Smart Lock System Using RFID

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Abstract - *Security is the foremost matter that must be tackled in the present world. IoT has been proven to be the Progressive technology unraveling many security associated issues. Internet of Things (IoT) is an ecosystem of connected physical objects that are accessible through the internet. The entrance plays an significant role in room safety. So, furnishing a protected door system for houses, offices, etc has turn out to be a essential research. The purpose is to carry out a security system by combining mobile phone and IOT using RFID. Here is a Room security solution based on IoT using RFID. We are going to build an **RFID Based Access Control System using Node MCU.** The same system can be named like Smart Lock System using RFID. If you have been to big hospitals or companies, you might have seen how they used RFID based locks to restrict access to certain areas. To establish a smart locking system which will only accessible for users with authorized cards and to maintain track of users entering and exiting the room through an online interface. As the device is connected to Internet it can be controlled from any place with internet connectivity. Thus one can monitor any room/property from anywhere*

***Key Words*: RFID, Node MCU, Security, IOT, Sensors, Servo Motor, ThingSpeak, RFID tag**

1. INTRODUCTION

Safeguarding homes has turn into one of the concerning topic. Today homes are being farther open to numerous threats mainly being burglarised. Hence home security is required. Home security obliquely requires a protected system for the door. As stated, the purpose of this work is to resolve one of the security problems existing in the present world. It has been very tough for people to ensure effective security solutions even however in the enriched technological situations. Internet of Things is becoming a trend in many of the big cities and creating lots of revolutionary effects. So the idea of Smart door lock system has been proposed. You are given a card and you just need to put it in front of a RFID Reader box, and the lock gets unlocked with a Beep and a Blink of LED. This RFID Door Lock can be made easily at your home and you can install it in any door. These Door lock is just electrically operating door lock which gets open when you apply some voltage (typically 12v) to it. With this system, only the legitimate persons can acquire the clearance to access the doors. By using RFID the system will be able to

differentiate a valid user with an invalid one. Also. The system can be monitored from anywhere in the world due to the continuous updating of the status of the door. With this system, only the authorized individuals can gain the permission to access the doors. Thus one can monitor his/her house from anywhere. A digital door locking system is also implemented and governed by RFID reader which authenticate and validate the user and open the door automatically. It also keeps the record of check-in and check-out of the user. It's very important to authenticate the user before entering into a secure space and RFID provide this solution. The system enables user to check-in and check-out under fast, secure and convenient conditions. The system include door locking system which open when the user put their tag in contact with reader and the user information matched with the information already stored in database. The RFID controls the opening and closing of the door. In this study we utilize RFID technology to provide solution for secure access of a space while keeping record of the user.

2. RELATED WORK

In [1], SMART DOOR LOCK SYSTEM By, Nayana R and Shashidhar R**.** This paper gives an overall idea about how we use fingerprints of an authorized person to enter in the room. The finger prints of the authorized person are stored previously in the microcontroller, and a matching algorithm is used to check whether the person is authorized or not. If the person is authorized, OTP (One Time Password) has been sent to that person's mobile number using GSM. If an unauthorized person tries to enter the room, the buzzer will turn on indicating that someone is trying to access door. This system can be implemented to places where security place major role that is in banks, offices, etc. The main aim of this research is to provide high security with low cost, because security plays major role in our society in almost every sector.

In [2], SMART DOOR LOCK AND LIGHTING SYSTEM By, Rahul Satoskar and Akarsh Mishra**.** In the proposed approach, a smart door lock and lighting system using IoT for smart home is presented. A smart door lock system is a system which uses digital password for opening and closing the door. The door lock is the foremost and

endmost thing people come across in entering and leaving the home respectively, the home automation function in digital door lock system allows users to comfortably control and monitor home environment and situation all at once. It also allows users to remotely overlook the situation inside the house through World wide web or any other public network. A smart lighting is proposed which can be remotely controlled using Internet.

In [3], ANDROID BASED SMART DOOR LOCKING SYSTEM By, Manish Kumar, M Hanumanthappa, T V Suresh Kumar and Amit Kumar Ojha**.** This paper gives detailed information about system in which we can unlock the door by using pre-decided password. It increases the security level to prevent an unauthorized unlocking done by attacker. In case the user forgets the both passwords, this system gives the flexibility to the user to change or reset the password. This automatic password based lock system will give user more secure way of locking-unlocking system. First the user combination will be compared with pre-recorded password which are stored in the system memory. User can go for certain number of wrong combinations before the system will be temporarily disabled. The door will be unlocked if user combination matches with the password. The same password can be used to lock the door as well. This system will give the user an opportunity to reset his own password if he wants.

