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Wakesense Portable IOT Based Anti-Drowsiness Alert System for Drivers

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Abstract
One of the main contributing factors to traffic accidents is driver fatigue, particularly during lengthy drives. In order to improve road safety in cars without integrated monitoring systems, this project suggests a portable driver drowsiness detection system. The system uses a webcam and AI-based facial analysis to track head movements, eye closure, and yawning in order to identify drowsiness. A buzzer and seat vibrations alert the driver upon detection, and the system lowers the speed of the vehicle to avoid collisions. The system automatically sounds an alert if the driver's face is hidden by sunglasses or poor vision. Furthermore, when an accelerometer sensor detects a crash, the Raspberry Pi uses Telegram to send an emergency SOS with GPS location. This system is perfect for improving safety in older cars because it is affordable, flexible, and simple to install. The system offers an effective real-time safety solution for long-distance travel by combining automated speed control, AI-based detection, and emergency alerting.

Keywords: Driver drowsiness detection, Road safety technology, Facial Recognition AI, Eye closure detection, Smart transportation, Speed control mechanism.

1. Introduction

Driver fatigue is a major cause of road accidents, particularly during long-distance travel. Drowsy driving impairs reaction time, decision-making, and overall vehicle control, increasing the risk of fatal collisions. To address this issue, WakeSense – a portable IoT-based anti-drowsiness alert system – is designed to enhance road safety by continuously monitoring the driver’s alertness and preventing accidents. This system integrates AI-driven facial recognition, real-time alert mechanisms, and automated speed control to detect signs of fatigue such as eye closure, yawning, and head movement. A web camera captures the driver’s face, while deep learning algorithms analyse facial expressions to identify drowsiness. If fatigue is detected, a buzzer and seat vibration motor are triggered to alert the driver, and the motor driver reduces vehicle speed to ensure safety. Additionally, the system features an accelerometer and GPS module to enhance emergency response. In the event of a crash or the driver becoming unresponsive, the system automatically sends an SOS alert with GPS coordinates via Telegram, ensuring timely assistance. By combining IoT, AI, and real-time alerting, WakeSense provides a cost-effective, adaptable, and easy-to-install safety solution for older vehicles, making long-distance travel safer and reducing accident risks caused by driver fatigue.

2. Insights and Innovations about Wake Sense anti Drowsiness

A cutting-edge, portable, and effective safety solution made especially for cars without sophisticated driver monitoring systems is the WAKE SENSE Anti-Drowsiness Alert System. The main innovation is its real-time facial analysis, which uses an inexpensive webcam and AI models that can identify signs of drowsiness like head movement, yawning, and eye closure. WAKE SENSE, in contrast to conventional solutions, combines several alert systems, such as a buzzer, seat vibration motors, and an LED, to increase driver awareness. Because the system is portable, affordable, and modular, it can be easily installed in older cars. It is not only intelligent but also proactive in preventing crashes and fatigue-related accidents thanks to its integration with the Raspberry Pi, OpenCV, and Telegram API for emergency alerting.

3. Problem Statement

Worldwide, road accidents brought on by drowsiness and fatigue in drivers are a serious concern, particularly when traveling long distances. The majority of older cars don't have systems in place to recognize and notify drivers when they are feeling sleepy. The difficulty lies in developing a cost-effective, non-intrusive, and efficient system that can track driver attentiveness, send emergency SOS in the event of an accident, and initiate timely alerts—all without relying on the sophisticated systems of automakers.

4. Literature review

Deng and Ruoxue's DriCare system Wu in IEEE Access (2019) integrates facial landmark detection, sophisticated face tracking algorithms, and fatigue analysis in real time to identify driver drowsiness.
The system can precisely detect symptoms of fatigue and issue alerts by concentrating on the driver's mouth and eye areas. By addressing fatigue in real time, this non-invasive solution improves driver safety and lowers the chance of drowsiness-related accidents.
Unaiza Al, Muapzam A. Khattabal, Awal Shabirvi, Asad Waqar Malik, and Sher Muhammad investigated IoT-based accident detection systems for smart cars in a thorough study that was published in 2020. Their study emphasizes how crucial it is to combine machine learning algorithms, GPS, and other sensors in order to automatically identify accidents.
These systems are extremely relevant for contemporary transportation systems because they provide significant advantages like enhanced road safety and faster emergency response times.
The work published in IEEE Access in 2023 by Hanane Lamaazi, Aisha Ruba Ali, Eadul Rabeb, and Mizouni O is another noteworthy contribution. IoT sensors and mobile crowdsourcing are used in their smart edge-based driver drowsiness detection system.
While its primary focus is on motion detection and environmental monitoring, the system also demonstrates how edge computing and real-time data analysis can improve user safety and energy efficiency in smart transportation applications.

