Faculty of Electrical and Electronic Engineering Technology

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

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Tarikh: 27 JANUARI 2023

Tarikh: 23 FEBRUARY 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.

Signature : 

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

Date : 23 FEBRUARY 2023

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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

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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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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

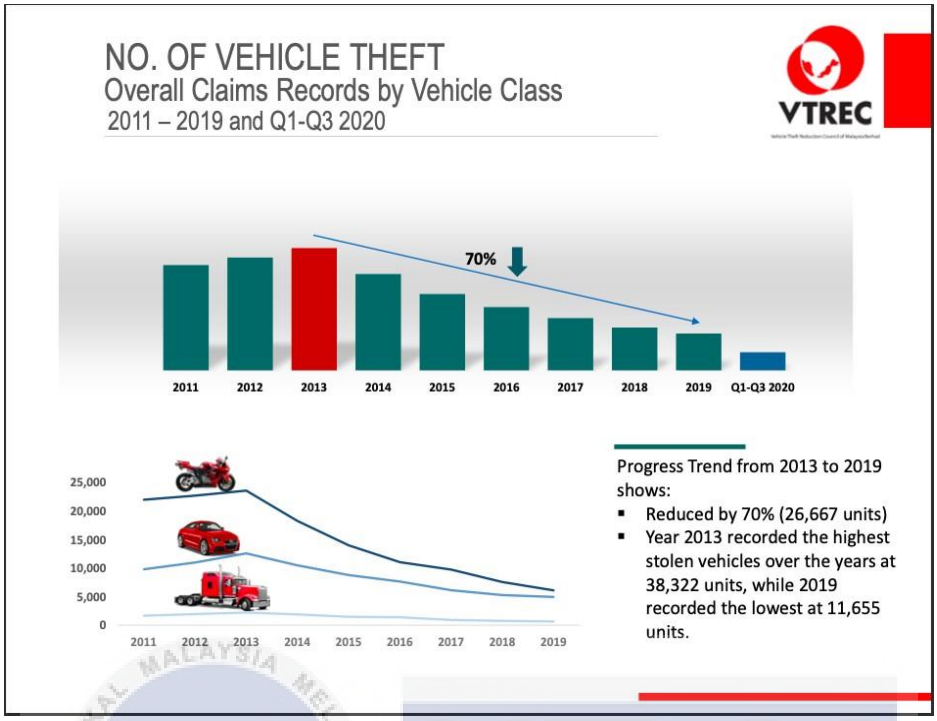

Figure 1.2: Vehicle theft by class from 2011-2020

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.

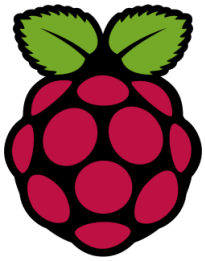

Figure 2.1: Raspberry Pi Logo

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

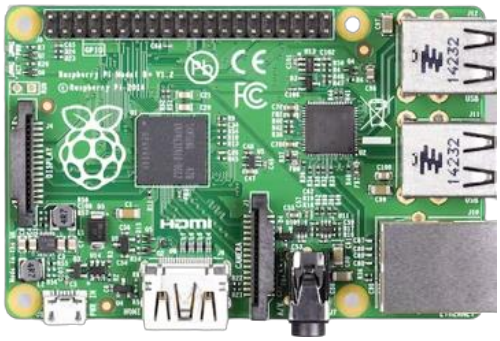

Figure 2.2: Raspberry Pi B+ [13]

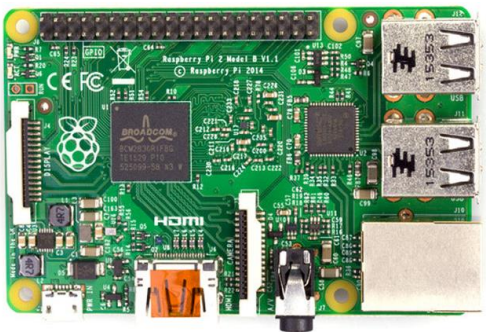

Figure 2.3: Raspberry Pi 2 B [13]

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