SMART CAR SYSTEM WITH SECURITY PROTECTION BY USING ANDROID AND ARDUINO MICROCONTROLLER

MUHAMMAD MU'IZ BIN NOR AZAM

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BACHELOR OF ELECTRICAL ENGINEERING TECHNOLOGY

(Industrial Automation & Robotics) WITH HONOURS

2020

Faculty of Electrical and Electronic Engineering Technology

SMART CAR SYSTEM WITH SECURITY PROTECTION BY USING ANDROID AND ARDUINO MICROCONTROLLER

Muhammad Mu'iz Bin Nor Azam

Bachelor Of Electrical Engineering Technology

(Industrial Automation & Robotics) With Honours

2020

SMART CAR SYSTEM WITH SECURITY PROTECTION BY USING ANDROID AND ARDUINO MICROCONTROLLER

MUHAMMAD MU'IZ BIN NOR AZAM

A thesis submitted
in fulfillment of the requirements for the degree of
Bachelor of Electrical Engineering Technology
(Industrial Automation & Robotics) with Honours

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2020

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: SMART CAR SYSTEM WITH SECURITY PROTECTION BY USING ANDROID AND ARDUINO MICROCONTROLLER

Sesi Pengajian: 2020/2021

Saya **MUHAMMAD MU'IZ BIN NOR AZAM** mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (X)

☐	SULIT*	Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

☐ TERHAD* Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan.

☒ TIDAK TERHAD

Yang benar,

.....

MUHAMMAD MU'IZ BIN NOR AZAM

Alamat Tetap:

NO 296, FELDA TENGGAROH 6,

JEMALUANG, 86810 MERSING,

JOHOR.

Tarikh: 18/2/2021

Disahkan oleh penyelia:

.....

MUHAMMAD FAREQ BIN IBRAHIM

Cop Rasmi Penyelia

MUHAMMAD FAREQ BIN IBRAHIM
Jurutera Pengajar Kanan
Jabatan Teknologi Kejuruteraan Elektrik
Fakulti Teknologi Kejuruteraan Elektrik dan Elektronik
Universiti Teknikal Malaysia Melaka

Tarikh: 22/2/2021

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

*Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini

DECLARATION

I hereby, declared this report entitled SMART CAR SYSTEM WITH SECURITY PROTECTION BY USING ANDROID AND ARDUINO MICROCONTROLLER is the results of my own research except as cited in references.

Signature:

Author : MUHAMMAD MU'IZ BIN NOR AZAM

Date:

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

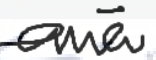
APPROVAL

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 (Industrial Automation and Robotics) with Honours The member of the supervisory is as follow:

Signature: .....

Supervisor : MUHAMMAD FAREQ BIN IBRAHIM

MUHAMMAD FAREQ BIN IBRAHIM
Jurutera Pengajar Kanan
Jabatan Teknologi Kejuruteraan Elektrik
Fakulti Teknologi Kejuruteraan Elektrik dan Elektronik
Universiti Teknikal Malaysia Melaka

Signature:  .....

Co-supervisor: PUAN ROHAINA BINTI JAAFAR

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ABSTRAK

Tajuk projek ini adalah Sistem Kereta Pintar dengan Perlindungan Keselamatan dengan menggunakan Android dan Arduino mikropengawal. Kajian ini akan membentangkan mengenai kaedah keselamatan kereta yang menggunakan sistem penggera biasa dan sistem kereta yang menggunakan kunci sebagai alat untuk menghidupkan enjin kereta. Idea ini diperolehi daripada masalah dalam mengelakkan pencurian kereta berlaku dengan lebih kerap dan mengelakkan dari jenayah pencurian kereta semakin berleluasa di masa akan datang. Oleh sebab itu, struktur perancangan bagi menghasilkan projek ini dibuat dengan berdasarkan objektif dan skop projek. Projek ini menggunakan Arduino sebagai komponen utama dalam menghasilkan projek ini. Projek ini juga menggunakan aplikasi Android dan modul bluetooth dalam membuat kunci pintar yang hanya menggunakan Android dalam menghidupkan enjin kereta. Bagi sistem perlindungan keselamatan kereta pula, modul GSM dan komponen sistem penggera digunakan dalam melaksanakan sistem ini. Daripada projek ini, apa yang boleh dilihat adalah apabila kecurian kereta berlaku, kereta akan mengaktifkan sistem penggera biasa dan pada masa yang sama, modul GSM akan menghantar mesej melalui SMS kepada pemilik kereta tersebut agar pemilik kereta boleh bertindak dengan cepat dengan menelefon polis. Komponen yang akan digunakan untuk membuat sistem penggera adalah LED, dan buzzer. Komponen ini akan aktif apabila seseorang hendak mencuri kereta itu. Sesetengah pencuri akan mencuri kereta dengan menggunakan trak tunda. Disebabkan itu, projek ini akan mengatasi masalah tersebut dengan memasang penderia ultrasonic di bawah kereta. Apabila pencuri tunda kereta sehingga 10 cm ke atas, modul GSM akan menghantar SMS dan akan menghidupkan sistem penggera biasa untuk memberi amaran kepada pemilik kereta. Justeru, seperti yang diharapkan, projek ini akan dapat menghasilkan sistem yang sangat berkesan kepada semua pengguna lebih-lebih lagi pemilik-pemilik keret

