DMAS - Driver Monitoring And Alerting System

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Abstract: The face, a vital component of the body, communicates a lot. In this study, we present a system that, without fitting the drivers' bodies with gadgets, uses video images to determine the drivers' fatigue status, such as yawning, blinking, and duration of eye closure. We offer a novel face-tracking algorithm to increase tracking accuracy due to the inadequacies of earlier systems. Then, we assess the drivers' condition using these facial areas. The technology can notify the driver of drowsiness by fusing the features of the eyes and lips.

In case of a heart attack or other medical emergency, the heart beat tracker in this system detects the heart rate and alerts the emergency contact. Hence, the system lowers fatalities related to heart attack. The device has a safety button as well, which t he motorist can use to alert the control center if they are okay a nd don't need medical treatment. Therefore, it benefits solo tra velers. Python is being used to implement the system, along with open CV for machine learning.

Keywords— ***GSM (Global System for Mobile Communications), Arduino UNO R3***

I.INTRODUCTION

The National Highway Traffic Safety Agency (NHTSA) claims that sleepy driving is a serious issue. Around 1,500 fatalities attributed to drunk driving were documented in 2023, according to 100,000 police reports of collisions. These figures, however, are probably understated because tired driving contributes to more than 6,000 fatal crashes annually. According to reports, from 2014 to 2018, drowsy driving contributed to 1.8% to 2.2% of all injury crashes and between 2.1% and 2.5% of death crashes 3.

According to the fig, sleepy driving is a significant cause of road fatalities and accidents. In order to boost the safety of transportation, drowsiness detection is a crucial topic of research. Driver drowsiness is a widespread problem that can seriously impede a person's ability to respond to changing road conditions, resulting in collisions and even fatalities Researchers have created a range of drowsiness detection techniques to address this issue, including physiological, behavioral,and performance-based indicators.

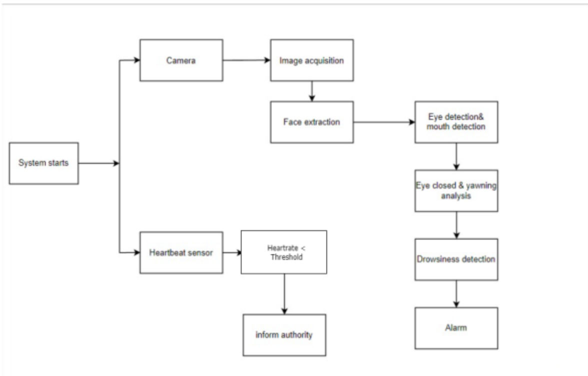

Fig 1.1: System Architecture

Monitoring variations in a driver's body temperature, heart rate, respiration rate, and brain activity are all examples of physiological measures. Monitoring head and eye movements, facial expressions, and yawning are examples of behavioural measures. Tracking a driver's response time to stimuli, vehicle speed, and lane position are all part of performance-based measures.

Machine learning algorithms that can assess data from a variety of sensors, including physiological, behavioral, and performance-based measurements, are one of the most promising methods for sleepiness detection. These algorithms can be trained to identify drowsiness-related patterns of behavior, and they can then be used to anticipate when a motorist is most likely to fall asleep at the wheel. Drowsiness detection is a significant field of study that might greatly increase the security of transportation. Researchers can contribute to the prevention of accidents and the preservation of lives on the road by creating trustworthy and accurate methods for detecting tiredness.

The government of India has put in place a number of measures to aid in reducing the number of road accidents brought on by drowsy driving, including public awareness campaigns, tougher drowsy driving laws and penalties, and infrastructure improvements to lessen the number of long and monotonous stretches of road where drowsy driving is more likely to occur. Nonetheless, despite these initiatives, sleepy driving is still a significant issue in India, and more has to be done to solve it. Several things, such as lack of sleep, working shifts, and some drugs, might contribute to drowsy driving. Drivers should be aware of the dangers of fatigued driving and take precautions to avoid it.

We put out a new technique to address this problem that does not require the drivers to have any gadgets attached to their bodies in order to detect their level of weariness. The technology assesses the drivers' state by using various facial regions. The technology can notify the driver of drowsiness by fusing the features of the eyes and lips. Additionally, it has a heartbeat tracker that detects heartbeat and alerts authorities in the event of a heart attack or other medical emergency. Also, it has a safety button that will send a message if the driver is safe and does not need medical attention.

