UTM
UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF ENGINEERING

SCHOOL OF COMPUTING

SEMESTER 1/20212022

SECP1513 – TECHNOLOGY INFORMATION SYSTEM

SECTION 02

PROJECT – PHASE 2 (PROJECT PROPOSAL)

[IoT- SMART LOCK]

LECTURER:

DR. IZYAN IZZATI BINTI KASMANI

GROUP NO: 03

Name	Matric ID
ANG YI QIN	A21EC0163
YEW RUI XIANG	A21EC0149
LAU YEE CHI	A21EC0042
FONG KHAH KHEH	A21EC0026

TABLE OF CONTENT

INTRODUCTION

1.1 Overview of Project

This project was about the smart lock that related to the Internet of Things (IoT) technologies which is one of the 4IR technologies. A smart lock is one of the IoT technologies which is able to improve the safety system in many different places such as campuses, houses, offices, and others. In further detail, the smart lock is a keyless entry device that is compatible with other IoT devices, smart assistants in order to operate a Smart Home Management System. The user can access doors remotely with an application that is installed on the phone and thus, it enables users to unlock their door without a key. In another word, the smartphone application is distributed as virtual keys which are more secure compared with traditional physical keylock.

1.2 Problem Statement

a. Traditional Padlock

- Users have the responsibility to keep keys
- Unable to unlock without their keys
- Easy to break through since users are unaware of their doors' security
- Easy to become rusty, causes users difficult to unlock/lock
- Short Life Span
- Less secure as keys can be duplicated
- need to make copies of a key or leave key
- No recorded data about the time and people enter/exit through the door

b. Password Lock

- Unable to unlock if users forget password
- Easy to break through since users are unaware of their doors' security
- Less secure once the password is deciphered
- Low efficiency as much time required to unlock
- No recorded data about the time and people enter/exit through the door
- High cost
- Passwords are easy to break

1.3 Proposed solution

The proposed solution is to create a smart lock system with IoT-based technology that will improve the security of the gates and doors by providing an automated and convenient security management system that is efficient, easy to handle, and updated in real-time.

The smart lock performs security functions as it is less likely to be broken into by thieves or outsiders and protects the expensive items in your house. The smart lock is a digital lock that has dual types system------biometric lock system and smartphone application system. A biometric lock system is a system that users activate these locks with their fingerprint or retina. A smartphone application system is a system that allows users to use the application on their phone to unlock the door.

To illustrate, the fingerprint sensor and retina sensor will be designed in the smart lock. Furthermore, an application also will be created for the smart lock. They can be controlled remotely using a smartphone application. The application will have a lot of functions such as unlocking records and remote updates. As a result, all the designs of the smart lock are for improving the security system and anti-theft system.

1.3.1 Feasibility Study

a. **Compatibility**

As Smart Lock is conducted as one of the IoT devices in Smart Home, it offers additional functionality through compatibility with other IoT devices, smart assistants, and Smart Home Management System. In further detail, there are some functions included while users unlock the doors through Smart Lock. For example, turning on lights in the common area and adjusting the thermostat at home when the door is unlocked. By applying this technology, it could be one of the important steps to realize the progress of Smart Home.

b. Security and Safety

Smart Lock plays an important role as the main security guard for our home's safety. If the door is unlocked out of expected time, the Smart Lock will trigger the security system to record and send a video of situations outside.

Besides, a Warning alarm will be triggered to notice neighbours around if there is someone unknown breaking through the door in an aggressive way.

c. Accessibility

The Smart Lock supports different account permissions. The authorized user can assign passwords to visitors remotely via a smartphone app and make restrictions on when and how long it can be used. Besides, since the Smart Lock supports different account permissions, the authorized user can give authorities the unlocking door to trusted friends or family members.

1.4 Objectives

In today's society, security is a topic of concern for everyone. So, the emergence of smart locks is to improve the security of your house. The smart lock is used to ensure and improve the security system by providing a convenient and automatic method that is easy to handle. We do not need to make copies of a key that is easy to lose because smart locks do not need to use a key to unlock the door and gate. It is a keyless lock that allows you to open the door without a physical key.

Furthermore, it is one finger for everything. We only need to use our fingers to control the application on the smartphone to unlock all the doors it needs to open. Therefore, we do not need to carry a bunch of keys. The smart lock can connect to your home's WiFi network, which allows it to receive the smartphone command to lock or unlock. It is a convenient tool for those who often forget their keys or forget to lock their doors.

As a result, a smart lock is a device that makes you wonder how you ever lived without it. With smart locks, you can ditch your keys and enjoy the safety and convenience of managing your lock wherever you are.

1.5 Scopes

This item is suitable for all users in different fields and it is specially designed for use at places such as campuses, houses, offices, and others for security purposes.