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ABSTRACT

The title of this project is Smart Car System with Security Protection using Android and Arduino Microcontroller. This study will present the car safety method using the common alarm system and the car system that uses the key as a tool to start the car engine. Preventing car theft more frequently and preventing car theft more rampant in the future, therefore, the planning structure for producing this project is based on the objectives and scope of the project, using the Arduino as a key component in producing the project. The project also uses android applications and Bluetooth modules to create smart locks that use only android to turn on the car engine, while car safety systems, GSM modules and alarm system components are used in implementing this system. This project, what can be seen is that when car theft occurs, the car will turn on normal system alarms and at the same time, the GSM module will send a text message to the car owner so that the car owner can respond quickly by calling the police. The components that will be used to make regular alarms are LEDs and buzzers. This component will be activated when someone wants to steal the car. Some thieves will steal cars by towing trucks. As a result, the project will solve the problem by installing an ultrasonic sensor under the car. When the car towers are up to 10 cm high, the GSM module will send an SMS and will turn on a regular alarm system to alert the car owner. Therefore, as expected, the project will be able to produce a very effective system for all users especially car owners.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

TABLE OF CONTENTS

		PAGE
TABLE OF CONTENTS		viii
LIST OF TABLES		xiii
LIST OF FIGURES		xiv
LIST OF SYMBOLS		xvii
LIST OF ABBREVIATIONS		xix
LIST OF APPENDIX		xviii
CHAPTER 1	**INTRODUCTION**	**1**
1.1	Introduction	1
1.2	Background	1
1.3	Problem Statement	3
1.4	Objective	4
1.5	Scope and Limitation	5
CHAPTER 2	**LITERATURE REVIEW**	**6**
2.1	Introduction	6
2.2	History of Automobile	7
2.2.1	Before 1930 Years	7
2.2.2	Early in 1930s	8
2.2.3	1930's until 2000's	10

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2.2.4 2000's Upper 12

2.3 Alarm System of Car 13

2.3.1 History of Car Alarm System 13

2.3.2 Types of Car Alarm System 13

2.3.2.1 OEM Alarms 14

2.3.2.2 Aftermarket Alarms 14

2.3.2.3 Remote 14

2.4 Microcontroller Device 15

2.4.1 Arduino Microcontroller 15

2.4.2 PIC Microcontroller 18

2.4.3 Intel 8051 Microcontroller 21

2.4.3.1 8052 Microcontroller 21

2.4.3.2 8031 Microcontroller 22

2.4.4 Motorola 68000 Microcontroller 23

2.5 Arduino Mega 2560 23

2.5.1 Arduino Mega 2560 Board 24

2.5.2 Arduino Mega 2560 Technical Specification 25

2.6 Ultrasonic Sensor 26

2.6.1 Ultrasonic Sensor Technical Specification 27

2.6.2 Distance Calculation 28

2.7 Mobile Operating System 28

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2.7.1 History of Mobile Operating System 28

