

Modern home security systems with Camera and Smart door lock

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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 “**Modern home security systems with camera and smart door lock**”, submitted by Surove Paul ID: 191-15-2635 AND Rifat Sikder Pranto ID: 191-15-2493 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 30/01/2023.

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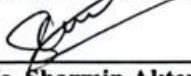
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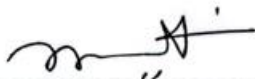
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DECLARATION

We hereby declare that, this project has been done by us under the supervision of Dr. S.M. Aminul Haque, Associate Professor, 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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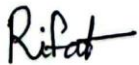
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First of all, we are thankful to Almighty Allah, by whose infinite mercy we have been able to complete this project.

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ABSTRACT

The supremacy of the IoT extends to all fields. The security sector is no exception. IoT is also an alternative to modernizing security and safety systems to meet the global challenges ahead. Our project is the **Modern home security systems with camera and smart door lock**. This project can contribute to the ongoing modernization of home security systems. We completed the project at the knowledge acquisition stage and made it through research. We believe it will be able to add new aspects to home security. The fusion of hardware and software has made this project quite attractive.

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CHAPTER 1

Introduction

1.1 Introduction

The security system is one of the major concerns of our day-to-day life. Smart security system assists developed countries in survival. Science has made the unfeasible to become feasible where IoT has been a massive part of it for fewer decades [6]. IoT has given uncountable consolation to living beings with its application in different sectors where the implementation in the security sector is one of the most dominant ones. In the context of today's world, the stronger the economy of a country, the more influential it is to influence others and being able to develop quickly in other fields. Therefore, if IoT-based security systems are ensured in important places including homes and offices, the entry of unauthenticated people can be stopped, and proper security will be ensured. Building a smart security system based on IoT will be able to act as a major regulator in the economy. A smart security system is a system that builds an automated and transparent agricultural system through a networking system using various sensors, software, and smart devices. The involvement of IoT in our security system can be an aid to prevent any kind of harmful effect on our homes, offices, and industries even before it occurs. So, if we can detect destruction earlier than it occurs then we will be able to make a great impact on society. So from now on the development of a sustainable security system has become very foremost. Smartly advanced data collection, analysis, and processing through IoT integration in the security system can make owners of homes, offices, or industries decision-making much uncomplicated. Above all, we can say that IoT, a smart home security system made up of a combination of sensors, hardware, and software, will introduce people to the modern system and bring them in touch, as well as build a strong security system.

1.2 Project Motivation

The impact of IoT (Internet of Things) is present in almost all cases. In this age of automation, there is no alternative to IoT. The security sector is no exception. The factors that have inspired the implementation of this project are discussed:

First, most doors usually use manual locks. Even if the key to the door is stolen in any way, the security of the room/house is threatened. So with this in mind, we have arranged for a biometric door lock so that there is no risk to the key and the owner of the house or the person in charge of the room can decide who will have access to unlock the door.

Secondly, another thing that has inspired us to work on this project is - it is often seen that the homeowner locks the door when he goes somewhere. At this time, if there is a guest or someone in the house, the owner of the house is not around, he has to wait a long time outside, or there is a kind of unwelcome situation when entering the house. To address this problem, we've introduced a system that allows homeowners to use the Internet and apps from anywhere in the world to directly monitor who's coming in front of their door and unlock the door with an app to let them in if needed.

1.3 Objectives

- Live to monitor of the home security system
- Remote access to the door unlocking
- Reducing manpower for door unlocking
- Smart and cost-effective system

The project's core components are some sensors, and the use of contemporary technology will provide the user a chance to introduce himself to it. In this project, we've included a smart home security system.

1.4 Expected Outcomes

Our project “Modern home security systems with camera and smart door lock”

is carried out through the following phases:

- Gain ideas by reviewing existing systems
- Necessary data collection
- Collection of necessary instruments
- Implementation of the project

Before starting work, we gained ideas and knowledge from some of the projects that have been related to this topic and found out their limitations. Then we decided what we wanted to do. Later, we made a list of what equipment we need. Lastly, we have been able to successfully implement the project by using the equipment properly.

1.5 Project Management and Finance

Now that we know what IoT is and what it can do for us. If i am working with a remote team on a sensitive project I can track it from anywhere. IOT is the biggest platform now solve any kind of problem.

1.6 Report Layout

We addressed the contribution of IoT and its broad scope in the introduction of the first chapter of this project report as our project is focused on IoT and home security systems. Additionally, the IoT's contribution to the continual improvement and modernization of security systems has been considered as well. The essence of our project is then emphasized. Later, we discussed the project's strengths and procedures. The technique is applied throughout all stages of this project's execution, from the beginning to the present.

The second chapter then delivers illustrations of the background. Prior to working on this project, we conducted a prior study on the subject, highlighting some of the important information we learned from it and other work that is related to our project.

Our project is a confluence of hardware and software. Therefore, in the third chapter, we illustrated the hardware and software we had to employ.

In the fourth chapter, we outline our full implementation procedure. The implementation strategies are now first demonstrated. The correct code was afterward highlighted. Additionally, a flowchart is displayed and described.

The picture of the project's outcomes is what we saw as a result of it in Chapter 5.

In the future, this project may do more and expand. Therefore, Chapter 6 outlined some possible directions for this project in the future. At the end of this chapter, we clarified the conclusion of the project.

Important references are included at the end of the report.

