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Vision Guard: Accident Prevention and Detection Device

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Abstract: *Road accidents are increasing day by day, and one of the main reasons behind the road accidents is driver sleepiness while driving,and the late emergency response system. Many times, accidents happen because the driver feels sleepy or is under stress during long driving hours and does not realise it in time. In many cases, after the accident, help does not reach quickly, which increases the risk to human life.*

This paper presents VisionGuard, a smart accident-prevention and detection device. The system works in two stages. In the first stage, it checks whether the driver is feeling sleepy or stressed by using a camera and OpenCV image processing. If the system finds that the driver's eyes are closed, it detect the driver is sleeping, it gives an alert through a buzzer and also reduces the speed of the vehicle(through the PWM signals).

In the second stage, if an accident happens due to another reason, like road damage or collision with another vehicle, the system detects the accident using the sensor. After that, it sends the live GPS location to family members, nearby hospitals, and police stations to save their lives.This system helps in both accident prevention and emergency response..

Keywords: Include Driver Drowsiness, IoT, OpenCV, GPS, GSM, Accident Detection

I. INTRODUCTION

Road safety is aconcern in today's world. Many people lose their lives in road accidents every year. One major reason is driver drowsiness. If the driver feels tired or sleepy while driving, it becomes difficult to respond on time, and this can cause accidents.

Most existing systems work only after the accident. For example, airbags and emergency buttons help after the collision, but they do not stop the accident before it happens.

To solve this problem, we developed **VisionGuard**, a smart system that works before and after the accident.

Before the accident, it monitors the driver continuously. After the accident, it automatically sends the location to emergency contacts.

This makes the system more useful and practical for real-world use.

II. PROBLEM STATEMENT

Road accidents are increasing day by day. One main reason is driver drowsiness and distraction while driving. Many drivers feel sleepy during journeys or lose focus due to stress, mobile phone use or fatigue. This reduces their reaction time. Increases the chances of accidents.

Another major problem is that current safety systems are not fully effective. Most existing systems only work after the accident occurs, such as airbags or manual emergency calls. They do not help in detecting driver sleepiness before the accident.

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- Also, in cases, emergency help does not arrive on time because accident information and location are not sent automatically.

Because of these problems, there is a need for a system that can both prevent accidents before they happen and send quick alerts after an accident occurs.

The main problem is that normal vehicles do not have a cost-effective system that can both prevent accidents and send emergency alerts automatically.

III. OBJECTIVES

The main objectives of this work are:

- To detect driver drowsiness using camera vision.
- To alert the driver in real time.
- To reduce vehicle speed automatically.
- To detect accidents using sensors.
- To send live location in emergency cases.
- To improve road safety using IoT technology.

IV. PROPOSED SYSTEM

The proposed system works in two stages.

A. Pre-Accident Stage

In this stage, we fix a camera near the dashboard so that it can keep watching the driver's face during driving.

The camera captures the face of the driver continuously.

Using OpenCV, the eye movement is checked.

If the camera detects that the driver is not opening their eyes for some time, it indicates that the driver may be feeling drowsy or sleepy.

