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Fingerprint and RFID Based Bike and Car Ignition System

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Abstract: ***This project deals with the issue in a more preferable way and ensures the safety of the vehicle. This system aims to create a simple biometric vehicle ignition and security system that protects the vehicle from unauthorized users. This system comprises of Arduino Uno along with EM18 RFID (Radio Frequency Identification) module and R305 Fingerprint sensor. The RFID module checks for the validity of the RFID tag code and permits to proceed further. Proceeding further the fingerprint sensor checks for the authenticity of the fingerprint and ignition takes place. Protecting of vehicles from thefts is important of individuals. Vehicle has ignition keys (normal keys) those can be easily cloned. There are some smart keys available with expensive prices. Smart keys can be copied using some technical loopholes. Here we want to design and develop vehicle access with RFID based license card and fingerprint access. This kind design can't be cloned easily because of two level authentications. The proposed project title is car ignition control with fingerprint and RFID using Arduino Uno.***

Keywords: RFID module, Ignition system, Arduino Uno, Proteus, LCD screen, Microprocessor, Relay, Fingerprint module Buzzer, Motor, Microcontroller.

I. INTRODUCTION

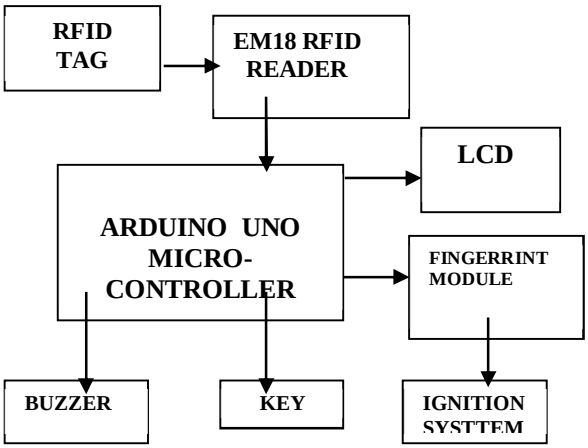
The main objective of the project is to develop keyless authentication for automobiles based on biometrics is provided through RFID tags and fingerprint recognition. To avoid car theft, the suggested method therefore involves developing a keyless authentication system for a vehicle rather than opting for a key-based authentication system. This project aims to develop a complex system that will allow numerous users to readily access the motorcycle using either biometric or RFID technology. A biometric scanner verifies users' identities using their biologically unique identification. Fingerprints are determined IDs, and a registration step for reference biometric data usually precedes a biometric authentication process.

This technology utilizes electromagnetic fields for the automatic detection and tracking of tags that are affixed to items. This project's objective is to develop a sophisticated system that will make it simple for several individuals to access the car using either biometric or RFID technology. This study focuses on developing a fingerprint sensor-based car ignition prototype. This technology can stop car theft. It is designed to let you use a fingerprint scanner to start your car. The GSM SIM 900 in this system links to the Arduino, the project's microcontroller.

A fingerprint and RFID based ignition system adds an extra layer of security to your vehicle by replacing the traditional key. Here's how it works:

1) The system typically involves an RFID reader and a fingerprint sensor connected to a microcontroller unit (MCU) like Arduino. During setup, authorized users enroll their fingerprints with the system. The MCU stores these encrypted fingerprint templates.
2) For starting the vehicle, the user first swipes an RFID tag, like a key card, which is programmed to the vehicle. The RFID reader transmits the ID from the tag to the MCU. The MCU then verifies if the ID matches a authorized user.
3) If the RFID check passes, the system prompts the user to place their finger on the sensor. The fingerprint sensor captures the fingerprint image and converts it into a digital template. This template is then compared against the stored templates.
4) If both the RFID tag and fingerprint match, the MCU recognizes the user as authorized and sends a signal to activate the vehicle's ignition system, allowing the engine to start. In case of failed verification at either stage, the system usually triggers an alarm or disables the ignition.
5) Furthermore, integrating these technologies into vehicle ignition systems can also enhance tracking and monitoring capabilities. RFID tags, for instance, can be used to track the location of a vehicle, which can be useful in case of theft or unauthorized use. Fingerprint recognition can also be used to track who is driving the vehicle, providing additional security and accountability.
6) The integration of both fingerprint and RFID technologies not only enhances security but also streamlines the vehicle ignition process. Gone are the days of fumbling for keys or worrying about unauthorized access to the vehicle. With this advanced ignition system in place, drivers can enjoy peace of mind knowing that their vehicles are protected against theft and unauthorized use.

