

FACE DETECTION DOOR LOCK WITH HOME AUTOMATION

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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 “FACE DETECTION DOOR LOCK WITH HOME AUTOMATION”, submitted by MD. ABUL KALAM AZAD, ID No: 143-15-4608 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 (B.Sc.) and approved as to its style and contents. The presentation has been held on 03 May 2019.

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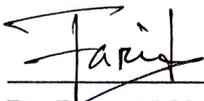
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DECLARATION

I hereby declare that, this project has been done by me under the supervision of **Saiful Islam, Senior Lecturer, Department of CSE** Daffodil International University. I 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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Finally, I must acknowledge with due respect the constant support and patients of my parents.

ABSTRACT

Nowadays we face a big problem to securing our residence, expensive goods by simple lock. Day by day the thief becomes so expert. They can break any simple lock. To secure our own house and expensive goods, I made an IoT base security system that helps us with very effectively called “**FACE DETECTION DOOR LOCK WITH HOME AUTOMATION**”. The lock will be controlled with the help of microcontroller-based system having face detection door unlock, password match unlock, Bluetooth connected door unlock and AC load control by android phone, IR remote controlled door unlock and AC load control. We can unlock our door lock by authorized person face, IR remote and Bluetooth connected android phone. We also can control our home’s AC loads by IR remote & Android phone. Main goal of this project is securing our home from unauthorized person.

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CHAPTER 1

Introduction

1.1 Introduction

In our regular life, we always worry about security of our house & expensive goods. Because it is easy to break any simple lock for thief. Which lock become open by key, this type of lock can't give us proper security. The thief can open this type lock very easily, because this lock access from outside of our room. The thief can try to break our door lock easily. As a result we lost everything.

So I plan to develop a system which become IoT base and give us a solution of this type of problems of door lock. In this project I use face detection door unlock using Raspberry Pi module. At first system detect any face in front of camera. If face matches at least 50% of any training face, then door will be unlocking otherwise door become lock. On the other hand, we can unlock door lock by password, Android phone and IR remote. We also control AC loads by IR remote & android phone. It makes our life easy.

1.2 Motivation

Nowadays home security is most important. Every day we hear many stolen news. We lost our every expensive goods for low security system. Simple door lock can't give us proper security because thief can break this type lock very easily. If we use IoT base door lock system then we can reduce this type of problem. But in Bangladesh smart IoT base home lock solution is not available as well. Which few products we get, those are very expensive. So I plan to build a very cheap IOT base door lock device, which can buy every person.

1.3 Objectives

Day by day our technology becomes more modern, but in Bangladesh we use simple lock for home & our expensive goods security. We face many problems with key, sometimes we lost key, thief broke our lock, as a result we lost our every expensive goods. But we can easily handle this type of problems by using IoT base smart home lock system. Which provide us proper security & save our expensive goods. If maximum peoples can use IoT base products then our country can reach a goal of Digital Bangladesh.

1.4 Expected Outcome

Main target to save our home and expensive goods from unauthorized person. The door lock will be unlocking when an authorized person's face match. Lock also unlock when authorized person input correct password. We can also unlock the door lock from inside our room by press a button of simple IR remote and Bluetooth connected android phone. We can control our home's AC loads such as light, fan by IR remote and android phone.

1.5 Report Layout

This report composes by six chapters and here I discuss about summary of all six chapters.

Chapter 1: Chapter one have introduction, motivation to develop this project and expected outcome of this project.

Chapter 2: In this chapter I discuss about related research work and challenges.

Chapter 3: Here I provide business process model with requirement collection and analysis. Also provide use case diagram of whole project. Logical data model is also available here.

Chapter 4: Here I provide front and back end design, interaction design and discuss about implementation requirements.

Chapter 5: Discuss about implementation related topic.

Chapter 6: Discuss about conclusion and future works.

CHAPTER 2

Background

2.1 Introduction

Nowadays technology becomes update very fast. Day by day technology covers every parts of our life. But maximum people use old lock system for their home and other expensive goods security. On the other hand, day by day thief become more updates. They use different mechanism to unlock door lock.

At present we live in modern civilization where every researcher connected with different part to the internet. In that situation Internet is the power of things to create more helpful device for human.

In this scenario security problem issue is too much important. Any special case inter-related with high priority of security. This concept is initial stage of commercial deployment still now with low budget, but many industry and person successfully done with high budget.

2.2 Related Works

This is not a new idea. At present have many existing implementations like this system for home security. However, this is a new plan for designing a complete door lock solution with proper secure strengthens in low budget.

Tutorial [1], Face recognition based door lock using Raspberry Pi B+ module and OpenCV. Here use Servo motor instead of electric door lock, Raspberry pi and OpenCV.

The article [2], FACE RECOGNITION Door Lock. Proposed a model for face detection door lock with OpenCV and Raspberry pi. The main purpose of the project is to improve

security systems in homes, offices etc. The idea is to unlock a door by recognizing the face of an authorized person.

The article [3], HOW TO SET UP AN IR REMOTE AND RECEIVER ON AN ARDUINO. Infrared (IR) communication is a widely used and easy to implement wireless technology that has many useful applications. The most prominent examples in day to day life are TV/video remote controls and infrared thermometers

The article [4], IR Communication proposed on the architecture and design of to use wireless communication technology. IR light is very similar to visible light, except that it has a slightly longer wavelength. This means IR is undetectable to the human eye - perfect for wireless communication. For example, when you hit a button on your TV remote, an IR LED repeatedly turns on and off, 38,000 times a second, to transmit information (like volume or channel control) to an IR photo sensor on your TV.

The article [5], Bluetooth Controlled Servo proposed a model how to control a servo motor with a Smartphone via Bluetooth. For this project use a Bluetooth HC-05 module with an Arduino Uno to control a servo 9g.

2.3 Comparative Studies

In my study, I am intended to find a feasible solution of home door lock system. In all paper and article motivated different type of door lock systems with different way. But I see the all procedure and learn micro-controller device and inter-related all connectivity process which is used all prestigious papers and articles.

