Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF CAR IGNITION SYSTEM BASED ON FINGERPRINT RECOGNITION METHOD USING RASPBERRY PI

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Bachelor of Computer Engineering Technology (Computer System) with Honours

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DEVELOPMENT OF CAR IGNITION SYSTEM BASED ON FINGERPRINT RECOGNITION METHOD USING RASPBERRY PI

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in partial fulfillment of the requirements for the degree of

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2023

DECLARATION

I declare that this project report entitled “Development of Car Ignition System Based on Fingerprint Recognition Method Using Raspberry Pi” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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APPROVAL

I approve that this Bachelor Degree Project 2 (PSM2) report entitled "Development of Car Ignition System Based On Fingerprint Recognition Method Using Raspberry Pi" is sufficient for submission.

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APPROVAL

I hereby declare that I have checked this project report, and, in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Engineering Technology (Computer System) with Honours

Signature :

Supervisor Name : TS. DR. HASRUL 'NISHAM BIN ROSLY

Date :

Signature :

Co-Supervisor :

Name (if any)

Date :

DEDICATION

This Dissertation is dedicated to my parents

Roslim binti Ali

and

Zainal bin Amat

who given me invaluable educational opportunities

I also dedicate this dissertation to my friends who have supported me throughout the process.

I will always appreciate all they have done.

I dedicate this work and give special thanks to my best friend

Muhammad Muaz bin Mazlan

For being there for me throughout my completing the research.

Along with all hardworking and respected.

Lectures

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ABSTRACT

One of the causes of car loss and theft is due to the car's ignition system that uses keys. Although the latest cars use a key that contains a radio signal to turn on the car, it is still easy to duplicate. Based on this problem, a new concept based on fingerprint recognition to turn on the car have been developed. The system used Raspberry Pi as the main circuit and will be connected to a fingerprint sensor along with the car ECU (Electrical Control Unit). When the car is turned on, the owner/user fingerprint will be stored in the database and compared. If the fingerprints are matching, the car will turn on and if they're not, the car's alarm system will make a sound. Hence,the new car starter concept using fingerprint recognition is able to improve the security system on the car in addition to preventing car theft.

ABSTRAK

Salah satu sebab kereta hilang dan dicuri ialah sistem penyalaan kereta menggunakan kunci. Walaupun kereta terbaharu menggunakan kunci yang mengandungi isyarat radio untuk membuka kereta, ia masih mudah untuk direplikasi. Berdasarkan masalah ini, konsep baharu untuk memusingkan kereta berdasarkan pengecaman cap jari telah dibangunkan. Sistem ini menggunakan Raspberry Pi sebagai litar utama dan akan disambungkan kepada sensor cap jari bersama-sama dengan ECU (Unit Kawalan Elektrik) kereta. Cap jari pemilik/pengguna kereta akan disimpan dalam pangkalan data dan dibandingkan apabila kereta dihidupkan. Jika cap jari padan sama, kereta akan hidup, jika tidak, sistem penggera kereta akan berbunyi. Oleh itu, konsep penghidup kereta baharu menggunakan pengecaman cap jari dapat meningkatkan sistem keselamatan kereta dan mengelakkan kereta daripada dicuri.

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CHAPTER 1

INTRODUCTION

1.1 Project Background

Nowadays, all cars required their owner or user to have the keys or wireless key fob to start the engine before they can drive the car. Due to the advancement of technologies, having the keys misplaced or lost could be prone to car theft since the wireless key fob could be easily duplicated, thus they can use the duplicated wireless keys to get away with the car.

1.2 Problem Statement

The push start button system works by recognizing the low-frequency signal emitting from the wireless fob, before enabling the button to operate. The car system picks the signal from the fob before turning on the push start button, thus can be pressed by the user to start the engine. The problem arises when the duplicated wireless key has the same low frequency that the car system picks to enable the push start button system. This is a huge threat for the car owner if they lose the keys since the car engine could only be started by the presence of the wireless fob and the person with the duplicated wireless fob can get away with the car without the hassle.

The thievery could happen when the duplicated wireless key has the same low frequency that the car system picks to enable the push start button system. Based on the article written in Vehicle Theft Reduction Council of Malaysia Berhad, the process could be done in 60 seconds

where the one person could bring thetransmitter nearby the intended car for theft and the other person would scan nearby perimeter, forinstance, houses using an amplifier and if the key is close enough, the car will pick up the signal from the transmitter that has the amplified signal, thinking it is the real key, thus the thief can runaway silently with the car. This could be a huge threat for the car owner if they have spare wirelesskeys in their house and are left unattended.

The statistics in Figure1.1 below show vehicle theft is the highest from 2013 to 2019 in Selangor, Kuala Lumpur, and Johor which are the most populated areas. Although we see in Figure 1.2 that vehicle theft is down by 70% due to the presence of keyless technology in modern cars that enable the car engine to start only by using the wireless fob, this doesn't mean the modern vehicle isn't vulnerable since almost all the modern cars use the exact same technology of keyless system hence poses a huge threat.

VEHICLE THEFT CLAIMS RECORDS BY STATE
2013 to 2019

VTREC

NO	STATE/YEAR	2013	2014	2015	2016	2017	2018	2019	TOTAL
1	Selangor	8,710	6,683	5,201	4,275	3,692	3,163	**2,332**	34,056
2	WP Kuala Lumpur	4,386	3,283	2,692	2,318	2,188	1,929	**1,572**	18,368
3	Johor	4,018	2,976	2,350	1,879	1,504	1,440	**1,006**	15,173
4	Kedah	2,241	2,034	1,370	1,070	1,014	834	**495**	9,058
5	Sarawak	2,176	1,852	1,469	1,034	1,165	751	**454**	8,901
6	Perak	2,246	1,668	1,292	929	821	748	**443**	8,147
7	Pulau Pinang	1,803	1,559	1,048	935	886	701	**433**	7,365
8	Kelantan	1,695	1,355	1,164	864	804	598	**316**	6,796
9	Pahang	1,420	1,114	836	624	441	360	**245**	5,040
10	Negeri Sembilan	1,016	764	643	457	391	360	**222**	3,853
11	Melaka	1,076	809	515	450	330	341	**180**	3,701
12	Terengganu	1,240	797	540	357	315	185	**126**	3,560
13	Sabah	666	638	392	325	267	235	**158**	2,681
14	Perlis	171	159	142	75	52	66	**24**	689
15	WP Putrajaya	65	43	38	24	20	19	**14**	223

Figure 1.1: Vehicle theft by state from 2013 - 2019

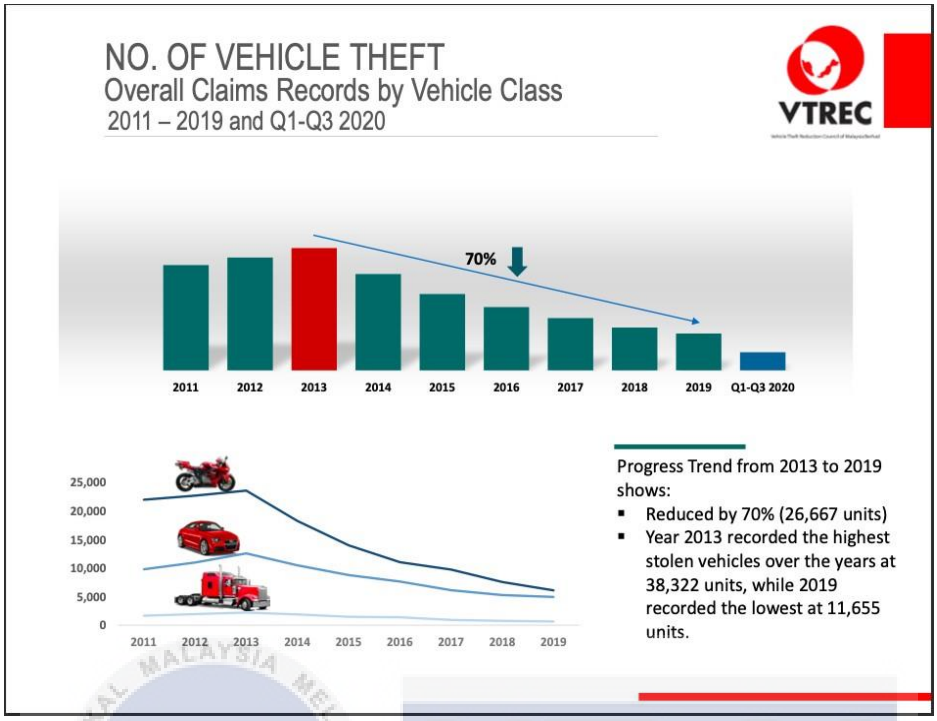

Figure 1.2: Vehicle theft by class from 2011-2020

1.2 Project Objective

The main aim of this project is to propose a reliable and secure system for car owners to use and keep their car from any threat as follow:

a) To develop a smart start car ignition system based on fingerprint recognition.

b) To identify the optimal settings on the Raspberry Pi that involve sensor connections.

c) To analyze the effectiveness of the prototype developed to start the car using fingerprint.

1.3 Scope of Project

The scope of this study is to do research and review literature from journals, publications, and other sources to gain a better understanding of project requirements and make modifications to meet the project's goals. To ensure that none of the project's duties are delayed, resulting in wasted time and higher expenses, a survey of the hardware, tools, and software utilized in the project should be done. This project's hardware and software components are separated. This project's hardware and software must all do their assigned tasks and work together as a system. This system is made up of three parts. The user will first scan their fingerprint with the fingerprint module sensor to verify their identification as the principal user, after which they will be able to be registered user fingerprint and to start the engine. The Raspberry Pi 4 Model B, which will function as the system's brain, is the processor for this project. It will connect to other hardware and regulate the system's functioning, such as processing input and sending commands to output channels such as the LCD display unit, and Speaker 2.0 USB Powered. We have an LCD display for the output unit that will show if the fingerprint matches or mismatches the data inside the Raspberry Pi as "Detected" or "Unregistered fingerprint." If the fingerprints did not match, the speaker will sound an alarm.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Biometrics is a rapidly advancing technology that is frequently employed in crime detection and prison security and has the potential to be broadly embraced across a wide range of applications. Fingerprint recognition is the most extensively used biometric identification method. Fingerprint scanners have become commonplace on a variety of gadgets. In our society,fingerprints have been scientifically studied for many years. Fingerprint characteristics were studied as early as the 1600s. Meanwhile, the use of fingerprints as a means of identification began in the mid-1800s.

