

# Smart door locking system

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## Abstract:

As we know, security is a defence practice to against the threats. In order to keep our valuable items safe, we use security. We also use various levels of security in our devices to protect the confidential data. Similarly, our houses, offices, hospitals also need security. A multi factor security solution is proposed which can authenticate, authorize and validate the user and open the door for the user after three types of verification. The door will be unlocked when the user passes RFID identification, filling correct passcode. The main aim of proposing this solution is using the current available technology and providing a security which can really maintain the confidentiality and integrity.

## Existing Solutions and Related work:

Nowadays, there are many security cameras with face detection algorithms but those devices do not prevent the robbery or breaking of confidentiality

because cameras can capture or maximum, they can inform to police or someone else but that will lead to a delay.

Systems which automatically unlock the door based on GPS location of the user are providing more comfort than the security

While talking about security we can't compromise in any field. A multi factor authentication device is required to

provide the security. So, a device which will be verifying the identity in various ways is proposed Which on authorization will open the door and the admin will have the rights to increase and decrease the levels of authentication from the application. The user will be able to enter the building only after passing the certain levels of authentication. This is necessary in order to anticipate the vulnerabilities. The main difference of our solution, is the use of low-priced ESP modules which, in turn, significantly lowers the price of the proposed locks while increasing the level of functionality

## Proposed Solution

- A security system contains door locking system using passive type of RFID.
- The system used hardware as well as software.
- In order to increase the security passcode is used for two-factor Authentication.
- The hardware components are Processing Board, RFID reader & tags, keypad, electric door lock, USB connections and connecting cables etc.

- Few Actuators like LED, Servo Motor, Buzzer can also be used to enhance User-Interface
- Each Log will be stored on Amazon Web Services using MQTT services.

### Pros:

- Two factor authentication.
- RFID tags do not use power
- Monitoring from anywhere in the world using internet

### Cons:

- Internet connectivity must be available for 24x7
- Electric power should be available for each second

## Software Part of Solution

### Algorithm

1. The System Validates the UID of the person
2. Only if the UID is valid, the person will be able to enter the Passcode
3. The person will can have maximum 3 attempts to fill the passcode and after that UID Tag needs to be verified again
4. If the person enters the Correct passcode within or less than 3 attempts the Door will be opened.
5. There will be no action If there is an invalid UID, but the Log will be created.

Each Data will be logged into the cloud at Amazon Web Services (AWS)

## Programming Environment

- Boards are Programmed with Arduino IDE
- **Programming Language - Embedded C**
- Embedded C language is used to develop microcontroller-based applications. Embedded C is an extension to the C programming language including different features such as addressing I/O, fixed-point arithmetic, multiple-memory addressing, etc. In embedded C language, specific compilers are used.

## Hardware Solution

### Algorithm

1. The RFID reader retrieve the information contained by tag as it come in the range of reader.
2. Board will Check if the UID detected is valid or invalid
  - I. if the UID will be Invalid, no further action will be done
  - II. if the UID is valid the person has to enter the password,
    - a) if the entered password is correct then the door will be opened by relay and servo motor and an indication will be given using a green LED
    - b) if the entered password is wrong, the RED LED will blink and user will have to re-enter the password
    - c) if the user tried to enter the wrong

password more than 3 times then a buzzer will be turned on and the person has to validate their RFID again to enter the password.

Each Log will be sent to AWS IoT Core using MQTT service.

## Required Hardware

- Arduino Uno
- NodeMCU
- MFRC522
- 4x4 Matrix Keypad
- LEDs and Buzzer
- Servo Motor
- Relay Switch
- Solenoid Lock
- Jumper wires
- Resistors

## Cloud Platform

AWS IoT Core supports device connections that use the MQTT protocol

- Our System will be publishing the Logs using Wi-Fi Connection
- That Logs can be extracted by Subscribing to that Topic
- We can Monitor Logs from any corner in the World with internet

## Analysis

- IoT core provides a JSON file of the MQTT messages transferred, which can be used as an API for analysing and extracting information like
  - Frequency of a person getting entry
  - Frequency of Emergency situations
  - Time of Emergency situations
  - Frequency of incorrect passwords by each individual
  - Usual/Unusual Entry Time of individuals
- AWS IoT Analytics can also be used to analyse the data collected using MQTT services by creating a rule in AWS IoT Core

