeASys.

4 Samples Tested

Following are the tested samples under conditions mentioned below:

1. Constant distance from camera.
2. Tilted to one side.
3. Looking straight in front.
4. Deep drowsy state.
5. Looking at a rear view mirror.

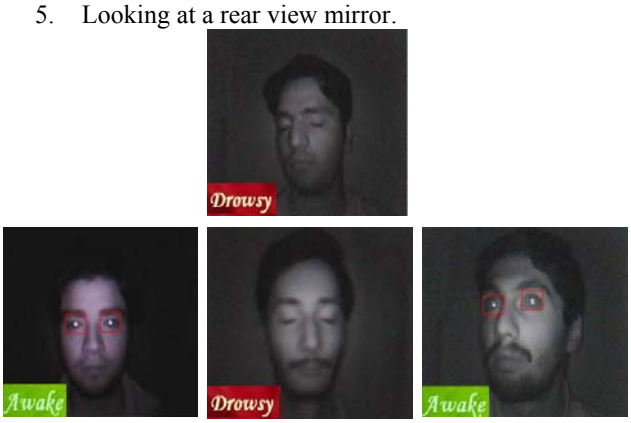

Figure 3 : Tested Samples.

5 Conclusion

As shown in the tested samples in Figure 3, the system works on a variety of samples. The results of the experiments carried out on around 70 samples indicate a success rate of 90%. Thus this approach will be used to implement the system on a full-fledged basis.

References

[1] Qing Ji and Xiaojie Yang, "Real-Time Eye, Gaze, and Face Pose Tracking for Monitoring Driver Vigilance," Real-Time Imaging, 8, pp.357-377 (2002)

[2] M. Yang, D. Kriegman, and N. Ahuja," Detecting faces in Images: Survey," IEEE Trans. on PAMI, Vol.24, No.1, pp.34-58 (2002)

[3] E. Hjelmas, "Face Detection: A Survey," Computer Vision and Image Understanding, 83, pp.236-274 (2001)

[4] Estimation of Face Direction Using Near-Infrared Camera Takuya Akashi, Hironori Nagayama, Minoru Fukumi, and Norio Akamatsu University of Tokushima.