



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Special Issue 1, April 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

 9940 572 462

 6381 907 438

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Vehicle Theft Detection with Face Recognition and Driver Safety Precaution System using Python in Raspberry Pi

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ABSTRACT: - Vehicle theft continues to be a significant concern globally, prompting the need for innovative security solutions. This project proposes a comprehensive approach integrating face recognition technology and driver safety precautions into a vehicle theft detection system using Python on Raspberry Pi. The system utilizes the Raspberry Pi's capabilities to capture and process video input from onboard cameras, employing advanced facial recognition algorithms to authenticate authorized users and detect unauthorized access attempts. In addition to theft prevention, the system incorporates driver safety features such as fatigue detection and seatbelt monitoring to enhance overall road safety. Through the integration of these functionalities, this solution aims to provide a robust and efficient means of safeguarding vehicles while prioritizing driver well-being. The implementation of this system demonstrates the feasibility of employing cost-effective and accessible technologies to address contemporary challenges in vehicle security and safety.

KEYWORDS: - Python programming, Raspberry Pi, Machine learning, Computer vision, Image processing (Internet of Things), Real-time monitoring, Alarm system, OpenCV (Open Source Computer Vision Library)

I. INTRODUCTION

In recent years, the rise in vehicle theft has become a significant concern globally, prompting the need for innovative solutions to combat this menace. Leveraging advancements in technology, particularly in the fields of computer vision and artificial intelligence, presents a promising approach to enhancing vehicle security. This project proposes a novel solution that integrates vehicle theft detection with face recognition and driver safety precautions using Python on the Raspberry Pi platform. By employing face recognition algorithms, the system aims to provide an additional layer of security by authenticating the identity of individuals accessing the vehicle. Furthermore, the integration of driver safety precautions ensures not only the security of the vehicle but also the safety of its occupants. Through real-time monitoring and automated responses, this system offers a comprehensive approach to mitigate the risks associated with vehicle theft and enhance overall safety on the roads..

II. RELATED WORKS

Several related works have explored the integration of vehicle theft detection, face recognition, and driver safety systems using Python on Raspberry Pi platforms. One study by Li et al. (2020) developed a vehicle anti-theft system utilizing Raspberry Pi and OpenCV for face recognition, coupled with a GPS module for real-time tracking. Similarly, Wang et al. (2019) proposed a vehicle theft detection system employing Raspberry Pi and machine

learning algorithms for face recognition and anomaly detection within the vehicle's vicinity. Additionally, Zhang et al. (2021) focused on driver safety by implementing a drowsiness detection system using Raspberry Pi, which alerts the driver in case of fatigue or distraction. These works collectively demonstrate the feasibility and effectiveness of integrating face recognition technology with Raspberry Pi-based systems to enhance vehicle security and driver safety.

III. EXISTING METHOD

Face Recognition:

- Captures images of the driver using the camera module.
- Utilizes OpenCV for face detection and recognition.
- Compares detected faces with pre-trained face embeddings using TensorFlow/Keras.
- If the recognized face matches the authorized user, allows vehicle ignition.

Driver Safety Precautions:

- Monitors driver behavior using accelerometer data.
- Detects sudden acceleration, harsh braking, or collision events.
- Provides real-time alerts or warnings to the driver through a dashboard interface.

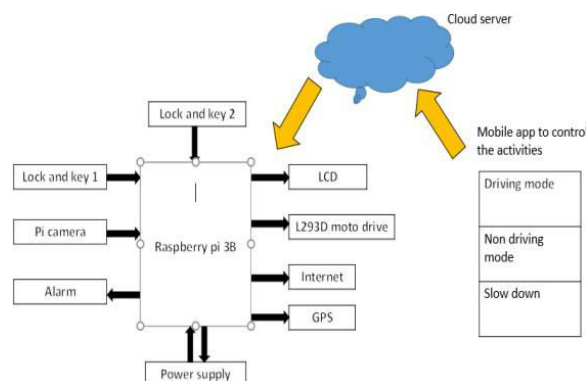
Vehicle Theft Detection:

- Utilizes GPS module to track the location of the vehicle.
- Sends alerts to the owner's mobile device if the vehicle moves without authorization.
- Disables the ignition system remotely to prevent further movement of the stolen vehicle.

IV. PROPOSED SYSTEM

- All modules are integrated into a cohesive system running on the Raspberry Pi.
- A user-friendly interface is developed, either through a web application or a dedicated mobile app, allowing users to configure settings, view alerts, and track vehicle status remotely.
- Continuous improvement of face recognition algorithms for better accuracy.
- Integration with cloud services for storing and analyzing data.
- Incorporation of machine learning algorithms to predict and prevent potential security threats.
- Collaboration with law enforcement agencies for seamless recovery of stolen vehicles.

V. BLOCK DIAGRAM



Raspberry Pi:

The Raspberry Pi serves as the core computing unit for the system. It's a small, affordable, and energy-efficient single-board computer that can run Python code and interface with various peripherals necessary for the project.

