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Line following automatic robot using mecanum wheel /  
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**LINE FOLLOWING AUTOMATIC ROBOT USING MECANUM**

**WHEEL**

**MAH HOONG MING**

**MAY 2009**

“I hereby declare that I have read through this report entitle “*Line Following Automatic Robot using Mecanum wheel*” and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Control, Instrumentation and Automation )”

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Date: 15/5/2009

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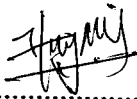
**A report submitted in partial fulfillment of the requirements for the degree  
Of Bachelor In Electrical Engineering  
(Control, Instrumentation and Automation)**

**Faculty Of Electrical Engineering**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**MAY 2009**

I declare that this report entitle "*Line Following Automatic Robot using Mecanum Wheel*" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature:  .....

Name : MAH HOONG MING

Date : 15/5/2009

To my dearly loved father and mother

To all my teachers and friends

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## ABSTRACT

The usage of the automatic robot replacing the work done in industry field and public in this modern age is increasing rapidly. So, automatic robot becomes more important in our life because it not only can increase productivity and effectively in industrial and it can also help humans such as lifting heavy object. This project describes ongoing research on the navigation automatic robot and investigate decision line junction that are able to configure themselves automatically according to the structure of the problem under consideration. To meet the requirements of the automatic robot application, require only the limited memory of an embedded system and operate in real time. For completely fulfill the requirement, PIC is one of the types of controller that are used to control system automatic robot. It is popular in industrial due to its low cost and wide availability, comprehensive user base and extensive collection of application note. In this report, will discussing about the automatic robot navigation using sensor sense the line junction as coordinate to control direction of robot and also discuss combination of electronic device with control circuit in PIC controller. Other than that, this report will also discuss on the program used, MPLAB IDE. MAPLAB IDE is a multi-usage development tool for PIC micros that uses C language as its program language. For the automatic robot navigation, two DC brushless motor are used as mover in robot and fiber optical sensor sense the color of line act as signposts for the robot to follow in navigation. Besides that, automatic robot will enhance the motion of navigation to multiple directions with the mecanum wheel.

## ABSTRAK

Pada zaman kini, penggunaan robot automatik dalam bidang industri dan kalangan masyarakat kian meningkat untuk menyenangkan manusia dan menggantikan tenaga kerja. Justeru, robot automatik semakin penting dalam hidupan manusia kerana ia bukan sahaja dapat meningkatkan produktiviti dalam industri, automatik robot juga dapat membuat kerja-kerja yang susah payah dan membantu manusia dalam kerja-kerja yang bahaya seperti mengangkat benda yang berat dan kerja yang bahaya. Projek ini membincangkan penyelidikan dalam robot automatik pelayaran dan menyiasat keputusan di persimpangan garis mampu untuk mengkonfigurasi mereka sendiri dengan automatik mengikut kepada struktur pertimbangan bawah dan masalah. Untuk memenuhi keperluan robot automatik, hanya perlukan satu sistem terbenam dan beroperasi dalam masa nyata. Untuk melengkapkan keperluannya, PIC adalah salah satu jenis alat kawalan yang lengkap digunakan untuk mengawal sistem-sistem automatik robot. Ia mendapat sambutan yang baik in bidang industri kerana harga yang murah, skop penggunaan yang luas, dan cara pengerbitan program yang senang. Dalam laporan ini akan membincangkan tentang pembentukan satu pelayaran robot automatik menggunakan persimpangan garis sebagai menyelaraskan serta komponent-komponent elektronik dan litar kawalannya menggabungkan dengan PIC. Selain itu, laporan ini juga akan meliputi penjelasan program yang digunakan iaitu MPLAB IDE. MPLAB adalah satu alat pembangunan PIC yang menggunakan Bahasa C sebagai bahasa programnya. Dalam pelayaran robot automatik robot, dua buah DC brushless motor dan penderia warna akan digunakan untuk merasa garis warna dalam pelayaran demi mengerakkan robot. Selain itu, robot automatic



itu akan meningkatkan cirri-cirinya, iaitu menggunakan tayar mecanum. Tayar Mecanum akan meningkatkan penggerakkan kepada berbagai arah untuk mempercepat pelayaran dalam pertandingan dan menjimatkan masa.

