WALL FOLLOWER MOBILE ROBOT PROTOTYPE

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"I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Power Electronic and Drives)."

Signature : .....

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Date : 27 APRIL 2007

"I hereby declared that this report is a result of my own work except for the excerpts that have been cited clearly in the references."

Signature : .....

Name : NAWAI ANAK LANGAR

Date : 27 APRIL 2007

Dedicated to my beloved family especially my father, mother, sister, brother and to all my friends.

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I wish to take this opportunity to thank my supervisor Mr. Ahmad Aizan Bin Zulkeflee that give me full support in this project that I made with my own. Without his support and guidance, this project will not be success. And also special thanks for him for his patience, kindness, co-operation and sharing knowledge.

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ABSTRACT

The purpose of doing this project is to apply the micro technologies onto the operational of other technology, so that it can work independently. Wall follower mobile robot project contains an external knowledge of PIC program and mixture of control circuit, such as motor and sensor. The PIC16F84A will be used to control the component to get the desired output. The goals of this mobile robot is able to travel follow the wall on its left then make a corner when encounter the wall edge and continuous walking. This mobile robot use optical sensors. The optical sensors are used to detect or sense the wall and to avoid collision with the wall. This can make sure the mobile robot moving follow the wall. To program the mobile robot, PIC microcontroller is used to control the movement of the mobile robot. Direct current motor used to move the mobile robot and consist of H-bridge circuit to control the DC motor. Overall, this project involves the interaction of hardware and software. The part of hardware consists of electronic circuit and combines with microcontroller circuit and PIC. Software is a main operation use to program the robot and to control the robot movement.

ABSTRAK

Tujuan utama perlaksanaan projek ini adalah untuk mengaplikasikan teknologi di dalam pengoperasian sesuatu teknologi yang boleh beroperasi secara sendiri. Projek robot bergerak mengikuti dinding ini melibatkan pengetahuan mengenai program PIC dan gabungan litar kawalan seperti motor dan sensor. PIC16F84A digunakan untuk mengawal komponen untuk mendapat keluaran yang betul. Objektif robot ini adalah ianya mampu untuk bergerak mengikut dinding pada sebelah kiri dan membelok ke kanan apabila terdapat dinding yang bersudut 90° dan seterusnya akan bergerak mengikut dinding semula. Robot ini menggunakan sensor optik. Sensor optik digunakan untuk mengesan dinding dan mengelak perlanggaran dengan dinding. Ini akan membolehkan robot mobil ini bergerak mengikut dinding. Untuk memprogramkan robot ini, pengawal mikro PIC digunakan untuk mengawal pergerakkan robot mobil ini. Motor arus terus digunakan untuk menggerakkan robot mobil ini dan mengandungi litar H-bridge untuk mengawal kelajuan motor. Secara keseluruhannya, projek pembinaan robot ini melibatkan interaksi antara 'hardware' dan 'software'. Bahagian 'hardware' mengandungi litar elektronik dan litar kawalan mikro. Bahagian 'software' pula merupakan operasi utama untuk mengaturcara dan mengawal pergerakan robot.

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LIST OF ABBREVIATION

DC - Direct Current

PIC - Programmable Interface Controller

RAM - Random Access Memory

ROM - Read Only Memory

I/O - Input/Output

EEPROM - Electrically Erasable Programmable Read Only Memory

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CHAPTER I

INTRODUCTION

This chapter will discuss overall the objectives of the project, scope of project, problem statement, problem analysis, methodology of project and expected result to develop the prototype of wall follower mobile robot.

1.1 Project Objectives

The main objective of this project is to construct the prototype of wall follower mobile robot. This robot is developed by using PIC microcontroller. To develop this robot need to do research on the wall follower mobile robot algorithm and its behaviors and achieved goal to navigate the mobile robot using PIC microcontroller. This wall follower mobile robot able to travel along the wall and turn 90° to the right when encounter a wall. Then it wills continuous walking follow the wall.

Other objectives are to gain knowledge in microcontroller, expose to the PIC and other software that will be used in this project and also to study different types of sensor in mobile robot. Here, need to study the development of an optical sensor that being used to detect the wall and avoid making collision with the wall. Lastly this project objective is to enable student to experience the hands-on in designing, implementation and evaluation of wall follower mobile robot algorithms.