5. Existing System

The majority of today's drowsiness detection systems are found in luxury cars and frequently rely on pricey, proprietary technologies like infrared sensors, steering behavior analysis, and eye tracking via in-dash cameras. When these systems notice indications of driver fatigue, they send out alerts. However, because they are expensive and unavailable in older or less expensive cars, they are not available to the general public. Certain research-based solutions use wearable technology, such as smart glasses or EEG headbands, to track blink rates or brain activity, but these are frequently uncomfortable for extended use

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and unsuitable for daily driving. There are also smartphone apps that use the camera on the phone to identify drowsiness, but they are not very accurate, need a steady phone mount, and can be distracting. The WAKE SENSE system is a cost-effective, dependable, and simple-to-install substitute for current systems, which generally lack affordability, portability, or real-time

6. Proposed System

The suggested WAKE SENSE system detects drowsiness in real time by using an AI-based facial recognition module and a Raspberry Pi coupled to a webcam. The software analyzes video frames to measure head movements, yawning frequency, and eye closure duration. A buzzer sounds and two DC motors built into the driver's seat vibrate to warn the driver if the system notices symptoms of fatigue, such as eyes closed for longer than three seconds or frequent yawning. The alarm system is automatically activated if no face can be detected because of obstructions like sunglasses or dim lighting. The system also has a gyroscope and MPU6050 accelerometer to identify collisions. The Raspberry Pi uses GPS location data to send an emergency SOS via Telegram to pre-configured contacts when it detects a crash. When drowsiness is verified, the system also uses a motor control interface to lower the vehicle's speed. This approach to improving driver safety is inexpensive, simple to implement, and very successful.

7. Hardware and software Implementation

In order to provide an efficient real-time driver safety solution, the WAKESENSE Anti-Drowsiness Alert System combines hardware and software. The Raspberry Pi 3 Model B, which manages processing duties, is the central component of the hardware. The driver's face and eye movements are tracked by the system using a standard USB webcam. To identify sudden changes that might point to a car crash, the MPU6050 accelerometer and gyroscope sensor is connected. Real-time location data is provided by a GPS module that is utilized for demonstration purposes. Two tiny DC vibration motors and a buzzer are used to alert the driver. A motor driver (L298N) that regulates seat vibration and vehicle speed reduction systems is controlled by the Raspberry Pi. On the software side, real-time video feeds are used for face and eye detection using the OpenCV and dlib libraries. The Raspberry Pi (for peripheral control) and laptop (for vision processing) communicate via socket programming. Communication with the MPU6050 sensor is made easier by the smbus2 library. The system sends emergency alerts with GPS location when it detects a crash or drowsiness using the Telegram API.

8. Circuit Diagram

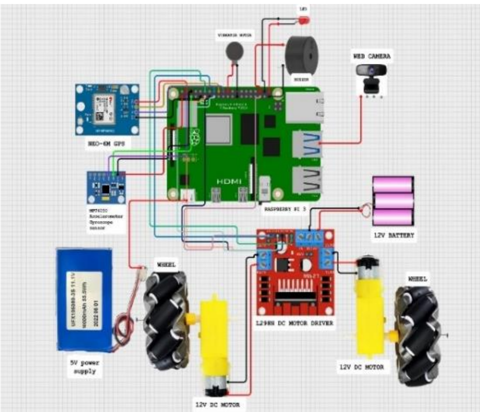

Figure 1 Circuit diagram

9. Architecture diagram

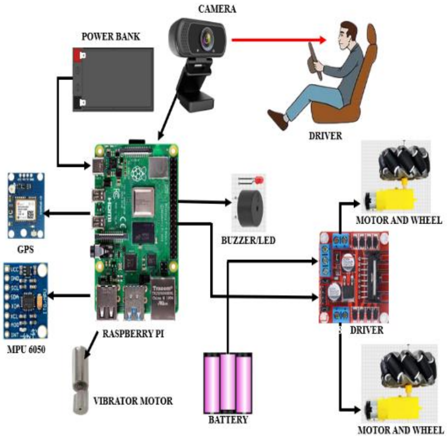

Figure 2 Architecture diagram

10. Operational Scenarios for this project

The proactive monitoring and response mechanisms of the WAKESENSE Anti-Drowsiness Alert System ensure ongoing driver safety in a variety of real-world driving scenarios.