2.2 Introduction of Raspberry pi

The Raspberry Pi is a low-cost, credit-card-sized computer that connects to a computer monitor or TV and operates with a standard keyboard and mouse and developed by Raspberry Pi Foundation, United Kingdom. It is a capable little device that allows people of all ages to experiment with computing and learn to program in languages such as Scratch and Python. It can do everything a desktop computer could do, from browsing the internet and watching a high- definition video to creating spreadsheets, word processing, and playing games.

Furthermore, the Raspberry Pi can share information with the outside world and has been used in a wide range of digital maker projects, including music machines and parent detectors, as

well as weather stations and tweeting bird houses with infrared cameras. Seeing kids all over the world using Raspberry Pi to learn how to program and understand how computer work is our focus, since Raspberry Pi is compact but powerful machine to use.

2.3 History of Raspberry Pi

The Raspberry Pi was designed to be an educational computer. In recent years, the proliferation of electronic terminals such as smartphones and PCs has made it possible for young people to use these devices without first learning about them in school. However, few people understand how they work or are capable of doing their programming and software development. This is also because electronics are becoming more advanced and more complete products are available, giving people less opportunity to disassemble equipment and create their hardware and software.

The Figure 2.1 show the Raspberry Pi logo. The fruit pie, raspberry pie, inspired the name Raspberry Pi. This is because many companies in the computer neighborhood where Raspberry Pi was founded used fruit names as company and product names, such as Apple and apricot. The mathematical constant "Pi" is also associated with the programming language "Python.

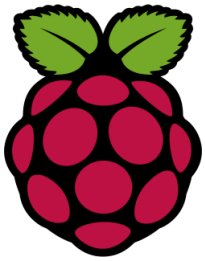

Figure 2.1: Raspberry Pi Logo

2.4 Comparison of Raspberry Pi Model

Table 2.4.1: Comparison of Raspberry Pi Model

Features	Raspberry Pi Model B+	Raspberry Pi 2 Model B	Raspberry Pi 3 Model B+	Raspberry Pi 4 Model B
Processor	ARM11	ARM Cortex-A7	ARM Cortex-A53	ARM Cortex-A72
CPU Speed	700 MHz	900 MHz	1.4 GHz	1.5 GHz
Storage	Micro-SD	Micro-SD	Micro-SD	Micro-SD
Ethernet	Yes	Yes	Gigabit Ethernet over 2.0(maximum throughput 300Mbps)	True Gigabit Ethernet
Wireless	No	No	Wi-Fi and Bluetooth	Wi-Fi and Bluetooth
RAM	512MB	1GB	1GB	1GB, 2GB, 4 GB or 8 GB
GPU	Video Core IV @ 400Mhz	Video Core IV @ 400Mhz	Video Core IV @ 400Mhz	Video Core IV @ 500Mhz

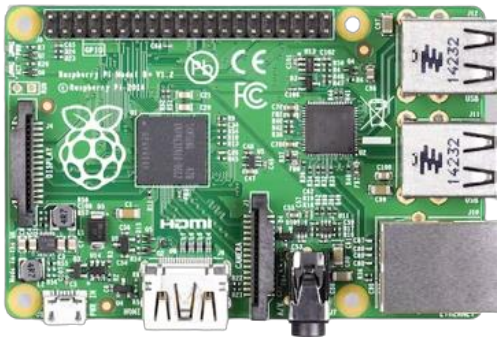

Figure 2.2: Raspberry Pi B+ [13]

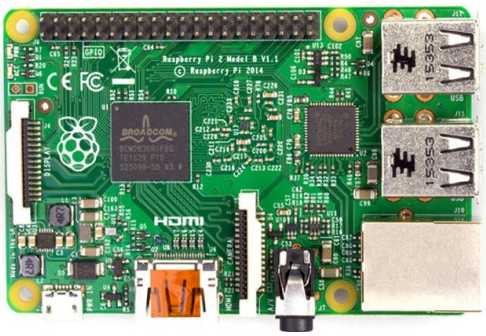

Figure 2.3: Raspberry Pi 2 B [13]

Figure 2.4: Raspberry Pi 3 B+ [13]

Figure 2.5: Raspberry Pi 4 Model B [13]

Though there are several dozens of Raspberry Pi boards on the market today, only a few are worth considering. The Table 2.4.1 represent is a comparison of such boards. In Figure 2.2 show Raspberry Pi Model B+ is the final revision of the original Raspberry Pi. Initially, it had 40 GPIO pins and RAM capacity of 512MB. In July 2014, it replaced the Model B and was superseded by the Raspberry Pi 2 Model B in Figure 2.3. When compared to previous releases, the Raspberry Pi 2 B significantly improved, particularly in memory and speed. RAM capacity has been increased to 1GB. The Raspberry Pi 2 B is available in a standard size with four USB ports. Raspberry Pi 3 Model B+ is the final revision of our third- generation single-board computer that show in Figure 2.4. Raspberry Pi 3 B+ features 1.4GHz 64 bit quad-core processor, dual-band wireless LAN, Bluetooth 4.2/BLE, faster Ethernet, and Power-over-Ethernet support(with separate PoE HAT). In Figure 2.5 show Raspberry Pi 4 Model B is a vast improvement from its predecessors, with a varying memory capacity from 1 GB RAM to 8GB RAM. It also has a faster

1.5GHz processor and a good mix of 2.0 and 3.0 USB ports. Raspberry Pi 4 B is an ideal Raspberry model as it is suitable for virtually every use case with higher RAM capacity to satisfy even the most dedicated programmers.

2.5 Fingerprint Based Vehicle Starter and Vehicle Tracking System

In this project, we propose an implicit authentication solution that adds a security layer to the password pattern. Biometric technologies have long functioned as reliable security methods in a variety of fields. Fingerprints are the most common and earliest biometric authentication method. A car tracking system is an electronic device that is installed in a vehicle that allows the owner or a third party to track the whereabouts of the vehicle. This study proposes developing a car tracking system based on GPS and GSM technology, which would be the most cost-effective method of vehicle tracking while also serving as an anti-theft system. The goal of this study is to show a working prototype of a fingerprint-based car start and tracking system. Agents in the system are effectively communicating, and appropriate output is delivered in response to user input. The system asks the user's finger, processes it, and outputs suitable results depending on whether the finger is saved in the fingerprint module. At the user's desire, the system can also enroll a new user's finger, although it will first ask for a passcode. Passcodes can also be modified within the system. When an unauthorized user tries to start the car, the alarm sounds, and a message is sent to a mobile phone through GSM and GPS modules. It uses a GPS module to determine the vehicle's location. The output is displayed using an LED. We developed an anti-theft system that can track a car equipped with the proposed device. It can also be used to track wildlife, assets, and vehicles that have been stolen [1].

2.6 A Prototype of a Fingerprint Based Ignition Systems in Vehicles

The Figure 2.6 show the block diagram prototype fingerprint-based ignition system. Instead of the typical way of using keys, this study focuses on the use of fingerprints for vehicle ignition. The following components could be used to break down the prototype system: The hardware interface module and the ignition system module are two software modules that accept fingerprint images for fingerprint analysis. Valid vehicle users' fingerprints can be stored in a database using fingerprint recognition software. Before a user can start the vehicle, his or her fingerprint image is matched. The vehicle will not start if the user's fingerprints do not match those in the database. The vehicle's ignition system is under control. This is performed by delivering the required signals to the parallel port of the computer, which is subsequently sent to the interface control circuit. According to the findings, using biometric security systems is a far more effective and foolproof technique for preventing unauthorized users from starting automobiles. Furthermore, it is plausible to conclude from the outcomes of this study that fingerprint pictures can be used to control the ignition system of a motor vehicle. When parallel port control codes are paired with fingerprint analysis codes, they can allow only authorized people to start a car who has been authenticated using their fingerprint images [2].

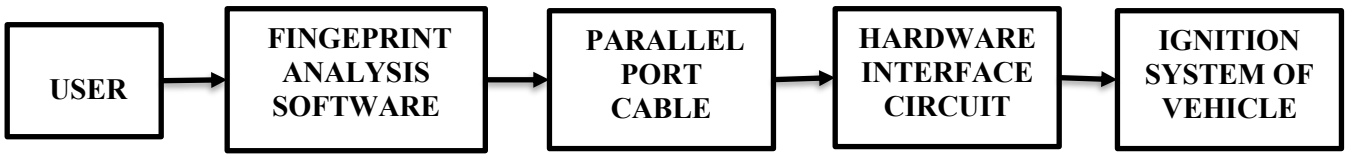

Figure 2.6: Block Diagram Prototype Fingerprint based Ignition System [2]

2.7 Anti-Theft System for Vehicles Using Fingerprint Sensor

The block diagram of the vehicle ignition system is shown in Figure 2.7. This research focuses on using microcontrollers and GSM modules to prevent car theft. We're becoming better at producing accurate and proficient results. It can be beneficial toindividuals who seek a vehicle with better and more modern security**.** The best technique to safeguard a car from numerous sorts of theft is to use a vehicle locking framework. It is a car security device that provides a more comprehensive and luxurious insurance for one's vehicle. Thisframework, however, cannot be set up to provide complete security and visibility to the car in theevent of a break-in. As a result, a more secure framework makes use of an inserted framework thatis centered on GSM and GPS innovation. This clearly defined and constructed framework is installed in the vehicle with the goal of giving real-time tracking and active notification to the user, as well as assisting in the prevention of possible theft. Passwords are still used by the great majorityof computer users on a regular basis. Because the haven of passwords is based primarily on user behavior, research that experimentally examines patterns of password development and use is critical in evaluating alternative security strategies. The main goal in developing this anti-theft system for cars was to incorporate all of the above functions equally. The most important elementis car theft protection, which is ensured by offering multiple layers of anti-theft protection [3].

