A REVIEW ON AN DRIVER SLEEP DETECTION AND ALARMING SYSTEM

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***Abstract* — Road accidents have become more frequent as population is increasing. 20% of traffic accidents, according to research, are the result of drowsy drivers. Drowsiness turns out to be a significant issue for both the driver and other users of the road. Being sleepy turns out to be a serious problem for both the driver and other road users. A safety alarm system called the Motorist Drowsiness System warns the driver whenever he begins to feel sleepy.**

***Keywords*—Arduino nano, Sleep Detection, Bluetooth, Embedded Technology, Sensor.**

I. INTRODUCTION

Driver fatigue is a crucial factor in many car accidents. Recent statistics indicate that fatigue-related crashes cause approximately 1,800 fatalities and 96,000 injuries annually. The yearly death toll from traffic accidents has stabilised at 1.25 million worldwide, according to the WHO's global status report on road safety, which contains data from around 180 nations. A startling 70% of the 1.34 lakh fatal traffic accidents reported in India each year are attributed to tiredness.
The highway sees a lot of daytime and night-time traffic. Sleep deprivation affects long-distance travelers, bus and truck drivers, and cab drivers. Thus, driving when fatigued becomes highly unsafe. Distracted driving is the primary factor in most collisions. In India alone, there are about 500,000 accidents per year, according to a recent analysis. The cause of 60% of these collisions is drowsy driving.

II. LITERATURE REVIEW

An approach for a machine learning-based real-time driver tiredness surveillance system was proposed by K. Sudha, Neeraj Kumar, Kusum Tharani, and Ankita Anand [1]. In recent years, driver weariness has become a key factor in traffic accidents and fatalities. Fatigue and falling asleep behind the wheel are common contributors to fatal accidents. Thus, it has been a continuing research focus to identify driver weariness before any catastrophic circumstance occurs. Drowsiness detection techniques can annoy and divert drivers. Some have behavioral features that require incredibly expensive sensors. The proposed system by the author captures videos and image processing, recognizes the driver's face in each frame. Using face characteristics like the Eye Aspect Ratio (EAR) and Eye Closure Ratio (ECR) signs of sleepiness. Analyzed the mouth and eye regions only, failing to take other parts of the head and face into account when looking for blinks and yawns. They have several restrictions to drowsiness detection for practical systems; hence they are not accurate enough. This is because, among other actions, nodding off is a natural state in the human body. The procedure starts with recording the driver's footage and identifying their faces using facial recognition. Facial landmarks are then used to identify their eyes, and the alarm is then set off after checking for sleepiness. Importing libraries like OpenCV, NumPy, and Play sound requires RM software. In accordance with the needs, a straightforward system that includes video acquisition, face detection, eye detection, and drowsiness detection was created. To capture live photographs while the test is in progress, the system is coupled with an Android device. Android devices will sound the alarm if they detect sleepiness. As a result, it would be unnecessary to equip the car with numerous isolated equipment, such as a camera and a sound system, as the Android device would already come equipped with both functions. Additionally, this technique can be applied to taxi services, particularly those that cater to tourists, where the drivers frequently experience exhaustion and drowsiness due to long hours of continuous driving.

Ya. Ar Becerikli and Burcu Kir Sava presented a technique. Based on a Multi-Task Convolutional Neural Network, a Real-Time Driver Fatigue Detection System. In this methodology, a Multi-tasking Convolutional Neural Network (ConNN) model is proposed to detect driver drowsiness/fatigue. The driver's behaviour model makes use of eye and mouth characteristics. Driver weariness is tracked through changes to these traits. Unlike the studies in the literature, the suggested Multi-task ConNN model simultaneously incorporates mouth and eye information into a single model. Driver weariness is measured by calculations of the frequency and length of mouth and yawning sneezes, as well as the duration and percentage of closed eyes (PERCLOS) (FOM). In this study, the degree of driver fatigue is divided into three groups. The proposed model correctly identified fatigue on the YawdDD and NthuDDD dataset with an accuracy of 98.81%. Success of the model is proved compared. The Multi Task ConNN is made to recognise driver drowsiness via mouth and ocular traits. The driver's behaviour model is then developed using it. Additionally, information from the lips and eyes is combined into one model at the same time. The YawDD and Nthu-DDD video datasets are used in the Multi-task ConNN model, and the regions of the face, mouth, and eyes were determined using the dlib algorithm to determine whether the mouth is open or closed and the eyes are open or closed and labelled as "1" for opening state and "0" for close state.

Sandeep Kumar et.al [3] proposed a technique for "Early Identification and Detection of Driver Drowsiness by Hybrid Machine Learning." Support vector machines and image processing clustering techniques are used in the proposed approach for real-time classification and video editing, as well as analysis that pulls data from the required hardware. Numerous input variables have been utilized and evaluated with the algorithm. It was found that the recommended algorithm performed more accurately when the camera was at the ideal distance from the light source. But as the light level dropped and the distance to the camera grew, accuracy suffered. Overall, the segmentation detection rate was 100%. However, after taking into consideration a variety of circumstances, the total accuracy for recognizing emotions and gestures was 83.25%.

Pankaj Dadheech et.al [4] proposed a technique for “Fatigue detection using artificial intelligence”. This proposed approach makes use of a camera and begins by capturing the frame-by-frame, grayscale video stream that is used to search for face points. The eye coordinates that are subtracted when facial characteristics are detected are used to calculate the EAR (Eye Aspect Ratio), which is then tested for the predefined threshold value. The counter value rises if the threshold is lower. When the counter value rises over 15, the system will decide that probably the driver is tired, and the warning system will be activated. This convolutional neural network-based representation technique enables them to accurately classify the driver as being sleepy or not utilizing a number of automatic features. Latent relations are used in picture data to better represent raw data, and superior features are developed utilizing intelligence-based artefacts.