1. A typical driving situation

The AI-enabled webcam is used by the system to continuously track the driver's facial expressions under normal driving circumstances. Real-time analysis is done on yawning frequency, head movements, and eye openness. The system stays in passive mode, reducing resource consumption while preserving constant vigilance, if no indications of drowsiness are found.

2. Identification of Drowsiness

The system identifies drowsiness if the driver yawns frequently or starts to close their eyes for longer than three to five seconds. To warn the driver, it instantly turns on a buzzer and a seat vibration motor. Accident risk is decreased by simultaneously lowering the vehicle's motor speed via a controlled signal transmitted from the Raspberry Pi to the L298N motor driver.

3. The "Face Not Detected" scenario

The system perceives a possible threat when the camera cannot detect the driver's face (for example, because of sunglasses, dim lighting, or the driver turning away). The driver is alerted and encouraged to realign their face with the camera by the buzzer and vibration motor. This guarantees that visual impediments won't affect system performance.

4. Emergency Alert and Crash Detection

The Raspberry Pi automatically creates an SOS message if the MPU6050 accelerometer detects a sudden, high-impact force that could be a sign of a crash. To ensure prompt assistance and response, the system notifies the registered emergency contact via Telegram of this alert along with GPS coordinates.

5. Driving at Night or Over Long Distances

When driving at night or on lengthy trips, when driver fatigue is more likely to occur, the system works especially well. Because of its AI-powered detection and low-light camera adaptability, it consistently maintains accuracy and responsiveness.

6. Auto-Resume and System Startup

The camera, sensors, and alert mechanisms are all automatically initialized by the system when the vehicle is turned on. It is intended to automatically return to its previous state and carry on monitoring without user input in the event of a brief malfunction or system reboot.

These operational scenarios show how the WAKESENSE system is resilient, flexible, and responsive in real time, resulting in safer driving conditions and encouraging wise transportation choices.

11. RESULT AND DISCUSSION

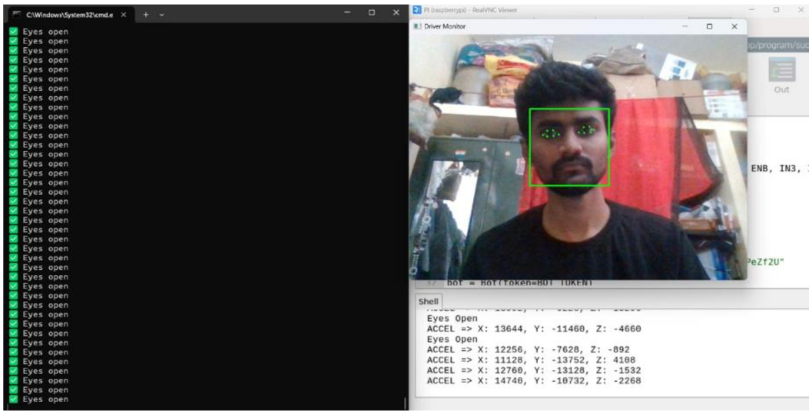

Figure 3 face detection eye open

The user's facial features are being actively monitored in real time by the drowsiness detection system. The detected face is highlighted by the green bounding box, and the important landmarks surrounding the eyes are indicated by green dots. These eye landmarks are essential for monitoring eye movement and identifying symptoms of sleepiness or exhaustion, such as gaze deviation, frequent eye closure, or slow blinking. The title bar suggests that the system is running on a Raspberry Pi, and it is probably using computer vision techniques for facial landmark detection, perhaps with the help of libraries like OpenCV and Dlib. The subject appears to be alert in this picture since they are fully conscious and staring straight at the camera. A crucial component of driver or operator monitoring systems intended to improve safety and avert fatigue-related incidents, the reliable detection of facial and eye landmarks verifies that the system is operating as intended and maintaining high accuracy in face tracking.