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7) Moreover, the implementation of such technology aligns with the broader trend towards digitization and connectivity in the automotive industry. As vehicles become increasingly connected and smart, incorporating biometric and RFID-based security features represents a natural progression towards enhancing both safety and user experience.

8) Overall, the introduction of fingerprint and RFID-based car and bike ignition systems represents a significant step forward in vehicle security, convenience, and tracking capabilities. These systems offer a high level of security, convenience, and peace of mind to vehicle owners, making them a valuable addition to any vehicle.

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III. METHODS AND SOFTWARE

Implementing the Fingerprint and RFID based bike and car ignition system involves several proposed solutions and technologies. Here are some key components and solutions:

1) *Logging and Auditing:* Software that logs authentication events for auditing and analysis purposes.
2) *Authentication Logic:* Software that integrates fingerprint and RFID authentication results to determine access to the ignition system.
3) *Microcontrollers or PLCs:* Use microcontrollers or programmable logic controllers (PLCs) within the energy meters to process and transmit data efficiently.
4) *Centralized Control Server:* Set up a central control server or cloud-based platform to receive and manage data from sensors. Implement robust security measures to protect data during transmission and storage.
5) *Switch Control Devices:* Utilize control devices (e.g., relays, smart switches) to remotely control electrical loads based on commands from the central server.
6) *Real-time Monitoring Software:* Develop user friendly software for consumers/ users and utilities to monitor energy consumption and control loads in real time.
7) *Two-way Communication:* Enable two-way communication between software and the central server to allow for remote configuration and firmware updates.
8) *Data Encryption:* Implement strong encryption protocols to secure data transmitted over the network to protect against unauthorized access.
9) *Demand Response:* Implement demand response programs that use real-time data to manage peak load by shedding or shifting loads during high-demand periods.
10) *Disconnect/Reconnect:* Enable remote disconnect and reconnect capabilities for utilities to manage service disconnections and reconnections without physical visits.
11) *Alerts and Notifications:* Implement an alert system to notify consumers and utilities of unusual energy consumption patterns or system issue.
12) *Scalability:* Design the system to be scalable, allowing for the addition of more energy meters and load control devices as needed.
13) *Backup Power:* Include backup power solutions battery backups in fingerprint sensors /cpu /meters and RFID modules to ensure continuous operation during power outages.
14) *Regulatory Compliance:* Ensure that the system complies with local regulations and standards for energy metering and remote control.
15) *User Education:* Educate consumers about the benefits of the system, how to use control features, and how to monitor their usage.
16) *User Interface:* Consider adding an LCD screen or LEDs to provide feedback to the user during the authentication process.
17) *Safety Measures:* Implement fail-safe mechanisms to rid of unauthorized access & ensure the system does not interfere with normal operation of vehicle.

