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VEHICLE ANTI-THEFT FACIAL DETECTION SYSTEM ALONG WITH ALCOHOL DETECTION AND SAFETY MEASURES

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ABSTRACT

In today's modern world the use of vehicles has become an essential part of our lives. It has not only increased the number of vehicles but also vehicle theft and accidents. This affects owners, and public safety in all countries. Drunk driving and negligence such has avoiding use of seat belts has resulted in increased number of accidents and loss of lives. In order to prevent vehicle theft, latest systems based on innovative technologies must be implemented. This paper introduces the design and implementation of a vehicle anti-theft facial detection system along with alcohol detection and other safety measures. Our vehicle anti-theft facial detection system works on vehicle safety by avoiding unauthorized users to access the vehicle. Only the owner approved user can get the access and unlock the safety door. Further consumption of alcohol of the user is detected through alcohol detector and the system only proceeds further if alcohol is not consumed by the driver. Final step is the mandatory use of seatbelts without which the vehicle won't start. This initiative looks forward to implement this system in vehicles to reduce number of vehicle thefts and accidents in future.

INTRODUCTION

With the increasing number of car thefts, road accidents due to drunk driving, and injuries caused by failure to wear seat belts, there is an urgent need for more advanced and intelligent safety systems in the automotive industry. Traditional vehicle security measures such as key-based ignition and alarm systems are no longer sufficient to deter unauthorized access or ensure the driver's safety. These systems can be easily bypassed and do not provide a comprehensive solution to modern security and safety challenges.

To address these concerns, this project proposes the development of an **intelligent Vehicle Anti-Theft and Safety System** that integrates **facial recognition**, **alcohol detection**, and **seat belt compliance monitoring**. The core objective of this project is to implement a multi-layered security system using **Raspberry Pi**, combining the power of **computer vision**, **IoT**, and **embedded systems**. The system begins by using facial recognition technology to verify the identity of the driver before ignition. Only authorized individuals whose facial data is pre-registered in the system database will be allowed to start the vehicle. This step significantly reduces the chances of vehicle theft by preventing unauthorized users from operating the car.

In addition to facial recognition, the system also features an **MQ-3 alcohol sensor** to detect the presence of alcohol in the driver's breath. If the alcohol concentration exceeds a predetermined safe threshold, the vehicle remains immobilized and cannot be started. This not only helps in enforcing sober driving but also reduces the risk of accidents caused by intoxicated drivers.

Moreover, a **seat belt sensor** is integrated into the system to ensure that the driver fastens the seat belt before the vehicle can be driven. This feature ensures compliance with basic safety protocols, minimizing the risk of injury in the event of an accident. The vehicle will not start unless the seat belt is properly secured, promoting responsible driving behavior.

To enhance the system's effectiveness further, **real-time alerts and GPS tracking** capabilities are included. If any unauthorized access is attempted, or if the system detects a safety violation, instant alerts can be sent to the vehicle owner and emergency contacts. GPS tracking allows the owner to monitor the vehicle's location, providing an additional layer of security and rapid response in case of emergencies or theft attempts.

In conclusion, this project presents a **comprehensive smart vehicle safety and security solution** that goes beyond conventional methods. By incorporating **facial recognition for authentication**, **alcohol detection for driver sobriety**, and **seat belt monitoring for safety compliance**, the system provides robust protection against theft and accident-related hazards. The use of **Raspberry Pi** and integration of **IoT technologies** make it a cost-effective and scalable solution for modern vehicles. This intelligent system is a significant step toward the development of **future-ready smart vehicles**, offering enhanced protection and promoting responsible driving habits.