CHAPTER 2

BACKGROUND

2.1 Preliminaries

First off, the IoT is a physical networking system consisting of sensors, software, and technology, according to the criteria we have stated for it. Our project " Modern home security systems with camera and smart door lock" is an Internet of Things-based project. The present world is moving towards automation day by day. Different tasks are gaining more importance in automated systems. And the IoT is playing an important role in building all automated systems. IoT is a system that combines software with various sensors/devices to exchange data and provide output over the Internet. At present, the free movement of IoT is noticeable in almost all sectors [5]. The security sector is no exception. IoT has important role in making the security sector smart and automated. Therefore, mobile apps will be assimilated and alerts will be given to the owners and users so that they will be able to develop a robust security system using the virtual and actual combination. Smart IoT technology, including sensors or WSN and remote control devices, will be used in security systems [7].

Before working on this project we looked at some research papers of previous works related to our topic and found out what they did and their limitations. Table 1.4 shows that-

Table 2.1: Some existing works and their limitations related to the smart security system

Existing Works	Limitations
We have seen a security system where the movement of someone near the door can be detected through the PIR sensor and its image will be captured through the camera and sent to the owner in the form of a notification and from there the homeowner can control the accessibility of the door through the app [1].	Door accessibility is discussed here only through images which may not always provide accurate information. Biometric door unlocking would have been more effective.
We have also seen another sensor that integrates with the mobile app using the biometric sensor for door unlock. That is, if the user checks his fingerprint on the mobile app, he can gain accessibility to the door [2].	There is no mention of remote security system monitoring or door access control.
When someone approaches the door, the image will be captured and sent to the homeowner through the app, or if someone tries to break the lock or damage the door, then the mobile app will send an alert. Besides, the homeowner can control the door lock-unlock through the mobile app [3].	If the system has a live video monitoring system, it could have turned into a more effective and robust security system.
Another type of door lock has worked where biometric sensors are used for door unlocking. By linking the biometric device with the fingerprint of the mobile via Bluetooth, accessibility is made easier for the user [4].	No system of remote monitoring has been worked here.

2.2 Related Works

- IOT based Smart Home Security System with Alert and Door Access Control using Smart Phone[1]
- Smart Door Locking System using IoT[2]
- Security and Usability Improvement on a Digital Door Lock System based on Internet of Things[3]
- Biometric Door Lock Using Mobile Fingerprint[4]

2.3 Comparative Analysis

Smart door lock is a strong competitor of normal door lock. It is a far better option for anyone as we are all use a smartphone.

2.4 Scope of the Problem

Most doors usually use manual locks. Even if the key to the door is stolen in any way, the security of the room/house is threatened. So with this in mind, we have arranged for a biometric door lock so that there is no risk to the key and the owner of the house or the person in charge of the room can decide who will have access to unlock the door.

2.5 Challenges

- Failure to install or open the app on mobile devices
- Failure to control remotely or receive notification/warning messages
- Incorrect information or no response on the screen

CHAPTER 3

REQUIREMENT SPECIFICATION

3.1 Introduction

In this part, we will discuss the process of collecting and analyzing the necessary materials for this project. We will also present a flow chart based on this project.

3.2 Hardware Requirements:

- Fingerprint Sensor
- 12v Solenoid door lock
- I2C Display Adapter
- LCD Display
- Push Button
- Arduino UNO
- Node MCU (ESP8266)
- Relay Module (2 Channel)
- ESP32 CAM
- 12v DC Adapter
- Jumper Wire



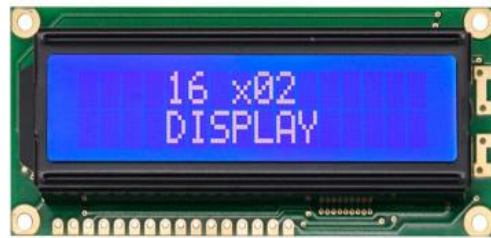
Fingerprint Sensor



12v Solenoid door lock



I2C Display Adapter



LCD Display

Figure 3.2.1 Required Hardware [8]

Fingerprint Sensor: A fingerprint scanner is a type of technology that identifies and authenticates the fingerprints of an individual in order to grant or deny access to a system. Here, we use a fingerprint sensor to check the authenticated person to give access to a room or home.

12v Solenoid or lock: The solenoid lock denotes a latch for electrical locking and unlocking. It is available in unlocking in the power-on mode type, and locking and keeping in the power-on mode type, which can be used selectively for situations. As, we making a project like prototype so we used 12v solenoid door lock.

I2C Display Adapter: The number of connection pins on the main LCD display is much higher. So providing its connection is complicated enough. The I2C display adapter is used to connect LCDs easily with a small number of connection pins.

LCD Display: LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation.



Push Button



Arduino UNO



Node MCU (ESP8266)



Relay Module (2 Channel)

Figure 3.2.2 Required Hardware [8]

Push Button: In our project the push button will act as a kind of door-bell. A push switch (button) is a momentary or non-latching switch which causes a temporary change in the state of an electrical circuit only while the switch is physically actuated.

Arduino UNO: Arduino UNO is a low-cost, flexible, and easy-to-use programmable open-source microcontroller board that can be integrated into a variety of electronic projects.

Node MCU (ESP8266): NodeMCU is an open-source LUA based firmware developed for the ESP8266 wifi chip. It will do three task in this project. Firstly, it will connect the whole system with the internet. Secondly, it will assist to send notification to the owner. Last one is, it will assist the owner of home/room to unlock the door via app.

Relay Module (2 Channel): The 2 Channels Relay Module is a convenient board which can be used to control high voltage, high current load such as motor, solenoid valves, lamps and AC load. It will act like a digital switch of the door lock.



ESP32 CAM



12v DC Adapter



Jumper Wire

Figure 3.2.3 Required Hardware [8]

ESP32 CAM: The ESP32-CAM is a small size, low-power consumption camera module based on ESP32. It will help the owner/user to show the live view in front of the door in this project.