2.7.2 Types of Operating Software (OS) for smartphone 29

2.7.3 Android OS 29

2.7.4 iPhone OS 30

2.7.5 Windows Mobile 30

2.8 GSM 31

2.8.1 History of GSM 31

2.8.2 2G Network 32

2.8.3 3G Network 32

2.8.4 4G Network 33

2.8.5 5G Network 33

CHAPTER 3 METHODOLOGY 34

3.1 Introduction 34

3.2 Flowchart 34

3.3 Block Diagram of Proposed Project 37

3.4 Choosing the Microcontroller 38

3.4.1 Arduino Mega 2560 38

3.4.2 Arduino Mega 2560 Specification 39

3.5 Designed Smart Car System 39

3.5.1 Software 40

3.5.1.1 Simulation and Designed Circuit 40

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

3.5.1.2 Programming the Codes 41

3.5.1.3 Android Interface 42

3.5.2 Designing the Circuit 44

3.5.2.1 Alarm Circuit 44

3.5.2.2 GSM Circuit 45

3.5.2.3 Bluetooth Module Circuit 46

3.5.3 Electrical Component 47

3.5.3.1 GSM Component 47

3.5.3.2 Bluetooth Component 50

3.5.4 Project Testing 52

3.5.4.1 Alarm Testing 52

3.5.4.2 Smart Key Testing 52

3.5.4.3 Analysis 53

CHAPTER 4 RESULT AND DISCUSSION 54

4.1 Introduction 54

4.2 Experimental Setup 54

4.3 Hardware and Software Progressing 54

4.3.1 Base and Car Design 55

4.3.2 Circuit Design 58

4.3.2.1 Input and Output Connection 59

4.3.2.2 Hard Wiring Progress 61

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

4.3.3 Program Code Design 64

4.3.3.1 Arduino IDE 64

4.3.3.2 Software Application 65

4.3.4 Android Application 66

4.3.4.1 Screen 1 Android Application 67

4.3.4.2 Screen 2 Android Application 68

4.4 Testing and Analysis Method 69

4.4.1 Effect of Final Product with Difference Distance 70

4.4.2 Effect of Final Product with Different Surface Area 73

4.4.3 GSM Output Result 74

CHAPTER 5 CONCLUSION 76

5.1 Introduction 76

5.2 Achievement of Final Result 76

5.3 Problem Encountered and the Limitation of Smart Car System 78

5.4 Recommendation for Future Project 78

REFERENCES 79

APPENDIX 81

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.1:	Comparison between Arduino Uno, Arduino Due, Arduino Leonardo, Arduino Mega 2560, Arduino Mega ADK and Arduino Micro	16
Table 2.2:	Comparison between every types of PIC Microcontroller	19
Table 2.3:	Comparison between 8051, 8052 and 8031 microcontrollers	22
Table 2.4:	Arduino Mega 2560 specification	25
Table 2.5:	Ultrasonic Sensor specification	27
Table 4.1	The Connection of the I/O Module to Arduino Mega 2560	59
Table 4.2	Connection for GSM Module	60
Table 4.3	Bluetooth Module Connection	60
Table 4.4	The Analysis of Ultrasonic Sensor	70
Table 4.5	Analysis of Different Surface Area	73

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 1.1:	The Item Used for Alarm System	2
Figure 1.2:	The Installation Diagram of Alarm system	3
Figure 1.3:	Factory at Tanjung Malim	4
Figure 2.1:	The Evolution of Cars	7
Figure 2.2:	Steam-Powered vehicle	8
Figure 2.3:	First Electric Car	9
Figure 2.4:	Austin Seven	10
Figure 2.5:	Volkswagen Beetle	11
Figure 2.6:	Gurgel Supermini	11
Figure 2.7:	Toyota Corolla	12
Figure 2.8:	PIC Microcontroller	18
Figure 2.9:	Intel 8051 Microcontroller	21
Figure 2.10:	Motorola 68000 Microcontroller s	23
Figure 2.11:	ATmega2560 board	24

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Figure 2.12:	Ultrasonic Sensor	26
Figure 2.13:	Android OS	29
Figure 2.14:	iPhone OS	30
Figure 2.15:	The Structure of GSM Network	31
Figure 3.1:	Flowchart of workflow project	36
Figure 3.2:	Block diagram of proposed Smart Car system	37
Figure 3.3:	Arduino Mega 2560 module	38
Figure 3.4:	Proteus Software	40
Figure 3.5:	Arduino IDE software	41
Figure 3.6:	MIT App Inventor	42
Figure 3.7:	Diagram of Alarm Circuit System	44
Figure 3.8:	GSM Module Circuit	45
Figure 3.9:	Bluetooth Module Circuit	46
Figure 3.10:	SIM900A GSM GPRS Wireless Extension Module	47
Figure 3.11:	Buzzer with wired	48
Figure 3.12:	Light Emitting Diode **(**LED)	48
Figure 3.13:	Ultrasonic Sensor	49
Figure 3.14:	Bluetoth Module	50