Information is very powerful gathering for knowledge. In whole study, I decide to make a door lock system with appropriate way and I care about lowest cost effectively. I use very low cost electric parts such as TV remote, IR sensor and receiver etc.

2.4 Scope of the problem

This project focus on finding a way to develop a complete door lock solution to reduce regular problem with simple door lock as well as better performance than others.

Real time face Detection

In this door lock system, user can unlock his door lock using real time face detection. Camera always detects any human face if available. It reduces user hassle to carry any key. User can unlock the door by his face.

2.5 Challenges

Power Supply

As we using raspberry-pi computing device, Arduino Uno, IR receiver, Bluetooth module, relay switch in system that's all are connected with power supply. Minimum efficient power supply 10 watt needed otherwise we are not able to unlock door lock. As my thinking on all procedure completed with low budget that's why I noticed entire whole power supply above all 10 watts.

Low light for face detection

Light is very essential for face detection, as we use a USB camera which is 5megapixels that's why sufficient light is important while detect any face. We use a condition to unlock the door lock which is if detect face match at least 50% with authorized person's face only then open the door lock.

CHAPTER 3

Requirement Specification

3.1 Business Process Modeling

To making this system, we need a processing system. Which task will be done after which task. In this business process model, we show that how the system works. This model shows the whole criteria of our system. The business process model represents the system core process.

In the Fig 3.1 shows the system business process model,

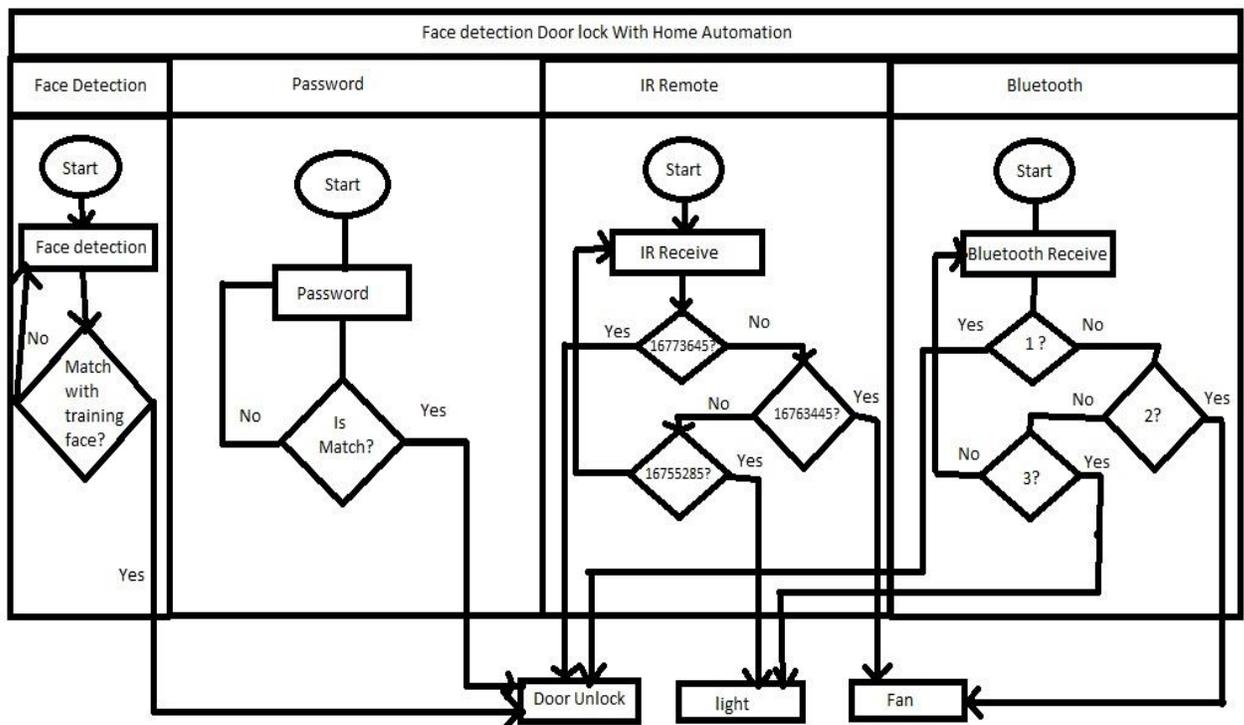


Fig 3.1: System Business process model

3.2 Requirement Collection and Analysis

Requirement assortment & analysis is consisting of some approaches taken to figure out specific choices, demands, expectation by human activity with the system users. It desires a mix of hardware, software package and human factors expertise.

One of the most major requirements is a micro-computer that's been using for the task of image processing. The next device is a USB Camera that's got built in libraries for the micro-computer to be operated. The reason of using a computer rather than a traditional micro-controller device is, the amount of processing to capture frames and storage of the camera is quite a difficult and lengthy task to do. Never the less, the video feed detects faces resultant of image processing.

The USB camera usage of the system along with other processes makes it difficult to process this big amount of data from storage to the processor. That's the main reason that enabled us to use a high gain microcomputer instead.

The other physical sensors can be implemented through the general I/O pins of the computer itself.

3.3 Use Case Modeling and Description

The following figure 3.2 shows use case diagram for the face detection door lock with home automations. User can unlock his door lock with his face, by IR remote, password and Bluetooth connected mobile phone. At first need to train the raspberry pi with user faces. Then if detect any face that match greater than 50% then door will open.

