



**DESIGN AND DEVELOPMENT OF A SELF-BALANCING SCOOTER:  
MATERIAL SELECTION AND INTERFACING OF A SELF-BALANCING  
SCOOTER**

**EZHAM HAZNAL BIN ZAHARIMAN  
(2005388684)**

A thesis submitted in partial fulfilment of the requirements for the award of Bachelor  
Engineering (Hons) Mechanical

**Faculty of Mechanical Engineering  
Universiti Teknologi MARA (UiTM)**

**MAY 2009**

## ACKNOWLEDGEMENT

In the name of ALLAH S.W.T, The Most Beneficent, The Most Merciful. Furthestmost, all praise to ALLAH for the entire incredible gift endowed upon me for giving me the health and strength to complete this thesis and project.

I would like to take this opportunity to express my most grateful appreciation to Mr. Mohd Asri Bin Mohd Nor, Mr. Zulkifli Bin Mohamed, Mr. Muhamad Azhan Bin Anuar, Mr. Helmi Bin Rasid, Mrs. Nursalbiah Binti Nasir and special thank to Associate Prof. Dr Ahmad Maliki Bin Omar for their guidance, advice and willing in sharing the knowledge towards the completion of this project.

I also thank to my friends, Muhamad Yusuf Bin Ibrahim, Noor Fadzliana Binti Usop, Azhana Binti Ahmad, Andi Bin Sabudin and Mohd Fadhil Bin Mamat @ Ibrahim which helping and sharing idea with me during the period of this project.

This project would not have been like this if they had not given great support and put pressure on me when other academic matter appeared to occupy both my mind and time.

Finally I would like to express my deepest gratitude to my beloved parents and my fellow friends. Therefore once again to all persons above, either direct or indirect, I would like to say thank you very much to all of them in helping me accomplished my project and love you all.

## **ABSTRACT**

The aim of this project is to select and implement a suitable component and material for the Self-balancing Scooter so that the prototype of the scooter can move forward and backward. The self-balancing scooter is a two wheeled self-balancing vehicle which is capable of carrying via the wheels underneath the rider's centre of gravity. It involves the program and application of the control system to perform specific task. The programming will control the movement of the scooter. A small scale model of the self-balancing scooter will be developed and will be integrated with the program. To implement the project, the main consideration will be on the component and material selection for the development of the scooter. This will be interfaced between the design part which is the hardware and the control part which is the program. Therefore it is important to select a suitable component and material for the scooter so that the scooter will be fabricated based on the suitable components and materials.

## TABLE OF CONTENT

CONTENT	PAGE
PAGE TITLE	i
ACKNOWLEDGEMENT	ii
ABSTRACT	iii
TABLE OF CONTENT	iv
LIST OF TABLE	vii
LIST OF FIGURE	viii

### CHAPTER 1 INTRODUCTION

1.0	Background	1
1.1	Objective	3
1.2	Significant of the Project	3
1.3	Scope of Project	3
1.4	Problem Statement	4
1.5	Project Methodology	4

### CHAPTER 2 LITERATURE REVIEW

2.0	Self-Balancing Scooter	5
2.1	Recent Reseach and Development	7
2.1.1	The Segway Model	7

2.1.2	The Blackwell's First Model	8
2.1.3	The EDGAR Model	9
2.1.4	The Beckwith Model	10
2.1.5	The Chudleigh Model	11
2.1.6	The Larson Model	13
2.2	Related Components	15
2.2.1	Gyroscope	15
2.2.2	PIC Microcontroller	16
2.2.3	Coding for PIC	18
2.2.4	PIC Programming	19

### **CHAPTER 3 METHODOLOGY**

3.0	Introduction	20
3.1	Literature Review	22
3.2	Component Selection	23
3.3	Purchasing of Component	23
3.4	Preparation of Component	24
3.5	Fabrication Process	24
3.6	Testing	24
3.7	Troubleshooting	25
3.8	Improvisation	25
3.9	Report Writing	25
3.10	Project Completed	26

### **CHAPTER 4 MATERIAL SELECTION**

4.0	Introduction	27
4.1	Carbon Brush DC Motor	28
4.2	Wheels	29
4.3	Motor Controller	30
4.4	Gyroscope (ADXRS300)	34
4.5	Accelerometer	36