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SMART DOOR LOCK

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➢ ABSTRACT :-

This abstract presents an overview of an Arduino Uno and RFID-based smart door lock system. The project combines the capabilities of Arduino Uno, a popular microcontroller board, with Radio Frequency Identification (RFID) technology to create a secure and convenient door access control system.

The Arduino Uno serves as the core component of the project, providing a programmable platform for controlling the smart door lock. It utilizes the ATmega328P microcontroller, which offers a wide range of digital and analog input/output pins, making it suitable for interfacing with various electronic components.

The RFID technology is employed to authenticate users and grant access to the door lock. RFID tags or cards, containing unique identification information, are assigned to authorized users. When a user presents their RFID tag or card near the RFID reader connected to the Arduino Uno, the system verifies the identification and triggers the door lock to open if the user is authorized.

The project involves connecting an RFID reader module to the Arduino Uno, along with other necessary components such as an electronic lock, power supply, and feedback mechanisms. The system can be customized to include additional features like a display for user feedback, an activity log to record access events, or integration with other home automation systems.

The Arduino Uno's programming flexibility allows for the implementation of various security measures, such as encryption techniques, to ensure the integrity of the communication between the RFID reader and the microcontroller. Additionally, the system can be expanded to include remote access capabilities through wireless communication modules, enabling users to control the door lock remotely via a smartphone or computer.

Overall, the Arduino Uno and RFID-based smart door lock system provides an efficient, secure, and customizable solution for access control. It offers the convenience of keyless entry, enhanced security through RFID authentication, and the flexibility to adapt to individual requirements. The project showcases the potential of Arduino technology in creating innovative and practical home security solutions.

Keywords – Arduino, RFID, GSM and Servo-motor

➢ INTRODUCTION :-

The Arduino Uno based smart door lock is an innovative and secure solution that combines the power of Arduino microcontroller technology with modern home security systems. It offers a convenient and efficient way to control access to your home or office, providing enhanced security and peace of mind.

Traditionally, door locks have relied on mechanical keys or simple electronic systems. However, these methods can be cumbersome, prone to key loss, or vulnerable to unauthorized access. The Arduino Uno smart door lock overcomes these limitations by leveraging the

capabilities of the Arduino platform to create a sophisticated and customizable security system. Arduino Uno, a popular open-source microcontroller board, forms the foundation of this smart door lock project. It is equipped with an ATmega328P microcontroller and a wide range of digital and analog input/output pins, making it ideal for building electronic projects with various functionalities. The smart door lock project utilizes additional components such as electronic locks, proximity sensors, keypads, RFID readers, and Wi-Fi modules, which interface with the Arduino Uno. These components enable different methods of access control and authentication, enhancing security and convenience.

Key Features of Arduino Uno based Smart Door Lock:

Keyless Entry:
The smart door lock eliminates the need for traditional keys, offering keyless entry options such as PIN codes, RFID cards, or even smartphone-based authentication methods.

Customization:
With Arduino Uno's flexibility and programmability, the smart door lock can be easily customized to suit individual requirements. Users can modify the code to implement specific functionalities or integrate the lock with other home automation systems.

Remote Access:
By incorporating Wi-Fi modules or other wireless communication technologies, the smart door lock can be remotely controlled and monitored using a smartphone or computer. This feature allows users to grant access to guests or monitor the lock's status from anywhere.

Enhanced Security:
The smart door lock provides a higher level of security compared to traditional locks. It can incorporate advanced encryption techniques, two-factor authentication, or biometric sensors for added protection against unauthorized access.

Activity Logging:
The Arduino Uno's memory capabilities enable the smart lock to record and store access activity logs. This feature allows users to monitor who accessed the lock and when, providing valuable information for security purposes.
Low Power Consumption: Arduino Uno's power-efficient design ensures that the smart door lock operates for extended periods using minimal power. This is particularly beneficial for battery-powered applications, such as outdoor or remote locks.

➢ LITERATUTE REVIEW :-

- D. Xiong and H. Yu published in his research paper about the use of Bluetooth in smart lock but we used the cellular network which is more diversified and cover more area than bluetooth. We used the encrypted lock key which is more secure.
- T. Kim and Y. Lee mainly focused on the smart home but our project focus on overall to make smart Like hospital, bank and Intitution.
- K. Saravana Kumar and S. Ramaraj published in the journal about the controlling part of the smart lock .We gain the knowledge from this journal and make our project advanced to control system and increase efficiency of overall system.
- A. Al- Fuqaha et al published in journal about the security and privacy of smart lock .To improve the security and privacy of our smart lock we used the encrypted key with unique code.