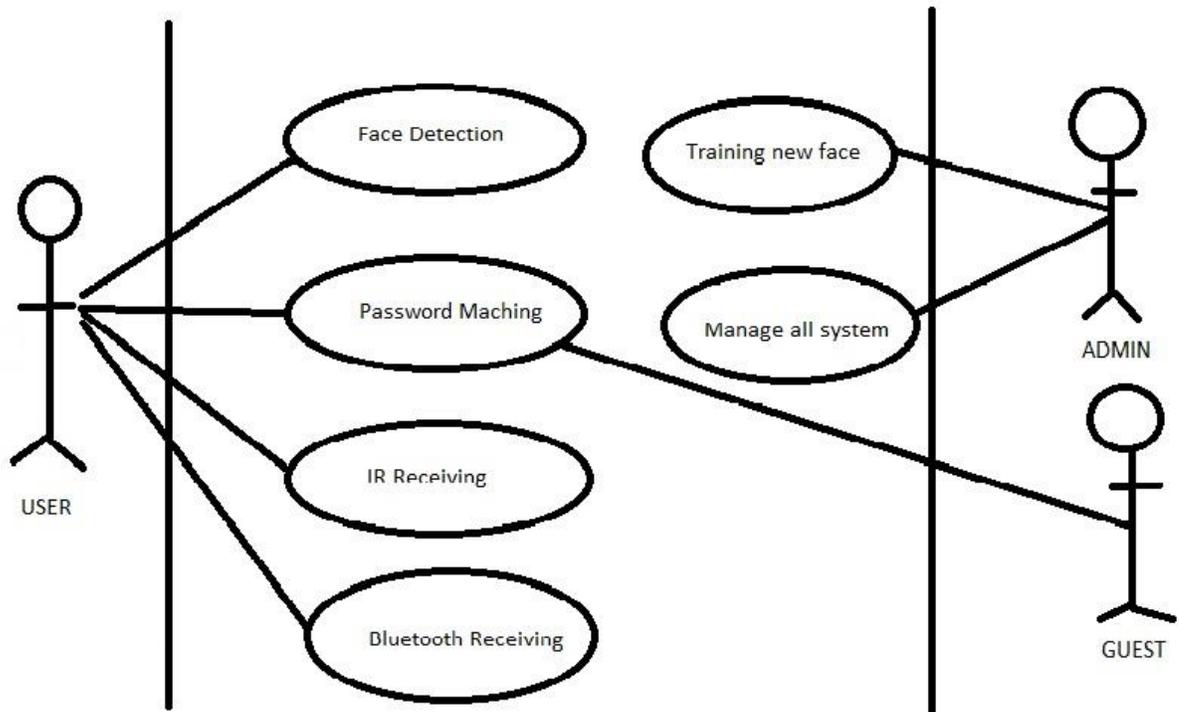


Fig 3.2: Use case diagram of the system

Face Detection

Table 3.1 shows use case description for face detection outside the door using USB camera. If face match with train data, then door will open.

TABLE 3.1: USE CASE DESCRIPTION- FACE DETECTION

Use Case Name	Face detection outside the door.
Pre-Condition	System Should be in Active state.
Basic Path	Raspberry pi gets reading from USB camera & compare it with training faces.
Post Condition	Lock is open.
Exception Path	Face can detect less than 50%

Password Matching

Table 3.2 shows use case description for password matching. If entered password becomes a match with predefined password, then the door lock will be open.

TABLE 3.2: USE CASE DESCRIPTION-PASSWORD MATCHING

Use Case Name	Password Matching
Pre-Condition	Arduino must be connected with Key pad device.
Basic Path	Arduino get password from key pad.
Post Condition	Lock is open.
Exception Path	Fails to capture password.

IR Receiving

Table 3.3 shows use case description for IR Receiving inside the room using IR sensor with pre-condition and post-condition. This also provides basic path and exception path.

TABLE 3.3: USE CASE DESCRIPTION- IR RECEIVING

Use Case Name	IR Receiving
Pre-Condition	Arduino must be connected with IR receiver.
Basic Path	Arduino gets data from IR sensor and compare.
Post Condition	Lock is open.
Exception Path	Unable to receive IR data.

Bluetooth Receiving

Table 3.4 shows use case description for Bluetooth Receiving with pre-condition, post condition and exception path. This case will be unlocking the door when exact code is match.

TABLE 3.4: USE CASE DESCRIPTION-BLUETOOTH RECEIVING

Use Case Name	Bluetooth Receiving
Pre-Condition	Arduino must be connected with Bluetooth module
Basic Path	Arduino processes Bluetooth data and match with defined data.
Post Condition	Lock is open.
Exception Path	Fails to receive Bluetooth signal.

Training new face

Table 3.5 display use case description for Training new face with post condition, pre-condition and exception path.

TABLE 3.5: USE CASE DESCRIPTION-TRAINING NEW FACE.

Use Case Name	Training new face
Pre-Condition	Raspberry pi must be connected with USB camera.
Basic Path	Raspberry pi is capturing new face and update training data.
Post Condition	Successfully trained new face.
Exception Path	Fails to capture new face.

3.4 Logical Data Model

In fig-3.3, flowchart shown face detection part. If detect face match with training face the door lock will be open and repeat the program again.

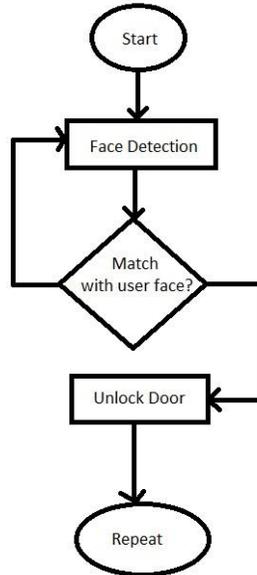


Fig 3.3: Flow chart diagram for face detection

In fig-3.4, flowchart shown password detection part. If input password match with data, then the door lock will be open and repeat the program again.

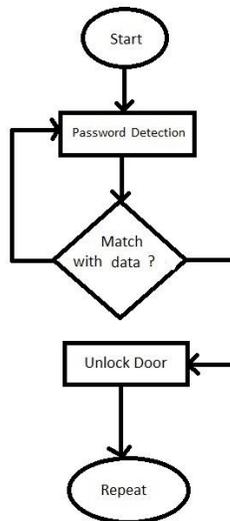


Fig 3.4: Flow chart diagram for Password detection.