AWS ARCHITECTURE DESIGN

2.1 Scopes Boundaries of Database Application

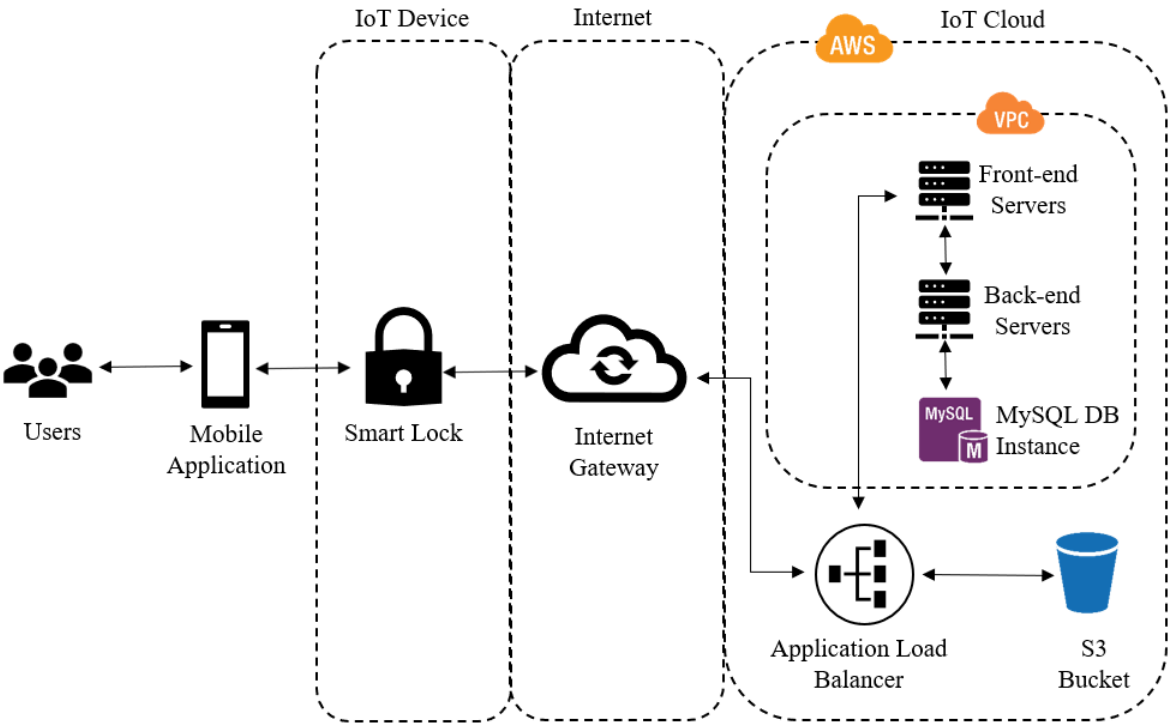
The system proposes high usability and a reliable digital lock system using IoT. This smart lock is equipped with a biometric scanner for thumb or retina impressions. Before the use, users need to be authorized and their details will be stored in a database or cloud storage.

Only the users have the right to control the smart lock using the smartphone application system. The authorized user can give and revoke remote access to visitors. If the person is a guest, he/she needs to be recognized by the biometric scanner with the control of the system by the person who is authorized. Hence, Smart Lock not only enables authorized users to access the door at specific times but also gives unlimited access to trusted friends or family.

This smart lock is able to store data for 5 people to be recognized by the scanner for automatically unlocking purposes. Authorized person can view their details through the smartphone application system, checking on the status of a door remotely, ensuring it is locked no matter how far from home they are. For any unlocking of the lock, the image captured will be recorded and stored in the database or cloud storage.

The users can view the enter-and-exit records through a smartphone app. If the person who is not recognized by the biometric scanner uses the smart lock, a piece of alert information will be sent to the authorized person. And hence, the authorized person will receive a notification whenever the door is opened, allowing users to be immediately alerted in case of unexpected access.

2.2 AWS Cloud Computing Architecture



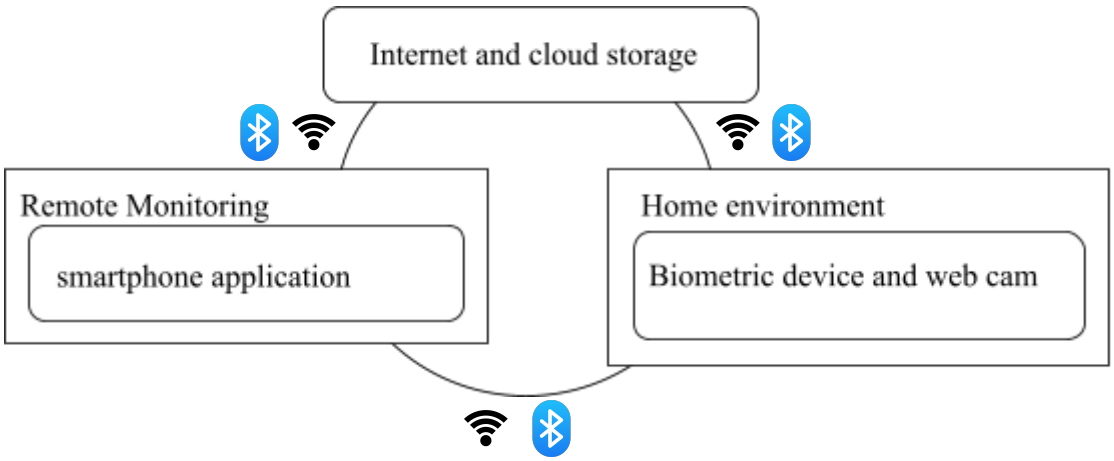
Back-end Server – The back-end server runs the code behind, receiving requests from the clients and sending the appropriate response back to the clients. For the database, the back-end server will persistently store all of the data for the application.

