IoT Based Vehicle Ignition System

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Abstract - The IoT-based vehicle ignition system is a project designed to enhance the security and safety of vehicles by incorporating multiple sensors and technologies. This system utilizes alcohol detection, fingerprint recognition, RFID (Radio Frequency Identification), and eye-blink sensors to authenticate the driver and ensure that only authorized individuals can start and operate the vehicle. The integration of these sensors and technologies into the vehicle's ignition system enables a multi-layered approach to driver authentication and safety. By combining alcohol detection, fingerprint recognition, RFID, and eye-blink sensors, the system ensures that only authorized drivers who are not intoxicated and are alert can start and operate the vehicle. Overall, the IoT-based vehicle ignition system using alcohol, fingerprint, RFID, and eye-blink sensors provides an advanced and comprehensive approach to vehicle security, driver authentication, and safety.

***Key Words*:** RFID, Fingerprint sensor, Alcohol sensor, Eye blink sensor, Raspberry pi pico.

1.INTRODUCTION

Vehicle theft is a major problem in modern society, with many vehicle owners worried about the safety of their cars, especially in unguarded areas or public places. In response to this issue, we propose a new system that incorporates alcohol detection, fingerprint recognition, RFID (Radio Frequency Identification), and eye-blink sensors to create a highly secure and efficient solution for vehicle ignition. RFID technology uses radio waves to identify and track objects that are equipped with RFID tags. Our proposed system utilizes this technology to authenticate the vehicle owners license and determine if they have the authority to access and start the vehicle. Alongside the use of RFID, our system also includes fingerprint sensors to provide an additional layer of security. These sensors are used to confirm the identity of the vehicle owner before granting access to the vehicle, significantly reducing the risk of theft. the system ensures that only authorized drivers who are not intoxicated and are alert can start and operate the vehicle. Overall, the IoT-based vehicle ignition system using alcohol, fingerprint, RFID, and eye-blink sensors provides an advanced and comprehensive approach to vehicle security, driver authentication, and safety.

2. BODY OF PAPER

2.1 HARDWARE COMPONENTS:

The brief introduction of different modules used in this project is discussed below:

[1] RASPBERRY PI PICO

The Raspberry Pi Pico is a microcontroller board created by the Raspberry Pi Foundation and launched in January 2021.It makes use of the RP2040 microcontroller chip, which was also developed by the same foundation. The Pico is designed to be a cost- effective and user-friendly alternative for physical computing and DIY projects. The Raspberry Pi Pico features with a dual-core ARM Cortex-M0+ processor, 264KB of RAM, 2MB of flash memory, 26 GPIO pins that can perform multiple functions, a 3-pin SWD debug connector, and a USB 1.1 interface. Additionally, it supports various communication protocols such as ADC, DAC, I2C, SPI, and UART. Can program the Pico using multiple languages including Micro Python, C, and Circuit Python. It also has a thriving community of developers and users, who have created vast range of tutorials and projects using the pico.

[2] R307 FINGERPRINT MODULE

The R307 Fingerprint Module is a fingerprint scanner module that allows users to add fingerprint scanning and recognition functionality. This module uses an optical sensor to capture fingerprints and has an on-board processor to perform fingerprint recognition. It supports 1:1 and 1:N fingerprint matching, meaning it can match a single fingerprint against a pre-registered template or match a fingerprint against a database of templates, respectively. The R307 Fingerprint Module communicates with microcontrollers via a UART interface and can be easily integrated. The Fingerprint module which we are using in our project can directly interface with

3.3v or 5v microcontroller and it can store up to 1000 fingerprints. The scanning speed is upto 0.3 seconds and verification speed is upto 0.2 seconds.

[3] RFID TAGS

RFID (Radio Frequency Identification) tags which will be placed in cards (Drivers licence) are small electronic devices that can store and transmit data wirelessly using radio waves. They typically consist of a microchip and an antenna that allows them to communicate with RFID readers or scanners.The RFID valid cards (Drivers licence) contains combination of 12 alphanumeric string characters (For instance 6900D30210A8) and invalid cards will not have any alphanumeric string characters.

