UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FACULTY OF ENGINEERING TECHNOLOGY

CAR SEAT SECURITY SYSTEM FOR UNATTENDED CHILD USING GSM MODULE

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree Project in Electrical Engineering Technology (Industrial Power)

Submitted by

Muhammad Hafiszan Bin Mohd Akhir

B071210306

Supervised by

Intan Mastura Bin Saadon

© Universiti Teknikal Malaysia Melaka

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory committee is as follow:

.....

(Principal Supervisor)

.....

(Cp-Supervisor)

© Universiti Teknikal Malaysia Melaka

DECLARATION

"I, hereby declare that this thesis entitled, CAR SEAT SECURITY SYSTEM FOR UNATTENDED CHILD USING GSM MODULE is a result of my own research idea concept for works that have been cited clearly in the references."

Signature : .....

Author's Name : MUHAMMAD HAFISZAN BIN MOHD AKHIR

Date : 1 JUNE 2016

© Universiti Teknikal Malaysia Melaka

ABSTRAK

Pada masa kini, terdapat beberapa kes-kes yang berkaitan dengan kematian kanak-kanak yang ditinggalkan di dalam kereta kerana pitam dan hipotermia. Oleh itu, sistem ini telah direka dan dijangka dapat membantu untuk mengatasi kejadian yang tak diingini seperti ini. Sistem ini direka untuk mengesan kehadiran kanak-kanak atau suhu badan kanak-kanak yang telah ditinggalkan di dalam kerusi kanak-kanak dalam kereta. Projek ini dikenali sebagai "Car Seat Security System for Unattended Child Using GSM Module". Tujuan utama projek ini adalah untuk mewujudkan satu system yang menggunakan Global System for Mobile Communication (GSM) yang boleh berkomunikasi dengan manusia. Ia digunakan untuk menghantar dan menerima SMS yang berasaskan kepada tindakan yang sewajarnya diambil oleh manusia.Untuk mengawal keseluruhan system, mikropengawal PIC akan digunakan. Fungsi utama mikropengawal PIC adalah untuk memberi arahan pada modul GSM yang dilampirkan dan membuatkan ia bersedia untuk berkomunikasi dengan pengguna dengan menghantar SMS ke telefon mudah alih. MicroC Compilers digunakan sebagai perisian untuk mikropengawal PIC.

© Universiti Teknikal Malaysia Melaka

ABSTRACT

Nowadays, there are quite a number of incidents that is related to the death of the children left in a parked vehicles due to heatstroke and hyperthermia. Therefore, the system designed is expected to help in order to overcome this unwanted incident. This system project is created to sense the presence of a child or detect a body temperature of child that had been left in the child car seat of a car. This project is called "Car Seat Security System for Unattended Child Using GSM Module". The main purpose of this project is to create a system which uses Global System for Mobile Communication (GSM) that can communicate with human. The GSM modem is the medium by which the user can interact with the module. It is used to send and receive SMS text messages based on which appropriate actions taken by user. To control the whole system, PIC microcontroller will be used. The main function of PIC microcontroller is to initiate the attached GSM module and make it ready to communicate with users by sending an SMS to the mobile phone. MicroC Compilers is used as a software for PIC microcontroller.

© Universiti Teknikal Malaysia Melaka

DEDICATION

Special dedication to my loving family, all my siblings, and my kind hearted supervisor Puan Intan Mastura Binti Saadon and also dearest friends

© Universiti Teknikal Malaysia Melaka

ACKNOWLEDGEMENT

First of all, I would like to wish and express my sincere appreciation and gratitude to my supervisor Puan Intan Mastura Binti Saadon for her continuous guidance, encouragement and advice during my work which gave me inspiration in accomplishing my thesis of this project. I had gained chances to learn new skills and knowledge throughout the development of this project.

Furthermore, special thanks also I dedicate to University Technical Malaysia Melaka for supporting and providing information sources that assisted my studies. My sincere appreciation to the staffs at the Department of Electrical Engineering Technology (Industrial Power) specifically, who had put efforts on the lectures and always nurtured and guided me with precious advices. Thank you for willing to share those experiences that really helped me.