➢ METHODLOGY :-

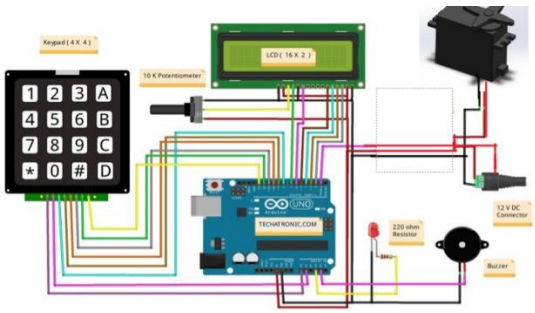
The methodology for implementing an Arduino, GSM, servomotor, and RFID-based smart door lock system can be outlined in the following steps:

1. Requirements Analysis: Determine the specific requirements of the smart door lock system, such as the desired features, security levels, and user interface.
2. Hardware Selection: Choose the necessary components, including an Arduino board (such as Arduino Uno or Arduino Mega), a GSM module (such as SIM900 or SIM800), a

servomotor, and an RFID reader module (such as MFRC522).

3. System Design: Design the overall system architecture, considering the connections between the components and the flow of data and control signals.
4. Circuit Design: Create a circuit diagram that includes the connections between the Arduino board, GSM module, servomotor, and RFID reader module. Ensure proper power supply and appropriate connections.
5. Arduino Programming: Write the Arduino code to control the system. This includes configuring the GSM module for communication, programming the RFID reader to read RFID tags, and controlling the servomotor for door locking/unlocking.
6. RFID Tag Management: Establish a method to manage authorized RFID tags or cards. This can involve creating a database or list of authorized IDs that the system will recognize for access.
7. User Interface: Design a user interface for interacting with the smart lock system. This can be a mobile application, a web interface, or a simple SMS-based interface for controlling the lock remotely.

It is important to note that this methodology provides a general framework, and the specific implementation may vary depending on the exact components used and the desired functionality of the smart door lock system.



COMPONENT

Arduino Uno (R3) :-

The Arduino Nano has a number of facilities for **communicating with a computer, another Arduino or other microcontrollers**. The ATmega328 provide UART TTL (8V-20V) serial communication, which is available on digital pins 0 (RX) and 1 (TX).

Arduino nano cable :-

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3. x). It has more or less the same functionality of the Arduino Du emilanove, but in a different package. It lacks only a DC power jack, and works with a **Mini-B USB cable** instead of a standard one.

LCD :-

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation

Radio Frequency Identification (RFID) :-

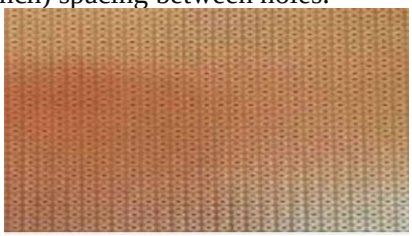
Radio Frequency Identification (RFID) is a technology that uses radio waves to passively identify a tagged object. It is used in several commercial and industrial applications, from tracking items along a supply chain to keeping track of items checked out of a library.

GSM (Global System for Mobile Communications) :-

It is a set of mobile communications standards and protocols governing second-generation or 2G networks, first developed and deployed in Europe. GSM is a digital cellular communication standard that is universally accepted.

Zero PCB :-

Zero PCB is basically **a general-purpose printed circuit board (PCB), also known as perf board or DOT PCB**. It is a thin rigid copper sheet with holes pre-drilled at standard intervals across a grid with 2.54mm (0.1-inch) spacing between holes.



Buzzer :-

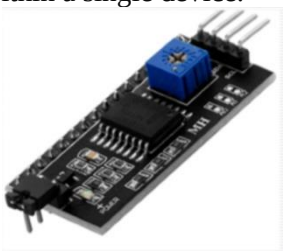
Also known as a sounder, audio alarm or audio indicator, a buzzer is a basic audio device that generates a sound from an incoming electrical signal.

