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VEHICLE ANTI -THEFT USING FACIAL RECOGNITION AND ALCOHOL DETECTION SYSTEM

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ABSTRACT
Nowadays, we all use vehicles as an integral part of our day-to-day lives. In today's world, making duplicate keys is not that difficult, as it increases the risk of robbery. We need to improve vehicle security as technology develops. At the same time that the number of accidents caused by drunk driving has increased over the years, we have to provide safety to vehicle drivers. So to overcome all the possible issues, this project developed a facial recognition-based vehicle starter and alcohol detection system. In this project, using a Raspberry Pi Pico board as the central component and an Esp32 camera for the detection of authorized and unauthorized persons, an MQ3 alcohol sensor for detecting the alcohol concentration, a buzzer for alerting, an LCD display for displaying the vehicle status, and a GSM for sending the SMS to the relevant authorities, when the system detects an unauthorized user or an exceeding level of alcohol in the breath sample, the system will automatically cut off the vehicle engine. This system prevents alcohol-intoxicated drivers from being on the road and provides security from thefts.
Keywords: facial recognition system, alcohol detector, Raspberry Pi Pico, message services, global system/mobile**.**

I. Introduction
Over the years, the popularity of the automotive sector has been steadily increasing. At least one vehicle is purchased in every household, representing a significant investment. However, the potential issue lies in the fact that the automotive industry has not adequately addressed vehicle security, which remains a pressing concern for vehicle owners. In addition to security, another issue faced is driving under the influence of alcohol, which poses dangers to the drivers and others. This has led to a rapid increase in accidents caused by drunk driving.
Today, cars have lots of safety features, but they can still be stolen because of some weaknesses in how they work. That's why we need better ways to keep them safe. People who own cars often look for ways to stop thieves from taking them. But many of the current methods don't stop theft before it happens.
We are suggesting a new system that uses technology to recognize faces. A camera is used to spot faces, figure out who owns the car, and stop anyone else from getting in. By integrating facial recognition and alcohol detection technologies, our project aims to contribute to a safer driving environment and reduce the risk of vehicle theft.

II. Literature
You can keep track of where something is by using a GPS tracker. This device uses the Global Positioning System to find the exact location of things like cars, people, or other items. It records these locations regularly and in real-time [1].
More cars seem to be getting stolen and never found again. To stop this, an anti-theft system like a fingerprint scanner can help. In this system, an Arduino is connected to the fingerprint sensor. Changes are made to the car's ignition system. To control the Arduino, power comes from the ignition switch through a voltage regulator. Then, the Arduino uses the fingerprint sensor to scan

their fingerprint. If the scan matches, the starting relay turns on, allowing the engine to start. After that, the fingerprint reader turns off. If no fingerprint is scanned or if the scan doesn't match, the starting system won't activate, so the car won't start. This way, only the starting relay is controlled, which decides if the engine can crank or not [2] [3].

Poushya, K. Rup sari, N. Supritha, K. Hema, and R. Tejaswini from the Electronics and Communication Engineering department at VVIT, AP, presents a mechanism for vehicle theft prevention. Their system utilizes IoT applications to send notifications when unauthorized individuals attempt to start the vehicle. Additionally, the system continuously tracks the vehicle's location in real-time to enhance security measures [4].

Reducing the frequency of car accidents resulting from drunk driving has emerged as a critical objective within the transportation sector. Typically, authorities employ field sobriety tests to evaluate drivers suspected of intoxication [5].

Auto parts theft is a big issue in Sri Lanka, but the response from the country isn't enough. To see if Colombo, Sri Lanka, needs a better vehicle security system that can check if vehicle parts are real and find out which parts are stolen most often, a survey was done [6].

Two common ways to keep your car safe from theft while it's parked or on the road are to install a vehicle theft surveillance system and study ways to stop car theft [7]. Reducing the incidence of car accidents caused by the irresponsibility of drunk drivers has become a crucial objective in the transportation sector [8].

Finding the stolen car was tough because there weren't many clues, and the investigation started slowly. It would be useful to have a device already on the car that can show where it is and tell the owner if someone tries to steal it. To fix these problems, researchers [9] made hardware that could be put on cars. This hardware can tell the owner where the car is and warn them if someone tries to start the engine without permission.

Driving a car under the influence of alcohol is among the most perilous activities one can undertake [10]. Therefore, when a driver irresponsibly decides to operate a vehicle while intoxicated, the likelihood of a road accident significantly increases [11].

