A Survey on Drowsy Detection Technology

Binita Sumant Singh[1], Asst Prof Ravi Krishan Pandey[2]

[1] *Student, Computer Engineering, GTU PG SCHOOL, Gujarat, India*
[2]*Head of Department, Computer Science Engineering, Laxmi Institute of Technology, Gujarat, India*

ABSTRACT

Nowadays we see many of the accident taking place on road and on machines. There are many reason behind these accidents, but major types of accident occurring during night is because of drowsy condition of the driver driving a car and even with worker working on a machine. Drowsiness of the driver and workers may be because of night shift, driving for long distance, medical issue, drunk or it can be any other. To avoid this accident many drowsy detection systems have been developed till date. This article presents several surveys on different approach for detecting drowsy detection.

Keyword: - *Drowsy Detection, visual based detection, physiology based detection, vehicle based detection and eye gazing*

1. INTRODUCTION

There are millions of vehicles travelling across the world and thousands of accidents take place every month. According to the survey on road accident, many accidents take place because of the drowsy condition of the driver. Around 53% of road accident is due to drowsy condition of the driver in India in the year 2014.Many techniques are developed to overcome these problems, but still we see same scenario. Alarm method, alert system, detection system, etc are developed for detecting drowsiness. Drowsy detection system has now become very challenging for the researcher to avoid accident and try to solve these problems. In this survey, we have gone through many technologies to detect drowsy condition and tried to find the best among all.
In this survey, we have gone through many technologies and had tried to present it in this paper.

2. SURVEY PAPERS

2.1 Paper 1: Real-Time Nonintrusive Monitoring and Detection of Eye Blinking in view of Accident Prevention due to Drowsiness

In this paper, author had used eye blinking as an input. According to the rate at which the eye blinks, drowsy condition is detected. Camera is used to capture the image of an eye, placed in front of the driver in a car. This system was implemented based on 8-15 frames per second. If the drivers eye blinking pattern changed for more than 3-4 seconds, than driver is declared in a drowsy condition and as a result buzzer alarm and vibration will be generated. Classification of the drowsy condition is done using SVM classifier.

Technology Used: It is implemented using Open CV and Raspberry pi
Limitation:

1. In Open CV, memory allocation is a big issue and it does not have its own IDE for execution.
2. Raspberry pi do not give real time data and does not contain Analog to Digital Convertor
3. Only one eye is considered for monitoring.

2.2 Paper 2: A Driver Assistance Framework based on Driver Drowsiness Detection

In this paper, author had done switching between the manual and automatic driving. Whenever the driver is found in a drowsy condition, driving mode of the vehicle will be switched from manual mode to automatic mode. Drowsy condition is detected based on facial expression and steering wheel data. The features extracted from both the approach are passed to the SVM classifier to classify the state of the driver.

Technology Used: Simulated TestBed, which includes driving simulator, tool to design road and script to control simulator's behavior.

Limitation:

1. Using automatic driving is not reliable and also not liable.
2. More expensive to implement in real life.
3. Small technical issue in automatic mode may be dangerous for the driver.

2.3 Paper 3: Wearable Driver Drowsiness Detection System Based on Biomedical and Motion Sensors

In this proposed model, self designed wrist watch is used to detect drowsy condition. Photoplethysmogram sensor and galvanic skin response sensor is built in watch. The sensor data are sent to the mobile device for signal processing along with the accelerometer and Gyroscope, which already built in the watch. Five features are extracted using these sensors which are moved further for drowsy detection. SVM is used to classify drowsy condition. If driver is in a fatigue condition, than graph will be generated on a mobile phone along with the vibration in watch.

Technology Used: PPG, GSR, accelerometer and Gyroscope is used for signal processing.

Limitation:

1. Phone may get misplaced while driving, so driver will be unable to see the graph.
2. Wearing watch while driving may not be found comfortable sometimes for a long distance.

2.4 Paper 4: Drunken driving detection and prevention models using Internet of things

IoT is latest technology developed for communication between physical devices in a network. In this model IoT is used to process data from one end to another in case to drowsy driver. In this approach detection is done on the basis of alcohol concentration, facial expression, nature of the road and the movement of the vehicle. If the driver is found in a drowsy condition than the information is passed to the local traffic control. Data acquired from the entire stream will be clustered and classification will be done on the basis of this cluster.

Technology Used: Internet of Things

Limitation:

1. Very complex to implement.
2. Inaccuracy in any one data may lead to poor result.

3. CLASSIFICATION OF DROWSY DETECTION SYSTEM

From the above discussed few papers, we have come to the conclusion that drowsy detection is done on the basis of three technology. They are Visual Based, Non-Visual Based and Vehicle Based.