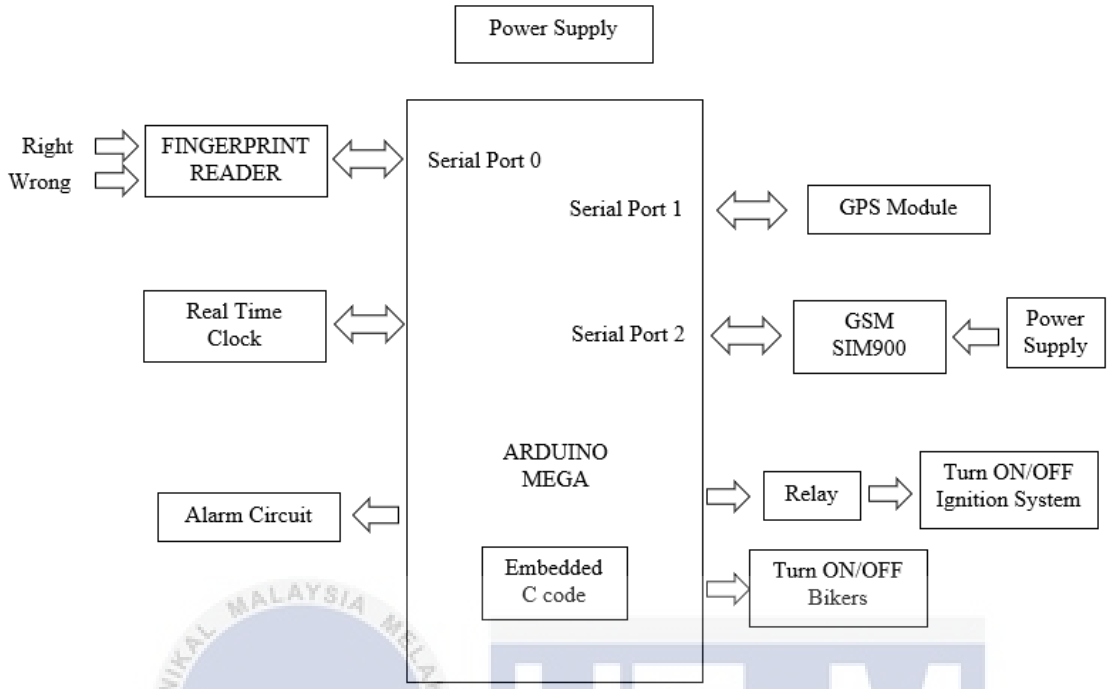

Figure 2.7: Block Diagram of the Vehicle Ignition System [3]

2.8 Vehicle Anti-Theft System Using Fingerprint Technique

This project is focused on protecting two-wheeler vehicles from unauthorized persons and preventing vehicles from being stolen. system of security is being developed and will be used for global security. The fingerprint module will be used in place of the key and starter, and the bike will be unlocked without the use of a key. However, with this fingerprinting technique, it is possible to ensure the safety of the vehicle as well as start the bike by using a fingerprint sensor. Assume that people occasionally forget the key, which can be problematic in emergencies; this type of problem can be solved with this project. The yields are obtained for both authorized and unauthorized people's finger impressions. The microcontroller is linked to the Arduino board. When a finger is placed on the sensor, it checks and correlates with pre-stacked information, and

assuming the finger impression coordinates match, the engine is turned on; if the finger impression does not match, the engine is not turned on. When the Arduino regulator receives unique mark coordinates, that is approved individual information, it activates the relay, which prompts and turns on the vehicle's motor. The Arduino controller does not fulfill its duty when a finger impression does not coordinate, signaling that unauthorized individual information is delivered, and the relay remains off position. The component that they used in this project are Power Supply, LCD Display, Motor, Fingerprint Module, Atmega328 Microcontroller, Buzzer, Arduino Uno and Max232 [4].

2.9 Fingerprint Vehicle Starter with GPS Vehicle Tracking and Theft Detection

They propose a solution to this problem in this paper, which uses a fingerprint-authenticated vehicle starter system. It also suggests using a GPS-based vehicle monitoring system to track the vehicle and provide tracking information to the user through SMS. The system's command and control center is the microcontroller. A GPS modem is included in the system, which maintains the vehicle's location in terms of latitude and longitude, allowing them to keep track of their automobiles. The GPS receives satellite data in real-time and stores the latitude and longitude information in the AT89s52 microcontroller's buffer. It also goes off if the IR sensor detects an accident, the temperature sensor detects a fire, or the theft sensor detects a theft connected to the car [5].

2.10 Vehicle Anti-Theft System Using Fingerprint Recognition Technique

This work of this project is to keep cars safe from unauthorized users and to prevent vehicle theft. A biometric fingerprint security system allows only authorized users to start the vehicle. Figure 2.8 show the fingerprint of an authorized person is scanned, and the engine is started. As a result, the vehicle is in good working order. This project is about vehicle security, and it results in

the creation of an anti-theft system for a car using the AT mega 328. To detect the fingerprint, an inside-the-vehicle fingerprint sensor is being used. The pre-assigned data is used to assess the fingerprint sensor data reading obtained in the AT mega 328. After authenticating the person as the car owner or an authorized fingerprint user who can take control of the vehicle, the engine ignition system commences. The engine will not start if it is an intruder. In Figure 2.9 show the engine is turned off while the fingerprint of an unauthorized individual is scanned. Other security systems can be stolen, but in this case, the key is a fingerprint, which would be unique to each individual and thus provides extra protection. The vehicle's engine cranking method is secured by interfacingan Arduino UNO board, a fingerprint sensor, and a relay, which create the anti-theft system as wellas provide enhanced security from unauthorized individuals [6].

Figure.2.8: The fingerprint of an authorized person is scanned, and the engine is started [6]

Figure.2.9: The engine is turned off while the fingerprint of an unauthorized individual is scanned [6]

2.11 Design Development of Fingerprint Based Car Starting System

The purpose of this study is to design and develop a fingerprint-based car ignition system that will aid in the prevention of car theft and illicit use. Armed robbers have recently intensified their attention on stealing cars, particularly brand-new ones, which has resulted in a rise in a car hijacking. As a result, the need to protect vehicles against hijackers has become crucial. No one can start the vehicle in this paper unless they have been allowed by a system that has already registered their fingerprints and pattern features as part of their enrolment This is accomplished with a fingerprint module, a PIC18F4620 microcontroller, and a Liquid Crystal Display (LCD) module.

Fingerprint technology increases the security of vehicles by allowing only authorized people to operate them. The achievement of our auto security system comes in a low-cost and easily accessible form because of deploying this system on vehicles. The output is displayed using an LED. Traditional methods of personal identification are less secure and convenient than biometric recognition technology [7].

2.12 Biometric Attendance Monitoring System Using Raspberry Pi and Fingerprint

A fingerprint-based biometric system that automatically tracks attendance as described in this study. This system consists of a Raspberry Pi, which acts as the project's brain, and a fingerprint sensor, which detects the person's identity. To gain their attendance in educational institutions, for example, students must place their fingers on the fingerprint sensor. The captured fingerprint is recorded in flash memory, and the obtained fingerprint is compared to the record in the flash memory each time, after which the student has rewarded attendance [3][4]. It can eliminate problems like a proxy, where no student can give attendance for an absent friend, by using this technique.

The software platform is based on the Raspberry Pi (Linux OS) and Python programming languages. It demonstrated a low-cost biometrics architecture based on the Internet of Things. The Raspberry Pi was successfully used as a remote wireless enrolling node. On the Raspberry Pi,the encryption module ran smoothly as well. The Raspberry Pi client transferred the encrypted biometric features to the cloud for decoding. Unlocking a door, logging information about a person entering and exiting a facility, attendance management, accessing a specific service, and other security and access control measures are all possible with the suggested system. Whenever authentication is required, this approach can be utilized. The avalanche effect demonstrated the safety of the IoT-based biometric solution [8].

2.13 Anti-Theft Protection of Vehicles by using Fingerprint.

In previous studies, an alternative approach to device switching is proposed that combines fingerprint identification with GSM as shown in Figure 2.12 SMS alert and GPS functionality. This method allows more than one person to control the device's functionality, and the authentication feature provided by thefingerprint sensor helps to reduce the time required to correct a fault. In Figure 2.11 show the setup of a model.

The Arduino board used in this model is the most affordable and can be used in a variety of applications. The use of device switching is not limited to controlling a device from a distance; it can also be used in automobile applications. The proposed design not only provides switching functionality, but also specifies the device's exact location. As a result, theft of the device is easily detectable. It teaches you everything you need to know about designing microcontroller-based systems and developing embedded software. Cloud computing can be added to this project in the future so that every activity performed on the device can be closely monitored. This reduces the need for all log-in information to be stored in computer storage [9].