MySQL DB Instance – In our design, MySQL DB instance is used to create a MySQL DB instance and connect to a database by using AWS Management Console (Amazon Relational Database Service under database section).

Application Load Balancer – Load balancing is essential in a cloud environment with multiple web services, and hence, Application Load Balancer plays an important role as a feature of Elastic Load Balancing. It allows developers to configure and distribute incoming end-user traffic to applications based in AWS public cloud.

S3 Bucket – S3 Bucket is a public cloud storage resource available in Amazon Web Services' Simple Storage Service (S3). Basically what S3 Bucket does is provide object (file) storage through a web interface for storing, protecting, and retrieving data within resources, so-called "buckets".

2.3 Infrastructure of Iot System (Major User Views)

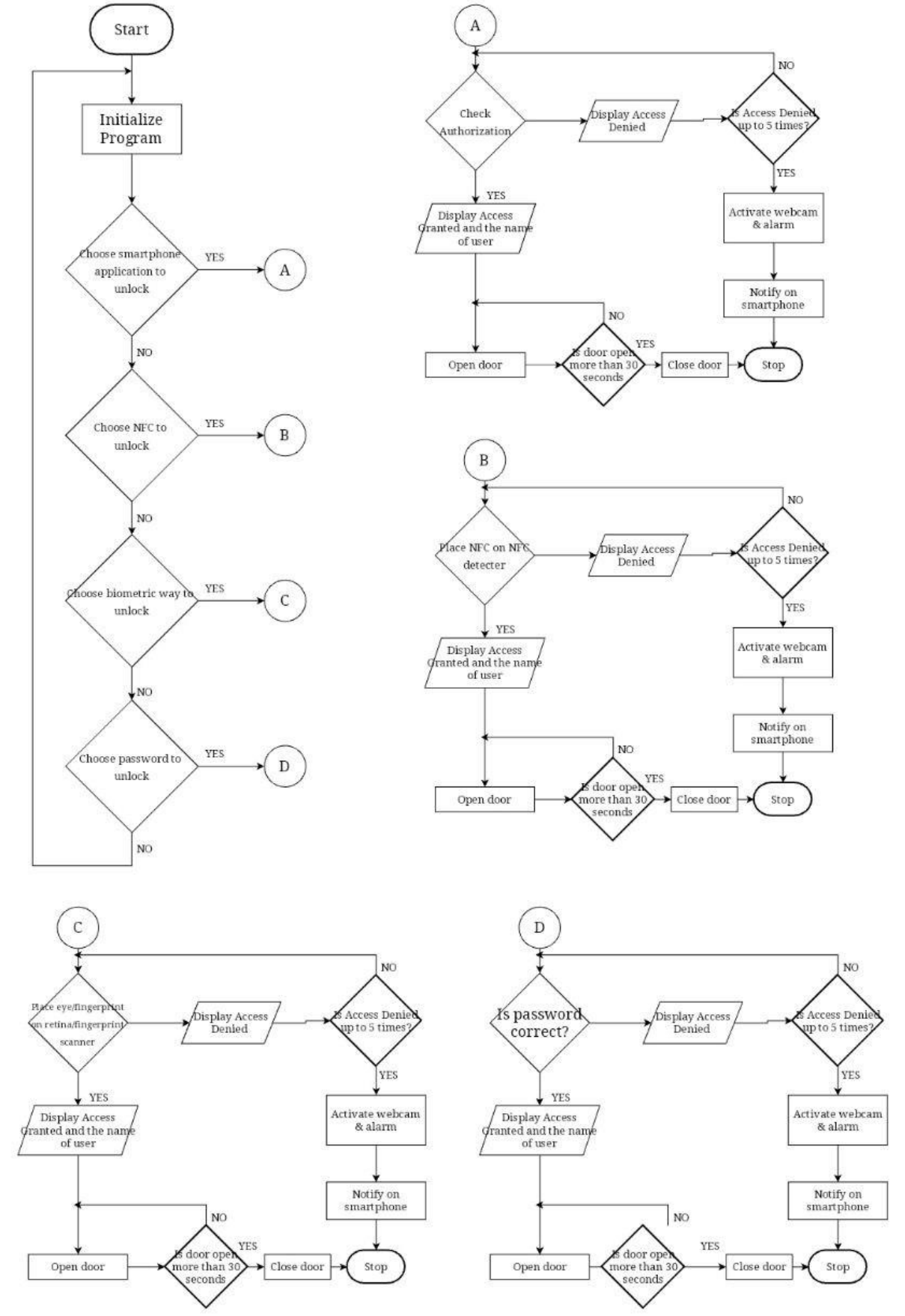


As the vast variety of devices can start communicating with each other new business and functionality will bloom. However, as connectivity increases, transmissions will be harder to control and more intermediates will be included in global systems, resulting in an expanded surface of the potentiality for IT attacks. And large amount IoT devices will be made out of simple electronics with no capability of authorization, making devices easy to hijack and exploit. Thus, in our design of infrastructure of the IoT system above, there are three particular characteristics worth mentioning, Internet and Cloud storage, Remote Mentioning and Home Environment. For Internet Cloud storage, AWS Cloud is chosen for the database and storage system in which the architectural designs shown above is designed for the Android Application. For Remote Monitoring, a smartphone application is used to monitor the authorisation of smart door lock by the host in deciding who can unlock the door. Lastly, for home environment, biometric device and webcam are installed in our smart door lock as manual ways to unlock doors. Biometric device which detects the retina while unlocking the door while a webcam detects strangers or unknown people around. Besides, as mentioned in our Project Part 1, there are two types of network design implemented in the system, which are Direct Internet Connection (DIC) where the lock device is directly connected to the internet via WiFi, giving a direct established connection the API and the database, and Device Gateway Cloud (DGC) which is our back-up network design while in emergency or disasters caused the break-down of the internet (lost of WiFi connection). DGC serve as a wireless access portal to give Smart Lock access to the Internet by connecting the user's devices to Cloud IoT Core through HTTP protocol like Bluetooth beacons protocol.