METHODOLOGY

This project aims to enhance vehicle security and safety by using facial recognition, alcohol detection, seatbelt monitoring, and remote authentication via Telegram, preventing unauthorized access and ensuring safe driving conditions. Here's a breakdown of the project's components and functionality: 1) System Architecture and design The system is structured into multiple modules to ensure secure access authentication module and safe vehicle operation. The uses a camera for facial recognition, verifying authorized users before granting access. safety module includes a seatbelt push button and an alcohol sensor to ensure that only a sober and properly secured driver can operate the vehicle. The safety module, powered by a Raspberry Pi, processes all inputs and determines the necessary actions. To manage vehicle functions, the vehicle operation module utilizes a servo motor as a door lock and a gear motor to simulate engine ignition. Additionally, an alert and communication module is integrated, which sends notifications via telegram if an unauthorized individual attempts to access the car. The authorized owner can then approve or deny entry remotely, adding an extra layer of security. 2) Hardware components The project is implemented using several key hardware components. The Raspberry pi serves as the central processing unit, executing image processing and decision-making tasks. A Camera module is used to capture the facial image of anyone attempting to access the car. A servo motor controls the door lock, ensuring that entry is only granted when authentication is successful. The gear motor represents the vehicle engine, which starts only when all safety checks are passed. A seatbelt push button detects whether the driver has fastened their seatbelt, acting as a necessary prerequisite for engine ignition. The alcohol sensor is responsible for detecting alcohol levels in the driver's breath, preventing an intoxicated individual from operating the vehicle. Lastly, the Wi-Fi module connects the system to the internet, allowing real-time alerts to be sent via Telegram. 3) Software development The software is responsible for processing input data and making real-time security and safety decisions. The facial recognition system uses OpenCV and machine learning-based face detection to verify individuals attempting to enter the car. When someone pulls the door handle, the camera captures their image and compares it with the stored database of authorized users. If a match is found, the system proceeds to the next step. However, if the face does not match, a telegram notification is sent to the owner, who can then approve or deny access remotely. If the owner clicks "Yes," the servo motor will rotate, allowing entry. If the owner clicks "No," the door remains locked, preventing unauthorized access. Once the individual enters the car, the system verifies seatbelt compilence . The seatbelt push button acts as a switch; the engine will not start unless the button is pressed, indicating that the driver has fastened their seatbelt. If the seatbelt is detected, the system moves to the alcohol detection stage. The alcohol sensor then analyses the driver's breath. If the alcohol level is above a set threshold, the engine will not start, preventing the individual from driving under the influence. If no alcohol is detected, the gear motor (engine) starts, allowing safe operation of the vehicle. 4) Communication and alert system To enhance security, the system integrates telegram API for real-time alerts and remote access control. If an unauthorised person attempts to access the car, the Raspberry Pi immediately sends a telegram message to the authenticated owner. The message includes an option for the owner to either approve or deny access. If the owner approves by clicking "Yes," the door unlocks automatically using the servo motor. If the owner denies access, the door remains locked, effectively preventing theft or unauthorized entry. This feature provides real time remote monitoring , ensuring that only approved individuals can access the vehicle.

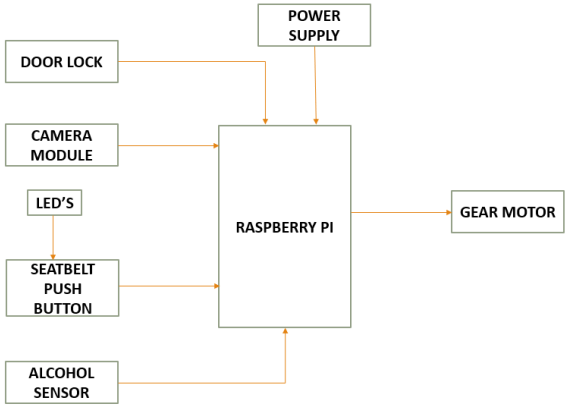

Fig 1 – Block Diagram

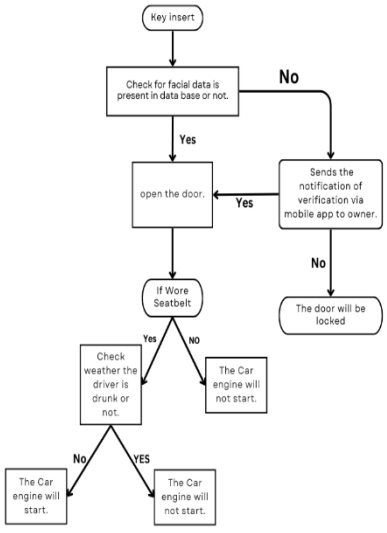

Fig 2 – Flowchart of The System

The entire system is systematically described in the following subsections.

A. System controller – Raspberry pi

FIG 3 - RASPBERRY PI

Raspberry Pi is a small, affordable computer that was originally designed to promote computer science education. Developed by the Raspberry Pi Foundation, it has evolved into a versatile tool for various applications, from learning programming to creating DIY electronics projects.The processor is optimized for **low-power** operation, making it suitable for battery-powered devices.

It includes **264 KB of SRAM**, enabling it to handle moderate-sized programs and data.

The programmable I/O (PIO) allows developers to create custom protocols, offering flexibility

Parameter	Specification
Operating Voltage	5v DC
Clock Speed	133 MHz
DC current per I/O pin	20mA at 5v

Table 1 – Parameters of Raspberry pi

B. For facial authentication – Camera module

Fig 4 – Camera module

Camera modules have become an essential component in a wide range of modern electronic devices, including smartphones, tablets, drones, and security systems. These compact and powerful modules are designed to capture high-quality images and videos, playing a crucial role in enhancing user experience and device functionality. In smartphones and tablets, camera modules offer various resolutions, allowing users to take clear and detailed photographs, while advanced features like autofocus and image stabilization ensure sharper images even in motion or low-light conditions. Drones utilize camera modules for aerial photography, surveillance, and navigation, often requiring lightweight yet high-performance cameras. In security systems, these modules are integral for monitoring and surveillance, with features like motion detection and night vision. Additionally, many modern camera modules are equipped with advanced capabilities such as facial recognition, enabling biometric authentication and enhancing security. The continuous development of camera technologies has significantly expanded their applications across industries, making them a vital part of today's digital world.