A. *Software*

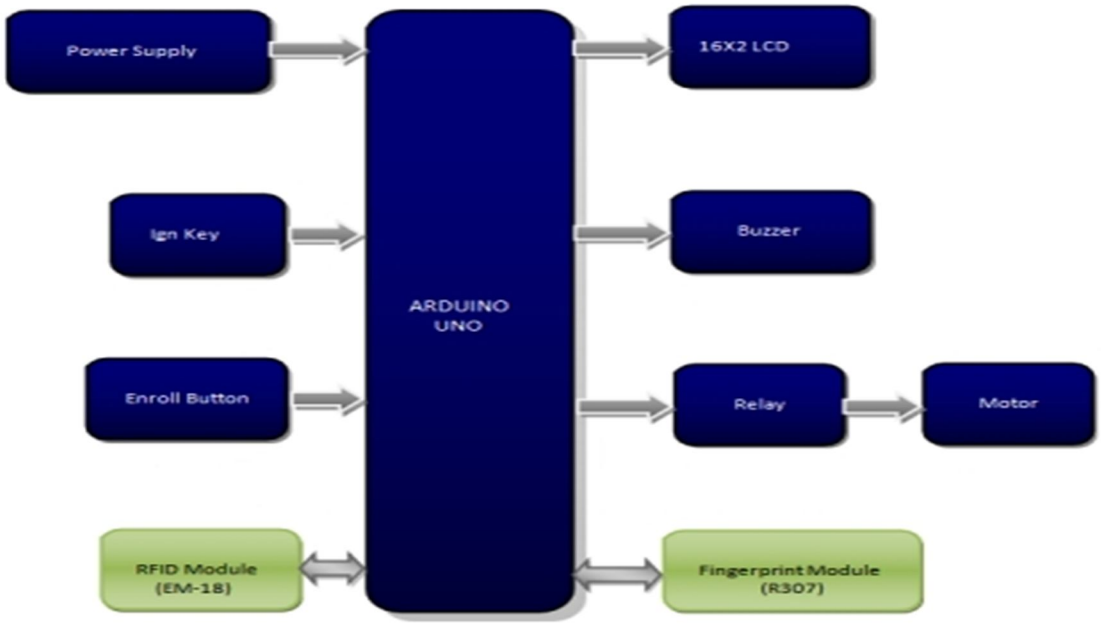
Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs-light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A world wide community of makers students, hobbyists, artists, programmers, and professionals has gathered around this open- source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike. Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

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Arduino has been used in thousands of different projects and applications. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux.

Teachers and students use it to build low cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments.

In existing solution the design and development of a energy meter reading with load control using GSM was the electric bills were sent to the registered mobile numbers through SMS. Also the electric appliances were controlled by the user through SMS. The code was written so after every one plus the bill was sent and also the units in energy meter. Also no need of any human efforts.



IV. RESULTS AND DISCUSSION

This security system employs an Arduino UNO board, AS608 fingerprint module, RC522 RFID, Limit switch, and 5V DC relay as shown., the Access Control for this system is connected to the battery, limit switch, and DC relay. The NO terminal of the DC relay is attached to the MCB while the common terminal is attached to the limit switch. The Arduino board is connected to the fingerprint module, and the input supply pin is connected to the relay, with the ground connected to the ground terminal and the VSS pin connected to the allotted pin. Despite the development and utilization of various vehicle antitheft devices, vehicle robbery is still prevalent due to each device's limitations.

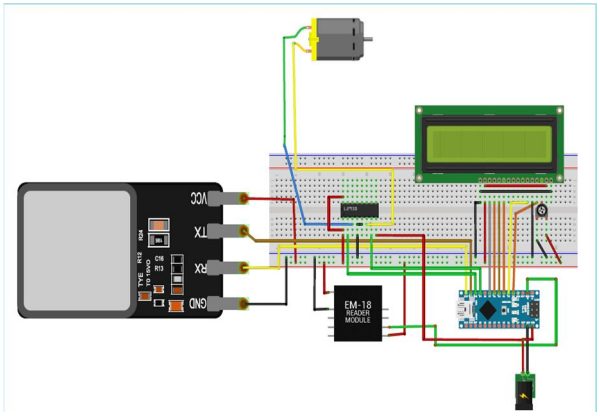


FIG : Circuit Diagram

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The vehicle control procedure involves finger scanning or RFID verification in addition to stand removal to enable the engine to start. The main objective is to recognize the fingerprint or RFID access and side stand removal to close the control circuit and start the vehicle. If the side stand is applied, the push button is closed, and the vehicle cannot start. To start and drive the vehicle, the owner must complete both fingerprint or RFID verification and remove the side stand. This system's main advantage is that it requires both interlocking systems to be satisfied for the vehicle to start. Once the safety and security system is recognized, the battery supply activates the fingerprint module or RFID reader, and the vehicle starts after successful recognition.The system comprises of the following parts. Arduino Uno, R305 Fingerprint sensor, EM18 RFID Reader, 16*2 Alphanumeric LCD, SIM900A GSM Module, Buzzer, DC Motor, L293d Motor driver IC, Connecting wires, 12V battery.