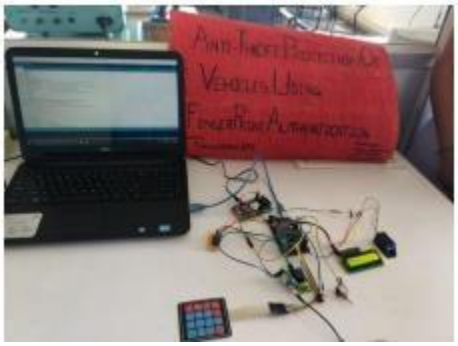

Figure 2.11: Setup of a model [9]

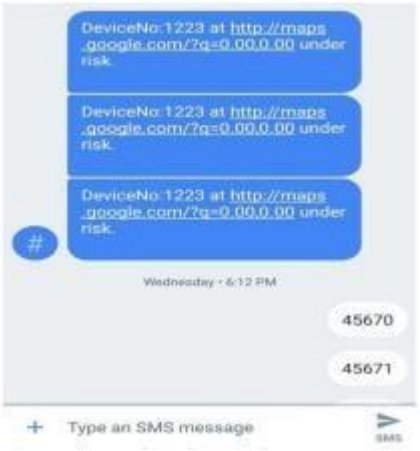

Figure 2.12: SMS alert [9]

2.14 Fingerprint and Raspberry Pi Based Vehicle Authentication and Secured Tracking System

Figure 2.13: Vehicle Location Information Update on Google Map [10]

Figure 2.14: Total system response of the proposed system [10]

Keys are frequently the only tools available to operate (start/stop) the car. The use of a key-based car entry system will prevent theft. Based on historical security problems and current Indian requirements, we recommended a high level of protection for the car. An authorized individual can operate the vehicle using a fingerprint authentication system. By placing one's thumb on the fingerprint scanner, which is subsequently connected to the Raspberry Pi via serial mode interface, the vehicle can be controlled. Each unique finger impression can be verified using fingerprints stored in the Scanner's Digital Flag Controller. The digital signal controller compares the data. If the data matches what is available, send the information to the Raspberry Pi. According to the processor, only approved individuals are permitted to operate the car. Figure 2.14 shows the total response of the proposed system. Following the instructions, if an unauthorized person tries to start the vehicle, the security alarm will be activated. It can track the vehicle using GPS in the event of an emergency. The website's information can be updated via a Google Maps connection, as shown in Figure 2.13, which updates vehicle location information on Google Maps. Regrettably, the information might also be utilized to pin point when a theft had a place. It also can transmit commands over IoT to stop the car, and it will not start again once it has been stopped [10].

2.15 Development of Vehicle Ignition Using Fingerprint

As shown in Figure 2.15, the final output when the authorized user is detected, the project's objectives for developing vehicle ignition using fingerprints have been met with success. In a nutshell, this prototype of vehicle ignition using a fingerprint scanner has been developed successfully. This system works perfectly for enrolling new users and deleting registered users. This project has successfully completed the necessary steps to notify the authorized user via SMS using GSM. When the vehicle is turned on and an unauthorized user is detected, SMS messages are sent to the owner. Aside from that, the user's status is displayed on the LCD. When the vehicle is turned on, the LCD displays the status of the vehicle, whether it is ready to start or not, as well as the condition of the fingerprint. For a successful user attempt, the output of this system is revealed via LED and motor. The LED will bring to light and the dc motor will begin to run, indicating that the ignition was successful, while the buzzer will sound, indicating that an attempt was made. Failure is an unauthorized user. This fingerprint recognition technology focuses on automobiles and is only available to the authorized user to use In the event that this is implemented, The system on locally produced vehicles will make the car a tight security system that is also reasonably priced [11].

Figure 2.15: Final output when the authorized user is detected [11]

2.16 Raspberry Pi Vehicle Anti-Theft Face Recognition System

This project is used to reduce the rate of theft. The GPS technology is used to track the location, and the Wi-Fi module is used to send notifications of car door security breaches and face detection via the application. The email information about the security breach also includes an image of the burglar. This system is important in theft tracking because, in addition to initially notifying the owner, it provides a significant lead on the burglar and aids in the activation of the kill switch and steering lock. The Raspberry Pi monitoring system, as well as the webcam, had been completed and tested. Not only is the Raspberry Pi used as a server, but the webcam is also used as a motion detection sensor. This system can be enhanced further by adding an additional infrared emitting system to detect the person's face if he or she is wearing a mask on his or her face. The thermostat or control device can control the seating arrangement in the house and adjust it to the desired temperature. It intends to make available a wireless relay connection as well as a wireless sensor that is movable as well as operable and can be used in business to provide security to the entire building with a single system and the Figure 2.16 show the final output when the authorized user is detected [12].

Figure 2.16: Final output when the authorized user is detected [12]

2.17 Table of Comparison

Table 2.17.1: Table of comparison

No	Author(s)	Techniques/Component Used	Advantages	Disadvantages
1.	Gopu Priyanka, Bala Bhadruni Pranavi, Krishnamsetty Manaswini, A. S. R. Sai Srinivas , A. V. Rajan. (2020)	Fingerprint sensor module, GPS, GSM.	Equipped with GPS tracking system in case of car loss or theft.	Any unauthorized user who knows the passcode could override the whole system such as deleting the fingerprint or change the default passcode.
2.	Elijah Omidiora, Fakolujo O.A, Oladiran Tayo Arulogun, David Oluwagbemiga Aborisade. (2011)	Fingerprint analysis software, Parallel Port Cable, Hardware Interface Circuit.	Using parallel port to send electric current from the fingerprint recognition software by using relay thus triggering the car ignition system.	Long process before it can be use, user has to initialize, upload, and extract the fingerprint template before it can be stored and use.
3.	JoelSachin, Kiran Rana Gill. (2016)	Arduino Mega, Arduino Nano, Fingerprint, GSM, GPS, Microcontroller.	The car engine could be turn off by sending message using phone to the GSM embedded in the system.	The Arduino in this project can only be powered using type-b USB, which is not universal since the nowadays car have normal port.

4.	Peetla Suresh, Masina Venkatesh, Chenchula Vijay Kumar, Mopurisiddareddygari Lakshmi, Gajjala Karthik. (2021)	Power Supply, LCD Display, Motor, Fingerprint Module, Atmega328 Microcontroller, Buzzer, Arduino Uno, Max232.	Enhanced security, users need to scan 2 times their fingerprint to prevent accidental scanning.	System malfunctioned when the 2 times attempt by the authorized user didn't match.
5.	Raj Vardhan, Udit Bahuguna, Varun Mishra, Simon Chauhan. (2019)	GPS, GSM, Atmega Microcontroller, Arduino Uno, Power Supply, Resistors, Capacitors, Transformer.	Alert the location of the car to the owner using GSM techniquefor 3 unsuccessful attempts of the fingerprint scanner.	Theft could happen when the registered mobile phone goes out of battery, disabling the alert notification to the owner's phone.
6.	Z. Brijet, B. Santhoshkumar, N. Bharathi. (2017)	Vehicle Security System, Fingerprint Scanner, Arduino Uno, Engine Ignition System, Relay.	The proposed system used relay to supply voltage directly to the ignition system after successful attempt.	Can be easily hot-wired.
7.	Lateef Adesola Akinyemi, Comfort Folorunso. (2015)	Power Supply, Switch, Power Regulator, PIC 18F4620, Fingerprint Scanner, LM016L LCD, Ignition Start Phase, Engine Start Phase.	Have control button on the scanner to access the fingerprint stored.	Need outsource battery to power the system.

8.	Huzefa Shabbir Sadikot (2018)	Raspberry-pi 3, Fingerprint Sensor, Switch Circuit, Operating System SD card.	Use cloud encryption for the fingerprint database using raspberry pi, can easily be accessed remotely.	The system is rigid, anyone with the admin password can tamper with the data.
9.	Bindu Nagendra, B Bhargavi, Ramyashree K, Sukanya K, Nagashree R N. (2018)	Power Supply, LCD, Arduino, Relay, Alarm Circuit, Fingerprint Module, GPS, GSM.	Enhanced security, the authorized user can grant other user to use the fingerprint scanner by scanning the fingerprint scanner and using registered device paired to the system to grant the access.	A bit hassle for the authorized user since they need to scan and then granted their access through device to start the engine.
10.	Rajeshwar Rao Arabelli, Keerthana Revuri (2019)	Raspberry Pi, USB to Serial Converter, Fingerprint Module, Push Buttons, LCD, 10k Pot, Jumper wires, LED, Resistor.	Built-in GPS to obtain the vehicle's latitude and longitude, which is then displayed in Google Maps.	Only works when the vehicle is linked to Wi-Fi; it is ineffectual if the vehicle becomes lost in an area where there is no network service.

11.	Jamil Abedalrahim Jamil Alsayaydeh, Win Adiyansyah Indra, Adam Wong Yoon Khang, Vadym Shkarupylo, Dhanigaletchmi A. P. P. Jkatisan. (2019)	Arduino, Fingerprint Sensor, GSM, LCD, Vehicle Ignition, LED, Buzzer.	Only the master fingerprint id (car owner) can perform actions such as adding or deleting other user fingerprints.	The system cannot receive more than one master fingerprint in case of emergency happened and the master fingerprint could not use the scanner.
12.	Mirza Aqeel Raza, Pavan D, Raviraj P Shrivastava, Rohith V R. (2019)	Raspberry Pi 3, GPS, GSM, Raspberry Pi Camera, DC Motor,	Use facial recognition, only authorized user can start the engine.	Owner with face mask will have a difficult time to use the car.

The table of comparisons between the research found is shown in table 2.17.1. In this table, we compare authors, the components they utilized, and their advantages and disadvantages. Based on this research, the most used component is Arduino, but for this project it will choose to use the Raspberry Pi 4 as a core component.

2.18 Summary

Cumulatively, after reading and observing previous related projects, it is completely obvious that the traditional microcontroller has several disadvantages when compared to the Arduino and Raspberry Pi, which are advancements over the old technology. As a result, due to practical specifications, it is safe to say that Raspberry Pi is the best and most understandable concept that can be implemented in this project. The car ignition system project research facilitates in the achievement of the goals of the development of a car ignition system-based fingerprint recognition method using Raspberry Pi. The characteristics of the indigenous spine and their relationships determine the personality of the fingerprints. The trivial similarity is used to support many automation systems of the local fingerprint comparison unit. Fingerprint recognition is now one of the most advanced biometric technologies, and it is supported by fingerprint imaging. They raise the level of fingerprints in this manner. In the case of fingerprint recognition, a critical step influencing system accuracy is the match between the model and the fingerprint queries. This method promotes individual personality and separates biometric tool separation to transfer information obtained in this manner they mistreat fingerprints and the same algorithmic rule, and they store information to show who is approaching access using a web page created within the native server.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The methodology is the overall research strategy that outlines how the research will be conducted and, among other things, identifies the methods to be used. These methods, which are described in the methodology, define the methods or modes of data collection or, in some cases, how a specific result is to be calculated. The methodology does not define specific methods, even though much attention is paid to the nature and types of processes to be followed in a specific procedure or to achieve an objective. When appropriate to a methodology study, such processes form a constructive generic framework and can thus be broken down into sub-processes, combined, or their sequence changed. This chapter demonstrate the methods that will be used to complete the Development of Car Ignition System Based on Fingerprint Recognition Method Using Raspberry Pi project. This chapter explain the starting point of the project, the direction and step taken to complete the project and the implication of the compiles project. The technical part of project will be explained which is the process of project flowchart and the block diagram of the system. This chapter represents each of hardware and software specifications used for the system and explains each functionality. In addition, hardware development for this project is required.