12v DC Adapter: They convert alternating current (AC) into the required direct current (DC). In this project we used 12v DC Adapter.

Jumper Wire: Jumper wires are electrical wires with connector pins at each end. They are used to connect two points in a circuit without soldering.

3.3 Software Requirements:

We also had to use the software as part of our project implementation.

They are-

- Arduino
- Blynk



Arduino



Blynk

Figure 3.3.1 Required Software [8]

Arduino IDE: The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. Here we use this for programming and upload code of the project.

Blynk: Blynk is a new platform that allows you to quickly build interfaces for controlling and monitoring your hardware projects from your iOS and Android device. We use this software in this project for monitoring and controlling the security system.

CHAPTER 4

IMPLEMENTATION AND TESTING

4.1 Implementation Method

Here we will describe the system as a whole. In the first step of implementation, we have selected the necessary materials. We have installed and connected the Fingerprint Sensor, 12v Solenoid door lock, I2C Display Adapter , LCD Display, Push Button, Arduino UNO, Node MCU (ESP8266), Relay Module (2 Channel), ESP32 CAM, 12v DC Adapter, Jumper Wire. We later implemented the entire system by placing the appropriate Arduino code. In Figure 4.1 we are providing a picture of our Arduino circuit.

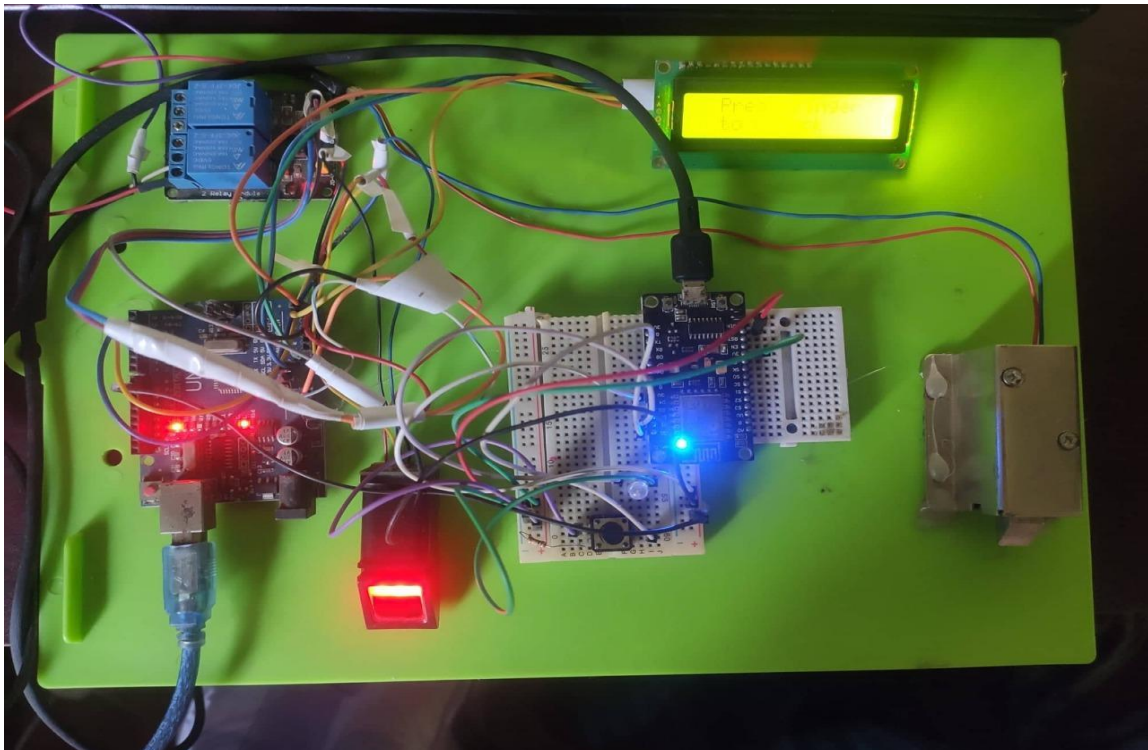


Figure 4.1 Arduino Circuit for Modern home security systems with camera and smart door lock

4.2 Arduino Code Implementation

We use appropriate arduino code in the back-end of the project and run it successfully. We show the screenshot of our Arduino code in the next figures (Figure 4.2.1).



```
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File Edit Sketch Tools Help

enroll

#include <Adafruit_Fingerprint.h>

#if (defined(__AVR__) || defined(ESP8266)) && !defined(__AVR_ATmega2560__)
// For UNO and others without hardware serial, we must use software serial...
// pin #2 is IN from sensor (GREEN wire)
// pin #3 is OUT from arduino (WHITE wire)
// Set up the serial port to use softwareserial..
SoftwareSerial mySerial(2, 3);

#else
// On Leonardo/M0/etc, others with hardware serial, use hardware serial!
// #0 is green wire, #1 is white
#define mySerial Serial1

#endif

Adafruit_Fingerprint finger = Adafruit_Fingerprint(&mySerial);

uint8_t id;

void setup()
```

Figure 4.2. Necessary Arduino Code for fingerprint enrollment

4.3 Flowchart

In this chapter we have highlighted the flowchart. Here is our complete project with what is shown in the flowchart.

4.3.1 Flowchart of the system

There is no substitute for a flowchart to enhance the graphics view of a project. So in Figure 4.3.1 we have highlighted the project management through the use flowchart of our project.