In [4], PASSWORD BASED SECURITY LOCK SYSTEM By, Arpita Mishra, Siddharth Sharma, Sachin Dubey and S. K. Dubey. This work has considered about a secure access for a door which needs a password to open the door. Using keypad it enters a password to the system and if it is entered correctly door is open by motor which is used to rotate the handle of the door lock. It will give three attempts to enter the password when it is entered incorrectly a t the first time. Some features like adding new users and changing old password are configure by the keypad. LCD module is used to display messages to the user.Now a day's most of the systems are automated in order to face new challenges and present day requirements to achieve good results. Automated systems have less manual operations, so that the flexibility, reliabilities are high and accurate. Hence every field prefers automated control systems, especially in the field of electronics.

3. PROPOSED SOLUTION

The basic idea behind building this work is building a system which includes a RFID reader in order to open the door. Once the door is opened by a Valid user, the data is entered on the web using ThingSpeak. The basic principle of RFID technology: the RF signal to be transmitted by the reader&writer is coded and loaded onto the high frequency carrier signal, and then sent out through the antenna. The electronic label entering the working area of reader&writer receives the signal. The relevant circuits of the chip in the card perform voltage doubling rectifying, modulating, decoding, deciphering, and then judging the command request, password, authority, etc. Finally, signal processed by tag according to the command. The data is stored on the ThingSpeak website and displays the user who have last entered the room.

The objective of this work is to provide remote access to door lock system. The obvious motivation for providing such a kind of remote access to door lock is to make properties much more secure and enable it to automatically distinguish between a valid user and an intruder. This work also ensures that the owner need not worry about whether the door is left unlocked or not and hence ensures peace of mind for the owner.

The proposed system aims to achieve Access control mechanism in a smart way. By using RFID the system will distinguish a valid user with an invalid one. Also, the system can be monitored from anywhere in the world due to the constant updating of the status of the door on we(ThingSpeak).
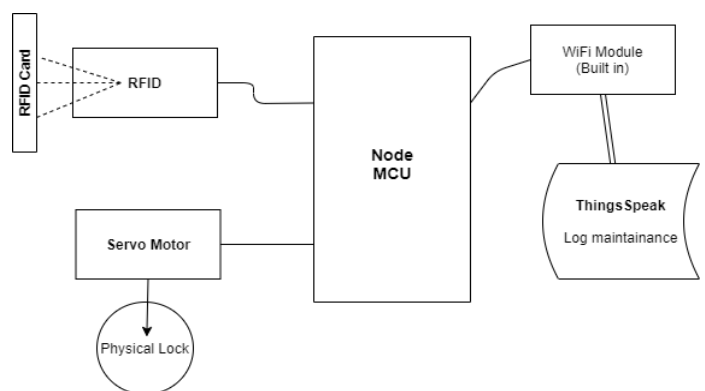
3.1 Components

Fig-1: Block Diagram of the System

Node MCU: NodeMCU is an open-source firmware and development kit that helps you to prototype or build IoT products. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. NodeMCU Dev Kit/board consist of ESP8266 wifi enabled chip. The ESP8266 is a

low-cost Wi-Fi chip developed by Espressif Systems with TCP/IP protocol.

RFID EM-18 reader: RFID stands for Radio Frequency Identification. Each RFID card has a unique ID embedded in it and a RFID reader is used to read the RFID card no. EM-18 RFID reader operates at 125 KHz and it comes with an on-chip antenna and it can be powered with 5V power supply. It provides serial output along with weigand output. The range is around 8-12cm. serial communication parameters are 9600bps, 8 data bits, 1 stop bit. The output provided by EM-18 RFID reader is in 12 digit ASCII format. Out of 12 digits first 10 digits are card number and the last two digits are the XOR result of the card number. Last two digits are used for error checking.

RFID Tags : These tags have 1kb of memory and have a microchip that can do arithmetic operations. Their operating frequency is 13.56 MHz and the operating distance is up to 10 cm depending on the geometry of antenna.