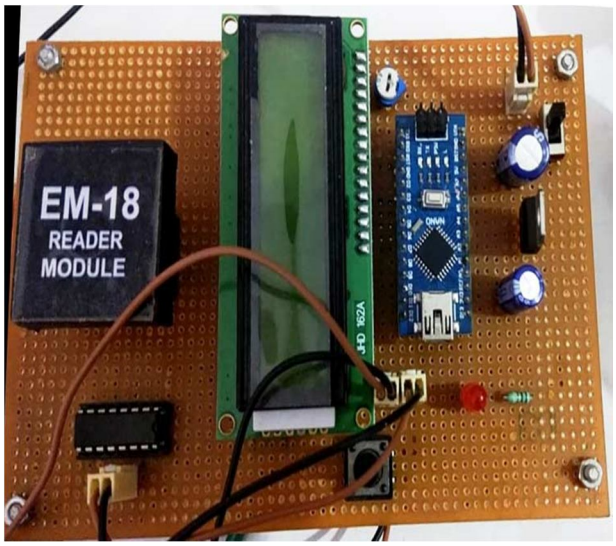


FIG: Complete Circuit connected

The parts are arranged as illustrated The RFID Reader, Fingerprint Sensor and buzzer are controlled by Arduino. All the modules are programmed in such a way that the entire system achieves synchronization. The Arduino microcontroller is programmed in such a way that the RFID Reader and the fingerprint sensor are made to work in the desirable way.

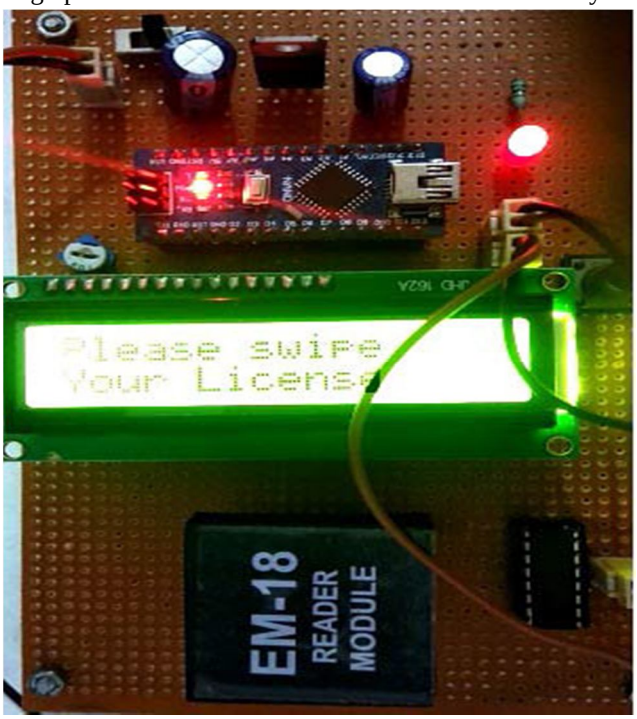


FIG: Display system on LCD

The output from the RFID Reader will be displayed in the LCD that is connected to the system. If the tag verified by the RFID reader is valid then the system allows the operator to proceed further. The LCD displays “USER ID VERIFIED”. Then the user has to place his finger in the provided fingerprint sensor. If the finger print is recognized by the sensor then the ignition starts. If the tag is not verified by the RFID reader then it will reject the permission requested by the RFID tag and the LCD will display “INVALID USER ID”. In this case the ignition will not start. In case of three repeated attempts to operate the vehicle by an invalid RFID tag the buzzer rings raising the caution alarm. The GSM Module SIM900A sends an auto generated message stating that “YOUR CAR IS IN DANGER” to the updated mobile number. Furthermore the system locks the steering and the tires of the car, thereby providing complete security solution. When an unauthorized person bearing an invalid RFID tag tries to steal the vehicle, the RFID reader tests for the authenticity of the tag and turns down the request raised by the person to operate the vehicle. Upon three repeated invalid attempts the steering and the tires of the car are locked. In addition to this an alarm rings to warn the owner about the prevailing situation and also sends a message regarding this to their mobile number. Even if someone is able to steal the valid RFID tag and tries to steal the vehicle they will be unsuccessful as this system requires both the valid RFID tag and authorized fingerprint to start the ignition and start the system. Only the individual with the valid RFID tag and authorized fingerprint is able to operate the vehicle.

