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Drowsiness Detection System

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ABSTRACT--

Drowsiness is a significant contributor to traffic accidents, leading to reduced alertness, impaired judgment, and slower reaction times. To address this safety concern, we propose a novel drowsiness detection system that employs a combination of physiological and behavioural cues to accurately identify drowsy drivers. The system employs a combination of computer vision, machine learning, and physiological signal processing techniques to analyse facial features, eye movements, and physiological data. It continuously monitors the driver's facial expressions, head movements, and gaze patterns using a high-resolution camera. By analysing these visual cues, the system can detect subtle changes in the driver's facial appearance, such as drooping eyelids, yawning, and head nodding, which are indicative of drowsiness. The proposed system is designed to provide real-time drowsiness detection, enabling timely interventions to prevent accidents. It can be integrated into vehicles or used as a standalone device, offering a practical and cost-effective solution for enhancing road safety. By leveraging multiple modalities of data and employing sophisticated machine learning techniques, our drowsiness detection system aims to significantly reduce the number of drowsiness-related accidents, improving the safety of our roads and saving lives.

Keywords-- Machine learning, Facial features, Eye movement, Driver drowsiness, Fatigue detection, Road safety, Driver monitoring system, Vehicle safety, Accident prevention, Real-time monitoring, Driver alertness.

1. INTRODUCTION

Driver drowsiness and fatigue are one of the most common reasons for accidents. The number of fatalities due to such accidents is increasing worldwide each year. This paper aims to lessen the number of accidents due to driver drowsiness and fatigue. This will in turn increase transportation safety. Driver drowsiness detection is a technology in vehicles that is useful in preventing accidents and saving the lives of drivers when they are getting drowsy. This project uses computer vision for the detection of drivers' drowsiness. With the constant improvement and novelty in technology, there is an advancement in transportation modes. Our dependencies on it have started increasing at a high rate. It has greatly affected our lives in many ways. Considering any social status, there are some rules which should be followed by any vehicle driver. One is to stay alert and the other one is being active while driving. The existing technologies to detect driver drowsiness are either very costly systems that apply to the high-end car models or systems that are affordable but are not robust. [1]

The effective count of showing cars and automobiles running on the road is constantly increasing in advanced countries. The problem with the increase in the use of cars and vehicles is that it furnishes an increase in the number of road

accidents. Reasons for these road accidents are highway traffic, over speeding, use of mobile phones while driving, drunk drivers, and drowsiness of the driver [8]. Drowsiness is defined as the middle stage between wakefulness and sleep. As the research, in India in 2018, 1.51 hundred thousand lost their lives in roadway disasters due to over speeding of vehicles and sleepiness [9]. Hence drowsiness prevails as a primary source regarding road disasters. Effective count of accidents that occurred were 4,67,044 and deaths recorded were 1,51,417 and caused injuries to 4,69,418 in 2018. An average of 1280 accidents and 415 deaths occurred were every day in 2018. The WHO Global Report on Road Safety says that India ranks 1st in the world for road accidents in 2018.

India accounts for almost 11% of the accident recorded in the world. The working-age groups from 18-60 years were almost as high as 84.7% of total deaths in road accidents. The total no of males and females contributed to 86 % and 14% respectively in road accidents. But research shows that 50% or more of road accidents are due to drowsy driving. The major contributor of the road accidents is lack of sleep as it appears in all deaths and fatal injuries occurred in road accidents.

In this paper, a module for eye detection is presented to decrease the figure of accidents triggered by driver tiredness and thus improve road safety. This approach handles the automatic discovery of driver drowsiness based on face recognition using our cascade models. It is estimated that vehicle collision results in an annual loss of $20 billion in India. The expenses associated with this figure are collision victim, property damage and administration expenses. All these aspects guided to the improvement of Smart Transportation Systems (STS). STS contains driver support methods like Traffic Jam Assistance, Cruise Control, Pedestrian Detection Systems, Intelligent Headlights, etc. The major road accidents occur because of drivers' reckless behaviour and it results in loss of human life.