2.4 Business Flow (Consumer Internet of Things)

There are two different spheres to the business model concerning the IoT systems which are business-to-business and business-to-consumer. Business-to -consumer delivers the products to the end-user whereas business-to-business targets enterprises. In our project, our main focus in this study will be oriented towards the end-users (business to customer) because they are more exposed to IoT attacks due to the lack of technical expertise and deployment of protection methods to avoid any potential attacks. For the flowchart diagram below, we have our smart lock flow in customer view (front-end view) in flowchart form. As we can see in flowchart, there are several keyless ways to unlock the door through smartphone application, NFC, biometric ways and password.

**For clearer view of flowchart, please refer to this webpage: Flowchart


Start
Initialize Program
Choose smartphone application to unlock
YES
A
NO
Choose NFC to unlock
YES
B
NO
Choose biometric way to unlock
YES
C
NO
Choose password to unlock
YES
D
NO
A
Check Authorization
Display Access Denied
Is Access Denied up to 5 times?
NO
YES
Activate webcam & alarm
Notify on smartphone
YES
Display Access Granted and the name of user
NO
Open door
Is door open more than 30 seconds
YES
Close door
Stop
B
Place NFC on NFC detecter
Display Access Denied
Is Access Denied up to 5 times?
NO
YES
Activate webcam & alarm
Notify on smartphone
YES
Display Access Granted and the name of user
NO
Open door
Is door open more than 30 seconds
YES
Close door
Stop
C
Place eye/fingerprint on retina/fingerprint scanner
Display Access Denied
Is Access Denied up to 5 times?
NO
YES
Activate webcam & alarm
Notify on smartphone
YES
Display Access Granted and the name of user
NO
Open door
Is door open more than 30 seconds
YES
Close door
Stop
D
Is password correct?
Display Access Denied
Is Access Denied up to 5 times?
NO
YES
Activate webcam & alarm
Notify on smartphone
YES
Display Access Granted and the name of user
NO
Open door
Is door open more than 30 seconds
YES
Close door
Stop

