**APPLICATION OF LDR SENSOR ON LINE FOLLOWER ROBOT**

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**MAY 2007**

"I hereby declare 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 (Control, Instrumentation and Automation) ."

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Date : 06 MAY 2008

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

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This report is submitted in partial fulfillment the requirement for the Bachelor of Electrical Engineering (Control, Instrumentation and Automation)

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May all of this effort and sacrifice from all, will get bless from Allah S.W.T. The good is from Allah and the bad is from us.

## ABSTRACT

The focuses of this project are on the research, design and implementation of robot which is control by PIC microcontroller and LDR sensor as the drivers. In this project, a line follower with PIC microcontroller is integrated thus a complete automation system produced. The main task in this project is to make the robot to follow the line and make turn when meet the junction. This project contains two main parts. The first part is software development and the later is hardware development. For hardware development, it contains design of voltage regulator circuit, motor controller circuit, sensor circuit and PIC circuit. It also contains the mechanical mechanism such as gear, driver and cassis. For the software development, it contains the programming for the controller. After that, the analysis, discussion and conclusion for the entire project will be made.

# ABSTRAK

Projek ini pada asasnya memfokuskan kepada kajian, rekabentuk dan aplikasi robot pengikut garisan yang dikawal oleh mikropengawal PIC dan dipacu oleh pengesan LDR. Gabungan ini akan menghasilkan sistem automasi yang lengkap dan sempurna. Fungsi utama projek ini adalah untuk menggerakan robot mengikut garisan dan membelok apabila menemui garisan bergrid. Projek ni mengandungi dua bahagian. Bahagian pertama projek ini ialah penbangunan perkakasan dan bahagian kedua pula ialah pembangunan perisian. Untuk pembagunan perkakasan, ianya mengandungi litar pengatur voltan, litar pengawal motor, litar pengesan dan litar mikropemproses PIC. Ianya juga mengandungi mekanisma mekanikal seperti gear, pemandu dan casis. Untuk pembangunan perisian, ianya mengandungi atucara untuk pengawal mikropemproses PIC. Selepas itu, analisa, pembincangan dan kesimpulan untuk keseluruhan projek dibuat.

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## LIST OF ABBREVIATONS

PIC - Peripheral Interface Controller

IC - Integrated Circuit

DC - Direct Current

PSM – Projek Sarjana Muda

LED – Light-emitting Diode

# CHAPTER I

# INTRODUCTION

## 1.1 Introduction

Line follower is a machine that can follow path. A path can be a white line on a black surface (or vise-versa). Sensing a line and maneuvering the robot to stay on course, while constantly correcting fault moves using feedback mechanism forms a simple yet effective closed loop system. This is an opportunity to 'teach' the robot how to follow the line thus giving it a human-like property of responding to stimuli.

This project purpose is to implement the usage of LDR (Light Dependent Resistor) sensor on Line Follower Robot that follow a grid line. This includes the prototype of the Line Follower robot with the controller for the system. The controller used to control the robot is PIC micro controller. This controller is programmedusing C language from PIC C or also known as CCS Compiler software.

To design the project, many methods and ways that must be taken. One of them is to identify the weakness of the LDR sensor. The research carried out is the light that reflects to the LDR sensor surface. Also for the motor, the weakness is to stop the motor immediately without any overshot. The transmitted signal and the motor type also studied so that a good prototype can be made and function smoothly. One of the research on the LDR sensor and motor weaknesses.

In designing the controller for the robot, the method used is to develop the C language using PIC C software. The language will be programmed to the PIC micro controller and it will control the whole process of the robot. In this context, a perfect C program must be designed so that the system will operate in systematic and efficient condition.

Developing a good prototype is so challenging and high skill and precision is needed to develop it. Literature review is the suitable way to overcome any problem that occurs in developing this project.

## 1.2 Objective

The main purpose of this is to develop a line follower robot by using LDR sensor so that the robot can make turn on grid line. The objective for this project is:-

i. To implement LDR sensor as the sensor for the line follower robot.
ii. To design prototype of the robot that can follow the line and can turn when meet the junction.
iii. To design Controller circuit that controls the operation of the robot.

## 1.3 Scope

In this project, the robot is programmed to turn to direction that programmed in the PIC micro controller. Hence, it will integrate both hardware and software to produce a working robot.

This project requires the robot to receive signal from input sensor, move and turn as programmed in the PIC microcontroller.

## 1.4 Problem Statement

### 1.4.1 LDR sensor

Nowadays, many Line Follower Robots use Infrared as input sensor while this project uses the LDR sensor as replacement to Infrared sensor as an input for line follower robot. This project will prove the LDR sensor not only applies in switching device but it also can be use in the mobile robot.

### 1.4.2 Line Follower

The line follower robot basically will follow the line that has different brightness. For example, the line is white and the background is black. It is difficult to mechanical device to detect lines. The suitable way is to use the LDR sensor as a detector. It can detect the light that reflect on the bright surface and transfer the PIC micro processor as the input.