In order to reduce the consequences of driver abnormalities, a scheme for malfunction monitoring has to be ingrained with the vehicle. The real-time finding of these behaviours is a serious matter concerning the design of advanced safety systems in vehicles. This paper concentrates on a driver abnormality detection system in STS on the automotive sphere. Fig. 1 depicts the number of accidents due to fatigue and hours of driving.[2]

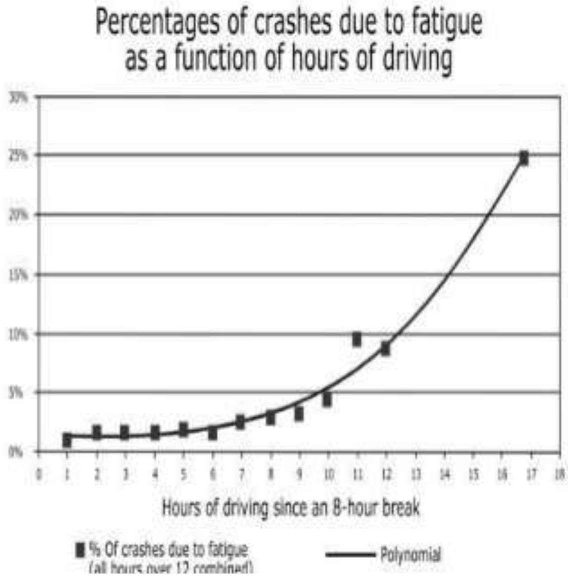


Fig.1 Correlation Between Fatigue & hours of driving.

2. BACKGROUND RELATED WORK LITERATURE REVIEW

Nivetha S., Agilandeeswari Loganathan, Tirthankar Chakraborty, and Vikash Chand [1], proposed developing a deep learning model capable of using input from a camera in real-time to detect drivers' drowsiness levels. This would involve extracting features from facial frames, such as eye and mouth coordinates.

Yaman Albadawi, Maen Takruri, and Mohammed Awad [2], highlight recent challenges in driver drowsiness detection, assessing the practicality and reliability of four system types. They also explore future trends in the field.

Inakollu Kumar, Vipul Agarwal, and Munnangi Siva Reddy [3], aim to detect driver drowsiness using Python programming language and the Haar training algorithm. Their approach involves identifying driver's eye movements by capturing images.

Mahek Jain, Bhavya Bhagerathi, and Sowmyarani C N [4], utilize the Eye Aspect Ratio (EAR) to compute the ratio between horizontal and vertical eye landmarks for drowsiness detection. Additionally, they calculate a YAWN value based on the distance between the lower and upper lips, employing a threshold value for yawn detection. Furthermore, they implement an eSpeak module for issuing voice alerts when the driver is drowsy or yawning.

Varun Chaudhary, Ziyad Dalwai, and Vikram Kulkarni [5], employ a Computer Vision approach with Support Vector Machine (SVM) to develop an innovative driver assistance system, aiming to enhance road safety through advanced technological solutions.

Yuvraj Suryavanshi and Sushma Agrawal [6], utilized a camera for real-time drowsiness detection, employing Local Binary Pattern for facial detection and Haar cascade for eye detection. Additionally, a custom eye blinking file is crafted for blink detection, while AdaBoost is applied to monitor eye movements concurrently.

Jagendra Singh [7], introduced a drowsy eyes detection module utilizing 68 key points for facial region detection. This novel approach assesses the driver's state by using these facial regions as key points, achieving an impressive accuracy rate of up to 92.5%.

3. TECHNOLOGY USED

A. Python:

Python language is based on OOPs concept, it is easy to understand and suits best when working with Artificial Intelligence.

