

**INTELLIGENT ENTRY AND NOTIFICATION SYSTEM FOR ACADEMIC
OFFICE**

BY

Lai Shao Jun

A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF INFORMATION TECHNOLOGY (HONS) COMPUTER

ENGINEERING

Faculty of Information and Communication Technology
(Perak Campus)

JAN 2018

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ABSTRACT

In 21st centuries, internet has become one of the most common things in our daily life. As Internet of Things, known as IoT comes into our life, the introduction of smart city has starting to be taken. IoT can be defined as a global infrastructure which combines intelligent services with situational awareness, and allows mutual communication between one thing and another, and between people and intelligent things over a network (Ilkyu Ha, 2015). Smart cities lead to Smart Offices. Smart Cities lead to Smart Offices. To build intelligent environment it is important to design and make effective use of physical components such as sensors, controllers and smart devices. By using the information collected by these sensors, the software can reason about the environment and trigger actions in order to change the state of the environment. Such sensors networks need to be self-organized in order to create a ubiquitous/pervasive computing platform. In this way, to design and build a Smart Office, it becomes fundamental a selection of middleware that decreases the development and usability effort of software solutions that bring together all the data collected by the sensors, and then reasons about the environment and acts on it (Ramos, 2011). This project aims to create an Intelligent Entry and Notification System for Academic Office using the hardware Arduino, Raspberry PI and Android app Telegram. The main objective of this project is by entering the password on the 4x4 matrix keypad installed in front of the door, only the door will open. The LCD screen will update the status entered by the user using the Android app Telegram through internet. The door can also be open by typing the command in the Telegram. The sensors in the room will update the current status of temperature and humidity to the user. The door can be opened by pressing the IR Remote. The keypad can be enabled and disable by the IR Remote. This system uses both hardware and software. The door status is updated with the presence of the hall effect sensor. The temperature and humidity of the room will be recorded in a database time by time. A webpage is created to display not only the current temperature, humidity and door status, whether it is close or open, also the history of both temperature and humidity and also the commands that has been typed. Graphs of the temperature and humidity of the room from the start of time to current time is plotted according to the data that has been collected. The status of the room will be shown according to the temperature and humidity.

TABLE OF CONTENTS

Front Cover	i
Report Status Declaration Form	ii
Title Page	iii
Declaration of Originality	iv
Acknowledgements	v
Abstract	vi
Table of Contents	vii-ix
List of Figures	x-xii
List of Tables	xiii
List of Abbreviations	xiv
Chapter 1: Introduction	1-9
1-1 Problem Statement.....	1
1-2 Background information	2-3
1-3 Motivation.....	3
1-4 Project Scope	4-5
1-5 Project Objectives	6
1-6 System Flowchart	7
1-5 Impact, significance and contribution.....	8
1-5 Achievement	9
1-5 Report Organization.....	9
Chapter 2: Literature Review	10-17
2-1 Literature Review	10-14
2-2 Fact Finding	15-16
2-3 Critical Remarks	17
Chapter 3: System Design	18-41

3-1 Description of Project	18
3-2 Top-Down System Design.....	19-25
3-2-1 System Design Diagram	19
3-2-2 System Flowchart.....	20
3-2-3 Block Diagram	21
3-2-4 Breadboard Diagram.....	22
3-2-5 Schematic Diagram.....	23
3-2-6 Explanation of System	24
3-2-7 Codes Name and Explanation.....	24
3-3 Setup Procedures.....	25-29
3-3-1 Arduino	25-26
3-3-2 Raspberry Pi.....	26-27
3-3-3 Telegram	27-28
3-3-4 VNC	28-29
3-4 Commands	29
3-5 Webpage	30-32
3-6 Graph	32-35
3-7 Webpage	36
3-8 Coding.....	37-40
3-9 Implementation Issues and Challenges	41
3-10 Upgrades and Improvements from FYP 1 to FYP 2.....	41
Chapter 4: Methodology and Tools	42-44
4-1 Design Specification.....	42
4-2 Methodology.....	42
4-3 Tools	43-44
Chapter 5: Implementation and Testing	45-53

5-1 Implementation	45-47
5-2 Testing	48-52
5-3 Improvements	53
5-4 Limitations	53
Chapter 6: Conclusion	54-55
Bibliography	56
Plagiarism Check Result.....	57-58
FYP 2 Checklist	59

LIST OF FIGURES

Figure Number	Title	Page
Figure 1.1	System Flowchart	7
Figure 2.1	Block diagram of Door locking System	11
Figure 2.2	Proposed System Architecture for E- Notice Board	14
Figure 3.1	System Design Diagram	19
Figure 3.2	System Flowchart	20
Figure 3.3	Block Diagram	21
Figure 3.4	Breadboard Diagram	22
Figure 3.5	Schematic Diagram	23
Figure 3.6	Keypad Schematic	25
Figure 3.7	IR Remote	26
Figure 3.8	Screenshot of Raspberry Pi	27
Figure 3.9	Screenshot of Telegram	28
Figure 3.10	Screenshot of enabling VNC	29
Figure 3.11	Webpage main page	30
Figure 3.12	Webpage history page	31
Figure 3.13	Webpage graph page (Temperature)	33

Figure 3.14	Webpage graph page (Humidity)	33
Figure 3.15	Webpage graph page (Temperature of Previous Day)	34
Figure 3.16	Webpage graph page (Humidity of Previous Day)	34
Figure 3.17	Webpage graph page (Temperature of Previous Month)	35
Figure 3.18	Webpage graph page (Temperature of Previous Month)	35
Figure 4.1	Prototyping Model	42
Figure 4.2	Pictures of hardware used	43-44
Figure 5.1	Prototype 1	45
Figure 5.2	Prototype 2	46
Figure 5.3	Prototype 2 inside the box	47
Figure 5.4	Prototype 2 Locker	47
Figure 5.5	Commands of Telegram	48
Figure 5.6	Lock Opened	49
Figure 5.7	Lock Closed	50
Figure 5.8	Message of Telegram	51
Figure 5.9	Message Shown	51

Figure 5.10	Webpage main page	52
Figure 5.11	Webpage history page	52

LIST OF TABLES

Table Number	Title	Page
Table 2.1	The function of each system box	11
Table 2.2	System Components	13
Table 2.3	Products and their Functions	16
Table 3.1	Name and Functions of Remote	26
Table 3.2	Command Name and Functions	29
Table 3.3	Graphs Name and Explanation	32
Table 3.4	Database Storing System	36
Table 3.5	Database Text File	36

LIST OF ABBREVIATIONS

IoT	Internet of thing
ICT	Information and Communication Technology
IR	Infrared
CPU	Central Processing Unit
OS	Operating System
LCD	Liquid Crystal Display
SMS	Short Message Service
IDE	Integrated Development Environment
NOOBS	New Out Of Box Software
VNC	Virtual Network Computing
SD	Secured Digital
AI	Artificial Intelligence

CHAPTER 1: INTRODUCTION

1-1 Problem Statement

The problem domain of this project is the security of the lock system is not that good and convenient enough. To know the status of the staff, whether the staff is in the office or not, or the staff is went for lunch, or the staff is already off work. If the staff is out from the room, the approximate time that the staff will be back is not shown. It is very inconvenient if there is no notification board in front of the door of the staffroom. Other people need to call or text the staff in order to locate the staff, or to know around what time the staff will be back, which it is very time wasting. It will also bring inconvenient to the staff as he/she need to reply or answer the phone if somebody message or call him/her regarding of his current status or location. The other problem is a lot of people tend to accidentally locked their keys in their room while going out without taking it out. When this problem occurred, it may need to cause the user to get the extra key from somewhere else, or maybe need to break the door due to this kind of careless mistake. Also another problem is what if the key is lost or steal, and the worst, both the original key and extra keys. Another problem is, there is no database to record down the past status the room, for example like the temperature and humidity and also the door status. It is for safety purposes. Nobody knows what happen to the room. User can trace and see the temperature and humidity of the room and see the difference changes. User can also trace the door status, which means user can know whether the door's room is opened at which time as for safety purposes as maybe the door is not opened by the user himself but the other people.

1-2 Background Information

This project uses many kinds of hardware and software. The hardware that is used is Arduino Uno Board and Raspberry Pi. Arduino is used to build electronic projects. It consists of 2 things, which is the board and it is programmable, and the IDE which is the software that used to write and burn the code to the Arduino board. The other hardware is Raspberry Pi. Pi is a like a small CPU, and it is basically runs with the OS Linux. It can be programmed to run other OS like Windows, but normally Linux is installed because it is easier to use for a programmer as Linux is more compatible with Python coding and since this project uses Python. Since it is a small CPU, so it also needed a Monitor screen to see the interface, but it can be configured to view the screen in a laptop by using the software called VNC Viewer. The Arduino Uno Board is connected to Raspberry Pi using I2C method, by using some wires through the I2C pins.

For the software part, an Android mobile app call Telegram is used. This app normally is used to send messages between users. But in this project, this app is use to communicate with Raspberry Pi. By adding BotFather in the Telegram, a new bot can be created to communicate with Raspberry Pi. BotFather is a third-party application which is like a robot that runs inside Telegram. After creating a new bot in BotFather, a new bot is created to communicate with the Raspberry Pi. Users can communicate with this bot by sending commands to it and it will reply the user when a message is sent. By creating a Python code in Raspberry Pi and launched it, the program is started and is ready to do the task whenever the user sends messages to the bot.

For the webpage part, a python code is written in the Raspberry Pi to be launched. The webpage can be opened as long as the code is running without launching the main program but just the latest values of the sensors will not be received. When launched, the code will collect the data from the database and output it to the website. Two other codes, which is the HTML code and CSS code are also implemented to associate with the python code to be run.

To launch this whole project, The Arduino must be connected to the Raspberry Pi in hardware. The Raspberry Pi must launch the main Python code. Both the Raspberry Pi and Telegram in the mobile phone must be connected to the internet. The bot in the Telegram is opened and message or command is typed by user and sent. The Raspberry Pi will receive the message since the Python code is running, which means if the Python code

is not running, Raspberry Pi will not receive anything. At the same time, The Raspberry Pi will send the message to the Arduino Board. If the message entered is a command set in the code, it will do something, for example, open the door, or retrieved the temperature, humidity value or door status and send back to the Telegram so that user can check the status. If it is not a command, then the message will be prompted on the LCD of the Arduino. The webpage Python code will display the current message printed on LCD, the history of message typed before, the current temperature, humidity value and door status, and also the history of temperature of humidity. The history of command will also be shown in the webpage and graphs of temperature and humidity from time to time will be displayed on the website. This problem is important to those who encounter it. This problem has to be solved.

This project uses Python, C, HTML and CSS programming language. Some Linux command prompt is also used while installing the drivers or library for the Python coding.

1-3 Motivation

The motivation of this project is to bring convenient to people and improve system security. This problem brings a lot of disadvantage to staffs and students in companies and universities. For example, if a security system is not good, not only it will be easily open by other people, even if it is opened, there is no history to record when it is opened. A good security system must have a database to store the data which when the door is open or close for safety purposes. For convenient purposes, if the user forgets to bring their key to open their door, they may ended up need to go back to their house to take. If a security system is not convenient for users, then it may make the users not convenient by consuming of their time and easily make the users frustrated and lose patients. The staffs of an office in company or universities will have the problem. Also, the staffs and students of universities will face this problem too, and a solution is needed. In order to solve it, a system must be created which fulfilled the solution to solve the problem stated above, which is this project called Intelligent Entry and notification system for academic office.

1-4 Project Scope

To tackle the above problems and limitations, Intelligent Entry and notification system for academic office introduces some new features. These features can be used to solve the above problems and make a better project. This project is a system that contains two main important functions. Firstly, the Intelligent Entry, which is the Door locking system. It uses an Android Mobile App called Telegram to lock and unlock the door by connecting it to wifi, or using phone data. By typing a certain command, for example 'Open' or 'Close', the locker of the door will be lock or unlocked. Why a mobile app is used? That is because nowadays people tend to forget to bring their keys to go out, but it is very sure that they will not forgot to bring their mobile phone. Not only open the door by using a wireless device, it also provided with a keypad in front of the door for the person to unlock the door. Why a keypad? Worst come to worst, if the user does not have the key with him, and his phone does not have line for Internet, then at least the keypad comes to work. To unlock it, you need to enter the password. Also, there is a remote control, to open the door when the user is near to the room's sensor. The door is locked by using a locker, and to open or close it, it is manipulated by a servo attaching a wire to the locker's lock. When the button of the remote is pressed, or the command of Telegram is entered, or when the password is entered correctly, the servo will turn, and the locker's lock will be shifted so the door will open.

Secondly, the notification system, it is something like an office door sign, but it is built in an electronic way. Instead of using cards to replace your status in front of the door of staffroom, a LCD screen is replaced to show your current status. You can update it when you are away from your office, as long as your phone is connected to the internet. The apps can let the user to update the current status. Other than these two, there are also sensors to keep track the status in the room. The sensors used are DHT11 and a hall effect sensor. The DHT11 is a temperature and humidity sensor, and the hall effect sensor can keep track whether the room's door is open or close. The value will output 1 if the door is closed as the sensor will detect the magnet which is sticked on the door. The values collected are stored in a database to be later output to the webpage. By typing the correct command in Telegram, user can check the current status of room.

There is an extra feature for this project which is the webpage design. It is associated with both these notification and intelligent entry system. This webpage is written in three languages which are Python, HTML and CSS. The python code is

Chapter 1: Introduction

launched in Raspberry Pi and is connected to the HTML and the CSS is used to design the webpage interface. The webpage Python code will display the current message printed on LCD, the history of message typed before, the current temperature, humidity value and door status, and also the history of temperature of humidity. The history of command will also be shown in the webpage and graphs of temperature and humidity from time to time will be displayed on the website. These data are collected from the database. The database used is text file, which means the data are stored in text file.

The scope of this project is the staffrooms and offices for universities and companies. Technically, it can also be used to put outside the room of any houses for fun purposes, or for the room for student hostels.

1-5 Project Objectives

The first objective of this project is to implement a low cost system. This project does not need a lot of money as it uses Arduino Board, Raspberry Pi, DHT11 sensor, IR remote and receiver, hall effect sensor and other things which are not expensive. If we want to make any changes in the current project in terms of programming, no cost is needed as it is just needed to be reprogrammed as what the user demands. The only cost is time cost but not cost in terms of money.

The second objective is to improve the security of the universities and companies. Currently, a lot of universities and companies do not have a proper or a good security system. Many of their doors are just locked by using a normal key. Nowadays staffroom has a keypad for user to enter password, but it does not have a function which is to disable the keypad. By disabling the keypad, nobody can try out the password for the door when the staff is not around. Nowadays staffroom doesn't have a sensor to record when the door is open or close. By implementing this, the security is enhanced.

The third objective is to design a remote notification system. So far what we can see is the electronic notice board that views the notices and articles in universities or schools. But, it is less that every staffroom has its own notification board. This will bring convenient to both the user and the other staffs.

The fourth objective is to create a database. The reason is to store the data time to time. The user can check trace back the data if anything happens or that he needs to check for the history for something else.

The last objective is to design a webpage. A webpage functions to display the data that has been stored in the database. Not only the data but also the webpage will display the status of the room according to the data collected. The principle behind this project is also easy to understand which will make this whole project user friendly.

