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DRIVER DROWSINESS DETECTION ALERTING USING IOT

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ABSTRACT

In recent years, detecting drowsy drivers has become a critical measure to prevent road accidents globally. This study aims to develop a smart alert system for intelligent vehicles that can automatically detect and mitigate the effects of driver drowsiness. Since drowsiness is a natural condition influenced by various factors, it is essential to design a robust alert mechanism to prevent accidents. This paper presents a drowsy driver detection system that utilizes Video Stream Processing (VSP) to analyze eye blinks through the Eye Aspect Ratio (EAR) and Euclidean distance of the eye. A face landmark algorithm is employed for accurate eye detection. Upon detecting driver fatigue, the IoT module sends a warning message with collision impact and location information, while also issuing an alert via a voice command through the Raspberry Pi monitoring system.

I.INTRODUCTION

Driver fatigue has been the main issue for countless mishaps due to tiredness, tedious road condition, and unfavorable climate situations [1]. Every year, the National Highway Traffic Safety Administration (NHTSA) and World Health Organisation (WHO) have reported that approximately 1.35 million people die due to vehicle crashes across the world. Generally, road accidents mostly occur due to inadequate way of driving [2]. These situations arise if the driver is addicted to alcohol or in drowsiness [3]. The maximum types of lethal accidents are recognised as a severe factor of tiredness of the driver. When drivers fall asleep, the control over the vehicle is lost [4]. There is a need to design smart or intelligent vehicle system through advanced technology [5]. This paper implements a mechanism to alert the driver on the condition of drowsiness or daydreaming. A camera monitors the driver' eye

blinking, eye closure, face detection, head posture, etc. with face landmark algorithm and Euclidean distance in the behavioral-based approach. These characteristics help to measure driver fatigue and instantly alert him with the help of voice speaker and forwarding an e-mail to a person (owner of vehicle) who can make him conscious [6]. An e-mail is being transmitted to a destination using IoT module, which relies on wireless transmission [7, 8]. But, the proposed system is being integrated by a credit card-sized computer known as Raspberry Pi3 and Pi camera which can trace an eye movement [9] thereby monitoring intensity of collision effects that happen at the time of accident and alerting the emergency ward of the hospitals or owners that are nearby to the accident spot along with GPS location of the accident [10, 11].

II. LITERATURE REVIEW

1. Drowsy Alert System Designed Using Electroencephalography (EEG), Electrocardiography (ECG), Electrooculogram (EOG), and Electromyogram (EMG) Algorithm

Budak et al. [21] designed a drowsy detection system through EEG technique which is designed with various components like AlexNet method, VGGNet method, and wavelet transform algorithm. This process effectively analyses the state of sleepiness using the brain indicator signal (EEG), camera, and sensors that are activated with the help of machine learning method to alert drowsy driver. Hayawi and Waleed [22] proposed a method to observe drowsiness through signal of Heart Rate Variability (HRV) which is obtained using EEG sensors. Hayawi and Waleed [23] established an intrusive method for measuring eyeball movement using EOG technique to construct a fatigue alert system that is also embedded with an Arduino controller board with *K* Nearest Neighbors (KNN) classifier to improve the percentage of accuracy. Song et al. [24] proposed a system to identify the fatigue of driver through the movement of muscular skin of eyes which is processed using EMG sensors with the help of a human machine interface. Similarly, the closure of eyelids and muscle part movements are also observed through the EMG sensors signals that function with the help of ESP8266 to provide or monitor the drowsy data on the Internet, which is designed by Artanto et al. [25]. Ma et al. [26] designed a driving fatigue detection system by measuring the EEG signals. It

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provided a robust platform for detecting drowsiness which is based on a deep learning process to find the accuracy of fatigue through EEG signals. But the deep learning process is structured through a principal component analysis network (PCANet) that preprocesses EEG data to create accuracy of detection. This process was tested in small sample size and offline mode, but it violates the accuracy in a large population of samples in real-time situations. Due to that reason, the IoT module is used to test online or offline in large sample sizes. Ma et al. [27] proposed an efficient application for the detection of driver fatigue through facial expression. Here, the facial movement is observed by deep learning of multiblock local binary patterns (MB-LBP) and AdaBoost classifier. But it is also used to accurately and quickly detect drowsiness with the help of a fuzzy inference system. When the driver wears a glass, then the accuracy of detection is decreased. So IoT modules are used to make it more intelligent and to improve accuracy level of fatigue detection.