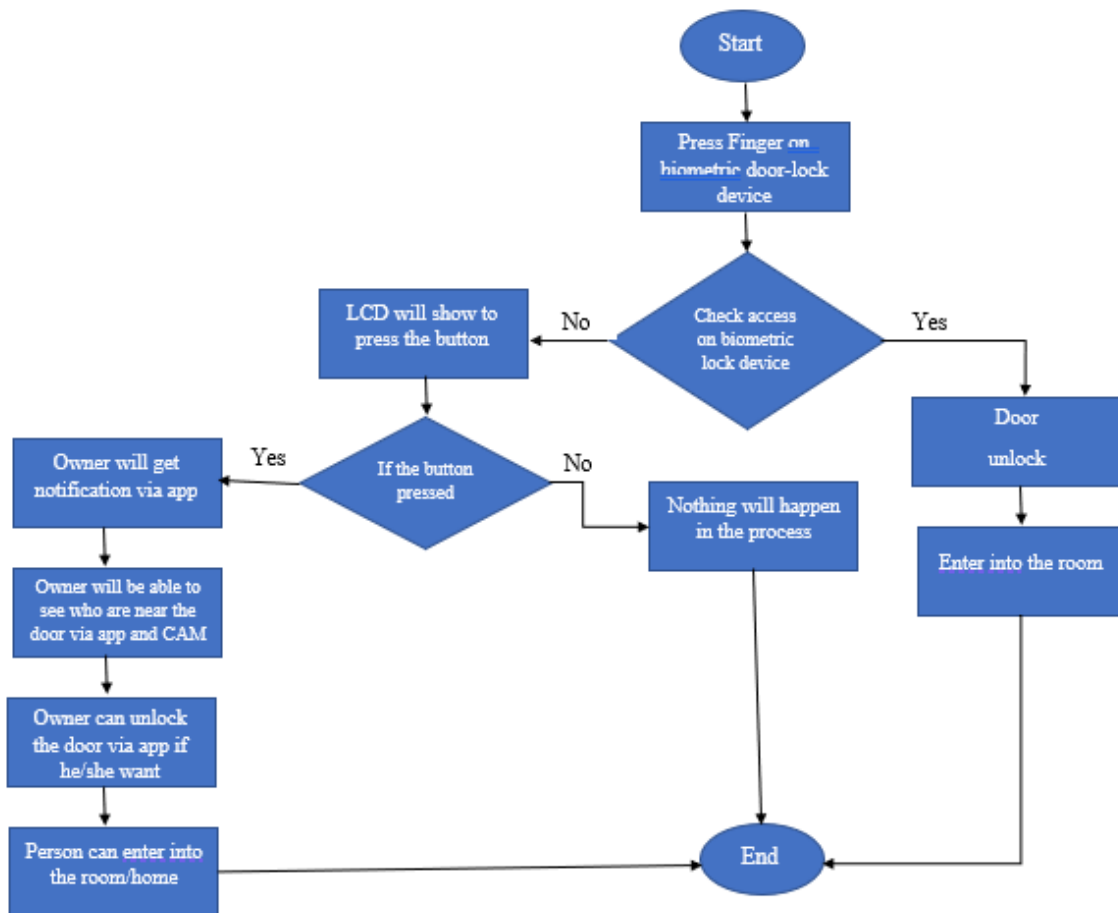


Figure 4.3.1 Flowchart for Modern home security systems with camera and smart door lock

4.4 Working Procedure of The System

We are showing the working procedure of the whole system via a block diagram (Figure 4.4) below-