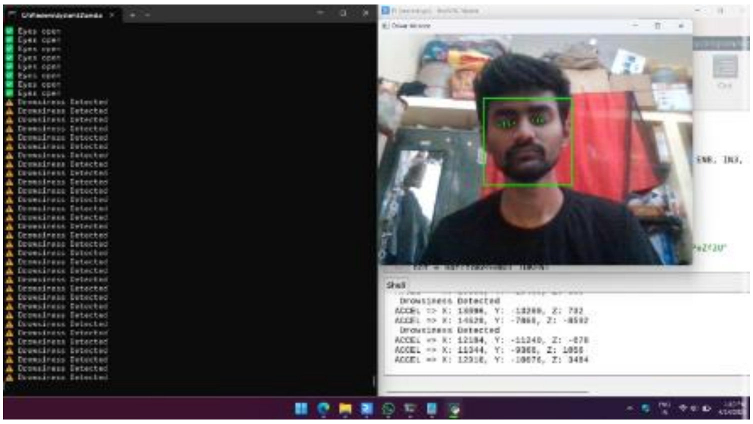

Figure 4 face detection eye close

With improved monitoring outputs, the drowsiness detection system is demonstrated in operation. Similar to the earlier pictures, capturing the user's face with a bounding box and facial landmarks surrounding the eyes. The system is actively recording the user's eye condition in the terminal (Command Prompt) output on the left. The user was alert, as evidenced by the log's repeated entries of "Eyes open." The constant barrage of "Drowsiness Detected" messages that follows, however, indicates that either the eyes are closed for an extended period of time, surpassing the threshold for drowsiness, or the system has detected signs of fatigue.

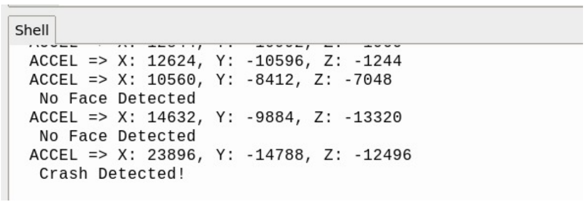

Figure 5 Crash Detected

The shell (terminal) of a real-time monitoring system that combines accelerometer and facial recognition data to improve safety, probably in a driving or simulation situation.

1. Accelerometer readings (ACCEL => X, Y, Z):

These numbers show the three-axis orientation or movement of the device. The data points to increasing values over time, which could be the result of abrupt impact, steering, or braking and indicate sudden or intense movement.

2. No Face Detected Messages:

This suggests that a face in the camera frame is no longer picked up by the system. This could indicate a loss of consciousness or control, as the person may have slumped forward or sideways or moved out of view (possibly as a result of a sudden jolt).

3. A Crash Was Found! Alert:

This important message indicates a possible crash situation and is displayed following an unusually high spike in the accelerometer readings (X: 23896, Y: -14788, Z: -12496). The system is probably set up to recognize abrupt and excessive acceleration as a sign of an accident or collision.

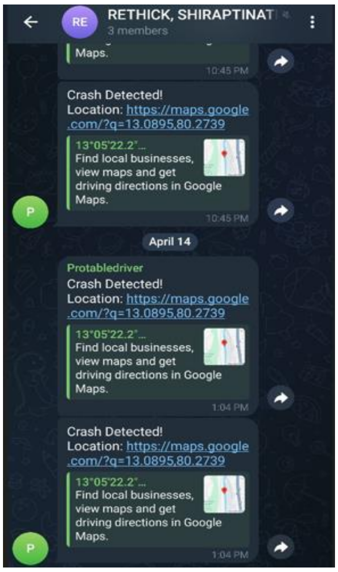

Figure 6 Emergency alert via Telegram

Where crash alerts are being sent by a bot called "Protabledriver." A Google Maps location link appears after the messages stating that a crash was detected. These notifications are most likely a component of a real-time crash detection and alert system, which may be implemented by combining GPS technology, computer vision (for driver monitoring), and sensors (such as an accelerometer). When the system detects a crash event, which could be caused by sudden changes in acceleration or impact, it instantly notifies the users (who could be teammates, developers, or emergency contacts) by sending the live location to the Telegram group. The system's ability to send numerous alerts or updates to guarantee that the crash is reported right away is demonstrated by the messages' repetition. Road safety can be greatly enhanced by this system, particularly in projects involving remote driver monitoring or vehicle automation.

12. CONCLUSION

The Wake Sense Project effectively used data-driven methodologies and contemporary sensing technologies to identify and assess human wakefulness. The system was able to recognize patterns linked to alert and sleepy states by utilizing techniques like motion sensors and machine learning models. The outcomes showed Wake Sense's potential in a number of real-world applications, such as detecting driver drowsiness, improving workplace productivity, and tracking individual health or sleep patterns. Even with encouraging results, accuracy and adaptability across various user profiles could be improved. Future improvements might concentrate on giving real-time feedback for proactive intervention and integrating the system with wearable technology. All things considered, Wake Sense is a big step toward creating human-centered, intelligent monitoring systems that can enhance everyday efficiency, safety, and well-being.