4x4 Matrix 16 key membrane switch keypad 8-pin Keyboard :-

The 4x4 matrix keypad is a simple mechanism that resembles the numeric input on your computer keyboard, except that it has an additional '*,' '#' and 4 other auxiliary buttons that can be used for various functions in the application.

I2C Led Interface Device :-

The Inter-Integrated Circuit (I^2C) Protocol is a protocol intended to allow multiple "peripheral" digital integrated circuits ("chips") to communicate with one or more "controller" chips. Like the Serial Peripheral Interface (SPI), it is only intended for short distance communications within a single device.



Soldering Wire :-

Solder wires are **wires with a low melting point which can melt along with the soldering iron**. Depending on the application and soldering temperature, many different types of soldering wires are available. Solder wires are generally two different types - lead alloy solder wire and lead-free solder.

Hookup wire :-
Hook up wires, also known as lead wires, are **single core insulated cables used in the internal wiring of electronic and electrical equipment**. Specific applications include motors transformer, switchboard, panels, rectifier and electronic circuits.

Servo-motor :-
A DC motor is defined as a class of electrical motors that convert direct current electrical energy into mechanical energy.

Charger(12V) :-
To convert A.C supply into D.C and give power supply to the system.

Small Wooden Plank :-
Where the whole system is installed and run.

Jumper Wire :-
Jumper wires are electrical wires with connector pins at each end. They are used **to connect two points in a circuit without soldering**. You can use jumper wires to modify a circuit or diagnose problems in a circuit.

RESULT AND EXPERIMENT :-

Features:

- User authentication using RFID cards or key fobs.
- Remote control and monitoring via GSM network.
- Secure communication between the system and authorized users.
- Real-time notifications for door access events.
- Integration with a mobile app or web interface for additional control.

Experiment Setup:

- Connect the RFID reader module to the Arduino board as per the manufacturer's instructions.
- Connect the servo motor or electronic door lock mechanism to the Arduino board to control the door lock/unlock action.
- Connect the GSM module to the Arduino board using appropriate connections.
- Write an Arduino sketch to handle RFID card detection, user authentication, and door lock control.
- Program the GSM module to send SMS notifications and receive commands from authorized users.
- Configure the system to communicate with a designated phone number or web interface for remote control and monitoring.
- Test the system by presenting an authorized RFID card to the reader and verifying if the door unlocks.
- Experiment with different scenarios, such as using an unauthorized RFID card or sending commands via SMS, to ensure the system behaves as expected in terms of access control and notifications.

In this experiment, you would be testing the functionality and performance of the Arduino-based smart door lock system. The system should successfully authenticate authorized users based on RFID cards, control the door lock mechanism accordingly, and send notifications via SMS using the GSM module. By experimenting with various scenarios, you can ensure that the system operates securely and reliably, providing the desired access control and monitoring features.
Remember to refer to the documentation and libraries of the specific components you are using, as they may have their own setup instructions and sample code available to help you build the system successfully.

➢ CONCLUSION :-

By combining these technologies, the smart door lock system offers robust security, ease of use, and remote access capabilities. It enhances convenience, eliminates the risk of lost or stolen keys, and provides an efficient access control solution for homes, offices, or any other location where secure entry is essential. However, it is important to note that while the Arduino, GSM, and RFID-based smart door lock system provides an advanced and secure solution, no system is entirely foolproof. It is crucial to implement appropriate security measures, regularly update software, and maintain the system to ensure its reliability and effectiveness.

Overall, the Arduino, GSM, and RFID-based smart door lock system combines the power of microcontroller

programming, wireless communication, and contactless authentication to create a versatile and secure access control solution that offers convenience and peace of mind.

REFERENCES :-

- This paper by D. Xiong and H. Yu published in IEEE Communiction Magzine and his research paper about the use of Bluetooth in smart lock
- This paper by T. Kim and Y. Lee, published in the International Journal of Smart Home, provides a review of smart lock technologie
- This paper by K. Saravana Kumar and S. Ramaraj, published in the Journal of Advanced Research in Dynamical and Control Systems, focuses on the use of smart door locks for home security.
- This paper by A. Al-Fuqaha et al., published in the IEEE Internet of Things Journal, provides a comprehensive review of the state-of-the-art in smart locks