2-STEP DOOR LOCK SECURITY SYSTEM

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project titled "**2-Step Door Lock Security System**", submitted by Md.Safiul Haque Ony, ID No: 142-15-3641, Md. Mamdud Hasan Hemon, ID: 142-15-3456, Md. Golam Rabbany, ID: 142-15-3468 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 05th May, 2018.

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Ms. Farah Sharmin, Senior Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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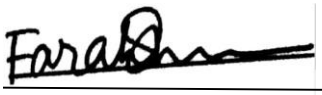

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ABSTRACT

Technology made life easier than before but set some alarming issues to be careful about. Security is one such major concern of today's life. For keeping information secured access control, password protection, and biometric measures are implemented with high care. This project presents a 2-way security-controlled door opening system which can be widely used in different organizations and even in apartments or houses. In this project embedded systems and biometrics have been used to protect unauthorized access. If knock pattern and finger print matches then the door will be opened. Otherwise it will set an alarm for neighborhood and system will send an email to the authorized person in his/her mobile. An alarm and email can make the neighborhood and the authorized person alert respectively and thus they can take necessary actions.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

As the protection of our life and assets means security, we are trying to strengthen our security system with the change of modern world. To ensure the safety of our assets in this project and their belongings we are focusing to prevent the illegal handling. With the use of mechanical lock, crime can easily happen because the criminals can easily break the lock system [1] [2]. There are many projects presenting different types of digital door lock system for security system. We also chose a door lock security system named "2-step door lock security system".

1.2 Motivation

Nowadays most organizations use some security system which on RFID card based. That one step security system can easily be broken as someone can steal the card and easily unlock the door. This RFID card system is also convenient to unlock the door and takes less time to unlock the door [1].

But in this project, the unlocking system based on 2 step verifications. In first step authorized people have to match the knock detecting pattern, to reach the second step to verify their Bio-metric System and the door will opens only for specified user. Hence if the verification failed, a message will be sent to avoid unauthorized access and alert the system is also cost efficient and user friendly. So, any organization can easily afford it.

1.3 Objective

This project will have contained these features.

- 2 step systems to unlock a door

- Highly secure than 1 step security system
- Authorized people can easily recognize
- Keep a biometric storage of authorized people
- Unauthorized people can easily detect through message
- Easily updatable system pattern by admin
- Cost efficient security system
- Simple system interface

1.4 Report Layout

Chapter 1: Introduction

In this chapter we have discussed about the introduction, motivation and objectives of the project. Later followed by the report layout.

Chapter 2: Background

We discuss about the background circumstances of our project. We also talk about the related works, comparison to other candidate systems, the scope of the problem and challenges of the project.

Chapter 3: Requirement Specification

This chapter is all about the requirements like business process modeling, the requirement collection and analysis, the use case model of the project and their description, the logical data model and the design requirements.

Chapter 4: Design Specification

In this chapter all the designs of the project. System design, back-end design, interaction design and UX and the implementation requirements

Chapter 5: Implementation and Testing

This chapter contains the implementation of database, front-end designs, interactions, test implementation and the test results of the project.

Chapter 6: Conclusion and Future Scope

We discussed about the conclusion and the scope for further developments which pretty much derive about the project

CHAPTAR-02

BACKGROUND

2.1 Introduction

Security system is generally hardware-based system and to develop the system.it required to select particular tools for doing it. Arduino Uno, Arduino mega is a type of device that works like a micro controller for security system.

In our project Arduino mega is the tool we used as a microcontroller. For different authentication as like knock detecting we use piezo speaker as input signal device. R307 fingerprint module is used as a bio metric verification.

Arduino micro controller is most widely used device to develop security system. The programming environment and the language itself are very easy to understand even for people who have not programmed before, but it still allows more advanced folks to dig deeper into the possibilities.

2.2 Related Works

When it is the matter of security, each one tries to establish some safe security to ensure the advantages and in addition themselves. Since there are some security system like Bio-metric verification to open the door, RFID system, password system etc.

Features of RFID reader:

- RFID provides greater accuracy in sustaining data.
- The RFID tag stores data in a long-lasting microchip, instead of paper or barcode labels which deteriorates overtime and need replacement.
- It also provides better data security as tags cannot be cloned as easily as bar code or paper label.

- RFID asset status is recorded, so that you can know which asset is missing, moved, misplaced or present.

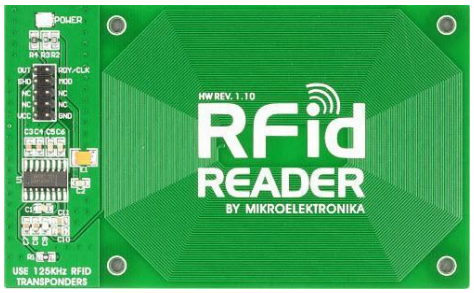

Figure 2.1: RFID

Limitations of RFID

- RFID system are often more expensive than Barcode system.
- RFID technology is harder to understand, can be less reliable.
- RFID tags are usually longer than Barcode labels.
- Possibility of unauthorized reading of passport and credit cards.
- More than one tag can respond at the same time.

On the other hand, password system lock is another type of security system that is easy to unlock a door quickly and easily without using any key. And it is secure because of unauthorized or registered user can't easily open the door or break the security system. The system is also less power consumptions, uses of commonly available components and also simple and easy implementation.

But currently if the personal identification number is somehow forgotten, the system could not be accessed. Powered electricity may not function properly in the case of a power failure.

2.3 Comparative Studies

In smart door lock system there is no hassle to give a knock pattern. After that giving biometric authentication very harder and tough to break for thieves and intruders. By installing smart system, you are ensuring that your personal things safe [3].

This type of system needs less electricity. A digital door lock can run for many years with a single battery. So, this makes it maintenance free, cost efficiently and you don't need to worry about electricity.

So, we choose smart door lock security system for best and reliable security as in our project with two steps security system.

In our security system we are tried our best to make all the system together in one way, more reliability, cost efficiency. We made this system with 1st step to knock the door with accurate pattern as he or she registered by the authority. If the pattern matches the system will notify user to go through the next step.

In the 2nd step of the security system it will show users to match the bio matric finger print. If it matches the finger print the system will unlocked on the other hand if it will not match then the system will be alarming, and a security message will have sent to the admin. And the system will go to the 1st step again.

2.4 Scope of the Problem

Problems will arise when we try to solve a problem. In our security system, we are not able to create a log-file which will keep all the logs o users who used the system. The system is based on Arduino. Though it is a micro-controller, it has some issues. It is not fully customizable. Yet if it is possible to create a log file. But we were not able to do that now.

Changing the pattern is easy in this system. Which could compromise the system a little bit. So, we were thinking to make it a password based changing system for the knock pattern. But it needs a higher skill. And we are now one the beginner level of microcontroller. So, these are some problems which has no solution right now for us.

2.5 Challenges

To complete the project we, had a lot of challenges like,

- Whenever an admin tried to change the old pattern by using a push button, sometime it takes automatically an unusual pattern and for that reason there were happening some problem to set a new right pattern. It was happening due to the same ground we used for every component. We had to change the ground for buzzer. Then it was taking the new pattern.
- The 5v DC engine was running under 5v battery. Utilizing the engine over and again by a battery it takes a ton of charge from battery. So, we need to change the battery over and again.
- The unique fingerprint module we utilized was newly available. So, it had a considerable measure of issues. The principle issue was, the wire mix with Arduino. The RX and TX link isn't perfect with the majority of the digital pins of Arduino mega. This was another model, so there was no assistance from the web moreover. We needed to check the wire connections for just about 20 pins combinations for ourselves. This was our greatest challenge.

CHAPTER 3

REQUIREMENT SPECIFICATION

3.1 Two Step Door Lock Process Modelling

In our project we have made a processing model. By that you can understand the whole process of our project **Two Step door lock System.** In this model you can have the total understanding the total process that how the system is working.

So, the model is giving below:

