



## **UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

### **FINGERPRINT BASED SECURITY BOX USING ARDUINO**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Computer Engineering Technology (Computer Systems) with Honours.

by

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## **DECLARATION**

I hereby, declared this report entitled “Fingerprint Based Security Box Using Arduino” is the results of my own research except as cited in references.

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## **APPROVAL**

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Computer Engineering Technology (Computer Systems) with Honours. The member of the supervisory is as follow:

.....  
(Dr. Suhaila Binti Mohd Najib)

## **ABSTRAK**

Teknologi kini semakin berkembang pesat, antaranya bidang telekomunikasi yang telah membawa kita kepada dunia yang mudah, ringkas, cepat dan selamat. Peti keselamatan adalah alat yang mambantu untuk menyimpan barangan berharga seperti emas, dokumen dan barangan berharga yang lain. Pada masa sekarang ini, hampir setiap orang mempunyai peti keselamatan sendiri tetapi adakah dia selamat atau tidak. Tetapi kadar kecurian meningkat setiap tahun dilaporkan sering berlaku. Oleh itu, peti keselamatan menggunakan pengibas cap jari adalah salah satu aplikasi yang penting dalam era ini untuk mencegah kadar jenayah kecurian atau rompakan yang kebanyakan meningkat satinggi hari. Selain itu, tujuan projek ini adalah untuk mengintegrasikan teknologi sistem pengibas cap jari dan sistem global untuk komunikasi mudah alih untuk meningkatkan keselamatan. Peti keselamatan ini dilengkapi dengan menggunakan teknologi papan kekunci, pengibas cap jari, mikropengawal Arduino UNO dan GSM untuk tujuan projek ini. Mikropengawal digunakan sebagai perantaraan di antara pengibas cap jari, papan kekunci dan GSM. Mikropengawal, mengawal segala operasi yang berlaku semasa sistem ini berjalan. Dalam projek ini, GSM modul berserta dengan kad SIM telah digunakan. GSM bertindak sebagai menghantar maklumat sekiranya sesuatu berlaku ke atas peti keselamatan. Sistem ini akan dilaksanakan dengan menggunakan mikropengawal Arduino UNO.

## **ABSTRACT**

Technology is growing rapidly, including telecommunications that has brought us to the world of easy, simple, fast and secure. Security box a tool to help to save valuable items such as gold, documents and other items valuables. At the present time, almost everyone has a safe alone, but is being secure or not. But the rate of increase per year reported theft often occurs. Thus, the safe use fingerprint flap is one of the applications that are important in this era to prevent the crime of theft or robbery that most increases every day. Moreover, the purpose of this project is to integrate fingerprint scanner system technology and global system for mobile communications to improve safety. A safe is equipped with a keypad technology, fingerprint scanner, Arduino UNO microcontroller and GSM for the purposes of this project. Microcontrollers are used as intermediates in the fingerprint scanner, keypad and GSM. Microcontroller, controlling all the operations that took place during the system is running. In this project, together with the GSM module SIM card has been used. GSM act as transmitting information in case something happens to the safe. This system will be implemented using a microcontroller Arduino UNO.

## **DEDICATION**

To my respectful and beloved parents Mr. Ghazali Bin AB Bakar and Mrs. Zubaidah  
Bin Harun, my course mates, 4 BETC KOHORT 3.

Dedicated in thankful appreciation for your supporting encouragement and best  
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## **LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE**

GSM	-	Global System for Mobile
SMS	-	Short Message Service
LCD	-	Liquid Crystal Display
SIM	-	Subscriber Identity Module
RX	-	Receiver
TX	-	Transmitter
ID	-	Identity Document
PIC	-	Peripheral Interface Controller
FPGA	-	Field Programmable Gate Array
GUI	-	Graphical User Interface
DNA	-	Deoxyribonucleic Acid
CMOS	-	Complementary Metal Oxide Semiconductor
PCB	-	Printed Circuit Board
PWM	-	Pulse Width Modulation
Wi-Fi	-	Wireless Internet Free Internet
USB	-	Universal Serial Bus
AVR	-	Automatic Voltage Regulation

# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 Background**

Biometrics are a method for identifying a person based on physiological characteristics or behavior. Out of this, the characteristics that can be measured to identify a person was like the face, veins, fingerprints, hand geometry, iris, handwriting, voice, and retina. Of biometric data is different and different from personal information and biometric template cannot be reverse-engineered to create personal information. They cannot be stolen and used to access personal information card (Shakil and Nandi, 2013). Using a unique, physical properties of the human body, such as fingerprints, to easily identify and verify the claims of the person concerned, is the best solution and the easiest on the market today. Although biometric technology has been around for many years, modern advances in new technologies, coupled with a substantial reduction in costs, make biometrics readily available and affordable to the consumer, education, business owners and public sector alike.-

The fingerprint verification is one of the most popular biometric system. Fingerprint verification and fingerprint recognition is one of the most frequently used ways to verify the authenticity or identity of a person wherever security is a question that is problematic because it is believed that no two people have the same fingerprints



in the world. A human behavior, personal characteristics, unique examples show that every fingerprint is unique, different from the others. Three basic patterns of the fingerprint ridge have been identified as a spiral, arches, and loops (R.Vacca, 2015).

1. Arch is a pattern where the ridges enter from the side of the finger, rise in the middle to form an arc, and then out of the other side of the finger.
2. Loop is a pattern where the ridges enter from the side of the finger, forming a curve, and tend to come out of the same side they entered.
3. In the circle pattern, ridges form circularly around a central point of the finger. Scientists have found that family members often share common fingerprint patterns are the same, leading to the belief that these patterns are inherited.

Due to the uniqueness and consistency over time, fingerprints have been used to identify more than a century, and more recently because of the development of the capabilities automatically calculated. Fingerprint authentication is popular because of its inherent ease of acquisition, many resources available for the collection and use of proven and collection by law enforcement and immigration.

The fingerprint can be used to give more secured on the security box. In case of something on security box, Global System for Mobile (GSM) will take the action to send information to the owner of the security box.

## **1.2 Problem Statements**

Biometric based personal authentication system using physiological characteristics for example, fingerprint and face or behavior to be popular, as compared with traditional method which is based on the password. Traditional authentication system is unable to distinguish between an impostor who fraudulently obtain user access privileges example key or password.

Moreover, the biometric authentication system can be more convenient for users because there is no password to be forgotten or key will disappear and a single biometric feature can be used to access the account without the burden of remembering multiple passwords.

Before the security box system was set up, there were many crimes which happened most of the time, for instances robbery. In addition was the percentage of having broken by theft or being rob is nearly ninety percent not every year or every month but almost every day. When this happen people scared to leave their house and some even take the risk to bring their valuable stuff together where ever they go. Accordance to the design, the box security with its key and security has been invented..

To solve these problems, this project using the fingerprint recognition methods. A fingerprint based security box using Arduino system may be needed to keep the valuable safely. This security box system need fingerprint and password to open the security box. If fingerprint and password does not match so security box cannot be opened. This project will apply fingerprint image as a personal password to open the box. Fingerprint recognition is safer to apply in the electronic key system of fingerprint as different person how different fingerprint, even twins have their own fingerprint unique.

### **1.3 Objectives**

The main objectives of this project are:

1. To study how to integrate the Arduino, fingerprint, keypad with GSM module.
2. To design the security box using biometric fingerprint.
3. To develop the integration between fingerprint and GSM module.
4. To analyze the optical sensor fingerprint and semiconductor silicon sensor fingerprint.

## 1.4 Scope of Project

This project is based on a fingerprint, keypad, GSM module and Arduino board. In addition, the scope of this project is to study the function of fingerprint in providing the security to the box. The owner security box will be received an SMS if one or both verification system and declined using GSM module technology.