1.2 Scope of Project

The scopes of this project are as follow:

i. Identify the suitable PIC Microcontroller
ii. Develop an algorithms for robot movement
iii. Develop the PIC programming
iv. Design the circuit for robot and optical sensor
v. Simulating and verifying the circuit
vi. Integrate the software and hardware

1.3 Problem Statement

At industry for example in one department this robot moving following the wall to avoid the robot without collide the other machine. It can be used to bring object or goods to other places by itself. Nowadays the wall follower robot is developed to introduce the advance technology for industry by archived goal as been mention in the objectives. In this project the selection of PIC software and the selection of appropriate sensors are emphasize or strongly considered in order to satisfy the need of this project design.

Beside that, the wall follower robot usually collide the wall. The collision can damage the robot and other component inside. So, to make sure the robot not damage because of collision, the optical sensor for mobile robot can be performs. This sensor is much better from others sensor such as ultrasonic sensor, touch sensor and limit switch that used before.

1.4 Problem Analysis

Some of the approach that has to be considers overcoming the problem statement mentioned above:-

i- Identify all the problem statement and try to overcome it.

ii- Design and develop an experiment based on the problem.

iii- Familiarized with all the equations, concept and theory related to the problem.

iv- Collecting data from the experiment and try to overcome the data.

1.5 Project Methodology

Literature review

a) Reading the appropriate or relevant books

b) Research on current papers related to the project

c) Widen knowledge about the project

Generate the hardware

a) Design the circuit

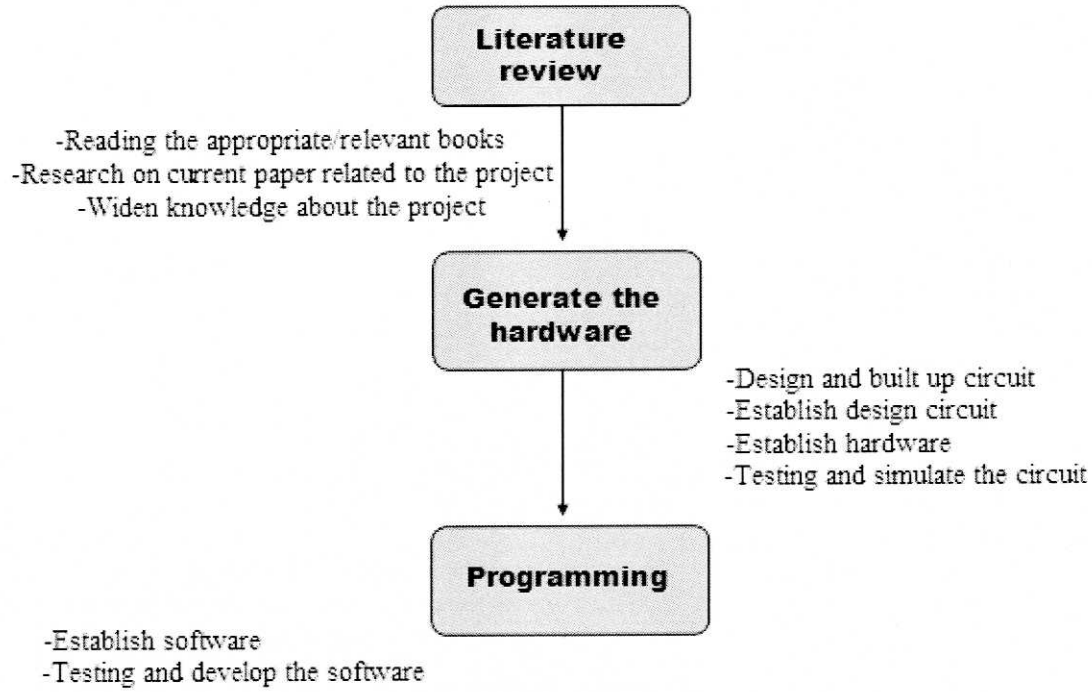
b) Build hardware using suitable devices or tools

c) Testing and simulate the circuit

Programming

a) Establish the software

b) Testing and develop the software



1.6 Expected Result

By the end of this project, below are the expected results:

i. The wall follower mobile robot will travel follow the wall.

ii. Robot will be able to turn 90° and make a corner-negotiation.

iii. Optical sensor will control the distance between the robot and the wall.

iv. Achieved goal of the project objectives.

CHAPTER II

LITERATURE REVIEW

This chapter will discuss about the theory and concept of the project. It includes the methods which use to implement the wall follower mobile robot. There is an introduction to the PIC microcontroller, its general function and hardware form. Beside that this chapter views also type of sensor and motor use to construct the prototype of wall follower mobile robot.