## TABLE OF CONTENTS

<b>CHPATER</b>	<b>TITLE</b>	<b>PAGE</b>
	<b>ACKNOWLEDGEMENT</b>	v
	<b>ABSTRACT</b>	vi
	<b>TABLE OF CONTENTS</b>	xi
	<b>LIST OF TABLE</b>	xiii
	<b>LIST OF FIGURE</b>	xiv
	<b>LIST OF ABBREVIATION</b>	xvii
	<b>LIST OF APPENDICES</b>	xviii
1	<b>INTRODUCTION</b>	
	1.1 Introduction	1
	1.2 Problem Statement	2
	1.3 Project Objective	2
	1.4 Project Scope	3
2	<b>LITERATURE REVIEW</b>	
	2.1 Introduction	4
	2.1.1 Review 1 : ABU Asia-Pacific Robot Contest	5
	2.1.2 Review 2: Desktop Line Following Robot	6
	2.1.2.1 Description	6

		x
	2.1.2.2 Specification	7
	2.1.2.3 Photo Reflectors Sensor	7
	2.1.2.4 Tracking Control	8
	2.1.3 Review 3: Designing Omni-Directional Mobile Robot with Mecanum Wheel	10
	2.1.3.1 Description	10
	2.1.3.2 Mechanical Design	10
	2.1.3.3 Electronic Design	11
	2.1.3.4 Mecanum Wheel Motion	12
3	<b>METHODOLOGY</b>	
	3.1 Planning in Study	14
	3.2 Methodology Flowchart	15
	3.3 Introduction	16
	3.4 Project Flowchart	17
	3.5 Gantt Chart	18
	3.6 Hardware Part	19
	3.6.1 Interface Free Controller From Cytron Technologies	19
	3.6.2 Main Board	20
	3.6.3 Power Card	20
	3.6.4 Digital Input Card	21
	3.6.5 Brushless Motor Card	22
	3.6.6 Interface Free Controller System Overview	23

3.6.7	USB ICSP PIC Programmer	24
3.6.8	Brushless DC Motor	24
3.6.9	Motor Driver	26
3.6.9.1	Brushless DC Motor System Configuration	28
3.6.9.2	Motor Driver Connection	29
3.6.10	Digital Fiber Sensor	30
3.6.10.1	Input/output Circuit Diagram	32
3.7	Software Part	33
3.7.1	MPLAB IDE	33
3.7.1.1	Component of MPLAB	34
3.7.1.2	Using MPLAB IDE	37
3.7.2	PICKIT 2 Development Programmer	42
4	<b>FINAL RESULT AND DISCUSSION</b>	44
4.1	Introduction	44
4.1.1	Basic Structure Robot and Basic Navigation Operation	45
4.2	Mechanical Development	50
4.2.1	Robot Base	50
4.2.2	Mecanum Wheel	52
4.2.3	Mechanism of Fiber Sensor Head	53
4.3	Electrical and Electronic Development	54
4.4	Software Development	56

	4.4.1 Program Flowchart	58
5	<b>CONCLUSION AND RECOMMENDATION</b>	60
	5.1 Conclusion	60
	5.2 Recommendation	60
	REFERENCES	62
	APPENDICES	64

**LIST OF TABLE**

<b>NO</b>	<b>TITLE</b>	<b>PAGE</b>
2.1	Specification of desktop line following robot	5
4.1	Number of pin and function in LCD	38

## LIST OF FIGURE

<b>FIGURE</b>	<b>TITLE</b>	<b>PAGE</b>
2.1	ROBOCON game field	5
2.2	Line Following Robot	6
2.3	Operation of Photo Reflectors Sensor	8
2.4	Track control of desktop line following robot	9
2.5	Design structure of macanum wheel mobile robot	11
2.6	System Hardware Electronic Design	12
2.7	Required wheel actuation for general movements	12
3.1	Methodology flowchart	15
3.2	Project flowchart.	17
3.3	Interface Free Controller Board	19
3.4	Main Board	20
3.5	Power card	20
3.6	Digital Input Card	21
3.7	Brushless Motor Card	22
3.8	Interface Free Controller System Overview	23
3.9	USB ICSP PIC Programmer	24
3.10	Brushless DC Motor	25