Furthermore, this project can be divided into three big parts, the first part, the fingerprint and the keypad, second part Arduino microcontroller and the last part is GSM module. In addition, the box will be more secured as the keypad with be used for password verification.

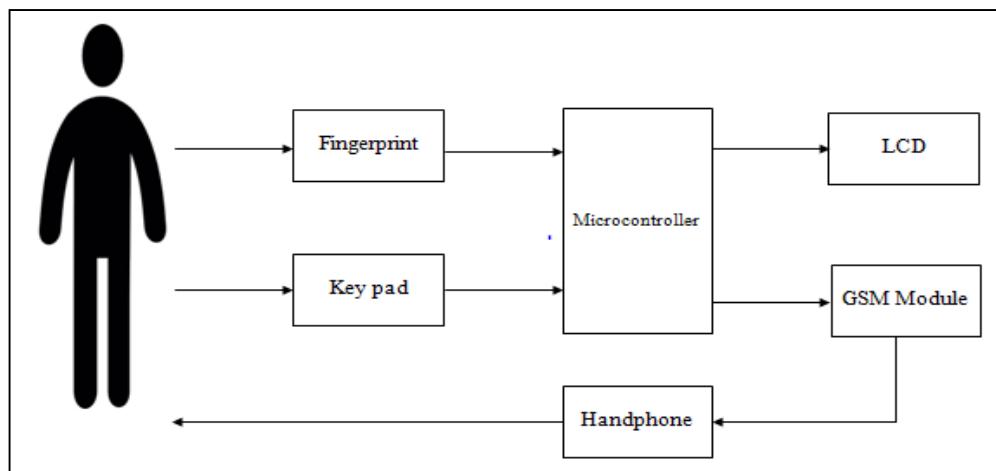


Figure 1.1: Block Diagram

The Arduino microcontroller will be used for this project. Figure 1.1 shows the block diagram of the security box based fingerprint using Arduino. The operation of this security box system can be easily understand with the above block diagram that consists of microcontroller, fingerprint, keypad, LCD and GSM module. Firstly, the owner enter the password on the keypad and place the finger on the fingerprint. The fingerprint module gives the input to the microcontroller, and then the microcontroller processes the data and correspondingly drives and LCD. If the unauthorized user enter the wrong password and fingerprint not matched, GSM module will send the SMS to owner.

## **1.5 Limitation of the Project**

This project has limitation. The fingerprint sensor used for this project only can store the ID of fingerprint until 162 templates. Every fingerprint have different memory depends on manufacturer. This project of fingerprint based security box using Arduino suitable used in normal size box and can be used for personal and office to keep important document.

## **1.6 Thesis Outline**

This project report consists of five chapter. The first chapter discusses the background of the project where the problem statements, objectives, scope of work, and the proposed system are described. Basically, this chapter is intended to give a clear overview on what this project is all about.

In Chapter 2, all the theories and literature review related to the proposed project that the author analyzed and studied are discussed. It includes the information about the differences about watering system.

Chapter 3 will discuss the methodology of this project. A clearer explanation regarding the workflow of the project, the approach has been use in designing the watering model and android application. The method of analysis and the process of the working plan also stated there.

In the next chapter, which is the Chapter 4, all the obtained results are discussed and analyzed. The problem face during the project was done also included in this chapter.

The conclusion regarding the project is discussed in Chapter 5. Some future recommendations are also stated to enhance the project in the future so that it will be more interesting and capable to give more benefits in agriculture smart watering system.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Security Box

The box is usually located in a house owned by the bank and the private rights which are used to store valuables. A safe deposit box is purchased from the company and can be accessed with keys, pin numbers or some other security pass. Valuables such as documents and jewelry placed inside and customers rely on the safety of buildings to protect those valuables. Figure 2.1 shows the traditional security box used in the past before the advent of technology.



Figure 2.1: Traditional Security Box (Flickr Creative Commons, 2013).