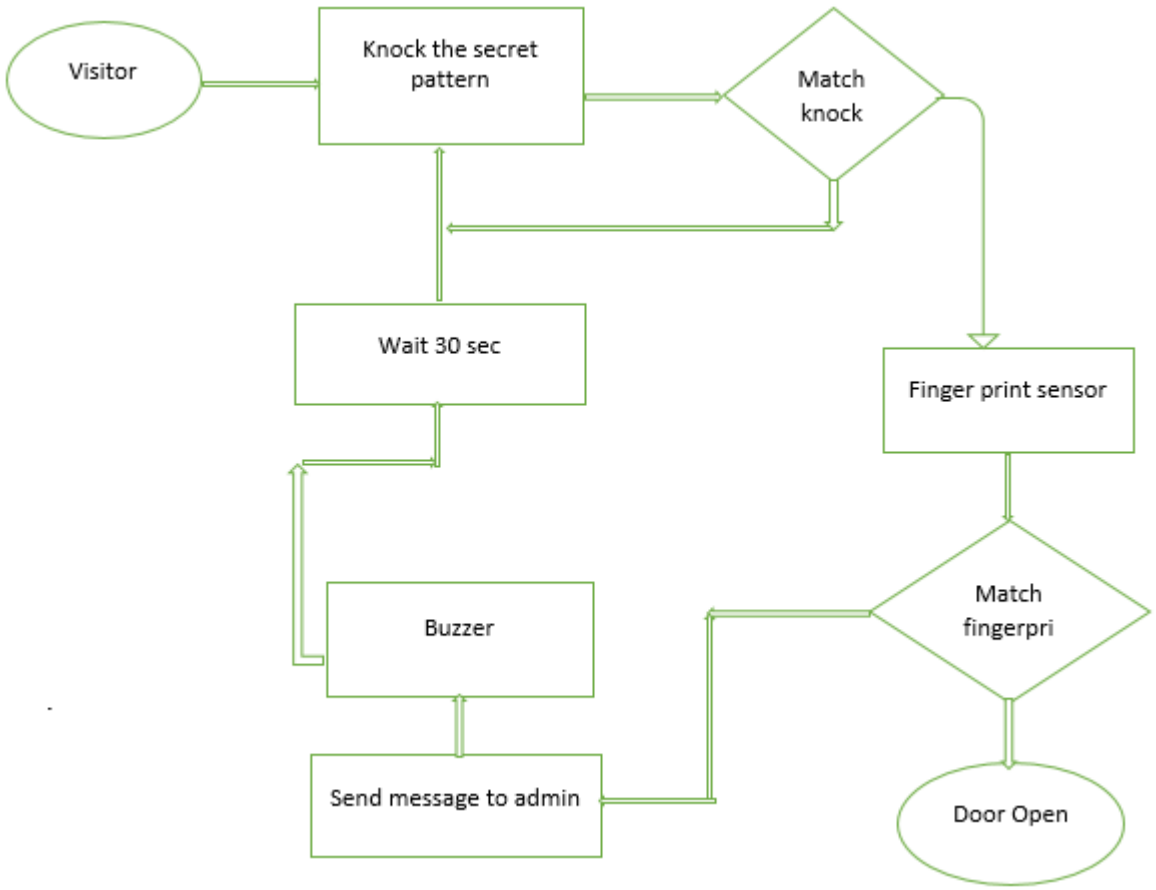

Figure 3.1: Two Step Door Lock Process Model

3.2 Requirements Collection and Analysis

Two step security System project requirements: -

1. A visitor.
2. An authority to maintain everything.
3. User friendly.
4. Better security.
5. Time convenience.
6. System should be work faster in response.
7. Can detect an unauthorized access.
8. A siren will be on for unauthorized access.
9. Reliable system.

Hardware requirements for our system: -

- Arduino mega 2560
- Fingerprint sensor. (R307)
- 16x2 LCD display
- 10KΩ Potentiometer
- 4x4 keypad
- Power bank
- 1 5v Gear reduction motor. The higher torque the better
- 2 Piezo speakers. (30mm)
- 1 SPST momentary pushbutton. (normally "off")
- 1 Red LED

- 1 Green LED
- 1 NPN Transistor P2N2222A
- 1 2.2k ohm resistor (1/4 watt)
- 1 10k ohm resistor (1/4 watt)
- 1 1M ohm resistor (1/4 watt)
- 2560-ohm resistor
- 19-volt battery clip and 9v battery
- Connector wire

Software Requirements:

Arduino IDE.

Analysis:

We have analyzed our current securities for many homes or offices. First of all, these systems are so costly and most of them are single security system.

So, we have developed a two-step door lock system which is cost efficient and reliable [4]. So, we added a simple knock system for first step security which can even recognize the pattern of a knock and biometric fingerprint security for second step security which will be a great security system [5]. So, by combining these two-security systems we can achieve greater and reliable but cost-efficient security system [6].

3.3 Use Case Modelling and Description

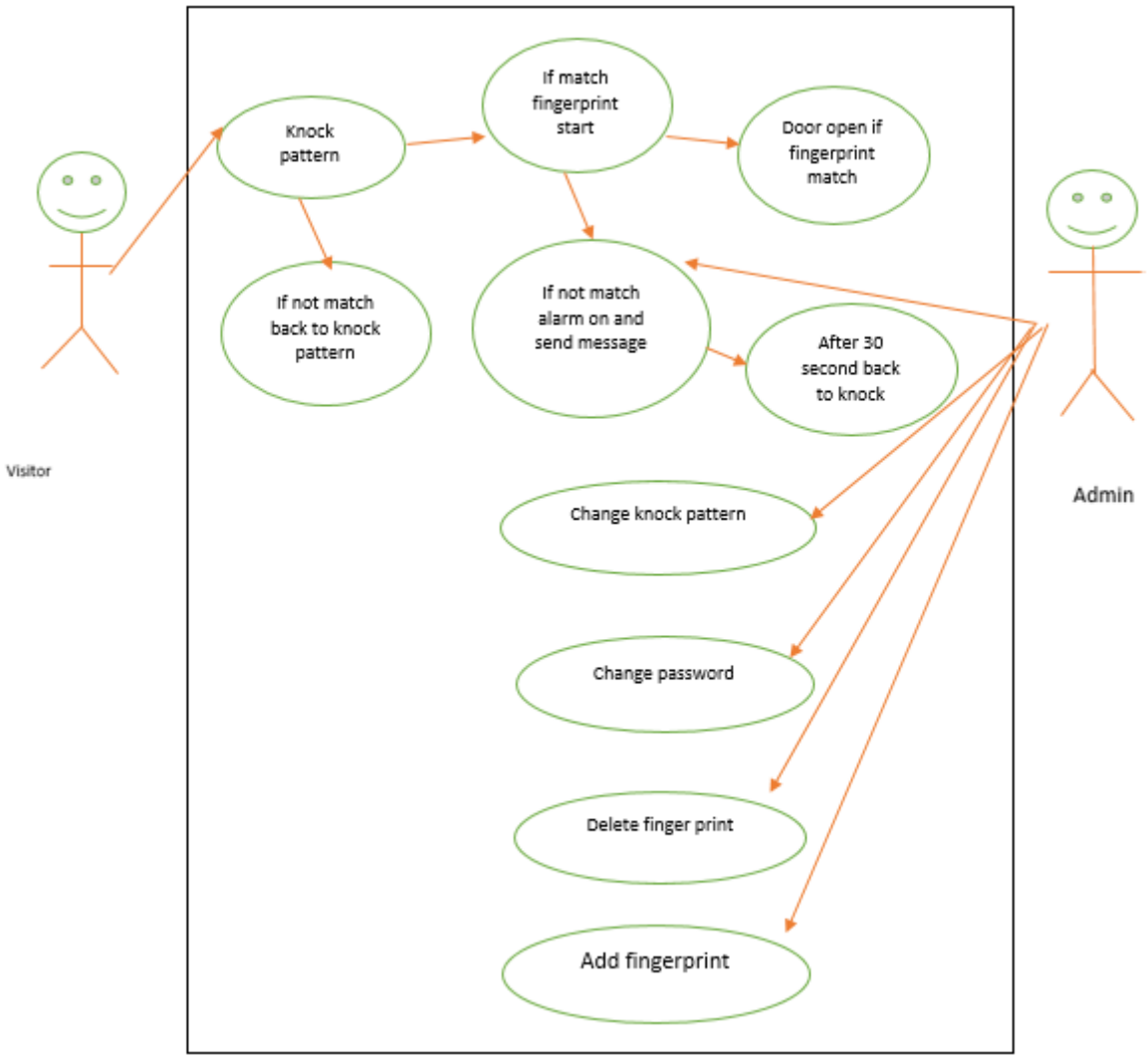

Figure 3.2: Use Case of Security System

Description:

Over the utilization of use case graph there are working procedure amongst on-screen character and administrator board.

Actor: Visitor and Admin.

Main Flow of The Diagram:

The Visitor can unlock the door going through the steps,

1st the visitors have to match the knock pattern. If the pattern matches then the visitors go to the next level of authentication which is Bio-metric finger sensor.

After matching the knock pattern, it will hold visitor for 2 second,

After matching the finger print there will be display a well come message and the door will successfully unlocked.

Alternate Flow

In the alternate way if any visitor can't match the knock pattern the process will undo again and again means, the process will request visitors for actual or right knock pattern.

In the event that guest effectively coordinate thump design and in the second step if guest miss coordinates the unique mark, the guest will get a siren from Buzzer and a confirmation message will send to the administration.

After sending the message, the system will hold for 30 second and the system will back to the 1st step of authentication.

Admin Flow:

An admin generally handles the whole security system,

There is a password for access to the admin panel. The password can be changed by admin any time if it is needed.

A knock pattern easily can be hacked by any unauthorized user. To solve the problem, admin can update the knock pattern.

An admin can register a new user's fingerprint as an authorized user.

Admin can also delete any registered user.

3.4 Logical Data Model

Logical Data Modelling is a process used to define and analyse requirement needed to support the business processes within the scope of corresponding information systems in organizations. The Entity-Relationship model or Entity-Relationship diagram(ERD) is a logical data models, it includes the entity, attributes, table and relationships.

