UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF COIN PAYMENT SYSTEM AND RFID ACCESS LOCKER FOR PHONE CHARGING STATION

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

by

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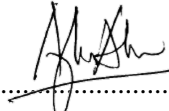
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I hereby, declared this report entitled DEVELOPMENT OF COIN PAYMENT SYSTEM AND RFID ACCESS LOCKER FOR PHONE CHARGING STATION is the results of my own research except as cited in references.

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Date: 18 JANUARI 2021

APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology with Honours. The member of the supervisory is as follow:

Signature: ………………………………..

Supervisor: Encik Azhar Bin Ahmad

ABSTRAK

Pembangunan Sistem Pembayaran Duit Syiling dan Akses RFID untuk Stesen Pengecasan Telefon adalah projek yang dapat membantu orang ramai di restoran, taman rekreasi atau pusat membeli-belah yang sangat memerlukan kuasa sokongan untuk mengecas telefon pintar mereka sekiranya tiada bank kuasa dan kekurangan soket suis. Tujuan projek ini adalah untuk melaksanakan sistem Pengenalpastian Frekuensi Radio (RFID) untuk kunci keselamatan dan menerapkan ciri sistem berbayar ke Stesen Pengecasan Telefon. Projek ini menggunakan alat penerima syiling untuk menerima dan mengesan duit syiling yang sah yang disisipkan oleh pengguna. Kemudian pembaca RFID akan dihubungkan dengan kunci solenoid untuk mekanisma penguncian. Pengaturcaraan Arduino akan digunakan untuk memprogramkan nilai syiling dengan masa pengecasan yang setara bersama input dan output yang digunakan. Kemudian program akan dimuat naik ke mikrokontroler Arduino. LCD akan menunjukkan jumlah duit syiling yang dimasukkan oleh pengguna dan nilainya terus meningkat selagi pengguna memasukkan jumlah duit syiling yang mereka mahukan. Keadaan kunci solenoid bergantung pada pembaca RFID yang membenarkan akses hanya apabila teg yang dikesan oleh pembaca adalah sah. Geganti akan menghidupkan dan membenarkan bekalan kuasa mengalir ke telefon sejurus sensor inframerah mengesan penutupan pintu dan dikunci oleh solenoid. Apabila pengiraan masa pengecasan selesai, geganti akan mematikan bekalan kuasa ke telefon. Teknologi sistem RFID akan menjadikannya lebih selamat dan cepat diakses oleh pengguna apabila Stesen Pengecasan Telefon ini diletakkan di tempat awam. Sistem berbayar menggunakan duit syiling dapat diimplementasikan ke Stesen Pengecasan Telefon sebagai pertukaran bekalan kuasa dengan mata wang yang dapat menguntungkan pemiliknya.

ABSTRACT

Development of Coin Payment System and RFID Access for Phone Charging Station is a project that can help peoples at the restaurant, recreational park or shopping malls that urgently need a back-up power to charge their smartphone in the absence of power bank and lack of switch socket outlet. The aim of this project is to implement Radio-Frequency Identification (RFID) for security lock and to apply the paid system to Phone Charging Station. This project use coin acceptor to receive and detect valid coin insert by user. Then RFID reader will interfaced with solenoid lock for locking mechanism. The Arduino programming will be use to program the value of coins equivalent with time of charging to user alongside other input and output used. After that, the program will be upload to Arduino microcontroller. Liquid Crystal Display (LCD) will shows amount of coins inserted by user and the value keep incrementing as long as user insert amount of coin they desired. The solenoid lock state depend on RFID reader that will allow the access only when tag detected by reader is valid. Relay will switch on and allow the flow of power supply to phone soon after the infrared sensor detect the closure of door and locked by solenoid. When the time charging countdown finish, relay will turn off the power supply to phone. The technology of RFID system will make it more secure and fast-access to user if Phone Charging Station are located at public places. The paid system using coin are able to implemented to Phone Charging Station as a power supply exchange with currency that can be profitable to its owner.

DEDICATION

To mum and dad

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In a nutshell, I want to thank my best friends because always been there during my up and down and they are the person who always I can count on if I need any help, motivation and encouragement for me to stay strong during my mental breakdown and whenever I feel unmotivated to complete my PSM. They always giving their ideas and help in troubleshooting my project. This accomplishment may never be a reality if all of them are not being on my side. Thank you.