2.1 The Robot

There are many definitions about the robot. The different definition is according to the point of view. Some view a robot through the aspect of reprogram while others more concern on the manipulation of the robot, behavior, intelligence and so on.

Here the some definition about the robot. According to the British Robot association define robot as:

> "A programmable device with a minimum of four degrees of freedom designed to both manipulate and transport parts, tools or specialized manufacturing implements through variable programmed motion for the performance of the specific manufacturing task [1]."

The Robotic Institute of America defines the robot as:

> "Reprogrammable multifunctional manipulator designed to move material, parts, tools or specialized devices through variable programmed motion for the performance of a variety of tasks [2]."

Based on the definition from two institutes it can be conclude that a robot must be an automatic machine and be able to deal with the changing information received from the environment.

2.1.1 Mobile Robot

Generally, robot can be classified into two categories that are fixed robot and mobile robot. Fixed robot is a robot mounted on fixed surface and the working materials are brought to the workspace. A mobile robot moves from one place to another place to a desired target to do their task. Mobile robots may further categories into wheeled, tracked or legged of robot.

Mobile robots are mostly use in difficult task and dangerous environment such as bomb defusing. Besides, mobile robot use in manufacturing area and agriculture related activity such as in placing the seeds in the soil and fruit harvesting. Mobile robot may be use in houses to take care for the elderly and doing household chores.

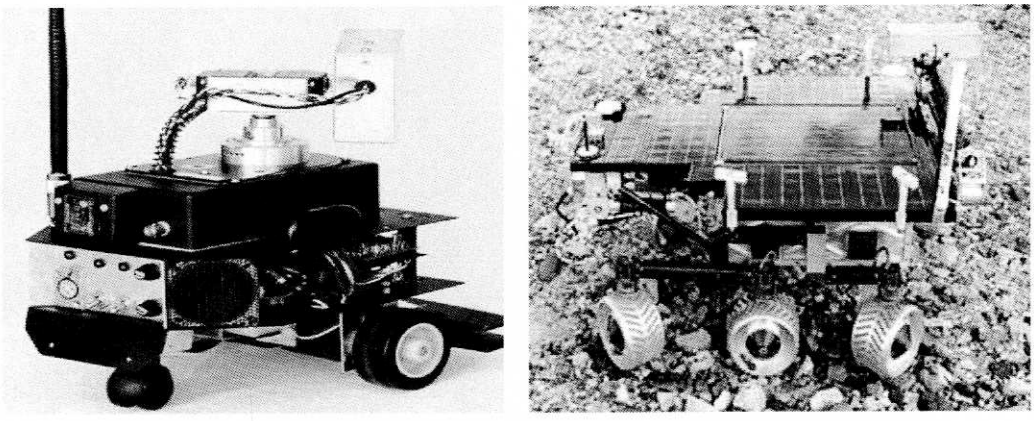


Figure 2.1 Types of mobile robot

2.2 Introduction To Microcontroller

A microcontroller is a computer-on-chip optimized to control electronic devices. It is a type of microprocessor emphasizing self-sufficiency and cost-effectiveness, in contrast to a general-purpose microprocessor, the kind used in a PC. The microcontroller contains a CPU (central processing unit), RAM (random access memory), ROM (read-only memory), I/O (input/output) lines, serial and parallel ports, timers and sometimes other built-in peripherals such as analog-to-digital (A/D) and digital-to analog (D/A) converters. The key feature however is the microcontroller's capability of uploading, storing and running a program.

A microcontroller is essentially an inexpensive single chip computer and easy to embed into larger electronic circuit designs. Their ability to store and run unique programs makes is extremely versatile. For example, we can program a microcontroller to make decisions and perform function based on predetermined situations (I/O line logic) and selection. The microcontroller's ability to perform mathematic and logic functions allows it to mimic sophisticated logic and electronic circuit.

2.3 PIC Microcontroller

Microchip Technology's series of microcontrollers is called PIC chips. These RISC- based MCUs are designed for applications requiring high performance and low cost. PIC is generally means programmable interface controller. PIC is the IC which has developed to control the peripheral device, dispersing the function of the main CPU. When comparing to the human being, the brain is the main CPU and the PIC shares the part of which is equivalent to the autonomic nervous.

The PIC family has several of types. It includes the 8-pin PIC12Cxxx family, the original PIC16C5x family, PIC16Fxxx family, the higher-end PIC17Fxxx family and the latest PIC18Fxxx family, which support a much larger memory map and is supposed to be more compiler-friendly, while retaining backwards compatibility with older members of the PIC line. Finally flash-based PIC is also available.