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ACCUALERT: Virtual Driving Assistant

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Abstract: In the contemporary world of transportation, en- suring the safety of both drivers and passengers remains a paramount priority, given the staggering number of lives lost eachyear, totalling millions, due to vehicular accidents worldwide. Anoften-underestimated but critical factor contributing significantlyto these accidents is driver drowsiness. This project aims to address these pressing challenges by developing an integrated system that combines real-time driver drowsiness detection, accident detection, and precise location tracking capabilities. Utilizing cutting-edge technologies like facial recognition and GPS-based tracking, our system will proactively identify signs of driver fatigue in real-time [1], offering a timely alert to drivers to prevent accidents caused by drowsiness. Simultane- ously, the system will employ sophisticated accident detection algorithms, distinguishing between minor incidents and severe crashes, ensuring that appropriate responses are triggered swiftly. This comprehensive solution not only enhances road safety but also expedites emergency responses, ultimately saving lives and significantly reducing accidents on our roadways.

Index Terms: Drowsiness Detection, GPS, GSM, Accelerometer, Location Tracking

I. INTRODUCTION

Drowsy driving is an insidious problem that poses a sig- nificant threat on our roads, yet it often doesn't receive the attention it deserves. This issue is compounded by the lack of legal consequences for drowsy drivers, as well as the absence of effective detection devices. Consequently, the proportion of accidents attributed to drowsy driving is steadily increasing, putting countless lives at risk. When a driver becomes drowsy, a simple alert can often make a substantial difference in pre- venting accidents. Implementing more drastic actions, such as shutting down the engine, may result in potentially hazardous situations. Therefore, finding an accessible and effective so- lution to detect drowsy driving is of paramount importance. Detecting drowsy driving is essential, but it is equally crucial to detect accidents and promptly alert the emergency services while providing the vehicle's precise location.

Several existing systems address the critical issue of vehicle safety and accident detection through various innovative ap- proaches. One such system treats every moving vehicle asa node, employing RF modules to transmit alert messages, which are received by vehicles within the RF module's range. These received messages are then relayed to a central base station, creating a network for real-time communication inthe event of an accident. Another solution focuses on rapid accident detection and reporting by using a microcontroller. It minimizes the response time after an accident by pre-fetchinga designated emergency contact number. The system relies on a vibration sensor to detect accidents, which, though efficient, carries a risk of generating false alarms due to its reliance on a single sensor. Various systems employ different sensor technologies, such as Piezoelectric, Accelerometer, Pressure, and Tilt angle sensors, along with GPS receivers to monitor vehicle speed and detect accidents based on deviations in speed. [2] These systems use GPS modules to pinpoint the vehicle's location and transmit alert messages to emergency services via GSM modules. In a different approach, a system combines an eye blink sensor and an automatic braking systemto address drowsy driving. It monitors the driver's alertness and, if drowsiness is detected, initiates automatic braking to bring the vehicle to a halt. Some systems include an alcohol sensor to monitor the driver's blood alcohol content, further enhancing safety by addressing the issue of impaired driving. These existing systems reflect the diverse methods and sensor technologies applied to enhance vehicle safety and accident detection in various ways, contributing to road safety andpotentially saving lives.

Our project aims to address these pressing challenges by developing an integrated system that combines real-time driverdrowsiness detection, accident detection, and precise location tracking capabilities. In contrast to numerous existing systemsthat employ pre-trained classifiers, we have opted for a differ- ent approach by utilizing custom haar-cascade classifiers [1]. These classifiers have been developed using carefully curated datasets to enhance drowsiness detection. Additionally, weaddress practical concerns like varying lighting conditions andhead tilting, which can affect the accurate detection of eyeand mouth regions. By employing a high-resolution webcam, our system not only enhances accuracy and efficiency butalso offers the advantage of easy integration into any vehicle without obstructing the driver's view or requiring the use of wearable devices.

Also, by incorporating GPS-based tracking into the system, we can track the location of the vehicle involved in the accident and communicate with emergency numbers for rescue. This system can be used in any car or vehicle, making it accessible to a wider range of drivers, and thereby, contributing to enhanced road safety.

II. LITERATURE REVIEW

1) *Aadil Yaqoob Gakhed, Aishvarya C M, Pramod H, PramodN, Kavitha S S "Machine Learning System for Detection of Driver Drowsiness", 2021 .*

The primary emphasis of this paper's analysis revolves around the recognition of faces within images and the subse- quent generation of alerts upon the detection of drowsiness in an individual. Notably, it has exhibited remarkable precision, underscoring its capacity to identify drowsiness even whenthe person is wearing glasses and under challenging low-light circumstances. [1].