Last but not least, to my beloved family that always share their love, fully support, understanding and consideration that had spent more time with them along my project, I really appreciate it. Their encouragement just an invisible spiritual pillar and makes me strong when I encountered with any obstacles. I also would like to say many thanks to all my friends who had offered positive feedback and suggestion for improvement in my project. Without their support, I would not have been able to finish my bachelor degree research project.

© Universiti Teknikal Malaysia Melaka

TABLE OF CONTENT

ABSTRAK		i
ABSTRACT		vi
DEDICATION		vii
ACKNOWLEDGEMENT		viii
TABLE OF CONTENT		ix
LIST OF FIGURES		xiii
LIST OF TABLE		xv
LIST OF SYMBOLS AND ABBREVIATIONS		xvi
CHAPTER 1		1
INTRODUCTION		1
1.0	Introduction	1
1.0.1	Explanation of Simplified Block Diagram	1
1.1	Background	2
1.2	Problem Statement	4
1.3	Objectives	5
1.4	Scope of Project	5
1.5	Thesis Outlines	5
CHAPTER 2		7
LITERATURE REVIEW		7
2.0	Introduction	7
2.1	Related Works	7
2.1.1	Baby Seat Belt Alarm System by Fred Mesina (2005).	7

© Universiti Teknikal Malaysia Melaka

2.1.2 Vehicle's Interior Movement Detection and Notification System by Fairuz R. M. Rashidi and Ikhwan H. Muhamad 9

2.1.3 Wireless System to Detect Presence of Child in a Baby Car Seat by Joseph Kinman Lee and Darren Paul 10

2.1.4 System and Method for a Child Safety Seat Having Sensing and Notification Abilities by Owen Chelsea 12

2.2 Microcontroller 14

2.2.1 Pin Configuration 14

2.2.2 PIC Architecture 16

2.3 GSM Module 17

2.3.1 Introduction of GSM module 17

2.3.2 GSM Technology 18

2.3.3 GSM Architecture 19

2.3.4 Mobile Switching Centre (MSC) 19

2.4 Proteus 8.0 Professional 20

2.5 AT command 20

2.5.1 Basic Command and Extended Command 21

2.5.2 General Syntax of Extended AT Command 21

2.6 Voltage regulator 22

2.7 Force Sensing Resistor 23

2.8 LM35 Temperature Sensor 25

2.9 Level Converter – MAX232 Driver/Receiver 26

2.10 Mobile Phone 27

2.11 Short Messaging Service (SMS) 27

© Universiti Teknikal Malaysia Melaka

CHAPTER 3 28
METHODOLOGY 28
3.0 Introduction 28
3.1 Flow Chart for This Project 29
3.2 Literature review 31
3.3 Circuit Design 31
3.4 Block diagram of the project 31
3.5 Construction of Hardware 34
3.5.1 GSM SIM900A 34
3.5.2 The Microcontroller (SK40C) 34
3.5.3 LM35 35
3.5.4 The IR Obstacle Sensor 36
3.5.5 LCD 37
3.5.6 Hardware Prototype 38
3.6 System overview diagram 38
CHAPTER 4 41
RESULTS AND DISCUSSION 41
4.0 Introduction 41
4.1 Project Overview 41
4.2 Simulation Analysis 42
4.3 Hardware Analysis 43
4.4 Overall Results 44
4.4.1 Results for IR obstacle sensor 44
4.4.2 Results for LM35 45
4.5 Overall Project Analysis and Discussion 46
4.6 Overall Project Cost 47

© Universiti Teknikal Malaysia Melaka

CHAPTER 5 48
CONCLUSION AND RECOMMENDATION 48
5.0 Conclusion 48
5.1 Future Work 49
APPENDIX 50
Coding 50
Gantt Chart 54
REFERENCES 55

© Universiti Teknikal Malaysia Melaka

LIST OF FIGURES

Figure 1.1: Block Diagram for process that uses GSM 2

Figure 1.2: The Temperature inside and Outside the Car That Kill Children 3

Figure 1.3: Graph about Causes of Heatstroke Death by Jan Null (2011) 4

Figure 2.1: Flow Chart of Alarm System of the Project of Baby Seat Belt Alarm System 8