Servo Motor: It is a closed loop servo mechanism that uses position feedback to control its motion and final position. It requires 100mA current, 3.0-7.2V voltage. Its speed is 53-62 RPM. Motor is paired with some type of encoder to provide position and speed feedback.

LCD: An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 translates o a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7 pixel matrix.

ThingSpeak: ThingSpeak is an IoT analytics platform service that allows one to aggregate, visualize, and analyze live data streams in the cloud. One can send data to ThingSpeak from his/her devices, create instant visualization of live data, and send alerts.

3.2 Working

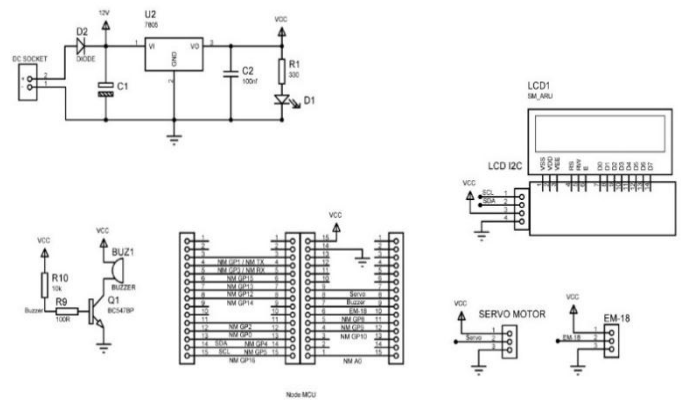The following figure depicts the circuit diagram of the system.

Fig-2: Circuit Diagram of the System

The actual working of the system starts when a user holds an RFID tag card over the EM-18 reader. The reader tries to scan the card. There is a possibility that the card help by the user is not an RFID tag but something else like id card, college card, atm card, etc. In that case the RFID reader is not able to recognize the card. If the card is to be an RFID tag, the scanner receives the12 digit number from the tag and then passes on to the microcontroller i.e. Nose MCU.

Once the scanning is done a buzzing sound is made to notify the user that the card has been scanned. Based on the code installed, the microcontroller either recognizes the tag number or it doesn't. If the tag number is not in the code it sends a signal to the LCD to display that the user is invalid. Also the system alarms thru the buzzer, notifying that the card is invalid. If the tag number is present in the code, LCD displays the User details and the card number on the screen. The servo motor is then signaled and it is rotated in order to open the door. After few seconds the motor is rotated back to close the door again.