2) *Unaiza Alvi, Muazzam A. Khan, Balawal Shabir, Asad W. Malik, Muhammad Sher Ramzan "A Comprehensive Study on IoT Based Accident Detection Systems for Smart Vehicles," IEEE, 2020.*

Numerous approaches have been suggested in existing research to automatically detect accidents. These methods encompass crash anticipation through smartphone technol- ogy, vehicular ad-hoc networks, GPS/GSM-based systems,and diverse machine learning techniques. Given the alarming rates of fatalities linked to road accidents, the field of road safety requires extensive investigation. This paper offers a thorough assessment of different strategies employed for the prediction and prevention of road accidents. It underscores their advantages, drawbacks, and the obstacles that must be overcome to enhance road safety and preserve precious lives. [3].

3) *Nazia Parveen, Ashif Ali, Aleem Ali "IOT Based AutomaticVehicle Accident Alert System" IEEE, 2020.*

The notion of accident detection in the automotive industry is not a novel one, and significant strides have been made in enhancing this technology. This paper represents an effort to contribute to this field of technology. Their focus is on accident detection using accelerometers, as they play a crucial role in pinpointing the occurrence of an accident. When the accelerometer's x, y, and z parameters surpass predefined thresholds, it triggers a response, initiating the transmission of alerts through code execution. This approach enables swift accident location identification, and the accident's precise coordinates can be dispatched via GPS to emergency services for timely assistance. [2].

III. SYSTEM ANALYSIS

A. *Objective*

Our primary objective is to create a robust and precisereal-time driver drowsiness detection system by harnessingthe power of facial recognition and other pertinent data. By continuously monitoring key indicators, we aim to promptly identify signs of driver fatigue and prevent potential accidents.Another crucial objective is the integration of GPS-based location tracking into our system, allowing us to accurately track and record the vehicle's coordinates at all times. This capability not only enhances road safety but also ensures that emergency responders can quickly reach the accident scene, saving valuable time [4]. We also emphasize the importanceof designing a dependable alert mechanism. Our goal is to develop an alert system that effectively notifies the driver when signs of drowsiness are detected and immediately informs relevant authorities and emergency services in case of an accident, thereby streamlining response times.

B. *Problem Statement*

Drowsy driving is an alarming issue that poses a gravethreat to road safety. It often goes unnoticed and unaddressed due to the lack of adequate attention and effective detection devices. The absence of legal consequences for drowsy driversfurther compounds the problem, and as a result, the numberof accidents attributed to drowsy driving continues to rise, jeopardizing countless lives. While basic alert systems can help mitigate this issue by warning drowsy drivers, implementing more drastic measures, such as shutting down the engine, can lead to potentially perilous situations. Therefore, the critical challenge lies in developing an accessible and efficient solution to not only detect drowsy driving but also swiftly identify accidents and alert emergency services while providing the exact location of the affected vehicle. To addressthese pressing challenges, there is an urgent need for an inte- grated system capable of real-time driver drowsiness detection,accident detection, and location tracking. Such a system must not only mitigate the risk posed by drowsy drivers but also expedite emergency responses by promptly notifying relevant authorities and providing precise vehicle location data in the event of an accident.

This problem statement underscores the imperative of developing a comprehensive solution that enhances road safety, reduces accidents, and saves lives onour roadways.

IV. DETAILS OF HARDWARE AND SOFTWARE

A. *Hardware Requirements*

1) Raspberry Pi
2) Camera
3) Accelerometer
4) Location Module

B. *Software Requirements*

1) Python
2) React Native
3) Mapbox

V. SYSTEM DESCRIPTION

A. *Block Diagram*

Figure 1 is the block diagram of that describes our proposedsystem.

The components used in our system are Raspberry Pi, Camera,Accelerometer, GSM Module, GPS and Power Supply.

The Raspberry Pi uses the camera to monitor the driver's eyesand face. It looks for signs of drowsiness like yawning by a person and closed eyes for a long time. If the system detects that the driver is drowsy, it alerts the driver by sending an alarm or a message alert.

The accelerometer is used to detect sudden changes in acceleration, braking, and steering. [5] These changes can be indicative of an accident. If the system detects an accident,it will automatically call emergency services and send thevehicle's location through GPS. The GSM module is used to send text messages or make phone calls.

