



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Development of Arduino Based Secret Door Knocking Pattern Detector

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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APPROVAL

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

.....
Mr. Aiman Zakwan Bin Jidin
(Project Supervisor)

ABSTRACT

Security is part of important aspects that needs to be concerned with the community. Especially when it involves lives and properties, many people encounter a problem of a weak security lock system which causing them to feel unsafe. As an example, a burglary problem which is often the case in recent years that may lead to a danger of loss valuable things, raped and murder. Otherwise, home safety lock system that is easy to be cracked by the theft or intruders where it can't guarantee the safety of a home. Based on the problem, a study is conducted. The purpose of this project is to develop a secret door knocking pattern detector which can recognize the specific knocking pattern and unlock the door if the pattern is correct. As the main controller, Arduino microcontroller is used to control the system of knocking pattern detector that communicates with a piezoelectric sensor. In this system, knocking is used to activate the system and unlock the door through a servo motor by turning the door lock. The system is made up of two main features, the knocking pattern detector and control mechanism. The knocking pattern detector was designed using the piezoelectric sensor to record and detect secret knock pattern. The control mechanism using a servo motor to turn the door lock after receiving a signal from the piezoelectric sensor. Both of the two main features were all controlled by Arduino microcontroller that had a program inside it. As an addition, a push button is added to record a knock pattern as the main step to save the password. This system can be programmable by pressing the programming button and knock again to create a new knocking pattern.

ABSTRAK

Keselamatan adalah sebahagian daripada aspek penting yang perlu di ambil berat oleh masyarakat. Terutamanya apabila ia melibatkan nyawa dan harta benda, ramai orang menghadapi masalah sistem kunci keselamatan yang agak lemah dan menyebabkan mereka berasa tidak selamat. Sebagai contoh, masalah pecah rumah yang sering berlaku sejak akhir ini membawa kepada bahaya seperti kehilangan barangan berharga, dirogol dan dibunuh. Selain itu, sistem kunci keselamatan rumah yang mudah di bolosi oleh pencuri atau penceroboh di mana ianya tidak boleh menjamin keselamatan sesebuah rumah. Berdasarkan masalah ini, satu kajian telah dijalankan. Tujuan projek ini adalah untuk membangunkan sebuah sistem pengesan ketukan rahsia pada pintu yang boleh mengesan corak ketukan tertentu dan membuka kunci pintu jika corak tersebut betul. Sebagai pengawal utama, Arduino pengawal mikro digunakan dalam mengawal sistem mengetuk pengesan corak yang berkomunikasi dengan sensor piezoelektrik. Dalam sistem ini, ketukan digunakan untuk mengaktifkan sistem dan membuka pintu melalui motor servo dengan mengubah kunci pintu. Sistem ini terdiri daripada dua ciri-ciri utama, mekanisme pengesan corak dan kawalan yang mengetuk. Pengesan corak mengetuk direka khas menggunakan sensor piezoelektrik untuk merakam dan mengesan corak ketukan rahsia. Mekanisme kawalan menggunakan motor servo untuk menghidupkan kunci pintu selepas menerima isyarat daripada sensor piezoelektrik. Kedua-dua ciri-ciri utama tersebut dikawal sepenuhnya oleh Arduino pengawal mikro yang telah mengandungi sebuah program aturcara khas di dalamnya. Sebagai tambahan, sebuah butang ditambah untuk merakam corak ketukan sebagai langkah utama untuk menyimpan kata laluan. Sistem ini boleh diprogramkan dengan menekan butang pengaturcaraan dan pengguna perlu mengetuk sekali lagi untuk membuat corak rahsia ketukan pintu yang baru.

DEDICATION

Every challenging work needs self-efforts as well as guidance of elders, especially those who were very close to our heart. My humble effort I dedicate to my sweet and loving

Father & Mother,

Whose affection, love, encouragement and prayers of day and night make me able to get such success and honour

Along with all hardworking and respected

Lecturers

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

3D	–	Three Dimensional
AH	–	Ampere Hour
AVR	–	Automatic Voltage Regulator
CPU	–	Central Processing Unit
DC	–	Direct Current
DAC	–	Digital-Analogue-Converter
EEPROM	–	Erasable Programmable Read-Only Memory
FTDI	–	Future Technology Devices International
GND	–	Ground
Hz	–	Hertz
ICSP	–	In Circuit Serial Programming
IDE	–	Integrated Development Environment
IoT	–	Internet of Things
KB	–	Kilobyte
KHz	–	KiloHertz
LED	–	Light Emitted diode
mA	–	Milliampere
mAh	–	Miliampere Hour
MHZ	–	Megahertz
MYR	–	Malaysian Ringgit
OS	–	Operating System
PCB	–	Printed Circuit Board