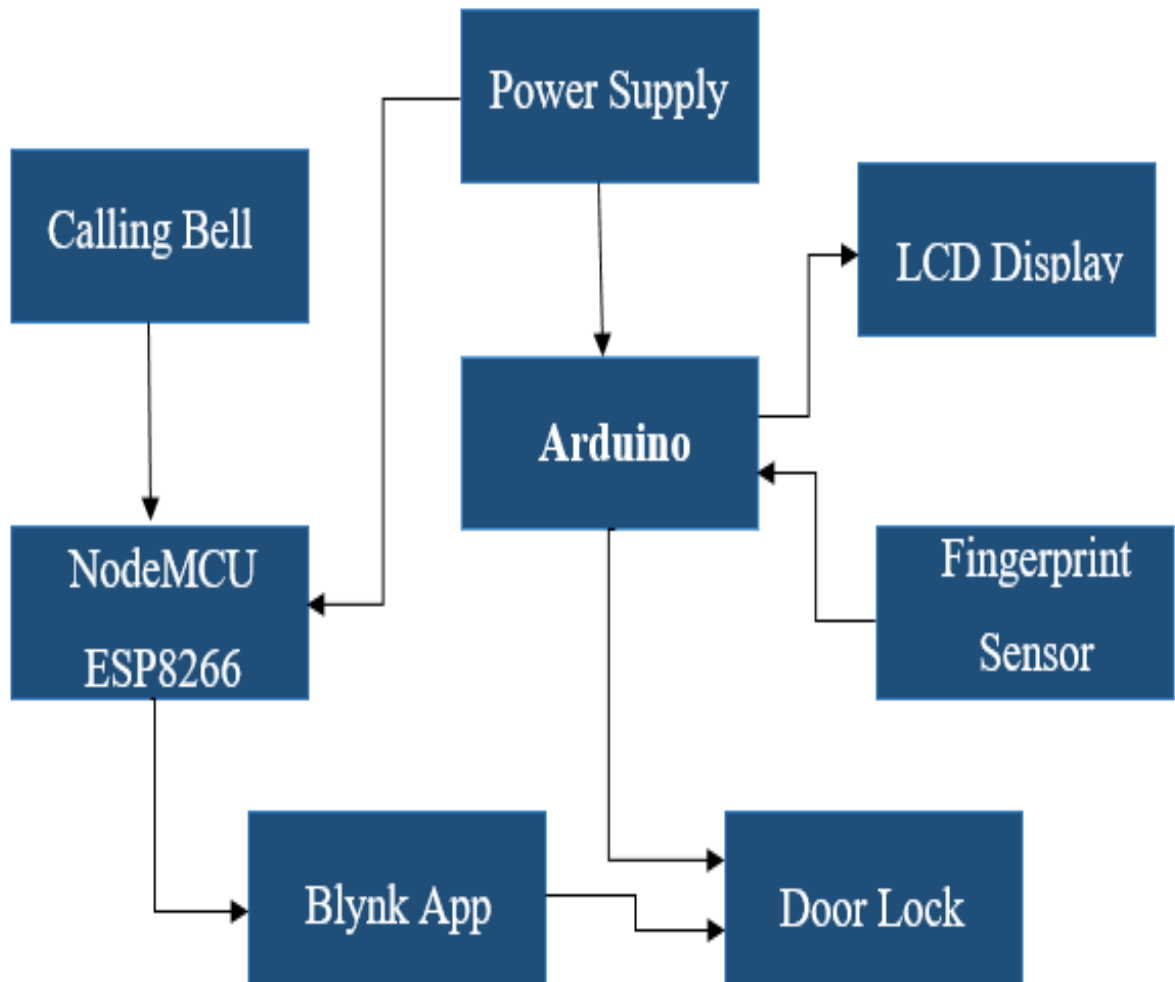


Figure 4.4 Block diagram for Modern home security systems with camera and smart door lock

In our project, we have introduced a system that will have a biometric door-lock, LCD monitor, buttons, camera, and a special app for room/home security monitoring through notification for any room/home door. That is, if we go to describe the whole system, we can see that the door of the room/house can be unlocked through fingerprint access. And

there will be an LCD display with the door and a button next to the door. That button will act as a doorbell.

In this case, if someone wants to enter the room/house by unlocking the door, if he has access to the biometric unlock, he can open the door and enter. And if no one has access to the biometric unlock, the text on the LCD display next to the door will show him as if he presses the side button. Pressing the button will notify the room/homeowner via the Blink app and he will be able to see live who is coming through the camera near the door. Then if he thinks that he will allow the person waiting near the door to enter his room/house, then he can open the door lock using the internet and blink one from any far-away end.

CHAPTER 5

RESULT DISCUSSION

First, when the user approaches the door, the LCD display will read Press Finger to Unlock (Figure 5.1).



Figure 5.1 Press finger to unlock

It is our main screen.

Then the user will press his finger on the fingerprint sensor device to verify his fingerprint access (Figure 5.2).

