

# Controlled Digital Lock Using Arduino

<sup>1</sup>Kushal Agarwalla, <sup>2</sup>Shubham Nandan, <sup>3</sup>Varun Anil Nair, <sup>4</sup>Azhagiri .M

<sup>1,2,3,4</sup>Department of Computer Science and Engineering

SRM Institute of Science And Technology, Chennai, India

**Abstract**— As thefts are increasing day by day, security is becoming the biggest concern nowadays. Locks have been a staple of homes, and the foundation of home security for centuries. They tend to be taken for granted, and it seems that locks have faded gradually into the background of security, even though they still hold a great amount of significance. Technology has done a lot of good for the world, and it even makes some of the most complicated tasks easier than ever to complete. In this project, we will make a digital door lock system with RFID (Radio Frequency Identification Device) using Arduino Uno. It will open your door only when the right tag is scanned and if an unknown tag is scanned then the access to open the door would be denied. This will allow homeowners to control their home in ways they never had. In this project, the devices that will be used are MFRC522 RFID Module, Servo Motor, LCD Display, Arduino Board, Proximity Sensor CNY70, Breadboard and Jump Wires. One of the main advantages of a RFID door lock is not needing to carry a bunch of keys with us. A person no longer needs to worry about losing our key or fidgeting at the door to get it open. This lock will be of great help to prevent burglary. Moreover, these locks will have an added advantage over heavier bulky locks as the access would be denied whenever somebody is trying to bring any unknown tag.

**Keywords**—Arduino, Internet of Things, Radio Frequency Identification, Proximity sensor, Servo Motor

## I. INTRODUCTION

As thefts are expanding step by step, security is turning into the greatest concern these days. Locks have been a staple of homes, and the establishment of home security for quite a long time. They have a tendency to be underestimated, and it appears that locks have blurred bit by bit away from plain sight of security, despite the fact that regardless they hold a lot of criticalness. Innovation has completed a great deal of useful for the world, and it even makes the absolute most convoluted errands less demanding than any time in recent memory to finish. In this venture, we will make an advanced entryway bolt framework with RFID (Radio Frequency Identification Device) utilizing Arduino Uno.

The proposed framework comprises of a computerized entryway bolt with RFID entryway tag. Gone are those occasions when we needed to utilize substantial mechanical locks to shield the entryway. The new idea will open the entryway just when the correct tag is examined. On the off chance that an obscure tag is examined, the entryway will deny the authorization. This computerized entryway bolt framework utilizes Arduino Uno. We will utilize labels that depend on the MIFARE convention and the MFRC522 RFID peruser. Notwithstanding the RFID module, we will utilize a nearness sensor for checking whether the entryway is shut or opened, a servomotor for the bolt system and a character show. This bolt will be of incredible help to forestall thievery. In addition, these locks will have an additionally preferred standpoint over heavier cumbersome bolts as one would require the tag to open the entryway generally, the entrance would be denied.

The proposed framework has a ton of focal points over the customary entryway bolt. A man doesn't have to convey a bundle of keys.

## II. RELATED WORK

Radio Frequency Identification (RFID) innovation uses the electromagnetic fields for information move with a specific end goal to perform programmed recognition and following of labels or labels of items. It can give approaches to plan and actualize generally economical frameworks, especially for security viewpoints. In the past models, they have proposed an advanced access control framework that can be utilized to an ensured region where none, however, individuals with verified qualifications can enter. Truth be told, they have executed the framework in the server room of an instructive Institute to test its proficiency and additionally consumption. The executed framework includes computerized entryway bolt which is open capable continuously to guarantee anchored get to indicating enactment, confirmation, and approval of clients before conveying the RFID card near the peruser. The whole framework is related to a focal customer server sub-framework to guarantee and keep up the general framework honesty. Related sub-framework likewise produces a log answer to keep up registration and registration status of guests as per the essential qualifications of each. The benefit of this idea is that it is secure and effective.

## III. HARDWARE COMPONENTS

### A. Arduino Uno:

Arduino Uno is an open source microcontroller which consist of a Processing programming-based interface. It is an easy to use hardware and software electronic platform. It was modelled on ATmega328p and developed by Arduino.cc The board consist of 14 Digital pins and 6 Analog pins. The board is programmable with Arduino IDE. Type B USB cable is used to charge and implemented the code on to the inbuilt memory of the board, that consist Flash - 32k bytes, SRAM - 2k bytes and EEPROM - 1k byte. This type B USB can be used to charge the electrical power it requires, or can be handled by a 9 Volt battery. Though it accepts 7V - 20V. The board comes with a pre-programmed bootloader that allows uploading new code onto the board without the requirement of an external hardware component. It uses Atmega16U2 programmed as a USB-to-serial converter. Each pin has its own function. The various pins inside Arduino Uno board are Analog Reference pin (orange), Digital Ground (light green), Digital Pins 2-13 (green), Digital Pins 0-1/Serial In/Out -TX/RX (dark green).

Arduino was created at Ivera Interaction design institute as a tool to be used for fast prototyping aimed for users without a background in electronics and programming.