1-6 System Flowchart

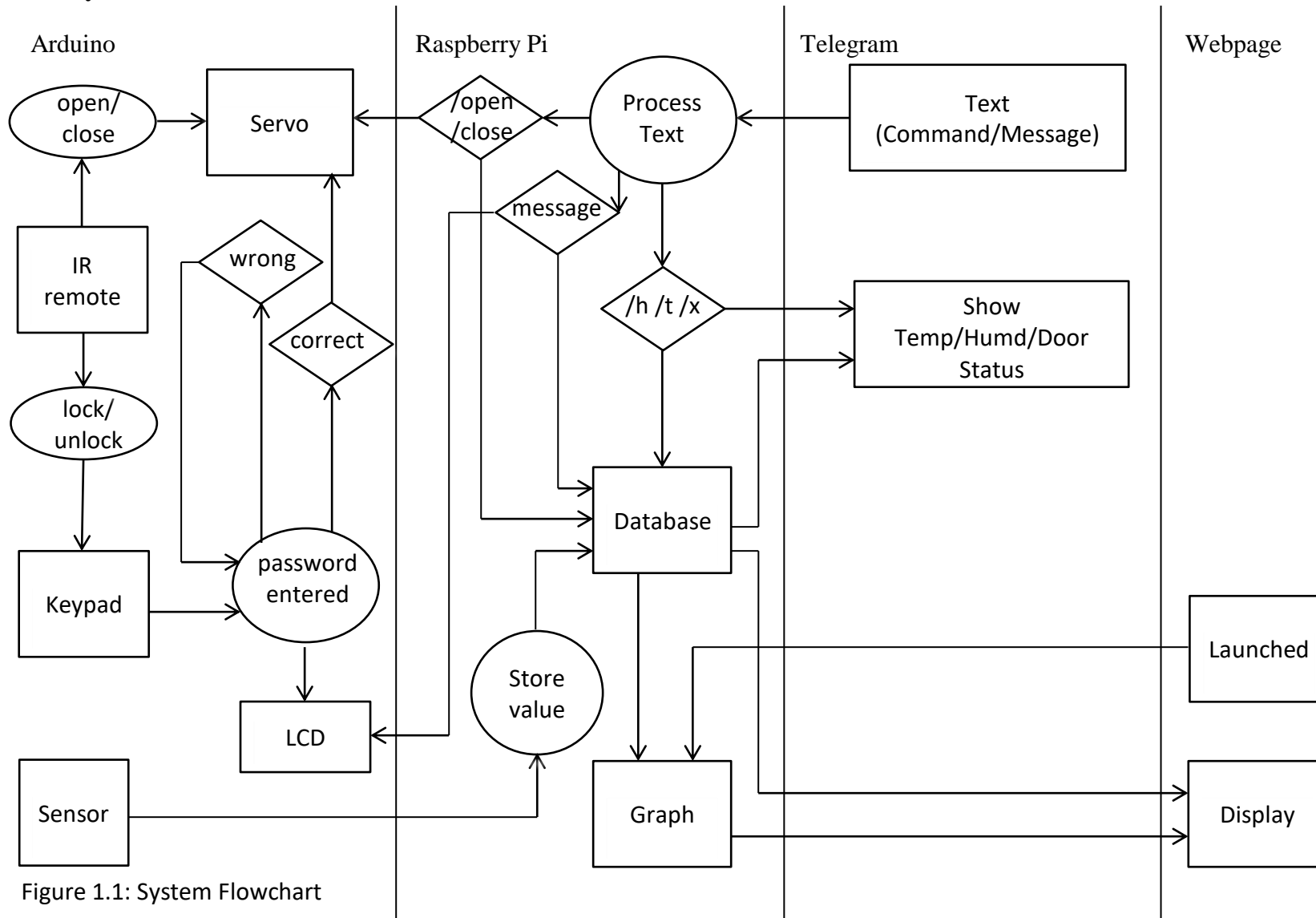


Figure 1.1: System Flowchart

1-7 Impact, significance and contribution

By implementing this project, not only the user himself, also everyone in the offices or universities is going to get the benefits. It is so convenient that you do not need to bring the keys to unlock the door. Before going out to work, people will always check that what are the things that must not be forget to bring along with them. So now, users will have less one thing to worry about when going to work. Imagine that the user is in his room, with door locked, and somebody come and knock the door, the user himself does not need to stand up and walk to open the door for the person outside the room. The user can just remain seated in the chair, and just take the remote and press open, and the door will be open without any effort. About the notification system, when the other staffs pass by the user's room, they can know the status of the user directly by checking the electronic notification board. Other staffs do not need to contact that person that they need to find. They can also know what time the user will be back, if the user has went out, and the status is updated about the estimated time the user will be back.

The keypad is installed outside the user's room. If the user is lazy to take out his key or mobile phone to open the door, the user can just directly type in the password and the door will open. By the way, the remote also has a function that brings extra security for this project which is the keypad can be enabled or disabled. The keypad is disabled so that other people cannot have the chance to try out the password. The keypad is enabled only when it is needed to unlock the door. The security is even been enhanced a lot by implementing the hall effect sensor that will record the time and date which when the door is opened or closed. By using this system, everyone in the universities or companies will gain a lot of convenient. The security will also be boosted greatly. As a person who is having IT-related knowledge, linking technology with surrounding to make all the people have a convenient and comfortable environment to do their work is something that shall be done. By implementing technology in life, life quality will be improved and everyone will have better work efficiency.

1-8 Achievement

1. A notification system which sends a message using phone to the LCD screen to update status has been implemented.
2. A status check system which checks the temperature, humidity and door status by using phone has been implemented.
3. A door lock system which open and close the door by using phone, keypad or remote has been implemented.
4. A keypad enable/disable function which turns on/off keypad by using a remote has been implemented.
5. A database which stores the temperature, humidity, door status, messages has been implemented.
6. A webpage that display the database's data, the graphs of the timeline of temperature and humidity has been implemented.

1-9 Report Organization

Chapter 1 talks about the introduction of the project, such as background information, objectives, project scope, problem statement and etc. Chapter 2 talks about the literature review. It is the review and comparison of the previous work. It highlights and compares the current project with previous work. Chapter 3 talks about the whole system design of the project, for example like how it is setup, the procedures, description, block, breadboard and schematic diagram, system flow chart and etc. Chapter 4 talks about implantation and testing, means that what shall be test for the input, and what will be the expected output. Chapter 5 talks about the implementation and testing, means how it is implemented and the testing to be done. There are also improvements and limitations stated in this chapter. Chapter 6 is mainly about the conclusion for this project and also the further improvements for this project.

CHAPTER 2: LITERATURE REVIEW

2-1 Literature Review

Based on the research, there are some similar products that are related to this project. One of the products is known as “Automatic Door Locking System” developed by (Majgaonkar, Et Al., 2016). By comparing, there is strength and weakness can found in this product.

This product uses Bluetooth device and Microcontroller technology, and it is a low cost system. It uses password to lock or unlock the door, and user can change or reset the password when it is needed. It is a high security system as it has two ways. First is to enter password for Bluetooth connection. Second is for unlocking the door in application.

According to the journal, the android phone is used as data input, which means that the user enter the password to the phone. The Bluetooth Module acts as the data receiver, means that it receives the password and later to be transfer to the microcontroller. The microcontroller is the data processing center, to check the password entered is correct or not, and to open the door. The battery is the power supply and the LED is the indicator.

The whole process of this door lock system is about the checking of the data sent by the app which is created and installed on the android phone. The Bluetooth module is connected to the Microcontroller. Both of them will be set with the same baud rate or else it will not be able to interpret the data sent out by the mobile phone. The data is then received by the Bluetooth Module and then sent to the Microcontroller. The microcontroller will read the data, and to check whether to perform the operations which is to unlock or to lock the door. This app is a password protected app and it will neglect any fraud access to the door. It is also been prevented to be provoked by other user. The weakness of this product is it has no wifi connection, which means u can only enter the password when you are near to the device. Also, there is no keypad that for the user to enter the password if there is a sudden breakdown in the apps, or when your phone is not available. (Majgaonkar, Et Al., 2016)

Chapter 2: Literature Review

Table 2.1: The function of each system box

No	System Block	Function
1	Microcontroller	As data processing center
2	Android phone	As data input
3	Bluetooth Module HC-05	As data receiver
4	Battery (5V)	As power supply
5	LED	As indicator

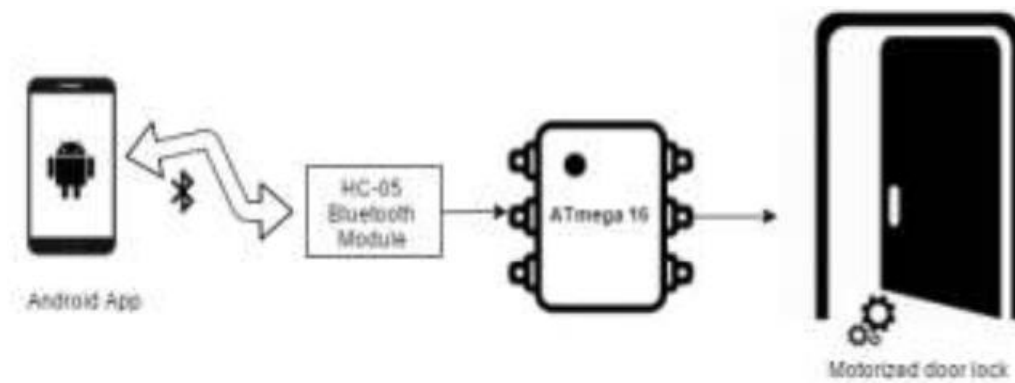


Figure 2.1: Block diagram of Door locking System

Chapter 2: Literature Review

Another product is “Android Based Smart Door Locking System with Multi User and Multi Level Functionalities” developed by (Kumar, Et Al., 2016). By comparing, there is strength and weakness of the product.

This product uses Arduino board, Android phone, Bluetooth Module HC-05 and Relay Switch. The Arduino board will receive the data from the apps and process the data. The command will determines the controls of the Electric door strikes. The Arduino Board and the Android Phone communicates by using the Bluetooth Module. By receiving the command from the Arduino Board, the electric door strike is turn off and on by the switch. The mobile app acts as the user interface, which is used to configure the functions of this system and manage the lock.

This product is almost alike as the product stated above, but there are a few functionalities which are more superior than the above product. Firstly is the Multiuser mode. When one or more user is authorized to operate this lock, multiuser mode can be very useful. Users can use their registered PIN with their ID respectively, to login in this module. By using own password, user can unlock or lock the door. If user forgot their password, they can recover the password by using registered email. The PIN can be reset by user if they want to.

Secondly is the Multilevel mode. When comes to controlling unlock or lock operations which is handled by multiusers, this mode will be very useful. This kind of system will be very handy for safe vaults or banks lockers, where the lock is needed to be unlocked by two or many keys. Two level verifications from two different users is needed to lock or unlock the system in this mode. In this module, users can use their registered PIN to login. By using their own password, the door can be unlocked or locked by the user. If users forgot their password, users can use their registered email address to recover the password.

Thirdly is the electronic door strike. By using electric current, an electronic lock functions as a lock, that means that if there is no electric supply, the lock cannot operate as no electric current to generate the magnetic power. Electric locks are mostly is device which is combined by a lock and an electronic control device. Normally, the access control system is connected to the electric lock. The Arduino Board will control the electric lock which it acts as a locker in this project. (Kumar, Et Al., 2016)

Table 2.2: System Components

Component Name	Purpose
Arduino uno	The Android Apps sends the command to the Arduino uno, and process it. The Electric Door Strike will do the task by the command it receives.
Bluetooth Module Hc-05	It is used to let the Mobile Phone and the Arduino Board to communicate.
Relay Switch (5V)	The Electric Door Strike is turn on or off by the relay switch. It will control the Electric Door Strike depend on the key received.
Android Smartphone	The Android App is needed to be installed which is developed by the user. It acts to configure the basic functionalities of this system and to manage the lock. Basically, it acts as a user interface.

Another product is “Electronic Notice Board for Professional College” developed by (Anushree, Et Al., 2014). By comparing, there is strength and weakness of the product.

This product is a paperless notice board as it is a board which shows notices and articles in an electronic way. This product not only allows users to view notices and articles on the notice board, also they can get the latest information through SMS each time the E-Notice Board is updated with the new information. Not only thru SMS, users can also see the latest info anytime and anywhere by opening the web app which is available online.

This product will make administrative work easier. The updates like add, delete, view are done by admin. The architecture for this E-Notice Board looks like this. The admin can create an account, delete and account and update a notice. The recommender or approver will recommend the notice of authorized user and approves the notices. Authorized users create and publish the notice after approved by recommender. Viewer is connected to the E-notice board thru internet and they can view notices, check for updated notices and download notices.

The notice board will be placed at strategic places. This notices acts like reminders, warnings, advice, results, appointments, exam venue n time. The old notices will not be removed as time passes, so that old notices still can be seen.

Chapter 2: Literature Review

There are some disadvantages about this product. The first example, on exam day we may see a lot of students surrounds a single notice to get their exam room number. This may cause panic to the student as too many students there any they might not be able to check their details. The other example is if too many notices are updated at a nick of time, student may not come across all of it any miss many or some of the updates. Also, when it comes to searching for a particular notice, there is space limitations are time consumption. Since the old notices are not removed from the notice board, this will cause a lot of outdated and not important notices will still be placed on the board. (Anushree, Et Al., 2014)

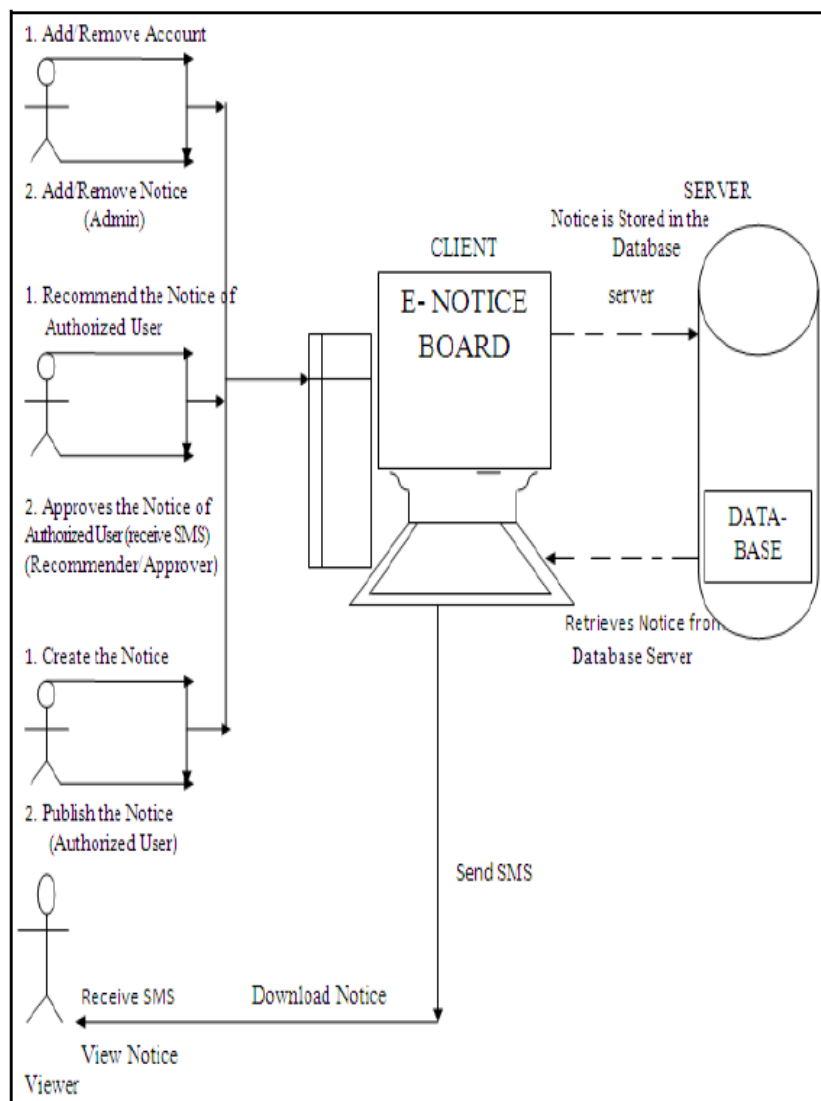


Figure 2.2: Proposed System Architecture for E- Notice Board

2-2 Fact Finding

The strength of the first product, which is a security system, is it combines the Bluetooth connection and password together to lock or unlock the door. This means that the user need to connect the mobile phone using Bluetooth to the Arduino, and after it is connected and the password is entered in the app, only the door can be open. This is a very strong security system as it needs a close range, and also need a password to open the door.