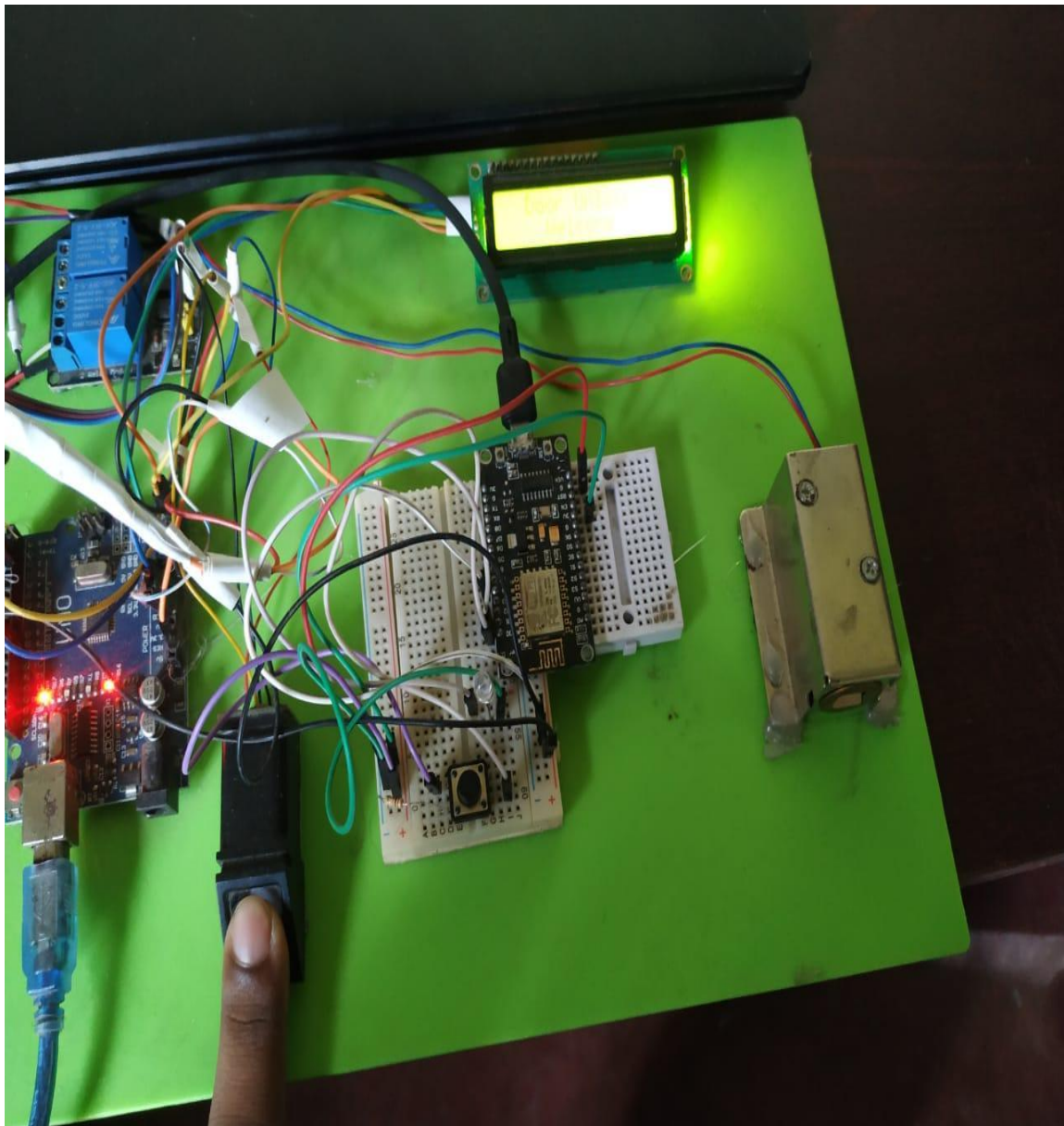


Figure 5.2 Pressing finger to the device

Here we pressing our finger to unlock .

If the fingerprint matches the system, he will know he has access, and immediately the LCD display will read "Door Unlocked, Welcome" and the door will open (Figure 5.3).



Figure 5.3 Door Unlocked (Welcome)

If we put right finger and the fingerprint is accurate then the screen will show this.



Figure 5.4 Not valid finger, press the bell

And if the fingerprint sensor cannot detect the user's fingerprint access then the LCD display will show "Not valid finger, press the bell" (Figure 5.4).

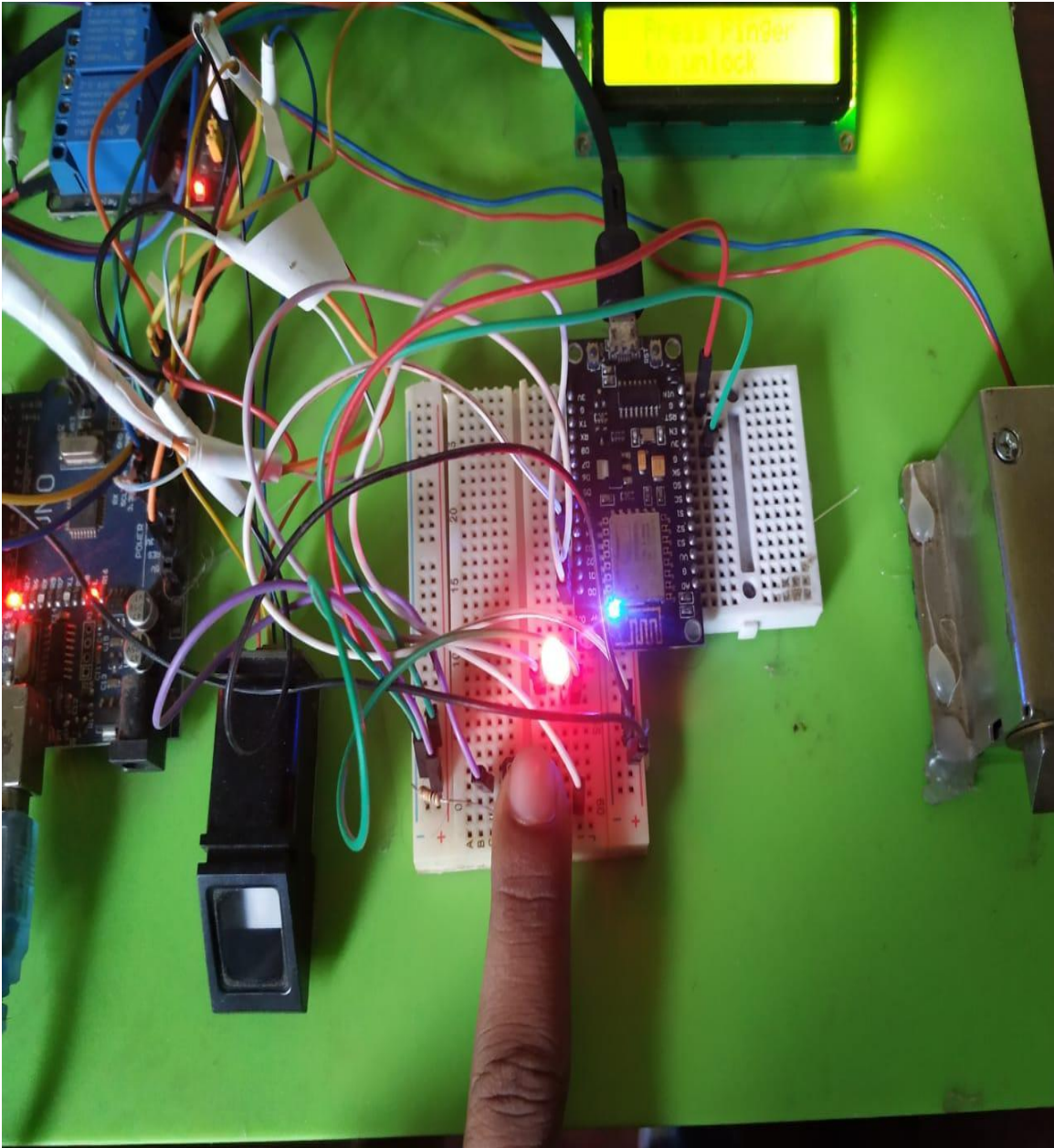


Figure 5.5 Pressing the bell

Then the user will press the bell next to the door (Figure 5.5).