Logical data model is giving below:

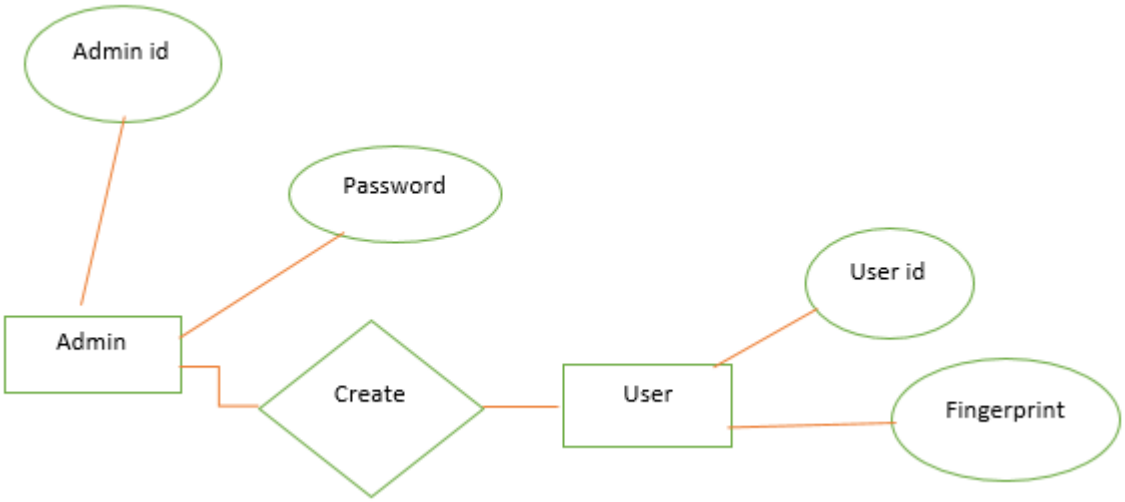

Figure 3.3: Entity Relationship Diagram

Description of The Relation Diagram:

- In the model admin can take the total control, like- he can add or delete any user.
- The admin has their id and password for accessing the admin panel.
- The admin can create users. And also, can create user's id and fingerprints.

- Users access to the security system by using their fingerprints.

3.5 Design Requirements

The following goals were kept in mind while designing the system:

Make System Simple and Flexible For Users:

The security system should be more adaptable to guests. As it is flexible, so the guests can without much of a stretch experiencing the way toward getting to the system.

Make The System Compatible:

The system should be perfect in security than one step verification system. Even also should compatible in reliability.

Efficiency:

It is the most important. The system should run and work in minimum time. Even the system implementation should be cost efficient.

Maintenance:

The system should be more reliable than any other security system for maintenance the system in future.

Detection of Unauthorized Access:

If any visitor gives wrong information to system for accessing purpose, then the system should detect the particular user as an unauthorized user.

What's more, a sound will show up through buzzer incorporate give a message as unauthorized access.

Now we will show the total system design through a context diagram.

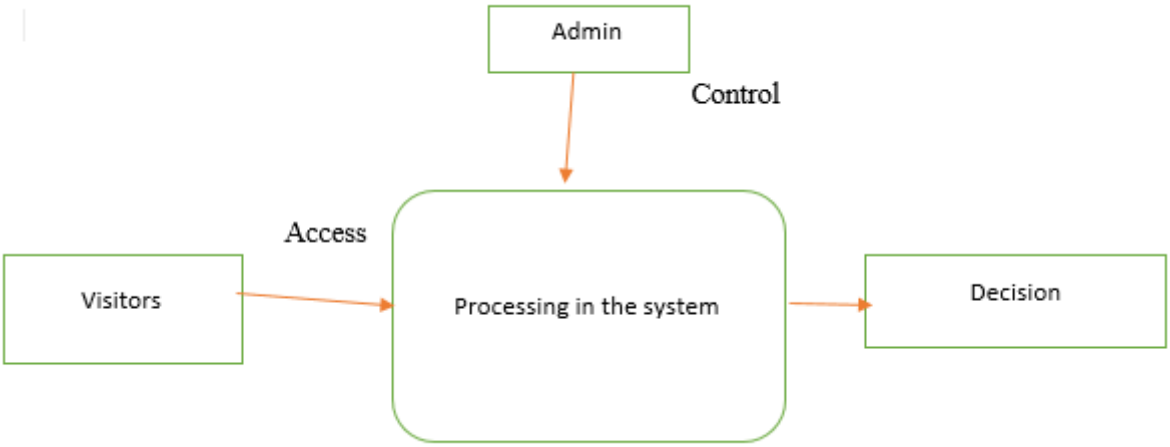

Figure 3.4: System Diagram.

CHAPTER 4

DESIGN SPECIFICATION

4.1 System Design

We have used many components to complete our full project. These components are based together to a meaningful circuit that works for our desired system.

Knock Detection System

We have used many components like PIEZO speaker, push button, 5v motor, 9v battery, NPN transistor, two led, some resistors and some wires with an Arduino mega 2560 to sense the vibration of a knock, so that we can compare the predefined vibration of a knock or changing the pattern of our knock by using push button.

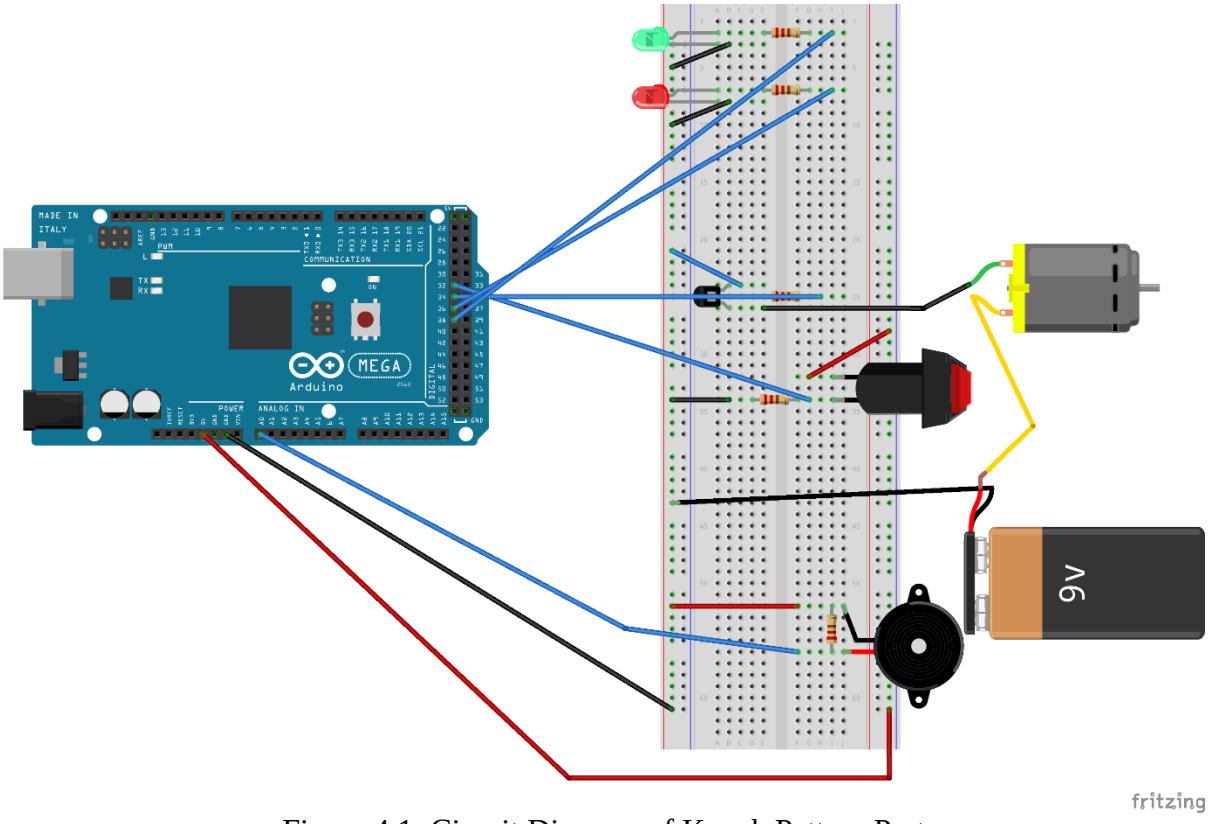

Figure 4.1: Circuit Diagram of Knock Pattern Part

We have used **Arduino mega 2560** which has 54 digital I/O pins, 16 analog input pins [7]. Arduino mainly processes our all components together and process our codes by defining the work of every component.

Piezo speaker usually used for making sounds, but it can also take input signal by analog pins of an Arduino. We have used two piezo speakers, one for detecting the knock and 2nd for setting the alarm when an unauthorized person tries to unlock the door.

Figure 4.2: Piezo Speaker

In this part we have used a **push button** which has two pins. This button mainly used to change the present knock pattern of the security system. When we push the button, our systems green and red led will be turned on. It indicates that the programming mode is on.

NPN transistor can be used as an amplifier or as an electric switch. This transistor controls the 5v motor which, can be turned on and off by coding with the timing of how much time this motor can run.

A **9v battery** is used in the security system to run the **5v volt DC motor**. Because we need to run our motor in higher torque. Arduino doesn't provide sufficient power to run the motor perfectly. So, we needed a 5v volt battery.

Display System:

For making this system user friendly, we have used a display to show the system of a process in this security system. This usually shows the messages of every step of our system. It shows when we are knocking, when it matches the pattern or every small detail that needs a user to know.

