Automatic Driver Drowsiness Detection and Accident Prevention System using Image Processing

M.S Antony Vigil, K.Vijay Sriram Charan, D.Sai Santosh, E.Bhargava Reddy

Abstract: Sleep is a primary need for human beings. The individual desires at least eight hours of sleep to hold on his day by day routine. When someone lacks in take enough relaxation his or her frame does not characteristic(function) properly. First of all, drivers need enough sleep to boost up their work. When we don't have enough sleep, we may become drowsy and falls asleep. Sometimes a few seconds of drowsiness can cost the lives of both driver and passengers as well. So, this gadget proposes a lively monitoring assistant that analyzes drivers' eye blinking action and additionally, mouth portion which exams whether driving is yawning. The system monitors the inputs from the camera located in the driving area and the pictures are captured continuously. These pictures are made into frames that assist the machine to discover d r o w s i n e s s o f f t h e d r i v e r . It is programmed with a time limit for eye blinking operatio n, if the driver extends the time limit, then a standard warni ng warns the driver for daily intervals until the driver retur ns to an active state and also when the driver yawns the dev ice senses yawning movement and the alarm starts beeping. . With the outcomes obtained from the frames, they are categorised into one-of-a-kind paperwork like a normal driver, driving force with dark skin and motive force having severe lights behind. This device overcomes the drawbacks of formerly present systems.

Keywords- Drowsiness,Gadget, Monitoring, Yawning, Blinking

I. INTRODUCTION

Detection of the levels of driver drowsiness has a key position in reducing the number of deadly injuries in traffic. Recent facts and reports display that 20 to 50 million people are killed or injured in vehicle crashes all around the international [1]. On Indian roads, approximately a hundred and forty,000 human beings die every 12 months of road accidents, in large part prompted because of the Drowsiness component. Assessments conducted by using US NHTSA (National Highway Traffic Safety Administration) confirmed that a hundred thousand vehicles accidents arise each yr. for which the drivers' drowsiness is one of the principal contributors. These injuries price over 12.5 billion$ and 1550 deaths and 71000 injuries [2]. National Sleep Foundation of u.s.a declared that 54% of adult drivers

Revised Manuscript Received on October 30, 2019.
* Correspondence Author
  M.S Antony Vigil*, Department of Computer Science and Engineering, SRM Institute of Science and Technology, Chennai.
  K.Vijay Sriram Charan, Department of Computer Science and Engineering, SRM Institute of Science and Technology, Chennai.
  D.Sai Santosh, Department of Computer Science and Engineering, SRM Institute of Science and Technology, Chennai.
  E.Bhargava Reddy, Department of Computer Science and Engineering, SRM Institute of Science and Technology, Chennai.

had pushed in the course of sleepiness and 28% of these drivers had fallen asleep absolutely [3].

The Road Safety Council of Germany (DVR) (Deutsche Verkeh Rswacht) states that 25% of fatal car crashes in toll road visitors are due to temporary sleepiness [4]. Investigations performed utilizing the Iranian legal medication have proven that visitors' injuries represent a huge quantity of the USA's fatalities. According to reports through this organization, such accidents cost over $four billion annually that is three.5 times the gross domesticmade of Iran. Based on the reports represented by the police, approximately, 23% of car injuries in Iran turned into because of drowsy driving and driving force fatigue [5]. Having considered such records, devising systems correctly to decide degrees of drivers' drowsiness is of top significance, which will lessen the wide variety of vehicle accidents. Generally, there three styles of systems exist to decide the stages of drivers's fatigue: strategies primarily based on physiological indicators, strategies primarily based on the driving force's performance and strategies based on photo processing [6]. Methods evolved primarily based on physiological signals, a few electrodes are attached to the frame to come across the indicators from the mind and coronary heart. This approach could be tense and is considered a nuisance to the drivers. The strategies evolved based totally on the driving force's overall performance, an awful lot time is required to analyze the driving force's performance, which therefore results in low accuracy. However, strategies evolved based totally on photo processing are fast and specific to hit upon drivers' drowsiness. Interpreting such indicators, the principals of the approach are evolved based totally on picture processing [7]. In many instances, step one in photograph processing is to apprehend the facial sector from the obtained photographs. Then, the parameters associated with drowsiness together with eyes are recognized and their modifications are investigated to come across the ranges of sleepiness. Amongst various facial features, eyes are quite of greater importance and much research was carried out at the processing of the condition of the eyes. For example, a few elements like PERCLOS (Percentage of Eye Closure), length of eyes closure and the range of blinks were utilized by IR Illuminator to decide the vigilance degree.