The weakness of this product is it is very not convenient for users. It needs a very near range to connect the Bluetooth and need to type the password to unlock or lock the door. It will be very time consuming.

The strength of the second product, which is also a security system, is way better than the first product. Besides what it has what the first product has, it also has multiuser system, which means it can be access by many users by logging in using respective username and password. The other strength is it has multilevel system, which means a lock can only be opened when 2 or more users has enter the password to unlock it. This system is way more powerful security than the first system.

The weakness of this product is also the same like the first product, which it cause inconvenient for users, as Bluetooth needs close range, and need to consume time to type the password.

The third product is about a notification system. The strength of this product is every users who registered an account can received any announces and notices by SMS. Users can also go to the website to download the notices. Users can directly view the latest and also the old notices on the Notification Board which is installed.

The weakness of this product is this notification system cannot be updated by using app. So it is not convenient since browsing a website is not convenient if the admin are not with their computers.

Chapter 2: Literature Review

Table 2.3: Products and their Functions

Product \ Function	1 st	2 nd	3 rd	FYP
Bluetooth Module	yes	yes	no	no
Password System	yes	yes	no	yes
Mobile App	yes	yes	no	yes
Use of Wifi	no	no	yes	yes
Multiuser System	no	yes	yes	no
Multilevel System	no	yes	no	no
Notification Board	no	no	yes	yes
SMS	no	no	yes	no
Keypad	no	no	no	yes
Remote	no	no	no	yes
Sensor	no	no	no	yes
Database	no	no	yes	yes
Webpage	no	no	yes	yes

2-3 Critical Remarks

From the first and second product, it is seen that both this product uses Bluetooth, password, and a mobile app for the security system. It is a very good system, but Bluetooth is a bit outdated for the current era. The best solution to replace Bluetooth is by using Wifi or mobile data. By using Wifi or mobile data, the mobile app can be connected very fast and directly to the hardware in a longer range, which means the user doesn't need to walk to that particular range just to connect it using Bluetooth. The password secure that is used in the mobile app is a good way too, but it is too inconvenient for the user because it is very time wasting, and also user may forget the password. The alternative way for this is to set a command in the app, and by typing it, it will just locked or unlocked. It sounds like a password, but a password is different than a command. The second product uses multiuser and multilevel system, but in this current project, these two modules are not needed, so it is not implemented in this project. This product does not come across a keypad that installed outside the door, and also a remote to open the door. These two functions are implemented in this project as it will bring convenient to the user himself. If a keypad is installed outside the door, which means it is not that good security, because other people can tryout the password. So, the remote is added a function which to enable and disable the keypad, which to boost the security.

The third product is a notification system that also uses an Electronic Board to show news and notices. This product is convenient as it can be updated by using Internet by accessing the browser, but it is not so convenient enough as it does not have a mobile app which is going to give convenient to the user as browser will be more troublesome than mobile app. So, to make a user easy, it is better to create a mobile app so that user can update their status by just pressing the app in the mobile phone. This product uses SMS notification, but in this project tis system is not used because nowadays smartphone users have their own mobile data, and a lot of advanced countries or places has Wifi around, so SMS is not really needed.

CHAPTER 3: SYSTEM DESIGN

3-1 Description of Project

The hardware that will be used in the project are Arduino Uno board, Raspberry PI, 4x4 matrix keypad, SG90 (Servo), DHT11 (temperature and humidity sensor), IR remote, IR receiver, LCD 1602 Display (Character LCD Module Display), A1120EUA-T(Hall effect switch), magnet, LEDs, resistors, wires, DC supply or Power bank used to supply power to the Arduino Uno Board. The software that will be used is Telegram which is an Android mobile app. Arduino software is used to write the code for the Arduino Uno Board. The LCD Display is to display the status which is typed by the user from the Android mobile app Telegram. The app must be connected to the internet. The LCD Display will display the message which is typed and pressed send by the user. The apps also have a function which is to lock or unlock the door wirelessly as long as it is connected to the internet. It will send the message to the Raspberry PI, then the Raspberry PI will receive the message and send to the Arduino UNO board, and will retrieve it and check the command, if it is the command, then the lock will either open or close depend on the command which is type. The IR remote has 2 functions, the first one is to unlock or lock the door. The second one is to enable or disable the 4x4 matrix keypad which is to prevent other people to attempt to tryout the password. The 4x4 matrix keypad is used to enter the password when the user wants to enter the room. The sensors are used to collect the data and information of the room which users can check it while they are not around. The sensor is checked by typing the commands in the Android mobile app Telegram. By typing the correct command, the status will be received. The door is also connected a hall effect sensor, which will detect whether the door is close or open. It is checked with the presence of a magnet, means that when the door is close, which means when it touches the magnet, it will state that it is close, and so on. A webpage has been designed to check the status of the room, current status or the history of it. Before the webpage is launched, it will create the graph of the timeline of the temperature and humidity which the data are retrieved from the database. Then, the webpage will show the information including which is retrieved from the database and also the graphs.

