King Fahd University of Petroleum and Minerals

College of Computer Science and Engineering

COE300: Principles of Computer Engineering Design

Progress Report 1

By:

Osama Bujwaied	**201661700**
Ali Al-Janbi	**201615180**
Taqi Al-Ajmi	**201614820**

For:

Dr. Yahya Osais

Assistant Professor

Descriptive Abstract

The objective of this report is to investigate the current problems of traditional keys, and to identify various solutions and recommendations that can help to overcome this problem.

20 February 2020

Table of Contents

List of Illustrations

Figures

1. INTRODUCTION

Figure 1: Various kind of keys.

Keys are one of the most important innovations in the world. they help to secure your home, office, money, and all your valuable belongings. Traditional keys have been around for so long. However, it has just improved mechanically a little bit. Because of that, traditional keys have several problems that restrict their efficiency and security. Nowadays, technology improvements during the last few decades should facilitate the transition to an innovative. Numerous technologies were invented to improve and replace traditional keys. To illustrate, mechanical lock system, password lock system, Biometric lock system and wireless based lock system can be a possible replacement of traditional keys. Although most people use traditional mechanical keys, they are probably going to shift to more advanced kind of keys if they find it more convincing and practical. In this essay, we will discuss the problems of traditional mechanical keys and show some attempts tried to solve the issues related to it.

2. PROBLEM STATEMENT

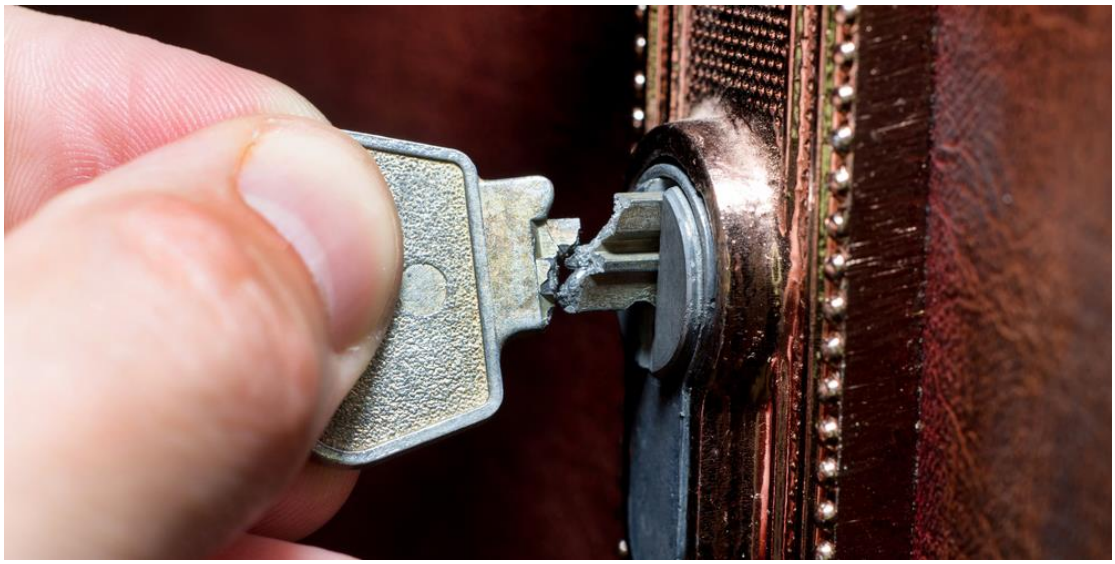

Figure 2: Broken key in the Door.

The main problems that made replacing traditional keys are related to losing the keys, carrying a lot of keys and sharing the keys with other people. Firstly, the most

common problem with traditional keys is losing them. if a key is lost, a thief could use it to break into the house. Consequently, you must the door lock and all old keys. Secondly, another problem with traditional keys is carrying them with you. They take a lot of your pocket space and they do not allow you to sit comfortably. But the most important thing it might scratch high cost devices in your pocket. According to Liao (2018), most new phones that made of Gorilla Glass are made of Corning. This type of glass is engineered to protect your phone from drops and cracked damage. However, it is too easy to scratch. Lastly, sharing traditional keys is so difficult. If someone want to reach to your home for a limited time, you should give him your own physical key. In addition, the person that you give him the key should be trustworthy. Otherwise, he might make a copy of your key to reach to your own properties without your knowledge.