3.2 Methodology

The purpose of the project is to use Raspberry Pi to create a fingerprint car starter with an alarm alert for failed tries to improve security and avoid theft for Malaysian automobile owners. The Raspberry Pi 4 will serve as the project's core module, controlling all of the other component activities. The fingerprint sensor's result is displayed on the LCD Display, whether it's a match or not. The power supply for all the components in this project is then a 12 Volt Power Supply. Furthermore, a Fingerprint Module sensor is used in this project to record user fingerprints and store them on the Raspberry Pi. This project also uses a speaker to make a sound. In addition, A speaker is also used in this project to produce sound. Furthermore, the speaker is used to indicate successful and unsuccessful fingerprint attempts. The Thonny Python IDE and Python language are used in this project, and the code is uploaded to the components and linked together.

3.3 Project of process flowchart

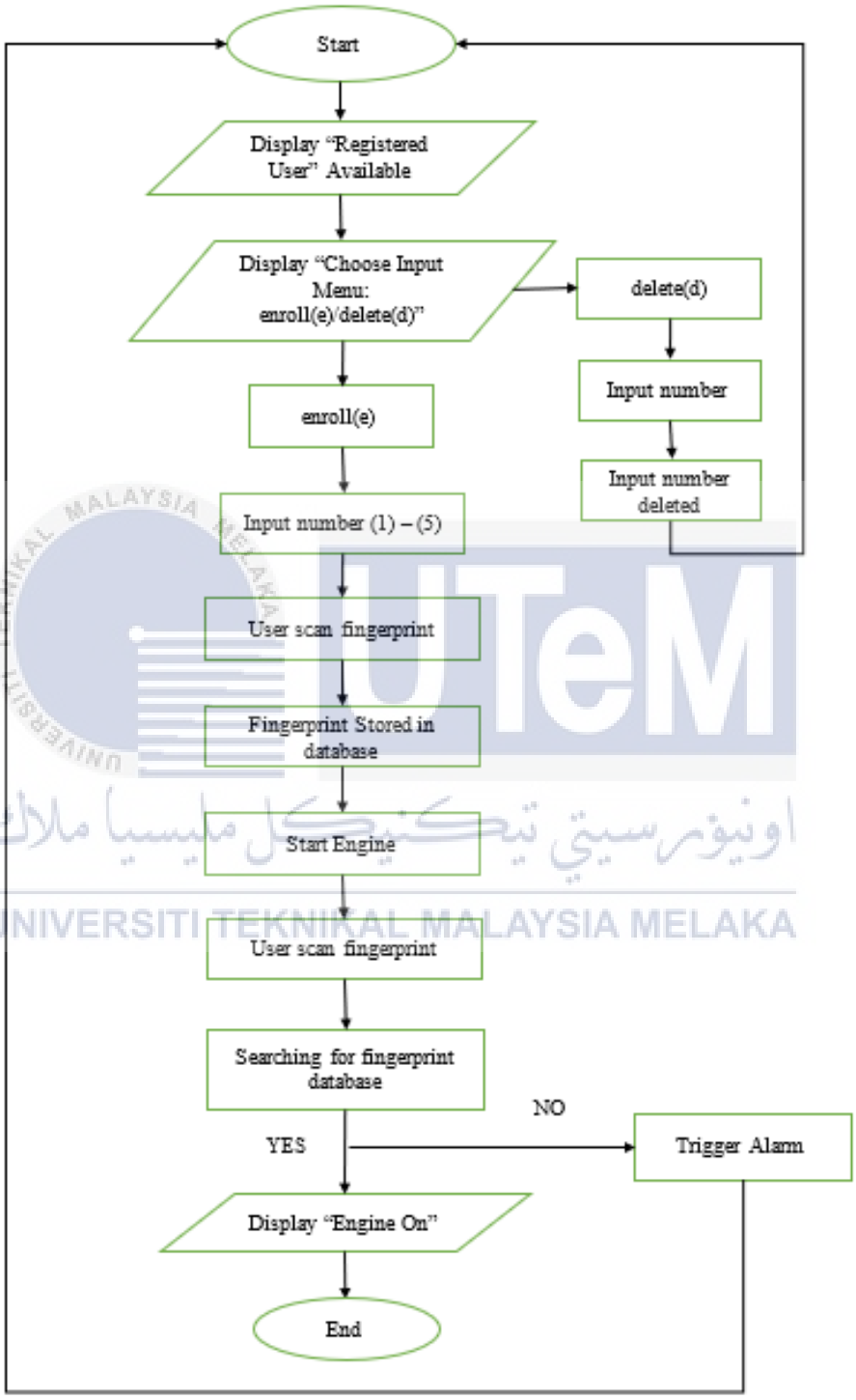

Figure 3.1: Flowchart

The system's flow is represented in a flowchart. The first step, as shown in Figure 3.1, is the LCD will display “Registered User” available and will display “Choose Input Menu” either enroll(e) or delete(d). Then, insert input number 1 through 5. After that, the user scans his or her fingerprint, fingerprint will be stored in database and the LCD will display “Stored’. Then, the user will scan the fingerprint again to start the engine. Next, if the user scans the fingerprint successful, the LCD will display “Engine On” and will make a sound. If the user scans unsuccessful, the LCD will display “Unregistered fingerprint” and the alarm will be triggered.

3.4 Block Diagram of Project

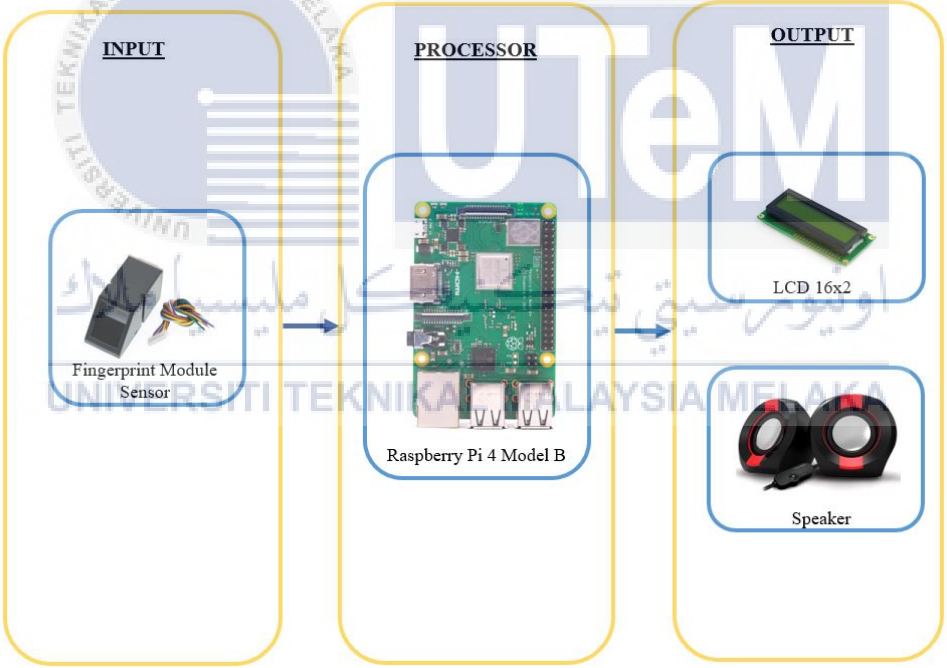

Figure 3.2: Block Diagram

The Figure 3.2 show the block diagram for this project and the project consists of Raspberry Pi 4 Model B, LCD Display, Fingerprint Module Sensor, and speaker powered by a 12 Volts power supply. The project starts its flow by working on the Fingerprint Module Sensor. User will scan their fingerprint first to have granted them as an authorized user. The fingerprint will send the data to the raspberry pi. Then, the LCD will display a message saying the user is fingerprint stored. After that, the user will scan their fingerprint for the first time to start the engine. At this time, LCD will display "Detected" as the fingerprint match the data inside raspberry pi. Then, the user will scan the fingerprint in which after the successful match of the data stored, raspberry pi will send a message to the LCD screen will display "Fingerprint detected." And it will trigger the sound on the speaker. If the fingerprint didn't match with the data, the LCD will generate an "Unregistered user" message, at the same time, Raspberry Pi will send a message to the speaker which would make an alarm sound.

3.5 Hardware Specifications

The hardware used in this project are as follows:

3.5.1 Raspberry Pi 4 Model B

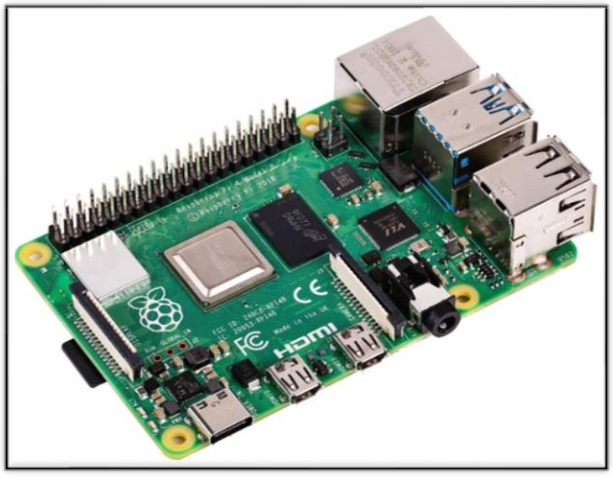

Figure 3.3: Raspberry Pi 4 Model B

The Raspberry Pi 4 Model B as seen in Figure 3.3 is the most recent addition to the popular Raspberry Pi computer line. It outperforms the previous- generation Raspberry Pi 4 Model B in terms of processor speed, multimedia, performance, memory, and connectivity while maintaining backwards compatibility and power consumption. The Raspberry Pi 4 Model B provides desktop performance comparable to entry-level x86 PC systems to the end user. A high-performance 64-bit quad core processor, dual-display support at resolutions up to 4k via a pair of micro-HDMI ports, hardware video decodes at up to 4Kp60, up to 4GB of RAM, dual-band 2.4/5.0 GHz wireless LAN, Bluetooth 5.0, Gigabit Ethernet, USB 3.0, and PoE capability are among the key features of this product (via a separate PoE HAT add-on). The dual-band wireless LAN and Bluetooth modules have modular compliance certification, which allows the board to be designed into end products with significantly reduced compliance testing, reducing both cost and time to market.