3-2 Top-Down System Design

3-2-1 System Design Diagram

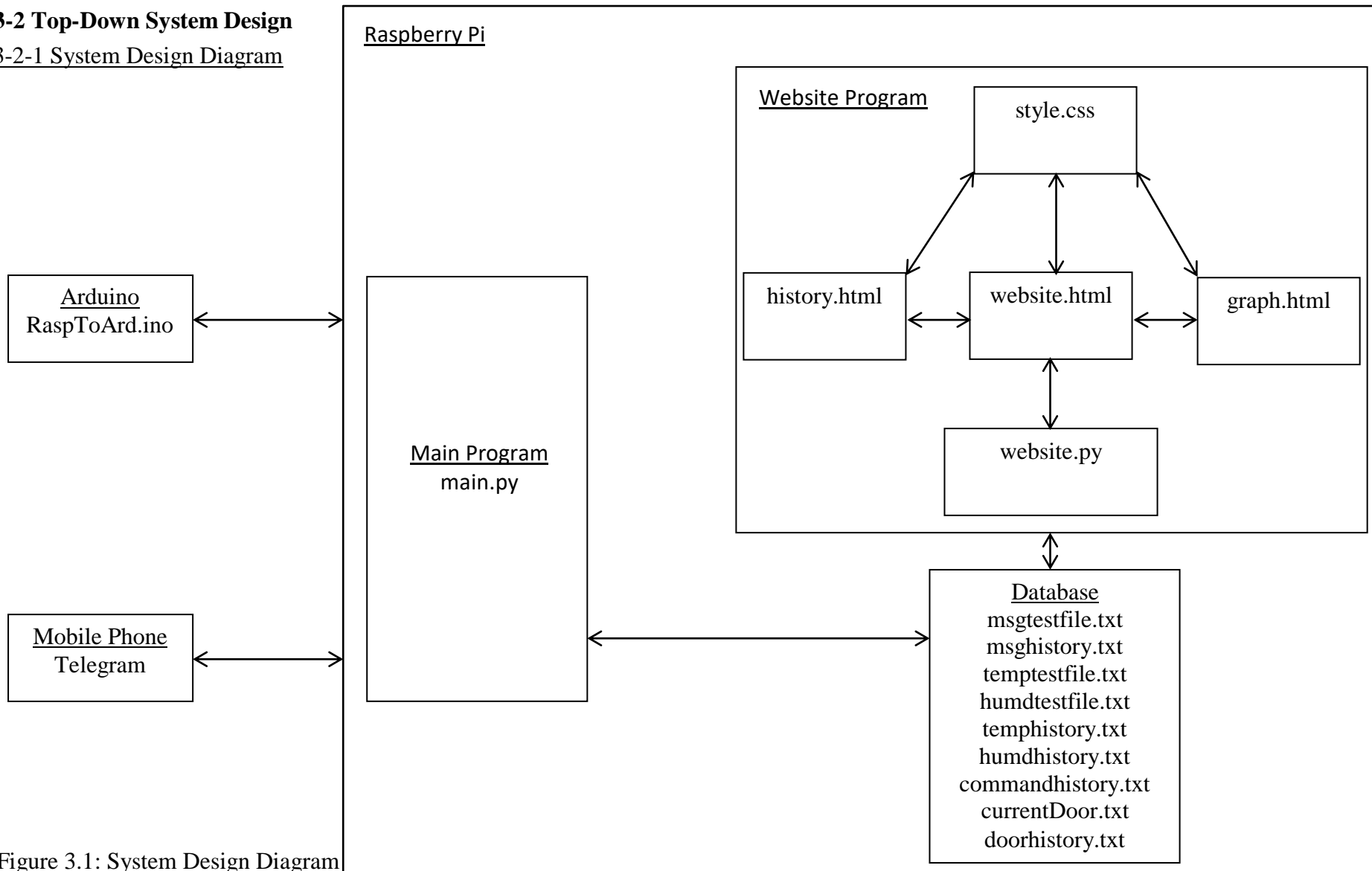


Figure 3.1: System Design Diagram

3-2-2 System Flowchart

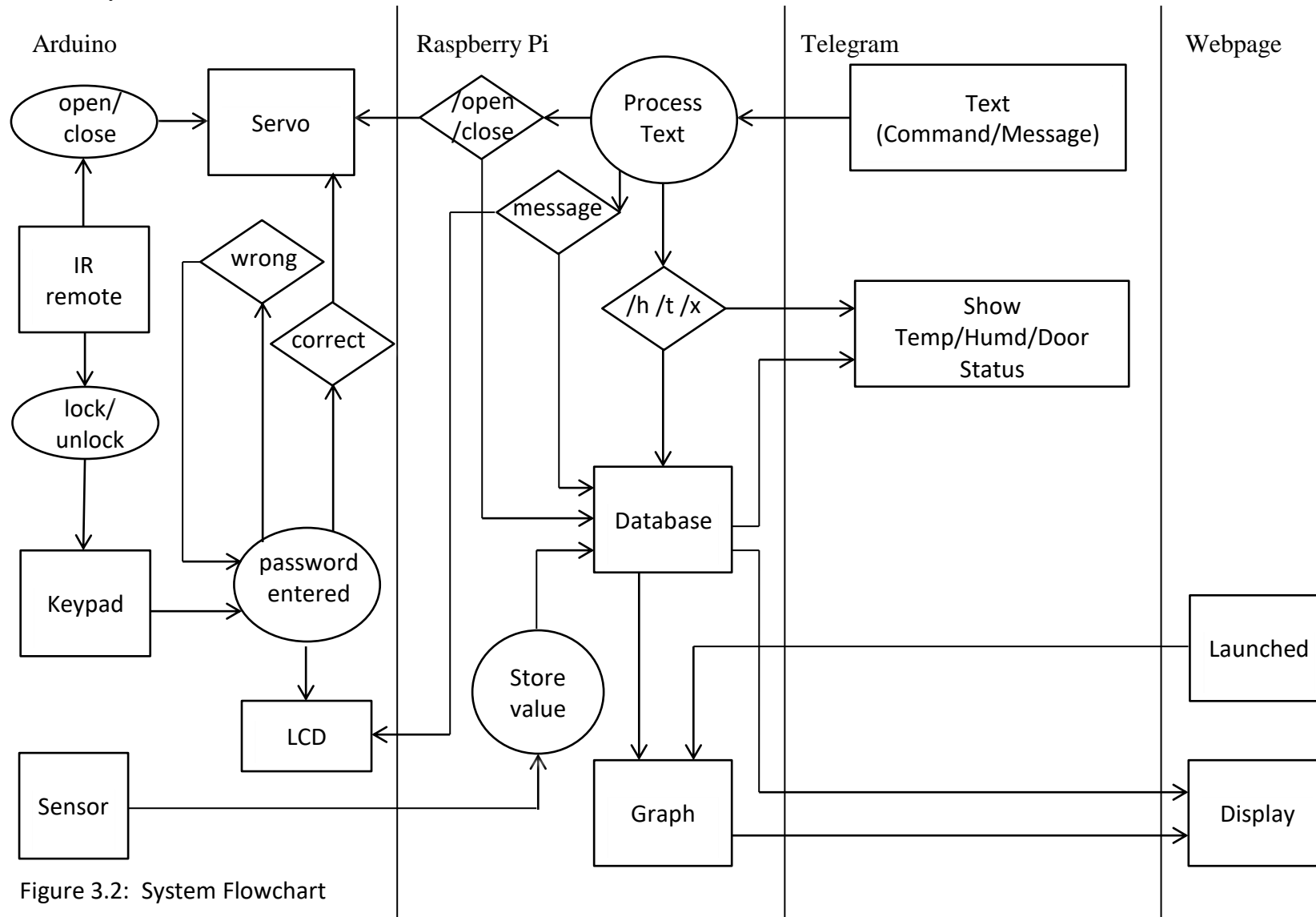


Figure 3.2: System Flowchart

3-2-3 Block Diagram

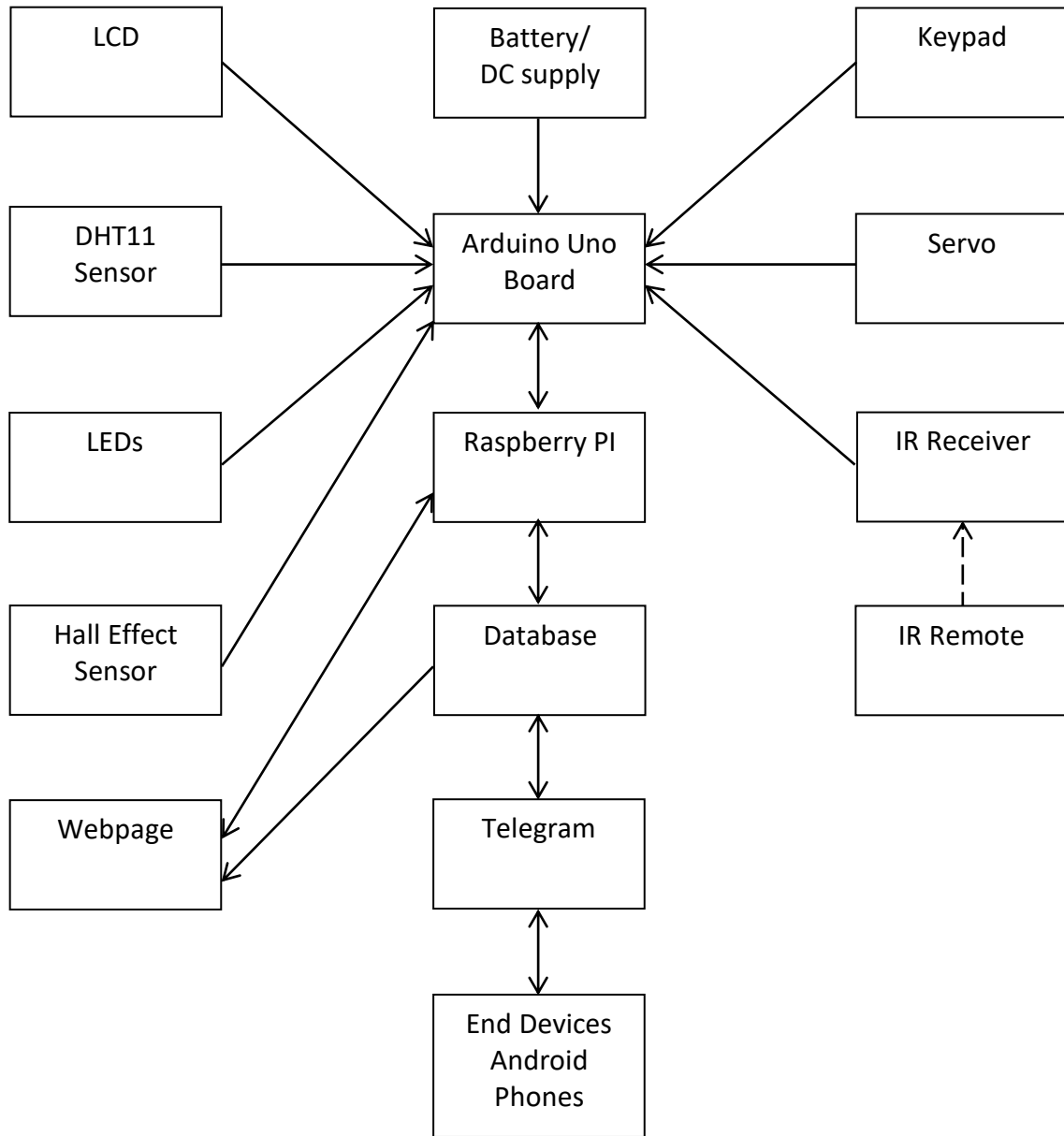


Figure 3.3: Block Diagram

3-2-4 Breadboard Diagram

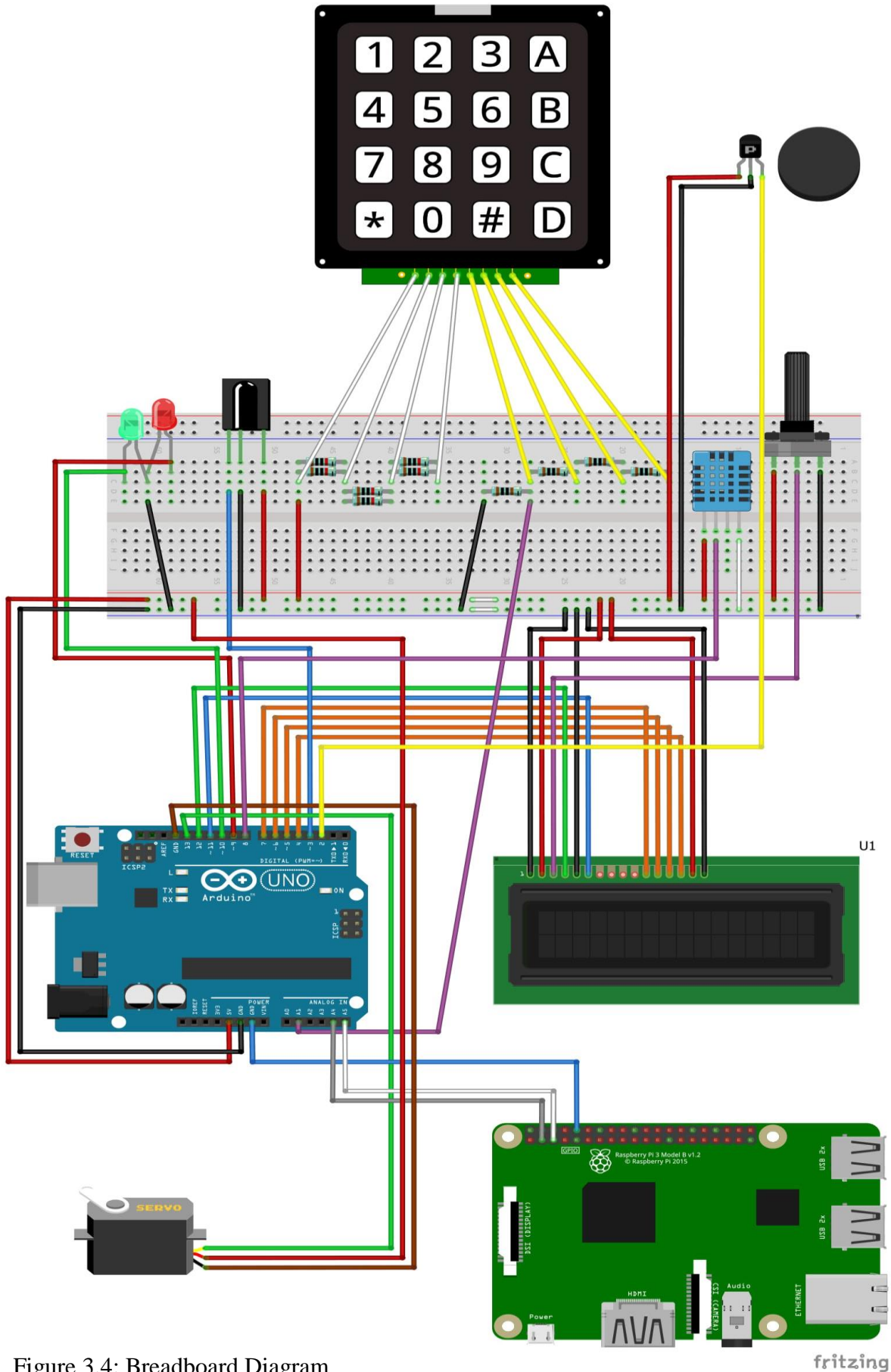


Figure 3.4: Breadboard Diagram

3-2-5 Schematic Diagram

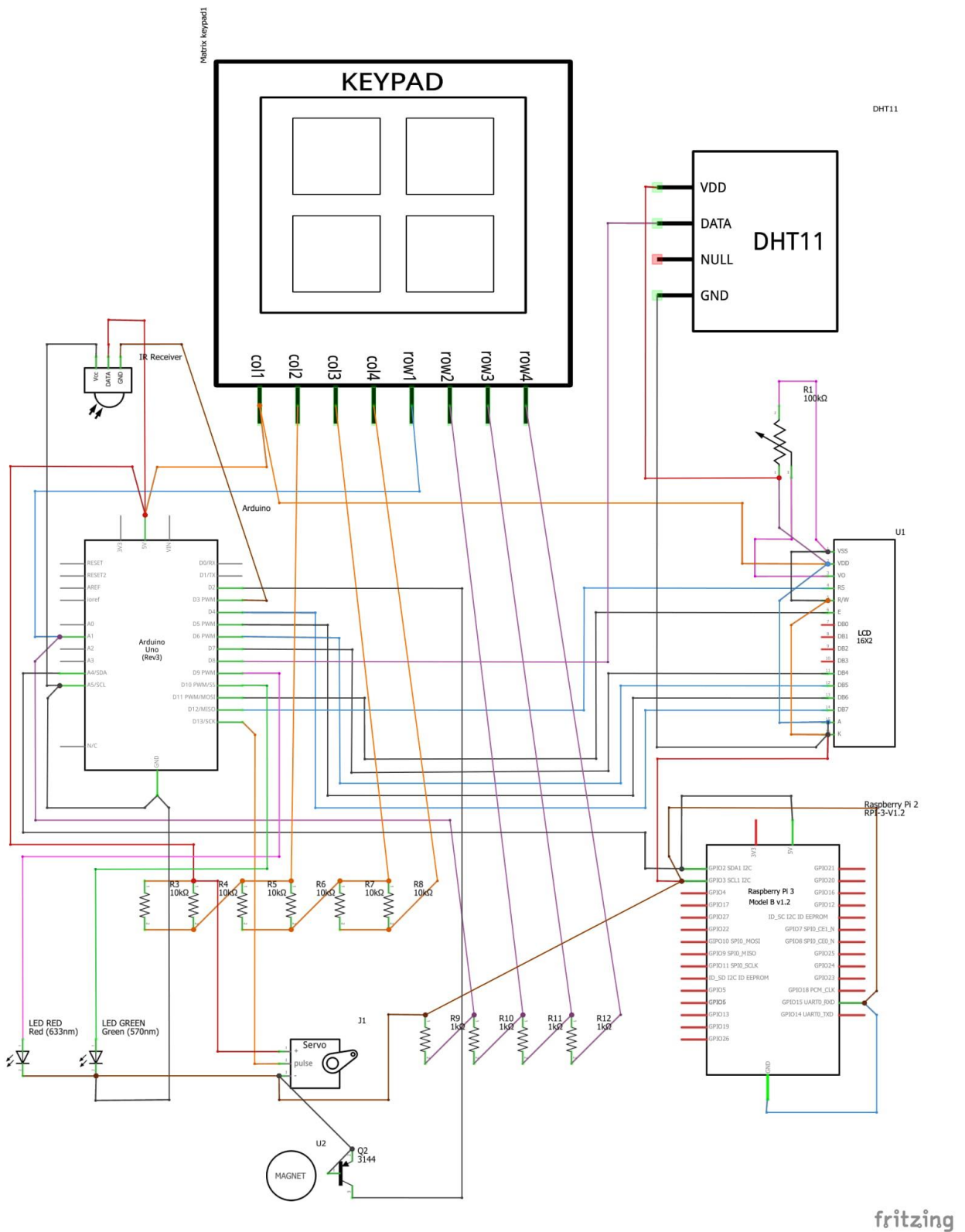


Figure 3.5: Schematic Diagram

3-2-6 Explanation of System

Arduino

1. Arduino will send the temperature and humidity every 10 seconds, and send the door status every 1 second, to Raspberry Pi to be stored in the database.
2. Arduino will receive the message by Raspberry Pi and output to the LCD.
3. Arduino will receive the command by Raspberry Pi and to lock or unlock the door.
4. The Keypad is for entering the password, if wrong password then the red LED will blink, else if correct the green LED will light up and the servo will turn to open the lock. The password will be display on the LCD while is entered.
5. IR remote can use to unlock or lock the door, and also use to lock or unlock the keypad.

Raspberry Pi

1. In Raspberry Pi, two codes are launched. 1st is the main code, which functions to process the data and to store data to database, named 'combine.py', 2nd is the webpage code, which functions to launched the webpage, named 'hello.py'.
2. The main code will process the data, which means when Telegram send a message or a command in, it will process whether it is a message or command, and to execute the next job. It will also receive the temperature and humidity every 10 seconds, and send the door status every 1 second, and to be stored in the database. The database system can be referred in Diagram.
3. When the webpage code is launched, it will collect the database data and to convert it to graphs. After that, it will display the graph and the other data on the webpage.

Telegram

1. Telegram will send the message to the Raspberry Pi. It will then output to Arduino.
2. Telegram will send the command to the Raspberry Pi. If it /h /t /x, it will return the temperature, humidity or door status to Telegram. Else if it is /open /close, it will trigger the servo to open or close the lock.

3-2-7 Codes Name and Explanation

1. RaspToArd.ino is the code that is written to the Arduino Uno Board.
2. Telegram is the software that is installed on the mobile phone.
3. main.py is the main program code to run all the system. It is launched in Raspberry Pi. If this code is not run, then the whole system cannot be used.
4. website.py is the webpage code. It is launched in Raspberry Pi. It is connected with website.html, graph.html, and history.html and style.css is connected to these 3 html files.

3-3 Setup Procedures

3-3-1 Arduino

1. The hardware is set up as shown in Figure 3.4.
2. For the keypad of this project, a one-wire-keypad is used. Instead of using 8 pins in Arduino Board, 1 pin is just need, with the combinations of some resistors and wires. This method is to save the other 7 pins for other usage.
3. The keypad is configured as shown below Figure 3.6.

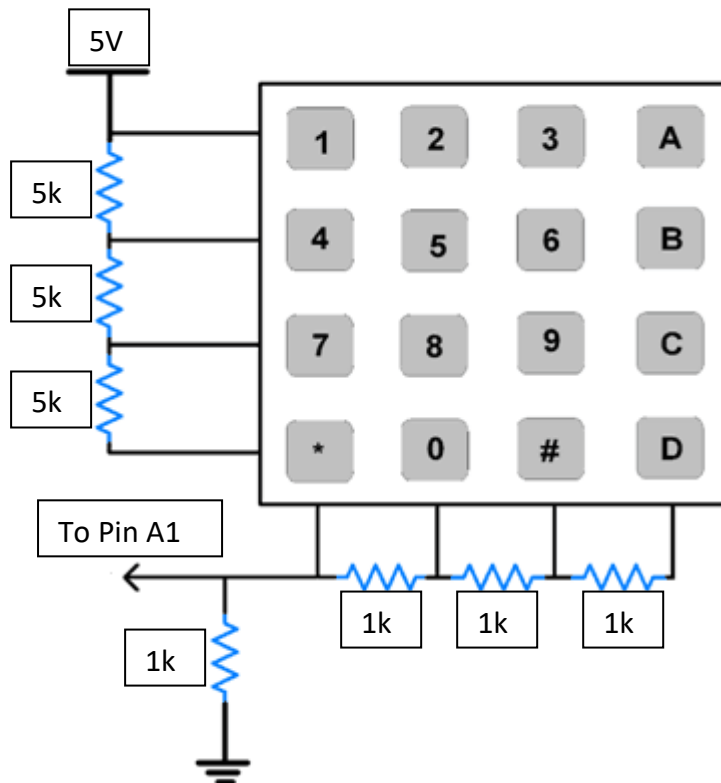


Figure 3.6: Keypad Schematic

4. The concept behind this one-wire-keypad is the pin will received different values by pressing different buttons, because of the resistors. Every buttons passes by different resistors, so different values will be received.
5. A module is needed for this keypad which can be downloaded at <https://playground.arduino.cc/Code/OneWireKeyPad>
6. For the IR of this project, 4 buttons on the IR remote is programmed to do some task.
7. Table below shows the names and functions of the button.
8. Figure below shows the picture of the IR remote and the functions.

Table 3.1: Name and Functions of Remote

Name	Function
PREV	Unlock the door
NEXT	Lock the door
VOL-	Switch off keypad
VOL+	Switch on keypad

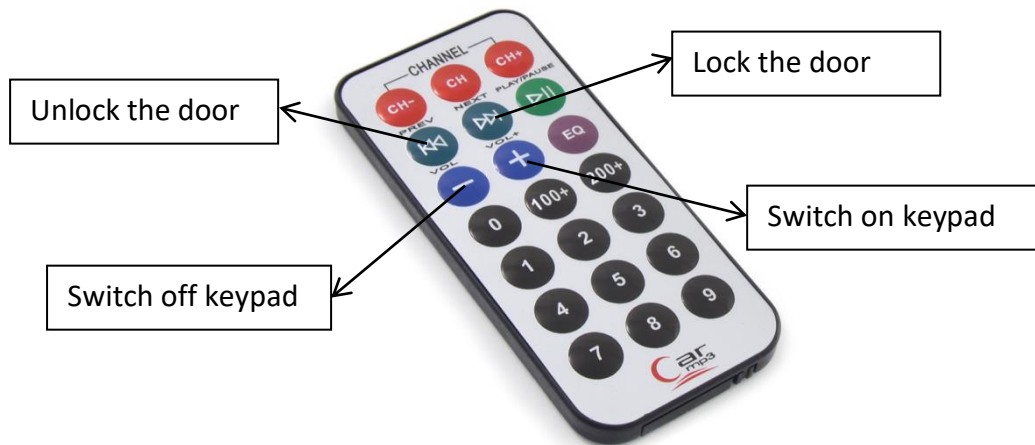


Figure 3.7: IR Remote

3-3-2 Raspberry Pi

1. A SD card with speed class of Class 10 and storage of 8GB is used.
2. Format the SD card.
2. Download the ZIP file of NOOBS from the official website, and extract the zip files.
3. The files in the extracted NOOBS folder are moved to the SD card.
4. Since it is a first boot, a monitor, keyboard and mouse is needed to do the installation.
5. Raspbian is chose, and the installation is started.
6. Installation is done.
7. The default username and password of Raspbian is not changed, which is pi and raspberry.
8. Connect it with Wi-fi.
9. After connected, open up the command prompt and type 'ifconfig' and find the IP address. This address is later used to do configuration for VNC Viewer.