Figure 2.2: Block Diagram of Illustrating a Control Unit 9

Figure 2.3: Flow Chart of the System for Vehicle's Interior Movement Detection and Notification System 10

Figure 2.4: An Illustration of the Invention of Wireless System to Detect Presence of a Child in a Baby Car Seat 11

Figure 2.5: The Process of the System for Wireless System to Detect Presence of a Child in a Baby Car Seat 12

Figure 2.6: Design of Safety Seat for System and Method for a Child Safety Seat Having Sensing and Notification 13

Figure 2.7: PIC16F877A Characteristic 16

Figure 2.8: Architecture of a GSM Network 19

Figure 2.9: Voltage Regulator Circuit 23

Figure 2.10: Resistance is Inversely Proportional to Force 23

Figure 2.11: FSR Schematic Circuit 24

Figure 2.12: LM35 25

Figure 2.13: USART to the PC 26

Figure 2.14: PC to USART 26

Figure 3.1: Flow Chart of the Project 30

Figure 3.2: Block Diagram of the Project 32

Figure 3.3: Flow Chart of the Software Development 32

Figure 3.4: Flow Chart of GSM 33

Figure 3.5: GSM SIM900A 34

© Universiti Teknikal Malaysia Melaka

Figure 3.6: SK40C PIC Kit **35**
Figure 3.7: LM35 Temperature Sensor **36**
Figure 3.8: IR Obstacle Sensor **37**
Figure 3.9: LCD Display **37**
Figure 3.10: Proteus 8 Professional **38**
Figure 3.11: Illustration of the System **40**
Figure 4.1: Overall Project **42**
Figure 4.2: Simulation Circuit **43**
Figure 4.3: Hardware Circuit **44**
Figure 4.4: Show that the LCD display when the IR sensor trigger and the SMS that will received by a user via GSM. **45**
Figure 4.5: Show that the LCD display when the LM35 trigger the high temperature and the SMS that will received by a user via GSM. **46**
Figure 5.1: Project Gantt Chart for BDP 1 and BDP 2 **54**

© Universiti Teknikal Malaysia Melaka

LIST OF TABLE

Table 2.1: Microcontroller PIN **14**

Table 2.2: Determination in the GSM System **18**

Table 2.3: Analogue Voltage Value Error! Bookmark not defined.

Table 4.1: Data Obtained for IR sensor **45**

Table 4.2:Data Obtained for LM35 Sensor **46**

Table 4.3: List of The Component and the Price **47**

© Universiti Teknikal Malaysia Melaka

LIST OF SYMBOLS AND ABBREVIATIONS

BBS	=	Bulletin board services
CMOS	=	Complementary metal–oxide semiconductor
GSM	=	Global System communication for mobile phone
EDGE	=	Enhanced Data Rates for GSM Evolution
EEPROM	=	Electrically erasable programmable read-only memory
EECON1	=	Contains control bits
EECON2	=	Register does not exist physically and serves to protect EEPROM from accidental writing.
EEDATA	=	Holds read data or that to be written
EEADR	=	Contains an address of EEPROM location being accessed.
GPRS	=	General Packet Radio Service
GMSK	=	Gaussian Minimum Shift Type
GPS	=	Global Positioning System
GPR	=	General Purpose Register
ISP	=	Internet Service Provider
IC	=	Integrated circuit
LED	=	Light emitting diodes
LCD	=	Liquid Crystal Display
PIC	=	Programmable Interface Controller
PDU	=	Protocol description unit
PCB	=	Printed circuit board
RC	=	Radio Controlled

© Universiti Teknikal Malaysia Melaka

RAM	=	Random Access Memory
ROM	=	Read-only memory
SMS	=	Short Messaging Service
SFR	=	Special Function Register
SPDT	=	Single pole, double throw
SSR	=	Solid State Relays
TTL	=	Transistor–transistor logic
RF	=	Radio Frequency
IR	=	Infrared

© Universiti Teknikal Malaysia Melaka

CHAPTER 1
INTRODUCTION

1.0 Introduction

One of the most recently used in communication system in the present universe of innovation is Global System for Mobile Communication (GSM). It has turn out to be extremely prominent and one of the wireless communication system that is dependable to use. Moreover, it is also accessible to be used by individual and very user friendly. One of the factors that makes this system dependable to use is because of the cost. The cost is exceptionally effective and affordable to own for individual who use this system. The network system is extended as the demand is growing. In the Car Set Security System for Unattended Child, there is one of the examples of the system that uses GSM.