Wanghua Deng and Ruoxue Wu proposed a methodology on “Real-Time Driver-Drowsiness Detection System Using Facial Features.”. They proposed a cutting-edge technology based on face tracking and facial key point identification for determining the extent of driver weariness. To enhance the original KCF algorithm, they have developed a new algorithm and suggest the MC-KCF algorithm to monitor the driver's face using CNN and MTCNN. Based on facial key points, they define the detecting zones for the face. Additionally, they present a brand-new sleepiness evaluation technique based on the conditions of the lips and eyelids. Due to its rapid operation, DriCare is thus almost a real-time system. According to the trial findings, DriCare can provide stable performance and is adaptable to many situations.

Federico Guede-Fernandez et.al [6] proposed the Thoracic Effort Derived Drowsiness Index (TEDD) technique. It is based on alterations in the respiratory signal. The suggested approach analyses respiratory rate variability (RRV) to find drowsy individuals. Additionally, RRV is linked to bodily movements rather than a sleepiness indicator. Outside observers have evaluated the algorithm's performance, and validation tests are run in a driving simulator cabin. The system has a sensitivity of 90.3%, a specificity of 96.6%, and a Cohen's Kappa agreement score of 0.75. The suggested algorithm is an effective system to warn against driving while fatigued. This algorithm is based on changes in frequency. As a result, the signal is first compressed and filtered. The breath-to-breath frequency estimation is performed to determine how long has passed since the respiratory signal crossed. In RRV time series, smoothing is used to look for a series of peaks over an extended period. The driver is deemed to be sleepy, and an alarm is raised if the RRV rises beyond the threshold.

Duk Shin, Hiroyuki Sakai, and Yuji Uchiyama [7] suggested a real-time technique to verify the effectiveness of the Slow Eye Movement (SEM) algorithm for sleep-related mishaps. The Electrooculogram (EOG), which measures the amplitude and mean velocity of eye movement, has been used in this method. The threshold values for the suggested SEM algorithm were determined by considering participants in an auditory detection task with EOG measurement. The participants in a simulated car-following activity later showed how effective SEM detection is at reducing drowsy driving. The system has a 98.1% specificity and a 70.4% sensitivity. The proposed method indisputably demonstrates the effectiveness of SEM detection algorithms in reducing sleep-related accidents. The converter, filtered, and sampled EOG signal is used to convert the horizontal eye movement. Eye movement is evaluated along with the first derivative of the 60-point smoothing technique. The SEM's mean velocity and amplitude are calculated using the calculator. The comparator compares the value and categorizes it as SEM or Non-SEM at the end.

Hafeez Ur Rehman Siddiqui et.al [8] proposed a technique on “Non-Invasive Driver Drowsiness Detection System.” A non-invasive, non-wearable, non-camera-based driver sleepiness monitoring system is built and described that wirelessly extracts respiratory rates. Using an easily available, commercial, off-the-shelf, medically approved pulse oximeter device, the respiration monitoring system has been validated. The respiration rate monitoring apparatus is validated and then utilized to capture the driver’s respiration rates before and after driving. To create a structured dataset, the age, labels, and respiration per minute (RPM) were used. Machine learning models were trained and validated using the dataset. SVM, a machine learning technique, has a greater accuracy rate than other ML models developed for this article. This research offers empirical backing for the assessment and confirmation of UWB as a reliable way to detect driver tiredness based on respiration.

Wachiraporn Aiamklin et.al [9] proposed a methodology on “Light Sleep Detection based on Surface Electromyography Signals for Nap Monitoring”. They proposed a practical application of the EMG signal in this methodology for the automatic classification of sleep stages for power naps. For the classification of sleep phases 1 and 2, they provide time- and frequency-domain features. A high level of classification accuracy can be obtained by combining FMD and RMS. They utilized EMG-based power nap monitoring using the features and LDA classifier in order to reduce fatigue and instantly avert mishaps. To develop a nap monitoring device was the goal of this system. The EMG features were gathered using a hardware-software system, which was then utilized to train LDA algorithms for automated sleep stage 1 and 2 classifications that would wake up the napper and help reduce drowsiness.

Gauri Thakare [10] proposed a technique on “Drowsy Driver Detection and Alert System.” This research suggests a system that is small and offers quick processing in real time. The system employs both conventional and cutting-edge techniques, including machine learning, to deliver outcomes that are superior to those of earlier systems. Since they don't make drivers feel uncomfortable like intrusive methods do, nonintrusive notions are applied. This technique could prevent numerous deaths that occur every day because of accidents caused by micro sleep. The suggested system is suitable for use in autos because to its compact, power-efficient technology that delivers significantly faster processing and can operate in low light. This technology analyses video frames to determine ocular landmarks for the aim of identifying driver drowsiness. The system recognizes the driver's eye landmark and calculates the distance to determine whether the driver's eyes are open or not. The car's alarm system will be ON when a driver closes their eyes even for a moment out of sleepiness, helping to avoid accidents.

III. CONCLUSION

Different methods for detecting driver tiredness have been discovered after doing a literature review, and they employ various forms of data as input for their algorithms. Following a review of various options, it was shown that the most effective implementation of these techniques in automobiles may prevent many everyday accidents caused by drowsy driving. According to the processed signals, which include physiological signals, face traits, and driving patterns, the presented and detailed methodologies are split into three classes. Accuracy, dependability, intrusiveness, and hardware requirements were reviewed along with the benefits and drawbacks of each class of approaches.

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