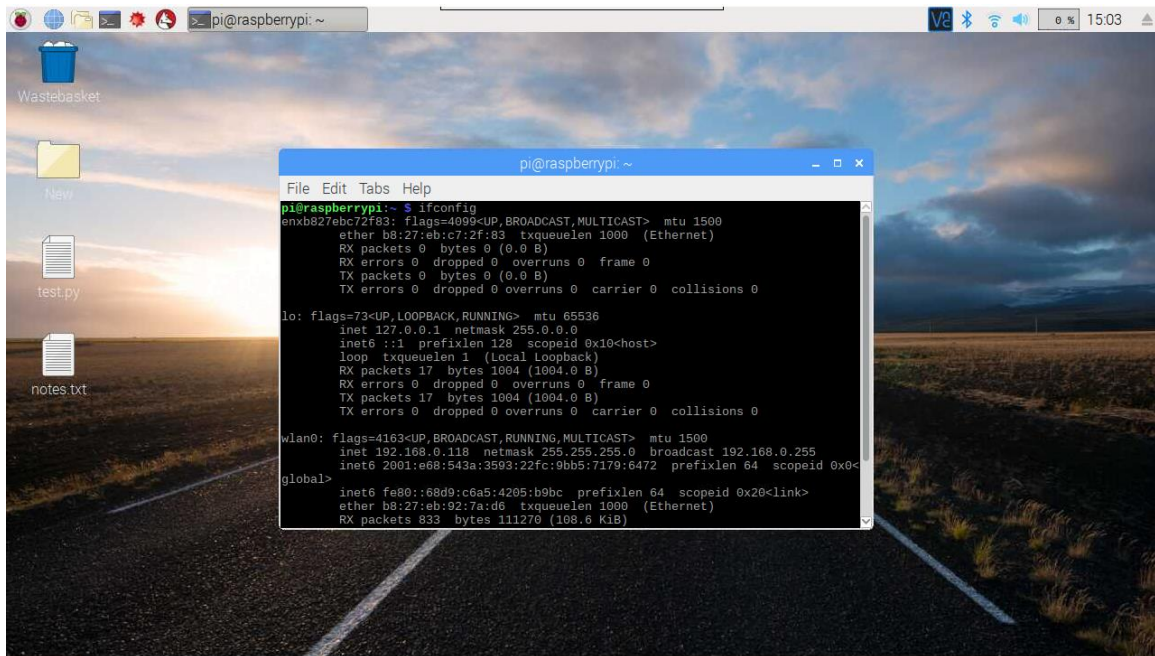


Figure 3.8: Screenshot of Raspberry Pi

3-3-3 Telegram

1. Telegram app in Playstore is searched and downloaded.
2. Telegram is logged in with the user's phone number.
3. Go to the website <https://web.telegram.org/> to access Web Telegram through a PC.
3. Go to the website <https://botsfortelegram.com/project/the-bot-father/> to add BotFather through Web Telegram by clicking 'Add BotFather To Telegram'.
4. After added, type '/start' at the chat bar of BotFather and press send.
5. BotFather will reply a long message contain a lot of commands, then type '/newbot'.
6. Then, BotFather will reply a message 'Alright, a new bot. How are we going to call it? Please choose a name for your bot.', SJBOT is typed as the name of the bot.
7. Next, BotFather will reply another message 'Good. Now let's choose a username for your bot. It must end in 'bot'. Like this, for example: TetrisBot or tetris_bot.', SJLAIBOT is typed as the username.
8. Lastly, BotFather will reply a message contained the token. This token is used to access the HTTP API which is to communicate between this bot and the other software.
9. This token is later added in the Python code which is going to be run in Raspberry Pi.



Figure 3.9: Screenshot of Telegram

3-3-4 VNC

1. This 2 commands must be type in the command prompt of the Raspberry Pi in order to use VNC Viewer.

i. `sudo apt-get update`

ii. `sudo apt-get install realvnc-vnc-server realvnc-vnc-viewer`

2. By enabling VNC Server, select Menu > Preferences > Raspberry Pi Configurations > Interfaces, and select 'Enabled' for VNC.

3. Figure 3.2.7 shows the screenshot of enabling VNC.

3. Now open VNC Server, click on the 'Menu' on top-right corner. Select 'Licensing...'.

4. Select 'Sign in to your RealVNC account'.

5. After signing in, go to VNC Viewer, click on 'File' on top-left corner, and select 'New Connection...'.

6. Type the IP address in the VNC server, and type a name for this connection, and click 'OK'.

7. Connect to the Raspberry Pi by double clicking the connection which has just been created.

8. A pop up message will be prompted to enter its username and password. Type it.
9. Once it is login successfully, the VNC setup is done.

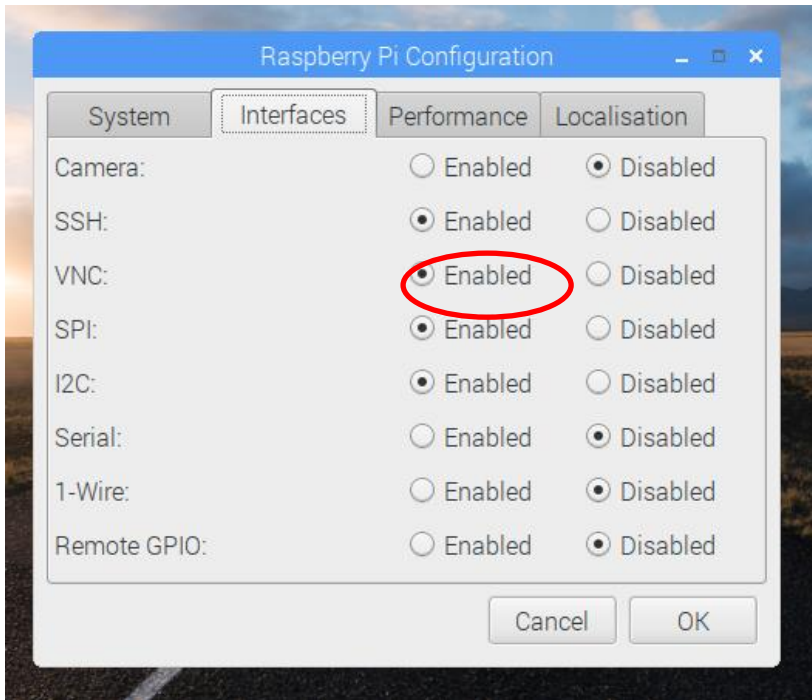


Figure 3.10: Screenshot of enabling VNC

3-4 Commands

1. There are 5 main commands for the user to type in Telegram.

Table 3.2: Command Name and Functions

Command Name	Command Function
/t	To check the temperature
/h	To check the humidity
/open	To open the door
/close	To close the door
/x	To check door status

2. If other than these 5 commands are typed, it will be categorized as the message that will be shown at the LCD which is the notification board.
3. If the command is typed is the 5 above, it will not be printed on the notification board.
4. The Python code name is named as 'combine.py', so the code is run by typing 'python combine.py' in the command prompt.
5. After the code is started, user can start to type any commands or message in Telegram.

3-5 Webpage

1. The user can access the webpage by typing python website.py in the command prompt first.
2. Then, type <http://127.0.0.1:5000/fyp> in the browser to access the main page of the website.
3. There are two other webpages, which is the history page, <http://127.0.0.1:5000/history> and the graph page, <http://127.0.0.1:5000/graph>, which shows the graph of humidity and temperature.
4. For all the 3 pages, there are some parts that are remain the same without changing which are the biggest blue title which is ‘Welcome to SJ’s FYP INTELLIGENT ENTRY AND NOTIFICATION SYSTEM FOR ACADEMIC OFFICE’, the “History” and “Graph”. These 3 boxes are not just boxes but also button to lead to another page.
5. By clicking the biggest blue title box, it will goes to the main page, by clicking the “History”, it will goes to the history page, by clicking the “Graph”, it will goes to the graph page.

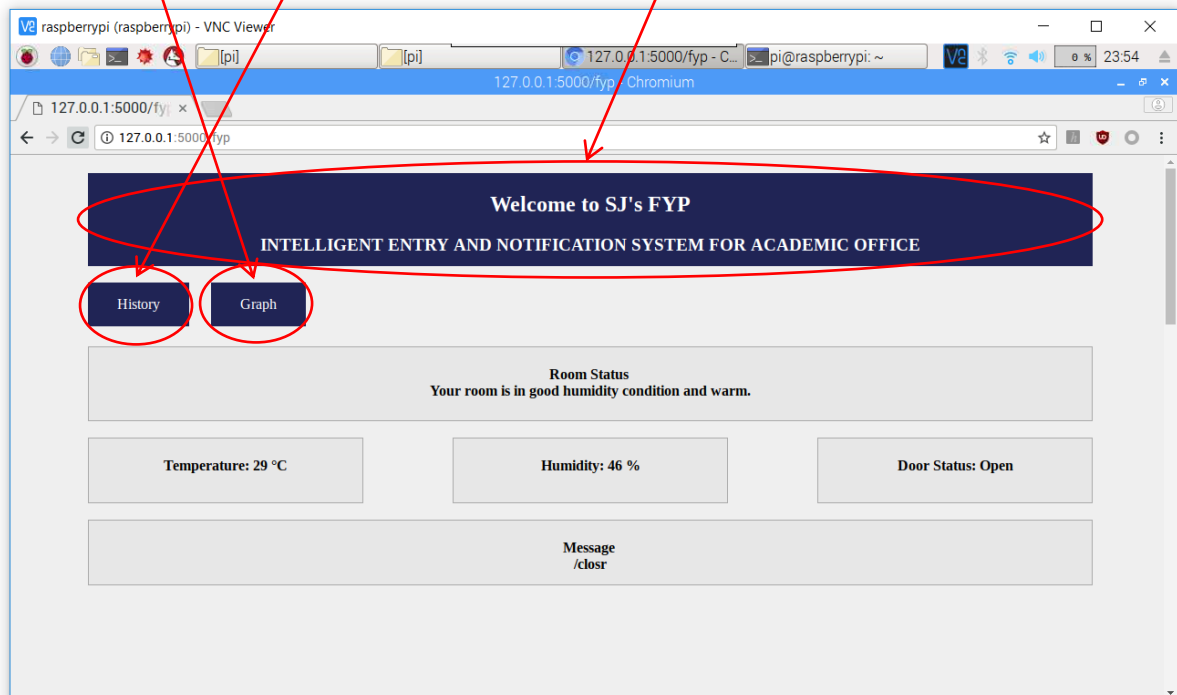


Figure 3.11: Webpage main page

Chapter 3: Proposed Method/Approach

6. Every page has these 3 blue boxes.

7. The main page will show the room status, current temperature, current humidity, current door status and current message display on LCD.

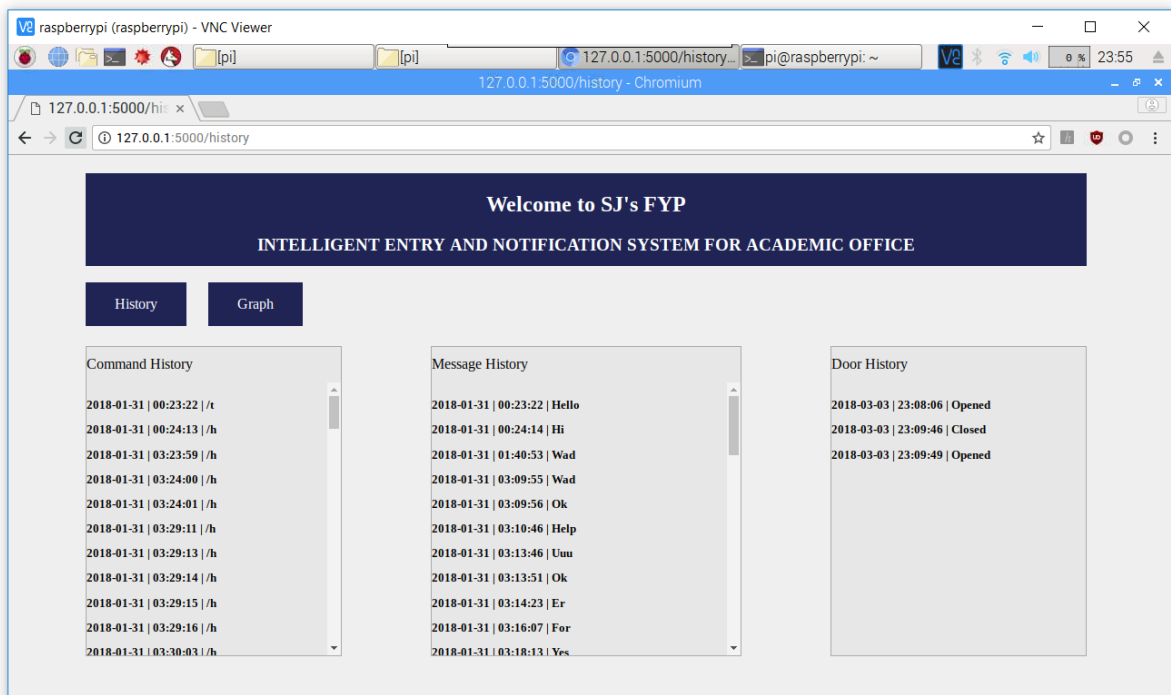


Figure 3.12: Webpage history page

8. The history page has 3 parts, which is the Command History, Message History and Door History.

9. All the time and date of the commands, messages and when the door is open or closed will be recorded together.

10. The boxes are made to be scrollable if there are many data.

11. So normally, the last message history will be the current message display on main page, and the last door history will be the current door status.

12. For the graph page, the default graph will be shown on 1st click to the webpage is the Temperature graph from the start of the time.

13. There are two buttons, left and right, by clicking right it will go to the next picture which is the humidity. By clicking left, it will go to the previous picture. If it is the 1st picture, then it will go to the last picture which is the 6th picture if left is pressed, and if it is the 6th picture, then it will go to the 1st picture while right is pressed. It can be set to any kind

Chapter 3: Proposed Method/Approach

of graph for example like previous day, last 2 days or last 3 days and etc by the user by changing the code. User can plot its own graph depend on what the user want.

14. For this project, 6 kinds of graph is set. These 6 kinds of graph are arranged into two types which is the temperature and humidity graph. Both of these types are arranged to 3 kinds of graphs which is from start time which means it takes all the data from database, last 24 hours which means it takes the last 24 hours of data, and lastly 30 days which is the last 30 days data. Table 3.3 shows the graphs name and explanations.

15. For more information, please refer to next section.

16. To see how the Webpage graph page looks like, please refer to pages 33-35.

3-6 Graph

The graphs are created when the program is launched. It takes all the temperature and humidity from the database to process to plot the graphs. The graphs can be plotted from anytime to anytime depend on what the user wants.