In 2007, Nissan introduced a potential solution to curb drunk driving by unveiling a concept car equipped with a drunk driving prevention system in its passenger vehicle models [12]. Similarly, in 2019, Volvo announced a driver monitoring system designed to prevent drunk driving.

III. Existing System

In the current system, car security is ensured through the implementation of biometric-based vehicle starters. This system utilizes an Ardunio board integrated with GSM and GPS technologies. While the fingerprint method for vehicle starting offers enhanced security compared to traditional physical keys, it does encounter certain drawbacks. Biometric authentication is susceptible to spoofing, and at some times, it fails to provide accurate results, resulting in time consumption. Moreover, despite replacing keys, manual placement of the finger on the fingerprint sensor is still required, which involves physical effort. Also, as people get older, changes in their fingerprints can make it harder for the system to work reliably.

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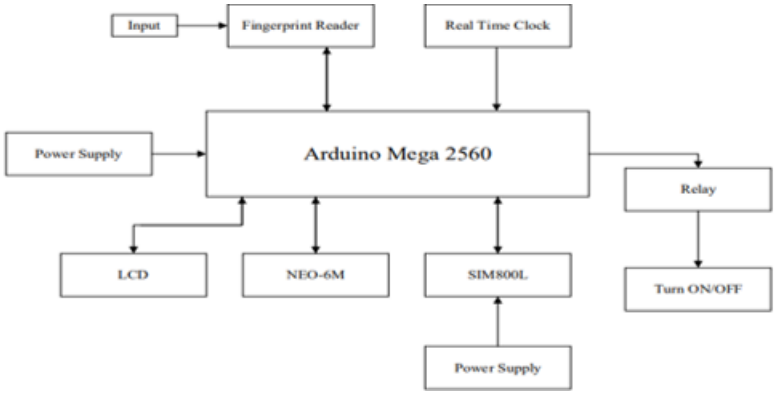

Figure 1: Biometric-based vehicle starter

IV. Methodology

The proposed system combines facial recognition and alcohol detection for a comprehensive solution. It offers hands-free operation by allowing users to register their faces and clear data when needed. During registration, faces are stored in the database. When someone tries to access the vehicle, the system compares their face with those in the database. If there's a match, it checks for alcohol levels. If it's below the limit, access is granted. Otherwise, if alcohol is detected or authorization fails, the engine is automatically shut off, denying access and sending the alert messages to the registered numbers.

4.1 Hardware Design

The block diagram shown in Figure 1 completely depicts the components that are used in the implementation of the system.

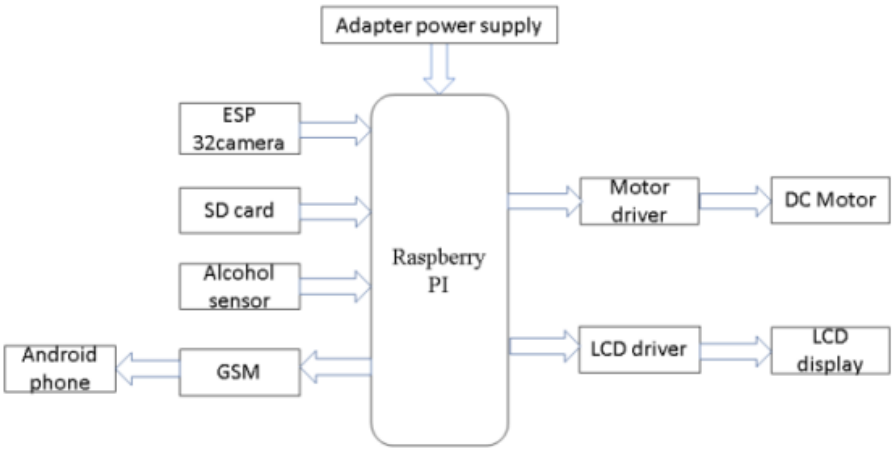

Figure 2: Block diagram of the system

Raspberry Pi Pico

The Raspberry Pi Pico is the central component of our project. We interface all other components to the Raspberry Pi Pico. It is a microcontroller board developed by the Raspberry Pi Foundation. It's designed to provide an affordable and versatile platform for electronics projects and learning. The Pico features a custom chip called the RP2040, which includes a dual-core Arm cortex-M0+ processor running at up to 133 MHZ, alongside 264KB of RAM and a range of peripheral interfaces. It supports various programming languages, including micropython and C/C++, making it accessible to both beginners and experienced developers. With its compact size, low cost, and rich features, the Raspberry Pi Pico is suitable for a wide range of applications, from simple LED blinking projects to more complex IoT devices and robotics.