TABLE OF CONTENT

ix

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS, SYMBOLS ABD NOMENCLATURE

PSM	-	Projek Sarjana Muda
RFID	-	Radio Frequency Identification
USA	-	United States America
KL	-	Kuala Lumpur
KLIA 2	-	Kuala Lumpur International Airport 2
VAC	-	Voltage AC power
RM	-	Ringgit Malaysia
UID	-	Unique Identification
CS	-	Coin Slot
CH	-	Coin Hopper
SPI	-	Serial Peripheral Device
I2C	-	Inter-Integrated Circuit
LED	-	Light Emitting Diode
LCD	-	Liquid Crystal Display
PV	-	Photovoltaic
AC	-	Alternating Current
DC	-	Direct Current
TNB	-	Tenaga Nasional Berhad
NPN BJT	-	Negative-Positive-Negative Bipolar Transistor
IRQ	-	Interrupt Request
MISO	-	Master In Slave Out
MOSI	-	Master Out Slave In
SCK	-	Serial Clock
SS	-	Serial Input
PIR	-	Passive Infrared Sensor
PIC	-	Programmable Interface Controllers
IDE	-	Integrated Development Environment

DNA	-	Deoxyribonucleic Acid
I/O	-	Input/Output
NO	-	Normally Open
NC	-	Normally Close
GND	-	Ground
SCL	-	Serial Clock
SDA	-	Serial Data
DPST	-	Double Pole Single Throw
DPDT	-	Double Pole Double Throw
SPST	-	Single Pole Single Throw
SPDT	-	Single Pole Double Throw
GSM	-	Global System for Mobile Communications
IOS	-	iPhone Operating System Device
AVR	-	Automatic Voltage Regulator
ARM	-	Advanced RISC Machines
IR	-	Infrared
VSS	-	Source Supply Voltage
VCC	-	Collector Supply Voltage
USB	-	Universal Serial Bus
PWM	-	Pulse Width Modulation
ROM	-	Read-Only Memory
RAM	-	Random Access Memory
CPU	-	Central Processing Unit
ICSP	-	In-Circuit Serial Programming
EEPROM	-	Electrically Erasable Programmable Read-Only Memory
PSP	-	Parallel Slave Port
CA	-	Common Anode
UART	-	Universal Asynchronous Receiver-Transmitter
CM	-	Communications Module
SSO	-	Switch Socket Outlet

COM	-	Common Connection
%	-	Percent

LIST OF APPENDIX

CHAPTER 1

INTRODUCTION

1.1   Background of Study

With the growth of technologies nowadays, the use of self service machine as been very widely used. For example, the vending machine that sells beverages and snacks. There is also a machine that provide secure and temporary storage for luggage or backpack for tourist usually located at the bus stations and airports. The locker machine existed uses many types of security including keypad password and also the newest one which is using biometric features. All these existed machine is very similar with phone charging station machine. Phone charging station is a kind of machine that provide power supply to mobile phones. The user will insert credits or currency into the machine in order to get its service. The use of technology can make the owners gain profits by providing basics services to consumer. In the other hand, the security system by using RFID access that can make the storage of the mobile phones get to be more secure instead of using the conventional system or biometric system which is considered to less secure or slower during first authentication of the user's biometric features.

A previous study showed a mobile charging machine project also used currency in the form of coins that will be converted to charging period for users. It used the input power supply 230VAC to operate the machine. Usually the machine will be operated in public areas like at the restaurant, hotels, coffee shops, shopping malls and a. ("*Cell Phone Charging Station Guide"*, 2019). This will cost the building owner more in electricity bills because the machine is in ON mode all the time in order that the display screen to be always switch on as a guide for the users. But if the renewable energy source is implemented to this machine, this machine can also be placed at the outdoor areas such as recreational parks, public places that usually

held huge festivals and at the sidewalk of a city like the public phone used to be located back in year 90s when smartphone is not invented yet.

But nowadays, the used of smartphone is crucial to most of people so the charging medium for smartphone is a the need for them in order to sustain the low battery of smartphone. A same study also state that the security for locker of phone charging station is by using biometric which is fingerprint of the users. After inserting coins, user have to registered their fingerprint so that they can access the locker to charge their phone in it and to also unlock the phone after the charging is completed. But in this project, different approach will be given which is by using RFID method which is more user friendly. RFID will make the user first-time-authenticating period will not take too long like the biometric system does. User just have to touch their RFID cards and they can access the locker and charge their phone conveniently and securely.

So the overall benefit of the system is it can fully utilize the whole potential of newest technology which is RFID. RFID technology has been implemented in many field nowadays and can be learned and implemented in this project. Furthermore, the RFID will increase the quality of data capture. By implementing RFID, data can be transmitted accurately and rapidly. By using RFID, the cost of RFID component are much lower than by using biometric scanner and equipment are considered quite expensive. The process of authenticating will be much shorter than other type of security authentication. Besides RFID, the implementation of coin acceptor system payment mechanism will make the owner or renter of this machine can gain profit by utilize many places that always become the centre for many peoples to come over. In the public sometimes, there will be a time when they need their phone to have a quick charge in case emergency of battery draining will happen. From this prototype project, the coin system mechanism will be implemented initially rather than other type of payment technologies because coin acceptor system is cheaper and easy to implement using Arduino.