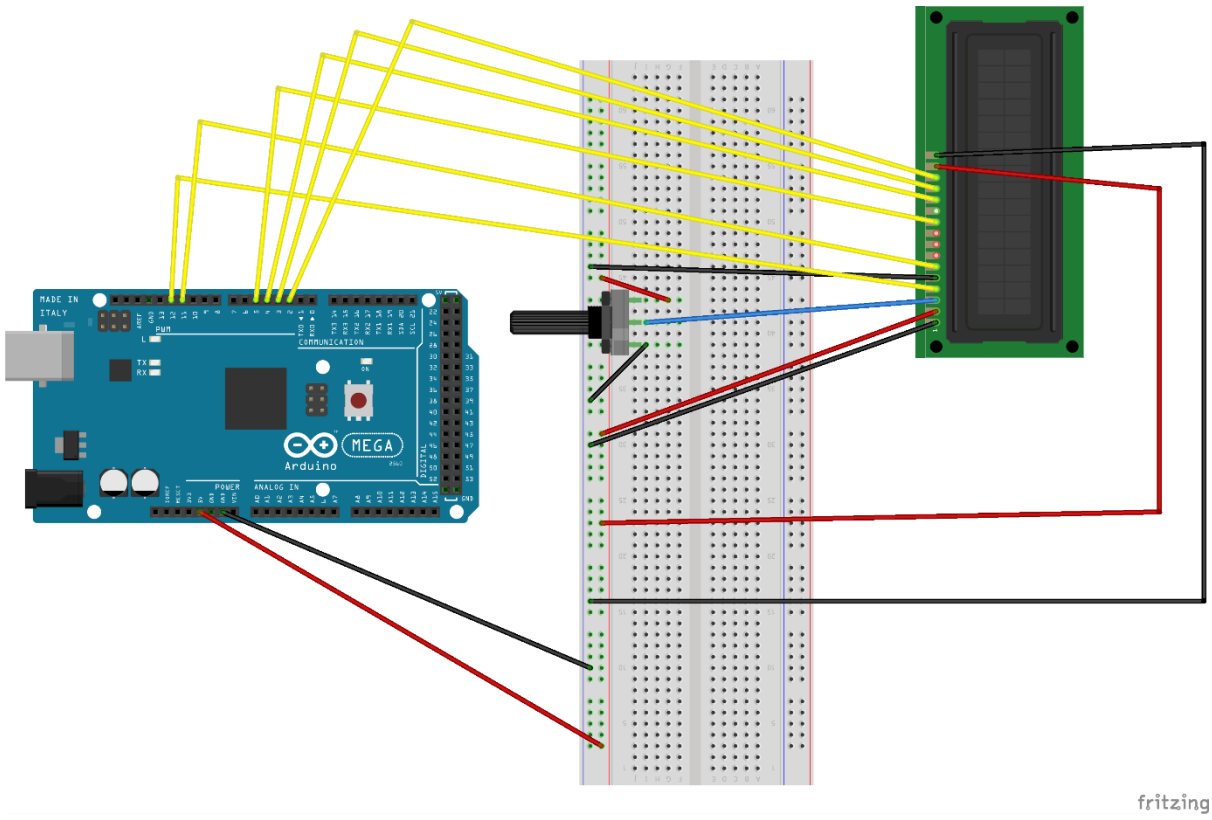

Figure 4.3: Circuit Design of Display Part

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data [8].

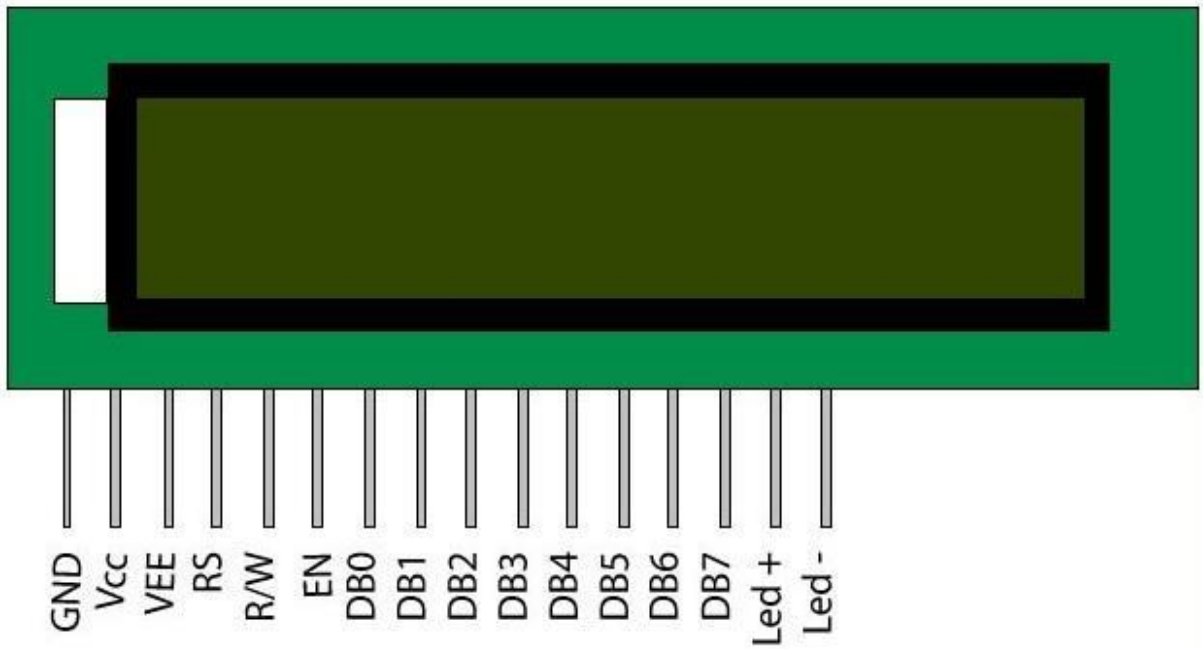

Figure 4.4: Display 16x2

We have used a **10k potentiometer** to control the brightness of the system display.

Fingerprint System:

This is one of the crucial part for our system. This is the heart of two step security system.

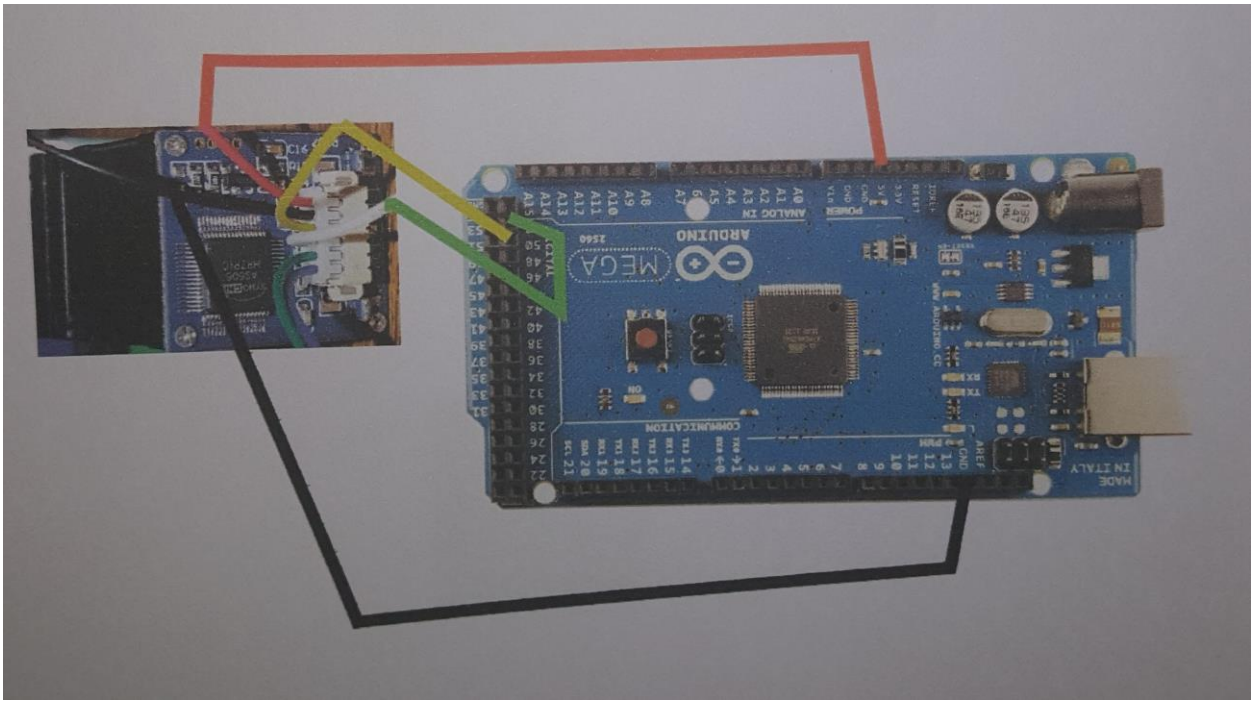

Figure 4.5: Circuit Diagram of Fingerprint

Our fingerprint module is r307. Which is a new product and it bringing a great security with accuracy [9]. This model can store 127 fingerprints.

Figure 4.6: Fingerprint r307

Keypad System:

We have used one 4x4 keypad to take input from the user. This is used to input password and inputs that can show many options for a user or for an admin.