Drowsiness turned into detected simply based on PERCLOS. A small digital camera performed the watching check detecting the levels of drowsiness via the quantity of eyes blinks and accuracy of 98 %[8].

Regarding the significance of detecting the ranges of drowsiness exactly without annoying the driver and thinking about the reality that nearly no actual time techniques for such motive had been stated in the preceding studies, an investigation of drowsiness with the aid of image processing of drivers and the movements in their eyes gives the result for further proceeding .

II. RELATED WORKS

System has been developed using nonintrusive machine-based concepts. The system is set up with a web camera that is placed facing driver which monitors drivers head movements to detect drowsiness of driver when drowsiness is detected warning signal is used to alert drivers from drowsiness. System numerous ways and algorithms for facial and eye monitoring are used to assess that they are appropriate for use in a very driver fatigue monitoring system[9]. within the case of face detection, the quality Viola-Jones face detector has been used, whereas the strategy of finding the attention centers exploitation gradients has been elite within the case of eye detection. The system conjointly has the potential to gather activity parameters required to estimate driver fatigue.[10] System is divided into three methods Vehicle based , Behavioral -based and Physiological based. These are based on vehicle deviations of the lane, movement of steering and pressure on the accelerator, Driver behavioral means yawning, eye closure, eye blinking, and head pose and psychologically based are the interaction between the ECG (Electrocardiogram) and the EOG (Electrooculogram) physiological signals. Tiredness is measured from pulse rate[10], heartbeat, etc. [11] Model detects driver drowsiness using Matlab code and image processing its detection process is done in two steps (1) The causes of driver drowsiness (2) The patterns of drowsiness in the first step it evaluates the causes for the drowsiness of driver like work schedule, no hours of sleep and his/ her sleeping environment. In second step system uses patterns of drowsiness which are the frequent flicker of eyes, Moving the head from side to side, mouth yawning. The system uses Matlab code to analyze the frames cut from the footage of camera present before the driver and using patterns of drowsiness if any one of them is detected alarm beep is used to alert the driver to get back to a normal state.[12]

The purpose of this paper was to device a way to alert drowsy drivers in the act of driving. This develop such a system using some hardware components like PIC micro-controller, Camera, Buzzer, Relay and Two-axis Robot. The system also contains some software components other than these hardware components; the system uses PIC16F887 micro controller chip and used to give software and hardware interrupts and Embedded C and Mat lab codes.This, develop a drowsiness detection system that will accurately monitor driver drowsiness. This system has many advantages other than many existing systems.[13]

III. Proposed architecture

The driver's face is identified using a lens that is installed on the front mirror. In the first step, the device will identify and monitor the face using a collection of frame shots captured by the camera. Then the location of eyes and mouth are

detected from the previously captured and detected face. The closed eye gesture is detected along with yawning detection. The mouth and eye geometrical features are then used to locate the yawn. The driver assistant will alert the driver using an Alarm. This is to be achieved in Different phases given below:

- detection of face

- detection of eyes

- Closed Eye detection
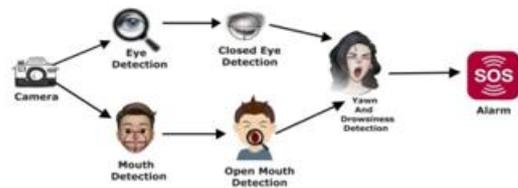
- Mouth detection

