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)"

Signature: .....

Supervisor's Name: En.Ahmad Zaki Bin Hj Shukor

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

ACKNOWLEDGEMENT

In preparing this report, I was in contact with many people, researchers, academicians and practitioners. They have contributed towards my understanding and thought. In particular, I wish to express my sincere appreciation to my main project supervisor, En.Ahmad Zaki Bin Hj Shukor, for encouragement, guidance critics and friendship. I am deepest gratitude from the bottom of my heart for all the support, encouragement and inspirations I obtained through the duration of this project. I am also very thankful to all my team member in ROBOCON and all the lab technician for their guidance, advices and motivation. Without their continued support and interest, this project would not have been same as presented here .

My sincere appreciation also extends to all my colleagues and others who have provided assistance at various occasions. Their views and tips are useful indeed. Unfortunately, it is not possible to list all of them in this limited space who offered me tremendous help and guidance along the completion of this project, My family, who inspired me weather through the storm and carry on, My beloved, who kept me through it all Lecturers and relevant personnel who helped me in one way or other; Friends and peers who are good companions in times of need.

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 munusia 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 menglengkapkan 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 loporan ini akan membincangkan tentang pembentukan satu pelayaran robot automatik menggunakan persimpangan garis sebagai menyelaras 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 menigkatkan cirri-cirinya, iaitu menggunakan tayar mecanum.Tayar Mecanum akan meningkatkan penggerakkan kepada berbagai arah untuk mempercepatkan pelayaran dalam pertandingan dan memjimatkan masa.

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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

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.

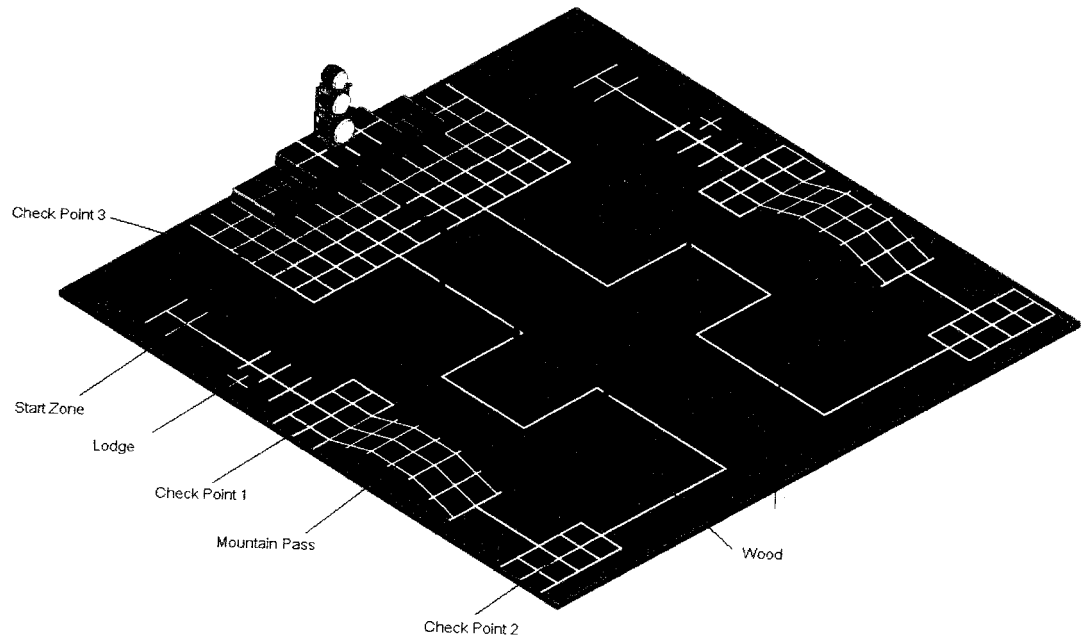

Figure 2.1: ROBOCON game field