1.0.1 Explanation of Simplified Block Diagram

This is the explanation of each block diagram for the Figure 1.0 below.

Mobile Device: A cellular phone that contain a SIM card. This device communicates through the GSM modem and mobile user will received an SMS using GSM technology.

GSM Modem: The hardware part that allows the ability to send and receive SMS to and from the system. GSM will communicate via RS232 (one after the other) port. The cell phone can be attached at the place of GSM hardware but it limits the hardware ability to do things such as sending or receiving the SMS.

© Universiti Teknikal Malaysia Melaka

PIC Microcontroller: Contains the software components that can execute a certain command that have been coded.

RS-232 interface for PIC microcontroller to GSM modem: For basic serial communication between a PIC microcontroller and GSM modem. Generally only needed to connect the Ground, Transmitter and Receiver lines.

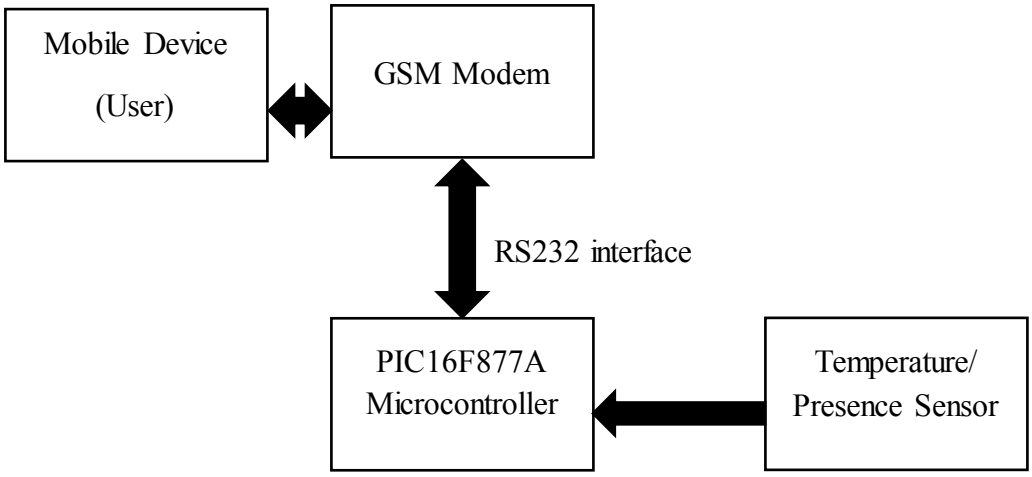

Figure 1.1: Block Diagram for process that uses GSM

1.1 Background

According to Ferrara, et al Pietro (2013) there are a lot number of cases that related to the death of child where the child had been left in a car by their parents due to the heat stroke and hyperthermia. When the body absorbs too much heat, this will cause a hyperthermia (Luethi M, Meier B, Sandi C, 2008). Children are easily to develop hyperthermia that adults when inside a closed and hot vehicle. There are two factors that make children to be more prone to hyperthermia than adults: children have a greater surface area body mass ratio compared to adults and a children thermoregulation is less efficient than adults.

Figure 1.2 shows that the transparent windows of a car was strikes by the sun's shortwave radiation, shown as the yellow colour wave. It tells that the child left in the

© Universiti Teknikal Malaysia Melaka

car will die because of the hot temperature from the outside and it will affect the child inside the car. Studies have proven that children heat rate is three to five times faster than adults.

Figure 1.2: The Temperature inside and Outside the Car That Kill Children

Some might say that leaving the vehicle's with window slightly open can reduce the warming rate inside the car. This does not basically can reduce the warming rate inside the car because children's bodies warm at a faster rate than adults.