PSM	–	Projek Sarjana Muda
PWM	–	Pulse Width Modulation
RFID	–	Radio frequency identification
RX	–	Receive
SPI	–	Serial Peripheral Interface
SRAM	–	Static Random Access Memory
TX	–	Transmit
TTL	–	Transistor-Transistor Logic
UART	–	Universal Asynchronous Receiver/Transmitter
USB	–	Universal Serial Bus
V	–	Voltage
VCC	–	Collect Supply Voltage
Wh	–	Watt hours

CHAPTER 1

INTRODUCTION

In this chapter is explain a briefly about the project. Where it cover the general overview about the project, objectives, and the problem statements. Thus, this chapter also includes the scope of work, problems statement and the structure of the report. Each of the parts is related to each other to make a clear understanding of this study.

1.1 Overview

Nowadays, security is now a basic need of human because it is a feeling of certainty that everything is fine. The term “Security” usually used in several aspects of contexts and senses. On the other hand, it also can be used into a system or any service that involves a connection with a data or an information that needs to be protected. It is related to each other, in order to achieve the condition safeguard of a security system. The security data must be ensured in the secure condition. Hence, it may express the ability of a system to act in the way it is meant. Even in the presence of a hostile state or even deliberate effort. There are several issues that cause people to feel unsafe. We believe the biggest one is burglary.

Hence, people need to predict how secure their home or property is from the burglary threat, based on the factors as the crime rate in the neighbourhood their life in. Hence, there are several people who like to build a secret door or a secret hideout in their house. It is because to make sure their valuable property can be stored securely and difficult to be found by any thief. Thus, it is also can be a safe place for hiding in case of any danger is happened. In a term, when people claim a privacy it means a personal perception that needs to be protected, it is often unclear

what they mean exactly. Explaining the possibility dangers of privacy that have been lost is very difficult and often it is not clear what kind of privacy. Furthermore, a security system requires a lot of machinery and the electronic devices is used. But with the development of technologies, the reliability of this devices is questioned and new technologies are needed to be developed.

Besides, with the old kind of a door locking system also can be a factor risk to burglary. So, this project is implement a development of Arduino based secret knocking pattern detector. Combining the use of servo motor that can control with a microcontroller which is the easiest way to get a movement to rotate the door lock. A piezo sensor is used as the detector of force or pressure that also can be classified to detect a knocking from users. It is a device that mounts to the door where it also provides the ability to detect and record a knocking pattern. Moreover, it also can be reprogrammable the knocking pattern which means after record the knocking pattern, users may reset the knocking pattern and then replace with a new knocking pattern. (Dirk Henrici, 2008).

1.2 Problem Statement

In this modern era, many technologies have been developed. But most of the security technology required high costs and most people can't afford it to cover the necessary costs. This project is to give people another way to secure themselves and property with a low cost. In addition, there have been dramatic increases in the number of burglaries in many regions in the past year, where it involves the loss of valuable properties. The increasing of crime burglary which often can be heard on the news or television until cause great harm or death, make people become more feeling insecure. The home is an eternal place that people want to feel safe and comfort. The environment also must be secured and reliable. In other words, a house can only become a home only if it really safely from any invaders. Besides that, as an age of people increase, they inclined to forget rudimentary things to bring the key house together while out of the house causing them to have a problem to enter the house. Which causing them to break the door house.

Furthermore, it is nature for a people who leave the house or property unattended as people were busy with the basic routine in life daily. Therefore, common people will use the home security system as an effective method to protect their home. However, most people were can not afford the necessary cost because it requires expensive installation cost. There are many projects that related to this case has been developed in order to solve it by researchers. Thus, a research of using the knocking pattern detector for a secret door lock is created. This security door locking system provides more secure than the systems which are currently used.

This project can help the people who always lose their keys and have difficulty in storing a key or any safety box that requires a key to open it. Besides that, with the use of a basic key it may cause thieves to easily detect any secret room and easy to open the secret room with the various type of technique. In assumption, with this secret door knocking pattern detector, it provides more secure to store valuable properties where it also may protect the secret hideout from the intruders that using a lock which is only can be open when it detect the secret knock pattern. Other that, this secret door knocking pattern detector is easy to use because only with using this proposed system enable people easy to unlock their door by using this development system. To conclude, this project also more secure than other door key system beside with using eco-friendly materials.