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Figure 3: Raspberry Pi Pico Board

ESP 32 camera

The ESP 32 camera plays a vital role in capturing facial images for recognition purposes. The ESP 32 camera module is integrated with the system to capture images of individuals attempting to access the vehicle. These images are then processed using facial recognition algorithms to determine if the person is authorized to use the vehicle.

The ESP 32 camera offers several advantages for this application, including its compact size, low power consumption, and built-in support for Wi-Fi connectivity. This allows the system to capture images wirelessly and transmit them to the processing unit for analysis.

Figure 4: ESP 32 Camera Module

MQ3: Alcohol Sensor

The MQ3 sensor works by measuring the concentration of alcohol vapour in the air. When alcohol is present, the sensor's resistance changes, and this change is detected by the system. By monitoring the sensor's output, the system can determine if there are any alcohol fumes in the surrounding environment.

The MQ3 sensor is employed to detect if the person attempting to access the vehicle is under the influence of alcohol. If the sensor detects alcohol above a certain threshold, the system can take appropriate actions, such as denying access to the vehicle or triggering an alert to notify relevant authorities.

Figure 5: Alcohol Sensor

GSM Module

The GSM module enables the system to send SMS notifications to relevant authorities when unauthorized access or alcohol detection occurs. It uses a cellular network to transmit these messages, providing a reliable means of communication even when Wi-Fi or other internet connections are unavailable.

In simpler terms, the GSM module acts like a text messaging device for the vehicle security system. When it detects suspicious activity, such as someone trying to start the vehicle without authorization

or being under the influence of alcohol, it sends a message to alert the necessary people, such as the owner or law enforcement, to take action.

Figure 6: GSM Module

Liquid Crystal Display (LCD)

The LCD display is like a small screen that provides visual feedback to the user. It shows important information. In simpler terms, the LCD display is like a dashboard for the security system, giving the user a quick and easy way to see what is going on with their vehicle's security at a glance.

Figure 7: LCD Display

DC Motor

The DC motor is like a little engine that can turn things on and off. It acts as a control mechanism to stop the car's engine from running if there's any suspicious activity detected by the security system.

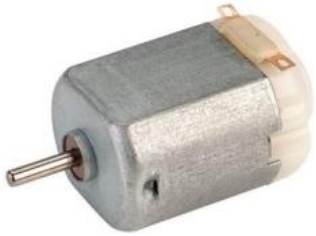

Figure 8: DC Motor

4.2 System Design

The flow chart diagram demonstrates the process flow of the alcohol detection system from the start to the end.

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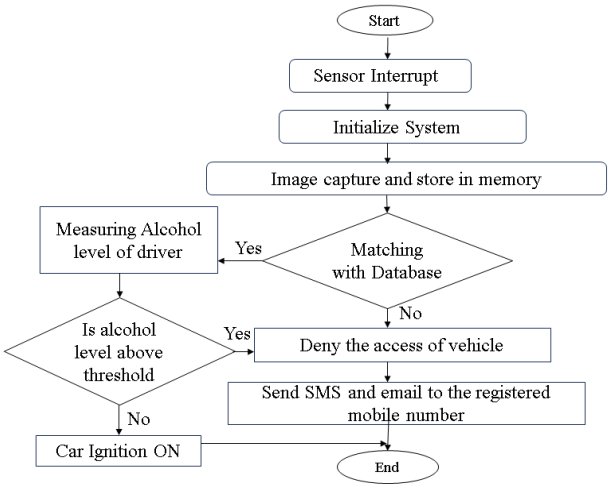

Figure 9: Operational Flowchart

Algorithm
Step 1: Start the vehicle.
Step 2: Initializing the Raspberry Pi Pico and ESP 32 camera.
Step 3: The camera captures the image and transmits it to the Raspberry Pi.
Step 4: Face detection takes place.
Step 5: The image of the face is checked with the database.
If yes, then go to step 6.
If not, then go to step 8.
Step 6: Measuring the consumption level of alcohol by the person.
Step 7: Checking the level of alcohol above or below the threshold value.
If yes, go to step 8.
If not, go to step 10.
Step 8: Denying access to the vehicle.
Step 9: Capture the image and send it to the owner of the vehicle, along with SMS to the mobile.
Step 10: Accessing the vehicle, i.e., vehicle ignition, is ON.
Step 11: End

V. System Implementation

The project's implementation entails sensor calibration and microcontroller programming after parts and modules are assembled inside the vehicle.