3.1Visual Based Drowsy Detection:

Technology used for visual based detection is image processing. Visual Drowsy detection is done on basis of the eye detection, head position, yawning and facial expression. There are many methods for eye detection.

a. Eye detection: It can be done in the basis of texture, shape, combination of texture and shape, blinking rate of eye, color based, EOG signals, Infrared oculography, Image Based, Haar like features, etc.

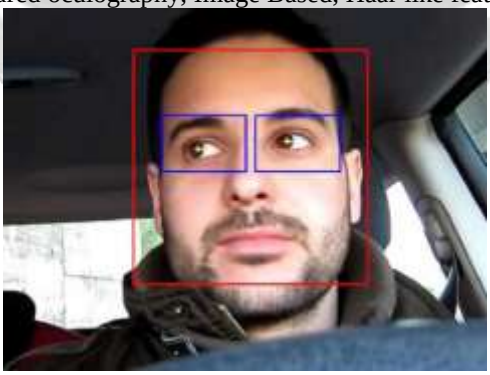

Figure 3.1: Eye Detected

b. Facial Expression: There are basically three methods for face detection. They are feature based, template based and appearance based. Feature based method is detecting invariant face features but difficult to extract feature in complicated background. In template based method, a pre-defined standard face pattern is done, and uses correlation to locate face. But in this method it is difficult to extend various scales. In appearance based method, face and non-

face are detected. But this method gives accurate result only with the simple background. LG expression method is used for extracting features for facial expression. Basic six facial expressions are happy, surprise, sad, anger, disgust and fear.

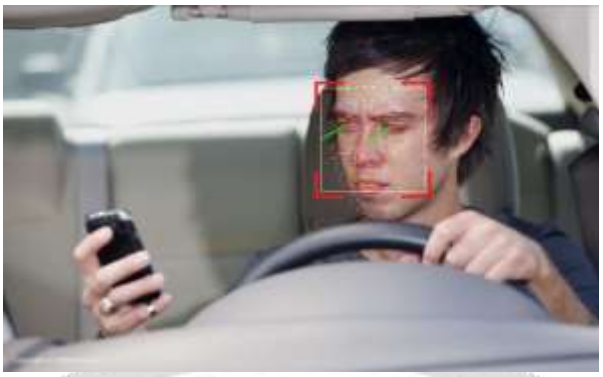

Figure 3.2: Face Detection

Head position: It is calculated by finding if the head is aligning down gradually for long time. Circular Hough transform (CHT) is used to extract mouth region.

Limitation of Visual Based drowsy detection:

1. Large processing power
2. Speed of processing is slow
3. Effects of light may reduce the accuracy of the result.

3.2 Non-Visual Based Drowsy Detection:

In physiological method, heart rate, pulse rate, brain rate, etc are calculated. Non-visual detection can detect in a very initial state of the drowsy condition. So there is more chance to prevent the accident. There are different types of signals which obtain from our body. They are EEG (Electroencephalogram), ECG (Electrocardiogram), PPG (Photoplethysmography) and EMG (electromyogram). Dry electrodes are placed in this sensor to detect the signal passing from the body. On basis of the EEG wave, brain signals are captured which helps to capture data from the brain and recognize whether the driver or worker is alert or drowsy. Same way all signals is used in different approaches to measure the drowsy condition. In non-vision method of detection, hardware is used. For example NeuroSky Mindwave is hardware used to get the signals from the brain. There are electrodes placed in Hardware, which capture the wave. Electrodes are placed in such system.

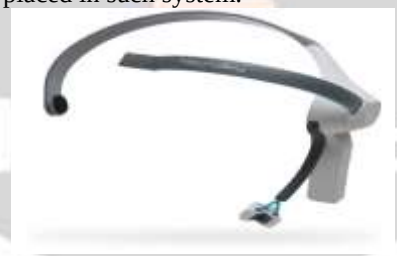

Figure 3.3: NeuroSky Mindwave for EEG wave

Limitation of Non- Visual Based drowsy detection:

1. Result is not accurate
2. Driver has to wear hardware while driving, which is not comfortable while driving.
3. Expensive

3.3 Vehicle Based Detection:

Driver behavior will include vehicle speed, lane observation, steering, pressure on acceleration pedal, car seat, acceleration, brake and gear change. Different types of sensors are placed on a vehicle. Gyroscope and accelerometer are placed to find the speed of the vehicle. But these sensors are fully automatic, so it will cost more and result may also vary from the actual data. Through this behavior of driver, drowsy condition of the driver may be detected and alarm is generated.

