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RFID-Based Digital Door Locking System

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ABSTRACT

This research presents the development of an RFID door lock system utilizing Arduino Uno microcontroller technology. The system aims to enhance security and convenience in access control applications. Radio Frequency Identification (RFID) is employed for user authentication, where RFID tags serve as unique credentials for accessing the secured door. The core components of the system include an Arduino Uno microcontroller board, an RFID reader module, a servo motor for controlling the door lock mechanism, and supporting peripherals. The Arduino Uno acts as the central processing unit, managing inputs from the RFID reader and controlling the servo motor to lock or unlock the door. The RFID reader module detects and reads data from RFID tags, which are assigned to authorized users. Upon detecting a valid RFID tag, the Arduino verifies the tag against stored credentials in its memory. If authenticated, it triggers the servo motor to unlock the door, allowing access. Programming for the system is implemented using Arduino IDE, leveraging the simplicity and flexibility of Arduino's programming environment. The code includes functionalities such as RFID tag detection, data verification, and servo motor control, ensuring efficient and reliable operation of the door lock system.

Introduction

According to Buzan, 1991, Security is defined as the pursuit of freedom from danger and the capabilities of states and the public to protect individual's identity and their integrity against the power of progress, which they see as threatening. Security Systems play a significant part in environments safety by restricting access to unauthorized personnel. Various entryway bolts like mechanical or electrical locks were intended to attain basic security measurements. However, these locks can be effortlessly hacked by unwanted people allowing them to enter the premises illegally. With advanced technology, solutions to end the security threats have been resolved by using Access Control System. The most well-known technique for access control is the conventional lock and key system. It is fine for small-scale applications however has various traps, particularly in an application where there is a countless number of users or a common door. A properly chosen access control system can solve these issues and can be organized with different systems to provide more effective security solutions.

This gadget is designed with the help of an Arduino using a servo motor that pushes the gear forward and back. When we scan our register card, there is a loop start of store programming in which the servo motor rotates 90 degrees, then the gear mechanism in it works, which locks and opens the lock. In simple language, when a card is scanned, the condition given in the programming matches, then the command given in that condition becomes active, such that when the correct card is scanned, the open condition will match, in which the servo motor will rotate 90 degrees and the door lock will be open but when an unregistered card is scanned then the condition of the wrong card will match and the door lock will not be open.

Project Description

RFID door locks are a type of wireless and electronic access control device that functions similarly to smart locks. An RFID door lock system uses radio waves to communicate with a key card or smartphone. The key card or smartphone must be programmed with a unique credential that is assigned by the building administrator. The administrator must also deactivate credentials if a tenant loses their key card or moves out of the building. RFID door locks are a more secure and convenient way to control access to your home or commercial premises. RFID door locks are harder to copy than traditional keys, so you have peace of mind that unauthorized users won't be able to gain access.

The ability to deactivate a key card if it is lost or stolen, preventing unauthorized access The ability to grant temporary access to visitors or service providers without having to give them a key. RFID door locks can be less expensive than traditional lock and key systems and can be fitted to many different types of doors and furniture.

Methodology

Components

Our created model RFID based door access control utilizing Arduino depends on keen innovation where advanced information is encoded in RFID labels which are caught by the RFID reader by radio waves. These RFID labels have a working recurrence of 13.56 MHz and 1 Kb of memory put away in it. The sign sent by the reader and antenna wire is utilized to control on the tag and mirror the vitality to the reader. When we switch on the power supply, the default white LED lights up, which demonstrates that the computerized framework is actuated. Each representative in the workplace has an ID card with explicit subtleties on it which can be followed by the RFID reader at whatever point it is put at a particular range. The RFID card tag of every representative is put away in the principal framework. Each time when a representative brings label near the RFID reader, the antenna wire in the reader sends a radio wave and reads the information of the RFID card. Every one of these activities are shown on the framework in the main office. At whatever point an individual with explicit ID label attempts to get into the limited territory, he/she needs to contact the card. On the off chance that the subtleties of that remarkable card are as of now put away in the framework the door opens consequently. In the event that the subtleties on the card don't coordinate with the record put away in the framework, at that point the passage of that individual is denied. The door does not open. The door will naturally open and close when the privilege RFID tag is set inside the scope of RFID reader. The leader of the workplace has a master card through which the passage of another card can be made into the framework.

The core components used are:

- Arduino Uno
- Servo Motor
- Power supply
- RFID Tag & Reader

Working

The RFID reader emits a radio frequency field. When an RFID tag comes within range of the reader, it powers up (if passive) and transmits its unique identifier to the reader. The RFID reader receives the identifier and sends it to the control unit. The control unit (Arduino Uno) checks this identifier against a database of authorized identifiers. If the identifier matches an authorized entry: The control unit sends a signal to the door's electronic lock to unlock the door.

If the identifier does not match: The control unit does not unlock the door, and access is denied. Logging: Many systems also log entry attempts, noting the identifier, time, and whether access was granted or denied.

Block Diagram

The Figure shows the access control system framework using RFID and Arduino. The system is composed of three main parts, an RFID reader, an Arduino Uno microcontroller, and an access controller using Servo Motor. The RFID reader reads the RFID Tag 1, Arduino UNO Servo Motor, DATABASE tags and the Arduino microcontroller receives the input data from the RFID reader, operates it, and uses the output of the data to either grant or deny access to the user using the access controller. The data will also be displayed on the database. All users required information is stored in the system. For instance, to add a new user, we must register the user with the system first then the recorded user information is burn in RFID tag. The new tag will now be accessible when system.

Hardware Implementation

The research procedure will follow these steps:

1.Gather the materials required to construct the proposed device

2. Follow the circuit design to assemble the materials.

3.Install the necessary code needed in the Arduino. Make a simple Database for the system using SQL.

4. Input the necessary data into the database of the system.

5. Test the device and the database for functionality and accuracy

Result

The RFID-based digital door lock system using Arduino, a servo motor, and a RFID tag & reader successfully provides secure and automated access control. Authorized RFID tags trigger the servo motor to unlock the door, while unauthorized tags are denied. The system is cost-effective, reliable, and suitable for residential and commercial applications.

Conclusion

The use of the Arduino UNO microcontroller in this project allows design simplicity, therefore, the project can be achieved in a shorter time than other technologies previously employed. And this door lock system is also very secure and saves the information of people coming and going.

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