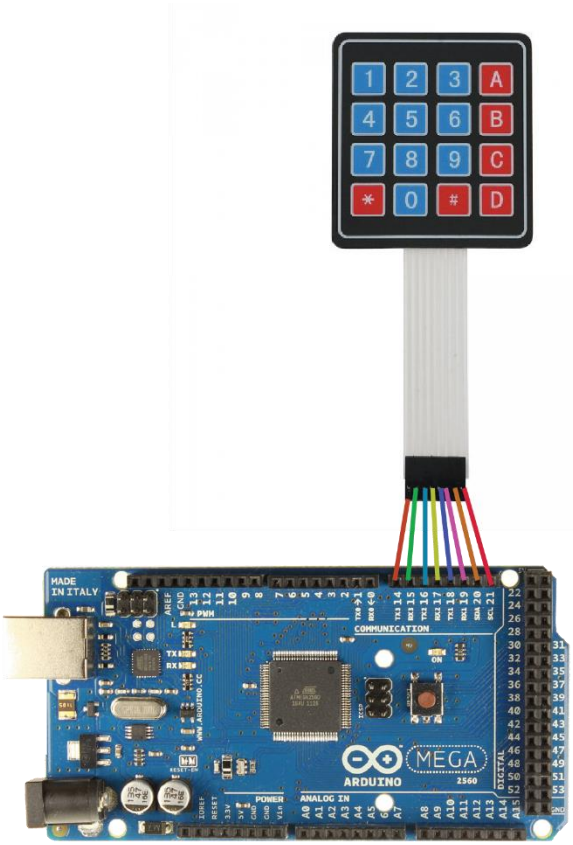

Figure 4.7: Circuit Diagram of Keypad

This keypad has 8 pins. In our system the keypad is mainly used for our admin. So that he can make changes through inputs by using the keypad.

Alarm System:

We have used a **piezo speaker** to just make a sound or tone to when someone tries to access the lock unauthorized.

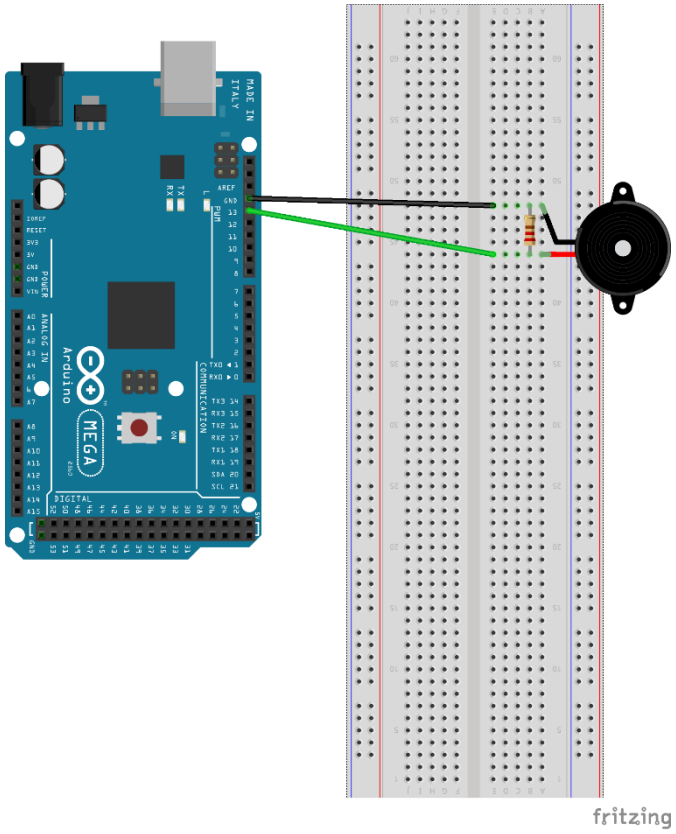

Figure 4.8: Circuit Diagram of Alarm System

WIFI design:

The **ESP 8266 WIFI** module can work alone because it has a processor. So, it can be used as standalone processor to manage hardware and to read the sensors data. But in our project, we are using it as a module and coding this module with the help of Arduino Mega. Then this module can connect with the desired home connection and send email to the desired email ID.

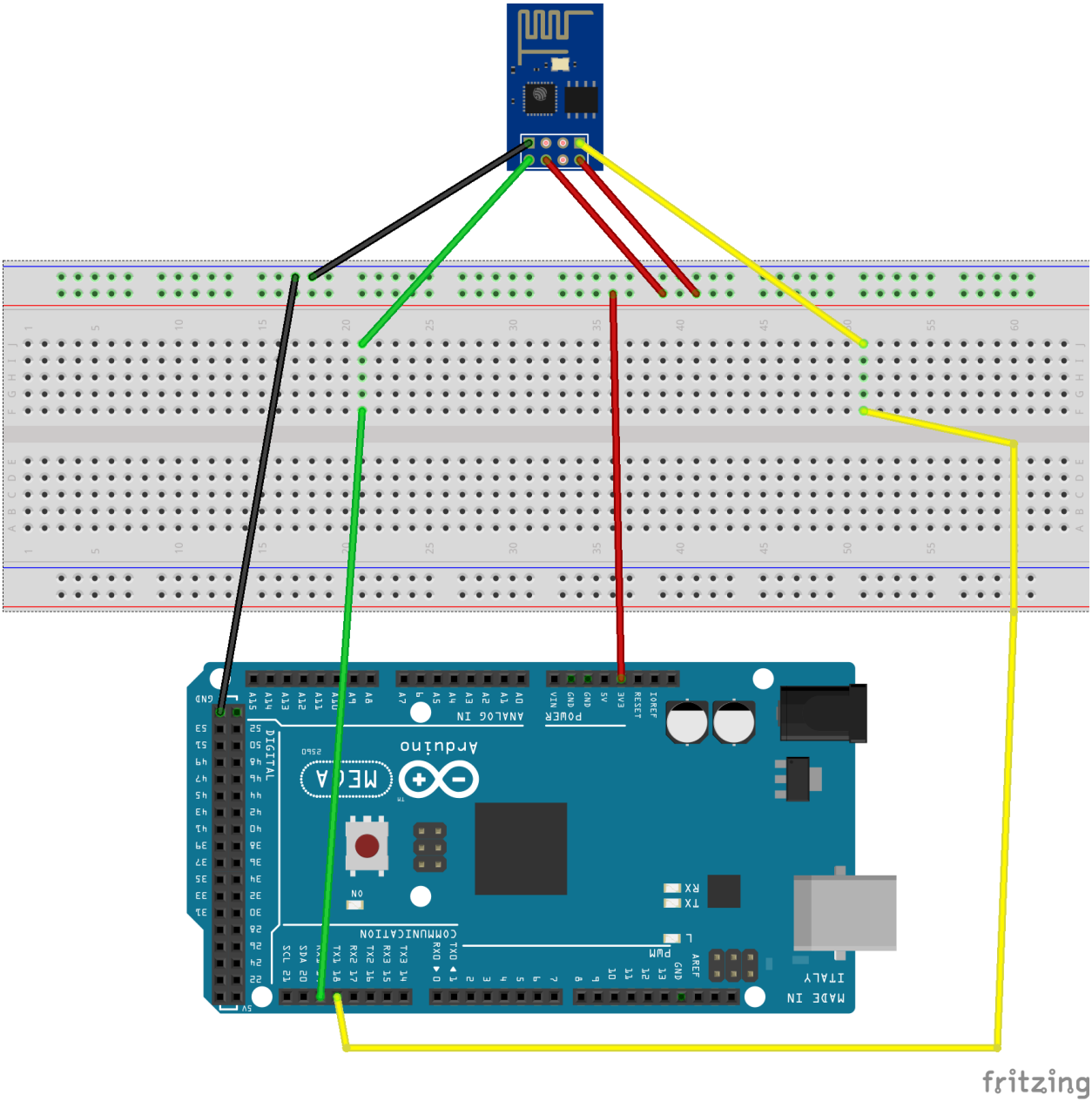

Figure 4.9: Circuit Diagram of WIFI design

4.2 Back-End System

The back-end system is the main part of a system. It requires a lot of work and time for a hardware-based system to design the back-end system. Now the user doesn't know the back-end part. The user only knows how to use the system. The user doesn't need to know the back-end to use the system.

Our project is a security system which uses two steps two verify a user if the user is authenticate or not. In a hardware-based system the back-end design indicates to the coding of the hardware that enables or make usable the hardware component that were used in making the system. We have used many components two build our security system. It needed a lot of system coding to ensure the security process. In short, we will discuss about the back-end of our system.

The knock detection system that is been used in this security system is made with piezo buzzer. Its primary use is to make sound but it can also detect vibration of a knock in a surrounding area.

As the system detects vibration which is not a digital value, so we had to use analog pin of the Arduino mega to perfectly capture the vibration value. We have used A0 pin to measure the vibration of a knock [Appendix B 1, B 2].

The display we have used is a 16x2 display for showing the messages of important things. It is not as simple as it shows in the display. It's not like the ordinary display system or output system for showing the message as we can see in the Serial monitor. It takes a lot of configuration to set up a display [Appendix B 3, B 4].

We have used a 4x4 keypad to take input of necessary things from the admin of the system. This keypad uses 8 pin configurations to work with it. And a ton of work to make it work [Appendix B 5, B 6].

There is many function for this keypad in our security system. This is the way to interact with the system without a computer.

Now the main security system in our system is fingerprint system. The fingerprint module is not user friendly to code it. It took almost two weeks to only code it [Appendix B 7].

It has many purpose. This module can enrol new fingerprint and cross-check a fingerprint to detect an enrolled finger to open the door. It is a hard system to break without an authorized fingerprint.

The alarm system that we used to notify the neighbour is also a piezo buzzer. But this time we had used it with only digital pin. Because now it just has to make some noise in order to notify the neighbours and the security.

One of the main thing in our code is to notify the admin of an unauthorized entry in the system. We have used a esp8266 Wi-Fi module to connect to the home network in order to send the system administrator an email. This Wi-Fi module has its own processor, this way it gave us a hard time to program it with our Arduino.