- Yawn detection

- Alarm Alert

Fig 1 : Block Diagram for Drowsiness detection

IV. PROPOSED METHODOLOGIES

In previously existing frameworks on this venture have a few disadvantages which are: The framework c a n n o t i d e n t i f y f o r d i m c l e a n e d individuals.Frameworks can't concentrate on the driver when there are any reflecting articles behind the driver.Troubles in perusing various countenances.Driver drowsiness framework is discovered quite a while in the past from that point different existing frameworks utilize diverse sort of calculations and strategies to conquer disserves.

Algorithms used beforehand are:

A. Viola-jones Algorithm

This algorithm is proposed by Paul viola and Michael jones.Its main purpose is to distinguish protest in an image or some pictorial content. The calculations are of four phases:Haar Feature selection , Creating internal pictures, adaboost training Falling, Classifiers. It is notable for having the option to distinguish faces and body parts in a picture, yet can be prepared to recognize practically any article.The initial step is to gather the Haar Features. A Haar feature thinks about nearby rectangular areas at a particular area in a recognition window, totals up the pixel powers in every district and ascertains the distinction between these aggregates.

B. Learning algorithm

The speed with which highlights might be assessed doesn't satisfactorily make up for their number, notwithstanding. For instance, in a standard 24x24 pixel sub-window, there are an aggregate of M = 162,336[4] potential highlights, and it would be restrictively costly to assess them all when testing a picture. In this manner, the article identification structure utilizes a variation of the training calculation AdaBoost to each choose the simplest highlights and to organize classifiers that utilization them. This calculation develops a "solid" classifier as an instantaneous mix of weighted straightforward "frail" classifiers.[14]

Each weak classifier is a threshold function based on t he feature

$$h(\mathbf{x}) = \text{sgn} \sum_{j=1}^{M} \alpha_j h_j(\mathbf{x})$$

$$h_j(\mathbf{x}) = \{ s_{-j} \ s_j \quad \text{if otherwise} f_j < \theta_j$$

The limit and polarity rates, as well as the coefficients, are calculated in the formula[14].

C. LocalBinaryPattern work

LBP features encode nearby surface data, which you can u s e f o r a s s i g n m e n t s , f o r e x a m p l e , characterisation,Identification-and acknowledgment.The function partitions the information picture into noncovering cells.

D. Eye-tracking

Eye-tracking is the approach toward estimating either the purpose of gaze or the movement of a watch the head.An eye tracker could be a device for estimating eye positions a n d e y e d e v e l o p m e n t . E y e trackers ar utilised in analysis on the visual framework in brain analysis, in cognitive psychology, showcasing, as an information device for human-PC collaboration, and an item set up.

E. ECG signals

Electrocardiography (ECG) is the procurement of electrical activity of the heart caught after some time by an outside terminal connected to the skin. ... These show up as little electrical signals on the skin which can be distinguished and enhanced by the ECG. F. EOG signals Electrooculography (EOG) is process used for estimating corneal retinal standing potentials that exist between the front and rear of the human eye. The subsequent signal is called the electrooculogram. Essential applications are in ophthalmological analysis and chronicle eye developments.