In fig-3.5, flowchart shown IR detection part. If input IR data match with stored data, then the door lock will be open and repeat the program again.

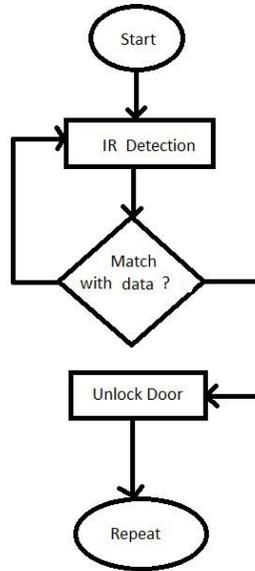


Fig 3.5: Flow chart diagram for IR detection.

In fig-3.6, flowchart shown Bluetooth detection part. If input Bluetooth data match with stored data, then the door lock will be open and repeat the program again.

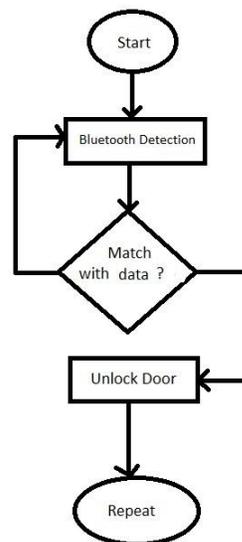


Fig 3.6: Flow chart diagram for Bluetooth detection.

3.5 Design Requirements

- ✓ Raspberry pi 3 model B+
- ✓ USB camera
- ✓ Arduino Uno
- ✓ Bluetooth module (HC-05)
- ✓ 12V Solenoid door lock
- ✓ IR Receiver
- ✓ TV Remote
- ✓ 12V Adapter
- ✓ 4*4 Membrane Keypad
- ✓ Jumper wire
- ✓ AC light
- ✓ 12V Fan
- ✓ 1,2 & 4 channel relay

Raspberry pi 3 model B+

Raspberry Pi 3 Model B+ has a 64-bit 1.2 GHz quad core processor, USB boot capabilities, on-board Bluetooth & Wi-Fi. It also has Power over Ethernet (PoE), USB & network boot. PoE allows the use of the Pi in hard-to-reach places (possibly without electricity).

A ceramic chip antenna is used by Wi-Fi and Bluetooth 4.1. The chip antenna moves the indicator LEDs that were present in Pi 2 to the lower side of PCB. The ACT and PWR LEDs are repositioned as shown below in Raspberry Pi 3 when compared to Pi 2.

In figure 3.7, Raspberry pi 3 model B+ is shown.

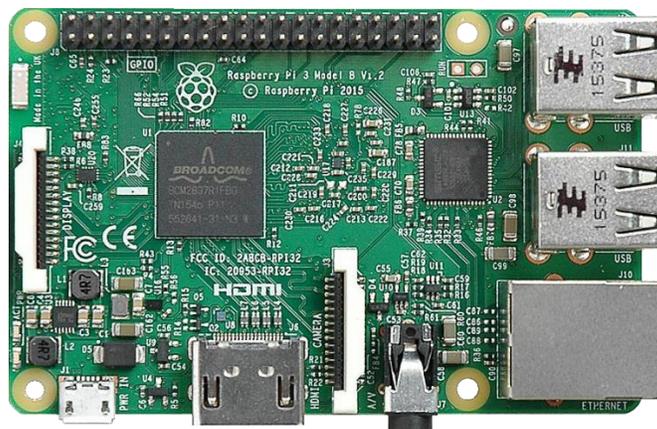


Fig 3.7: Raspberry Pi Model B+

USB Camera

USB web camera. It has Image Sensor, high resolution CMOS VGA Sensor, Automatic white balance, Automatic color compensated, Interface USB 2.0, Dynamic range is larger than 72db, Focus range is 3cm to infinity, transmission rate is 640*480 30 FS, Signal noise ratio is larger than 48db, Video format is YUY2

In figure 3.8, USB web camera is shown.



Fig 3.8: USB Web Camera

Arduino Uno

The Arduino UNO is one kinds of electronic board to induce started with electronics & coding. Arduino Uno is a microcontroller based mostly board. It's six analog inputs, fourteen digital input/output, a sixteen MHz quartz crystal, associate degree ICSP header and a push a USB association, an influence jack. It contains everything required to support the microcontroller. Generally connect it to a pc with a USB cable or power it with a AC to DC adapter or battery to induce started.

In figure 3.9, Arduino Uno is shown.



Fig 3.9: Arduino Uno

Bluetooth module (HC-05)

The HC-05 module is one kind of Bluetooth SPP (Serial Port Protocol) module, which implies it communicates with the Arduino via the Serial Communication. The particular module that I even have is power-driven from three to six volts, as a result of it comes on jailbreak board that contains a transformer. However, the logic voltage level of the information pins is three volt. So, the path between the Arduino (Transmit Pin that has 5V output) and also the Bluetooth module RX (Receive Pin that supports solely three.3V) must be connected through a potential divider so reduce the possibility of burn the module. On the opposite hand, the path between the Bluetooth module Tx pin and also the Arduino RX pin is connected directly so Bluetooth module get three volt form Arduino.

In fig-3.10, HC-05 Bluetooth module is shown



Fig 3.10: HC-05 Bluetooth module

12V Solenoid door lock

12V Solenoid door lock. It makes by Metal, its Color: Silver, Voltage: DC 12V. It is an electromagnetic lock. This Magnetic lock is one kinds of locking device that consists of an electromagnet and an armature plate. When the magnet is energized, a current passing through the magnet creates a magnetic flux that causes the coil plate to draw in to the magnet, creating a locking action. Because a power become generates between the space of the magnet and coil is comparatively giant, the force created by the magnetic flux is robust enough to stay the door latched even beneath stress.

In fig-3.11, 12V Solenoid door lock is shown



Fig 3.11: 12V Solenoid door lock

IR Receiver

Its full form is Infra-Red Receiver. IR receiver is an electronic part that sends information from an infrared remote control to another device by receiving and decoding signals. The receiver outputs a code to unambiguously determine the infrared signal that it receives. This code is then employed in order to convert signals from the device into a format that may be understood by the opposite device. It is a part of a tool that receives infrared commands from a foreign management.