Table 3.3: Graph Name and Explanation

	Graph Name	Explanations
1	Temperature	Temperature from Start of Time
2	Humidity	Humidity from Start of Time
3	Temperature of Previous Day	Temperature of Last 24 Hours
4	Humidity of Previous Day	Humidity of Last 24 Hours
5	Temperature of Previous Month	Temperature of Last 30 Days
6	Humidity of Previous Month	Humidity of Last 30 Days

Chapter 3: Proposed Method/Approach

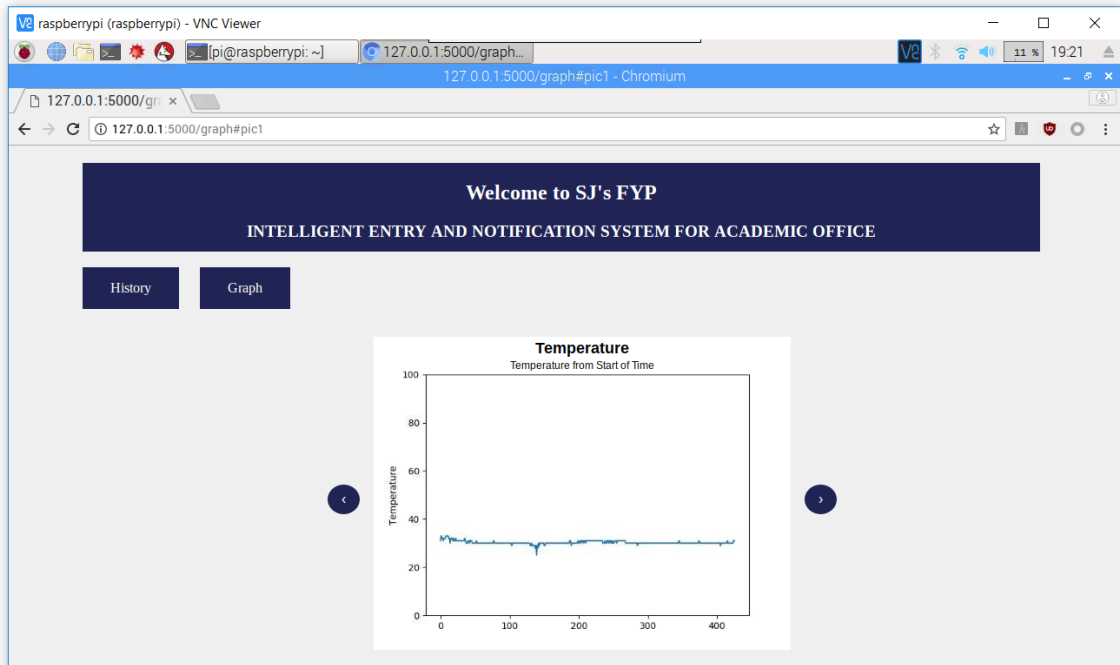


Figure 3.13: Webpage graph page (Temperature)

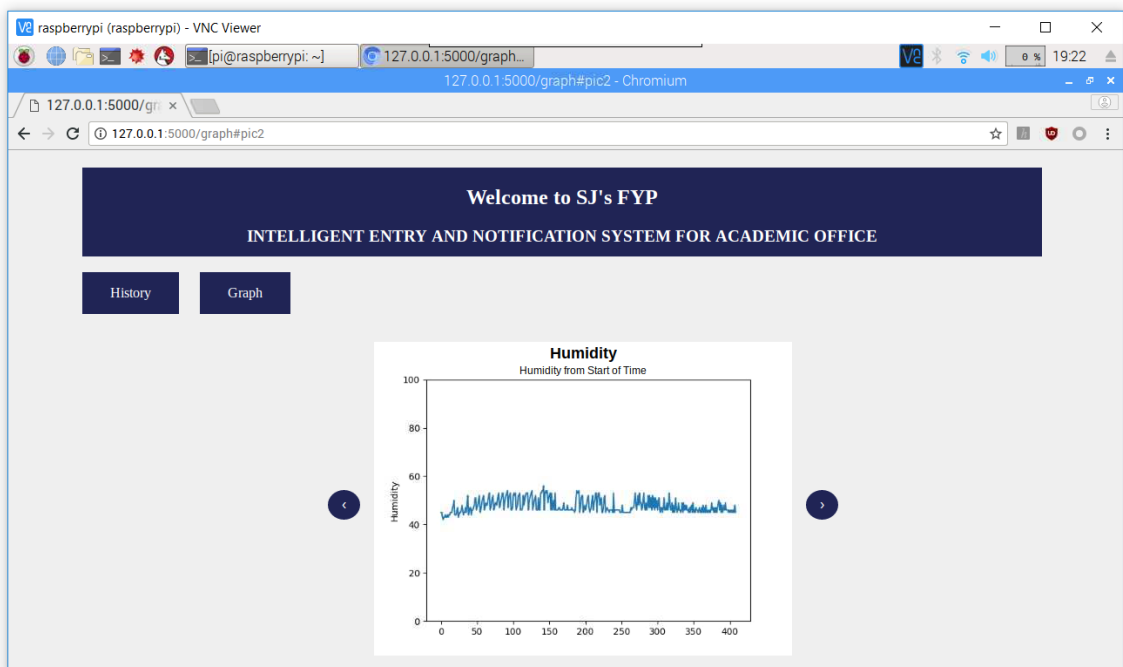


Figure 3.14: Webpage graph page (Humidity)

Chapter 3: Proposed Method/Approach

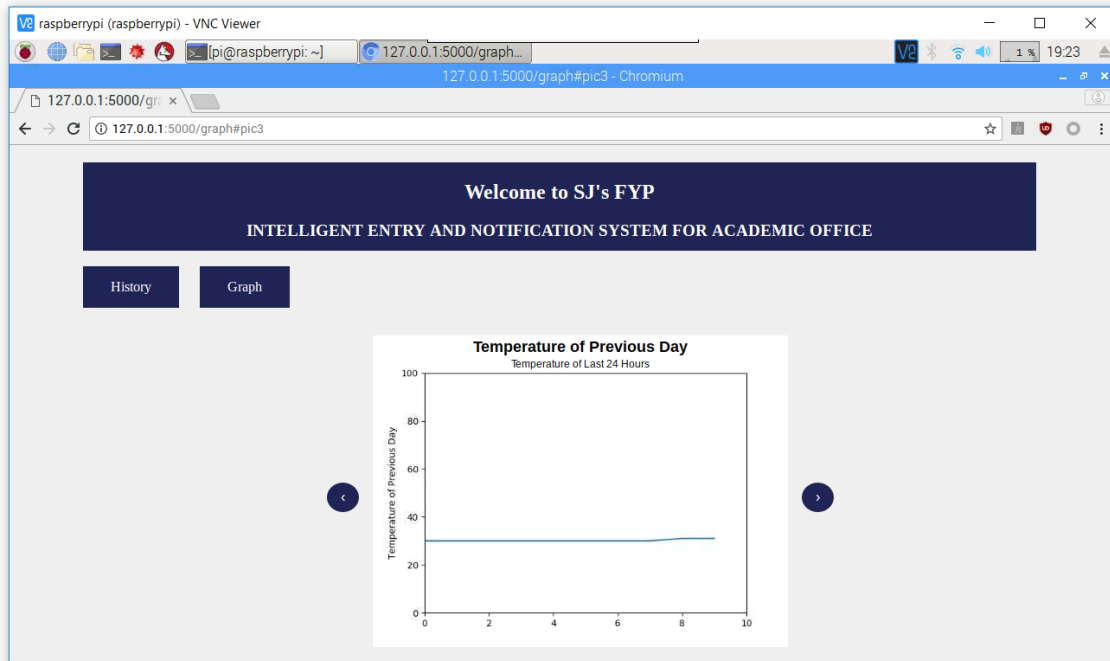


Figure 3.15: Webpage graph page (Temperature of Previous Day)

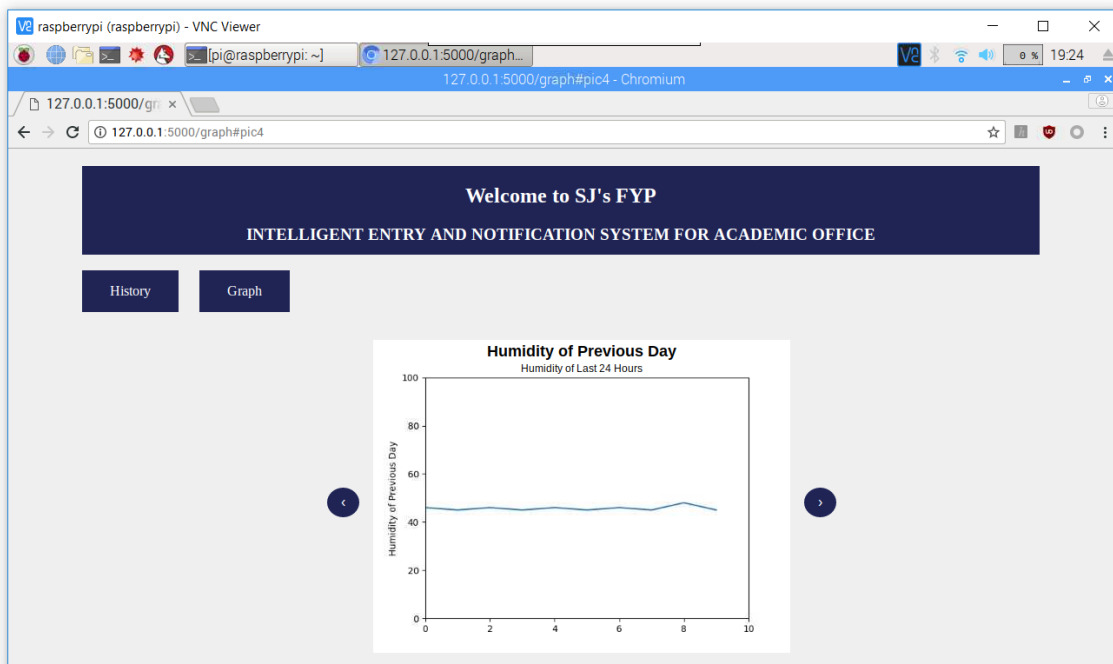


Figure 3.16: Webpage graph page (Humidity of Previous Day)

Chapter 3: Proposed Method/Approach

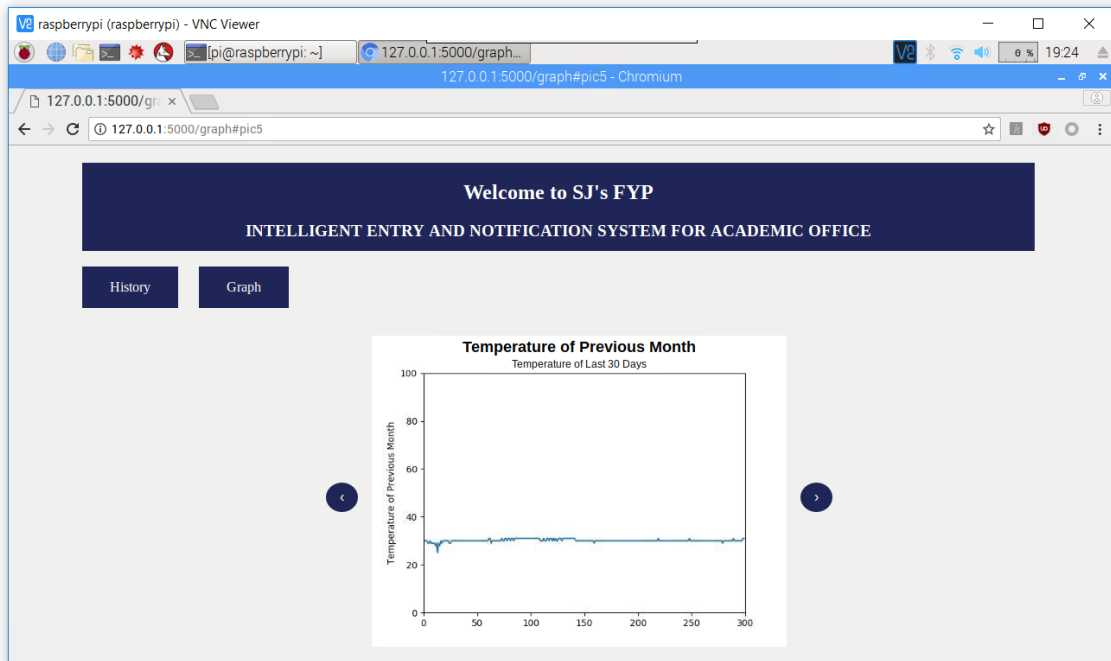


Figure 3.17: Webpage graph page (Temperature of Previous Month)

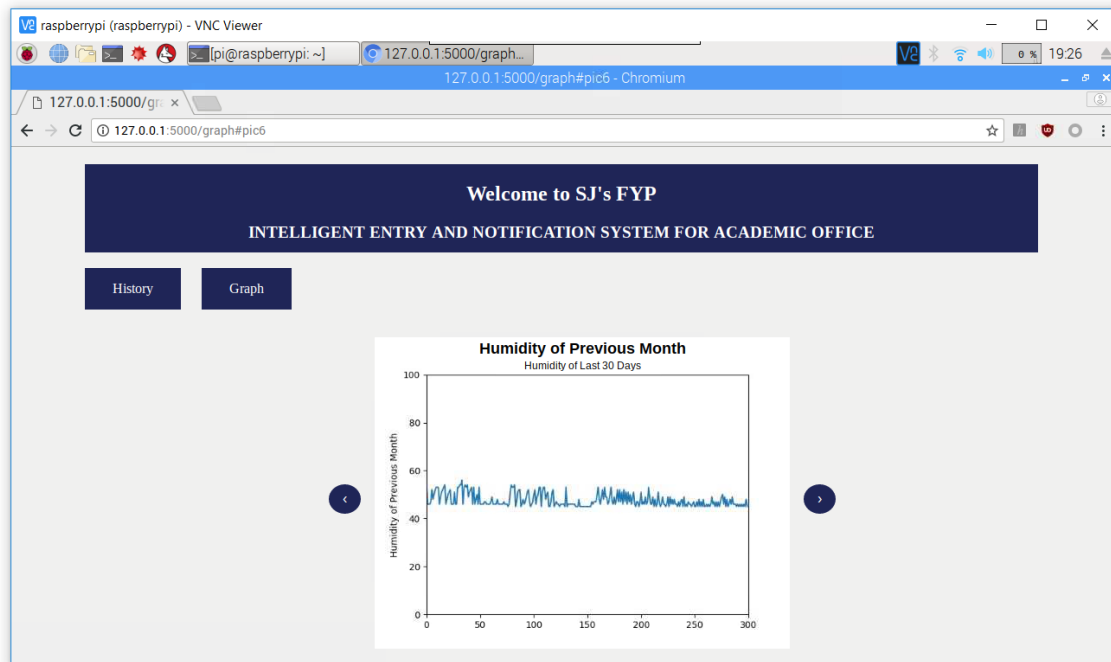


Figure 3.18: Webpage graph page (Humidity of Previous Month)

3-7 Database

The message and command will be store together with respective time and date while it is typed in the Telegram. The door status is checked every second, and it will be store together with respective time and date when there is a status change, means that when the door is opened or closed. The temperature and humidity data is collected every 10 seconds, and be stored in the database.

Table 3.4: Database Storing System

Data	Content	Checking	When to Store
Message Typed	Message, Time, Date	N/A	By Execution
Command Typed	Command, Time, Date	N/A	By Execution
Door Opened or Closed	Open/Closed, Time, Date	Every second	When status change detected
Temperature	Room Temperature	Every 10 seconds	Every 10 seconds
Humidity	Room Humidity	Every 10 seconds	Every 10 seconds

Table 3.5: Database Text File

Text File Name	Function
msgtestfile.txt	-store current message
msghistory.txt	-store all message (history of message)
temptestfile.txt	-store current temperature
humdtestfile.txt	-store current humidity
temphistory.txt	-store all temperature (history of temperature)
humdhistory.txt	-store all humidity (history of humidity)
commandhistory.txt	-store all commands (history of commands)
currentDoor.txt	-store current door status (0 or 1)
doorhistory.txt	-store when door is closed or opened

3-8 Coding

How to get the value of sensor, lock or unlock the door, and output the message to notification board by reading and sending the data.

```
DHT.read11(DHT11_PIN);  
int h = DHT.humidity;  
int t = DHT.temperature;
```

Written in void loop() to initialize the variables.

```
Wire.begin(slave_address);  
Wire.onReceive(receiveEvent);
```

Written in void setup() to start to send or receive data.

```
void sendDataTemp(){  
    int t =DHT.temperature;  
    Wire.write( t);  
}  
void sendDataHumd(){  
    int h =DHT.humidity;  
    Wire.write (h);  
}
```

These two functions act to send the values of temperature and humidity

```
void receiveEvent(int howMany) {  
    int numOfBytes = Wire.available();  
  
    byte b = Wire.read();  
    char string[16] = {}; //Initialize an empty string to later store the string get by Pi  
    for(int i=0; i<numOfBytes-1; i++){  
        char data = Wire.read(); // Read the byte one by one  
        string[i] = data; //Store the byte read into the empty string  
    }  
    if ((string[0] == '/')&&(string[1] == 'o')&&(string[2] == 'p')&&(string[3] ==  
    'e')&&(string[4] == 'n' ) )
```

```

{servo.write(45); //If the received string is /open, then unlock the door
}
else if ((string[0] == '/' )&&(string[1] == 'c' )&&(string[2] == 'l' )&&(string[3] ==
'o' )&&(string[4] == 's' )&&(string[5] == 'e' ))
{servo.write(135); //If the received string is /close, then lock the door
}
else if ((string[0] == '/' )&&(string[1] == 't' )) //If string is /t
{Wire.onRequest(sendDataTemp); //Request the temperature from the sensor
sendDataTemp(); //Send the temperature to the Raspberry Pi
}
else if ((string[0] == '/' )&&(string[1] == 'h' )) //If string is /h
{Wire.onRequest(sendDataHumd); //Request the humidity from the sensor
sendDataHumd(); //Send the humidity to the Raspberry Pi
}
else
{ lcd.clear();
//display number of bytes and cmd received, as bytes
lcd.setCursor(0, 0);
lcd.print("len:");
lcd.print(numOfBytes);
lcd.print(" ");

lcd.print("cmd:");
lcd.print(b);
lcd.print(" ");

//display message received, as char
lcd.setCursor(0, 1);
for(int i=0; i<numOfBytes-1; i++){
    lcd.print(string[i]);
}
}}

```

**//print the string that
is entered to LCD**

This code is to receive the command and do the task

How to lock the keypad by Remote

```
if (irrecv.decode(&results))
{
  if(results.value == 1386468383)
  {
    servo.write(45); //Unlock the door
  }
  else if(results.value == 3622325019)
  {
    servo.write(135); //Lock the door
  }
  else if(results.value == 4034314555)
  {
    lcd.clear();
    lcd.print("Keyboard Lock");
    KP.SetKeypadVoltage(0.00); //Lock the keypad by setting the voltage to 0
  }
  else if(results.value == 2747854299){
    lcd.clear();
    lcd.print("Keyboard UnLock");
    password.reset();
    KP.SetKeypadVoltage(5.0); //Unlock the keypad by setting the voltage back to 5V
    displayCodeEntryScreen();
  }
  Serial.println(results.value, DEC); //Checking purposes
  irrecv.resume(); //Receive the next value
}
```

This code is written in the void loop() for the remote part.