3.5.2 Fingerprint Module Sensor

Figure 3.4: Fingerprint Sensor Module - R307

In Figure 3.4 shows, the fingerprint sensor module R307 is made up of an optical fingerprint sensor, a high-speed DSP processor, a high-performance fingerprint alignment algorithm, high-capacity FLASH chips, and other hardware and software components. It has stableperformance, a simple structure, and functions such as fingerprint entry, image

processing, fingerprint matching, search, and template storage. The act of comparing a questioned and knownfingerprint to another fingerprint to see if the imprints are from the same finger is known as fingerprint recognition. It is divided into two sub-domains: fingerprint verification and fingerprintidentification. Fingerprint identification is the process of determining a person's identity based onhis fingerprint. Without knowing the person's identity, the fingerprint identification system compares his fingerprint to those in the database. For fingerprint recognition, an Artificial Neural Network (ANN) is used.

3.5.3 LCD (Liquid Crystal Display) Screen

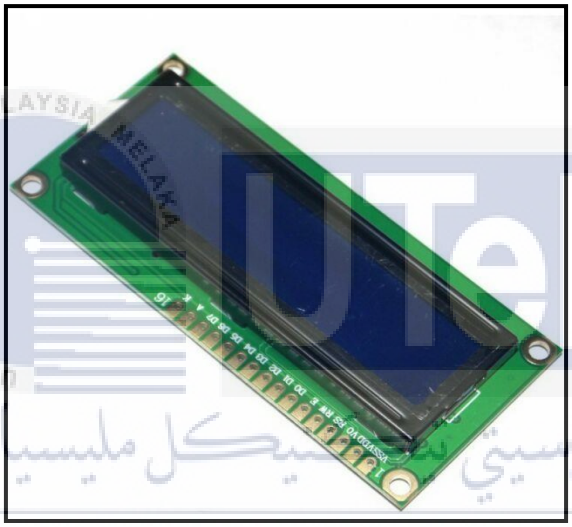

Figure 3.5: LCD Display 16x2

An LCD (Liquid Crystal Display) screen, as seen in Figure 3.5, is a versatile electronic display module. A 16x2 LCD display is a common component in a wide range of devices and circuits. On each of its two lines, a 16x2 LCD can display 16 characters per line. On this LCD, each character is displayed in a 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display can display 224 different characters and symbols. As you can see, the module includes two power pins for the LCD, Vss, and Vcc (from left to right). Vss should be connected to the ground and Vcc to 5V, but the LCD can work with voltages

ranging from 4.7V to 5.3V. The control pins which include Contrast (VEE), Register Select (RS), Read/Write (R/W), and enable, are next(E). The Contrast pin is used to modify the contrast (visibility) of the characters; it is generally connected to a 10k potentiometer for this purpose. Because we will only be writing characters to the LCD and not reading anything from it, the Read/Write pin will be grounded in mostcircumstances. The LCD's control pins, Register Select (RS) and Enable pin (E), will be connected to the microcontroller's digital pins, or GPIO pins. These pins instruct the LCD where to put acharacter when to clear it, and so on.

3.5.4 Speaker 2.0 USB Powered

Figure 3.6: Speaker 2.0 USB

In Figure 3.6 shown Speaker 2.0 USB powered. Raspberry Pi does not have a speaker. However, there are several audio output modes that you can connect a speaker to. We can connect Raspberry Pi to a speaker physically with an audio jack or a USB port, or we can connect wirelessly through Bluetooth. It is small and lightweight, making it easy to be set up and it matches perfectly with the compact size of Raspberry Pi board. It comes with USB A jack for power, you can connect this USB jack to any USB port on Raspberry Pi board (of course the USB A type barrel), and the standard 3.5mm audio jack can be easily

inserted to the Audio barrel on Raspberry Pi board too. Adjust the volume knob and can hear the sound from the stereo speaker.

3.6 Software Specifications

The purpose of using VNC Viewer as the core software applied in implementing this study to function intended. Besides, the use of this software as a platform to build project in this study. This Virtual Network Computing software is used to configure Raspberry Pi 4 Model B which have used as microcontroller for this project.

3.6.1 Virtual Network Computing (VNC)

Figure 3.7: VNC Viewer

It is open-sourced and free software that is primarily used to write and compile code for the Raspberry Pi operating system. VNC Viewer is pre-installed on the Raspberry Pi. The only requirement is that your Raspberry Pi has the Raspberry Pi OS installed. VNC allows it to control the Raspberry Pi over the network as if the mouse, keyboard, and display were physically connected to the Raspberry Pi. VNC is not only used on computers. The primary code was written on the IDE platform. On the board of each of them is a microcontroller that has been programmed and receives information in the form of code. The main code was

written in the Thonny Python IDE. This environment is compatible with the Python programming language and can be used to perform a variety of tasks. Python is also used as the main programming language by the Raspberry Pi foundation due to its versatility and simple syntax. The VNC Viewer software icon is shown in Figure 3.7.

3.7 Hardware Development

The hardware used in this project are Raspberry Pi 4 Model B, Fingerprint Sensor Module R307, LCD Screen Display and Speaker 2.0 USB Powered. In Figure 3.8 show here are three hardware that will be interfacing directly to Raspberry Pi 4.

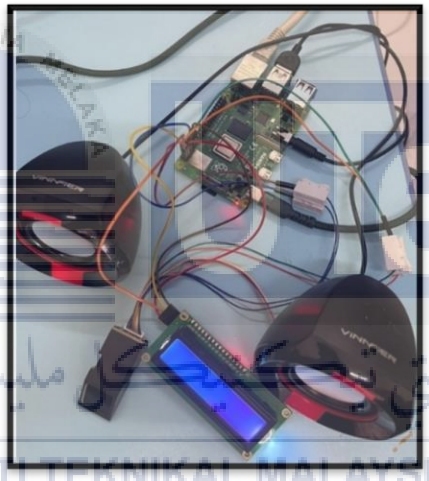

Figure 3.8: Three hardware to Raspberry Pi 4 Connection

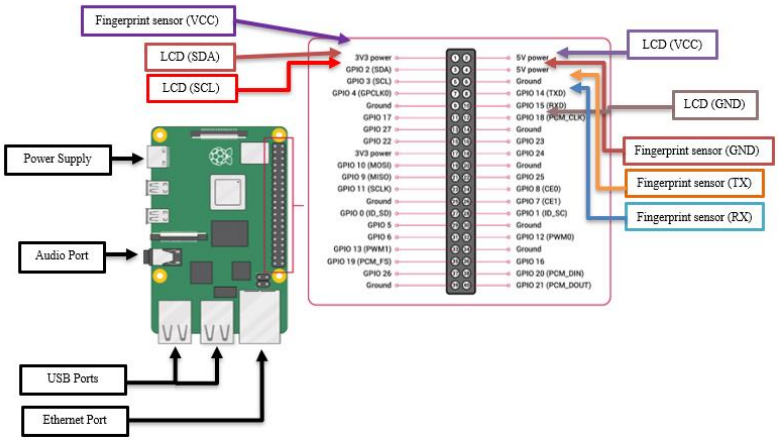

Figure 3.9: show Raspberry Pi GPIO and Spec details

From Figure 3.9 show the Raspberry Pi GPIO and spec details that used in this project. The fingerprint sensor module required connection of 4 pin for Ground to pin 6, TX to pin 8 (GPIO 14), RX to pin 10 (GPIO 15) and VCC to pin 1 (3V3 power). For LCD Screen Display required connection of 4 pin for Ground to pin 14, SDA to pin 3 (GPIO 2), SCL to pin 5 (GPIO 3) and VCC to pin 4 (5V power). Lastly, for Speaker required connection of 2 adapters to Raspberry Pi 4 Model B which is USB port and audio port.

3.8 Summary

The process for 'Development of a new car starter concept with fingerprint sensor using Raspberry Pi' is described and explained in this chapter. One of the most important chapters in project management is project methodology, which ensures that the project may be finished methodically by following the correct sequence of project techniques. At four stages of the approach, the project developer generates a project of process flowchart, block diagram of the project, hardware and software specifications, and hardware development. Control parameter was determined in the certain of the projectin the formulation of the project structure plan based on previous study and literature review. The analysis and identification of all the project's components and control elements is a crucial featureof this stage. A phase in the design and manufacturing of mechanical, electronic, and software design is defining the project. Following that, the entire project integration will be tested and troubleshot to achieve the project's key goals.

CHAPTER 4

RESULT & ANALYSIS

4.0 Introduction

This chapter gives the results and analyses on the development of Car Ignition System. The result consists of hardware. The complete system and function of each hardware during the system activation Apart from that, this chapter also will present the result of the analysis made during the project development.

4.1 Prototype Preparation

Figure 4.1: Drill Process

Figure 4.2: Spray Process

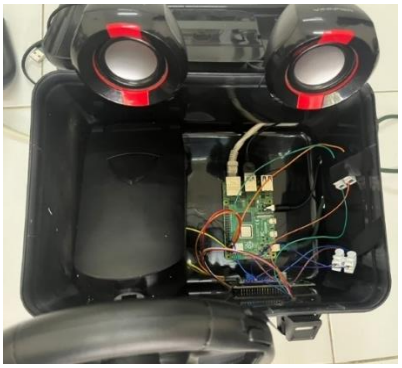

Figure 4.3: Hardware placement

Figure 4.4: Circuit connection

Figure 4.5: Prototype Completion

This prototype was created by placing components in a box. To keep things neat, the Raspberry Pi board, fingerprint sensor module, and LCD screen display were all placed inside the box. To make it easier to read, a hole for an LCD screen display was placed in front of the box. Meanwhile, a fingerprint sensor module will be installed in front of the box to make fingerprint scanning easier, and the Raspberry Pi board will be inserted next to the steering and a hole will be made for USB ports, cable ports, audio ports, and power supply ports. The speaker will be placed on top of the box. This prototype was prepared with tools such as a drill, screwdriver, cutter, and spray. Figure 4.1, Figure 4.2, Figure 4.3, and Figure 4.4 represent the overall step of prototype preparation. Figure 4.5 illustrates the finished prototype with part label.

