ISSN No:-2456-2165

AI-Based Drowsiness Driver Alert System

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Abstract:- Driver drowsiness is a major cause for highway accidents on Indian roads that leads to loss of human life and severe permanent injuries. To counter-attack this situation a reliable driver drowsiness model which alerts and controls the driver before a mishap happens. We design this real-time project for Light motor vehicles and transportation trucks or cargo which are heavy-duty vehicles. This working system uses a Web camera that continuously monitors the driver in live mode which will keep a track to detect the driver's condition while driving. Once Drowsiness is identified the system alerts the driver through a speaker placed in the system and the relay slows down the vehicle. The system also constitutes alcohol sensor to detect if the driver is drunk or not and the temperature of the driver also is monitored using temperature sensor and a vibration sensor detects accident with a GPS device to locate where the accident has taken place and to update GPS location to the nearby hospital. We also use an ultrasonic sensor to prevent collision between vehicles on highway. An alert message will be generated to the front-end page which is a web-based app when the driver is not in the position of continuing his journey to reach his destination when drowsiness conditions are observed by the Webcam which is done with the help of Haar Cascade Classifier which is an effective and reliable object detection approach used in this project. The alert message will be sent to the webserver interconnected with IoT. The Raspberry Pi 3 will be having Raspbian OS which will be installed by NOOBs. Raspbian is a Linux system distribution.

Keywords - *Drowsiness Detection, Raspberry Pi 3b, Haar Cascade Classifier, GPS, Vibration sensor, Alcohol sensor and Temperature sensor, Ultrasonic sensor, OpenCV, Eye Aspect Ratio (EAR)*

I. INTRODUCTION

The production of vehicles in automobile industry is increasing, which has led to lot of highway accidents on Indian roads. The WHO identified drowsiness, alcoholism, and carelessness as the causes of road accidents. Road traffic accidents result in large number of deaths worldwide where an individual will experience a mishap leading to injuries. Hence there is a need for reliable AI-based system that the automobile industry can quickly adjust to minimize road accidents and Intelligent Transportation System is needed all around the globe. Machine learning and many AI based approach techniques and its algorithms are used to overcome accidents. Every year about 3 – 4 % of the country's GDP was invested in road accidents. The Real-time vision processing method is followed to estimate fatigue level and an alert system is used followed by main techniques of AI-based approach. The fatigue level is monitored continuously till the destination location is reached. We predefine images to the system and then the real-time working of this project starts. AI-based Drowsiness Driver Detection can be carried out by Intrusive and non-intrusive techniques. The technique involved in this approach is eye-blinking, yawn detection, opening, and closing of the eye is monitored all these will be kept under systematic review. All the luxury cars only will have AI based features and non-luxury cars and transportation cargo will not have these features so a need to develop an all-round model is necessary and highly necessary for the Indian roads which can save a lot of life and to mainly monitor public safety.

II. LITERATURE SURVEY

From reference paper [1] Smartphone apps have become popular today as they offer valuable functionality over ordinary voice services for our everyday lives. They offer a small but powerful computing platform where certain life- saving items can be coded into intelligent algorithms that have a profound effect on our everyday lifestyles. A significant life-saving application running on smartphones is a mobile fatigue detection device proposed in this research. A module for the Advanced Driver Assistance System (ADAS) is taken from the reference paper [2]. To decrease the number of accidents due to driver fatigue and thus increase the safety of transportation. This system deals with the automatic detection of driver drowsiness based on visual Artificial Intelligence and information. [1,2]

To reduce the risks of drowsy drivers, many approaches have been developed this reference from paper [3]. The recent research on the identification of drowsy drivers, in particular changes in eyes and facial features.

This paper will also discuss the capturing aspects of natural gestures, driver reactions, actions, and task environment associated with sleepiness. To assess the driver's drowsiness or distraction level, most current approaches to visual identification of non-alert driving patterns rely either on eye closure or head-nodding angles is taken from reference paper [4]. The Visual characteristics such as eye index (EI), pupil activity (PA), and HP are used in the proposed scheme to derive crucial information regarding a vehicle driver's non-alertness. From the ratio of pupil height and eye height, EI determines whether the eye is open, half-closed, or closed. Support Vector Machine (SVM) classifies a series of video segments into the warning or non-alert driving activities. [3,4]

The main signs of fatigue behavior are eye closing, yawning, head tilting. The purpose of the reference paper is to recognize these symptoms to improve road driving conditions. Such signs are monitored by two cameras. This paper proposes a comprehensive framework that collectively senses facial gestures, head tilting, and lane departure for fatigue. The purpose of the reference paper [6]. To devise a way of alerting drowsy drivers. The use of the Raspberry Pi module to represent the degree of drowsiness in drivers was a requirement for this paper. The amount of head tilting and eye blinking was used to access whether a driver felt drowsy or not. This provided a very good 99% accuracy for eye and face detection. [5,6]