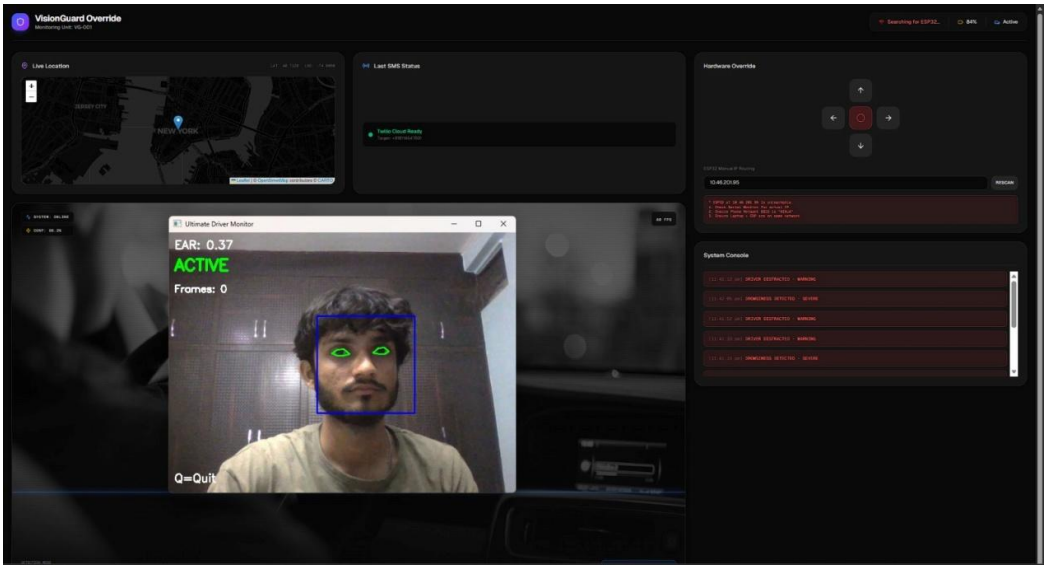
Then:

The buzzer starts beeping.

The Alert sound is generated.

Vehicle speed becomes slow through PWM control.

This helps in preventing accidents.



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B. Post-Accident Stage

If the accident happens because of another vehicle or road condition, the MPU6050 sensor detects sudden vibration or tilt.

After accident detection:

The GPS module gets coordinates.

GSM sends a message

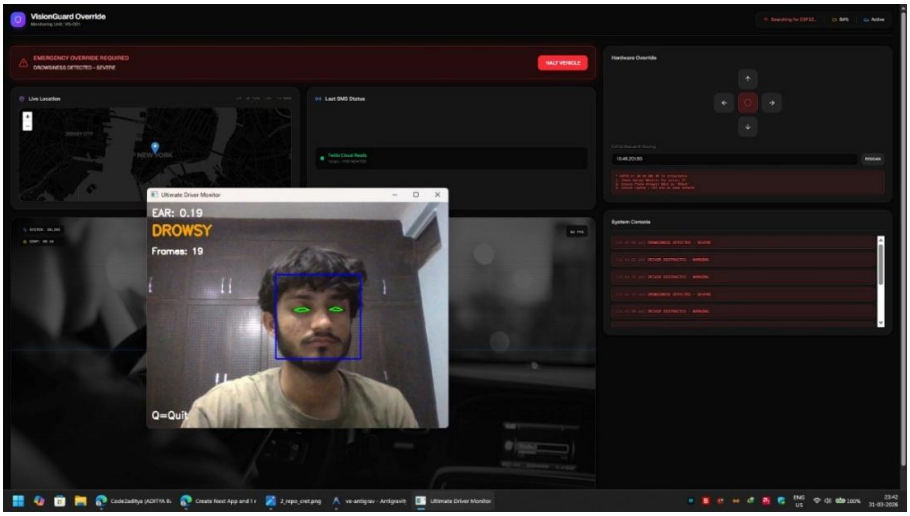
message goes to:

family

hospital

police

This helps emergency teams reach quickly.



V. COMPONENTS USED

The components used in this project are:

- A microcontroller (ESP32)
- A Camera Module
- MPU6050 Sensor for x,y,z access and direction
- GPS (Neo-6M)
- GSM Module for mobile network
- Buzzer
- Geared Motor
- Motor Driver

VI. METHODOLOGY

The VisionGuard system operates sequentially to monitor the driver and prevent accidents before they happen.

First, a **camera is placed in front of the driver**, generally on the dashboard or near the steering wheel. This camera continuously captures the **driver's face image in real time** while driving. The main purpose of this step is to keep observing the eyes and face movement of the driver, to detect whether the driver is sleeping, stressed, or alert.