3. LITERATURE REVIEW

For many decades, mechanical door locks were the only locking method available for any door. However, they have a lot of vulnerabilities due to their mechanical design.

3.1 Mechanical Door Looks:

This section will discuss the main components of the conventional door lock system and the mechanism of each component.

3.1.1 Key

The key is a metal piece that has 5 to 6 cuts [2]. The purpose of these cuts is to left the springs up in the cylinder to an exact location inside. The mechanical lock system will not open if there is no key. this is a major issue knowing that keys are small and can be lost or replicated easily.

3.1.2 Cylinder

Keys are inserted inside the cylinder to open the door. The cylinder consists of many springs. If all cuts and springs are matched, the cylinder will move. Otherwise, it will not rotate. [2] A door might have one or two cylinders. If a door has two cylinders, key can be inserted in both sides of the door. On the other hand, if the door has only one cylinder, a key can be inserted in one side only. The other side is opened with the doorknob only. Figure 3 shows a standard Yale Lock cylinder.

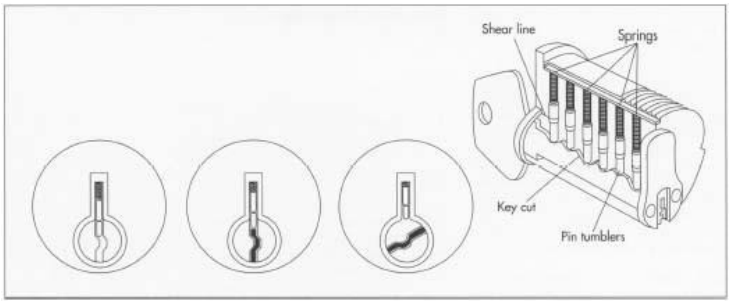

Figure 3: The cylinder from the inside. [3]

3.1.2 Bolt

There are two modes for the bolt; The lock mode and unlock mode. The lock mode is achieved when twisting the key 90° to the right. This act will make the cylinder rotate and push the bolt into the door frame. Doing the opposite is going to pull back the bolt. Hence, the door is unlocked.

We can clearly see that traditional locking systems does not provide an authentication mechanism. In addition, if the key is lost it is very hard to open the door using another way. Also, mechanical locks do not notify users of any security breaches. [4] Moreover, there is no sharing method other than giving the person you want a physical key.

3.2 Door Lock Control Based on a (NFC)

In these days, most of the smartphones contain NFC, and by using these devices, it is possible to dispose of carrying metal keys, pass cards, etc. Many individuals forget keys at home, and they are easy and small enough to lose. Rather than carrying such keys, we present an NFC-enabled Access Control and Management System, it is possible for individuals to use only one single key by the help of smartphones and NFC technology [6].