However, caution must be practised to prevent the unwanted incident to be occurred. Therefore, to prevent from this kind of bad situation happens; the vehicle that are used must be equipped with a device or some system that can be used to warn parents if they were negligent when leaving the vehicle. As a driver, they are usually left their car in a far place from their destination such as open air parking lot. So, there is no other way to communicate with them except through mobile phones connectivity. Hence, the notification system needs to have access to a wide-range phone communication such as Global System for Mobile Communication (GSM).

The system needs a technique on how to detect the presence of a child on a child safety seat to activate the system and send an SMS text message to parents to alert them. The system will also use another sensor which is temperature sensor as a

© Universiti Teknikal Malaysia Melaka

secondary alert to detect the body temperature of child that has been left in the car for more than half an hour and then send another SMS text message to parents alerting temperature body of the child rises. So by this project, it will make parents more alert if they were leaving their child alone in the car and can avoid from bad incidents to occur.

1.2 Problem Statement

In this era, people's daily life is more to choose to follow their fixed schedule and live in rushing and under pressure every day. And when there is a changes of routine, this may cause a distraction and become the main reason why they can forgot their own child in the car. There have been some cases about the tragic death of children that have been mistakenly left in the vehicles because the parents had forget to bring them together when they have reached the destination. Example case that happened in Malaysia is a father left his child for almost five hours in a car. This accident happened due to parents having busy schedule. To prevent this kind of incident from occurring, one system to overcome this case need to be created immediately after stopping the engine and locking the car. This system will alert the parents before they walk away from the car and leave the child inside.

The Figure 1.3 below shows the causes of children who died in a vehicles because of the heatstroke.

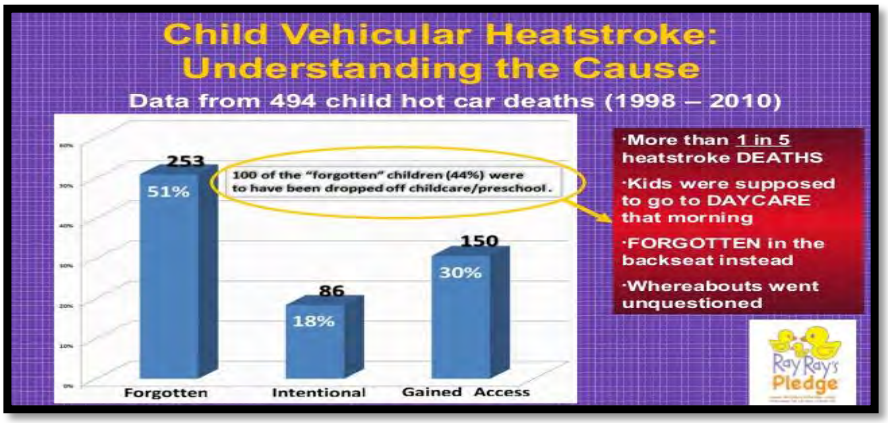

Figure 1.3: Graph about Causes of Heatstroke Death by Jan Null (2011)

© Universiti Teknikal Malaysia Melaka

1.3 Objectives

The objective of this project are:

a) To design the circuit system as to detect the existing human body in a car.
b) To propose a notification system that is intently to be a low-cost system so that it can be easily implemented and installed in any types of vehicles.

1.4 Scope of Project

This project has two types of sensor which is IR obstacle sensor and the LM35 sensor. The IR obstacle sensor will sense a presence of a baby on a car seat and for the LM35, this sensor will sense a surrounding temperature inside a car. Then the PIC will send a signal to GSM to send a SMS to a user. This system comes will a small part of circuit and can be implemented in any kind of vehicles.

1.5 Thesis Outlines

This Child in Car Alarm System is consists of five chapters as are outlined as follows.

Chapter I: Describes about the overview of the project including the background, objectives, problem statement and scope of the project.

Chapter II: Explains about the reviews on previous researches that are related to this project. Before starting the project, the background and literature review about development of the components that are using to build this system need to study and doing research well.