[4] RFID MODULE

Radio waves are used by the RFID (Radio Frequency Identification) technology to identify and track objects. The system consists of a tag or transponder and a reader or interrogator. The tag is powered by the reader's radio signal, which also reads the data it contains. The tag then responds by sending the reader its unique identification code back to the reader. RFID technology presents numerous advantages, including enhanced accuracy and efficiency in object tracking, decreased labor costs, and improved visibility into supply chain operations. The RFID which we used in this project is EM-18 reader module. It only reads the string characters provided by the RFID tags and further sends the signals to the Microcontroller board.

[5] EYE BLINK SENSOR

Eye blink Sensor is a relatively simple sensor used to detect eye blinks. It uses a simple infrared sensor to detect if the person's eye is closed and the corresponding data received can further be processed by any logic as required for the application.The eye blink system comes with an IR sensor mounted on glasses which the user can wear like regular glasses. The IR sensor works based on the principle of IR. The on-board IR array contains two components, an IR Emitter and an IR Photo-diode.The IR Emitter emits an IR light towards the eye. The IR Photo-diode is designed to detect if the radiation of the same wavelength is reflected back and detected. If the eye is closed, the IR rays will reflect back with a larger intensity and the photo-diode will detect it. If the eye is open, the IR rays will wither go into the eye or scatter across the eye thereby causing a very low intensity of reflected IR light. Therefore, by monitoring the Photo-diode, we can come to a reasonable conclusion if the eye is indeed closed or not. The module also comes with an on-board potentiometer which can be used to tune the sensitivity of the Photo-diode.

[6] ALCOHOL SENSOR

One of the MQ3 sensor series' most often used models is the MQ3 sensor. It is a MOS (Metal Oxide Semiconductor) sensor. Because sensing is based on the change in resistance of the sensing material when exposed to alcohol, metal oxide sensors are also known as chemiresistors. The MQ3 alcohol sensor uses 800mW of power and runs on 5V DC. It is capable of detecting alcohol concentrations of 25 to 500 ppm. Oxygen is adsorbed on the surface of a SnO2 semiconductor layer when it is heated to a high temperature. When the air is pure, oxygen molecules are drawn to the electrons in tin dioxide's conduction band. As a result, a potential barrier is formed in the form of an electron depletion layer immediately below the SnO2 particle surface. As a result, the Sn02 film becomes highly resistive and prevents electric current flow.

[7] SERIAL CONVERTER

The serial converter used in this project is USB to TTL UART module. A family of converter cables known as the USB TTL Serial cables enables communication between serial UART and USB interfaces. It has Four pins +5V, GND, RXD, TXD. These pins are connected from the fingerprint module by the jumper wires. With the help of serial converter we are dumping and storing the fingerprints into fingerprint module.

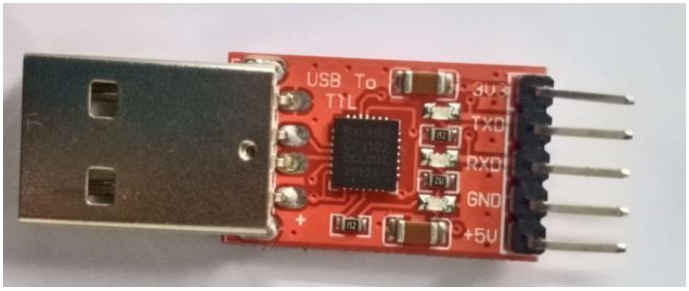

Fig-1: USB to TTL connector.