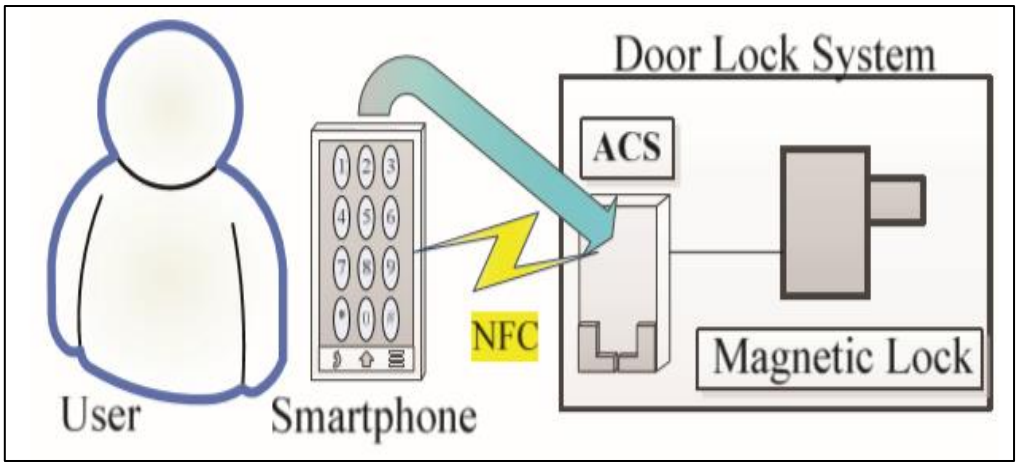

Figure 4: Arrangements of the door lock system.

3.2.1 Hardware Architecture

In figure 5 shows the architecture of the door lock system. There are five essential parts in the ACS: magnetic lock, microcontrollers (MCU), status indication, the NFC reader module and real-time clock module as shown in Figure 5. This system uses a low power MCU chip. There are LED lights and buzzer sounds to indicate what is taking place. Moreover, there are two more useful functions. First, it uses a real-time clock to read the time, which will guarantee to encode the time, passwords and card number, to make them all a serial number. Second, it obtained the data that are from a smartphone with an NFC card reader then decodes the data after that it uses the result to compare it with its data area to determine if an individual is an authorized user or not [7].

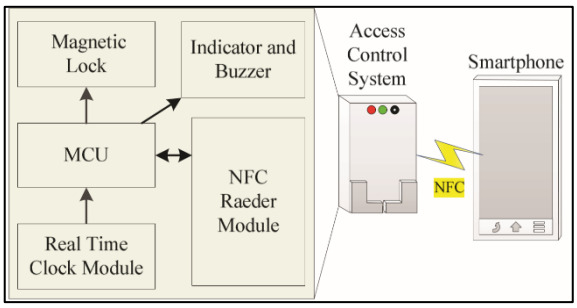

Figure 5: Hardware architecture of the door lock.

3.2.2 Software Design Implementation

The design of the software is divided into two modules: DLS operation module and smartphone. Most of the modern mobiles have an NFC that can be used with our system. The embedded platform is used to design the program of the DLS. The internal NFC data exchange format (NDEF) message uses the open-source library supported by the smartphone. When the user enters a password, he has a limited number, which is 3 times, to enter the right password to prevent bad people from breaking the lock code in order to get into a house [7].

4. DIAGONSTIC / ANLAYSIS

The main reasons that makes traditional keys inefficient have been illustrated in Fig.6 using a fishbone diagram. While figure 6 shows useful solutions to organizing keys are represented using the mind map diagram.

4.1 Fish Bone Diagram

Figure 6 shows that there are 5 main problems with using traditional keys. The first problem is if you lose your keys you shall change your own lock because someone might find it and use it to steal your stuff. The second problem is carrying number of keys will make noise while the person moving also, they become difficult manage. The third problem is sharing keys is not so easy, when person give physical key to others then they have to return it back. The fourth problem is the keys might stack inside the

door lock then that door cannot be used until you fix it. The fifth problem is the copied key may not work properly as the original one.