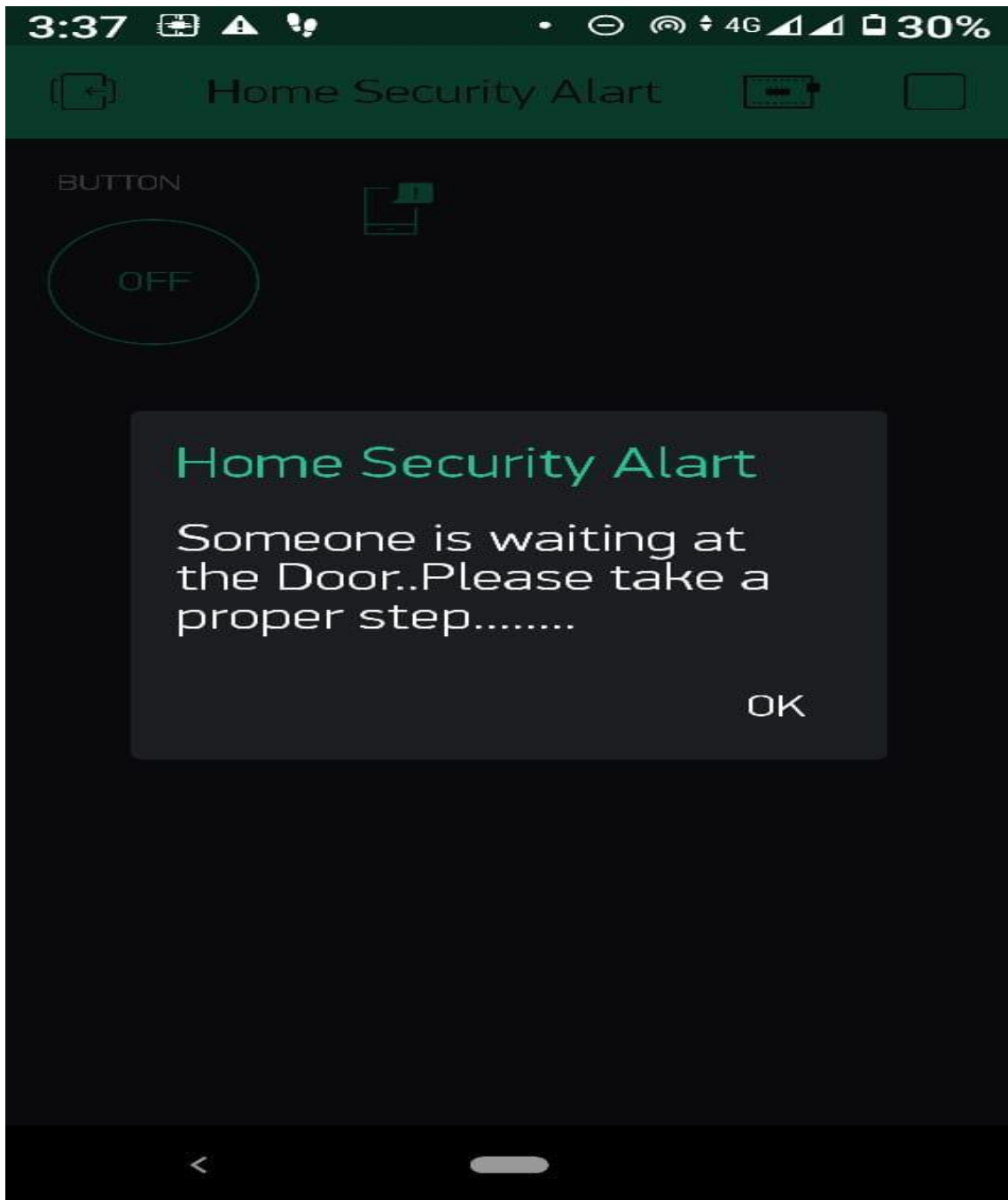


Figure 5.6 Security Alert to the homeowner

As soon as the bell is pressed, the home owner will get a notification via the Blink app saying "Someone is waiting at the door. Please take a proper step" (Figure 5.6).