V. CONCLUSION

In conclusion, the advancement in ignition system is non-stop process and new technology is always in progress. In this paper, an Arduino Uno and RFID and Fingerprint based smart ignition and security system has been proposed. We have proposed a practically efficient and feasible way to develop hardware integrated system to deal with the rising crisis of vehicle thefts that creates unrest in the society. Further approach of this system will be on reducing the crime rate and saving the manpower and time of the police personnel without going in vain. This proposed system not only improves the security of the vehicle by its biometric based security system but is also cheap and affordable that can be adopted by the vehicle manufacturers in upcoming days.

The fingerprint and RFID-based bike and car ignition system project has culminated in a groundbreaking solution that enhances vehicle security and user convenience. By integrating biometric technology like fingerprint recognition and RFID (Radio Frequency Identification), the system ensures that only authorized users.

Throughout the project, extensive research and development were conducted to create a robust and reliable system. The fingerprint recognition technology provides a high level of security, as each person's fingerprint is unique, making it virtually impossible for unauthorized individuals to access the vehicle. Additionally, the inclusion of RFID tags allows for seamless authentication, further streamlining the user experience. With the ability to register multiple fingerprints and RFID tags, owners can grant access to trusted individuals while maintaining control over who can start the vehicle. Moreover, the system is designed to withstand various environmental conditions, ensuring reliable performance in diverse settings.

Furthermore, the project involved rigorous testing and optimization to ensure compatibility with different vehicle models and operating conditions. The result is a versatile solution that can be seamlessly integrated into existing ignition systems, minimizing installation efforts and costs for vehicle owners.

Through meticulous design and implementation, the system ensures that only authorized users can start the vehicle, thus minimizing the risk of theft. The fingerprint sensor accurately identifies the user, while the RFID module communicates with the vehicle's ignition system to allow or deny access based on the stored user information. During the development phase, various challenges were encountered and overcome, such as optimizing the system's power consumption, ensuring reliable communication between components, and implementing robust security measures to prevent unauthorized access.

In conclusion, the fingerprint and RFID-based bike and car ignition system project represents a significant advancement in vehicle security and access control. Its innovative design, robust functionality, and user-friendly interface make it a valuable asset for vehicle owners seeking to safeguard their assets and enhance convenience.

VI. FUTURESCOPE

1) *Enhanced Security Features:* You could explore integrating additional security features such as GPS tracking, remote engine lock/unlock, and alarm systems to further enhance the security of vehicles.
2) *Mobile App Integration:* Develop a mobile application that allows users to control their vehicle's ignition system, monitor its status, and receive notifications on their smartphones.
3)