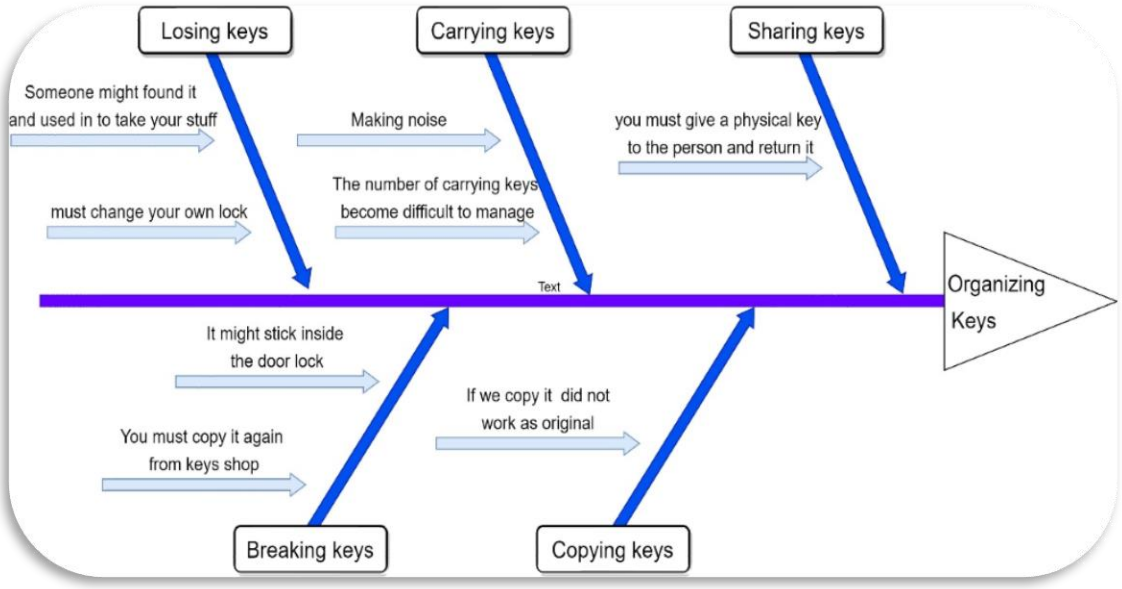

Figure 6: Fishbone Diagram

4.2. Mind Map

Some useful solutions to organizing keys is represented using the mind map diagram in figure 7. To begin with, the solution for carrying keys can be achieved through replacing the physical keys with a mobile application that uses NFC or Bluetooth to open doors. this will also solve the matter of keys breaking inside the cylinder. Moreover, Copying and sharing keys will become easier if we use a software that can store and share information using a network and a database. Furthermore, losing keys problem is resolved by using a mobile application that store and backup keys information from cloud. Doors should also be locked/unlocked remotely.