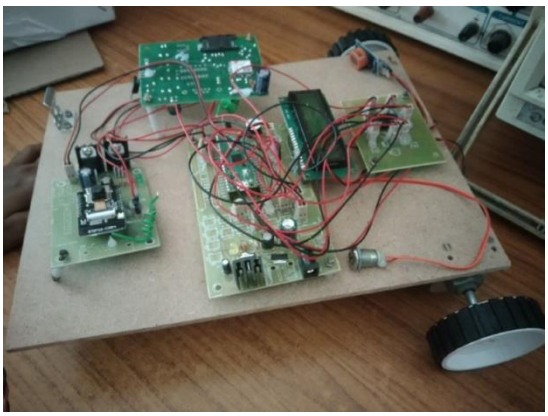

Figure 10: Hardware Module

To ensure smooth communication and feedback, the microcontroller is connected to other modules, like GSM and LCD displays, after programming. Thorough testing is then conducted to confirm the system's functionality and reliability.

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VI. Results

The result of this project is an advanced vehicle security system aimed at safeguarding vehicles from theft and other threats in unsafe surroundings. The system comprises multiple essential features.

6.1 Case-1

Face Detection is Successful, and alcohol consumption is low

The system accurately identifies a face and detects alcohol consumption when the person approaches the vehicle after consuming a small amount of alcohol as shown in figure 6.1 a. The system employs a camera to capture their faces. If the person's face matches any of the stored images in the system's database, it confirms successful face recognition, and the system recognizes that the person is not intoxicated, ultimately allowing access to the vehicle as depicted in 6.1 b.

Fig 6.1 a Allowing access to the vehicle

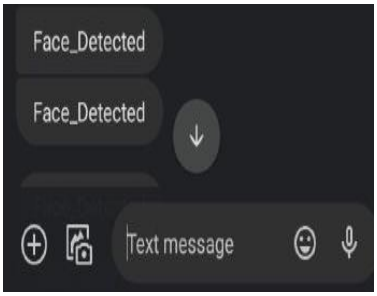

Figure 6.1 b Sending Message

6.2 Case-2

Face detection is Successful, and alcohol consumption is high

This test case involves examining the system's response when it accurately identifies a face but detects high alcohol consumption. When a person approaches the vehicle after consuming a significant amount of alcohol, the system determines that it exceeds a safe limit, indicating the individual's high level of intoxication as shown in fig 6.2 a. The system must prioritize safety and deny access to the vehicle as depicted in fig 6.2 b.

Fig 6.2 a Denying access due to alcohol

Fig 6.2 b Sending alert message

6.3 Case-3

Face Detection is Unsuccessful

When the system identifies the unknown person trying to access the vehicle, it doesn't allow the person to access the engine as depicted in fig 6.3 a. And it also sends an alert message to the owner of the vehicle as shown in fig 6.3 b.

Fig 6.3 a Denying permission due to Unknown access

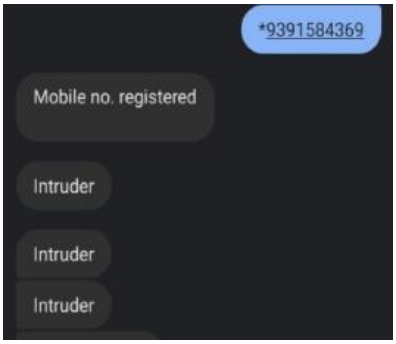

Fig 6.3 b Sending Alert message

Upon reviewing all the results, it's clear that this device is incredibly useful, providing the utmost protection to the vehicle and preventing theft.

Its primary function is facial recognition, which identifies authorized individuals and grants access to the vehicle ignition. If an unauthorized person attempts to start the ignition, their image is promptly sent to the owner's mobile device.

VII. Conclusion

The objective of this project is to develop a vehicle security and alcohol detection system utilizing wireless communication, particularly IOT notifications. This system aims to enhance vehicle protection by enabling real-time alerts and notifications to be sent to the user's device in the event of unauthorized access or suspicious activities. By leveraging IOT technology, we created a robust and efficient system that safeguards vehicles and provides peace of mind to owners, ensuring their assets are protected at all times.

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