Infrared is light-weight, it needs line-of-sight visibility for the most effective potential operation, but can however still be reflected by items such as glass and walls. Poorly placed IR receivers may result in what's known as "tunnel vision", wherever the operational vary of a foreign management is reduced as a result of their set to date back into the chassis of a device.

In fig-3.12, IR Receiver is shown



Fig 3.12: IR Receiver

TV Remote

The first factor regarding remote managements is we use it to remotely control (with no wires attached) some devices like TV. They communicate one another (remote and TV) by causation magnetic force signals. It can be anything like Microwaves, Radio Waves, Infrared, Ultra Violet, Visible Light, X- Rays or Gamma rays can be used. But most of the remote control uses Infra-Red Rays. When we press a button in a very device, it will complete the circuit beneath it and sends a coded binary sequence along the device address sandwiched between start and stop bits.

Each button press can transmit a special burst of signals. These burst of signals are going to be transmitted at in no time rate so it won't be detected.

In fig-3.13,TV Remote is shown



Fig 3.13: TV Remote

4*4 Key Membrane Keypad

Keypad is used in all types of devices, including door locks, cell phones, fax machines etc. Many kinds of electronics device use keypad for take user input. So it is very valuable to know that how a keypad works with Arduino or any microcontroller. If we can know how it works then we can build many different types of commercial products. When keypad is connected properly and programmed, then when a key is pressed, it shows up at the Serial Monitor of our computer. When we press a key, it shows up on the Serial Monitor.

For this project, I use a matrix keypad. This is a keypad which has much less output pins than there are keys and follows an encoding scheme. For example, the matrix keypad I am using has 16 keys (0-9, A-D, *, #), it has only 8 output pins. When database password will match with key press password then door lock will be unlock. Again when press # or * button then the door will be lock.

In fig-3.14, 4*4 Membrane Keypad is shown



Fig 3.14: 4*4 Membrane Keypad

Platform used for System

Platform: Raspberry Pi and Arduino Uno

Language: Python and C

Tools: Python IDLE, Arduino IDLE

Raspberry Pi

In my project, I have used Raspberry pi to program face detection part of this system.

Raspberry pi is also an open-source platform and used to develop electronics projects. Raspberry pi consists of programmable circuit board. Raspberry support different kind of OS. The Raspberry has become very popular among hobbyist and developers.

Here are some reasons of using Raspberry pi:

- It is also open-source and extensible software.
- It has a large community all over the world.

Arduino Uno

In this project I used Arduino Uno for password, Bluetooth and IR remote part. Arduino Uno is also an open-source platform used to develop electronics projects. Arduino consists of programmable circuit board.

Here are some reasons of using Arduino Uno:

- It is also open-source platform.
- It has a large community all over the world.

CHAPTER 4

Design Specification

4.1 Front end Design

In the front end design, I show circuit diagram of the system. How the Door lock and home automation system architect, its show in the front-end diagram. The USB Camera is connected with USB of the raspberry PI. Door lock is connected with raspberry pi and Arduino with different relay switch.

In the Fig 4.1 show the front-end design of face detection part.

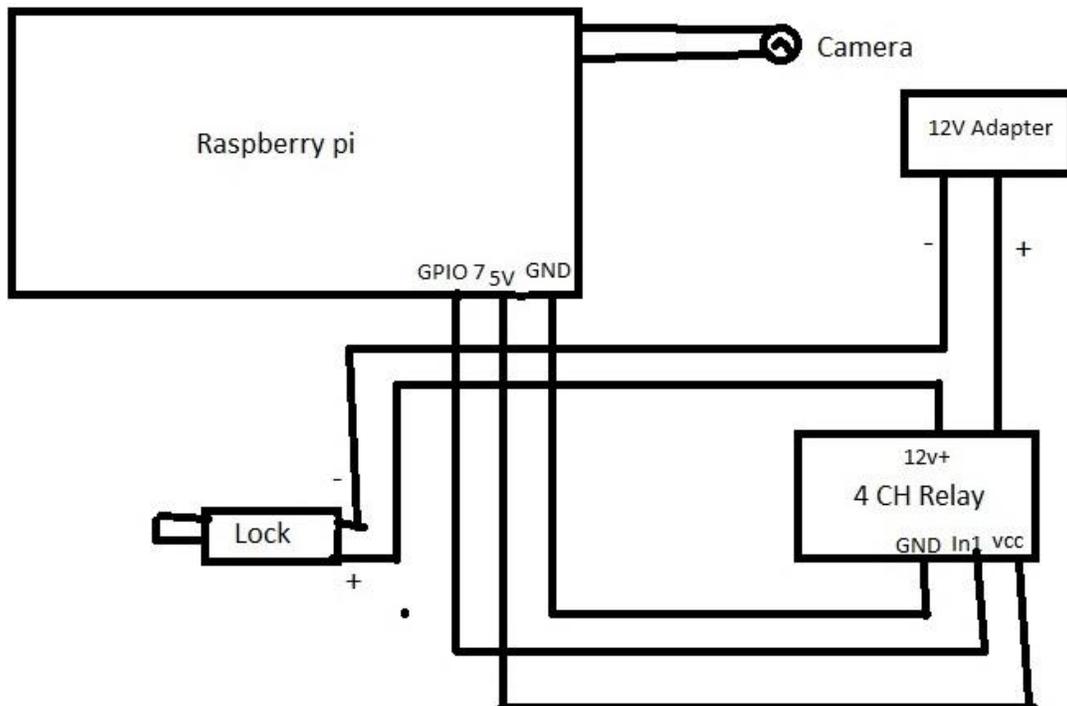


Fig 4.1: Front-end design of the Raspberry pi and camera.

In the Fig 4.2 show the front-end design of Arduino connected devices part.