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After capturing the face image, the next step is **image processing using OpenCV**. In this process, every video frame is taken one by one and converted into a form that can be easily analysed by the system. OpenCV helps in detecting the face and locating the eyes in each frame.

Once the eyes are detected, the system starts **monitoring the eye movement**. It checks whether the eyes are open, blinking normally, or staying closed for a long time. This step helps in understanding the alertness level of the driver.

After that, the system checks the **sleep threshold value**. A threshold time is already set in the program. If the driver's eyes remain closed for more than the defined time limit, the system understands that the driver may be feeling sleepy or entering a microsleep condition.

As soon as the threshold is crossed, the system **generates an alert immediately**. The buzzer starts beeping to wake up the driver and warn them. At the same time, the vehicle speed can also be reduced automatically in the prototype using PWM control.

This complete process keeps running continuously so that the driver can be monitored all the time during driving.

VII. APPLICATIONS

This system can be used in:

- Vehicles to help drivers stay alert during long-distance travel.
- The project is also suitable for taxi cars, cab services, and delivery vehicles because the drivers often travel for a long time without proper rest.School buses.
- Public transport
- For fleet management companies, all vehicle data, alerts, location and driver status can be monitored through the website dashboard.
- It can help in accident- highway areas by providing fast emergency alert and rescue support.

VIII. PRODUCT UNIQUENESS, SCALABILITY AND GROWTH

The main thing that sets VisionGuard apart is that it puts together intelligence-based driver monitoring, vehicle control and emergency response all in one system.VisionGuard is different from safety systems that just look at the vehicle or the road because it mainly looks at the driver and how alert they are.The system is always checking to see if the driver is feeling tired, distracted or stressed.It then takes action before an accident can happen.

This is why VisionGuard works as a way to prevent accidents from happening in the workplace and not just as a warning system.

Another great thing about VisionGuard is that it can be used in a lot of situations.The system is designed so that it can be added to new vehicles without having to make a lot of changes to the hardware.This makes it easy to use in vehicles that're already on the road as well as in new vehicles that have a lot of technology.VisionGuard can be used in different cities and with many different types of vehicles like taxis, buses and trucks.This makes it a good choice for people who own their vehicles as well as for companies that have a lot of vehicles.

In the future, systems like VisionGuard might be required in all vehicles for vehicles that travel long distances or transport a lot of people.One of the things about VisionGuard is that it does not cost a lot of money.

It is cheaper than a lot of the safety systems that come built into vehicles.The system is also simple to use. It does not require a lot of complicated changes to be made to the vehicle.

This makes it possible for individuals, companies and public transportation systems to have access to driver safety technology, which is something that VisionGuard provides.

IX. EXPECTED RESULT

The expected result of this project is a reduction in accidents caused by sleepiness and faster emergency response after accidents.

It will improve safety for both driver and passengers.

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Website Monitoring Dashboard

One important feature of the VisionGuard system is a website dashboard where all the important information can be seen in real time.

The website helps the user, family members and the emergency team to check the vehicle status from anywhere.

On the website, the following data can be viewed:

• camera video from the dashboard camera
• driver drowsiness alert status
• accident alert notification
• live GPS location on the map
• vehicle speed and movement status
• sensor values from the sensor
• time and date of alerts
• history of previous accident or drowsiness events

If the driver feels sleepy, the alert will also be shown on the website instantly.In case of an accident, the live location and camera feed can help family members and emergency teams reach the place quickly.

This website-based monitoring system makes VisionGuard more useful for:

• vehicles
• fleet management
• taxis
• school buses
• transport companies

The dashboard can be developed using web development tools and a database for real-time data updates.

X. FUTURE SCOPE

In future, this system can be improved by adding:

- AI face stress detection
- Mobile application
- Cloud dashboard
- Night vision camera
- Voice assistant

XI. CONCLUSION

VisionGuard is a smart and simple system that helps in road safety.

It works before an accident by detecting driver sleepiness and after an accident by sending an emergency location.

This makes it a useful IoT-based safety device for modern vehicles.

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