This code connects with the network to send emails of unauthorized try of entering into the system [Appendix B 8, B 9].

We cannot show all the back-end code of our project, because it will take a lot of time to understand it. So, this will be all to the system back-end design.

4.3 Interaction Design and UX

Interaction design is an important part with user experience (UX). How conveniently a system was made to satisfy the users is important. A system should be easy to use by the users. In short, the user should not have any difficulties to use the system in any way.

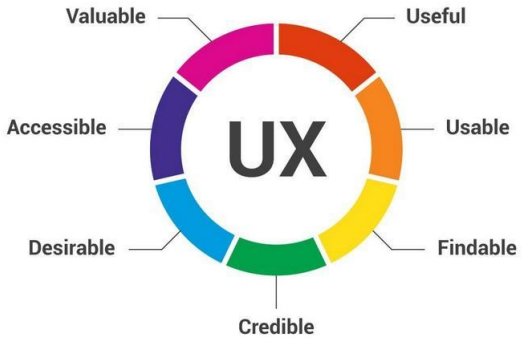

Figure 4.10: UX

Home Page Interaction Design and UX:

We have designed one home page for a user and admin. The user can only use a limited function like opening the door through valid knocking and giving an authorized fingerprint. The admin has to login to access other features. It's an easy system to understand. So, the user or an admin will not have any confusion about the system.

Admin Page Interaction Design and UX:

When the admin wishes to change anything in the system he has to input a pin. If it matches then it will show some other options like adding a new finger print or deleting one old user. An admin can easily interact with the system as it's designed for better user experience.

User Page Interaction Design and UX:

A user can be anyone who has been given privilege by the admin. This page shows that the user has to knock on the door. If he knocks then the next step is showed on the system screen. So, the user will not have any trouble using the system.

4.4 Implementation Requirements

The main implementation requirement was to make a system which is very secure and easy to use design. One should understand that how to use this system at a glance.

The list of implementation requirement is given below:

- Two step securities
- User friendly
- Admin to maintain the system
- Time convenience
- Faster response
- Detection of an unauthorized access
- Reliable system.

CHAPTER 5

IMPLEMENTATION AND TESTING

5.1 Implementation of Database

The system has not used any database like XAMPP or real-time database firebase. Then the question arises how the fingerprint or other related data will be saved. We have used a hybrid fingerprint module. Which has a memory to keep the data of fingerprint with an id which will be inputted by the admin in this case. It saves a lot of time which would be used to design and maintain the database.

Now, this fingerprint module r307 can store the data as itself so, the security measure grows even higher. So, there will be a lot of extra security. As we can handle the data easily by using some command then we can easily manipulate the data system as we wish to use it.

5.2 System Implementation

Here we will demonstrate the whole system of our project in the physical world. So, when one user comes in front of the door which is been secured by the 2-step smart door lock, will see a message in the display.

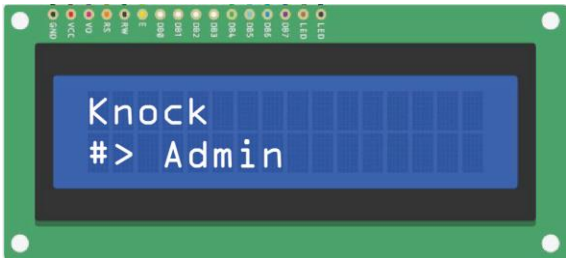

Figure 5.1: Home Page

If the user knocks on the door, it will show knock messages on the display.

Figure 5.2: Knock on The Door

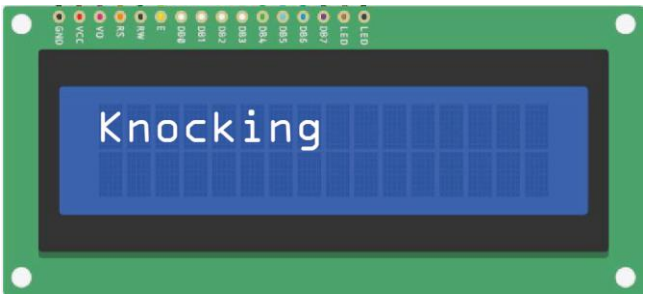

Figure 5.3: Knocking

Now, if the knock pattern matches, it will start the fingerprint sensor and asks for a finger to place on the sensor.

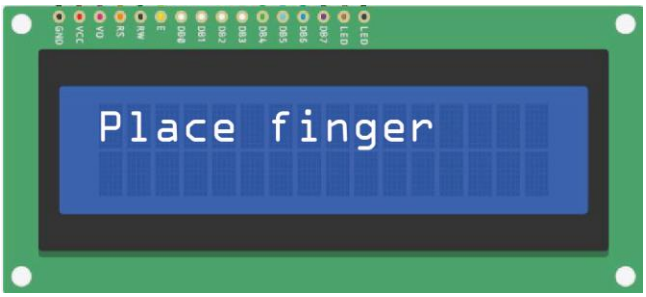

Figure 5.4: Place Finger

Figure 5.5: How to Place Finger

After placing finger on the sensor, if it matches the door will be unlocked.

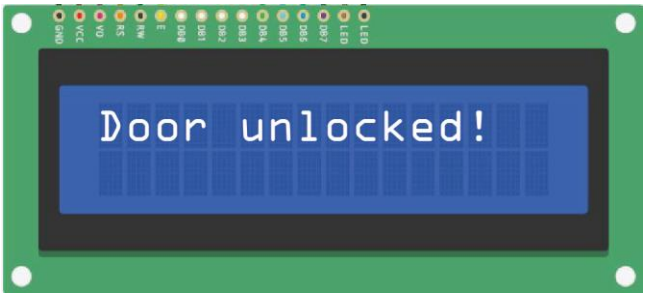

Figure 5.6: Door Unlocked

If the fingerprint does not match, it will start buzzer to notify the security. And it will automatically send a message to the admin using Wi-Fi.

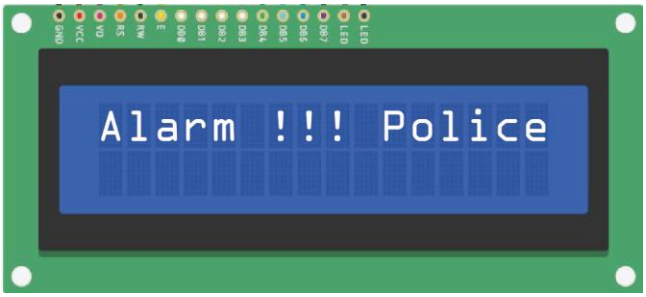

Figure 5.7: Alarm

If the admin wishes to change the system then the admin can use the keypad and type "#" to enter the admin panel. Well, the admin will be needed an extra password to enter the admin panel. If the password matches the admin can only then enter the admin panel. Or else it will ask the admin to retry.

Figure 5.8: Enter Password

Figure 5.9: Wrong Password

If the password matches the admin will see the admin panel. It has 4 options. He can choose any of those options with the keypad.

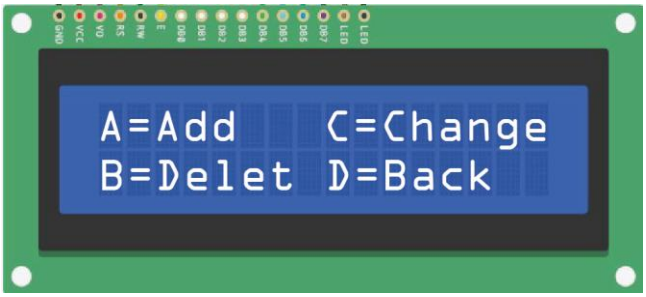

Figure 5.10: Admin Home

If the admin chooses “A” as input it will take the admin to enrol a new fingerprint system. From there the admin can add a new user to the system with an Id.

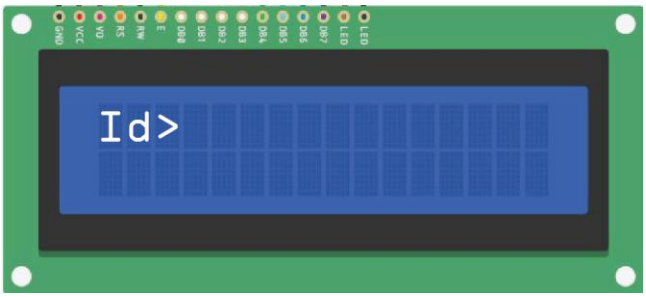

Figure 5.11: Enter ID

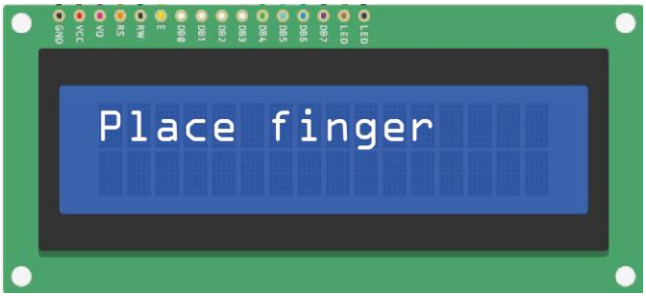

Figure 5.12: Place Finger

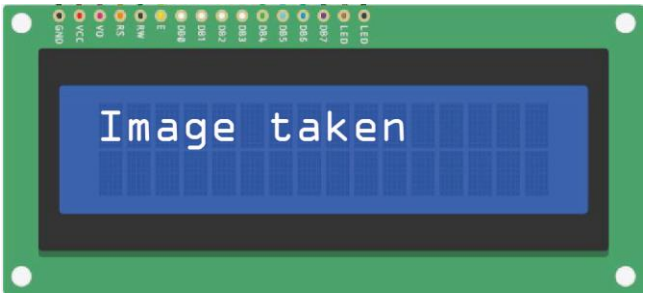

Figure 5.13: Image Taken

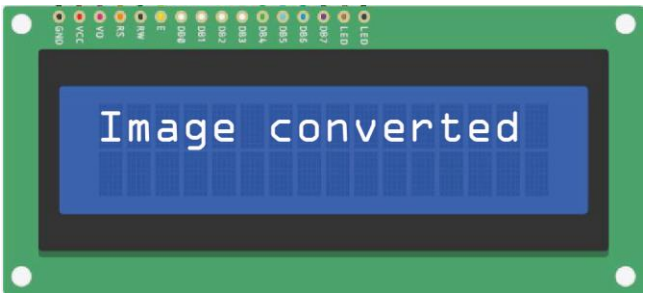

Figure 5.14: Image Converted

After the image conversion the system will ask the user to remove the finger from the sensor. And then again to put the same finger again.