PROJECT PLANS

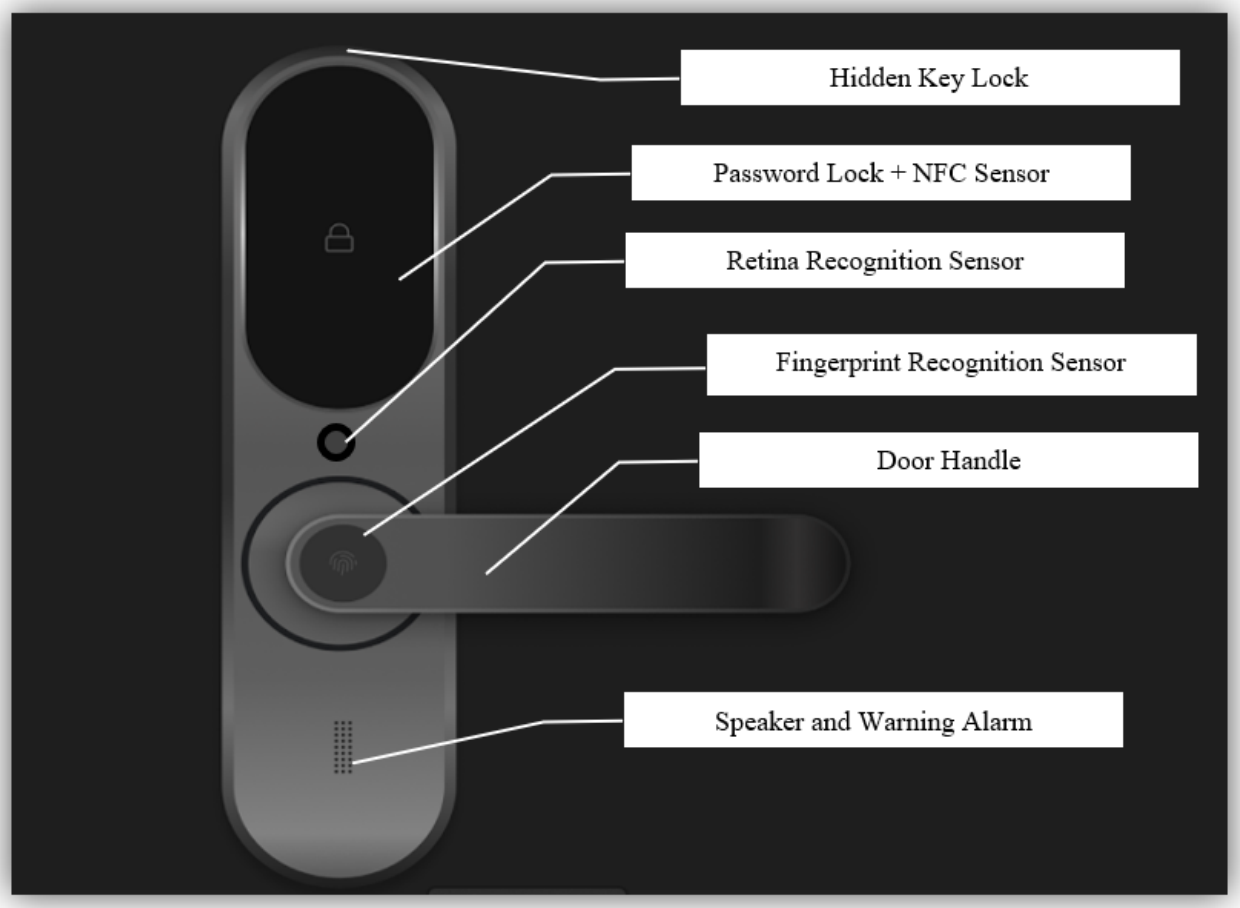
3.1 Gantt Chart

Task	Day 1	Day2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
1. Problem background										
1.1 Overview										
1.2 Problem statement										
1.3 Proposed solution										
1.4 Feasibility study										
1.5 Objectives										
2. System boundaries										
2.1 Scopes Boundaries of database application										
2.2 Major user views										
3. Project plan										
3.1 Human resource										
3.2 Work breakdown										

structure										
3.3 Gantt Chart										
4. Benefit and summary of proposed system										
4.1 Benefit										
4.2 Summary of proposed system										
5. Reflection from workshop 1										
5.1 Reflection										