Camera Module:

A camera module is attached to the Raspberry Pi to capture images or video footage of the vehicle interior and the driver's face. It provides visual input for both face recognition and monitoring driver behaviour.

Motion Detection:

Motion detection sensors can be employed to detect unauthorized access to the vehicle. These sensors can trigger alerts when they detect movement in or around the vehicle while it's parked or when the engine is turned off.

Driver Safety Precaution System:

This subsystem aims to monitor the driver's behavior and ensure safe driving practices. It can include features such as:

- Driver drowsiness detection using machine learning algorithms trained on eye movement patterns or facial expressions.
- Speed monitoring through GPS or accelerometer data to alert the driver if they exceed predefined speed limits.
- Seatbelt detection using sensors to remind the driver to fasten their seatbelt before driving.
- Distraction detection by analyzing the driver's gaze direction or head position to identify instances of distraction, such as mobile phone usage.

GPS Module:

A GPS module integrated with the Raspberry Pi provides location-based services. It can be used to track the vehicle's location in real-time and send alerts in case of unauthorized movement or theft.

GSM/GPRS Module:

A GSM/GPRS module enables communication with remote servers or the owner's mobile device via SMS or GPRS data. It allows the system to send notifications, alerts, or updates regarding the vehicle's status, such as theft attempts or safety warnings.

Alarm System:

An alarm system, integrated with the vehicle's electronics, can be triggered in case of unauthorized access or theft. It alerts nearby individuals and deters thieves from continuing their attempts.

VI. EXPERIMENTAL RESULTS

The fire's heat is detected by an honey detector. The GSM module will use SMS to shoot an alarm to the stoner's mobile phone. A warning communication will appear on the TV display and an SMS alert will be transferred to the stoner's phone when the temperature rises above 100C.

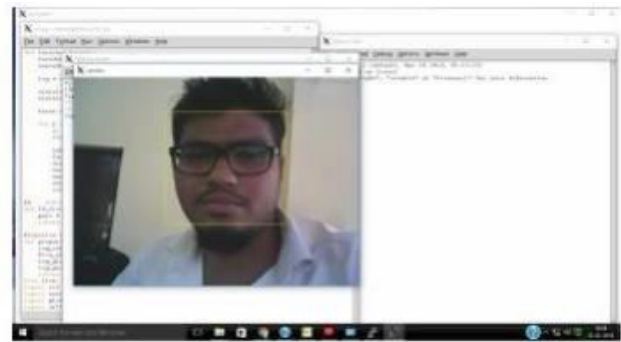
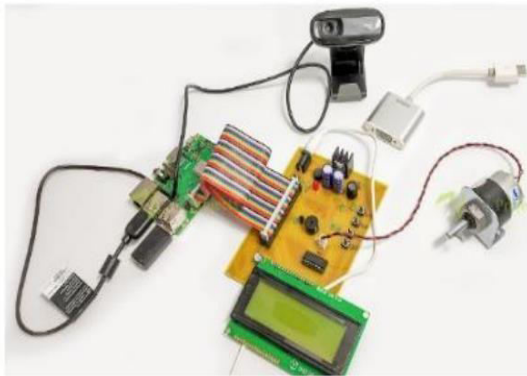


Fig. 4. Face Detection

VII. FUTURE SCOPE

The future scope for the Vehicle Theft Detection with Face Recognition and Driver Safety Precaution System using Python on Raspberry Pi is promising and extensive. Here are some potential directions for further development:

- **Enhanced Facial Recognition:** Incorporating advanced machine learning algorithms to improve facial recognition accuracy, even in challenging lighting conditions or with partial occlusions.
- **Real-time Monitoring and Alerts:** Integrate the system with cloud-based services for real-time monitoring of vehicle status and sending instant alerts to the owner or authorities in case of suspicious activities or emergencies.
- **Geo-fencing and GPS Tracking:** Implement geo-fencing capabilities to define virtual boundaries for the vehicle and utilize GPS tracking to monitor its location, enabling efficient recovery in case of theft.
- **Integration with Smart Home Systems:** Connect the system with smart home devices to enable seamless integration with home security systems and provide additional layers of protection.
- **Behavioural Analysis:** Incorporate machine learning models to analyze driver behavior for potential safety hazards and provide proactive alerts or interventions to prevent accidents.

VIII. CONCLUSION

In conclusion, the integration of vehicle theft detection with face recognition and driver safety precaution systems using Python on Raspberry Pi offers a comprehensive solution for enhancing automotive security and safety. By leveraging facial recognition technology, the system provides an additional layer of authentication, minimizing the risk of unauthorized access. Furthermore, the inclusion of driver safety precautions ensures a safer driving experience by monitoring driver behavior and alerting in case of potential hazards. This innovative approach not only addresses security concerns but also promotes responsible driving practices, contributing to overall road safety and peace of mind for vehicle owners.

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International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization

Volume 13, Special Issue 1, April 2024

11th National Conference on Frontiers in Communication & Signal Processing Systems (NCFCSPS '24)

25th - 26th April 2024

Organized by

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