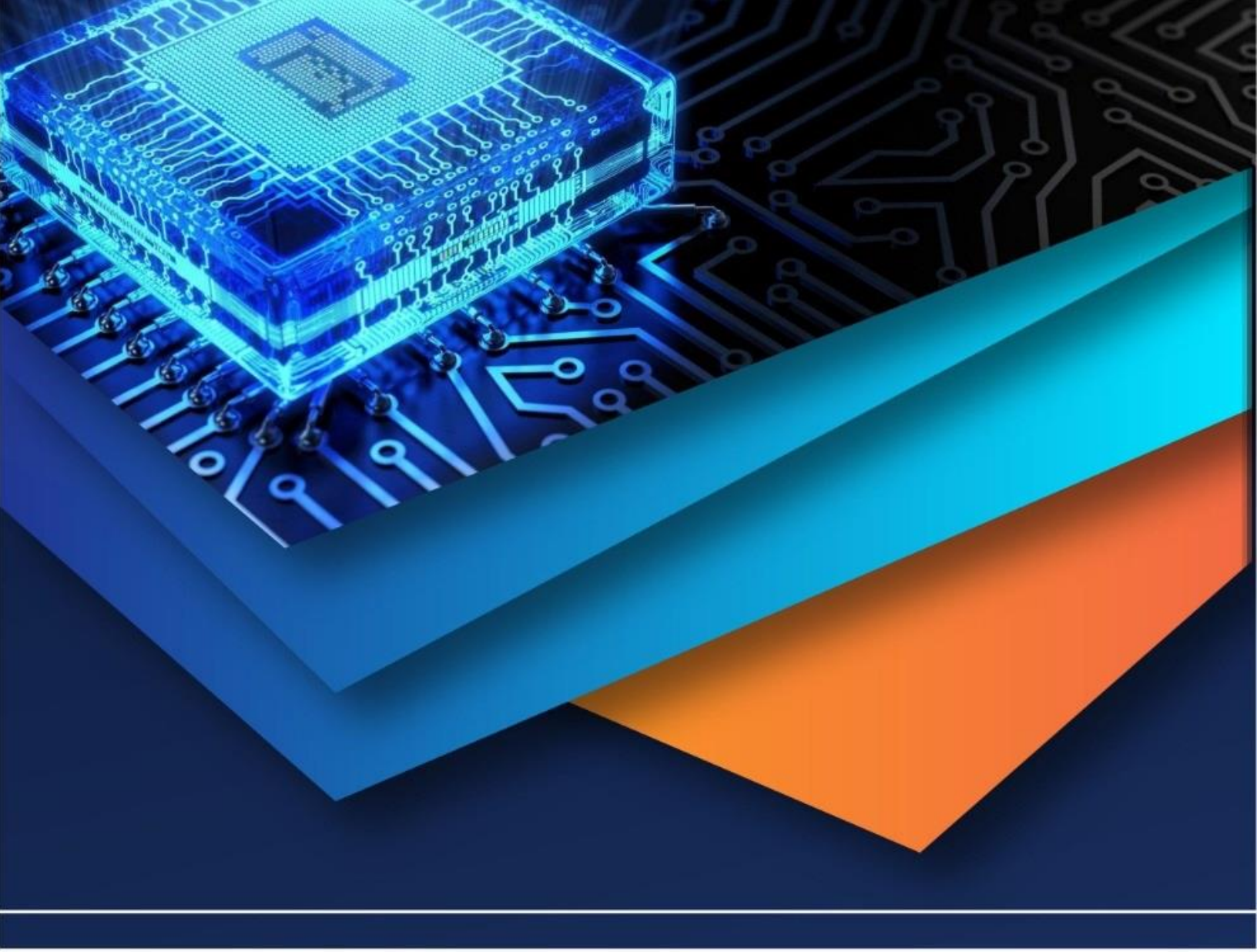
4) *Data Analytics:* Implement data analytics to track usage patterns, monitor vehicle health, and provide insights to users for better maintenance and performance.
5) *Integration with Smart Home Systems:* Integrate the ignition system with smart home systems to enable features like automatic garage door opening/closing, lighting control, and security system integration.
6) *Expand to Other Vehicles:* Explore expanding the system to work with other types of vehicles such as trucks, buses, and boats.
7) *Commercialization:* If your project proves successful, consider commercializing the product by partnering with automotive companies or selling it as an aftermarket accessory.
8) *Collaboration with Insurance Companies:* Collaborate with insurance companies to offer discounts to users who install your ignition system, as it can significantly reduce the risk of theft.
9) *Customization and Personalization:* Allow users to customize and personalize their ignition system settings, such as preferred ignition methods, access levels for different users, and vehicle performance settings.
10) *Integration with Payment Systems:* Integrate the system with payment systems to enable features like automated toll payments, parking fee payments, and fuel payments directly from the vehicle.
11) *Environmental Monitoring:* Include sensors to monitor environmental conditions such as temperature, humidity, and air quality, providing users with real-time data and alerts.
12) *Integration with IoT:* Integrate the ignition system with the Internet of Things to enable remote monitoring and control of the vehicle. This could allow owners to track their vehicles in real-time, receive alerts.

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