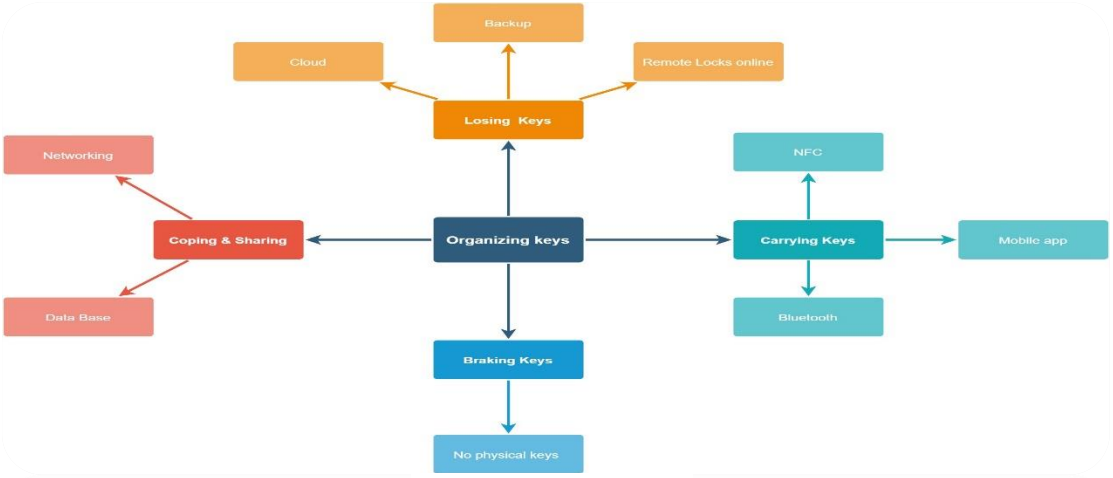

Figure 7: Mind Map

5. CONCLUSION

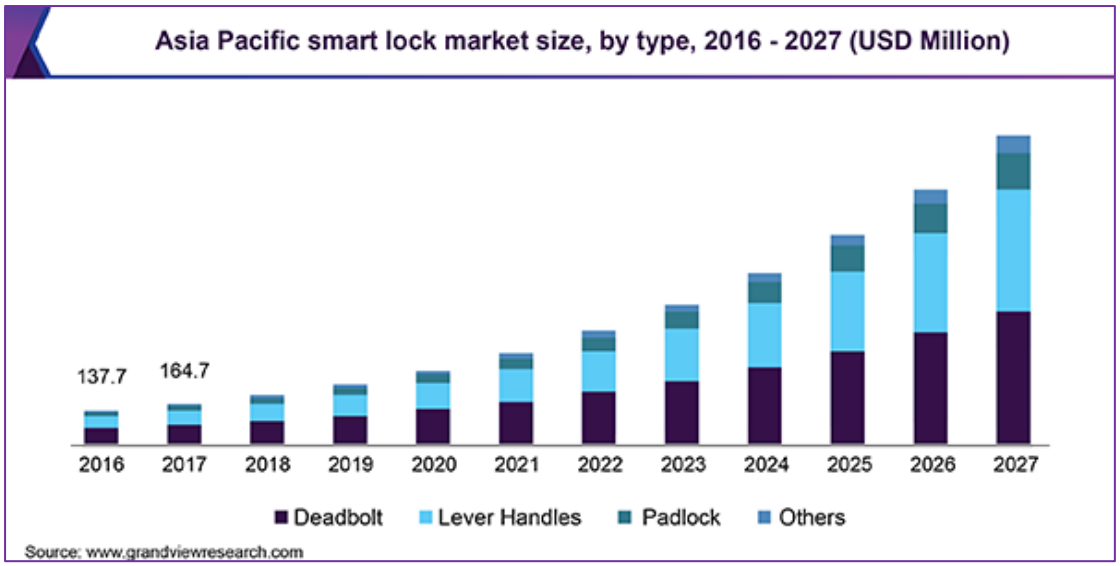

Figure 8: Estimation of smart lock market in the future (Grand View Research, 2020)

In conclusion, Conventional or traditional keys has many drawbacks as mentioned above. Rapid advancements in technology have improved many aspects in our lives. Therefore, several replacements of traditional keys were presented to the world such as mechanical lock system, password lock system, Biometric lock system, and wireless based lock system. Each one of these systems has its advantages and disadvantages. In today's world, almost all people carry at least one gadget such as smartphone or smart watches. They became an essential part in our daily life. In this report, we tried to offer more convenience, practical and secure kind of locks that are connected to our smart devices. This will allow more comfortable experience to people. It will also make their life easier.

6. REFERENCES

[1] S. Liao, “Why your brand-new smartphone will scratch just as easily as your old one,” *The Verge*, 19-Oct-2018. [Online]. Available: https://www.theverge.com/circuitbreaker/2018/10/19/17514174/gorilla-glass-scratch-resistance-google-pixel-3-samsung-galaxy-s9-note.

[2] C. Vongchumyen *et al*., "Door lock system via web application," *2017 International Electrical Engineering Congress (iEECON)*, Pattaya, 2017, pp. 1-4. doi: 10.1109/IEECON.2017.8075909\

[3] Madehow.com. (n.d.). *How lock is made - making, how to make, used, parts, components, steps*. [online] Available at: http://www.madehow.com/Volume-5/Lock.html.

[4] V. Pandit, P. Majgaonkar, P. Meher, S. Sapaliga and S. Bojewar, "Intelligent security lock," *2017 International Conference on Trends in Electronics and Informatics (ICEI)*, Tirunelveli, 2017, pp. 713-716. doi: 10.1109/ICOEI.2017.8300795

[5] “Smart Lock Market Size, Share, Trends: Industry Research Report 2027,” *Smart Lock Market Size, Share, Trends | Industry Research Report 2027*. [Online]. Available: https://www.grandviewresearch.com/industry-analysis/smart-lock-market.