The proposed Driver Fatigue Detection System aims to track the driver s alertness to prevent them from falling asleep while driving from the reference paper [7]. This proposed system uses the Haar Cascade classifier feature which provides a better-expanded training set that easily identifies changes in the face of the driver. To accurately provide the target's location and monitor eyes according to the strength, shape, and size of the pupils, a correlation matching algorithm is used. In this discussion from reference paper [8]

This algorithm from reference paper [10]. It is a proposed system using ML (machine learning) and image processing techniques to strongly enhance the robustness of blink detection as an important part of a driver fatigue monitoring system. The contribution of this work includes complementary algorithms that exploit different information in each image/frame to arrive at a more robust estimation of the driver blink rate along with their concurrent implementation on an embedded system achieving real-time requirements. This is about the Real-time, Grayscale simulation system that will have to detect driver drowsiness by image processing from reference paper [11].

An RGB image needs 24bits for each pixel. However, the system needs only about 8bit for each pixel. The system only demands one-third of the memory while using a color image. Using this we can find the region of concern in a good amount of time and with high accuracy. [10,11]

The second class of these techniques is taken from a reference paper [12]. It employs data collected from physiological sensors, such as Electrooculography (EOG), Electrocardiogram (ECG), and Electroencephalogram (EEG) data. This technique is the most accurate method, it results in an accuracy rate of over 90%. The last technique is Computer Vision, which is based on facial feature extraction. This approach using binary classification Convolutional Neural Networks (CNNs) methods have greatly produced good performance and accuracy. The drowsiness detection of the driver's eye can also be done by image processing techniques which are taken from the reference paper [13].

In the second step, we apply several artificial techniques like fuzzy logic, the neural network, detecting the various movements of the body. After sunset can cause problems in reading the images due to the non- availability of sunlight. In the future implementation of the infrared light source could be a better solution for the lack of light after sunset. [12,13]

The proposed system from reference paper [14]. It alerts their current state of fatigue and the driving time since the last break offers adjustable sensitivity and, if a warning is given, indicates nearby service areas using the COMAND navigation system. In this paper, we describe a real-time safety prototype that controls the vehicle speed. This project helps to detect driver drowsiness and fatigue level based on continuously monitoring eyes done by DIP (Digital Image Processing) algorithms.

Machine learning predicts drowsiness by using facial and eye-blink recognition technology taken from the reference paper [17]. A CO2 sensor chip detects additional drowsiness and fatigue level. Speech recognition technology allows the driver to request their preferred music or make a call to which brings them out from the state of drowsiness and keeps them active. [16,17]

This method uses a 5-MP Raspbian camera that captures the driver's face and eyes and processes the images to detect the driver's fatigue. On the detection of drowsiness, the programmed system alerts the driver and keeps him active in the run. The proposed method constitutes of various stages to determine the wakefulness of the driver. The warning message is generated the blink duration and eye aspect ratio of the driver are monitored by the Haar Cascade which is a reliable object detection approach mentioned in the reference paper [18].

III. METHODOLOGY

The drowsiness and fatigue condition of the driver is systematically monitored in various ways has per the model.

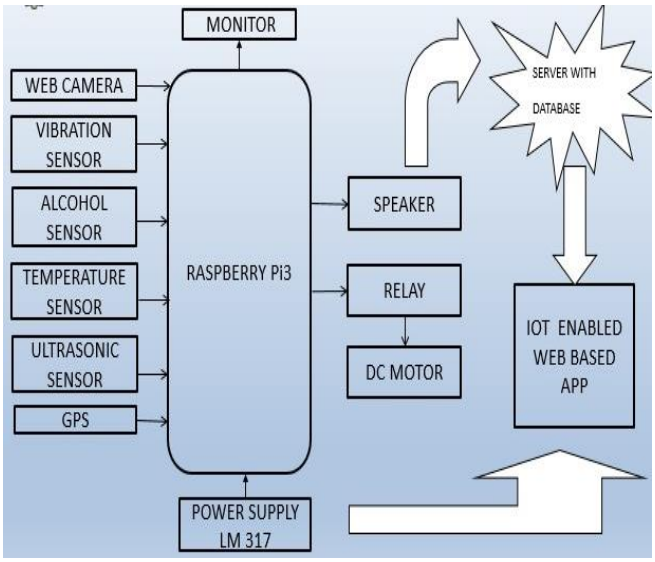

Fig.1: Overall block diagram

Features:

- Update the status of the web app.
- Detects the driver is sleeping or not.
- The relay slows down the vehicle as soon as the driver is found drowsy.
- GPS updates the location to the server if there is an accident detected.
- The alcohol sensor placed detects if the person driving the vehicle has consumed alcohol and updates it to the web app.
- All the activities and movements will be kept on track till the destination is reached.