Figure 1

#### B. RFID technology:

Radio-Frequency identification (RFID) is the use of radio waves used transfer data from an object to the reader. It contains electronically stored information. It consists of tag and reader. They are embedded with a transmitter and receiver. They work on the frequency of 13.56Mhz and transfers data at the rate of 10Mb/s. RFID tags can be passive, active or battery-assisted passive. An active tag has an onboard battery and Battery-assisted passive (BAP) has a small battery on board as if there weren't one. Tags can be either read only or read/write where the serial number can be changed according to the owner needs and requirements.



Figure 2

The reader is used to receive the radio signals from active tags. The reception range of the reader can be adjusted from 0-600m allowing flexibility in applications that it provides such as asset protection and supervision.

#### C. LCD screen:

Liquid crystal display screen it is the combination of two states of matter liquid and solid. These are relatively slim in nature therefore are use in various recent technology such as television, computer, mobiles, embedded technologies etc. It allows the display of the given screen to be thinner compared to cathode ray tube (CRT) technology.

Liquid crystal does not emit light directly instead it uses a backlight or reflector to create images on the screen. They use basic technology where the basic image is made of various small pixels instead of displaying large elements.

#### D. Servo motor:

The servo motor is a rotary actuator that allows the user to align the position of the shaft in its required position and control its velocity and acceleration. It uses position feedback to control its motion and final position. The position feedback measures the position and then is compared with the command position. Sophisticated servo motor use optical rotary to measure the speed of the output shaft and to control the motor speed.



Figure 3

### IV. SOFTWARE COMPONENT

#### A. Arduino IDE

The Arduino coordinated advancement condition (IDE) is a cross-stage application (for Windows, macOS, Linux) that is composed in the programming dialect Java. It is utilized to compose and transfer projects to Arduino board.

The Arduino IDE underpins the dialects C and C++ utilizing exceptional principles of code structuring. The Arduino IDE supplies a product library from the Wiring venture, which gives numerous normal information and yield methodology. Client composed code just requires two fundamental capacities, for beginning the outline and the primary program circle, that are incorporated and connected with a program stub principle() into an executable cyclic official program with the GNU toolchain, additionally included with the IDE distribution. The Arduino IDE utilizes the program avrduide to change over the executable code into a content record in hexadecimal encoding that is stacked into the Arduino board by a loader program in the board's firmware.



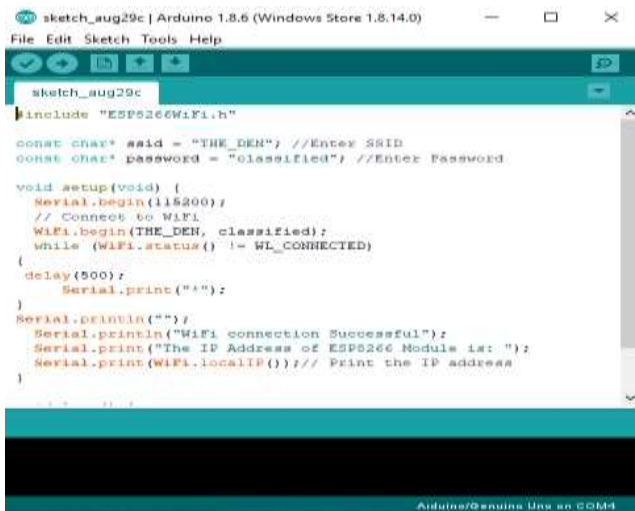


Figure 4

## V. WORKING

The existing system was hugely based on the fact of durability, composition of material, design and atomic structure being implemented on the lock. These consisted of a key on which certain pattern is inscribed that when matches with the pins leads to the unlocking of the door therefore granting access to the restricted area. This has been the primary lock system for centuries and has been outdated. Due to great need of upgradation the proposed system comes in play that has been updated with time and technology.

The entire project can be divided into various sub-modules. Each sub-module has a big role to play and they help in modelling and building the project. The RFID door lock project is being divided into three modules. Those are:

### A. RFID tags and RFID readers identifying users

These are the main components of the proposed system. They consist of tags that are provided to each user with a unique identification serial number. When the tag is brought up to close to the reader consisting of the proximity sensor that with the help of radio frequency transmits the data at the rate of 10Mb/s in the bandwidth of 13.56MHz. Once serial number is received by the reader. It is then transferred onto the Arduino Uno.

### B. Arduino Uno connecting all

The Arduino Uno is the nucleus of the system with all the info and instruction that are to be implemented. After the microcontroller receives the info from the RFID reader, it takes the serial number checks it with the serial number already existing in the system. If the number is to match from the given set of serial numbers, then the board is to grant access to the user by sending the required information to the servo motor to rotate its shaft according to the requirements. Displaying the result onto the LCD display indicating the access granted to the user. If the serial number is not to match with the given set of serial numbers in the system the microcontroller is to restrict the user access to the restricted area by indicating the result on the LCD display.