### 1.4.3 Processor

The processor is the most important part in the mobile robot. It's also known as the 'brain' for the robot. But as we all know, a mobile robot is small and has limited space. The best device that we call the 'brain' for the mobile robot is PIC microcontroller. With the size around 4 centimeters, PIC microcontroller is the suitable device. Although small size, PIC micro controller can processes around 32 commands which is good.

# CHAPTER II

# LITERATURE REVIEW

## 2.1 Introduction

This chapter contains Literature Review. Literature Review is really important when want to develop an application and prototype. This is because, through this, we can make review about others project that similar to us. With this review and research, it can recognize the advantage, disadvantage and the way they represent it. Through this, a prototype that is much better than others existing prototype that fulfill user needs can be created. Through this, the new approach can be identifying to develop new application. With this, an application that is more effective than existing prototype can be created.

This chapter also explains about the component that can be used in this project. It is important because, to create a good prototype, we must recognize the suitable component first. With this, it can make the prototype like user needs.

All the research is came from the internet and the book. From the sources, we can recognize the advantage, disadvantage and the way to represent it. It also can tell us the easier way to develop it. For example, from internet, we can compare about two projects and note the good components that suit our application.

## 2.2 No of Sensor

In [1] explain about how the number of sensors affects a robot's ability to follow a line. It represents three methods about the ability of using one, two or three sensor for the mobile robot. The number of sensor will effect the line follower detection. From the guide, the number of sensor is most important part to do research because, this factor will make our robot in line or not. The example in [1] is:-

### 2.2.1 1 sensor (The edge finder)

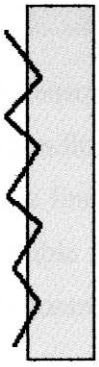

Figure 2.1: Mobile robot using 1 sensor

Figure 2.1 shows us about the mobile robot that used only one sensor. The sensor only provides two signals, over the line and off the line. Unfortunately, sometimes, the robot will lose the line.

### 2.2.2 2 Sensor (The line avoider)

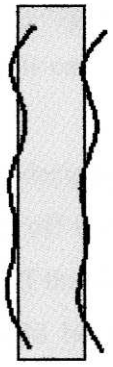

Figure 2.2: Mobile robot using 2 sensors

Figure 2.2 shows a robot with 2 sensors. The robot uses two motors and each sensor control each motor. It give four conditions, found right side of line, found left side of line, straddling the line or lose the line and not used unless sensors are placed less than the line's width apart. It is suitable to add Micro controller as controller to control the motors and the sensors. It will control the robot so that the robot will not lose the line.

### 2.2.3 3 Sensor (The line seer)

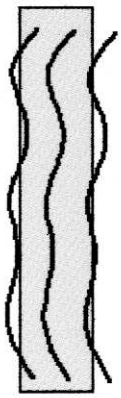

Figure 2.3: Mobile robot using 3 sensors

By adding a third sensor to the previous design, the robot recognize of the line and its edges. The robot now takes advantage if it's awareness of the line and deal with situations like losing the line. It can also adapt more readily to changing conditions like curves and straight always in the track. It can increase speed in the straight always or adjust steering more subtly.
This is one of the more common sensor designs used, especially with microcontrollers. The possible test conditions are moving off the line to the left, centered over the line, slightly off the line to the left, moving off the line to the right, not used, slightly off the line to the right and not used (but could be used in the advanced or maze solving contests).

# CHAPTER III

# THEORETICAL BACKGROUND

## 3.1 Microcontroller / Microprocessor

PIC microcontroller also known as Peripheral Interface Controller. The most popular application for PIC is to control and process the data from input and send the program to the output to complete the task from programmed. It also has calculation function, memory and controlled by program. PIC is small so that this device is suitable for small project such as line follower robot. Each pin on it has specific function. PIC also can be program by using the C language. The language is quite easy to learn and this is why some people like to use it. More importantly, PIC is like 'brain' for the robot.

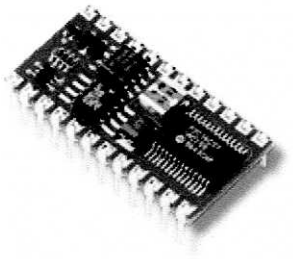

Figure 3.1: PIC microcontroller

PIC microcontroller can be differentiated by the serial number on it. For example, 12CEXXX, 16FXXX, 18FXXX. The differences of all the PIC is the size of its pin. For 16FXXX, it means the PIC has 16 bits.

PIC are popular because of low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.

### 3.1.1 PIC microcontroller 16F877

In this project PIC 16F877 is used because it is cheap, brilliant and useful. It also very easy to assemble and only need few additional elements to operate. This PIC microcontroller also can be programmed and erased up to 10,000 times. Many programming language are supported by this PIC such as C language, High-Tech C and PicBasic.