WEB CAMERA

Fig.2: Web Camera

Web Camera is attached to the Raspberry Pi slot to stream and capture images in real-time. The Camera module is a portable lightweight camera that supports Raspberry Pi. It feeds or streams an image or video using the real-time protocol. It is normally used in image processing, machine learning or surveillance projects, video broadcasting, and live recordings.

Raspberry Pi 3B

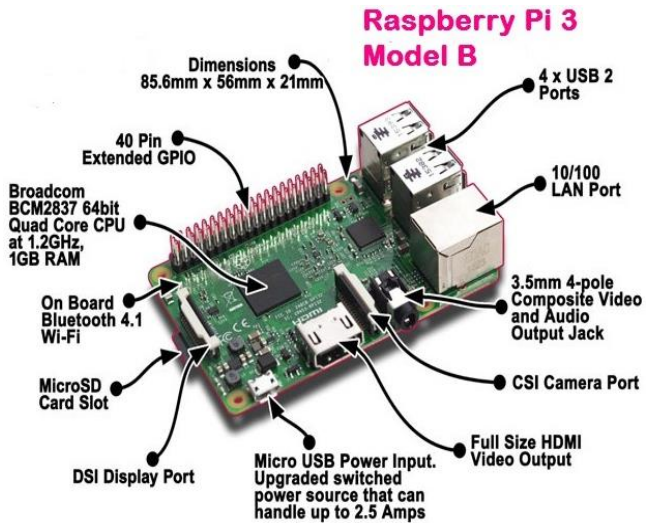

Fig.3: Raspberry Pi 3b

Raspberry PI itself acts a mini computer fetches all instructions and controls flow of the code 1 GB ram.

The basic features include:

- 100 Base Ethernet
- 17 GPIO helps in connecting directly to electronic devices used for a particular model.
- GPIO pins of Raspberry Pi work with 3.3V logic levels

The Raspberry Pi runs on Linux and the OS supported is Raspbian OS which is based on Debian is an open-source platform.

OpenCV

This is an open-source computer vision and machine learning software library. To initiate the program execution, it will import a few libraries like NumPy, OpenCV. OpenCV is a software toolkit for processing real-time image and video, as well as providing analytics, and machine learning capabilities. It has many applications such as facial recognition, driverless cars, machine learning, street vision, and more.

Haar Cascade Classifier

It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. Then we need to extract features from it where each feature is a single value obtained by subtracting sum of pixels.

ISSN No:-2456-2165

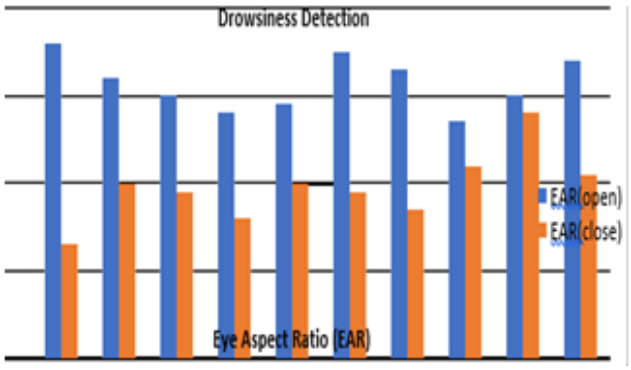

Fig.4: The result of fatigue detection for different samples

Fig.5: The result of opening and closing of the eyes which detect Drowsiness.

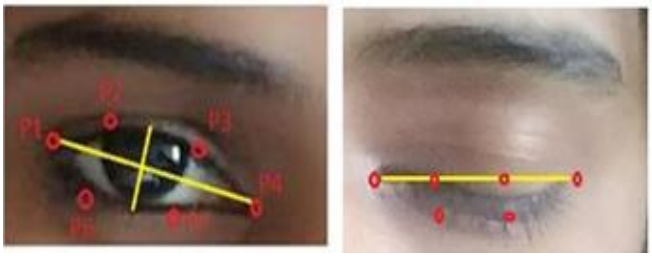

Fig.6: The land mark detection used for opening and Closing of the eye in detail.

IV. SCOPE AND CONCLUSION

At first, the alcohol sensor placed detects whether the driver is drunk or not and the temperature of the driver is also recorded using temperature sensor. The Fatigue state is detected by marking key landmarks on the face and the Euclidean distance between the eyes helps them with tracking in detail. Accurate eye detection and faces in every frame Drowsiness Detection Eye Aspect Ratio (EAR) will. The highest threshold is reached the driver will be given an alert by a loud warning from the speaker and the relay slows down the vehicle so that the driver will come back to his active state and if an accident is detected the GPS gives the location and an ultrasonic sensor used helps to calculate distance between the vehicles for radius set and alerts him to prevent collision used.

This forms the back-end part. The front-end part that is web page side (IoT) based web app is done and the front end and back-end his interconnected to IoT.

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