

# **SOUND ACTIVATED LINE TRACKING ROBOT**

This thesis is presented in partial fulfillment for the award of the  
*Bachelor of Electrical Engineering (Honours)*  
Of  
**UNIVERSITI TEKNOLOGI MARA (UiTM)**



**FAZMIN BIN FAKURRUDDIN**  
**FACULTY OF ELECTRICAL ENGINEERING**  
**UNIVERSITI TEKNOLOGI MARA**  
**40450 Shah Alam**  
**Selangor Darul Ehsan**

**FACULTY OF ELECTRICAL ENGINEERING**

## ACKNOWLEDGEMENTS

I would like to take this opportunity to express my sincere appreciation and gratitude to everyone who has contributed either directly or indirectly throughout this project especially to my supervisor, Assoc. Prof. Kartini Salam for patience, consistent consultation and invaluable advice throughout the preparation and completion of the project.

Special thanks goes to my highly skilled and professional panels, Assoc. Prof. Mahmud Bin Ibrahim and Assoc. Prof. Zulkifli who are willing to spent their golden time to evaluate my project

I also would like to express my appreciation to my beloved parents, En. Fakurrudin Bin Eshak and \_\_\_\_\_ for their financial support, prayers, expectations and encouragement through out my years in UITM. Last but not least, credits to all my friends for their ideas, suggestions and assistance in completing this project.

## **ABSTRACT**

The project objective is to design and build an autonomous, line following robot capable of following a track marked on a white surface separated with black lines. The robot is activated by a sound activated switch. The robot is based on the PIC 16F877A manufactured by Microchip. The microcontroller receives inputs from 3 pairs of infrared sensors; mainly the infrared emitter (OP165 – manufactured by Optec) and the infrared phototransistor (OP505 – manufactured by Optec), which are directed by an op-amp (LM324N – manufactured by ST Microelectronics). From these inputs it would be determined if the robot should move forward or the direction that the robot should turn. Forward motion is provided by a pair of stepper motor driving the rear wheels, which are driven from a pair of current driver IC's (ULN2003 – manufactured by Texas Instrument), controlled from the microcontroller. In order for the robot to turn, one wheel is stopped while the opposite wheel continues to turn. The robot will continue moving forward until one of the sensors spots a black surface and forcing one motor to move to either left or right direction.

**Keywords:** Line Tracking Robot, Sound Activated Switch, PIC 16F877A, Sensor

# TABLE OF CONTENTS

CHAPTER	LIST OF TITLE	PAGE
	<b>DECLARATION</b>	III
	<b>ACKNOWLEDGEMENT</b>	IV
	<b>DEDICATION</b>	V
	<b>ABSTRACT</b>	VI
	<b>TABLE OF CONTENTS</b>	VII
	<b>LIST OF FIGURES</b>	X
	<b>LIST OF TABLE</b>	XIII
	<b>ABBREVIATIONS</b>	XIV
<b>1.0</b>	<b>INTRODUCTION</b>	
	1.1 INTRODUCTION	1
	1.2 OBJECTIVE	1
	1.3 SCOPE OF PROJECT	2
	1.4 METHODOLOGY	2
	1.5 LAYOUT OF THE THESIS	5
<b>2.0</b>	<b>LITERATURE REVIEW</b>	
	2.1 INTRODUCTION	6
	2.2 HARDWARE SOLUTION	6
	2.2.1 STEPPER MOTOR	6
	2.2.1.1 CONCEPT OF STEPPER MOTOR	8
	2.2.1.2 CONTROLLING THE STEPPER MOTOR	9
	2.2.1.3 STEPPING SEQUENCES FOR A FOUR-PHASE UNIPOLAR STEPPER MOTOR	9
	2.2.2 ULN-2003A – SEVEN DARLINGTON ARRAY	12

# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 INTRODUCTION**

As technology develops, computers are making people's lives progressively easier and safer. Tasks that are used to be handled by human nowadays are undertaken by robots, resulting in improvement of work efficiency, reduce time consumption and reduce energy usage for workers. This thesis entitled “Sound Activated Line Tracking Robot”. This part of the project is to ensure that the robot is working as predicted. The development of this project is based on carefully organized schedule and is separated into software and hardware part.

In this part also the chassis of the robot will be built and assembling the chassis with the circuit will be done. Then the programming will be written into the microcontroller and lastly the robot is to be put under test to study the performance, capability and application field.

### **1.2 OBJECTIVE**

The objective of this project is to design and implement a microcontroller based Line Tracking Robot that is vision sensitive to a 1 cm thick dark line. The infrared sensors (IR) are used to detect the line. Besides that the robot starts and stop movement using sound activated switch. The main objective is however, to identify an application and change the design parameters such that it is suitable for the application after the constructions are completed.