3.11	Operation of Brushless DC Motor	26
3.12	Motor Driver	27
3.13	Brushless DC Motor System Configuration	28
3.14	Motor driver connection diagram and controller connection.	29
3.15	Digital Fiber Sensor	30
3.16	I/O circuit diagram	32
3.17	MPLAB Project Manager	35
3.18	The Design Cycle Of MPLAB	36
3.19	Compiler Convert Source Code Into Machine Instruction	37
3.20	Template of MPLAB IDE	37
3.21	Select Device	38
3.22	Project Wizard	38
3.23	Select Language Toolsuite	39
3.24	Create a New Project	40
3.25	Project Summary	40
3.26	Build All Program in Project	41
3.27	Template of PICkit 2 Programmer	43
4.1	Basic structure and sensor position in robot	45
4.2	Required wheel actuation for forward and reverse	46
4.3	Required wheel actuation for Right slide and Left slide	47
4.4	Turn right down movement	48
4.5	Turn right up movement	48



4.6	Turn right down movement	49
4.7	Turn left up movement	49
4.8	Robot base	50
4.9	Polyethylene (P.E.) L-shape joint	51
4.10	Motor attachment on robot base	52
4.11	Mecanum wheel and shaft	53
4.12	Mechanism of fiber sensor head operation	54
4.13	Optical fiber head placement	54
4.14	The connection of controller with motor driver and digital fiber sensor	55
4.15	Program sequence referring to the game field	56
4.16	Programming flowchart	60

**LIST OF ABBREVIATION**

PID	-	Proportional–Integral–Derivative controller
IR	-	Infrared
IFC	-	Interface Free Controller
ICSP	-	In-Circuit Serial Programming
USART	-	Universal Asynchronous Receiver/Transmitter
DC	-	Direct-Current
PWM	-	Pulse-width modulation
BLDC	-	Brushless DC motor
CW	-	Clockwise
CCW	-	Counter clockwise
LED	-	Light Emitting Diode
USB	-	Universal Serial Bus
APC	-	Auto Power Control
I/O	-	Input/Output
IDE	-	Integrated Development Environment

**LIST OF APPENDICES**

<b>APPENDIX</b>	<b>TITLE</b>	<b>PAGE</b>
A	Programming Code	64
B	Interface Free Controller	75
C	Brushless Motor Card Library Function	77
D	Digital Card Library Function	80
E	FX-300 Digital Fiber Sensor	82
F	Motor Driver AXH Series	89

# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

The line-following automatic robot using mecanum wheel navigation application outlined in this project makes extensive use of the PIC series of microcontroller to develop a program for implementing path planning for a mobile robot. The algorithm for robot navigation using line sensor acts as signposts for the robot to follow is implemented in the microcontroller localization of the robot. The purpose of this project is to provide a modular control algorithm in the aspect of controlling mecanum wheel navigation by using microcontroller.

Microcontroller has a ability to run programs and contains input and output pins that are used to control motor drive systems, read sensors, and communicate. Microcontroller is a highly integrated single chip device that contains the entire component comprising a controller. A single chip that contains the processor (the CPU),

non-volatile memory for the program (ROM or flash), volatile memory for input and output (RAM), a clock and an Input Output control unit. Unlike a general-purpose computer, which also includes all of these components, a microcontroller is designed for a very specific task to control a particular system. The main feature of the PIC is the microcontroller's capability of uploading, storing, and running a program.

## **1.2 Problem Statement**

Even though a robot using conventional differential drive has been widely used as automatic robots for the ABU ROBOCON competition, these existing microcontroller and conventional wheel in robot is design based on the specific purpose and function. However, conventional wheel are not truly omni directional because it needs to stop and re-orient its wheel to the desired direction. These mean that the features of conventional wheel automatic robot in navigation should be enhanced for fulfilling the requirement of the 2009 ABU ROBOCON competition. It can reduce the complete time on the ROBOCON competition and can be built according to strategy and rules.

So, line following automatic robot using mecanum wheel can be implement in the ROBOCON game to make the robot move faster and move effectively complete the competition task. This is because the automatic robot is the front carrier of the arrangement of robot in the 2009 ROBOCON theme.