PARAMETER	DESCRIPTION
Function	Face Deteection
Measurement range	0.5 M to 3 M
Operating voltage	3.3V
Application	Facial Recognition Systems

Table 2 – parameters of camera module

C. Alcohol sensor for Alcohol detection

Fig 5 – MQ3 Alcohol Sensor

An alcohol sensor, often referred to as a breathalyzer, is a device designed to measure the concentration of alcohol in a person's breath.

The **MQ-3 alcohol sensor** detects the **presence of alcohol vapors** in the air, especially in human breath. It **measures the concentration of ethanol** and outputs an analog signal that increases with higher alcohol levels. This signal can be used by microcontrollers (like Arduino or Raspberry Pi) to **determine if a person has consumed alcohol**.

PARAMETER	DESCRIPTION
Function	Alcohol detection
Measurement range	0.04% to 0.25% BAC
Operating voltage	5V
Application	**detect alcohol**

Table 4 – Parameters of Alcohol sensor

D. Seat belt sensor (Push button) :

FIG 6 – SEAT BELT SENSOR

A seat belt sensor detects whether a seat belt is fastened in a vehicle. It typically consists of a switch or a pressure sensor located in the seat belt latch. When the seat belt is fastened, the sensor signals the vehicle's onboard computer, which can then trigger various functions, such as turning off the seat belt warning light or enabling certain safety features

A seat belt sensor is an important safety component in modern vehicles, designed to detect whether or not a seat belt is properly fastened by the occupant. This sensor is usually integrated into the seat belt latch mechanism and consists of either a mechanical switch or a pressure sensor. When a passenger inserts the seat belt tongue into the latch, the sensor is activated and sends a signal to the vehicle's onboard computer system. This signal informs the system that the seat belt is engaged, allowing it to perform specific safety-related functions. For example, it can turn off the seat belt warning light and sound, which are typically activated when the seat belt is not fastened. Additionally, some advanced vehicles use this information to control or enable other safety features, such as airbag deployment settings or limiting vehicle movement until all seat belts are secured. In this way, the seat belt sensor plays a critical role in promoting occupant safety and ensuring compliance with safety regulations.

E. Servo motor :

FIG 7 - Servo motor

A servo motor is a small motor that **moves to a specific angle** (usually between 0° and 180°). It's controlled by signals and is perfect for tasks where you need **accurate rotation**, like turning a camera, opening a door, or moving a robotic arm.

PARAMETER	DESCRIPTION
Function	car gate lock i
Rotation range	**90°**
Operating voltage	4.8V to 6V DC
Application	Vehicle Safety Projects

Table 5 – servo motor parameters]

F. LED Display :

FIG 8- LED DISPLAY

The LED Display is used to display the results of sensors like , face is detected or not , the person is drunk or not, and the person is wearing the seatbelt or not.

G. Gear motor and tyre :

FIG 9– Gear motors and tyres

In the context of this project, these components function similarly to a vehicle's wheel, playing a crucial role in enabling the system to move forward or operate effectively. Just as wheels are essential for a vehicle's mobility and overall performance, these elements serve as foundational parts that drive the functionality of the project. They support the core objectives, contribute to the system's responsiveness, and ensure smooth integration between various subsystems. Without these components, the project would not be able to function properly, much like how a vehicle cannot operate without its wheels. Therefore, they are considered vital for the overall working and success of the project.

RESULTS

In this project, a comprehensive vehicle safety and security system was successfully developed and tested, integrating facial recognition, seatbelt detection, and alcohol sensing into a unified workflow. The system begins by using a real-time camera module that activates when an individual attempts to unlock the vehicle. The captured image is compared against a pre-stored database of authorized users using facial recognition technology. If a match is found, the vehicle door unlocks automatically. However, if the face is unrecognized, the system captures the image and immediately sends it to the registered vehicle owner via the Telegram application. The owner can then approve or deny access remotely, ensuring an additional layer of protection against unauthorized entry.

Once access is granted, the system proceeds to check if the driver is wearing a seatbelt. A seatbelt sensor is integrated to detect proper usage, and the system does not allow the vehicle to proceed unless the belt is fastened, thus enforcing this essential safety measure. Following this, the system conducts an alcohol detection test using an MQ-3 sensor. The sensor analyzes the driver’s breath to determine if alcohol is present. If the sensor detects alcohol levels beyond a predefined safe threshold, the vehicle’s ignition remains disabled, thereby preventing the operation of the vehicle under the influence of alcohol.