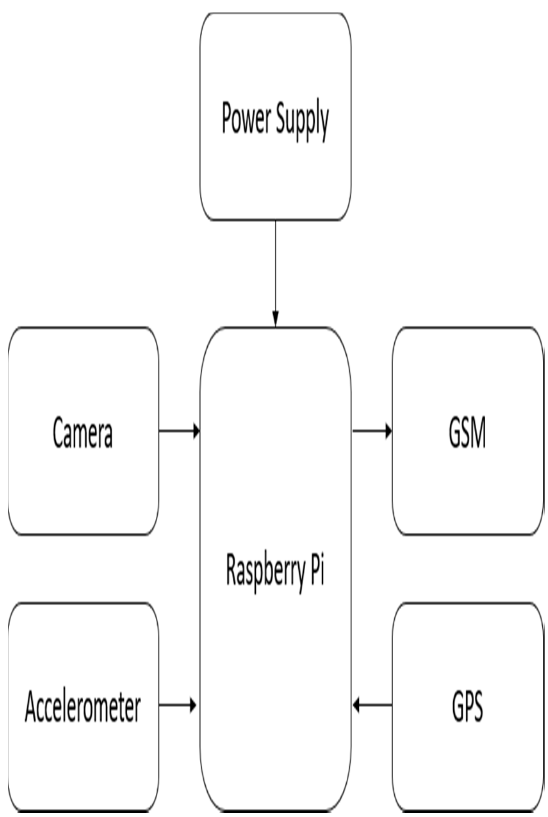

Figure 1: Block Diagram

B. Flowcharts

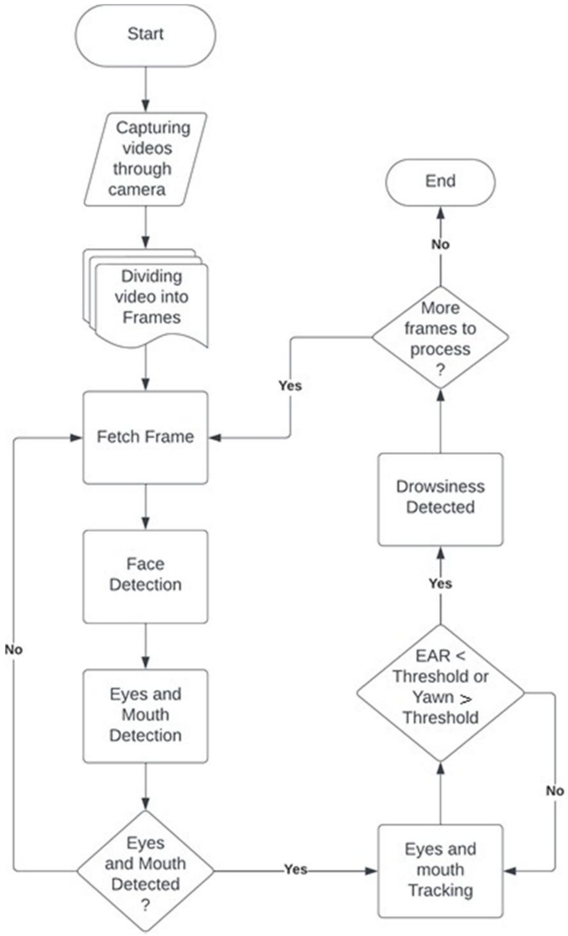

Figure 2: Flowchart for Driver Drowsiness Detection

Figure 2 is the systematic way of how our system works fordetecting the drowsiness of the driver by analyzing the eyes and mouth. It takes a video as input and outputs a drowsiness detection result. [6]

The system works as follows:

1) Capture video through camera: The system captures a video stream from a camera.
2) Divide video into frames: The system divides the video stream into individual frames.
3) Fetch frame: The system fetches the next frame from the video stream. Face detection: The system detects faces inthe frame.
4) Eyes and mouth detection: If a face is detected, the system detects the eyes and mouth in the face.
5) Eyes and mouth detected: If the eyes and mouth aredetected, the system proceeds to the next step. Otherwise,the system returns to step 3 to fetch the next frame.
6) Drowsiness detection: The system detects drowsiness by analyzing the eye aspect ratio (EAR) and yawn duration.
7) EAR < Threshold or Yawn > Threshold: EAR stands for
8) Eye Aspect Ratio. If the EAR is less than a threshold or the yawn duration is greater than a threshold, the system detects drowsiness. The threshold value for EAR is 3 andfor yawn is 20. Otherwise, the system does not detect drowsiness. [1]
9) Eyes and mouth tracking: If drowsiness is detected, the system tracks the eyes and mouth to refine the drowsiness detection result.
10) More frames to process: If there are more frames toprocess, the system returns to step 3 to fetch the next frame. Otherwise, the system outputs the drowsiness detection result.