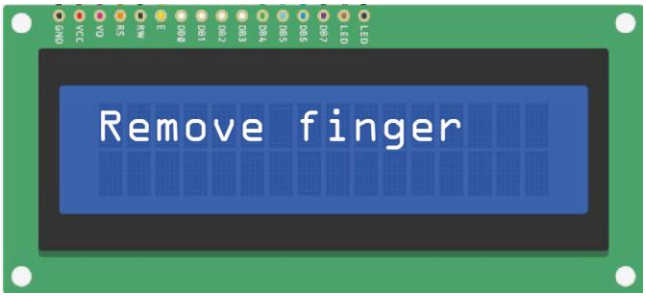

Figure 5.15: Remove Finger

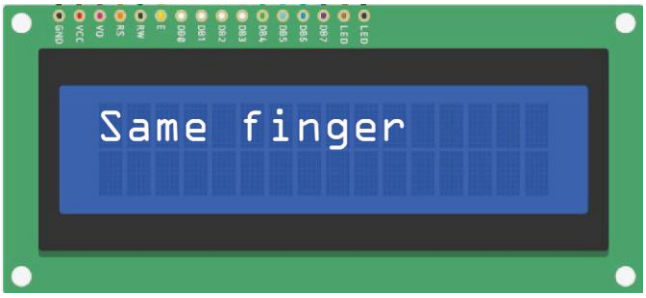

Figure 5.16: Same Finger Again

Then if the fingerprint matches the old fingerprint then it will store it with the database with its id.

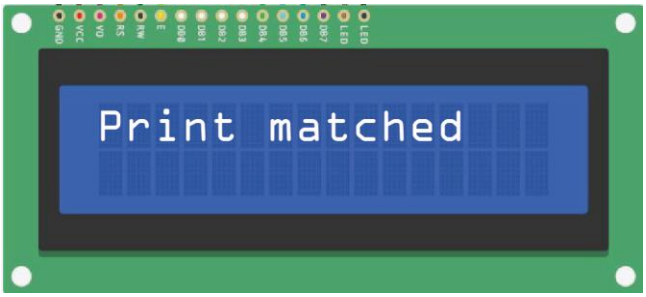

Figure 5.17: Print Matched

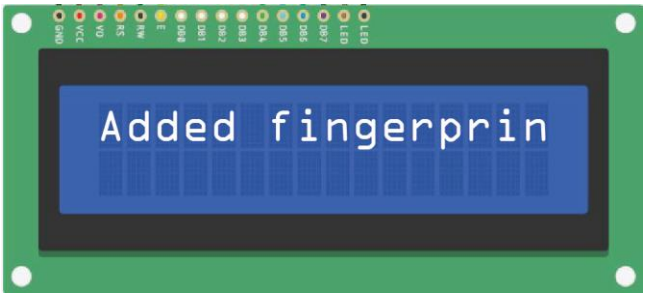

Figure 5.18: Added Fingerprint

Now the if the admin chooses “B”, then the admin can delete a fingerprint by entering the id, the admin wishes to delete.

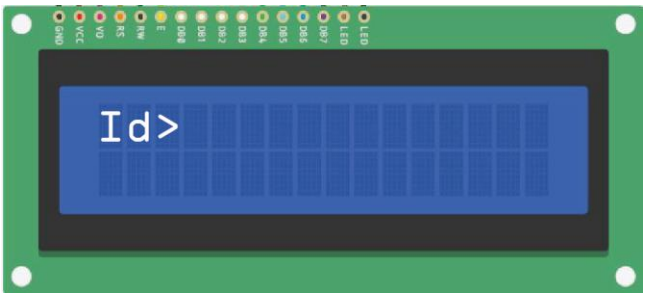

Figure 5.19: Enter ID

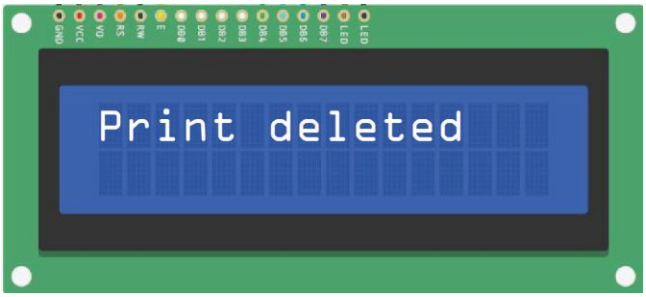

Figure 5.20: Print Deleted

The admin could wish to change the admin password. In that the admin should choose “C” to change the admin password. Then the system will ask for the current password. If the current password does match, then it will ask for new password or else it will say try again.

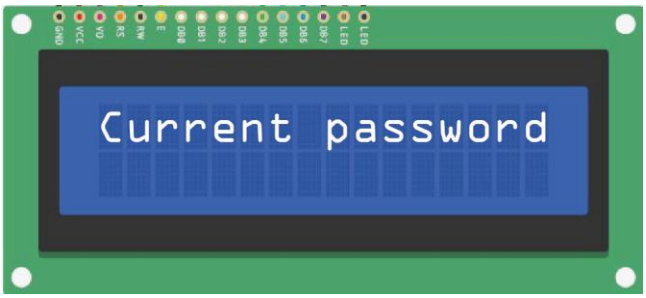

Figure 5.21: Current Password

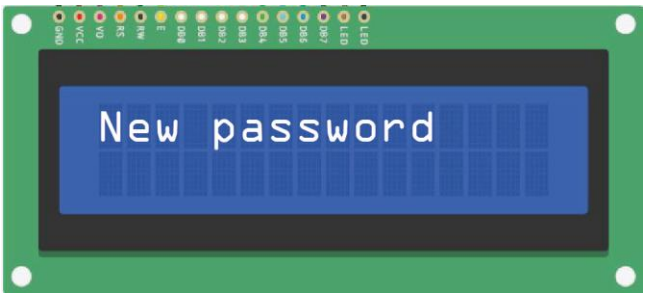

Figure 5.22: New Password

Or in the last the admin can get back to the main system by choosing “D”. it will take to the home screen.

Now, if someone wish to change the knock pattern then the user needs to push the button down and hold it till the knock is not finished.

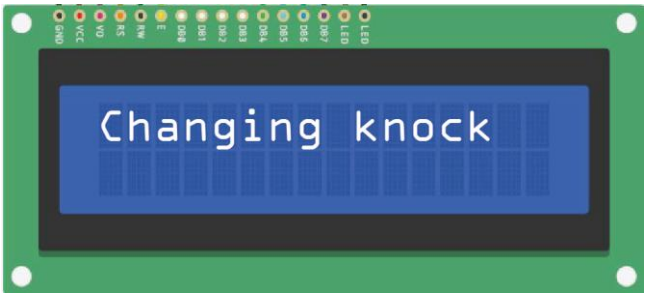

Figure 5.23: Changing Knock

This will save a new knock pattern for the door lock.

Figure 5.24: New Lock Stored

5.3 Implementation of Interaction

Interaction of this 2-step door lock is pretty simple. The system includes the messages for the user so that the user can understand what is going on, in every step. It will help the user to interact with the system easily.

Now the more the user-friendly the system is the more people will be using it. Here the user-friendly term is not used to express that, the system is easy to break. Its just convenient for the user to use.

We have placed all the necessary thing to see on the display. And we did not show any kind of message that could hamper any security issues of the system.

5.4 Testing Implementation

Testing implementation is process of testing the implementation of a system, where tester or system architect will see various cases and specification, is it implementable or it has limitations.

