xIlkogretim Online - Elementary Education Online,2021; Vol 20 (Issue 1): pp.3077-3082
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2021.01.345

# Smart Detection and Prevention system for Drowsy Driving

**R. Senthil Kumaran,** Associate Professor, Department of Electronics and Communication Engineering, IFET College of Engineering, Villupuram, Tamil Nadu, India. Email: sen19841@gmail.com
**M.P.Harinee**, UG Scholar,Department of Electronics and Communication Engineering, IFET College of Engineering, Villupuram, Tamil Nadu, India. Email: harineepandian@gmail.com
**K.Loga,** UG Scholar, Department of Electronics and Communication Engineering, IFET College of Engineering, Villupuram, Tamil Nadu, India. Email: logakrish.k08@gmail.com
**R.Dhanyasri,** UG Scholar, Department of Electronics and Communication Engineering, IFET College of Engineering, Villupuram, Tamil Nadu, India. Email: dhanyaramanujam99@gmail.com.

**Abstract**- Nowadays drowsy driving is the serious issue for traffic collision and accidents. Recently a huge number of accidents occurs because of drowsy driving and it leads to loss of lives and properties. To overcome this problem, many analyses were made in discovering systems which scrutinize driver's weariness and alert him in advance which forestalls any kind of accidents. Most of the traditional methods used vehicle based measurements, although, these measurements are mostly dependent on the road structure, vehicle types and driving skill. Other measurements include the physiological methods that provide finer efficiency in detecting the drowsiness of the driver but these methods are exceedingly annoying and thus disturb the driver. Here, the proposed system is non-invasive and it uses eye closure ratio as an input. When this ratio varies from standard value, the driver is alerted using buzzer and water sprayer. The main advantage of this system is automatically controlling the speed of the vehicle through automatic speed control method and then stops the vehicle through Raspberry-Pi. The Global System for Mobile communication (GSM) is used to send alert message to the responsible person through SMS and Global Positioning System (GPS) to send the location of the person.

**Keywords: Automatic speed control, Drowsy driving, Eye Aspect Ratio, speed control Raspberry-Pi, location**

## I. INTRODUCTION

Drowsy driving is the major issue to be observed for road accidents in our country. More than 50% of accidents have been encountered due to drowsy driving [2]. Drowsy driving occurs due to lack of sleep or health issues such as sleep disorders like insomnia [3]. This results in cognitive impairment of the driver. Many techniques were taken in order to detect the drowsiness through various measurements. Most of the existing methods have been based on vehicle based measurements [4]. To estimate the drowsiness of the driver, the sensors were fitted near the steering and accelerator. These techniques can also be further divided into two types [5]. The estimation can be done by Steering Wheel Movement (SWR) and Standard Deviation of Lane Position (SDLP). In SWR, the drowsiness can be measured by placing the angle sensor which measures the deviation of the steering pattern [6]. The external cameras were used in such methods to ascertain the driver affected by sluggishness [7]. This vehicle based methods are mostly dependent on the structure of road and also the nature of the vehicle [8]. So these existing methods based on vehicle measurements are not accurate [9]. Apart from these measurements there are some techniques which is based on psychological measures by monitoring the psychological signals of the driver [10]. This method includes recording signals by using electroencephalogram (EEG), electrooculography (EOG), electrocardiography (ECG) or electromyogram (EMG) [11]. This method provides finer accuracy on detecting the drowsiness [12]. These techniques were highly invasive and it may distract the driver [13]. The self-assessment during this situation is not that much accurate and not happens in real time [14]. This is the major drawback of existing psychological based measurement [15]. Our proposed methodology is designed to prevent the accidents through the automatic speed control method by determining the dizziness [16]. According to the previous studies, we developed a system which measures the drowsiness of the person based on Eye Closure Ratio. In this proposed system, the drowsiness can be detected by the use of Eye Aspect Ratio (EAR) [17]. The distance between the horizontal eye region and the vertical eye region has been measured [1]. The driver is detected sleepy immediately when the value of EAR decreases when compared with the value of threshold. After the detection, the buzzer alert is given to him and also the water is sprayed on their face to wake them up [18]. After that the speed of the vehicle has been gradually reduced and it can be stopped with the help of ultrasonic sensor which observes the obstacles behind the vehicle. The notification has been sent to the responsible person with GPS location. This paper deals with the methods and working of the smart detection and prevention of drowsy driving [19].