How the room status message works

```
if temp1 <20: //If temperature below 20
    tempmsg = " too cold. Be careful not to get a cold."
elif 21<= temp1 <28: //If temperature between 21 and 28
    tempmsg = " cool."
elif 29<= temp1 < 34: //If temperature between 29 and 34
    tempmsg = " warm."
else: //If temperature above 35
    tempmsg = " too hot. You need to open the air conditional."

if humd1 <40: //If humidity below 40
    humdmsg = "too dry"
elif 40<= humd1 <65 : //If humidity between 41 and 64
    humdmsg = "in good humidity condition"
else: //If humidity above 65
    humdmsg = "too humid"
```

This code is in website.py

```
Your room is {{humdmsg}} and {{tempmsg}}
```

This code is in website.html

So for example if the temperature is 29 Celsius and the humidity is 46%, then it will prompt the message “Your room is in good humidity condition and warm.” Please refer to Page 31, Figure 3.11 for the result.

3-9 Implementation Issue and Challenges

There are two types of challenges for this project, which are cost challenge and implementation challenge. The cost challenge is low for this project because the prices of the tools that are bought are not expensive. The hardware that are bought for example DHT11 the sensor, IR remote and receiver, 4x4 matrix keypad and others are just below RM20. The apps that are used which are Arduino IDE, Telegram, Fritzing, are all open source software and is free to download and use. The Raspbian used in the Raspberry Pi is also a free OS which can be downloaded free.

The implementation challenge for his project is also low. A lot of source code samples which are related to this project can be found in the internet. The items that are needed for this project is not hard to be get. The software can be downloaded easily and it is also not difficult to use.

3-10 Upgrades and Improvements from FYP 1 to FYP 2

This parts shows that the features of upgrades and improvements from FYP 1 to FYP2. The upgrades are as follows:

1. A hall effect sensor has been added to detect the opening and closing of door.
2. A database is created.
3. All the sensor values including temperature, humidity and hall effect sensor, also the commands typed, the message typed, are recorded into the database.
4. The graph of the timeline of the temperature and humidity is plotted.
5. A room status message is made which it will display different message according to the current temperature and humidity.
6. A webpage is created that shows the room status message, current temperature, humidity and room status, current message displayed on the LCD, history of message typed, commands typed, when the door is opened and closed, and the graphs of the temperature and humidity from time to time.
7. A better prototype has been implemented.
8. The LCD that displays the message, previously, is just able to display 1 line of message, now it can display 2 lines.

CHAPTER 4: METHODOLOGY AND TOOLS

4-1 Design Specification

To design and implement a multifunction and complex system, an appropriate design methodology is very important to complete the task. System development methodology is a framework which is used to structure, plan, and control the process of developing information system (Software development methodologies, 2016). There are 3 basic System Development Methodology which are Waterfall model, Prototyping Model and Spiral Model respectively. Design Methodology can help in estimate cost of the design of the system, make sure the quality and reliability of product in terms of function, reduce error and malfunction happened after produced so that avoid defected product. There will be discussion about hardware and software needed for the project after that.

4-2 Methodology

The methodology used is prototyping model. Prototyping model is an attractive idea for complicated and large systems which there is no manual process or existing system to help determining the requirements. When user's requirement is not clear and there is communication problem between developers and users, prototyping model is the best methodology. This model can debug easily and fix the error found immediately. That is the reason this model will be used for this project.

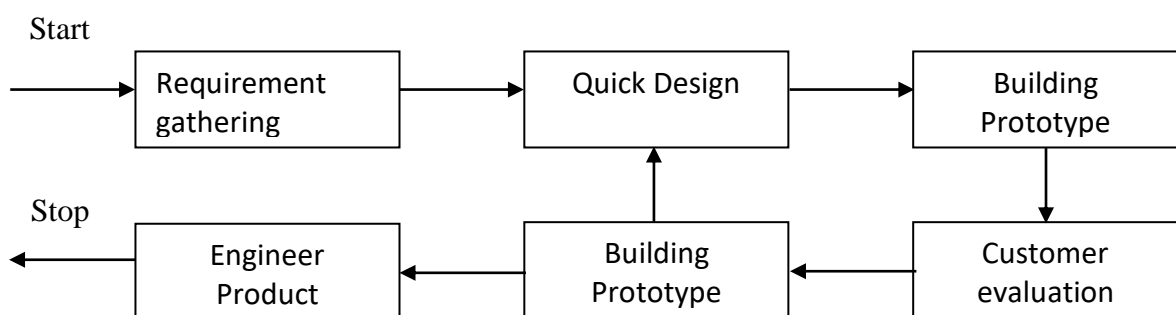
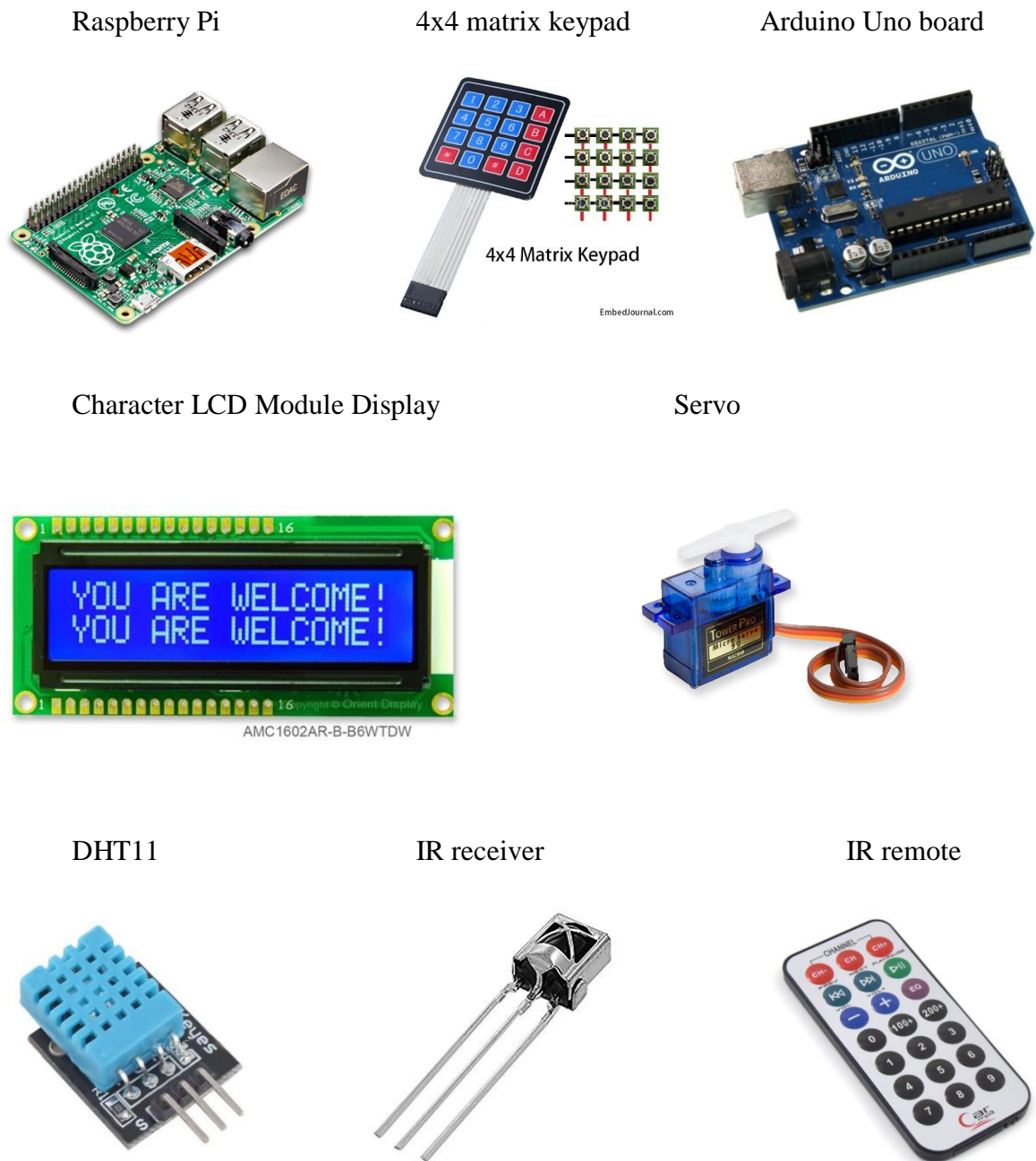


Figure 4.1: Prototyping Model

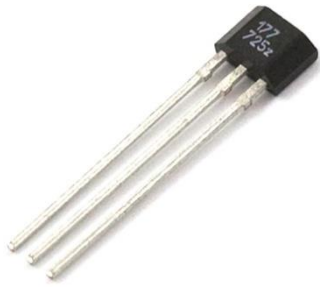
4-3 Tools

Figure 3.2 shows the hardware that is used in this project. The hardware that are used are Arduino Uno Board, Raspberry Pi, 4x4 matrix keypad, SG90 (Servo), DHT11 (Temperature and Humidity Sensor), IR remote and IR receiver, LCD 1602 Display (Character LCD Module Display), A1120EUA-T(Hall effect switch), magnet, LEDs, Resistors (10k and 1k ohm), Locker(created by using LEGO) and some wires.



Chapter 4: Methodology and Tools

Hall Effect Sensor



Magnet



Locker (LEGO)



Figure 4.2: Pictures of hardware used

CHAPTER 5: IMPLEMENTATION AND TESTING

5-1 Implementation

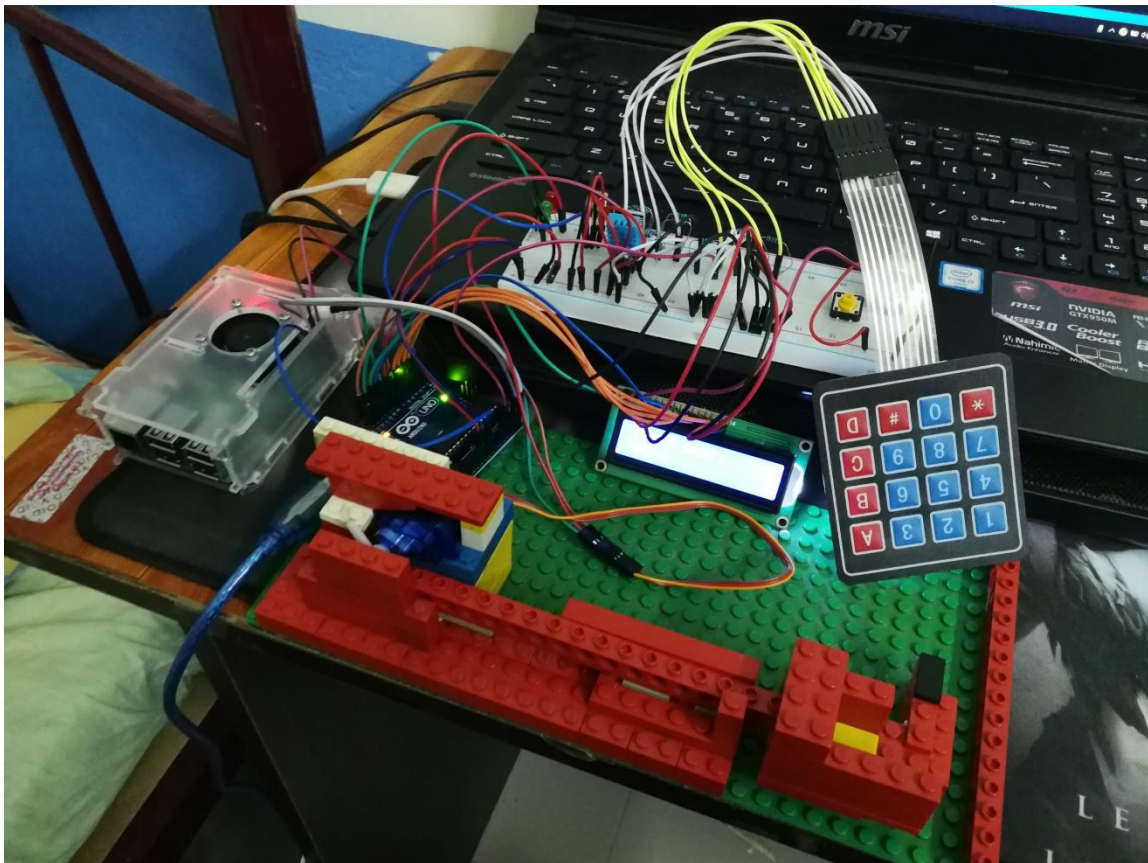


Figure 5.1: Prototype 1

Prototype 1 is used during FYP1. The prototype is upgraded to Prototype 2 and be used in FYP2.



Figure 5.2: Prototype 2

In this figure, the keypad is stick to the wall so that user can enter the password. The hall effect sensor and magnet is stick at the wall and the door so that when open and close it can be detected. The locker is installed on the door.

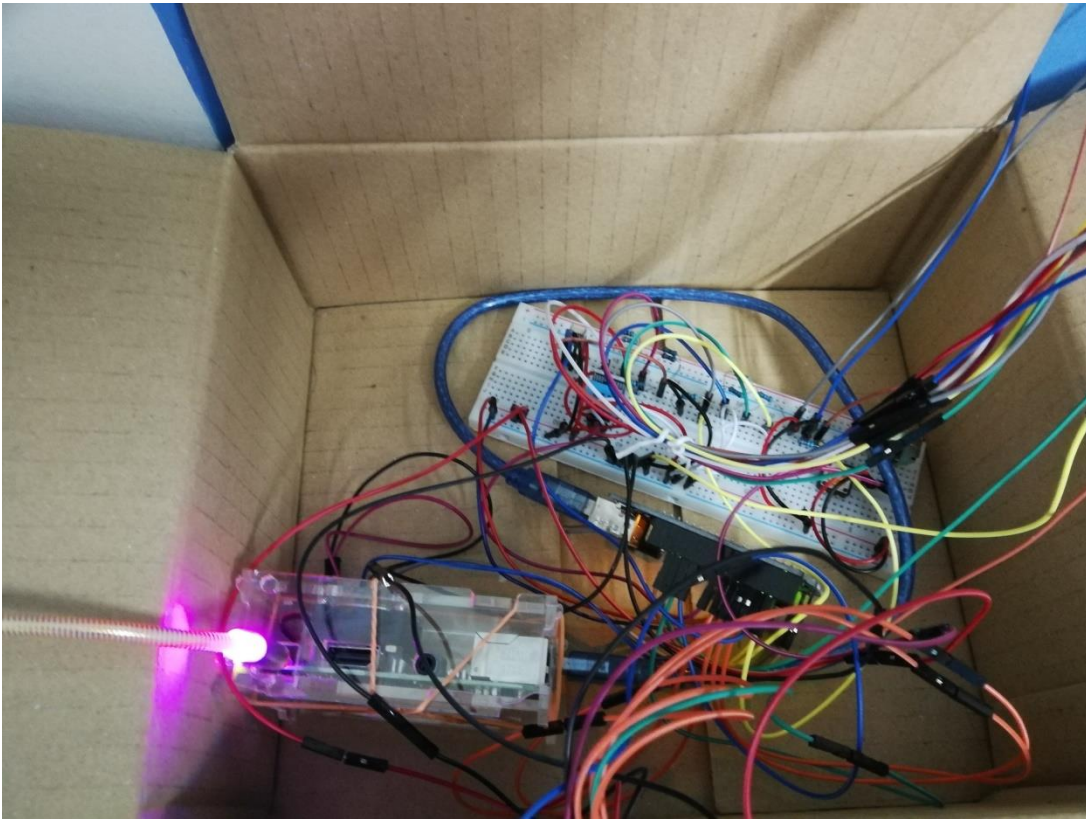


Figure 5.3: Prototype 2 inside the box



Figure 5.4: Prototype 2 Locker

5-2 Testing

There is a lot of testing that has to be done.