II. Literature Review

Accurate eye status detection method is very important for fatigue detection. Fatigue drivers have higher levels of blinking rate and flickering span, so Ugra *et al.*[1] used Harr's feature classifier to find the eye's range and layout coordination to track the eye for fast preparation. Yassine *et al.* [2] offer a computer vision-based framework for detecting driver intoxication. They use a transfer learning technique to extract deep features from a driver's face image, build a feature vector, exclude irrelevant features, and fed a binary classifier to determine if there is drowsiness. In order to detect the driver fatigue, Wu *et al.* [3] suggests a system called DriCare, which leverages the MC-KCF algorithm to track the driver's face while enhancing the original KCF algorithm with CNN and MTCNN. Based on facial key points, they defines the detection zones for the face and the outcomes of the trial revealed that showed that DriCare achieved around 92% accuracy.

Wang *et al*. [4] offer a deep learning-based system for real-time driver sleepiness detection. The system classifies tiredness using a SoftMax layer and a convolutional neural network (CNN) to extract data from facial landmarks. Lee *et al.* [5] suggest a method relies on a support vector machine (SVM) classifier to identify sleepiness based on indicators including the length of time that the eyes are closed, the opening of the lips, and head nodding. Based on the real-time video stream of the drivers, Tanvir *et al.* [6] uses CNN to recognise a data and localise whether the eyes are open or closed. This object detection challenge is carried out using the MobileNet CNN Architecture with Single Shot Multibox Detector. A separate algorithm is used based on the output given by the SSD_MobileNet_v1 architecture. A dataset of 4500 images was used to train the SSD_MobileNet_v1 Network and 600 randomly selected images were used to test the model using the PASCAL VOC metric. Dos Santos et al. [7] used the support vector machine (SVM) and multi-layer perceptron (MLP) to identify local binary pattern (LBP) feature images. The model is verified on the ZJU dataset with an accuracy of 95%. Burke *et al.* [8] suggests machine learning techniques include support vector machines, convolutional neural networks and hidden Markov models for drowsiness detection.

Satish *et al.* [9] offers two strategies for identifying someone who is drowsy. Initially, the HOG image processing method extracts facial features and detects the retina of the eyes before threshold values are determined.,while the threshold value is established using the Aurdino module, which incorporates elastomeric sensors for real-time computation of driver hand pressure on the steering wheel. Zhuang et al. [10] have been proposed a CNN for determining the driver fatigue state. In this work, In this study, 68 key points on the face were found using the Dlib face key point detection method. They used a segmentation-based eye status detection mode (SESDM) network to estimate the degree of eye openness of each frame and they calculate the PERCLOS value based on the level of eye openness.

III. Methodology

We designed a device that is installed in autos in order to discover a solution for minimizing accidents caused by driving fatigue and poor driver health. These systems primarily include two functional components: (a) a camera that focuses on the driver's face and (b) a heartbeat sensor that detects and monitors the driver's heartbeat.

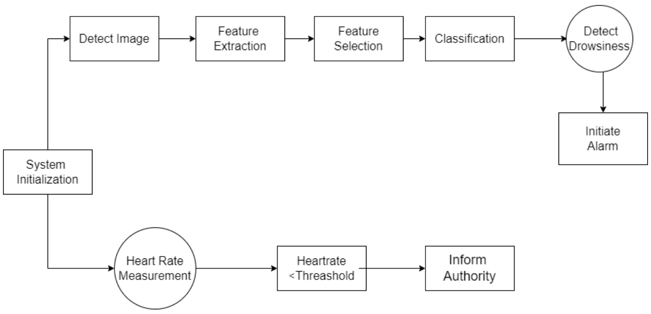

Fig 3.1: Data Flow Diagram

Using a webcam, the camera records real-time photos of the driver. The eyes and mouth are differentiated from this picture using tensorflow. These processed images are now being monitored in real time. When a driver is tired, the curvature of the eyelids reduces and yawning begins. This is determined by determining the aspect ratio of the eyes and lips. These are compared with the data set provided using the HAAR Cascade approach. If the results suggest that the driver is sleepy, an alarm is triggered.

The following function is the driver's cardiac condition. A heartbeat sensor is used to analyse it. A heartbeat threshold is established. If the person exhibits any indicators of a heart attack or stroke, his pulse rate falls below the threshold amount. In that case, the microcontroller Arduino Uno R3 identifies and an emergency message is sent to the control room through GSM. This message provides GPS-derived geographic coordinates. As a result, the authorities can assist the motorist who is in an accident.

III. HARDWARE CONFIGURATION

The hardware configuration consists of the following concepts.