2.2 WORKING:

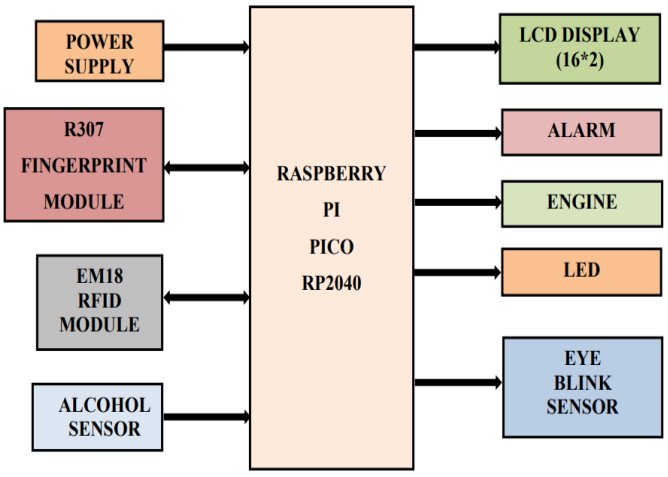

Fig -2: Block diagram

- **Alcohol Detection**: The Raspberry Pi Pico compares the alcohol concentration data from the alcohol sensor with a predefined threshold. If the concentration exceeds the threshold, the system determines that the driver is intoxicated, and further authentication steps are not performed. The vehicle ignition control system is prevented from starting the vehicle.

- **RFID Validation**: The Raspberry Pi Pico compares the identification data received from the RFID reader with the authorized driver's data stored in the system. If the data matches, the system proceeds to the next step.
- **Fingerprint Recognition**: The Raspberry Pi Pico processes the fingerprint data from the fingerprint sensor and compares it with the authorized fingerprint data stored in the database. If a match is found, then ignition starts.
- **Eye-blink Monitoring**: The Raspberry Pi Pico analyzes the eye-blink data received from the eye-blink sensor to assess the driver's alertness level. If the driver is determined to be sufficiently alert, the system proceeds to enable the vehicle ignition.
- LED Indicators indicate whether the engine is running or not.
- Based on the signal from the microcontroller, the Motor Start/Stop circuit uses the motor control circuit to start or stop the engine.
- If the user is intoxicated, the engine immobiliser circuit prevents the engine from starting.

2.3 SOFTWARE REQUIREMENTS:

The following software is required for the project:

1. Aurdino.
2. SYNO demo.

Our programme is written in embedded C. Liquid Crystal for LCD display and Ada Fruit for fingerprints are the libraries that have been added to the code. The "Adafruit Library for Fingerprint Sensors" is a software library created to work with fingerprint sensors from the "Adafruit Industries" company. This library offers a selection of features that make it simple to incorporate fingerprint sensing abilities. SYNO Demo is a software application that allows drivers to register their fingerprints in a fingerprint module. This application gives detailed instructions on how to enroll fingerprints and is made to be user-friendly and intuitive.

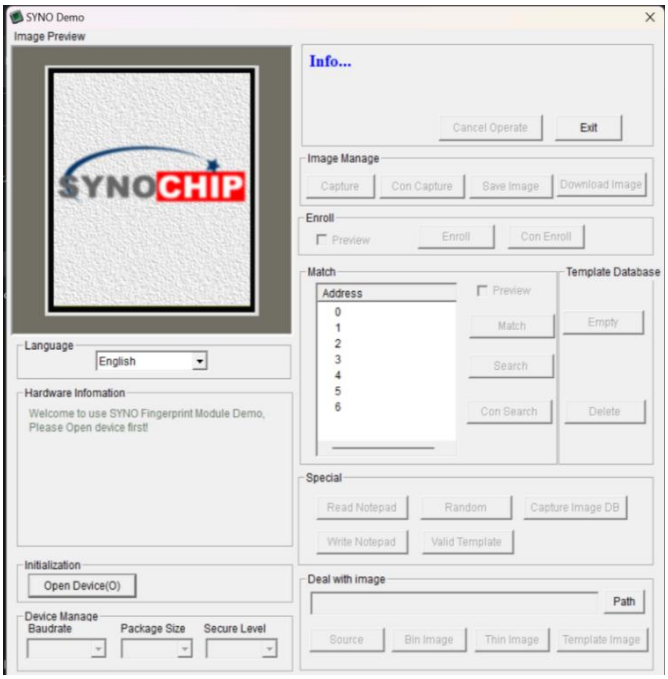

Fig -3: SYNO Demo Application.