B. OpenCV

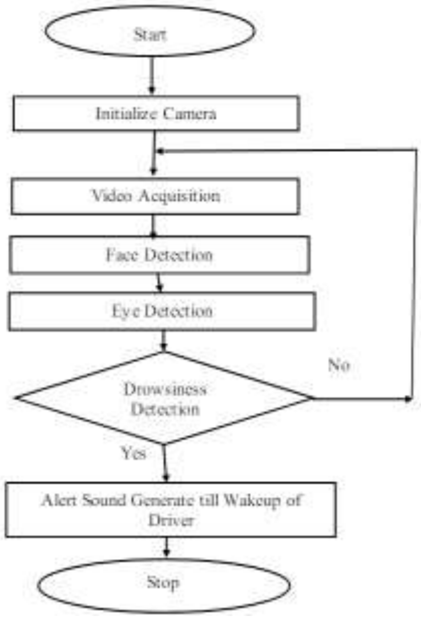
OpenCV is short for Open-Source Computer Vision Library. OpenCV was basically written in C++ but now these features can be used in other programming languages as well. Python is one of them. That can sound accurate to Face Detection and it is. An image in OpenCV is stored in the form of an array of pixels which are easy to access and manipulate using its own functions or using Imutils along with OpenCV. The grayscale image is being used to perform processing in our project. The project uses the Imutils function along with the OpenCV to get the frames from the video and then converting the frames into grayscale. A grayscale image is made of 8 bits per pixel. In other words, it can contain 256 variety of shade at a single-pixel location. The 0 pixels will show us the area of black colour while the other 255 depicts the white. The image below is a sample of a grayscale image that is shown in the form of an array.

C. Dlib

Dlib Library is used to map out the coordinates of a face from the 68 (x-y) coordinates. The reference pixels in the image start from 1 on the top right side of the face and ends and 68 on lips. Fig.3. below shows the Dlib coordinates.

4. PROPOSED WORK

The proposed work uses a behavioral-based approach to intercept the sleepiness of the driver in real-time. Drowsiness detection of the driver is achieved by video capturing in real-time. The computer vision library of Python is used to implement the algorithm. Methodology for Drowsiness Detection in the form of a flowchart is given in Fig.1.



As shown in the flow chart, the camera continuously monitors the driver's state by capturing his/her video. The system's camera captures video at a high definition. The time sleep is set to 1 second to detect the drowsiness of the driver with sound buzz at an instant. The drowsiness detection process will continue until the vehicle is being driven. The sound will buzz until the driver is fully awake in real-time. This is confirmed by the system which keeps taking input of the driver's face till the driver is fully awake. The methods for face, eye, and drowsiness detection are explained in the following sections.

A. Face Detection

Face spotting live is achieved by using the Local Binary Pattern Algorithm. Local Binary Pattern (LBP) is achieved by using cv2.CascadeClassifier command of OpenCV library. Local Binary Pattern cascade classifier is combined with the Histogram of Oriented Gradients (HOG) descriptor used in computer vision for particular object detection. The image is divided into cells for the encoding of features. LBP uses 9 picture elements (3x3 aperture) at a time. The midpoint picture element is compared to each neighbourhood pixel in the aperture. These picture elements can be greater than, less than, or equal to the midpoint picture element. If the value of the nearby pixel is greater than the central pixel then it is assigned 1 and otherwise 0.

Hence this aperture translates into a picture element value that is 0 either 1 inside a forward or backward direction, and then pattern a binary number.

B. Eye Detection

Face detection is achieved by the Local Binary Pattern. After the face is detected now eye pupil is detected through the Haar algorithm. Haar algorithm uses the OpenCV libraries which detect eyes. The computer vision uses to preprocess the features of the Haar algorithm and has the inbuilt haar wavelets. The Haar wavelet's major property is the real-time detector of a precisely described object in a rectangle window frame. A haar algorithm has a property of adjoining parallelogram place on a described position now a detection aperture, sums upward effective image element potency within a particular place, including computing effective divergence connecting those aggregate used to identify subsection or the target of an image.

C. Drowsiness Detection

Adaptive Boost continues to deploy toward merge and study or boost a poor algorithm. The Custom Blink Cascade file uses the Adaptive boost (AdaBoost) algorithm together with Haar cascade. As the AdaBoost used to train the poor algorithm of the Haar feature algorithm. The AdaBoost algorithm is a merging of a poor (Haar feature) learning algorithm into a bulk quantity, this produces a powerful concluding solution about effective advance classifiers as a powerful classifier.