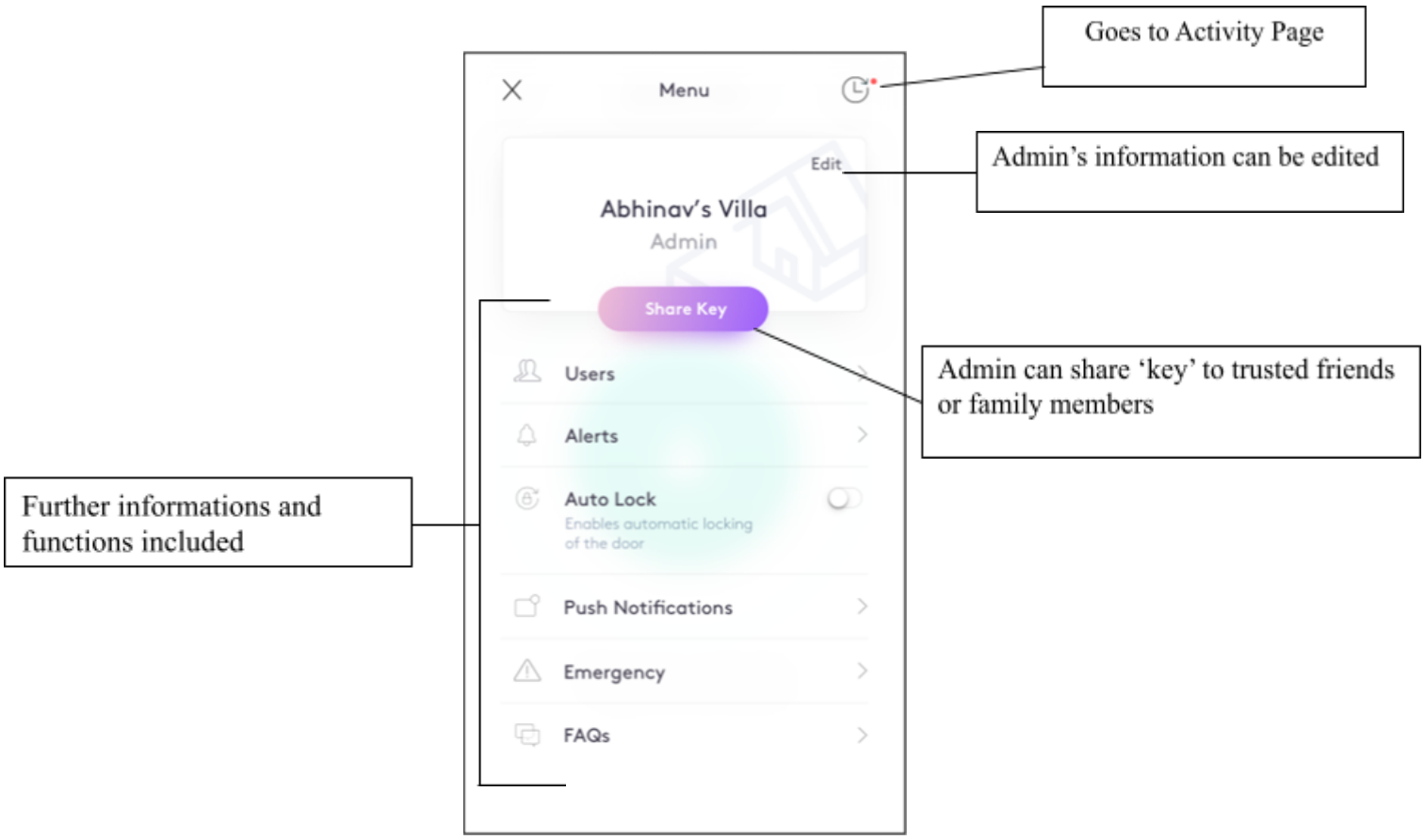
LOW FIDELITY MOCK-UPS

4.1 Smart Lock

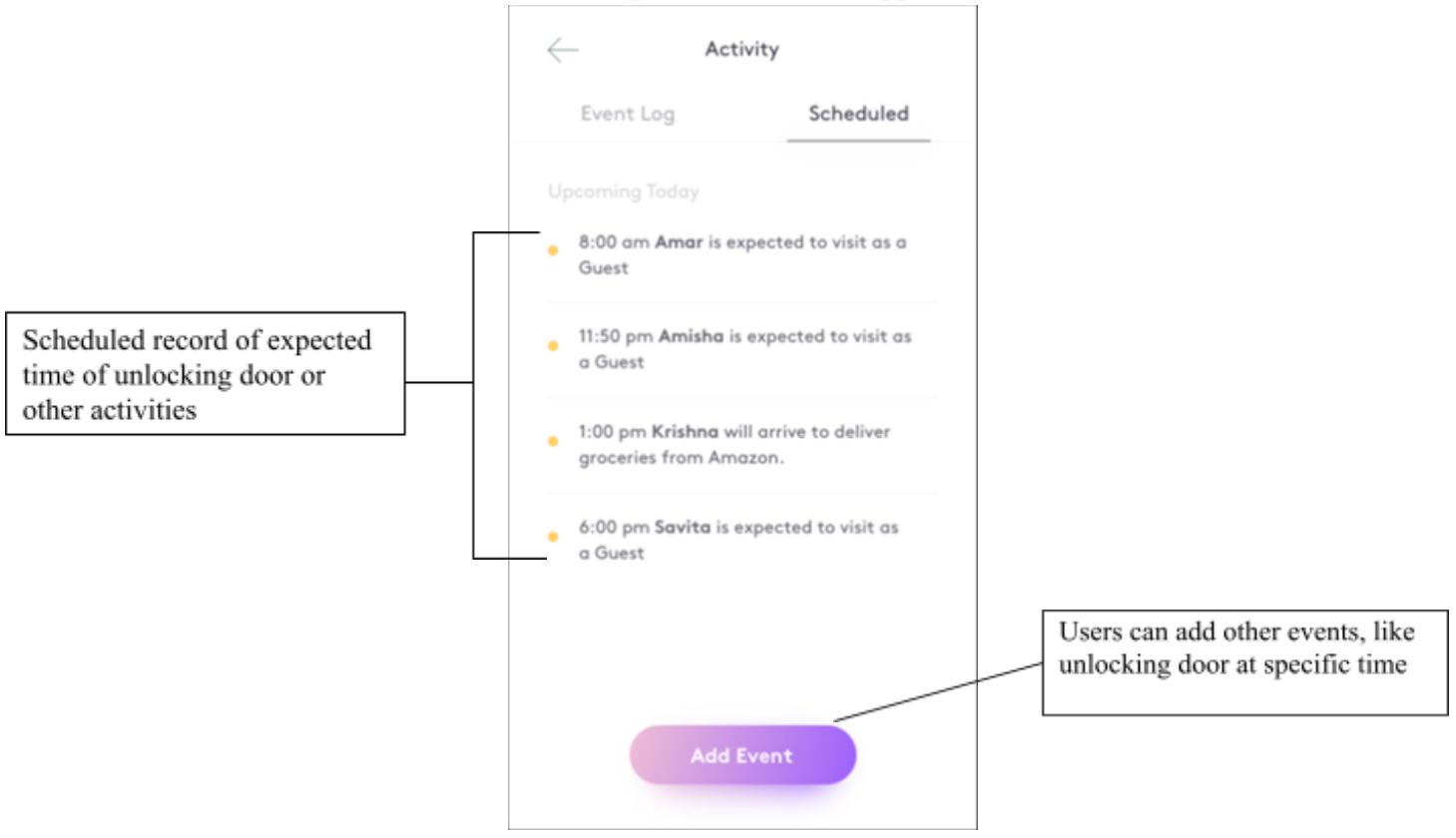


The figure of Smart Lock

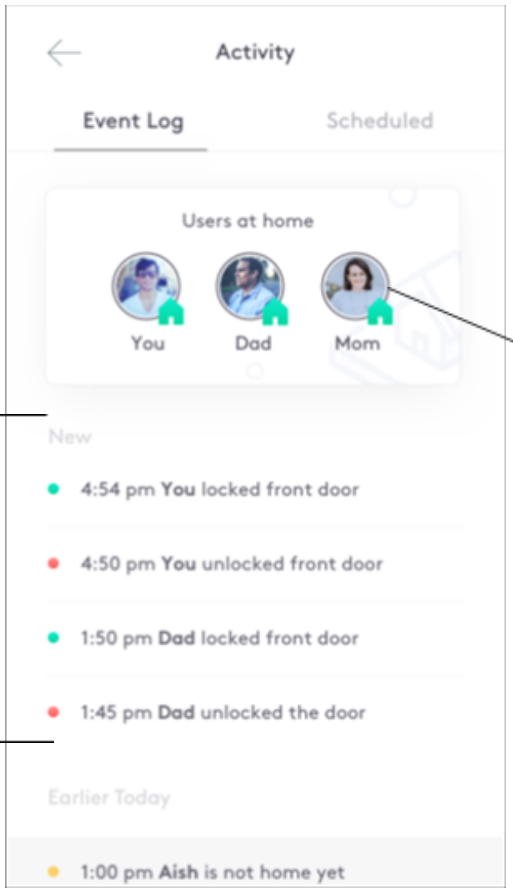
4.2 Smartphone Application for Smart Lock (Schematic Diagram)



Admin Page of Smart Lock App



Scheduled Record in Activity Page



All the users are stated here who have authorities to unlock/lock the door

Records of enter-or-exit by any users

Event Log Record in Activity Page

BENEFIT AND SUMMARY OF PROPOSED SYSTEM

5.1 Benefit

There are numerous benefits to this newly invented Smart Lock. First and foremost, there are six unlock options for the user to unlock the lock even if they are not at home. The six unlock options are [**fingerprint unlock, pin unlock, the smart app unlocks, NFC unlock, retina unlock, and also a backup key.**] Users can feel relieved with the use of smart locks as if there is no electricity at their housing area, the Smart Lock can use the stored battery to keep on functioning like a smartphone or laptop in which it is a keyless smart lock that avoids the lost keys and is unable to open the door.

Besides the numerous unlock ways, the newly invented smart lock can also prevent thieves as the Warning Alarm is also included in the Smart Lock system. Once there is someone trying to enter the house, the Warning Alarm will ring and the people around will notice that someone is trying to enter the house in an aggressive way. With this Warning Alarm system, users are more relieved when they are not at home for work or having a vacation. Apart from that, users can let their guests into their house even if they are not at home. For example, users can use the Smart App unlock to control the Smart Lock so that the guests can enter the house but not wait outside the house.

5.2 Summary of Proposed System

The purpose system improves the usability and high reliability of the digital lock system using IoT. This smart lock is very useful in providing security and reducing the human resources in the smart home. By the implementation of the proposed method, the safety of authorized and guest users are guaranteed. All the information and data collected can enhance the speed of tracking the users. A keyless door lock implemented also can avoid the trouble when forgetting to bring the key.

REFLECTION

6.1 Reflection