Fingerprint based security box using Arduino is design to make the box more safety. This project used a biometric fingerprint reader to secure the storage box. Besides using this device, a keypad is still used to enter the password. The system is designed with facility for sending information to the owner through a hand phone if any intruder that is trying to open the box. The Arduino control the GSM modul. The function of GSM module to get the information message through SMS by Smartphone user.

## **2.2 Past Related Search**

This section describes the search for articles related to the past where projects have been implemented. Before this there were a lot of existing research and studies that have been done before. Therefore, a comparison of the past researches will be discussed.

### **2.2.1 Biometric Security Using Fingerprint Recognition**

Subhran and Venkata introduced the security system using the biometric fingerprint. The main objective of this security system is to implement fingerprint recognition on the PXA27x DVK platform. In this article, the authors describe several types of fingerprint analysis. Features include a fingerprint patterns which were characteristic based on aggregate ridges, and minutia points, which is a unique feature that is found in the pattern. These three basic patterns were a fingerprint ridge arches, loops, and circles. In addition, the fingerprint sensor was also been used by the author. Fingerprint sensor was intended for shooting digital images called scans fingerprint pattern streaming. This live scan, digital processed to create a biometric template which has stored and used for matching. The fingerprint sensor technology used were optical, ultrasonic and capacitive. In this project the author uses Siemens ID Mouse.

Siemens ID Mouse was a device that uses capacitive fingerprint reader USB2.0. PXA27x platform support for Linux kernel versions up to 2.6.9 bond, for drivers Siemens ID Mouse is available in several versions for example in version 2.6.10 and above.

### **2.2.2 Security System Using Password**

S. R. Khan implemented the security system using password. To lock password-based microcontroller based, most of them used Peripheral Interface Controller (PIC) as microcontroller while there are also some implemented Atmel chip and FPGA. Electronic-based key presented which was based on key low-cost PIC with simple designs. 4x4 keypad used as an input and the relay was used as a key. Another key based password system named Office Access Control System (Khan, 2012). It is a low cost system that uses to block unauthorized persons to access in certain zones. PIC is used as a main controller and keypad 4x4 is available in the system. Generally, this system was a little bit different because it had an alarm function.

Another similar electronic key also introduced (Muhammed, 2012). Just like the previous key, it uses a PIC microcontroller and keyboard as input 4x4. However, it had some additional functionality that the password can be reset and function of the backspace added. In addition, the system must be seamless as the software was approved without any bugs. FPGA-based electronic key has been introduced. He allegedly unreliable as a process carried out by hardware and easy to modify because it can accommodate the latest design into an FPGA without any hardware changes. The main disadvantage is that the price might be higher than other locks that used a microcontroller chip (Angang and Decai, 2011).

In addition, Atmel based systems have multiple subsystems such as locking system, temperature control, lighting and fire detection system turns. In this project, a system used password authentication to receive input from the keyboard which was

considered locks. Lock was installed in the door where it was not visible from the outside, and this reduces the chance of damage by intruders. (Indeerpret, 2010)

### **2.2.3 Security System Using Biometric**

In this paper, author introduced about security system using biometric. For biometric security system based, there were several methods that have been proposed, such as face, iris, fingerprint and voice recognition. A facial recognition system designed to lock the door. A graphical user interface (GUI) was implemented using Matlab and PIC are used to control electronic key status in the system. A computer was required to perform the face detection procedure.

Soni-Key was another door locks that used voice-based biometric and fingerprint in the authentication process. It was developed by students from the University of Connecticut. It was designed to disable groups who used wheelchairs. The system can be controlled by either voice or fingerprint on which it depends on the position of the user. When users need to access from the outside, he or she must pass voice and fingerprint authentication. Meanwhile, this system only requires the user to establish a voice command in the house to operate. The system was having trouble accuracy as the sound is difficult to be constant for each access.

In addition, there was also a safety system that uses various types of biometrics being proposed by a researcher from India. The system uses iris and fingerprint as the dimension to verify authorized users. It was intended for used in offices where high security was required. It was a safe system as fingerprints and iris patterns were different for each person. Due to the advanced technology used, the cost of the system was also high.