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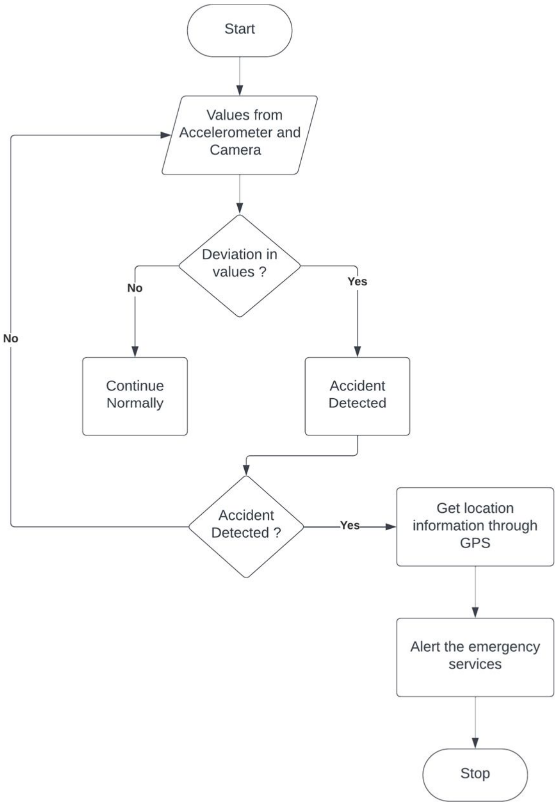

Figure 3: Flowchart for Accident Detection and LocationTracking

Figure 3 shows a flowchart for the system that detects deviations in values from accelerometer and cameras.
Here is a more detailed explanation of each step in the flowchart:

a) Read values from accelerometer and cameras: The systemreads values from the accelerometer and cameras. These values can be used to detect changes in the environment, such as movement, vibration, and light.
b) Check for deviation in values: The system compares the current values from the accelerometer and cameras tothe previous values. If there is a difference, the system determines if the difference is greater than a threshold.
c) Check if deviation is greater than threshold: If the difference in values is greater than a threshold, the system raises an alert. The threshold is a value that is set by the system designer. It is important to set the threshold at a level that is high enough to avoid false alarms, but low enough to detect real problems.
d) Continue normally: If there is no deviation in values, or if the deviation is less than the threshold, the system continues normally.

VI. RESULTS

Figure 4: Drowsiness Alert

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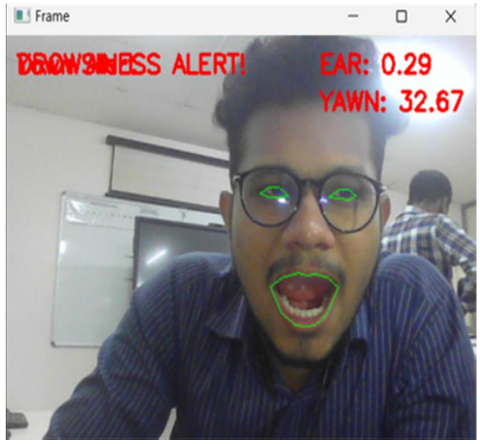

Figure 5: Drowsiness Alert with specs

VII. CONCLUSION

This project tackles the crucial issue of driver drowsiness, a major contributor to the millions of lives lost annually in vehicular accidents worldwide. For now, only the drowsiness detection is developed. By developing an integrated system that combines real-time drowsiness detection, accident detection, and precise location tracking using advanced technologies like facial recognition and GPS-based tracking, the project aims to enhance road safety. The system proactively identifies signs of driver fatigue, issues timely alerts to prevent accidents, and employs sophisticated accident detection algorithms to ensure swift responses. This comprehensive solution not only mitigates the risks associated with drowsy driving but also expedites emergency responses, potentially saving lives and significantly reducing accidents on our roadways. It under- scores the transformative potential of technology in addressing critical societal challenges, ultimately creating a safer and more secure transportation system for all.

VIII. FUTURE WORK

In terms of future developments, there are several potential avenues for enhancing this project. One area of focus could be expanding the system's capabilities to include a more comprehensive analysis of driver behavior, going beyond just detecting drowsiness. This could involve monitoring for distracted driving, aggressive behaviors, or other risky actions behind the wheel. Additionally, implementing a real-time feedback mechanism could provide drivers not only with alerts but also with valuable insights into their driving behavior, which could be used for training and improving overall road safety. Furthermore, incorporating crowdsourced data from similar systems in other vehicles could create a network of real-time information sharing on road conditions, accidents, and traffic, enhancing overall safety. Lastly, integrating environmental sensors to detect adverse weather conditions and adjusting the system's alerts and responses accordingly would be another valuable avenue for improvement.

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