a. What have you learned and your motivation to complete this project?

b. What issues and solutions are implemented to make the project a success?

c. What is your direction after completing this project?

d. What is the improvement necessary for you to improve your potential in the industry?

YEW RUI XIANG:

After struggling for a few months to complete this project, I really feel that I have learned too much knowledge and also soft skills in this project. I have learned the way to create a report and what the essential things that need to be included in a report are. This project also provided a chance for me to enhance my acknowledgment about the IoT and Smart Door Lock as I was required to find some related information in order to complete this project. Not only that, I also have a great improvement in my soft skills such as critical thinking skills, team-working skills and communication skills that are very useful in shaping myself to become an all-rounded graduate and thus improve my employability in future. It became my motivation to complete this project as this kind of project was the first time I got in touch with and I was interested in doing such challengefull task.

In order to complete this project, my groupmates and I have discussed the design of Smart Door Lock, the problems facing while completing the project, and the solution proposed to tackle the problems. We also did this project with a separate tasks method and each of us also showed a high responsibility toward our own task. Not only that, all of us are willing to help each other for those who are facing problems. Thus, from my own perspective, I think the keys to make the project successful were the highly cooperation of group members and the useful discussion meeting for sharing ideas and finding solutions to be implemented.

After completing this project, I would like to learn more about the Internet of Things (IoT) and its other applications such as Smart Watch, Smart Light and so on. This is because I am very interested in such fields and hope that what I learned from this project can be implemented in my future. In my opinion, the improvement that is necessary for improving my potential in the industry are hard skills and soft skills. These skills will be a good tools for me in order to enhance my employability and work performance.