1.3 The objectives of this project are as below:

- 1 To study the characteristic of the piezo sensor that can detect a knock pattern produced through a pressure or force from the user.
- 2 To develop a low-cost security system using Arduino microcontroller which can detect specific knocking pattern in order to open the secret door.
- 3 To analyze the functionality and reliability of the system to be developed with the Arduino controller that combine along with a piezo and servo motor to mount at the door.

1.4 Project scope

In this part describes about the task that involves in this project. By explaining each the step of implementation that need to do the hardware part, software part until a test and analysis part of the project.

1.4.1 Determine which element part to be used

Describe the main components that should be adopted in this project idea. Firstly, need to make a research about the Arduino microcontroller and study in details how the works operation of the Arduino that can be used as the microcontroller for this project. Besides that, make analyze how the Arduino combines its functionality and reliability work with the piezo sensor and servo motor.

1.4.2 Algorithm development using C programming language

Implementation of code program by using C programming language as a platform to build the program and run through the Arduino microcontroller work with the other electronic equipment. In the program, need to set up the percentage of the sensitivity of the knock detector. It also includes with the maximum knocks consumer may record and the most important part the reject value that used to determine the true or false of knocking pattern were knock by the consumer.

1.4.3 Construct and building the circuit

The structure of circuit project is using a Fritzing software to build the circuit and gather all the necessary electronic components. Then, assemble the electronic components into a Strip board and make a soldering all the parts like piezo sensor, servo motor, pushbutton, transistor, diode and other else. Lastly, prepare the case of the project like the button mount, motor mount and the arms for fitting in the door lock. Lastly, install all the parts into the case and make a test and debug whether in can work or not.

1.4.4 Test and analysis

A test in the project is the most important part to obtain a good implementation. Especially in the hardware part where the circuit needs to be tested in the breadboard. It is to avoid and detect any misconduct or an error before making in a strip board. Then, in the software part also played the important role to be tested and analyze the implementation of a code like making an algorithm and flowchart to obtain the desired result. Both of the results is needed to be analyzed to ensure no error or any improvements that can be added in this project.

1.5 Project Outline

This project is divides into 5 chapter to obtain and collect the overall of the implementation in this study. Where it gathered all the steps and method involved to gaining the successful of this project. In this chapter has introduces the whole idea of this project development. It also provides the overview, problems statement, the project objective, and the scope of work. In the chapter 2 is explain the literature review, where all the information of previous work that related in these project is described in details. All of the information like the part of hardware and software will classify from the journal, articles, book and some related sources.

Meanwhile, in the chapter 3 is briefly about all the methodology and the implementation process to achieve the goal of this project. A concept of the system architecture will be construct to get a better understanding how the overall operations of this implement system will be done. Like the required pin ports of Arduino board also need to be concerned. Both of the hardware and software operations details will be explained through of the flowchart that has included. Then, it the chapter 4 is the main part in this project. This chapter will contain the findings and analysis of the projects that is described in more detail. It is also includes the completion of the project, development, implementation, problem analysis projects and cost estimates. Last but not least, in the chapter 5 is discuss the whole findings of this project and thesis. A discussions, conclusions, appendix, references and some attachment will be includes together.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter is discuss a force sensors and material to be used to detect a pressure, force, load, and strain. Besides, it includes a source of a research that had been done by another researcher in order to optimize a technique as mentioned earlier. It's able to help in understanding about the technique to detect the force or material to be applied and as starting references of this study because this technique will be applied in knock detecting method. Hence, in this chapter is review the several techniques of force sensors and material to be used in this project.

2.2 Background

In this era, many types of force or vibration sensor had been produced and usually a technique to detect a knocking based on its function and requirement. Before it is become an advanced technology device. This technique field is actually had a many evolutions. In a term, a sensor is transducer which can be referred to a converter of one type of energy into another. Meanwhile, piezoelectric sensor developed and this applied in technique to detect a force or vibration. Historically, in the 1880 the Curie brothers found a theorem when the pressure is apply the quarts will be changes its measurements when exposed to an electrical field and will generates an electrical charge.

Since that, many researchers found the piezoelectric materials in hundred ceramic and plastics. It also show the electrical effects due to temperature changes and radiation. The essence of the developed was ability to react when a strained or