13. FUTURE ENHANCEMENT

1. **Wearable device integration:** Wake Sense can be combined with wearable technology, such as headbands or smartwatches, to improve portability and user convenience. This would make the system more feasible for everyday use by enabling continuous, real-time monitoring without the need for large, cumbersome equipment.
2. **Real-Time Alert System:** When drowsiness or inattention is detected, users can be promptly alerted by a real-time alert mechanism, such as sound, vibration, or visual signals. This is particularly helpful for preventing accidents in situations like driving or industrial settings.
3. **Fusion of Multi-Modal Data:** Accuracy can be greatly increased by combining data from multiple sources, including EEG, heart rate, eye movement, and facial expressions. Multi-modal fusion provides a more comprehensive understanding of a user's wakefulness while also lowering false positives.
4. **Models of Personalized Learning:** Over time, detection can be enhanced by using adaptive machine learning models that pick up on individual behaviour. Customized systems can adapt to each user's unique baseline level of alertness, boosting system efficacy and dependability.
5. **Cloud-Based Analysis and Storage of Data:** Cloud data storage enables remote monitoring, long-term tracking, and extensive analysis. It supports telehealth or remote supervision scenarios and can assist in recognizing behavioral trends over time.
6. **Development of Mobile Applications:** It is possible to create a companion mobile app that offers usage analytics, suggestions, and insights. In addition to offering recommendations for enhancing sleep or attention cycles, the app might alert users to their alertness patterns.

7. **Awareness of the Environmental Context:** Understanding how context (such as location, time of day, or noise level) influences wakefulness can be aided by integrating GPS and environmental sensors. By taking into consideration outside influences, this can enhance prediction models.
8. **Implementation of Energy-Efficient Hardware:** For long-term use in wearables or mobile platforms, the system must be optimized for low power consumption. For extended deployment, future iterations can concentrate on utilizing battery-optimized hardware and energy-efficient microcontrollers.
9. **Support for Different Age Groups and Health Conditions:** Future iterations can be made more inclusive by training models to work across different age groups and health profiles. For instance, the system could be adapted for elderly users, individuals with sleep disorders, or those with ADHD.
10. **Integration with Vehicle Systems and IoT:** For automotive applications, the system can be integrated directly into smart vehicles using IoT protocols. This would allow automated responses like slowing the vehicle or alerting emergency contacts when drowsiness is detected

14.REFERENCES

1. **Jap, B. T., Lal, S., Fischer, P., & Bekiaris, E. (2009).** Using EEG spectral components to assess algorithms for detecting fatigue. *Expert Systems with Applications*.
2. **Picot, A., Charbonnier, S., & Caplier, A. (2012).** On-line detection of drowsiness using brain and visual information. *IEEE Transactions on Systems, Man, and Cybernetics, Part A: Systems and Humans*.
3. **Grace, R., & Stewart, S. (2001).** Drowsy driver monitoring and warning system. In *Proceedings of the International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design*.
4. **Sahayadhas, A., Sundaraj, K., & Murugappan, M. (2012).** Detecting driver drowsiness based on sensors: A review. *Sensors*.
5. **Zhang, Z., Luo, P., Loy, C. C., & Tang, X. (2017).** Learning deep representation for face alignment with auxiliary attributes. *IEEE Transactions on Pattern Analysis and Machine Intelligence*.
6. **Khushaba, R. N., Kodagoda, S., Lal, S., & Dissanayake, G. (2011).** Driver drowsiness classification using fuzzy wavelet-packet-based feature-extraction algorithm. *IEEE Transactions on Biomedical Engineering*.
7. **Awais, M., Badruddin, N., & Drieberg, M. (2017).** A hybrid approach to detect driver drowsiness utilizing physiological signals to improve system performance and wearability. *Sensors*.
8. **Jabbar, H., & Khan, M. (2015).** Real-time drowsiness detection system using eye blink detection. *International Journal of Computer Science and Information Security (IJCSIS)*.
9. **Kim, J., & Andre, E. (2008).** Emotion recognition based on physiological changes in music listening. *IEEE Transactions on Pattern Analysis and Machine Intelligence*.
10. **Wang, Y., & Gong, J. (2014).** Real-time driving fatigue detection based on machine learning. *Proceedings of the 2014 IEEE 17th International Conference on Computational Science and Engineering*.