A.FACE RECOGNITION

1. NORMAL C270 CAMERA

The Logitech C270 is a typical webcam made for computer use. It can record video at up to 30 frames per second and has a 720p resolution (1280 × 720 pixels). Moreover, it has an integrated microphone and automated light correction for better image quality in dim lighting. For video conferencing, live streaming, and capturing videos for YouTube or other platforms, people frequently use the Logitech C270. With the built-in clip, it may be set down on a desk or monitor or mounted on a tripod. The camera may be used with a variety of software programs, including Skype, Zoom, Microsoft Teams, and OBS Studio, and it is compatible with both Windows and Mac operating systems. In general, the Logitech C270 is a trustworthy and reasonably priced camera that offers adequate video quality for the majority of everyday use scenarios

B. HEARTBEAT TRACKER

1.ARDUINO UNO R3

The Arduino UNO R3 is a microcontroller board based on the ATmega328P. It has a 16 MHz quartz crystal, 6 analog inputs, 14 digital input/output pins, a USB port, a power jack, an ICSP header, and a reset button. The digital pins can be set up as inputs or outputs and can connect to other digital components, including sensors or Lights. You can read analog signals from devices like potentiometers or sensors that produce variable voltages using analog inputs. The Arduino IDE, a software development environment containing a code editor, a compiler, and a serial monitor for interacting with the board, can be used to program the Arduino UNO R3. Due to their simplicity of use and adaptability in a wide range of applications, from robotics to home automation, Arduino boards are popular among experts and hobbyists alike.

By interacting with a heart rate sensor and analyzing the sensor's output signal, an Arduino UNO R3 can assist in the detection of heartbeats. In order to measure changes in blood volume, heart rate sensors often use optical or electrical methods. Optical sensors use light to pass through the user's skin and look for variations in the light reflection brought on by blood flow. On the other hand, electrical sensors track changes in the skin's electrical conductivity brought on by sweat and other elements. The Arduino UNO R3's analog-to-digital converter can read the analog signal the heart rate sensor produces after it is attached to the board (ADC). The ADC transforms the analog signal into a digital value so that the board's microcontroller can process it. Using the output signal from the sensor, the microcontroller can then run an algorithm to determine the user's heart rate. Many mathematical methods, including peak detection and Fourier analysis, can be used to accomplish this. The heart rate value can also be wirelessly transferred to another device for additional analysis or shown on an output device, like an LCD screen. It's crucial to understand that even while an Arduino UNO R3 may detect heartbeats, it shouldn't be used for diagnosing or treating medical conditions. It is only meant to be used for educational and recreational reasons. Please visit a doctor if you have any concerns regarding your heart health.

2. GSM MODULE

A GSM (Global System for Mobile Communications) module is a sort of electrical gadget that enables connection with a GSM network. A GSM module can be used to bring cellular connectivity to a number of devices because GSM networks are widely utilized for mobile communications worldwide. A SIM card slot, a GSM modem, and an interface for attaching to a microcontroller or other device are the standard components of a GSM module. The GSM modem handles communication with the network, while the SIM card gives the module access to the GSM network. With a GPRS (General Packet Radio Service) or EDGE (Enhanced Data Rates for GSM Evolution) connection, GSM modules can be used to send and receive SMS messages, make and receive voice calls, and access the internet. They are frequently employed in systems like security systems, remote monitoring, and control. A GSM module must normally be connected to a microcontroller or other device utilizing a serial or USB interface in order to be used in a project. Then, using software on the microcontroller or device, you can instruct the GSM module to do actions like making a voice call or sending an SMS message. It's vital to remember that GSM modules need a SIM card and a GSM network subscription to work. Also, there can be limitations and rules in place locally that apply to the use of GSM modules.

A heartbeat tracker can use a GSM module to communicate heart rate data to a distant location, enabling real-time user heart rate monitoring. A heart rate sensor can be connected to a microcontroller or other device, which is then connected to the GSM module, in order to use a GSM module in a heartbeat tracker. The microcontroller can process the analogue signal that the heart rate sensor generally outputs and utilize it to compute the user's heart rate. Once the heart rate has been determined, it can be sent to a distant device, like a smartphone or cloud server, using the GSM module. This makes it possible to monitor the user's heart rate in real-time even when they are not nearby the monitoring equipment. For further study, the heart rate data can either be saved on the microcontroller or on a different data logging device. This can reveal patterns in the user's heart health over time and point up potential problems or trends in their health.