The overall system performed effectively during testing. The facial recognition feature worked reliably under normal lighting conditions and was able to correctly identify authorized individuals with minimal delay. The seatbelt detection system provided accurate feedback and responded quickly when the belt was fastened or unfastened. The alcohol sensor was responsive and successfully identified alcohol presence in the driver's breath within a few seconds. Additionally, the use of the Telegram API to send alerts and receive authorization proved to be a practical and secure method of remote access control.

By ensuring that all safety protocols—driver authorization, seatbelt compliance, and sobriety—are strictly verified before vehicle ignition is enabled, the system significantly enhances both security and safety. It offers a viable solution to reduce vehicle theft, prevent drunk driving, and promote responsible driving behavior. The integration of these modules into a single intelligent framework demonstrates the potential of smart technology in the automotive sector.

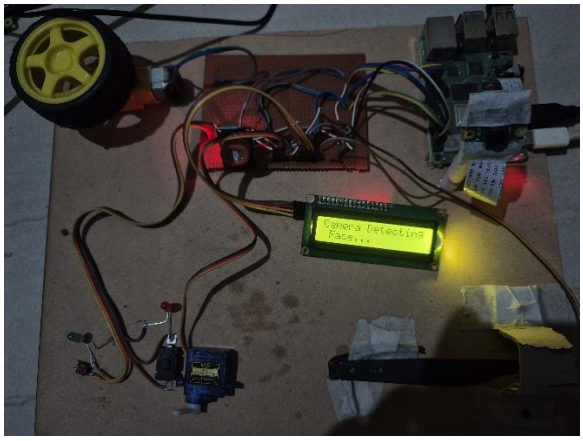

Fig 10 – System is detecting face

The system initiates the facial recognition process by activating an integrated camera module, which captures real-time images of the individual attempting to access the vehicle. These images are then processed and compared against a secured database of pre-authorized facial profiles to verify identity.

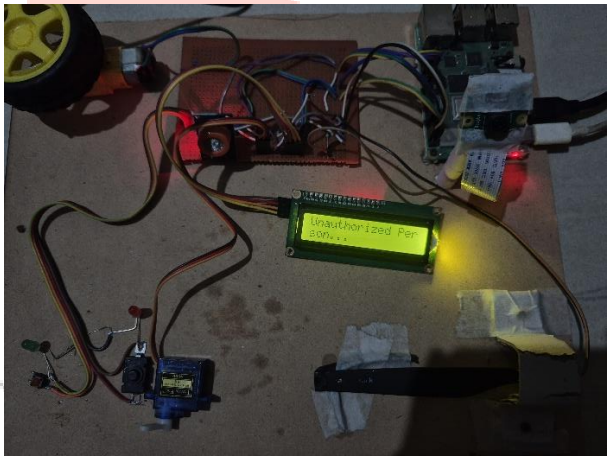

Fig 11 – [the person is unauthenticated]

If the captured facial data does not match any entries in the authorized database, the individual is classified as unauthenticated and access to the vehicle is denied.

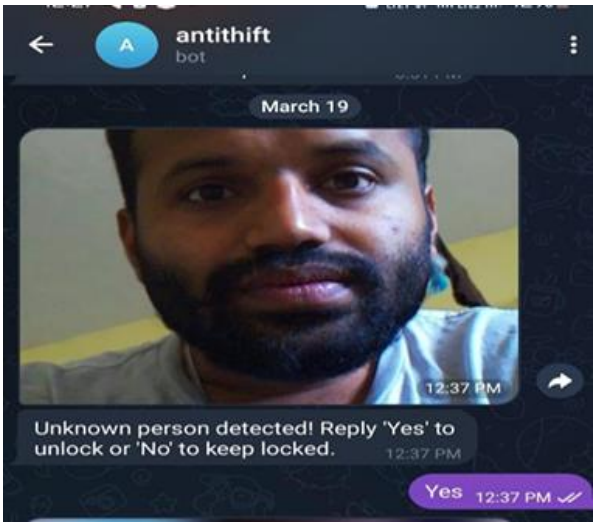

Fig 12 – [the system send the msg to the owner]

In above image, the system sends the message to the owner of the car asking for permission to unlock the door.

CONCLUSION

This paper proposed a Vehicle anti-theft facial detection system along with alcohol detection and other safety measures. Vehicle theft and accidents due to negligence are the major issues in today's society. Through this facial recognition system, the owner will get the photo of the person trying to access the vehicle (on his phone through notification) and only owner approved drivers will have access to the vehicle. Further on unlocking the safety door, alcohol and seat belt will be detected for safety and avoidance of accidents.

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