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Figure 3.15	AC Adapter	51
Figure 4.1	Off-road Remote Control Car Side View	55
Figure 4.2	Off-road Remote Control Car Front View	55
Figure 4.3	Off-road Remote Control Car Top View	56
Figure 4.4	Distribution Box	57
Figure 4.5	Magnet Door	58
Figure 4.6	4G Sim Card with GSM SIM900A Module	61
Figure 4.7	Bluetooth Module HC-05 to Arduino Mega 2560	62
Figure 4.8	Ultrasonic Sensor HC-SR04 to Arduino Mega 2560	63
Figure 4.9	Screen 1 block program of MIT App Inventor	65
Figure 4.10	Screen 2 Block Diagram of MIT App Inventor	66
Figure 4.11	Screen 1 Smart Car System Application	67
Figure 4.12	Screen 2 Before Connecting with Bluetooth	68
Figure 4.13	Interface for connect to bluetooth	68
Figure 4.14	Screen 2 Bluetooth Connected	69
Figure 4.15	The Serial Monitor 17cm and Above	71
Fgure 4.16	The Car Being Lifted	72
Figure 4.17	The Serial Monitor Show The Distance	72

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Figure 4.18	The Serial Monitor that appear for GSM Setup Connection	74
Figure 4.19	The Serial Monitor for SMS will Send to Owner	74
Figure 4.20	The Message that Accept to the Owner from GSM Module	75
Figure 5.1	Final Prototype for Smart Car System	77
Figure 5.2	Final Prototype of Testing Ultrasonic Sensor	77

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF APPENDIX

FIGURE	TITLE	PAGE
Appendix 1	Gant Chart PSM 1	81
Appendix 2	Gant Chart PSM 2	82
Appendix 3	GSM SIM900A Module	83
Appendix 4	Bluetooth HC-05 Module	85
Appendix 5	Ultrasonic Sensor HC-SR04	87
Appendix 6	Complete Arduino Code for Smart Car System	89

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF SYMBOLS

mm	-	millimetre
cm	-	centimetre
m	-	metre
km	-	kilometre
inch	-	inches
kB	-	Kilobytes
MB	-	Megabytes
V	-	Volt
A	-	Ampere
B	-	Bytes
g		Gram
Hz		Hertz

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF ABBREVIATIONS

UTeM	Universiti Teknikal Malaysia Melaka
BEEA	Bachelor Degree of Electrical Engineering Technology (Industrial Automation and Robotics)
DC	Direct Current
OEM	Original Equipment Manufacturer
SUV	Sport Utility Vehicle
MPV	Multi-Purpose Vehicle
RAM	Random Access Memory
ROM	Read only Memory
iOT	Internet Of Things
EEPROM	Electrically Eraseable Programmable read-only memory
SRAM	Static Random Access Memory

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter introduced the general background of the smart car with security protection by using android and Arduino microcontroller. Additionally, the inspiration of project to be developed is discussed along in the problem statement of this chapter. Others, such as two main objectives and scope limitation also been reviewed. Besides, this chapter will be explained general background and view of the developed project based on Industrial Revolution 4.0 (IR 4.0).

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

1.2 Background

Car is a wheeled motor vehicle used for transportation. Every people in this world wherever what country, car is the most important vehicle that everyone must have. People use a car because they want to travel to any place especially for traveling with their family, buying their basic needs in daily life, using car for go to work and have to go to city for important task. Almost people in this world have their own car to used either expensive car or cheap car.

In this world many types of car that have been produced such as Toyota, Honda, Aston Villa, Proton, Perodua, BMW and others. Most of the them like sport car such as Lamborghini, Ferrari, Porsche, and others. Usually people that buy this sport car is a rich man or rich woman.

Every car that have been produced have its own benefit and design but all of them have the same criteria which is can controls for driving, parking, passenger comfort, and variety of light. Therefore, the first car that have been produce in early 20th century. Nowadays, many modern design and types of the car that mostly more followed to industrial revolution 4.0.

Figure 1.1: The Item Used for Alarm System

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

From Figure 1.1 shows the common item used for alarm system at every car that produced in this world. Every car already installs this alarm car system when the car start produces before selling it. This common car alarm system activates when someone broke car window or break car door by force but this method useless anymore because the theft has many ways to broke and steal the car without made the alarm system of the car activate.

Car alarm system divided to two categories which is Original Equipment Manufacturer (OEM) and Aftermarket. Original Equipment Manufacturer (OEM) is a built into vehicle at the factory means that this type of car alarm system has already been install when produce the car at the factory. Alarm system from aftermarket is the item that can be installed at any time after car produce.