2.4 HARWARE IMPLEMENTATION:

Firstly, 230V AC supply is being given to the 0-12V transformer which is the step-down transformer. As we know, A transformer in which the output (secondary) voltage is lesser than its input (primary) voltage is called a step-down transformer. The step-down transformer decreases the output current for keeping the input and output power of the system equal. Then the LCD display, displays car ignition system.When the driver approaches the vehicle, the micro controller compares the alcohol concentration data from the alcohol sensor with a predefined threshold. If the concentration exceeds the threshold, the system determines that the driver is intoxicated, and further authentication steps are not performed. If not, they swipe their RFID card in front of the reader.

The on-board computer of the vehicle receives the data after the RFID reader has confirmed the validity of the card. The on-board computer signals the fingerprint reader to turn on if the RFID authentication is successful. To be verified, the driver places their finger on the fingerprint reader. The driver's fingerprint is scanned by the fingerprint reader, which then sends the data to the on-board computer. The on-board computer signals the ignition system to turn on if the fingerprint authentication is successful. The Raspberry Pi Pico analyzes the eye-blink data received from the eye-blink sensor to assess the driver's alertness level.

The on-board computer won't turn on the ignition system and the engine won't start if either the RFID or fingerprint authentication fails or found intoxicated. To show whether the engine has started or not, an LED is used. The vehicle ignition system can use RF-ID and fingerprint sensor technology to make sure that only authorized users can start the vehicle, making it more difficult for thieves to steal the car. Multiple authorized users, like family members or coworkers, can also be accommodated by the system's configuration.

Fig -4: Hardware implementation.

3. CONCLUSION

In this paper , we have successfully developed and tested an IoT based vehicle ignition system controlled by an Raspberry pi Pico. The IoT-based vehicle ignition system using alcohol, fingerprint, RFID, and eye-blink sensors with Raspberry Pi Pico is designed to enhance the security and safety of vehicles by incorporating multiple sensors and technologies. This system aims to ensure that only authorized individuals who are not intoxicated and alert can start and operate the vehicle.The system provides several benefits, including enhanced security by preventing unauthorized access to the vehicle, the prevention of drunk driving incidents through alcohol detection, driver identification through fingerprint recognition and RFID validation, and the monitoring of driver alertness to ensure safer driving conditions. By combining alcohol detection, fingerprint recognition, RFID, and eye-blink sensors, the system ensures that only authorized, sober, and alert drivers can start and operate the vehicle, thereby promoting road safety and security.

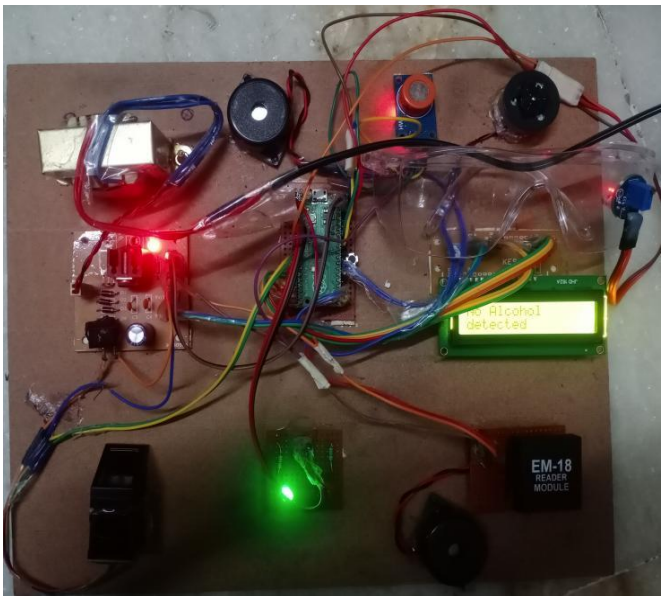

Fig -5: Authentication granted.

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