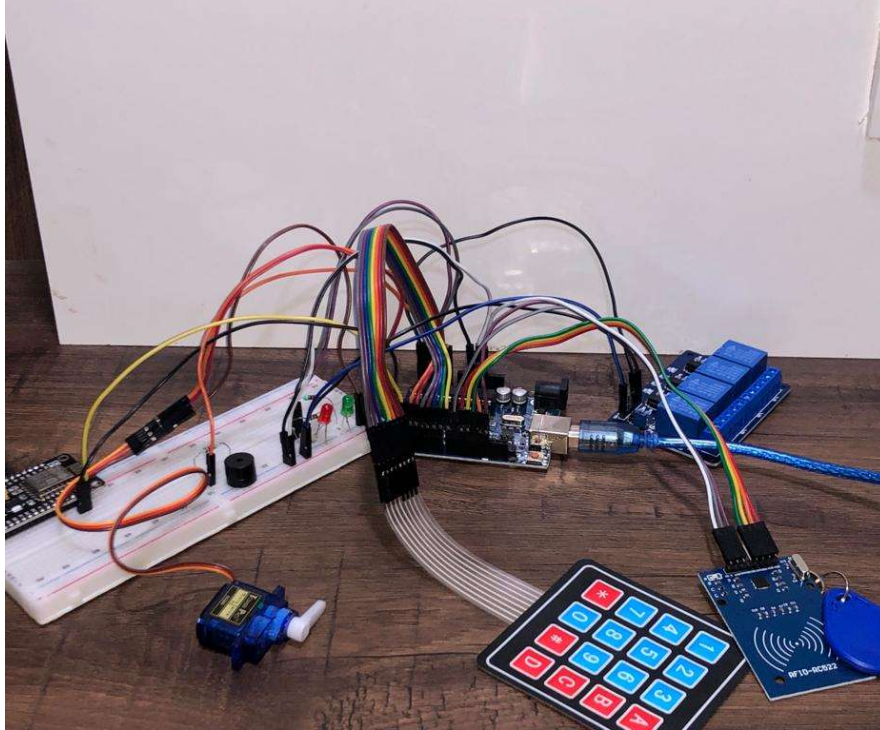
## Results

1. The person with invalid RFID is rejected
2. The person with Valid RFID
  - a. Was able to get entry when the entered Passcode is correct
    - i. Green LED Turns on
  - b. Wasn't able to get entry if the Passcode is not correct
    - i. Red LED turns on
3. The Person has to validate RFID again if there are more than 3 attempts made for Passcode
  - a. Emergency Situation
  - b. Red LED blinking

c. Buzzer Making Noise

4. Every data is sent to Cloud with a message and the UID scanned by RFID Scanner

## Circuit Connection



## Conclusion

- The problem has been formulated and various studies have been reviewed regarding the different electronic lock systems. RFID technology is one of the successfully incorporated in the door lock system. A security mechanism with RFID, Passcode provides two-factor authentication.
- Logs can be monitored from anywhere in world with internet.
- Finally, a multi-level authentication digital door access control system can be used in critical zones like Military Institute, Defence, Scientific Laboratory, etc too. which is cost

effective and increase the scale of security successfully.

## Future Scope

- A camera/fingerprint module can be used to increase security
- Data Generated by AWS IoT Core can be used as an API or can be used to create some specific Web Application or Mobile Application.
- Other Modules like GPS, GPRS can be included which will extract the Location by out Mobile and unlock the door for us when we are at some specific distance.

## References:

1. Smart Homes: Security Challenges and Privacy Concerns  
arXiv:2010.15394v1 [cs.CR] 29 Oct 2020
2. A Digital Security System with Door Lock System Using RFID Technology  
International Journal of Computer Applications (0975 – 8887) Volume 5– No.11, August 2010
3. Internet of Things and Smart Home Security ISSN: 04532198 Volume 62, Issue 05, June, 2020
4. Internet of Things Cyber Security: Smart Door Lock System
5. Marko Pavelić, Zvonimir Lončarić, Marin Vuković, Mario Kušek  
University of Zagreb
6. Super Secure Door Lock System for Critical Zones. Meera Mathew, Divya R S
7. Smart Door Locking System ISSN: 2278-0181
8. IOT BASED DOOR ACCESS CONTROL SYSTEM USING FACE RECOGNITION  
ID No: 300183
9. Door-automation system using Bluetooth-based android for mobile phone
10. Vol. 9, no. 10, october 2014 issn 1819-6608
11. IoT-Enabled Door Lock System
12. (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 10, No. 5, 2019
13. Smart door system e-ISSN: 2395-0056
14. VOL. 11, NO. 5, MARCH 2016 ISSN 1819-6608 ARPN Journal of Engineering and Applied Sciences
15. Smart Digital Door Lock for the Home Automation (zigbee) 978-1-4244-4547-9/09
16. <https://components101.com/article/s/introduction-rfid-modules-construction-types-and-working>
17. <https://learn.parallax.com/tutorials/language/propeller-c/propeller-c-simple-devices/read-4x4-matrix-keypad>
18. <https://www.toppr.com/bytes/principles-of-led/#:~:text=Working%20Principle%3A,in%20the%20form%20of%20photons.>
19. <https://www.electronicshub.org/what-is-relay-and-how-it-works/>
20. <https://circuitdigest.com/microcontroller-projects/arduino-relay-control>
21. <https://www.takigen.com/products/list/14020>
22. <https://techatronic.com/solenoid-lock-interfacing-with-arduino/>
23. <https://www.instructables.com/How-to-Interface-RFID-to-Arduino/>
24. <https://store.arduino.cc/products/arduino-uno-rev3/>
25. <https://components101.com/development-boards/nodemcu-esp8266-pinout-features-and-datasheet>
26. [https://www.microchip.com/en-us/product/ATmega328P?gclid=Cj0KCQiA-qGNBhD3ARIsAO\\_o7ykK23-Xu7Cwg2fhtTXgPqKHmxekIPB4IclPvtQk3D8d2SapylWoXkcaAiqOEALw\\_wcB](https://www.microchip.com/en-us/product/ATmega328P?gclid=Cj0KCQiA-qGNBhD3ARIsAO_o7ykK23-Xu7Cwg2fhtTXgPqKHmxekIPB4IclPvtQk3D8d2SapylWoXkcaAiqOEALw_wcB)
27. <https://aws.amazon.com/iot-core/>
28. <https://www.youtube.com/watch?v=28FS2qix2u4>
29. <https://www.youtube.com/watch?v=I8zROK4S2bE>
30. <https://www.youtube.com/watch?v=Mwlnm8GvIA&t=782s>