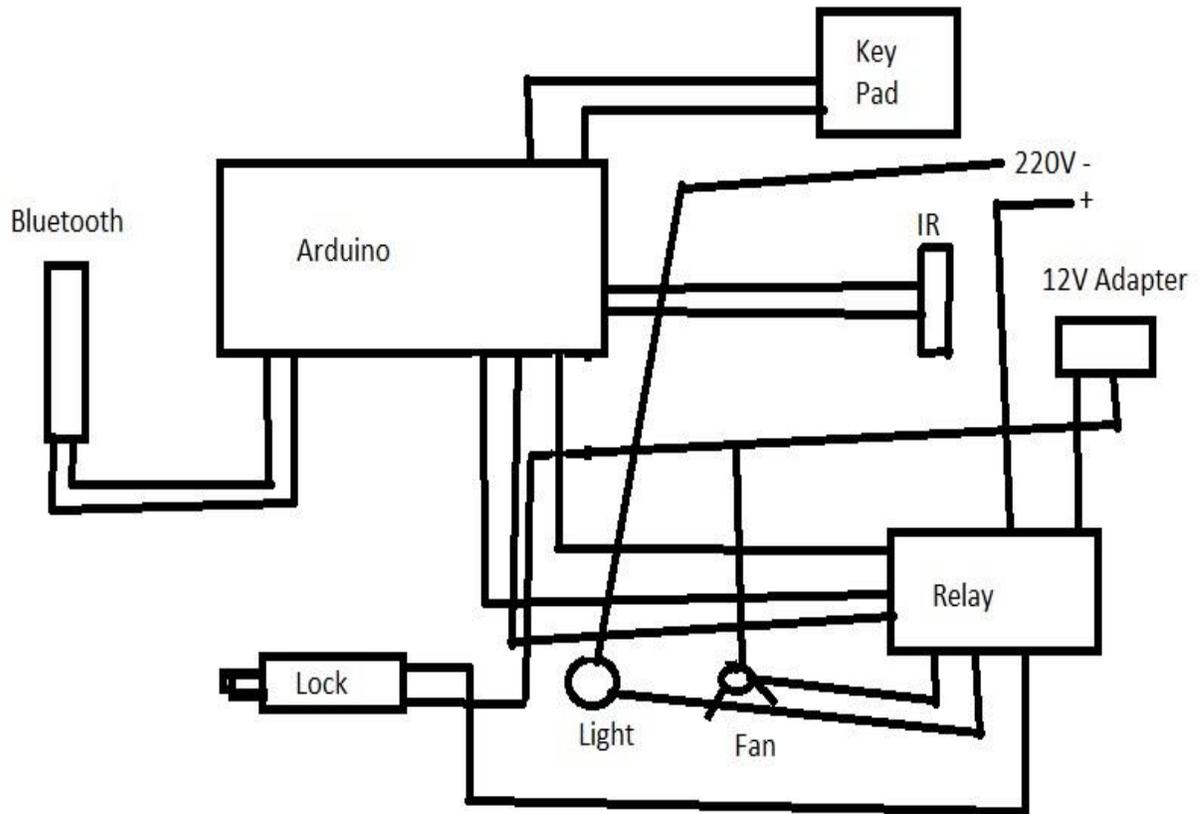


Fig 4.2: Front-end design of Arduino connected devices.

4.2 Back-end Design

In this proposed system user can control his home light, fan with door lock. The system is design as a combine system. Here I show back-end design for the whole system.

In fig-4.3, Back-end design of the system,

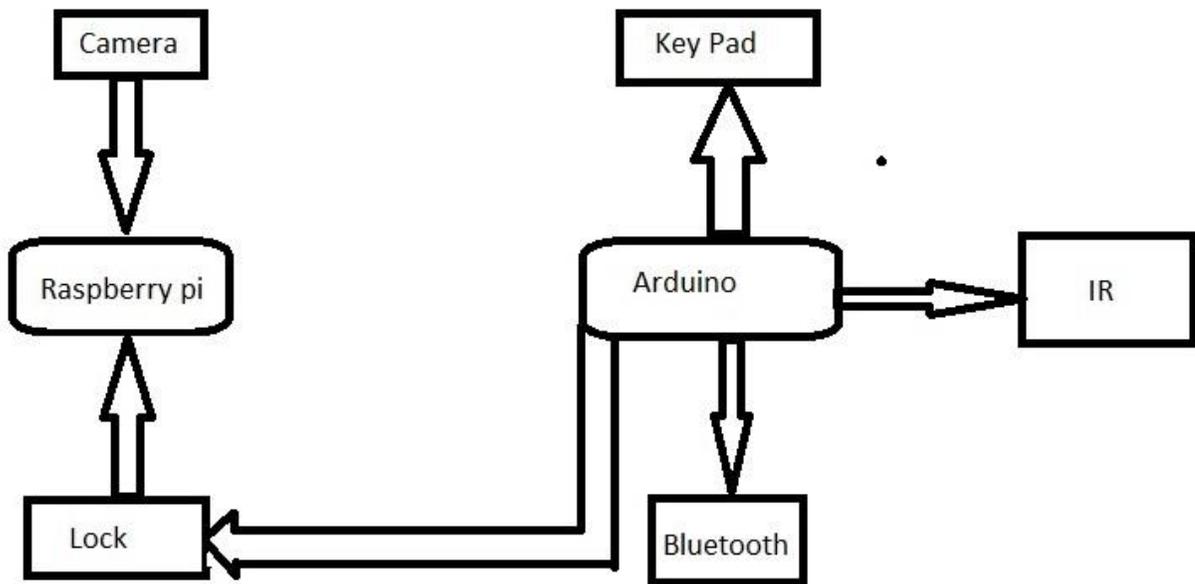


Fig 4.3: Back-end design of the face detection door lock with home automation System

4.3 Interaction Design

In the interaction system shows the functionality of the system. How the system physically and programmatically works. It is directly connected with the user. It shows the workability between user and hardware.