V. EXPERIMENTAL RESULTS

System	Sensors/Parameters	Algorithm	Accuracy
[1]	EEG, ECG	Mean power frequency	-
PODS [3]	Respiration Rate, Heart Rate, Heart Rate Variability	Power Spectrum	-
[4]	Cameras/Eyelid movement, gaze movement, gaze movement, head movement and facial expression	Kalman filtering tracking	Yawn–82% PERCLOS–86% AECS–95%
[5]	IR Camera	Thresholding, Mean	-
[6]	Camera/facial features of eyes, mouth and head	Fuzzy reasoning	Only focused on detection rate for facial tracking and face tracking rate
BCI [9]	EEG	Principal Component Analysis (PCA)	Training–92.6% Testing–74.6%
[11]	ECG, EEG	dynamic Bayesian network, first-order Hidden Markov Model	Drowsy (best)–91% Active (best)–91%
IVIS [15]	Eye movement, driving performance data	Support Vector Machines (SVMs)	Distraction detection (average)–81.1%

Fig 3 : Experimental Results

Therefore From The Obtained Experimental Results, We Can See That Eeg And Ecg Have The Best Results With A Detection Percentage Of 81.1%. With All The Aspects Its Should Check Like Eye Movement, Yawning, Face Position It Gives The Response In A Fraction Of Seconds.

VI. CONCLUSION

In this project, many facial and eye detection methods were tested to evaluate which of them is ideally applied in the driver fatigue monitoring system. ViolaJones face detector has shown to be the fastest and most sensitive among all face detectors, while the algorithm proposed by Timm and Barth outperformed the rest of the eye detectors. During the checking, the framework can choose whether the eyes are opened or shut. At the point when the eyes have been shut for two seconds, an admonition sign is given. What's more during observing, the framework can naturally distinguish any eye limiting mistake that might have happened. If there should bean occurrence of this sort of mistake, the framework can recuperate and appropriately confine the eyes. The proposed framework was tried on genuine driver pictures. The video picture [480 x 640 pixels] of 75 distinctive test people have been recorded during a few days, night and complex foundation at better places. also explores how sleepiness can be managed in simulated surroundings. The diverse measures used to diagnose somnolence consist of subject.

REFERENCES

1. WHO (2009)? Global Status Report on Road Safety Geneva, Switzerland. https://afro.who.int/sites/default/files/2017-06/vid_global_status_report_en.pdf [PubMed]
2. Rau P. (2005). Drowsy Driver Detection and Warning System for Commercial Vehicle Drivers: Field Operational Test Design, Analysis, and Progress. National Highway Traffic Safety Administration; Washington, DC,USA. [Google Scholar]
3. Drivers Beware Getting Enough Sleep Can Save Your Life This Memorial Day. National Sleep Foundation (NSF); Arlington, VA,USA: 2010. [Google Scholar]
4. Husar P. (2012). Eyetracker Warns against Momentary Driver Drowsiness. http://www.fraunhofer.de/en/press/research-news/2010/10/ eye-tracker-driver-drowsiness.html
5. Poursadeghiyan M, Mazloumi A, Saraji GN, et al. (2017). Determination the levels of subjective and observer rating of drowsiness and their associations with facial dynamic changes. Iran J Public Health, 46(1):93–102 [PMC free article] [PubMed] [Google Scholar]

6. Karchani M, Mazloumi A, Saraji GN, ++ al. (2015). Relationship between Subjective Sleepiness and Demographic Characteristics in Night Work Drivers. Advances in Environmental Biology, 9(3):1012– 1015 [Google Scholar]

7. Ying Y, Jing S, Wei Z. (2007). The Monitoring Method of Driver's Fatigue Based on Neural Network. Proc. International Conf. on Mechatronics and Automation, China pp.3555–9. [Google Scholar]

8. Lopar M, Ribarić S. (2013). An Overview and Evaluation of Various Face and Eyes Detection Algorithms for Driver Fatigue Monitoring Systems. Proceedings of the Croatian Computer Vision Workshop, Year 1 Zagreb, Coroatia, pp.15–18 https://arxiv.org/ftp/arxiv/papers/1310/1310.0317.pdf [Google Scholar]

9. Driver Drowsiness Detection System using Image Processing Technique by the Human Visual System. Authors: R.Sasikala, S.Suresh, J.Chandramohan, M.Valanrajkumar.