Limitation of Vehicle Based drowsy detection:

1. It is non-reliable
2. Require time to setup sensors in car

3. It is too late to prevent accident.

In many approach, combination of physiological method and driver behavior are used. But the result from this approach is not accurate and is also reliable.

On the basis of above survey, result from image processing technology is found as more accurate than compared to other technology. As real time information is processed for drowsy detection.

3.4 COMPARATIVE STUDY

Table 3.1: Technique of drowsy detection

No	Technique used	Strong point	Weak point
1	Brain computer interface	Very efficient in health care	Electrodes outside of the skull can detect very few electric signals from the brain
2	Geometry based	Small database, recognition rate 95%	Large number of features is used.
3	Template based	Recognition rate 100%	Complex
4	Color based	Simple and small database	Limited performance
5	Support vector machine	Flexible	Lack of transparency in result
6	Iris recognition	Produce high accuracy result in less time	Expensive

4. CONCLUSIONS

In our survey, we found that there are many technologies developed for drowsy detection. But the more accurate result is measured using Image Processing technology. In which face and eyes recognition is done. Haar like function is the best among all methods for face detection and Adaboost method is used along with Haar function to detect eyes. These two methods are used together because eyes is a small object in a face, so to get an accurate object both methods are used together. Viola Johns algorithm is best suitable algorithm applied on face detection, as it gives real time result. SVM classifier is found as a most suitable classifier to find whether the driver is fatigue or not. Thresholding is done on the data predefined or user specific.

In future we will work with the implementation of real time eye gazing detection system to get more accurate result.

5. REFERENCES

[1] Lee Boon Leng, Lee Boon Giin and Wan-Young Chung "Wearable Driver Drowsiness Detection System Based on Biomedical and Motion Sensors", 2015 IEEE

[2] Jaeik Jo, Sung Joo Lee, Kang Ryoung Park, Ig-Jae Kim and Jaihie Kim, "Detecting driver drowsiness using feature-level fusion and user-specific classification", 2013 Elsevier Ltd.

[3] Amna Rahman , Mehreen Sirshar and Aliya Khan , "Real Time Drowsiness Detection using Eye Blink Monitoring", Software Engineering Conference (NSEC), 2015 National, 2016, IEEE

[4] Anjali K U, Athiramol K Thampi, Athira Vijayaraman, Franiya Francis M, Jeffy James N and Bindhu K Rajan "Real-Time Nonintrusive Monitoring and Detection of Eye Blinking in view of Accident Prevention due to Drowsiness", 2016 International Conference on Circuit, Power and Computing Technologies [ICCPCT], IEEE

[5] Brandy Warwick1, Nicholas Symons1, Xiao Chen1, Kaiqi Xiong , "Detecting Driver Drowsiness using Wireless Wearables", 2015 IEEE 12th International Conference on Mobile Ad Hoc and Sensor Systems

[6] M. Stork, J. Skala, P. Weissar, R. Holota, Z. Kubik , "Various Approaches to Driver Fatigue Detection: A Review", University of West Bohemia, 2015

[7] Kai-Wei Ke, Muhammad R. Zulman, Ho-Ting Wu, Yu-Fu Huang and Jayasakthi Thiagarajan, "Drowsiness Detection System Using Heartbeat Rate in Android-based Handheld Devices", 2016 First International Conference on Multimedia and Image Processing 978-1-4673-8940-2/16 $31.00 © 2016 IEEE 100 2016 First International Conference on Multimedia and Image Processing

[8] Duy Tran, Eyosiyas Tadesse and Weihua Sheng, Yuge Sun, Meiqin Liu and Senlin Zhang "A Driver Assistance Framework based on Driver Drowsiness Detection", The 6th Annual IEEE International Conference on Cyber Technology in Automation, Control and Intelligent Systems June 19-22, 2016, Chengdu, China
[9] Suparna Sahabiswas and Sourav Saha "Drunken driving detection and prevention models using Internet of things", 2016 IEEE
[10] C. Jaya Bharathi , "Detection of Drowsiness in Human Eye using SVM", International Journal of Innovative Research in Computer and Communication Engineering (An ISO 3297: 2007 Certified Organization) Vol. 2, Issue 2, February 2014
[11] Mrs.N.Neelima1, Ms.S.Sri Lakshmi2, Mr.T.Jaya Vardhan3 "Design and Development of Warning System for Drowsy Drivers", International Journal of Scientific and Research Publications, Volume 3, Issue 11, November 2013 1 ISSN 2250-3153
[12] Chih-Jer Lin-IEEE Member, Chih-Hao Ding, Chung-Chi Liu and Ying-Lung Liu , "Development of a real-time drowsiness warning system based on an embedded system", 20151EEE