## II. PROPOSED SYSTEM

This system is designed to get over the limitations of the existing psychological method of measurement [20]. The main aim of this system is to make an efficient system that automatically prevents the accidents due to drowsy driving by speed control method. The Eye Aspect Ratio of normal human eye ranges above 0.25 and it is considered as the threshold value [21]. At once the driver becomes drowsy, the EAR value drops automatically beyond the standard value and the eye closure duration is measured [22]. The normal eye blinking pattern and the drowsy eyes of the driver can be distinguished by the use of total number of video frames. The increasing number of frames ensures the weariness of the person [23]. The proposed methods first try to wake up the driver using the buzzer and water sprayer. When this fails, the speed has been controlled automatically and stops the vehicle. Once the speed is controlled in the vehicle, the notification with GPS location is send to the responsible person. Figure 1 is the block diagram of our system [24].

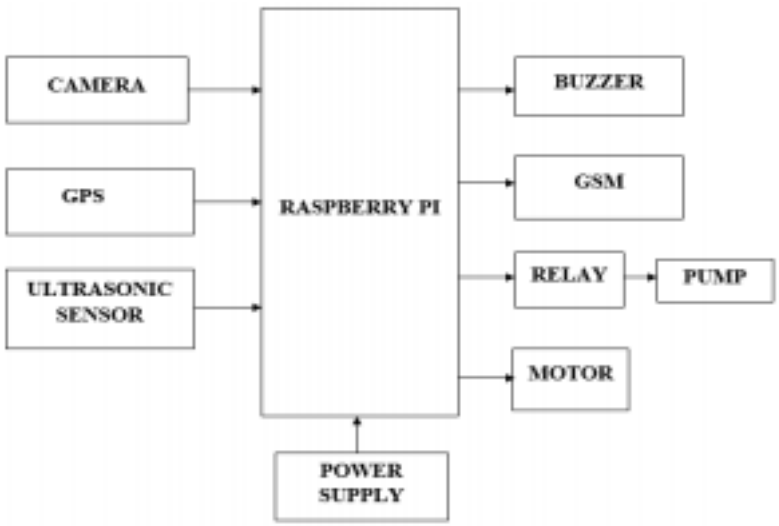


Figure 1. Block Diagram

## III. COMPONENT DETAILS

The major components of this proposed system are,

### A. Raspberry Pi

Raspberry Pi 3 Model B is used in our system. It is a 64 – bit quad core processor that runs at 1.4 GHz. It is integrated with Raspbian OS [26].

### B. Camera

The high definition video can be captured by the use of web camera. The model is QHM495LM and it is of 25 Megapixel qualities.

### C. GSM

GSM modem- RS232 model is used and it is built with SIM900A GSM engine and its operating frequency of 900/1800MHz. it is used to transfer the data through SMS [25].

### D. GPS

The NEO-6 GPS receivers are used and it is a high performance engine. The GPS is used to track the location of the driver.

E. Ultrasound sensor

The ultrasonic sensor used in this system is HC-SR04. If they encounter any object, the ultrasound pulses travels outward. The velocity is about 340m/s in air.

F. Motor

The BO series 1 100RPM DC motor is used in this system. It is cost effective.

## IV. Working Principle

A. Eye Aspect Ratio Determination

The EAR can be determined to observe the weariness. The facial landmarks were detected by constructing the image dataset [27]. After detecting the facial landmarks, the region of the eye is extracted using the coordinates function. The eye aspect ratio is computed by taking the ratio of interspace between vertical eye landmark and horizontal eye landmark.

The Euclidean distance can be detected by,

$$D(P,Q) = \sqrt{\sum_{i=1} (P_i - Q_i)} \quad (1)$$

D(p,q) – Euclidean distance

Pi, Qi – Cartesian coordinates

Every human eye has 6(x,y) coordinates [1]. The EAR determines the distance between both the eyelids. If a person blinks, it decreases to zero. The average eye blinking duration of an individual ranges from 100ms to 400ms approximately. The eye closure duration of a drowsy person can be greater the 400ms. In this proposed system, to represent the duration, four frames were considered which indicates those four frames with EAR less than 0.25 must be registered.

B. Turning on buzzer

When the driver is detected with weariness, the buzzer produces beep sound to alert the driver. In our proposed system, the drowsiness can be detected by the video frames. If the value of EAR falls beyond the standard value, then the buzzer is turned on.

C. Speed control

When the driver does not awakes on buzzer sound then by using the ultrasonic sensor which is fitted in the wheel of the vehicle to determine whether there is any vehicle near to it. Once there is no obstacle, the speed of the vehicle is reduced and stops gradually. This automatic speed control reduces the risk of accidents due to drowsy driving.