### C. Servo motor and LCD display

The servo motor is an integral part of the system that controls the access to the restricted area. The movement of the shaft of the servo motor is controlled by the Arduino Uno board which indicates when to grant the user access. The LCD display is used as mode of displaying the result to the input provided by the user. Here the LCD display is used to display whether the respective user is been granted access or not. This is a simple forum of communication between the user and the system that are understood by both.

## VI. CONCLUSION

The given undertaking is a standout amongst the most productive, basic, nimble, practical type of home security framework. It utilizes the most cost-productive apparatuses, that play out their individual tasks without coming up short. The current framework was crude in nature. It chipped away at the premises that the sturdiness, quality and couple of vulnerabilities of the given material were the best way to deal with developing a given bolt framework.

Whereas our venture has advanced with the occasions and incorporated with today's innovation. The task is more acclaimed in the angles for it being a home security framework.

It can additionally be adjusted to empower AI to perceive the development of the given client. Which would be difficult to infiltrate and with around 256-piece encryption utilized on the key so it cannot be unscrambled in the required range of time.

The proposed framework is more productive and secure than that of the current framework. It has prompted the advancement of the security arrangement of the present society to its zenith. This has caused a noteworthy interest in the security showcase, making different significant occupations and positions accessible for fit representatives.

## VII. FUTURE SCOPE

RFID based door lock system can be integrated into a more compact system in the near future. It has a tremendous future. As it is known, RFID based door lock system uses electromagnetic spectrum to communicate, so in the future a way must be implemented to not hamper the electromagnetic spectrum.

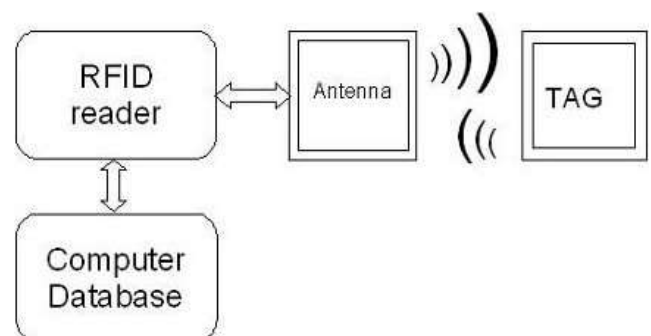


Figure 5

Moreover there can be upgradation over RFID door lock system. Biometric based door lock system can be used. In this system, the user's behavioural characteristics such as fingerprint, iris or vein can be detected by the system's stored data. In this way, the authentication can be provided by the system.

Another new technology which can be implemented is wireless door lock system. This is basically NFC based door lock system. The mobile application generates a code which is sent via the NFC signal to the microcontroller present. It verifies the current data with that of the stored data. After that, it grants authentication for the user.

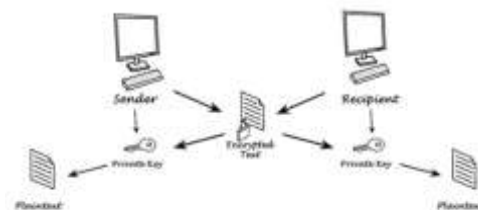


**Figure 6**

OTP based door lock system is another upcoming technology. Here, an OTP will be sent to the registered mobile number. When the OTP will be typed, then it will be matched with the server by the system. If the OTP matches, then the authentication will be granted otherwise it will be rejected. Moreover, if the intruder tries to repeatedly enter the wrong OTP, an alarm will be set off thereby informing the local police body about a forceful entry. This system will work fine as long as there is a healthy internet connection.

Cryptography based door lock system is also another upcoming technology. Here an encryption key will be

provided to the user. This encryption key will not be available to any third party. So, no hacker can guess the encryption key. The password will be converted into an encryption key and thus will be only available with the user.



**Figure 7**

## REFERENCES

- [1] Somjit Nath, Paramita Banerjee, Rathindra Nath Biswas, Swarup Kumar Mitra, Mrinal Kanti Naskar, "Arduino Based Door Unlocking System with Real Time Control" in 2nd International Conference on Contemporary Computing and Informatics, 2016, pp. 358-362.
- [2] Md. Kishwar Shafin, Kazi Lutful Kabir, Nazmul Hasan, Israt Jahan Mouri, Samina Tasnia Islam, Lazima Ansari, Md. Mahboob Karim and Md. Afzal Hossain, "Development of an RFID Based Access Control System in the Context of Bangladesh" in 2nd International Conference on Innovations in Information Embedded and Communication Systems, 2015.
- [3] Yong Tae Park, Pranesh Sthapit, Jae-Young Pyun, "Smart Digital Door Lock for the Home Automation" in TENCON, 2009, pp. 1-6.
- [4] Meera Mathew, Divya R S, "Super Secure Door Lock System For Critical Zones" in International Conference on Networks & Advances in Computational Technologies (NetACT), 2017, pp. 242-245.
- [5] Meera Mathew, Divya R S, "Survey on Various Door Lock Access Control Mechanisms" in International Conference on circuits Power and Computing Technologies [ICCPCT], 2017.
- [6] Madhusudhan M and Shankaraiah, "Implementation of automated door unlocking and security system," International Journal of Computer Applications, 2015, pp. 5-8.