## **1.3 Project Objective**

The objectives of this project are:

1. To design and develop the line following automatic robot navigation using mecanum wheel as prime mover and to further development of this knowledge based approach to left slide and right slide movement or any multi-direction movement.
2. To design and develop reliable and stable navigation for automatic robot, for 2009 ABU ROBOCON Competition.
3. To build the line following automatic robot using the custom-made mecanum wheel.
4. To develop a mecanum wheel for multiple direction motion in line-following automatic robot to smoothly navigate in the ROBOCON competition

#### **1.4 Project Scope**

The line-following automated robot navigation using mecanum wheel is main scope of this project. There are few point to be consider:

1. To design and develop the line following algorism and path planning by using mecanum wheel.
2. To examine and test the hardware through different task or environment before interface with software development.
3. To study and determine a suitable controller.
4. To test the program on the actual competition field.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

The automatic robot is incorporate into mechanical, electronic and software component. For the mechanical part contains of robot base and mecanum wheel. The mecanum wheel consist of the conventional wheel with a series of rollers attached to its circumference and the roller having an axis of rotation at 45% to the plane of the wheel in a plane parallel to the axis of rotation of wheel. It is controlled by the software program to move forward or reverse and any direction. In the electronic part the programmer has to execute the instruction to control four brushless motor and receive signal from the line sensor. For the software part, the MPLAB environment using C language will be used to develop the program.

### 2.1.1 Review 1: ABU Asia-Pacific Robot Contest 2009

The aim of this contest is to design and build robots comprising Manual Carrier and Automatic Carrier Robot to compete the task. The main task of the contest is for the Automatic Carrier Robot to lead in the front and a Manual Carrier Robot in the rear shall cooperate to carry an automatic Traveller Robot on Kago to the goal with the aim of completing the journey before the other team. The Kago is a basket suspended from a wooden pole, called here the Shoulder Pole. Various tasks stand in the way, including a task of boarding traveller robot at lodge zone, closing Mountain Pass and Woods. The Automatic Robot and Manual Robot are not allowed to enter the Goal zone. So, the Traveller Robot on Kago must not be dropped during navigation. The Traveller Robot must beat the three Victory Drums when it reaches the Goal Zone. The three traditional Japanese drums are arranged vertically on a platform. The team that beats all three drums first is the winner.

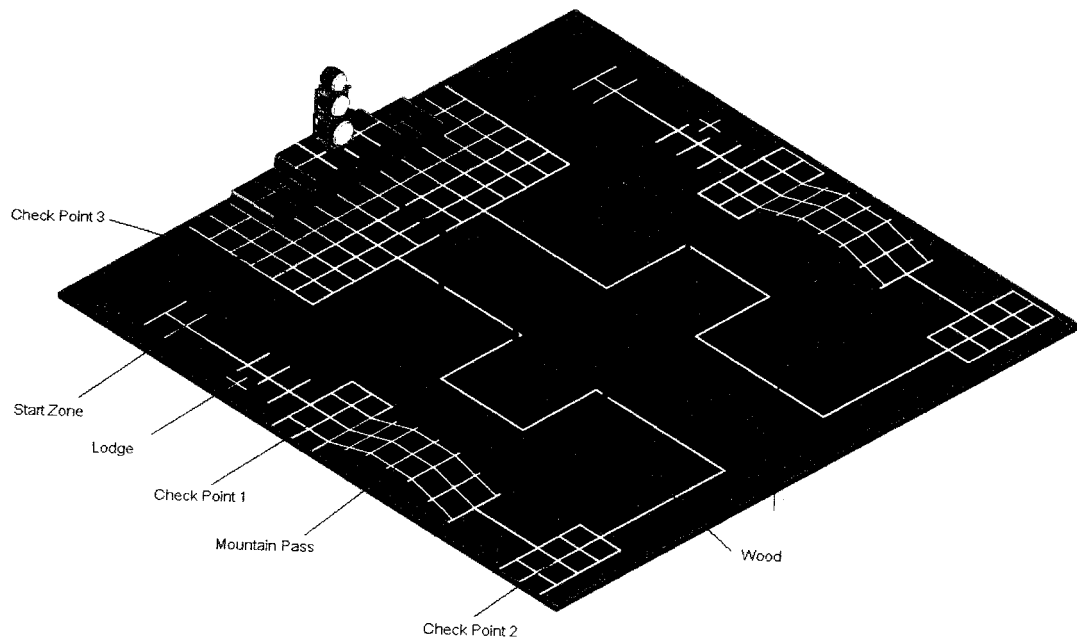


Figure 2.1: ROBOCON game field