2. Fatigue and Collision Alert System Using Smart Technique

Chen et al. [28] implemented a smart glass to detect fatigue. The rear light of the vehicle is automatically flashed with a message being sent using the IoT module or cloud environment. Kinage and Patil [29] proposed a system to detect the drowsiness using eye blinking sensors and any accidents or collisions that happened; then, the vibration sensor was integrated with heart rate measurement sensor for forwarding alert message to the authorized user. So, it is also attached to the GPS and GSM device for tracking the location and transmission of message. Siva Reddy and Kumari [30] introduced a system to control cause of unconditional mishaps using Arduino board with sensors which operated through camera. But, it is an efficient system with less estimation cost for construction of it. Jang and Ahn [31] implemented a system to detect an alcohol addict and drowsy drivers through sensors, where these elements are integrated with the Raspberry Pi controller module. So, the IoT modules are also used to send messages for any abnormal driver activities, which are properly invigilated with the help of a webcam (image processing) and controller unit. A new process has been developed for regular vigilance of facial detection and eye blink state, which predicts the driver's drowsiness. In addition to extra sensors, voice

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recognition application and machine learning methods are used to enhance the process of alert [32].

In the existing system, the fatigue of the driver is calculated through the eye or facial movements, deep learning, FPGA-based, ECG or EEG or EOG, vehicle steering movement, etc. But the implementation of the IoT-based technique helps to smartly control the various issues of driver drowsiness by the automatic buzzing of alarm, easily tracing the mishap location, and warning to the owner by sending emails or messages.

Face and Eye Detection by Machine Learning (ML) and Deep Learning (DL) Algorithms

Jabbar et al. [2] proposed Convolutional Neural Network (CNN) technique of the ML algorithm to detect microsleep and drowsiness. In this paper, detection of driver's facial landmarks can be achieved through a camera that is then passed to this CNN algorithm to properly identify drowsiness. Here, the experimental classification of eye detection is performed through various data sets like without glasses and with glasses in day or night vision. So, it works for effective drowsiness detection with high precision with android modules. The algorithm of Deep CNN was used to detect eye blink and its state recognition as provided by Sanyal and Chakrabarty [12]. Saleh et al. [13] developed an algorithm of LSTM and Recurrent Neural Networks (RNN) to classify driver's behaviors through sensors. Ed-Doughmi et al. [14] analyzed the driver's behaviors through the RNN algorithm. It specially focuses on construction of real-time fatigue detection to prevent roadside accidents. This system formulates a number of drivers' faces, which works on multilayered 3D CNN models to identify drowsy drivers and provide 92 percentage acceptance rate.

III. PROPOSED SYSTEM

The proposed system here is designed to minimise the occurrence of countless mishaps due to the drowsy driver. Nowadays, fatigue of driver causes road accidents every now and then across the world. So, these activities should be required to automatically handle an implementation of smart alert system or vigilance in a vehicle which is an objective of this system. To analyze different behavioral or visual-based attitudes of the driver, face movement and eye blink are measured to study the