The drowsiness detection system is a real-time operating system use to detect the sleepiness of the driver at instant so no need of utilizing the available dataset. The proposed system has been tested on people for which 90% accuracy is achieved on people’s drowsiness is detected correctly. When the eye is closed for 1 second the drowsiness is detected then a sound will give buzz till the driver is not fully awake. When the driver is awake then the camera will continue to as it was capturing before.

5. CONCLUSION AND FUTURE SCOPE

In conclusion, this drowsiness detection system represents a major leap forward in road safety. By continuously monitoring driver alertness through techniques like eye movement tracking and physiological data analysis, the system can effectively identify the onset of drowsiness and warn drivers before impairment becomes critical. This technology, leveraging advancements in facial analysis and deep learning, has the potential to significantly reduce drowsy driving incidents, saving lives and fostering a safer driving experience for everyone on the road.

Since Drowsiness Detection is gradually growing and improving with the ease of latest technology to perform better functioning. Future related works to be mentioned are as:

- Alarms and Alerts: Future drowsiness detection systems integrated with ADAS may trigger alarms, adjust seats, or initiate semi-autonomous driving for responsive interventions.
- Dynamic Seat Adjustments: Integrated with drowsiness detection, seats adjust posture dynamically, using sensors to prompt the driver with subtle vibrations for alertness.
- Haptic Feedback on Steering Wheel: Drowsiness detection may use steering wheel haptics, providing gentle vibrations to alert drivers and enhance focus on driving tasks.
- Integration with Driver Monitoring Systems: Integrating drowsiness detection with driver monitoring systems enhances fatigue detection using cameras tracking eye movements and facial expressions.
- Data Fusion and Decision Making: ADAS integration needs careful data fusion, prioritizing safety. Future advancements focus on robust algorithms, minimizing false alarms and unnecessary interventions.

REFERENCES

[1] Mahek Jain, Bhavya Bhagerathi and Sowmyarani (2021) “Real-time driver drowsiness detection using computer vision” Proceedings of International Journal of Engineering and Advanced Technology (IJEAT), Volume-11 Issue-1

[2] Jagendra Singh (2020) “Learning based driver detection model ” 2020 3rd International Conference on Intelligent Sustainable Systems (ICISS), Thoothukudi, India, 2020, pp. 698-701

[3] Nivetha S., Agliandeeswari Loganathan, Tirthankar Chakraborty, Vikash Chand, “Study on Drowsiness Detection System Using Deep Learning”, 2023.

[4] Yaman Albadawi, Maen Takruri, Mohammed Awad, “A Review of Recent Developments in Driver Detection Systems”, 2022.

[5] Inakollu kumar, Vipul Agarwal, Munnangi Siva Reddy, “Image Recognition based Driver Detection System using Python”, 2022.

[6] Varun Chaudhary, Ziyad Dalwai, Vikram Kulkarni, “Intelligent Distraction and Drowsiness Detection System for Automobiles”, 2021.

[7] Yuvraj Suryavanshi, Sushma Agarwal, “Driver Drowsiness Detection System based on LBP and Haar Algorithm”, 2020.

[8] O. Khunpisuth, T. Chotchinasri, V. Koschakosai and N. Hnoohom,"Driver Drowsiness Detection Using Eye-Closeness Detection," 12th International Conference on Signal-Image Technology & Internet-Based Systems (SITIS), Naples, 2016, pp. 661-668, doi:10.1109/SITIS.2016.110.

[9] N. Borulkar, P. Pandey, C. Davda and J. Chettiar, "Drowsiness Detection and Monitoring the Sleeping Pattern using Brainwaves Technology and IoT," 2nd International Conference on I-SMAC(IoT in Social, Mobile, Analytics and Cloud), Palladam, India, 2018,pp. 703-706, doi: 10.1109/I-SMAC.2018.8653772.