- i. 5 commands from Telegram
- ii. The message sends to the LCD to display
- iii. 4 buttons on IR remote
- iv. Keypad
- v. Webpage

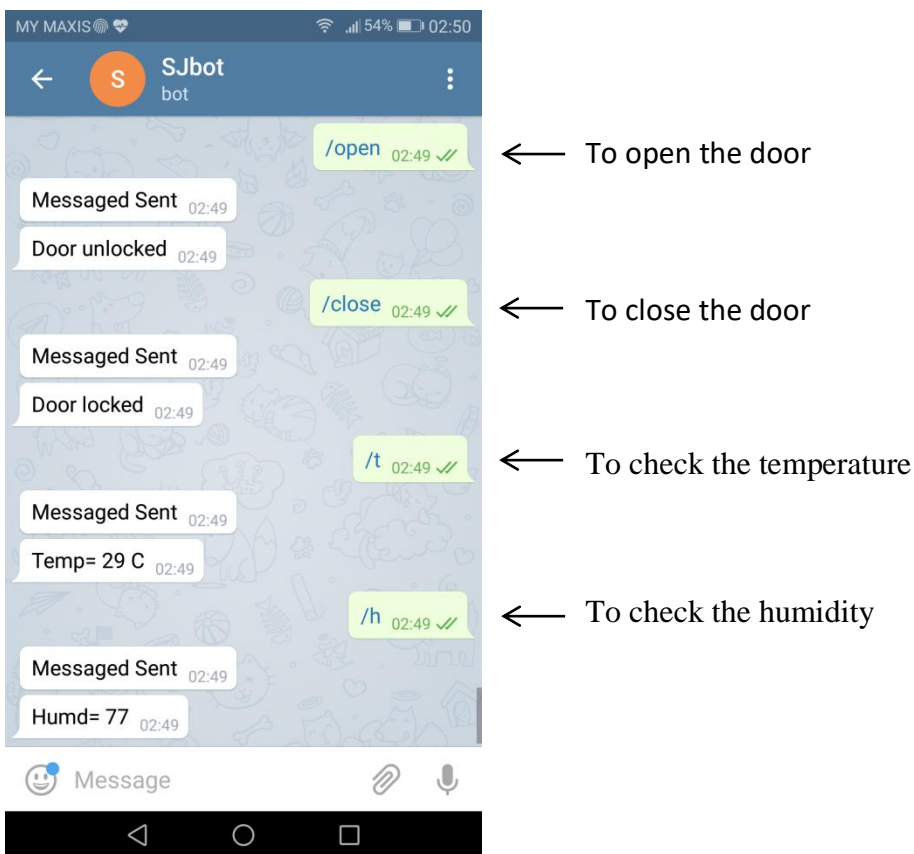


Figure 5.5: Commands of Telegram

Figure 5.5 shows the commands that have been typed and it can be seen that the temperature and humidity can be retrieved. The “Door unlocked” and “Door locked” message indicated that the correct command has been type. To see the result of these 2 commands, please refer to Figure 5.6 and 5.7.



Figure 5.6: Lock Opened

Figure 5.6 shows Prototype 2's lock has been opened. The lock will be open when the command `"/open"` has been typed and send in Telegram. It will also open when the `"PREV"` button is pressed in the IR remote. By typing the correct password at the keypad, it will also unlock the locker.



Figure 5.7: Lock Closed

Figure 5.7 shows Prototype 2's lock has been closed. The lock will be close when the command "/close" has been typed and send in Telegram. It will also open when the "NEXT" button is pressed in the IR remote. By pressing 'A' at the keypad, it will also unlock the locker.

Chapter 5: Implementation and Testing

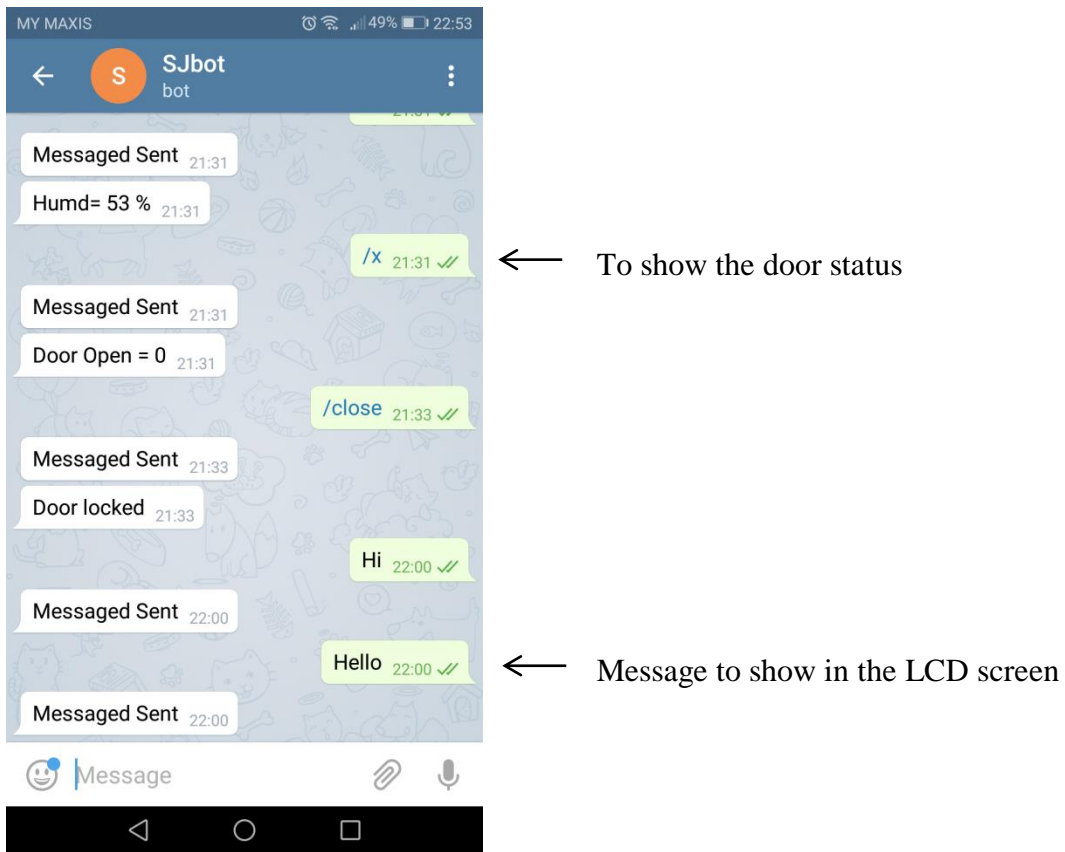


Figure 5.8: Message of Telegram



Figure 5.9: Message Shown

Chapter 5: Implementation and Testing

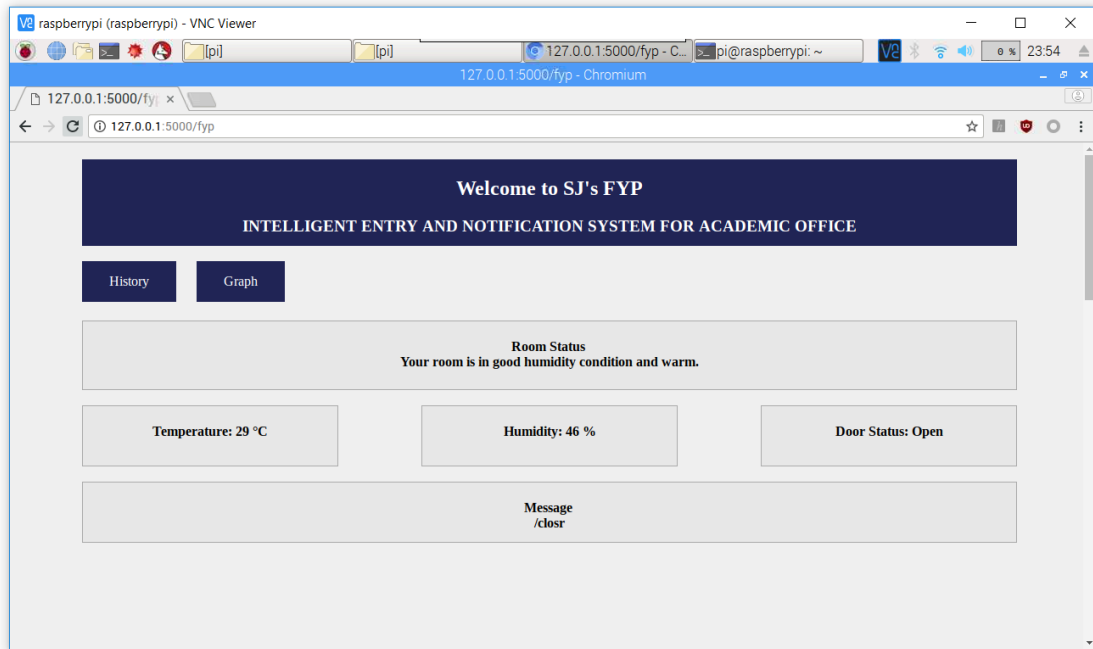


Figure 5.10: Webpage main page

Figure 31 shows that the details that are retrieved such as temperature, humidity, door status and message are correct. Some of the details such as Message can be checked through history page by clicking the “History” Button and scroll to the most bottom part.

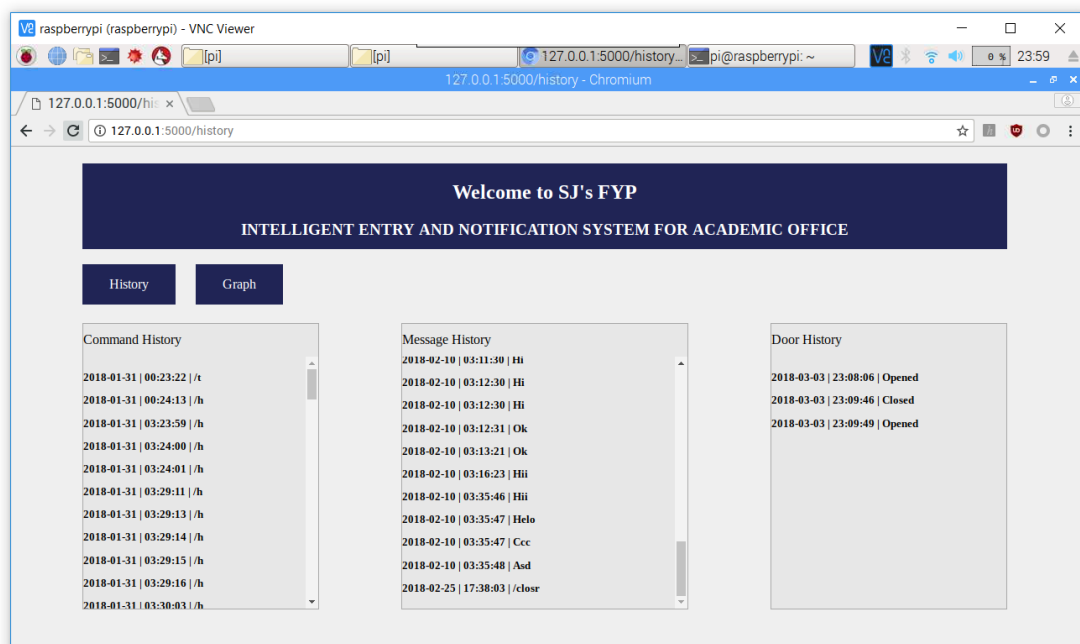


Figure 5.11: Webpage history page

5-3 Improvements

These are the summary of the improvements. The LCD that displays the message, previously, is just able to display 1 line of message, now it can display 2 lines. Currently, the data are now kept in the database so that the data can be retrieved to be observed. All the hardware are now kept in the box properly so that it can be carry to any place to be installed.

5-4 Limitations

There are some limitations for this project. These limitations are just small problems. The first one is the message that is sent through Telegram to the LCD is limited to 32 words. This is because it can only transfer 32 data to it at one time. The second problem is the IR remote and sensors are not good, as sometimes it cannot be detected properly. For this problem, if a better hardware is used, this problem will be fixed.

CHAPTER 6: CONCLUSION

This report is written about the design and implementation of intelligent entry and notification system for academic office.

The problem is the system security is not good enough. If a door is easily unlocked by other people, or when the door is unlocked by other people but not traceable, then it is not safe and this is a problem which needed to be fixed. It is not convenient for people to text or calls the person that they need to find in the office without an advanced notification board which can be updated as fast as possible. It is also not convenient if people forgot their keys which left at home, or lost their key, and they are unable to open their door.

The motivation is to give security to the office in universities or companies. It also the notification system gives convenient so that to reduce time for the other people to contact the user. With internet and smart-phone, users may be able to update their current status to the LCD screen so that everyone in the office will know. By using mobile phone to open the door using Internet, users don't need to worry about forgetting to take their keys or losing their keys.

One of the ways to solve the problem is the electronic notice board, which is the LCD screen, which the status can be updated by sending it through the Telegram app. The security system is improved by locked system keypad which means the keypad can be locked. The door can be unlock or lock by using an app using wifi or data connection. The door can be also lock and unlock using remote. The time and date of the door being open and close will be recorded in the database, so the security is secured. A monitoring system of temperature and humidity is also provided to monitor the status of the room.

Appropriate hardware and software is used as they are the crucial component to make this project. The hardware used is Arduino Uno board which is main hardware, connected to several sensors and Raspberry PI, and also connected to the Telegram Android apps which is the software. This project uses Python, C, HTML and CSS programming language. Some Linux command prompt is also used while installing the drivers or library for the Python coding.

The problem which is encountered during the whole project development is the value of the sensors is very hard to be retrieved correctly. Many times of modifications on the code has been made to get a good result.

Chapter 6: Conclusion

There are some improvements or further developments that can be made for this project. The first one is an automated message display, means that the system will detected the time the user go out of the room, and to prompt message on the LCD, for example like if the user leaves at between 11am to 1pm, then the LCD screen will automatic display the message saying that the user has went out for lunch. The second one will be a complex system which is an artificial intelligent system that can collect the data of when and what time the user when out or come back to the room, and the AI will automatic lock and unlock the door for the user. This will be a very difficult and complicated work to do.

In conclusion, this project will serve to be a convenient tool to be used in daily life. This project is completed in FYP 2.

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ABSTRACT

marks internet has become one of the most common ways in the world of communication. It has become an important part of our daily lives. It can be defined as a global information system which is defined as a network of computers and servers that are interconnected by a network. It is used to send and receive data, such as text, images, audio, and video. It is used to connect people and devices across the world. It is used to share information and resources. It is used to communicate and collaborate. It is used to create and share content. It is used to connect people and devices across the world. It is used to share information and resources. It is used to communicate and collaborate. It is used to create and share content.

INTRODUCTION

document of this project is the security of the web system. It is not just good enough to have the data of the user, whether the user is a student or a teacher. It is not just good enough to have the data of the user, whether the user is a student or a teacher. It is not just good enough to have the data of the user, whether the user is a student or a teacher.

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