[6] N. Saparkhojayev, A. Dauitbayeva, A. Nurtayev, and G. Baimenshina, “NFC-enabled access control and management system,” 2014 International Conference on Web and Open Access to Learning (ICWOAL), 2014.

[7] C.-H. Hung, Y.-W. Bai, and J.-H. Ren, “Design and implementation of a door lock control based on a near field communication of a smartphone,” 2015 IEEE International Conference on Consumer Electronics - Taiwan, 2015.

7. Appendices

7.1. Meeting Notes

<table>
<tr><th colspan="4">Meeting Notes</th></tr>
<tr><th>Meeting No.</th><th>Day & Date</th><th>Start Time</th><th>End Time</th></tr>
<tr><td>1</td><td>Monday 24/2/2020</td><td>4:00 PM</td><td>5:40 PM</td></tr>
<tr><td>Purpose</td><td colspan="3">Distribute the work among group members and assigning the responsibilities to each one for progress report 1.</td></tr>
<tr><td>Agenda</td><td colspan="3">1- Gather sources about the problem.
2- Create the fishbone and mind map diagrams.
3- Design the report file layout.
4- Edit the introduction and problem statement section.
5- Write the literature review.</td></tr>
<tr><td>Attendees</td><td colspan="3">1- Osama Bujweied
2- Ali Aljanbi
3- Taqi Alajmi</td></tr>
<tr><td>Discussion</td><td colspan="3">1- Osama will work on writing the introduction, problem statement and conclusion sections.
2- Taqi will edit the fishbone diagram and the mind map for the diagnostic analysis section. He will also work on the solution part of the literature review section.
3- Ali will work on the literature review section with Taqi. He will also write the meeting notes and the appendices.</td></tr>
<tr><td>Action Items</td><td colspan="3">
<table>
<tr><th>Task Name</th><th>Person(s)</th><th>Description</th><th>Deliverables</th><th>Deadline</th></tr>
<tr><td>Gathering sources</td><td>Osama, Taqi, Ali.</td><td>Read the literature for sources about the problem.</td><td>Information from the literature.</td><td>26/2/2020</td></tr>
<tr><td>Introduction</td><td>Osama.</td><td>Editing the introduction.</td><td>Introduction section of the report.</td><td>26/2/2020</td></tr>
<tr><td>Problem Statement</td><td>Osama</td><td>Write the problem statement</td><td>The problem statement</td><td>26/2/2020</td></tr>
<tr><td>Diagnostic analysis</td><td>Taqi</td><td>Prepare the diagrams of the diagnostic analysis section</td><td>Fishbone and mind map diagrams.</td><td>26/2/2020</td></tr>
</table>
</td></tr>
</table>

	Conclusion	Osama, Taqi	Write the conclusion	Conclusion section of the report.	26/2/2020
	Appendices	Ali	Prepare the meeting notes	The meeting notes.	24/2/2020

7.2. Table of Literature review:

Title of Paper	Problem Discussed in Paper	Proposed Solution	Relevance (What did You Learn from the Paper to Help You in Your Project?)
Door Lock System via Web Application	Losing keys, checking if the door is closed or not and Lock/unlock the door remotely. Also, sharing keys.	Combine the conventional door lock with Raspberry Pi and a web application mainly.	How the conventional door lock is structured. Moreover, one solution to the problem might involve using a web application.
NFC-enabled Access Control and Management System	Carrying Keys, pass-card, and gadgets in the pocket. Consequently, they occupy a lot of space and add more weigh.	Replacing traditional keys by smartphones to use them for opening/closing and locking/unlocking doors.	How to design a system using smartphones and NFC technology to replace traditional keys.
Access control and intrusion detection in door lock system using Bluetooth technology	Privacy of home automation.	A Digital door lock system based on Bluetooth. Data collected by sensors is stored in the database and can be accessed with a web application. The control module is responsible of notifying the owner and controlling the function of other devices.	Microcontrollers can be used to lock/unlock door and convert motion detection Analog signals to digital. How the control module function. Multiple ways of privacy can be integrated into making homes secure.