FONG KHAH KHEH:

I have learnt a lot of knowledge and gained valuable experiences in this project that I would not normally access in daily life. Through this project I also got to know more about 4th Industrial revolution technology such as cloud computing and Internet of things. I also learn how to use Figma to design an application page. These knowledges are very helpful for my course, so I put a lot of concentration on this project. I also learned how to write a full report and know the format. These skills will be very useful to me in the future workplace.

The motivation makes me to complete this project and makes the project a success is teamwork. Teamwork is very essential to us. I believe that the presence of teamwork increases the possibilities of attaining a higher degree of effectiveness and efficiency in work. I also believe that it provides a better performance leading to superior outcomes because the weakness of some particular individual belonging to the team may be compensated by the strength of another. For example, we had a meeting before starting the project. As we all known that communication is needed between teams in order to allocate task fairly and produce better performance. If we lack of communication, teamwork will not exist and the project will be ruined.

After completing the project, I have planned to look into other 4th Industry revolution technologies such as Augmented Reality and Big Data Analytics. The improvement necessary for me to improve my potential in the industry is soft skills. There are many elites in the technology sector who are not only strong in hard skills but also in soft skills such as leadership and communication skills. Therefore, all these skills are very useful to us. I think I need to participate in many industry talks to upskill myself .

LAU YEE CHI:

There are so many new things that I have learned throughout the progress of this project. From the design of the IoT system to the end of the low fidelity product, I learned about several types of network infrastructure that can be applied in our project, the basic structure of the IoT security system, and the cloud storage that we implemented in our application. I learn to design our AWS architecture which is applied for our application database system and also use online software to design our low fidelity mock-up. These are my first try at doing these hands-on designs and we learned a lot from them. My motivation to complete this

project is my desire to know and learn more about this IoT system and cloud which is burgeoned after listening to industrial talks 5 and 6 about network infrastructure and IoT systems as many interesting topics discussed are given in the talks which are useful in our project.

It is undeniable to say that it is not easy for me to complete all these new things for me and there are some issues faced while doing the projects, in which I have seldom knowledge on this IoT security system. Hence, I have to do lots of research on the Internet to fill my knowledge gap in order to complete every task in this project which took me lots of time to digest and master. Honestly to be said, the industrial talks gives me much courage and confidence to learn continuously about this IoT system since we have a golden opportunity to ask questions and receive suggestions, advice from the professors and expectations from different fields. After struggling and learning, we successfully applied this knowledge to IoT systems and Cloud in our project.

After completing this project, I am clear about what my passion is for the data field and back-end work. I wish to learn deeper about useful knowledge applied in back-end works especially in the database management system of an application. Besides, I am much clearer now on which parts are more tougher to complete in back-end developer's work and it is essential for me to study continuously on the progress of these back-end works especially on database stuff in order to handle these tough works.

The improvement necessary for me is the skills that apply the knowledge learned on certain projects which can contribute and help to perform the project in a better way. That is the direction I am fighting for my future career path as preparation. Like what I have mentioned above, I am clear what is more tougher in these works and how I will fight against and overcome it is keep learning and try to apply what I learned to the coming tasks and projects.

ANG YI QIN:

Based on this project, the knowledge that I have learned is uncountable. Not only knowing more about the Internet of Things, but I have also learned how to work as a team to produce a wonderful project for implementing a smart door lock with my fellow group mates. As a saying goes, many hands make light work. In my opinion, my groupmates and I are doing great throughout the entire project. We faced problems during the discussion session, but we successfully overcome them in the most suitable way. With this, I have learned how to

communicate with others in a proper way as we need communication to know what is the proper way to solve difficulties that we faced. The motivation for me to complete this project is most probably from my supportive groupmates. They will never give up and cheer each other up when some of us are lost. Besides, we used the knowledge that was learned during the industrial talks by the profession of different fields.

In fact, if I was the one who is doing this project, I will be unable to complete it in such a perfect project that my group and I did it together. One of our group mates initially have an idea of implementing the Smart Door Lock, others of us agreed with this creative idea. However, we are struggling with whether to choose the smart home system, smart chair system, or Smart Door Lock. We finally decided to choose Smart Door Lock as the topic of our project. Then, we figure out what system should be included in our Smart Door Lock system. In conclusion, we have decided that the Smart Door Lock can be unlocked using different ways, such as fingerprint unlock, pin unlock, the smart app unlocks, NFC unlock, retina unlock, and also a backup key.

The direction after completing this project is I will discover more about IoT whenever I have free time. After completing this project, I have learned more deeply about IoT which I have not learned before. Surprisingly, I found out that it is such an interesting topic that discover the about software and technologies field. Undeniably, IoT is something that is becoming more and more essential nowadays. Learning it more will definitely help in my future life for example internship or when I am working in a company.

The improvement necessary for me to improve my potential in the industry is to strengthen myself when I am working as a group. We have to implement good communication skills in order to communicate with others. Similarly, when we are working as a team, we must be responsible and always give motivation to other group members whenever we faced difficulties. Other than that, we must understand well in the topic in order to produce a quality project. Thus, I will pay more attention in discovering the background of the problems.