Then the microcontroller runs the script to send the data on web. While the data is being uploaded, the LCD displays "Uploading on Web". Using the API key of the ThingSpeak account, the microcontroller sends the data to the server. The received data is used to get a visualization. The visualization depicts when and which user had accessed the door. After successful uploading the data on web (after 18 seconds) the system is ready for scanning next tag.
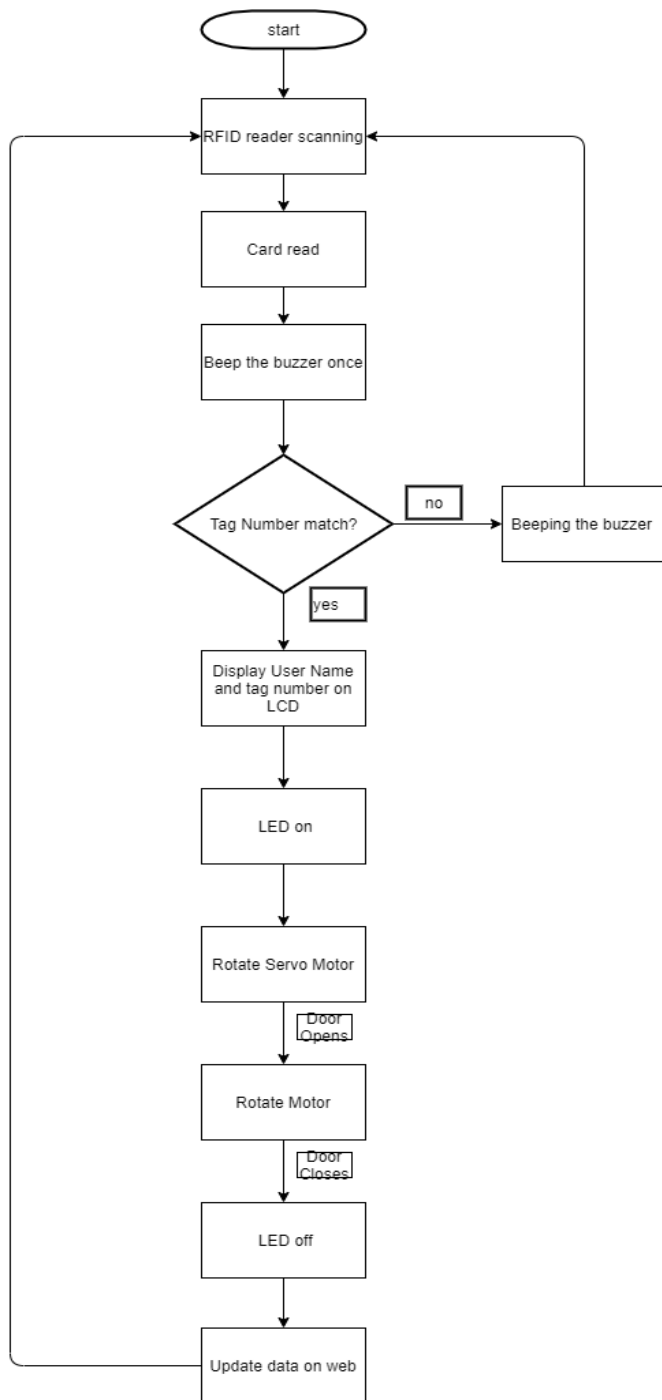
Fig-3: System Flowchart
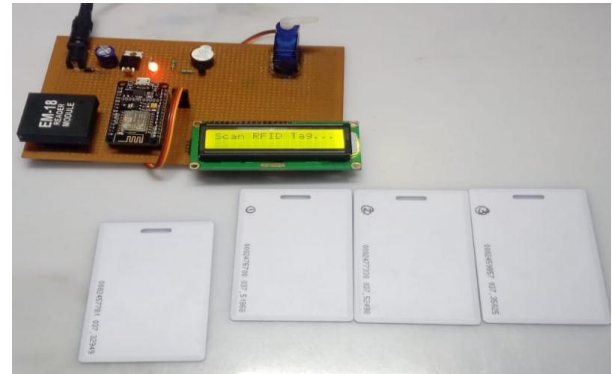
4. RESULTS AND DISCUSSION

Fig-4: Proposed System

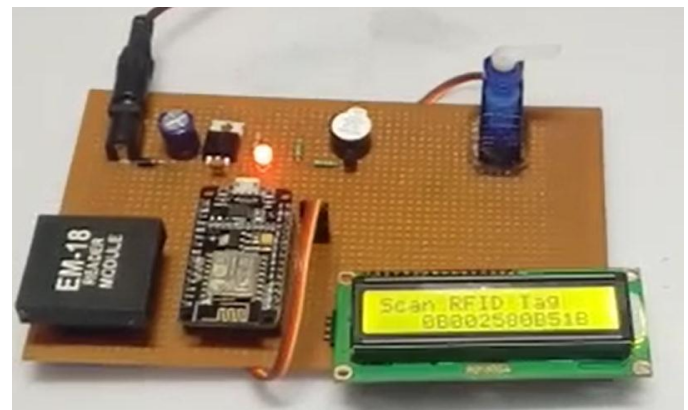The following image shows the LCD display when a card has been scanned.

Fig-5: Successful Scan

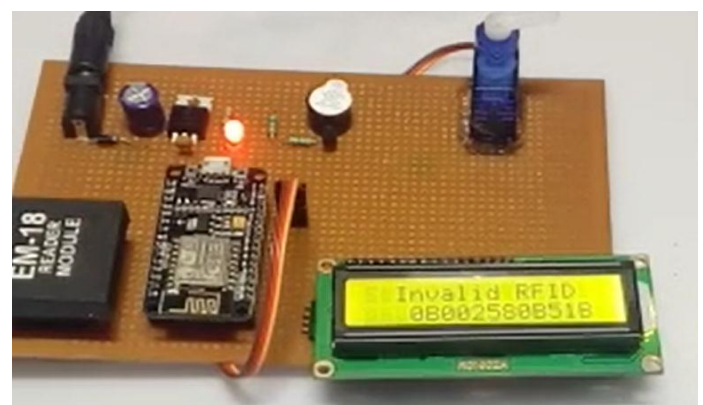The following image depicts the LCD when the card is invalid.