1.2   Problem Statement

Based on survey conducted by Veloxity in 2013, data is taken from 1200 respondent in 6 cities in USA stated that almost half of them which is 49% never use a phone charging machine yet. The other 51% have use the phone charging station while their battery are getting drain when they are were out to the cities. The statistic were taken at USA which the phone charging station are widely used. So the phone charging station machine is important to widely implement in Malaysia because the user of smartphone our country is increasing over the years according to Statisca Research Department. People who uses smartphone must be crucially need a back up power for their phone when the absence of power bank when they emergency need their phone to be recharged.
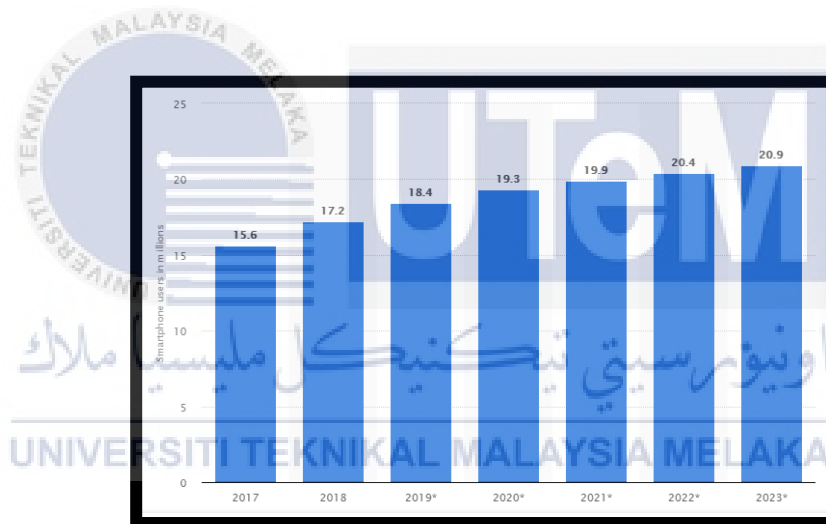

Figure 1.1: Statistics of number of people that use smartphones in Malaysia

From the existed machine that are already in the market and even had already been placed at the public area are majority using password that only can be remembered by the valid users. But if using the password, there will be a risk that the users can forget their passwords. There is also phone charging kiosk that not providing a security lock at all to the phone. It make the user cannot go anywhere while the phone is charging. It is also can contribute to electricity waste if the user tend to let the phone keep plug in to the charging port even though the charging is already complete. Some of the machine has implemented a biometric

features as security. But the system that using biometric is not user friendly whereas it require a longer time for a user to registered their biometric features.

A closer example has prove this theory right whereas a smartphone that equipped a fingerprint scanner will take a long time for user to set a new fingerprint. Another example are shown from the luggage locker station that located at KL Sentral where the machine use face recognition as a security feature. It also take a long time for user to set their face and also sometimes the machine are having problem in recognizing the valid user when the user wants to fetch their belonging back from the locker. So using RFID is an alternatives to reduce this kind of problem that user have to faced.

Figure 1.2: Phone charging station that are not equipped with fingerprint scanner and keypad password

Figure 1.3: Phone charging station that are not equipped with lockers

Figure 1.4: Phone charging station without security lock in KLIA 2

Figure 1.5: Face detection luggage storage in KL Sentral

Besides that, the most crucial part in this project is how to combine the system of RFID and coin payment mechanism together. As the existed research about this machine nowadays, they are not just only payment system provided to the machine but it also have a security mechanism implemented together with it using an Arduino microcontroller. At the same time in Europe, the householder waste

£134 million a year only due to overcharging their smartphones and laptop. One in five people most likely tends to leave their gadget plugged in to the power source. One in ten people admit that they are too lazy to unplug their gadgets even though this will resulting higher electricity bills they need to pay. So,iit is necessary to build time countdown system based on how much the coin are deposited to the machine into Arduino microcontroller so that electricity are not wasted.

Meanwhile, people keep questioning if we own a vending machine would be profitable? The answer is yes. According to average, the profit that are earn by the owner of the vending machine is RM 1500 per month. So the owner of machine basically will earn RM 18000 annually. So this kind of business can be implemented to phone charging machine that are basically the need to the public that also will give the return of investment to the owner while providing power source to the public. So that is why the coin payment mechanism will be develop in order to make profit from exchanging power source to peoples.

1.3   Project Objectives

The purposes of building this project is to achieve the following points:

1. To implement an RFID system as a security mechanism to unlock locker of Phone Charging Station
2. To apply paid system to Phone Charging Station using coin acceptor for power supply exchange with currency

1.4   Project Methodology

In order to make this project can be executed successfully, the methods that will be implemented soon in this project must be correct. This project is a innovation of phone charging station that are consist of RFID technology for fast-access security that will be programmed and executed by Arduino microcontroller.