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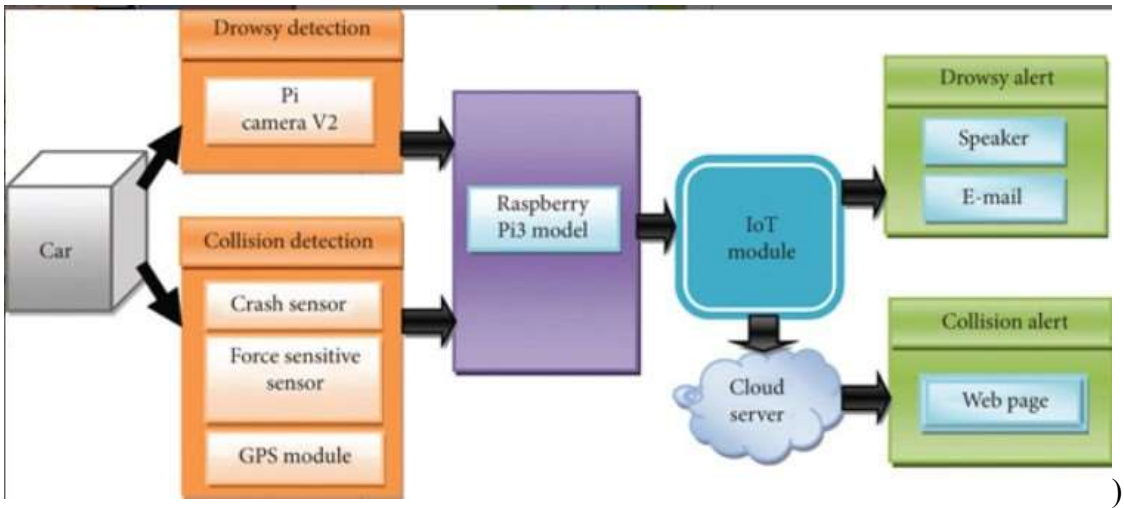
state of the driver. Here, eye blink is mainly focused to detect drowsiness of the driver. The threshold value of an EAR lies above 0.25 without any effect of exhaustion. When a driver automatically shuts down, then the threshold value of EAR falls below the given range. A threshold value of drowsy eye blink sample represents the number of video frames of the driver's closed eyes. If the consecutive counting frames increase above the range of the threshold value, then the drowsiness of the driver is detected. Here, a Pi camera is used to regularly record the total movement of an eye through which the threshold value of an EAR is calculated. A counter is also included in it for counting occurrence of frames. Suppose that it exceeded above a range of 30. In that case, a voice is activated by a speaker and a mail is automatically sent to an authorized person of the vehicle which is generally processed at the time of drowsiness detection. The described modules work properly through Raspberry Pi3 which is programmed in Python programming language.

The mail is received by an authorized one, who can alert the sleepy driver by ringing to him, if that drive is still not awake after turning on the voice alert message in the speaker. Thus, this process is successfully performed to detect a driver's drowsiness and detect the collision impacts due to braking of the vehicle through crash sensor and Force Sensitive Sensor (FSS). Due to the occurrence of the collision, the data collected from sensors and the location data are sent to an authorized person (owner) or any near hospitals with the help of a GPS module (Google Maps link.



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IV. PROPOSED METHODOLOGY

When the Pi camera model V2 is successfully integrated with Raspberry Pi3, it continuously records each movement of the driver's face. This proposed work specially focuses on behavioral measures of the driver with severity measurement of collision in following sections. The EAR is accurately calculated due to the use of

Raspberry Pi3 model B and Pi camera modules to make a persistent recording of face landmarks that are localized through facial landmark points. But the Raspberry Pi3 model B and Pi camera modules are securely processed due to the operating system of the controller and predictable secure shell (SSH) keys. The use of SSH host keys provides secure network communications and helps to prevent unauthorized communications or file transfers. The IoT-based application is being developed through the integration of some IoT modules like wireless sensors, GPS tracker, Pi camera, and smart code for detecting drowsiness of the driver. So the above modules are properly integrated with the Raspberry Pi controller module that intelligently controls and smartly warns a drowsy driver. The successful integration of IoT modules is robustly used to prevent the cause of mishaps and also warns the drowsy driver to avoid careless driving. The Internet of Things (IoT) is helping to manage various real-time complexities like handling complex sensing environments and also provides a very flexible platform to control multiple connectivities. The IoT module is a very reliable way of capturing images of the drowsiness of the driver as well as sending an alert message to the owner for awareness.

V. CONCLUSION

This research provides a robust method for detecting drowsiness of drivers and collision impact (severity) system in the present time. This method generally combines two different systems in one integrated system. But, the existing techniques are based on psychological or vehicle-based approach to detect drowsiness of drivers and also, the severity of collision is separately measured, but such technique is highly intruding as well as fully turns on the physical environment. So, the proposed system is used to construct a nonintruding technique for measuring drowsiness of the driver with severity of

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collision due to braking or mishap. This system's main components are the Raspberry Pi3 model B module and Pi camera module that are used for persistent recording of face landmarks that are localized through facial landmark points then to calculate EAR. However, if the calculated EAR value increases from the threshold range, then the eyes are kept open and no change in the state of system occurs. Similarly, if the EAR value falls from the threshold range, then the system urgently alerts using speech speaker and warning e-mail to the authority (owner) for extra supportive alertness to the driver. In addition, measurement of collision severity (impact) is made through implementation of sensors with the GPS module to properly track the location of accident thereby alerting the nearer medical service centre to serve emergency diagnosis.

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