Fig-6: Invalid User

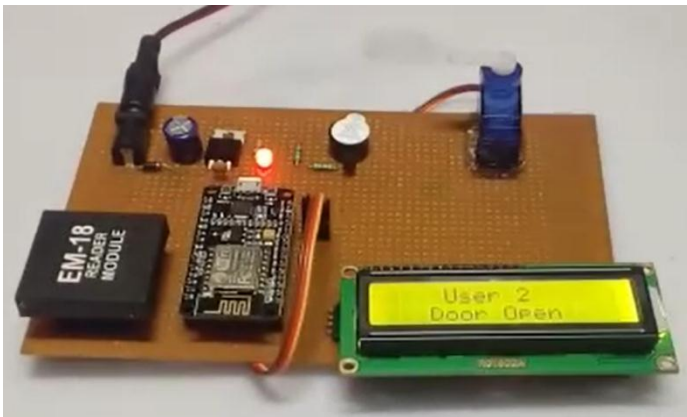The following image depicts the LCD when a user is valid and the servo motor is rotated.

Fig-7: Valid User and Door opens

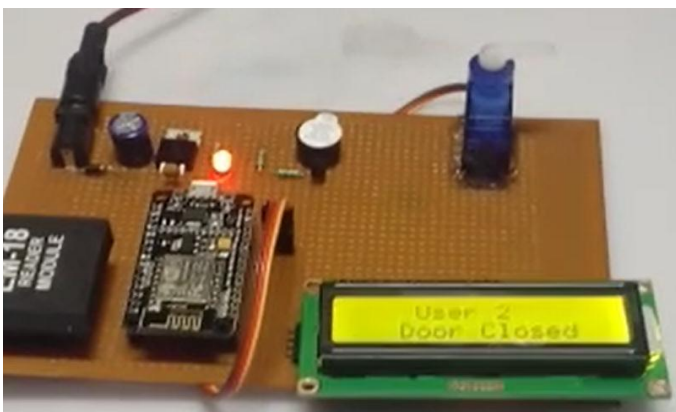The following image depicts that door has been closed.

Fig-8: Door closed

The following image depicts that the data is being updated on the web.

Fig-9: Updating on Web

The following chart depicts the log of users that open door.

Fig-10: User log chart

Fig-11: User log chart description

From the above chart the following data can be extracted which can act as a log.

Created at	Sr. no.	Entry id
2020-04-04 14:22:38 UTC	1	2
2020-04-10 16:10:41 UTC	2	2
2020-04-10 16:11:06 UTC	3	3
2020-04-11 09:45:37 UTC	4	1
2020-04-11 09:47:28 UTC	5	3

Fig-12: User log table

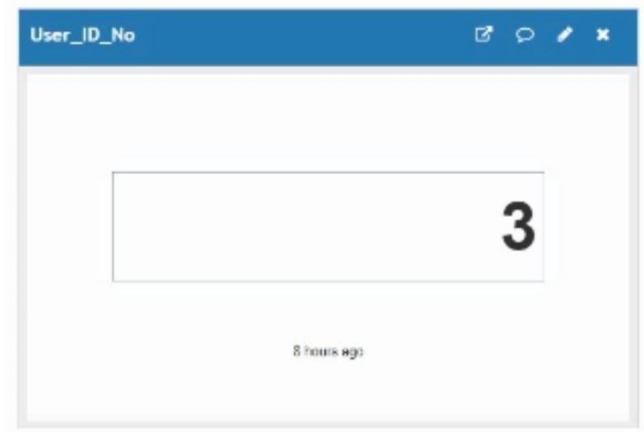The following chart displays the recent user that opened the door

Fig-13: Recent user chart

5. CONCLUSION

In this paper, a smart lock system is presented which is a novel access control system using IOT which includes the online monitoring. The smart lock system provide a convenient way to automate the access control feature thereby enhancing security and enabling the owner of the property care free. It is a low cost, flexible, and a very easy to install system with no overhead like planning, cabling, and construction works.

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