4.2 Results

Figure 4.6: LCD display Registered User Available

Figure 4.7: LCD display Menu

Figure 4.8: LCD display Input Number

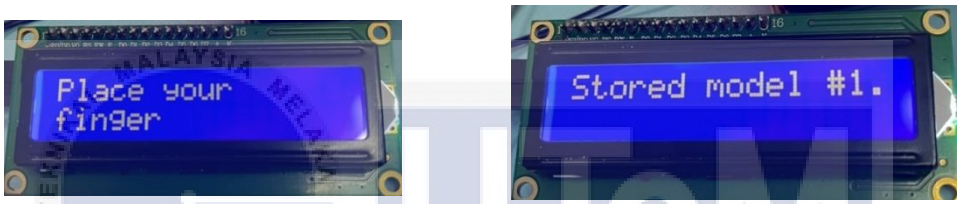

Figure 4.9: LCD display for enroll and successful stored

Figure 4.10: LCD display to start the engine

Figure 4.11: LCD display ‘Unregistered fingerprint”

Figure 4.12: LCD display to delete input number

This section contains the overall system output after the Raspberry Pi board has been supplied with 5 volts of input power. Figure 4.6 show output from LCD screen display that the registered fingerprint user available and from Figure 4.7 show “Choose the Input Menu” either enroll for registered user fingerprint or delete for remove the fingerprint on LCD screen display as shown in Figure 4.12. After that, enter the ‘Input Number 1 to 5’ that show in Figure 4.8. Figure 4.9 shows on the LCD display that to enroll the user's fingerprint, the fingerprint must be placed on the fingerprint sensor, and the message “Stored 1” will appear. Next, when user successful scan their fingerprint, as shown in figure 4.10 it will start the engine and the speaker will make a sound however, when user fails to scan their fingerprint, the LCD display will show “Unregistered fingerprint.” in figure 4.11 and the alarm will be triggered.

4.3 Data Analysis

This project's analysis is carried out by scanning the fingerprints of registered users. The project's outcome is obtained after ensuring that all the project's components work properly. The attempts of five registered users to start the ignition have been recorded. Each of the five fingerprints has been measures to obtain the response times. The time taken scanning user fingerprint of all five users is recorded, as shown in the Table 4.3.1 and Table 4.3.2.

Table 4.3.1: Fingerprint ID and Time Taken(seconds) for enroll.

Fingerprint ID	Time Taken (seconds)
1	24.40
2	23.68
3	22.94
4	20.93
5	22.80

Table 4.3.2: Fingerprint ID and Time Taken(seconds) for start the engine.

Fingerprint ID	Time Taken (seconds)
1	5.95
2	8.76
3	9.60
4	6.80
5	10.52

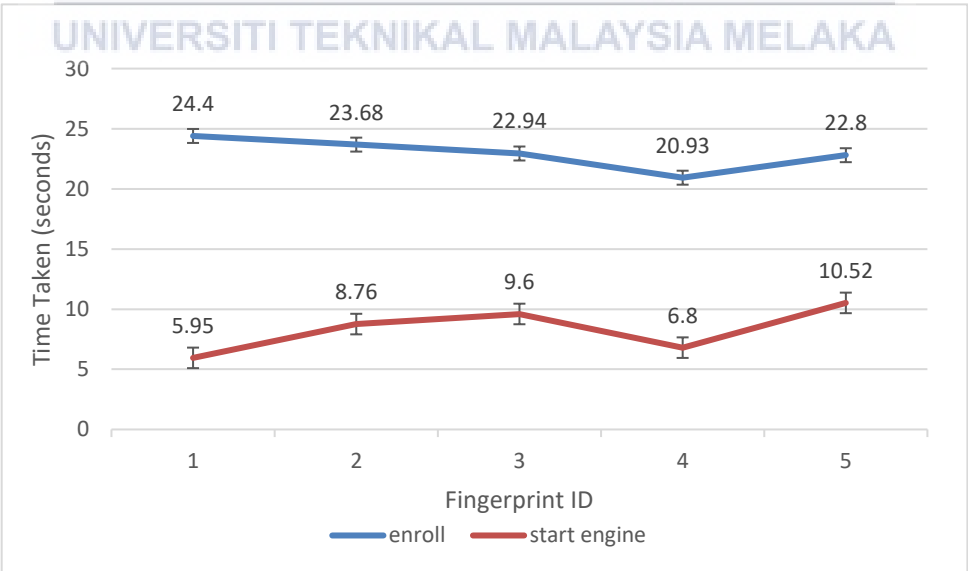

Figure 4.13: Data Analysis

Figure 4.13 represents the data analysis between Fingerprint ID and Time taken for the sensor to detect the fingerprint. As shown above, when the fingerprint ID 1 scans the fingerprint for enroll register the time taken to record the value is 24.4 seconds. Meanwhile, to start the engine fingerprint ID 1 need to scan the fingerprint again and it takes 5.96 seconds. For next fingerprint ID 2, 3 and 4 the time taken for enroll drops from 23.68 seconds to 20.93 seconds and the time taken to start the engine increasing. For fingerprint ID 5, the time taken for enroll is 22.8 seconds and the time taken to start the engine it takes 10.52 seconds. The average time to enroll is 22.95 seconds, while the average time to start the engine is 8.33 seconds.

Figure 4.14: Successfully stored when to enroll registered fingerprint user.

Figure 4.15: final output when authorized user is detected.

The successful output of the ignition system is shown in the Figure 4.14 and Figure 4.15 on the LCD. When a fingerprint user registers, the LCD screen displays "Stored model (fingerprint ID)." The user should then scan their fingerprint again to start the engine. When an authorized user is detected, the LCD screen displays "Detected (fingerprint ID)" along with a sound and the car starts.

4.4 Summary

This chapter explains one of the project's results. The outcome of the fingerprint sensor circuit construction is included. The expected outcome of this project is that the car will only start when the authorized user scans his or her finger on the fingerprint sensor module. The authorized user's fingerprints are saved in the fingerprint module. When a user places his or her finger on the fingerprint module and the data is found in the Raspberry Pi, a match condition occurs and the speaker makes a sound; otherwise, the speaker makes an alarm. Furthermore, the compiled coding results have been included as proof that the data was successfully collected without any troubleshooting. As shown in the graphs Figure 4.13, the components used are within their tolerance values, providing assurance of the system's proper operation. The average time to enroll is 22.95 seconds, while the average time to start the engine is 8.33 seconds.

CHAPTER 5

CONCLUSION

5.1 Conclusion

The aim of this study was on fingerprint sensors for car ignition, which will be useful in several situations. The usage of fingerprint sensors allows for the identification of genuine and registered users. There are a few adjustments or functionalities that might be added to this framework's current version to increase its security and portability. Car Ignition Fingerprint Sensor if the registered user's finger is defaced, defective, or colored, the gadget will not allow the user to start the vehicle. The LCD screen display discloses and displays the status using a fingerprint sensor that receives input from the user.

5.2 Future Work

Fingerprint technology is a very effective and low-cost security check technology for preventing vehicle theft. In the future, smart phone (for example android, windows, apple) applications can be created, and a dedicated smart phone installed in the vehicle can be interfaced with a fingerprint device to obtain real-time vehicle tracking with interactive mapping. Fingerprint technology improves automobile security by allowing only authorized users to use the vehicle. As a result of implementing this system on vehicles, the achievement of our car security system becomes affordable and easily accessible. LED is used to display the output. Biometric recognition systems provide greater security and convenience than traditional methods of personal identification.

5.3 Project Potential

This project serves a few criteria such as:

- Enhanced security: Many organisations are looking for additional authentication processes for their access control systems due to the risk of stolen and duplicated keys. They can make it more difficult for trespassers to enter a restricted area this way. Because fingerprints are unique, using them for access control systems can help improve security in your building. It can be used in conjunction with other verification methods such as an access card or a PIN to strengthen your security measures. Aside from that, fingerprints are unbreakable and difficult to steal or fake. They cannot be transferred digitally to another person because they require a physical appearance before they can be used. Therefore, fingerprint scanners are used in government agencies, banks, and healthcare facilities, among other places.
- Easy to use: If someone forgets their keys at home or forgets the password to the office door, they may need to contact management to gain access. Whereas your fingerprint will always be with you wherever you go. This makes it simpler and easier to use than other methods of authentication. Fingerprint scanning can also help relieve the difficulty of remembering complex passwords in the workplace. Because password resets are frequently performed to maintain security, your employees may easily forget them. Worse, they may end up scribbling it down on a notepad and leaving it somewhere for passers-by to see. Fingerprint scanning can also speed up the authentication process. It is useful for keeping track of timesheets. It helps with timesheet tracking because instead of manually signing a logbook, your employees can simply press their fingers on a fingerprint reader in the lobby.

- Faster access: Compared to typing a password, a fingerprint scanner can lock and unlock your workstation or device quickly. Plus, you will no longer have to remember complex passwords.

5.4 Potential Commercialization

This project is targeted for the market as below.

- Withdraw money at ATM using fingerprint.
- Used for door lock system for houses or offices.
- Used for voter registration.