3.GPS MODULE

A GPS module is a piece of equipment that uses signals from a group of satellites in orbit around the Earth to pinpoint its own location. The Global Positioning System, or GPS, is a widely used technology for location-based services and navigation. An interface for connecting to other devices, a microcontroller or other processing unit, and a GPS receiver are the standard components of a GPS module. The module's position, as well as other data like the current time and velocity, are calculated using the GPS receiver's ability to receive signals from GPS satellites. Many applications, including vehicle tracking, navigation systems, and location-based services, can make use of GPS units. They are frequently used to aid users in navigating and keeping track of their whereabouts during outdoor activities like hiking and camping. A GPS module must normally be connected to a microcontroller or other device using a serial or USB interface in order to be used in a project. Once the GPS data has been processed, you can use software on the microcontroller or device to do actions based on the current location, like displaying a map or setting off an event.

4.PULSE SENSOR

Real-time heart rate monitoring is done with the use of a pulse sensor, a particular kind of sensor. It usually operates by shining light through the skin and into the blood vessels using a light source, like an LED. Light is absorbed by blood as it circulates through the blood vessels, changing how much light is transmitted through the skin. These alterations are detected by the pulse sensor, which transforms them into electrical impulses so that the user's heart rate may be computed. Fitness trackers, smartwatches, and other wearable technology frequently use pulse sensors to track a user's heart rate while they are exercising.

They can be used in healthcare facilities to keep an eye on individuals receiving treatment or recovering from surgery. Pulse sensors come in a variety of forms, such as photoplethysmography (PPG) sensors, which measure blood flow using light, and electrocardiogram (ECG) sensors, which gauge the electrical activity of the heart. ECG sensors are normally more accurate and dependable; however, PPG sensors are frequently less priced and simpler to use.

The pulse sensor is applied to the user's skin and secured in place, usually on the wrist or finger. The pulse sensor's LED light shines light onto the user's skin. The skin's blood vessels absorb the light, and as blood flows through them, the amount of light that is transmitted through the skin fluctuates. The pulse sensor's photodetector transforms changes in the amount of light passing through the skin into an electrical signal.

In order to determine the user's heart rate, a microcontroller or other processing device processes the electrical signal. A linked device, such as a smartphone or smartwatch, receives the computed heart rate and displays it on a screen or sends it to that device.

5.SAFETY BUTTON

In the event of a potential heart attack, a safety button on a heart attack detector in a car can be utilized as an emergency feature to warn the officials or the driver's close relatives. A heart attack detector can be set up to examine the driver's vital signs and determine whether a heart attack is developing.

In the event that the heart attack detector detects that the driver is having a heart attack, it can sound an alarm to warn the other passengers and call for emergency assistance so that the patient can receive rapid medical care.
The safety button can be placed in an accessible spot for simple use, like on the dashboard or steering wheel, and can be made to be clearly visible and usable even under high-stress circumstances.

The heart attack detector's safety button can give an extra layer of security for drivers and passengers in the event of a medical emergency, potentially saving lives and lessening the severity of heart attacks.
Moreover, the safety button may be programmed to activate danger lights or bring the car to a safe stop without driver intervention. These elements may contribute to accident avoidance and lessen the possibility of driver and passenger injuries.

Overall, the employment of a safety button in a heart attack detector in a car can be a crucial safety feature that can aid in the preservation of life and the avertance of accidents. Drivers can stay safe on the road and reduce the risks of heart attacks while driving by having access to an early warning system and emergency response alternatives.

V. CONCLUSION

In recent times, the number of vehicles is increasing every day and so is the number of accidents. Other than Overspeed and accidents due to consumption of alcohol the major reason behind the accidents are the drowsiness of the driver and health issues faced by the driver. In order to reduce these types of accidents this system helps to detect drowsiness and heartbeat of the driver.
The driver's condition is monitored whole time when the person is driving. The camera that is fixed infront of the driver's position recognize the face part. The movements of face parts, that is eyes and mouth are focused in each millisecond. Measurable quantities like number of times of yawning, closing of eyes are used to detect whether the person is drowsy. If the result is drowsy the person will be notified using an alarm that is set inside the vehicle. The pulse sensor used to sense the heart rate of the driver will recognize when there is sudden change in the rhythm of heart beat. If the beat is more than a threshold value,

information will be passed towards nearest control room. This information can be used by the authority to save the life of person. This system not only helps in a health emergency but also in the state when the vehicle is hit or other life-threatening situations like the person's heart rate increases. This system also comprises with a safety button which he can use to inform the authority if he feels safe after a heart beat rate increasing situation.

This system not only helps in a fatigue or health emergency situation but in a life menacing situation.

This system will help save lives of many people and also reduce the damage that results when accidents occur. Thus, providing a safe journey to everyone.

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