10. Aldila Riztiane, David Habsara Hareva, Dina Stefani, Samuel Lukas. "Driver Drowsiness Detection Using Visual Information On Android Device", 2017 International Conference on Soft Computing, Intelligent System and Information Technology (ICSIIT), 2017

11. Mayank Chauhan, Mukesh Sakle"Study & Analysis of Different Face Detection Techniqes " International Journal of Computer Science and Information Technologies, Vol. 5 (2) , pp 1615-1618,2014. [12] K. Saldaña Altamirano y R. Rodríguez Urquiaga, «Detección de la somnolencia usando maquinas de soporte vectorial a partir de, » Universidad Nacional De Trujillo, Trujillo, 2014.

12. R. Jimenez Moreno, «Sistema de detección de nivel de cansancio en conductores mediante técnicas de visión por computador, » Universidad Nacional de Colombia, Bogotá, 2011.

13. Dinges D, Mallis M, Maislin G, et al. Final report: Evaluation of techniques for ocular measurement as an index of fatigue and the basis for alertness management.

14. Viola–Jones object detection frameworkhttps://en.wikipedia.org/wiki/Viola%E2%80%93Jones_object_detection_framework

15. Ribarić, J. Lovrenčić, N. Pavešić, "A Neural-Network-Based System for Monitoring Driver Fatigue", MELECON 2010 –2010 15th IEEE Mediterranean Electrotechnical Conference, pp. 1356-1361, Apr. 2010, V alletta.

16. J. Prakash, and K. Rajesh, "Human Face Detection and Segmentation using Eigenvalues of Covariance Matrix, Hough Transform and Raster Scan Algorithms", World Academy of Science, Engineering and Technology 15, 2008.

17. M. Kutila, "Methods for Machine Vision Based Driver Monitoring Applications", VTT Technical Research Centre of Finland, pp. 1-70, 2006.

AUTHORSPROFILE

Author 1 Name : **Mrs M.S Antony Vigil, Address**: No.15,Moogambiga -i street,jaibalajinagar,nessapakam ,Chennai-78 Tamil Nadu,India **Mobile** :9994535414 ,**E-mail**: antonyvigil@gmail.com,Date of Birth: 14/021985 ,**Institution address** : S R M Institute of, Science and Technology ,ramapuram campus Chennai-89 Tamil Nadu.,India .

Area of Research Interest :
- Image Processing
- Medical Imaging •   Machine learning **Publications:**
- Published 10 Research papers in peer Reviewed Journals.
- Published 6 Research paper in Non-peer Reviewed journals.
- Presented 8Research papers in IEEE Conferences.
- Presented 10 Research papers in International Conferences.
- Presented 8Research papers in National Conferences.

Author 2 Name: D. Sai Santosh Kumar ,**Address:** 9-33-5/5 T-1 Kr Palace   ,Maddilapalem,visakhapatanam-03 **Mobile:**8328678492,**Email:**santoshdevarasetty@gmail.com, **Institution address** : S R M Institute of   Science and Technology ,ramapuram campus Chennai-89 Tamil Nadu.,India, **Branch**: **B.tech/cse** Reg.no:RA1711003020775

Author 3 Name: k.v s charan naidu, Address:D.no:8-51,Maddala vari street,Veeravasaram-534245, W.G District, Andhra Pradesh,**Mobile :** 9963133360,**Email:** efghabcd767@gmail.com **Institution address** : S R M Institute of Science and Technology ,ramapuram campus Chennai-89 Tamil Nadu.,India, **Branch**: **B.tech/cse Reg.no**:RA1711003020750

Author 4 Name: Bhargava reddy, Address:1-c114,patha oour mundalapadu, penugranchiprolu,Krishna, Andhra Pradesh **Mobile:**7993656162, **Email:** madhubhargava22@gmail.com **Institution address** : S R M Institute of Science and Technology,ramapuram campus Chennai-89 Tamil Nadu.,India,**Branch**: **B.tech/cse, Reg.no**: RA1711003020717