In the Fig 4.4, show interaction design

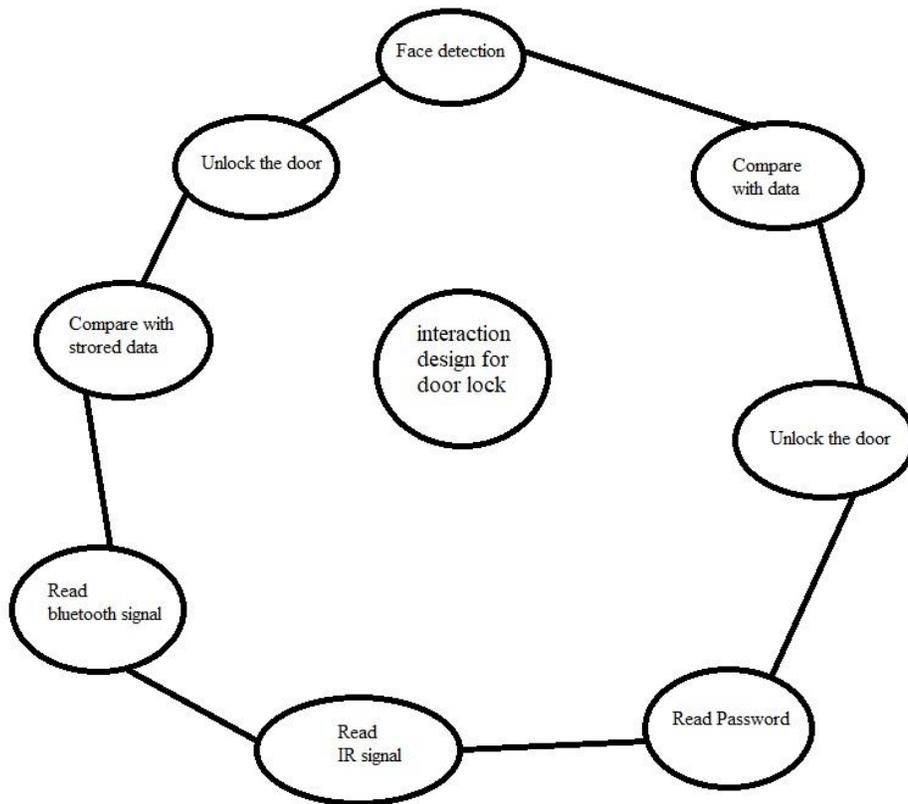


Fig 4.4: Interaction design of the system

4.4 Implementation Requirements

The full implementation process has to go through some needed credentials. It is required to use specific programming environments along with necessary libraries. The most fundamental requirements are as follows,

- Python Coding Environment
- Arduino Coding Environment

CHAPTER 5

Implementation and Testing

5.1 Implementation of Database

My Project is based on End-To-End serial communication system. I need not to implement any database. It uses a specific folder to store training faces and training file. It's an end-to-end process. When I capture new training face for new user the camera capture faces and store all to dataset folder for future use.

In the Fig 5.1, show database folder

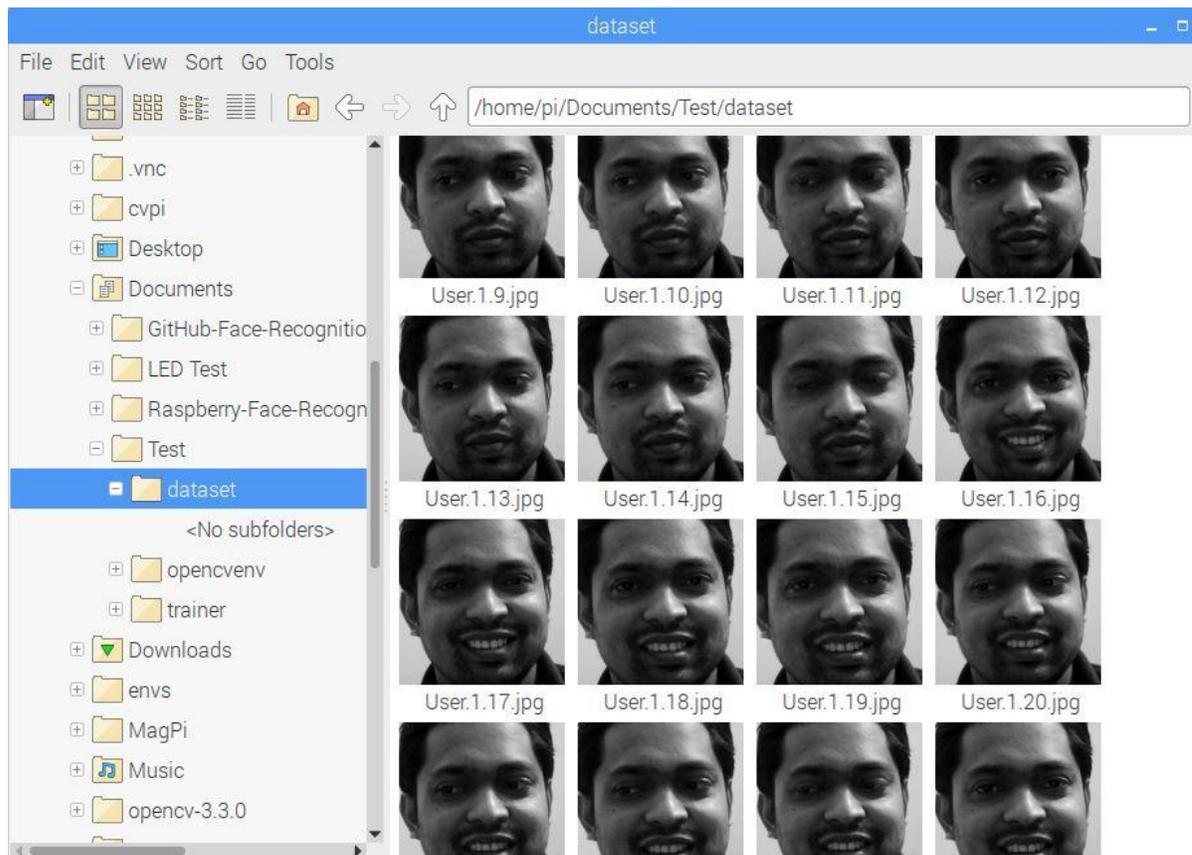


Fig 5.1: database folder of the system

5.2 Implementation of Front End Design

Front end design has been implemented with following environments.