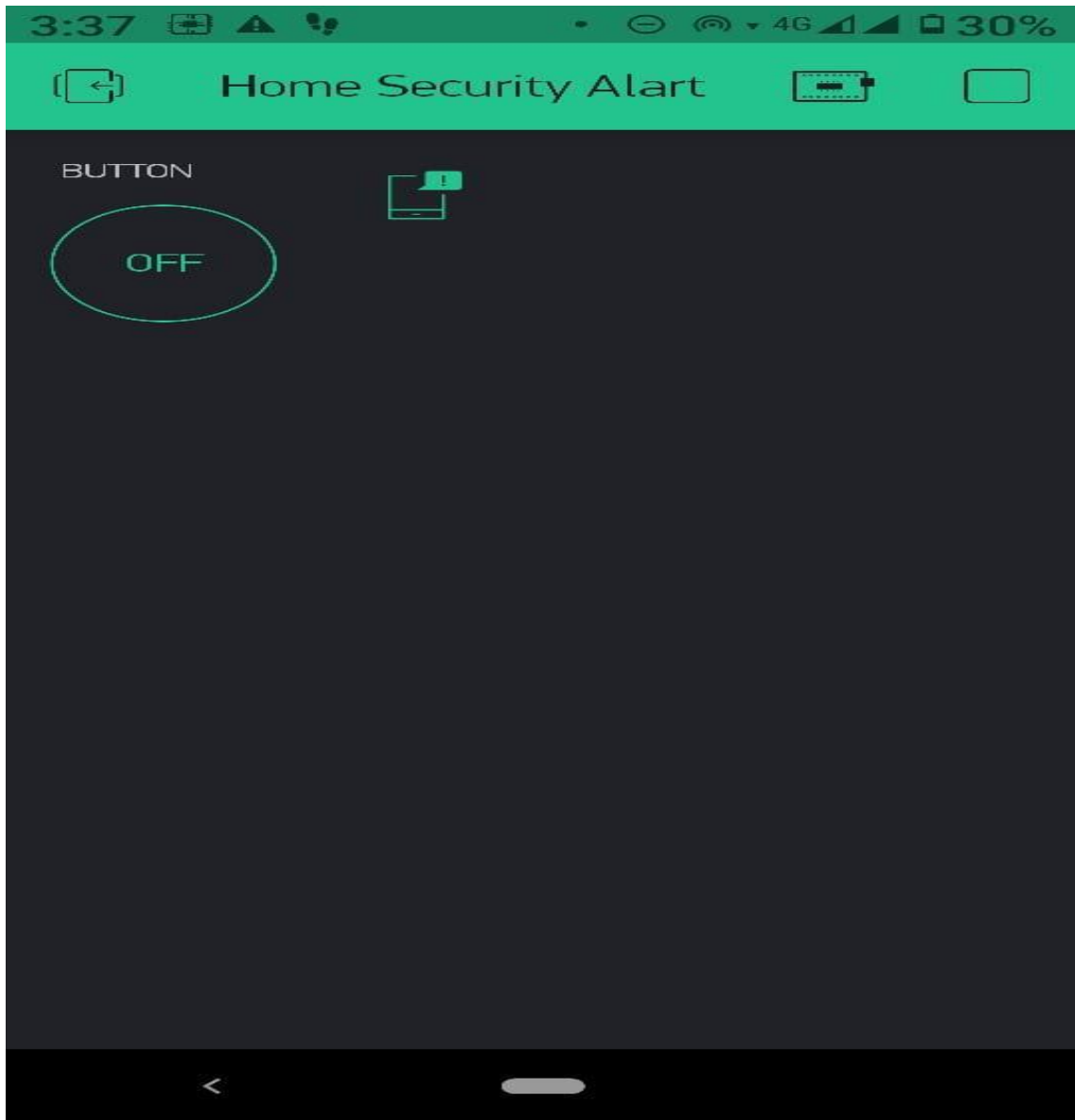


Figure 5.7 App interface for opening the door

Then the homeowner can use the app to open the door of his house if needed (Figure 5.7).

CHAPTER 6

IMPACT ON SOCIETY, ENVIRONMENT AND SUSTAINABILITY

6.1 Impact on Society

As a human being we love to live in a society and also try to always ensure our home security. So, to make sure that we are living with full home security and control system; CC camera and Motion detect can be so effective for us. Because CC camera can point it out whether any outsiders none other than family members come to the home and give signal with an alarm if it happens. So, this face Detection system of CC camera ensure the security of home and impact the Society in a positive way. On the other hand, motion detect system is proved to be also useful as it detects any unusual movement from any outsiders and give alarm and notification. So, in this way, this system is also ensuring a good controlled home Security and also making sure that there is no miss management or criminal works happen in people's home and people of the society can live there with great peace and security.

6.2 Impact on environment

Whatever we do, we are impacted by the environment and environment also get impacted by our work. So here home security system like using CC camera and motion detection system is not only securing our home but also securing our environment as well. These security systems are also very important for business people and business environment. A Secured business environment defines where there will be no corruption or miss-leading works happen or that environment Where Everyone can manage their business in Their own way without having no issues of security. Doing business with a better controlled and Security is a blessing. So, security system like CC camera and motion detection system exactly ensures that our business environment and other surroundings environment will remain secured and healthy for us. So, these home security systems have also a great impact on our environment surely.

6.3 Ethical Aspect

In our daily life whatever we do our ethics Should be in a Standard level. We Should make sure that we are not doing anything unethical or anything unethical work will be strictly protected in the Society. So, therefore if we consider this home security system; like CC camera face Detection and motion movement Detection ensure that no unethical issues or illegal theft doesn't happen with us and also ensure that unethical works are highly protected by these home security systems. So, considering the ethical aspect of the society, CC camera face Detection system and motion detection system serve us in a great way to protect any kinds of unethical works and inspire us to always stay ethical in our life.

CHAPTER 7

CONCLUSION AND FUTURE SCOPE

7.1 Discussion and Conclusion

Our system can be further developed/updated in the future and new features can be added.

That is-

- When the door is on/off can be added to the database.
- The Daily/Weekly/Monthly number of people entering or leaving the house can be determined by using the counter.
- RFID facility can be added for door-lock access.
- Two-way wireless communication

7.2 Scope for Further Developments

We have been able to work with hardware and software simultaneously even though our project is built on the Internet of Things. As a result, we have been offered the option to examine data and information pertaining to both hardware and software and take action as necessary. This project has benefited us in installing hardware components of equipment, learning how to configure them, and developing the coding relevant skills to implement their use in the system. Thank you to the person who gave all of our effort and overall direction. After all, we are hoping that our system will be able to at least somewhat contribute to contemporary home security systems.

7.3 Total Cost

● Fingerprint Sensor	3500 Taka
● 12v Solenoid door lock	800 Taka
● I2C Display Adapter	100 Taka
● LCD Display	350 Taka
● Push Button	20 Taka
● Arduino UNO	1200 Taka
● Node MCU (ESP8266)	900 Taka
● Relay Module (2 Channel)	200 Taka
● ESP32 CAM	1350 Taka
● 12v DC Adapter	200 Taka
● Jumper Wire	20 Taka

Total: 8640 Taka

Reference

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