D. Notifying the owner

After stopping the vehicle, the information about the drowsy driver has been intimated to the owner or responsible person. The SMS has been sent to the responsible person by the use of GSM. The mail can be send with the help of Simple Mail Transfer Protocol (SMTP). The current location of the driver can be intimated by the use of GPS. This helps in reducing the risk of accidents through drowsy driving.

## V. Result and Discussion

This proposed system successfully detects the drowsiness and also prevents from accidents due to drowsiness. The following figures show the successful prevention of drowsy driving system. represents the EAR value of a normal person, after closing the eyelids [1]. The alert for the responsible person helps to reduce the risk of accidents and safeguard of that driver as well as the vehicle.

Figure 2 represents the message which is send to the responsible person. Using the mail transfer protocol the email has been sent and an alert with location of the driver integrated in it. When the EAR value drops below the standard value, after giving alert to the driver, then the speed can be controlled.


Figure 2. SMS alert

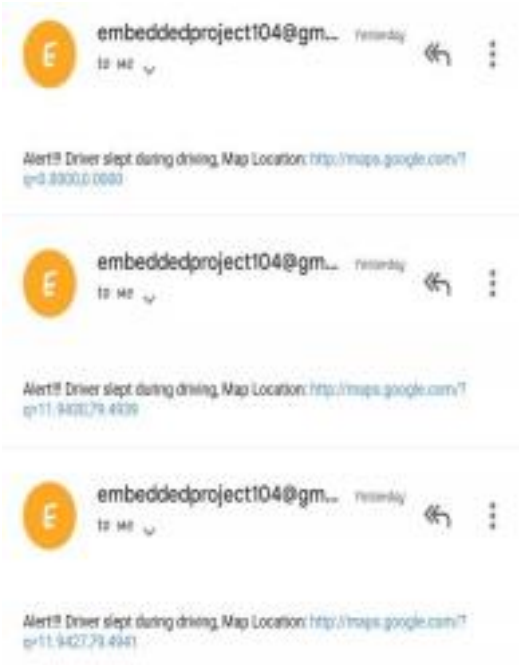


Figure 3. E-mail alert

Figure 2 and Figure 3 shows the experimental output of this proposed system which notifies the owner or the responsible person through the SMS and e-mail which is integrated with the GPS location in it. Through this proposed method the drowsy driving has been reduced in large amount.

## VI. Conclusion

The major aim of this proposed technique is to descry the drowsiness and to prevent the accidents due to drowsy driving. This proposed system not only detects the drowsiness but also prevents the driver from disasters. The existing system such as vehicle based and psychological measurements are invasive and it has many drawbacks. Our proposed system is non -intrusive and highly effective in measuring and prevention of drowsy driving. In this technique, the Raspberry-pi is used to obtain the facial landmarks and to detect the EAR value of the person. This method prevents the accidents by automatically controlling the speed of the vehicle and also it notifies the owner or responsible person through e-mail and SMS with the GPS location integrated in it.