- Python Implementation with Python version 3.5
- C Implementation with Arduino version 1.8.8
- Physical devices are connected with default connectors
- HDMI ports have been used for pasting code on Raspberry Pi
- USB port have been used for pasting code on Arduino

5.3 Implementation of interactions

In this area, I discuss my practical approach which has been taken to solve the problem. This proposed system delivers all expected result. Any kinds of face can detect by Raspberry pi and when match any face with trained face then door lock become unlock. The raspberry pi detects face continuously and whenever it gets any unauthorized person face then system lock the door.

When match key press with password then the door lock become unlock. Remote and Bluetooth function also work properly.

5.4 Testing Implementation

Integration test

Integration testing is a part of testing where individual modules are tested as a group and combined. It starts after the unit testing phase. The purpose of integrated testing is to expose faults in the interaction between integrated units.

System test

System testing of package or hardware is conducted in integrated & complete system to judge its compliance with it's the required needs.

System testing takes all integrated modules which also have passed integrated testing as its input. System testing aims to detect any kinds of in-consistence between the units integrated together.

5.5 Test Results and Reports

Table 5.1 shows integration test result, test case, expected results & observed results for individual module of the system.

TABLE 5.1: INTEGRATION TEST

Test Case	Expected Result	Observed Result	Test result
Raspberry pi must be able to detect face correctly.	Can detect face accurately.	Can detect face accurately.	Pass
IR receiver should be able to receive data from remote correctly and can on/off room light & fan.	Can detect data and can on/off room light & fan accurately.	Can detect data and can on/off room light & fan accurately.	Pass
USB camera should be able to capture the image.	Can capture image accurately.	Can capture image accurately.	Pass
Raspberry pi must be able to unlock door when detect user face	Can detect face and unlock the door accurately.	Can detect face and unlock the door accurately.	Pass
Arduino must be able to unlock the door when receive Bluetooth signal	Can open door by Bluetooth signal	Can open door by Bluetooth signal	Pass
Arduino must be able to on/off room light and fan when receive Bluetooth signal	Can on/off room light & fan accurately by Bluetooth signal.	Can on/off room light & fan accurately by Bluetooth signal.	Pass

Table 5.2 shows system test case & result, expected and observed results for individual module of the system.

TABLE 5.2: SYSTEM TESTING

Test Case	Expected Result	Observed Result	Test result
User should be unlock the door by face	Can unlock the door	Can unlock the door	Pass
User should be unlocking the door by IR remote.	Can unlock the door	Can unlock the door	Pass
User should be unlock the door by Password.	Can unlock the door	Can unlock the door	Pass
User should be unlocking the door by Mobile phone.	Can unlock the door	Can unlock the door	Pass
User should input new user face in Raspberry pi	Can Add new face	User can't add new face	Fail
User should be on/off room light & fan by Bluetooth connected phone and TV Remote.	Can on/off light & fan	Can on/off light & fan	Pass

CHAPTER 6

Future Scope & Conclusion

6.1 Scope for further development

I schematized a model, and its check results show glorious inhome property. The system offers inexpensive, low power consumption, period of time face recognition and detection, high flexibility, high accuracy with a decent anti-interference. Modularity is employed in response to the necessity for flexibility in fashionable systems style.

In this case, the user can add extra sensors whereas not having to modify the complete system. this method will be enforced in several applications requiring inexpensive.

6.2 Conclusion

In this study, I proposed and implemented using Raspberry-Pi and Arduino based Face detection door lock with home automation system. This system will ensure to proper door lock solution and home automation with lowest budget. It will provide best security to appropriate budget. It makes our life easier and comfortable. We can enter a IoT base environment. Our home and expensive goods become save from unauthorized person. After all, we may hope for a better do on this project.

REFERENCES

- [1] Learn about Website, available at <<<http://www.arnabkumardas.com/diy-project/face-recognition-door-lock-opencv/>>> last accessed on 03-29-2019 at 12:10 am.
- [2] Learn about Website, available at <<<https://electronicsclubiitg.wordpress.com/2017/06/17/face-recognition-door-lock/>>> last accessed on 02-20-2019 at 10:15 am.
- [3] Learn about Website, available at <<<http://www.circuitbasics.com/arduino-ir-remote-receiver-tutorial/>>> last accessed on 03-29-2019 at 12:10 am.
- [4] Learn about Website, available at <<<https://learn.sparkfun.com/tutorials/ir-communication/all>>> last accessed on 03-29-2019 at 12:10 am.
- [5] Learn about Website, available at <<https://create.arduino.cc/projecthub/JANAK13/bluetooth-controlled-servo-439997?ref=tag&ref_id=bluetooth&offset=18>> last accessed on 03-29-2019 at 12:10 am.
- [6] Learn about Website, available at <<<https://create.arduino.cc/projecthub/techmirtz/using-4x4-keypad-with-arduino-2d22e9>>> last accessed on 01-18-2019 at 09:20 am.
- [7] Learn about Wikipedia, available at <<<http://www.wikipedia.org/>>> last accessed on 03-25-2019 at 03:00pm.

APPENDIX

Project Reflection

From Fall-2018 semester I had begun my journey to create a system, where we can unlock any place lock by our face, Bluetooth connected mobile and TV remote. I adopted a model to apply and monitor our bodies, using the all effort and spending considerable time. Finally, I could achieve my goal. Therefore, I think that my “Face Detection Door Lock with Home Automation System” will be considered a positive and efficient factor for the users. I continuously update my system as soon as possible.

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