Chapter III: Elucidates the project methodology. It explains the flow of the system that will be designed and how the project was organized. The simulation has been done to make sure that the circuit would working properly before starting develop the prototype.

© Universiti Teknikal Malaysia Melaka

Chapter IV: Presents the result of project. This project has two parts of result. The first part is result at the simulation and the other part is result from real prototypes. It also consist the analysis and discussion of the results.

Chapter V: Is about the conclusion of overall analysis from chapter 1 until chapter 4. It also provides future work that contents some recommendations of what remains to be improved or learned.

© Universiti Teknikal Malaysia Melaka

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

In this chapter will study more about the previous journals and discuss on the previous project. This chapter also consists of the theoretical concepts and some useful ideas to implement in this project. Various types of references were consulted and reviewed to ensure effectiveness to implement this project.

2.1 Related Works

2.1.1 Baby Seat Belt Alarm System by Fred Mesina (2005).

Fred Mesina (2005), explain about the cases that involve the death of a child in a vehicles. This incident happens almost every year because of the negligence committed by parents who often abandons their child alone in the car. When a driver has safely arrived to their destination, they sometimes forget and overlook the presence of their child in the car because of their hasty exit from the car. A baby is susceptible to dehydration and this can cause them to become coma or something worse that will cause succumb to death. So to avoid this incidents from happen, a vehicles must be equipped with an alarm or sensor. If a sensor succeeds to detect the presence of a human body or a movement, the alarm will make a sound to alert the parents about it.

© Universiti Teknikal Malaysia Melaka

The alarm system will function when there is a child been buckled on a car seat and the car key is removed from ignition at the same time. The controller may be including belt buckled sensor, a key removed sensor, a transmitter and additional devices such as horn, air conditioning and some other devices.

Based on Figure 2.1 below shows the flow chart of the steps on how to activate an alarm when there is an abandon child in the car.

10- To detect either the seat belt is buckled or not.

20- If the seat belt is already buckled, transmitter will send a signal to a key module.

30- To detect whether the key I already removed from a keyhole or not.

42- Timer, or waiting period for delaying the activation of the alarm.

40- The key module will activates the alarm to alert the driver.

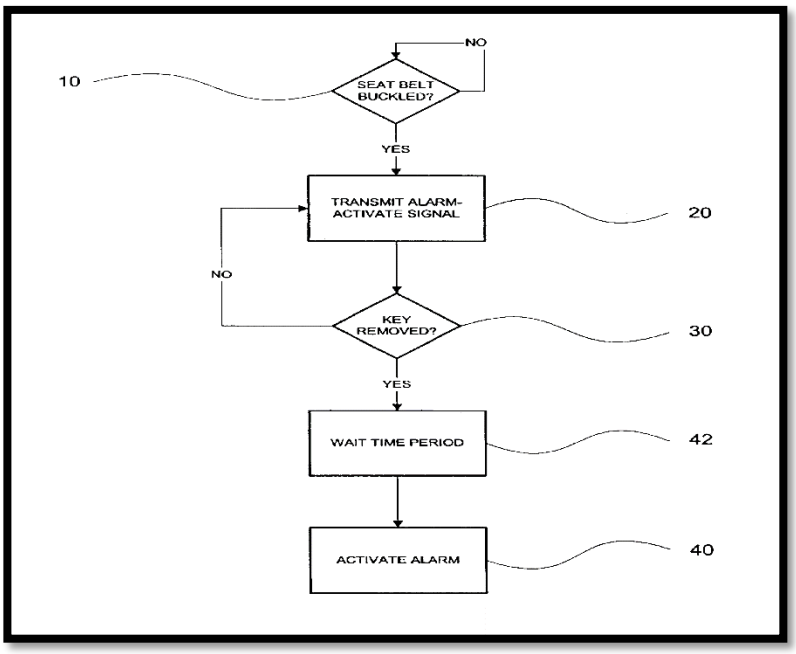

Figure 2.1: Flow Chart of Alarm System of the Project of Baby Seat Belt Alarm System

© Universiti Teknikal Malaysia Melaka