## References


1. M.Y. Hossain and F.P. George, "IOT Based Real time Drowsy driving Detection System for theprevention of Road Accidents," *2018 International Conference on Intelligent Informatics and Biomedical Sciences (ICIIBMS),* Bangkok, 2018, pp.190-195.and P.Rangarajan
2. "Drowsy Driving," National Highway Traffic Safety Administration (NHTSA), 01-Feb 2018. [Online]. Available: *https://www.nhtsa.gov/risky-driving/drowsy-driving.* [Accessed: 11 Apr-2018].
3. "Drowsy Driving: Asleep at the Wheel," Centers for Disease Control and Prevention, 07-Nov 2017. [Online]. Available: *https://www.cdc.gov/features/dsdrowsydriving/index.html.* [Accessed: 11-Apr 2018].
4. C. C. Liu, S. G. Hosking, and M. G. Lenné, "Predicting driver drowsiness using vehicle measures: Recent insights and future challenges*," Journal of Safety Research,* vol. 40, no. 4, pp. 239-245, 2009.
5. P. M. Forsman, B. J. Vila, R. A. Short, C. G. Mott, and H. P. Van Dongen, "Efficient driver drowsiness detection at moderate levels of drowsiness," *Accident Analysis & Prevention,* vol. 50, pp. 341-350, 2013.
6. S. Otmani, T. Pebayle, J. Roge, and A. Muzet, "Effect of driving duration and partial sleep deprivation on subsequent alertness and performance of car drivers," *Physiology &behavior,* vol. 84, no. 5, pp. 715-724, 2005.
7. P. Thiffault and J. Bergeron, "Monotony of road environment and driver fatigue: a simulatorstudy," *Accident Analysis & Prevention*, vol. 35, no. 3, pp. 381-391, 2003.
8. S. H. Fairclough and R. Graham, "Impairment of driving performance caused by sleep deprivation or alcohol: a comparative study," *Human factors,* vol. 41, no. 1, pp. 118-128, 1999.
9. M. Ingre, T. Åkerstedt, B. Peters, A. Anund, and G. Kecklund, "Subjective sleepiness, simulated driving performance and blink duration: examining individual differences," *Journal of sleep research,* vol. 15, no. 1, pp. 47-53, 2006.
10. E. Vural, "Video based detection of driver fatigue," *Graduate School of Engineering and Natural Sciences,* 2009.
11. R. Simons, M. Martens, J. Ramaekers, A. Krul, I. Klöpping-Ketelaars, and G. Skopp, "Effects of dexamphetamine with and without alcohol on simulated driving," *Psychopharmacology,* vol. 222, no. 3, pp. 391-399, 2012.
12. D. Das, S. Zhou, and J. D. Lee, "Differentiating alcohol-induced driving behavior using steering wheel signals," *IEEE Transactions on Intelligent Transportation Systems,* vol. 13, no. 3, pp. 1355-1368, 2012.
13. A. Craig, Y. Tran, N. Wijesuriya, and H. Nguyen, "Regional brain wave activity changes associated with fatigue," *Psychophysiology,* vol. 49, no. 4, pp. 574-582, 2012.
14. A. Picot, S. Charbonnier and A. Caplier, "On-Line Detection of Drowsiness Using Brain and Visual Information," in *IEEE Transactions on Systems, Man, and Cybernetics - Part A: Systems and Humans,* vol. 42, no. 3, pp. 764-775, May 2012.
15. Z. Ma, B. C. Li and Z. Yan, "Wearable driver drowsiness detection using electrooculography signal," *IEEE Topical Conference on Wireless Sensors and Sensor Networks (WiSNet), Austin*, TX, 2016, pp. 41-43, 2016.
16. R. Fu and H. Wang, "Detection of driving fatigue by using noncontact EMG and ECG signals measurement system," *International journal of neural systems*, vol. 24, no. 03, p. 1450006, 2014.
17. B. Mandal, L. Li, G. S. Wang and J. Lin, "Towards Detection of Bus Driver Fatigue Based on Robust Visual Analysis of Eye State," in *IEEE Transactions on Intelligent Transportation Systems*, vol. 18, no. 3, pp. 545-557, March 2017.

18. Z. Li, L. Chen, J. Peng, and Y. Wu, "Automatic detection of driver fatigue using driving operation information for transportation safety," *Sensors*, vol. 17, no. 6, p. 1212, 2017.
19. E. Portouli, E. Bekiaris, V. Papakostopoulos, and N. Maglaveras, "On-road experiment for collecting driving behavioural data of sleepy drivers,"*Somnologie Schlafforschung und Schlafmedizin,* vol. 11, no. 4, pp. 259-267, 2007.
20. R. OyiniMbouna, S. G. Kong and M. Chun, "Visual Analysis of Eye State and Head Pose for Driver Alertness Monitoring," in *IEEE Transactions on Intelligent Transportation Systems,* vol. 14, no. 3, pp. 1462-1469, Sept. 2013.
21. Yan, Chao. "Vision-based Driver Behaviour Analysis." PhD diss., University of Liverpool, 2016.
22. X. Fan, B.-c. Yin, and Y.-f. SUN, "Yawning detection based on gabor wavelets and LDA," *Journal of Beijing university of technology*, vol. 35, no. 3, pp. 409- 413, 2009.
23. E. Vural, M. Cetin, A. Ercil, G. Littlewort, M. Bartlett, and J. Movellan, "Drowsy driver detection through facial movement analysis," in *International Workshop on Human Computer Interaction*, 2007, pp. 6-18: Springer.
24. T. P. Nguyen, M. T. Chew and S. Demidenko, "Eye tracking system to detect driver drowsiness," 2015 *6th International Conference on Automation, Robotics and Applications (ICARA), Queenstown*, 2015, pp. 472-477.
25. A. Industries, "Raspberry Pi 3 - Model B - ARMv8 with 1G RAM," adafruit industries blog RSS. [Online]. Available: *https://www.adafruit.com/product/3055*. [Accessed: 06-Mar-2018].
26. "Raspberry Pi Software," *Exploring Raspberry Pi*, pp. 23–54, 2016.
27. P. Viola and M. Jones, "Rapid object detection using a boosted cascade of simple features," in Computer Vision and Pattern Recognition, 2001. CVPR 2001. *Proceedings of the 2001 IEEE Computer Society Conference* on, vol. 1, pp. I-I: IEEE, 2001.