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APPENDICES

Appendix A

File Edit View Run Tools Help

07012023.py

```
from PCF8574 import PCF8574_GPIO
from Adafruit_LCD1602 import Adafruit_CharLCD
import time
from time import sleep
import serial
import adafruit_fingerprint
import vlc



uart = serial.Serial("/dev/ttyS0", baudrate=57600, timeout=1)

finger = adafruit_fingerprint.Adafruit_Fingerprint(uart)

PCF8574_address = 0x27  # I2C address of the PCF8574 chip.
PCF8574A_address = 0x3F  # I2C address of the PCF8574A chip.
mcp = PCF8574_GPIO(PCF8574_address)
lcd = Adafruit_CharLCD(pin_rs=0, pin_e=2, pins_db=[4,5,6,7], GPIO=mcp)

mcp.output(3,1)     # turn on LCD backlight
lcd.begin(16,2)     # set number of LCD lines and columns

def get_fingerprint():
    """Get a finger print image, template it, and see if it matches!"""
    lcd.setCursor(0,0)
    lcd.message("Waiting for \n")
    lcd.message("image...")
    sleep(2)
    lcd.clear()
    while finger.get_image() != adafruit_fingerprint.OK:
        pass
    lcd.setCursor(0,0)
    lcd.message("Templating...")
    sleep(2)
    lcd.clear()
    if finger.image_2_tz(1) != adafruit_fingerprint.OK:
        return False
    lcd.setCursor(0,0)
    lcd.message("Searching...")
    sleep(2)
    lcd.clear()
    if finger.finger_search() != adafruit_fingerprint.OK:
        return False
    return True
```

Shell

```
Python 3.9.2 (/usr/bin/python3)
>>>
```

File Edit View Run Tools Help

07012023.py *

```
def get_fingerprint_detail():
    """Get a finger print image, template it, and see if it matches!
    This time, print out each error instead of just returning on failure"""
    lcd.setCursor(0,0)
    lcd.message("Getting image...")
    sleep(2)
    lcd.clear()
    i = finger.get_image()
    if i == adafruit_fingerprint.OK:
        lcd.setCursor(0,0)
        lcd.message("Image taken")
        sleep(2)
        lcd.clear()
    else:
        if i == adafruit_fingerprint.NOFINGER:
            lcd.message("No finger detected")
        elif i == adafruit_fingerprint.IMAGEFAIL:
            lcd.message("Imaging error")
        else:
            lcd.message("Other error")
        return False
    lcd.setCursor(0,0)
    lcd.message("Templating... \n")
    sleep(2)
    i = finger.image_2_tz(1)
    if i == adafruit_fingerprint.OK:
        lcd.setCursor(0,1)
        lcd.message("Templated \n")
        sleep(2)
    else:
        if i == adafruit_fingerprint.IMAGEMESS:
            lcd.message("Image too messy")
        elif i == adafruit_fingerprint.FEATUREFAIL:
            lcd.message("Could not \n identify features")
        elif i == adafruit_fingerprint.INVALIDIMAGE:
            lcd.message("Image invalid")
        else:
            lcd.message("Other error")
        return False

    lcd.message("Searching...")
    i = finger.finger_fast_search()
    if i == adafruit_fingerprint.OK:
        lcd.message("Found fingerprint!")
        return True
    else:
        if i == adafruit_fingerprint.NOTFOUND:
            lcd.message("No match found")
        else:
            lcd.message("Other error")
        return False


# pylint: disable=too-many-statements
def enroll_finger(location):
    """Take a 2 finger images and template it, then store in 'location'"""
    for fingerimg in range(1, 3):
        if fingerimg == 1:
            lcd.setCursor(0,0)
            lcd.message("Place your \n")
            lcd.message("finger")
            sleep(2)
            lcd.clear()
```

Shell

```
Python 3.9.2 (/usr/bin/python3)
>>>
```

File Edit View Run Tools Help

07012023.py *

```
        else:
            lcd.setCursor(0,0)
            lcd.message("Place the same \n")
            lcd.message("finger again")
            sleep(2)
            lcd.clear()

        while True:
            i = finger.get_image()
            if i == adafruit_fingerprint.OK:
                lcd.setCursor(0,0)
                lcd.message("Image taken")
                sleep(2)
                lcd.clear()
                break
            if i == adafruit_fingerprint.NOFINGER:
                lcd.message(".")
            elif i == adafruit_fingerprint.IMAGEFAIL:
                lcd.message("Imaging error")
                return False
            else:
                lcd.message("Other error")
                return False
        lcd.setCursor(0,0)
        lcd.message("Templating...")
        sleep(2)
        lcd.clear()
        i = finger.image_2_tz(fingerimg)
        if i == adafruit_fingerprint.OK:
            lcd.setCursor(0,0)
            lcd.message("Templated")
            sleep(2)
            lcd.clear()
        else:
            if i == adafruit_fingerprint.IMAGEMESS:
                lcd.message("Image too messy")
            elif i == adafruit_fingerprint.FEATUREFAIL:
                lcd.message("Could not identify features")
            elif i == adafruit_fingerprint.INVALIDIMAGE:
                lcd.message("Image invalid")
            else:
                lcd.message("Other error")
            return False
        if fingerimg == 1:
            lcd.setCursor(0,0)
            lcd.message("Remove finger")
            time.sleep(1)
            while i != adafruit_fingerprint.NOFINGER:
                i = finger.get_image()

    lcd.message("Creating model...")
    sleep(2)
    lcd.clear()
    i = finger.create_model()
    if i == adafruit_fingerprint.OK:
        lcd.setCursor(0,0)
        lcd.message("Created")
        sleep(2)
        lcd.clear()
    else:
        if i == adafruit_fingerprint.ENROLLMISMATCH:
            lcd.message("Prints did not\n ")
            lcd.message("match")
            sleep(2)
            lcd.clear()
```

Shell

```
Python 3.9.2 (/usr/bin/python3)
>>>
```

File Edit View Run Tools Help

07012023.py *

```
        else:
            lcd.message("Other error")
        return False

    lcd.setCursor(0,0)
    lcd.message("Stored model #%d...\n" % location)
    i = finger.store_model(location)
    if i == adafruit_fingerprint.OK:
        lcd.setCursor(0,0)
        lcd.message("Stored")
        sleep(2)
        lcd.clear()

    else:
        if i == adafruit_fingerprint.BADLOCATION:
            lcd.message("Bad storage location")
        elif i == adafruit_fingerprint.FLASHERR:
            lcd.message("Flash storage error")
        else:
            lcd.message("Other error")
        return False

    return True
def start_engine():
    lcd.message("Start engine")
    sleep(3)
    lcd.clear()
    if get_fingerprint():
            lcd.message("Detected #" + str(finger.finger_id))
            vlc_instance = vlc.Instance("--input-repeat=0")
            player = vlc_instance.media_player_new()
            song = vlc_instance.media_new("/home/nasha/Music/detect.mp3")

            player.set_media(song)
            player.play()
            sleep(2)
            lcd.clear()

            lcd.setCursor(3,0)
            lcd.message("ENGINE ON")
            vlc_instance = vlc.Instance("--input-repeat=0")
            player = vlc_instance.media_player_new()
            song = vlc_instance.media_new("/home/nasha/Music/Engine.mp3")

            player.set_media(song)
            player.play()
            sleep(2)
            lcd.clear()

    else:
            lcd.message("Unregistered \n fingerprint")
            vlc_instance = vlc.Instance("--input-repeat=0")
            player = vlc_instance.media_player_new()
            song = vlc_instance.media_new("/home/nasha/Music/alarmingcar.mp3")

            player.set_media(song)
            player.play()
            sleep(3)
            lcd.clear()
    return False
```

File Edit View Run Tools Help

07012023.py *

```
def get_num():
    """Use input() to get a valid number from 1 to 127. Retry till success!"""
    i = 0
    while (i > 5) or (i < 1):
        try:
            lcd.message("Input 1-5")
            i = int(input())
            lcd.message("\n " + str(i))

        except ValueError:
            lcd.message("User full")
    return i


while True:
    lcd.setCursor(0,0)
    lcd.message("----------------")
    lcd.clear()
    if finger.read_templates() != adafruit_fingerprint.OK:
        raise RuntimeError("Failed to read templates")
    lcd.clear()
    lcd.setCursor(0,0)
    lcd.message("Registered User")  ##start of the line
    sleep(2)
    lcd.clear()
    lcd.setCursor(0,0)
    lcd.message(str(finger.templates))
    sleep(1)
    lcd.clear()
    lcd.setCursor(0,0)
    lcd.message("enroll (e)")
    lcd.setCursor(0,1)
    lcd.message("delete (d)")
    sleep(1)
    lcd.clear()
    lcd.setCursor(0,0)
    lcd.message("Choose Input")
    lcd.setCursor(0,1)
    lcd.message("Menu")
    sleep(1)
    lcd.clear()
    c = input("> ")

    if c == "e":
        lcd.message("enroll\n")
        sleep(2)
        lcd.clear()
        enroll_finger(get_num())
        start_engine()

    if c == "d":
        if finger.delete_model(get_num()) == adafruit_fingerprint.OK:
            lcd.message("Deleted!")
            sleep(1)
            lcd.clear()
        else:
            lcd.message("Failed to delete")
            sleep(1)
            lcd.clear()
```

Shell

```
Python 3.9.2 (/usr/bin/python3)
>>>
```

GANT CHART PSM 1

PROJECT PLANNING														
List down the main activity for the project proposal. State the time frame needed for each activity.														
	2022													
Project Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
BDP 1 Briefing by JK, PSM, FTKEE	Briefing							Mid Term Break						
Submit project title														
Chapter 1: Introduction														
Study for raw materials														
Chapter 2: Literature Review														
Research for articles and journals														
Research for components and software														
Chapter 3: Methodology														
List out component and compare functions														
Editing of project report														
Testing & analysis														
PSM1 Documentation														
PSM 2 Presentation & Report submission														

GANT CHART PSM 2

PROJECT PLANNING														
List down the main activity for the project proposal. State the time frame needed for each activity.														
	2022/2023													
Project Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
BDP 2 Briefing by JK, PSM, FTKEE														
Buy and receive components														
Test components														
Write program code and testing														
Chapter 4: Result														
Development of hardware design														
Chapter 5: Conclusion														
Prepare and finalize report														
Slide and Poster Presentation														
Testing & analysis														
PSM2 Presentation & Report submission														

Briefing

Mid Term Break