Table 5.1: Testing Implementation

No	Tested case	Test input	Expected outcome	Actual outcome	Result	Tested on
1	Knock	Knock on the door by who knows the pattern	To show the knock accepted message	Showed the knock accepted message	passed	09.08.17
2	Knock	Knock on the door by who does not know the pattern	To show "knock failed" message	Showed the message	Passed	25.08.17
3	Knock change	Knock the door to set new knock pattern by push button	To store new knock pattern	Stored new knock	Passed	13.09.17
4	Keypad	Take input	To take input form 4x4 keypad	Took input from 4x4 keypad	Passed	22.11.17
5	Fingerprint	Start fingerprint	To start the fingerprint after knock pattern accepted	Started the fingerprint sensor	Passed	11.12.17

6	Enrol new fingerprint	Enrol a fingerprint	To enrol a new fingerprint in the system	Enrolled new fingerprint	passed	16.01.18
7	Delete fingerprint	Deleting a fingerprint by a id	To delete a fingerprint	Deleted a fingerprint	Passed	29.01.18
8	Door unlock	Door lock open by knocking and fingerprint	To open door using knock and fingerprint	Door opened using knock and fingerprint	Passed	13.02.18
9	Door unlock	Door unlocking by unauthorized person	To not open the door	Door didn't open	passed	13.02.18
10	Admin password	Admin panel password test by admin	To go to the admin panel	Started the admin panel	Passed	26.02.18
11	Admin password	Admin panel password test by unknown person	To not go to admin panel	Did not open admin panel	Passed	26.02.18

12	Change admin password	Change the password of 4 digit	To change the password for admin	Changed the password for admin	Passed	11.03.18
13	Go back	Going back to home page using back key	To go to home page	Gone to home page	passed	15.03.18

5.5 Test Results and Reports

We have tested our security systems to see if it works or not as we want to use it. So, the tested result will help us to understand the problem of our system and improve it. We should test every step of our project to make it a successful security system.

We have tested the 2-step smart door lock for many time with different type of people. It worked fluently. It did not open for unauthorized people. But it seems to have some problem with recognizing the finger sometimes. It because of the finger placement. The person was having this problem might have enrolled with a different position of finger. It might have been the problem. Or else it works fluently on a ratio of 97/100 times.

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 Discussion and Conclusion

Life in this modern world is becoming highly dependent on computer-based systems. From coffee making to dishwashing everything is done by modern appliances. Now comes the issue of our sweet home's security. "2 step door lock security system" is a cost-efficient system that can be used to ensure the security of our beloved nest. Even small organizations can use it easily as it identifies a particular knock-based pattern and then takes a fingerprint to open up the door. No key required in this system. If any of the pattern is mismatched an alarm will let others know that somebody unauthorized is trying to enter the house and an email will be sent to the owner so that he can take necessary actions.

6.2 Scope for Further Development

The scope of the project development we have planned many things. Such as-

- A camera module can be added in future to take picture of all users who are going towards the process of the security system.
- A log file of all users can be created and be informed to the admin through Email.

This project can also be further enhanced with retina scan, voice recognition and etc. Thus, can be widely used in offices hospitals, laboratories and even in cars.

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[8] “LCD”. Available: https://www.engineersgarage.com. [Accessed Mar 15, 2018].

[9] “Fingerprint sensor”. Available: https://www.adafruit.com. [Accessed Mar 15, 2018].

APPENDICES

Appendix A: Project Reflection

The purpose of this appendix is to provide an introduction to Project Reflection. The group research project was a challenging and enjoyable experience typical of the course as a whole. We have had little exposure to group work at university so it was a nice change to be part of an effective and dynamic team. I think we complemented one another quite well both in bringing together interdisciplinary perspectives and in balancing the work at hand.

The experience taught us that planning and crafting responses takes a longer time in teams than on your own. The extensive effort required was ultimately a good thing. When working alone, you can end up with a result that is identical to your initial plans. In our group, we were constantly developing and refining one another's ideas. It was fascinating just how productive our group meetings were. The time seemed to fly and yet we always got a lot done and managed to help another along the way towards the endpoint of having a substantive policy.

Appendix B: Related Diagrams

We had to write many codes in order to finish this project. We cannot show all our codes in our report. But there are some important parts which should be included to in our report in order to understand the functionality or how it started working.

```
// Pin definitions for knock
const int knockSensor = 0;
const int programSwitch = 32;
const int lockMotor = 34;
const int redLED = 36;
const int greenLED = 38;
int red;

const int threshold = 100;
const int rejectValue = 25;
const int averageRejectValue = 15;
const int knockFadeTime = 150;
const int lockTurnTime = 650;

const int maximumKnocks = 20;
const int knockComplete = 1200;

// Variables.
int secretCode[maximumKnocks] = {100, 100, 100, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0};  // Initial setup: "Shave and a Hair Cut, two bits."
int knockReadings[maximumKnocks];
int knockSensorValue = 0;
int programButtonPressed = false;
```

B 1

```
//
  pinMode(13, OUTPUT); // finger led
  pinMode(lockMotor, OUTPUT);
  pinMode(redLED, OUTPUT);
  pinMode(greenLED, OUTPUT);
  pinMode(programSwitch, INPUT);

  Serial.begin(9600);
  Serial.println("Program start.");

  digitalWrite(greenLED, HIGH);      // Green LED on, everything is go.
```

B 2

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(12,11, 5, 4,3,2);
```

B 3

```
//displ
  lcd.begin(16,2);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("knock the door");
//
```

B 4

```
#include <Keypad.h>
```

B 5

```
const byte ROWS = 4; //four rows
const byte COLS = 4; //four columns
char keypressed;
//define the cymbols on the buttons of the keypads
char keyMap[ROWS][COLS] = {
  {'1','2','3','A'},
  {'4','5','6','B'},
  {'7','8','9','C'},
  {'*','0','#','D'}
};
byte rowPins[ROWS] = {14, 15, 16, 17}; //Row pinouts of the keypad
byte colPins[COLS] = {18, 19, 20, 21}; //Column pinouts of the keypad
Keypad myKeypad = Keypad( makeKeymap(keyMap), rowPins, colPins, ROWS, COLS);
```

B 6

```
#include <Adafruit_Fingerprint.h>
#include <SoftwareSerial.h>
SoftwareSerial mySerial(50, 52);
```

B 7

```
#define BLYNK_PRINT Serial
/* Set this to a bigger number, to enable sending longer messages */
//#define BLYNK_MAX_SENDBYTES 128

#include <ESP8266_Lib.h>
#include <BlynkSimpleShieldEsp8266.h>

// You should get Auth Token in the Blynk App.
// Go to the Project Settings (nut icon).
char auth[] = "1261855bb12e4330ae0e8e948fdd47c0";

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "[redacted]";                // name of wifi
char pass[] = "[redacted]";                password of wifi

// Hardware Serial on Mega, Leonardo, Micro...
#define EspSerial Serial1
```

B 8

```
void setup()
{
  // Debug console
  Serial.begin(9600);
  // Set ESP8266 baud rate
  EspSerial.begin(ESP8266_BAUD);
  delay(10);
  Blynk.begin(auth, wifi, ssid, pass);
  Blynk.email("your_email@mail.com", "Subject", "My Blynk project is online.");

  // Setting the button
  pinMode(2, INPUT_PULLUP);
  // Attach pin 2 interrupt to our handler
  attachInterrupt(digitalPinToInterrupt(2), emailOnButtonPress, CHANGE);
}

void loop()
{
  Blynk.run();
}
```

B 9

Plagiarism Report

Checked by: https://my.plagramme.com

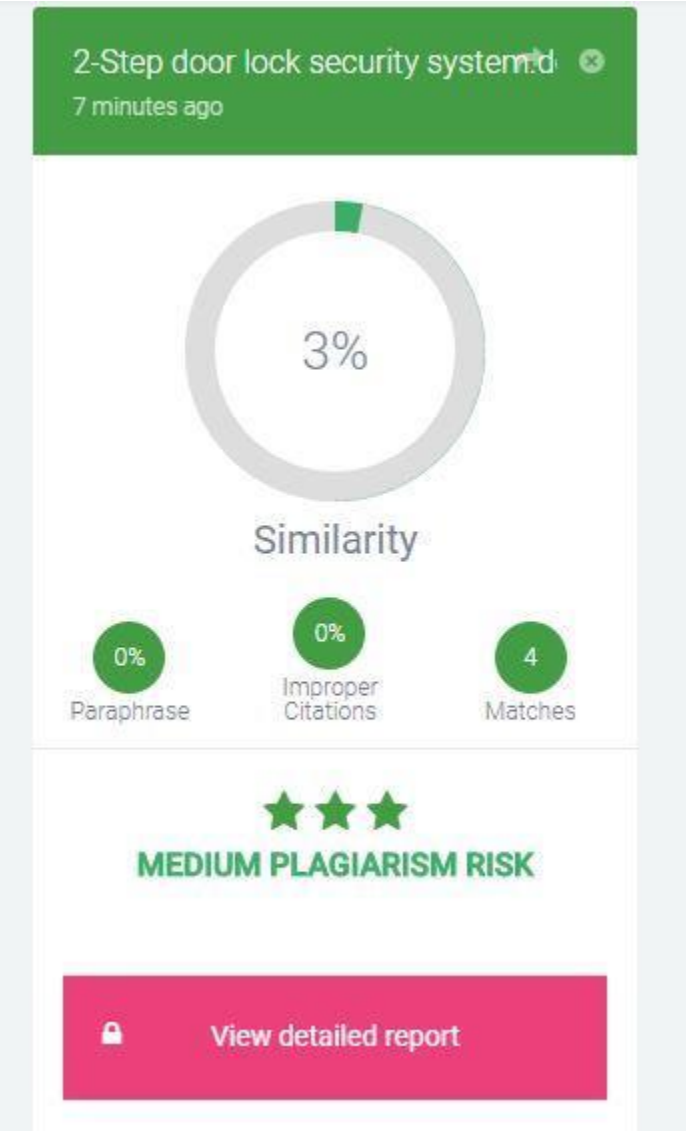

Figure: Plagiarism report