TORTOISE ROBOT

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This Report Is Submitted In Partial Fulfillment Of Requirements For The Bachelor Degree of Electronic Engineering (Computer Engineering)

Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer
Universiti Teknikal Malaysia Melaka

April 2007

UNIVERSTI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : TORTOISE ROBOT

Sesi Pengajian : 2006/2007

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DECLARATION

"Hereby, I declare that this report entitled, Temperature Monitoring System is a result of my own research idea except for works that have been cited clearly in the references."

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SUPERVISOR APPROVAL

"I declare that I have read this report and in my opinion, it is suitable in term of scope and quality for the purpose of awarding a Bachelor Degree in Electronic Engineering (Computer Electronic)"

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Specially dedicated to

my beloved parents, friends and to my special lecturer, Prof Abdul Hamid Hamidon

who have encouraged, guided and inspired me throughout my journey of education

ACKNOWLEDGMENTS

First of all, thanks to Dear Lord, Allah SWT because gave strength and patience to finish this Final Year Project. The number of individuals who have made it possible for exceeds those whose names grace the cover. At the hazard of leaving someone out, I would like to explicitly thank the following respective individuals for their priceless contribution and commitment towards in accomplishing this project proposal. First of all, I would like to thanks to supervisor Prof. Abdul Hamid Hamidon for the guidance throughout the whole two semesters and for giving an opportunity to come off with a challenging task and a successful one in order to complete this project. Secondly, I also want to contribute my acknowledgement to all of involved lecturers in Fakulti Kejuruteraan Elektronik & Kejuruteraan Komputer that's giving me moral supports and ideas to help me finish this project. Besides that, not forgotten to fellow colleagues who gave their ideas in solving some of the crucial part and sharing their opinions in this project from early until the end. Lastly, thanks a lot to beloved parents that fully support me and gives everything that they can to me in order to finish this project. Again, thousands of thank to all of you. I really appreciate the helps you give to me. Thanks.

ABSTRACT

This project is to design and construct a robot that can sense light and move towards the light. The robot can move forward, turn right and turn left when it senses a light source. A light-sensitive resistor was mounted on the shaft of the front steering wheel of the robot to ensure that the robot moves toward the light. Because of the slow movement and will be response to light, this robot is called *Tortoise Robot.*

The project involves the construction of the mobile base, design of a light sensor circuit and placement of motors. The robot moves using servomotors controlled by a Programmable Interface Controller (PIC). Programming of the PIC was done using PICbasic and simulated using Proteus software.

ABSTRAK

Projek ini adalah untuk mereka bentuk dan membina sebuah robot di mana ia boleh mengesan cahaya dan bergerak ke arah cahaya. Robot boleh bergerak kehadapan, pusing ke kanan dan pusing ke kiri apabila mengesan sumber cahaya. 'Light-sensitive resistor' dipasang di atas stereng roda hadapan robot untuk memastikan bahawa robot bergerak ke arah cahaya. Lantaran pergerakan yang perlahan dan akan bertindakbalas kepada cahaya, ia dipanggil *Tortoise Robot*.

Projek itu melibatkan pembinaan reka bentuk asas mobil, membina litar pengesan cahaya dan menempatkan motor. Pergerakkan robot ini menggunakan servomotors yang dikawal oleh 'Programmable Integrated Controller (PIC). Aturcara program adalah dibuat menggunakan PICbasic dan disimulasi menggunakan perisian Proteus.

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LIST OF ABREVIATIONS

PIC	-	Programmable Interface Controller
IDE	-	Integrated Development Environment
CdS	-	Cadmium Sulfide
FPGA	-	Field Programmable Gate Array
PLC	-	Programmable Logic Controller
DSP	-	Digital Signal Processing
PC	-	Personal Computer
LDR	-	Light-Dependent Resistor
LCD	-	Light-Crystal Display
DTMF	-	Dual-Tone Multifrequency
DC	-	Direct Current
PWM	-	Pulse-Width Modulation

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In 1948 Walter built a three-wheeled turtle like mobile robot. The mobile robot measured 12" high and about 18" long. What is fascinating about this robot is that it used just two electronic neurons but exhibited interesting arid complex behaviors. The first two robots were affectionately named Elmer and Elsie (ELectroMEchanical Robot, Light Sensitive). Walter later renamed the style of robots Machina Speculatrix after observing the complex behavior they exhibited.

In the 1940s the transistor had not yet been invented, so the electronic neurons for the robot were made using vacuum tubes. Vacuum tubes consume considerably more power than semiconductors, and so the original robot was fitted with a rather large rechargeable battery.

The robot's reflex or nervous system consisted of two sensors connected to two neurons. One sensor was a light-sensitive resistor and the other sensor was a bump switch connected to the robot's outer housing.

The three wheels of the robot were in a triangular configuration. The front wheel had a motorized steering assembly that could rotate a full 360 degrees in one direction. In addition, the front wheel also contained a drive motor for propulsion. Since the steering could continually rotate a full 360 degrees, the drive motor's electric power came through slip rings mounted on the wheel's shaft.

The photosensitive resistor was mounted onto the shaft of the front wheel steering-drive assembly. This ensured that the photo sensitive resistor was always facing in the direction that the robot was moving.

While primarily of a photovore (light-seeking) type, the robot exhibited four modes of operation, it should be mentioned that the robot's steering motor and drive motor were usually active.

- Search- Ambient environment is at a low light level or darkness. Robot's response: steering motor on full speed, drive motor on one-half speed.
- Move- Found light. Robot's response: steering motor off, drive motor full speed.
- Dazzle- Bright light. Robot's response: steering one-half speed, drive motor reversed.
- Touch- hlit obstacle. Robot's response: steering full speed, reverse drive motor.

1.2 Project Overview

The aim of this project is to build a tortoise robot similar to that proposed by William Gray Walter. This robot can search for a light source and move toward the light. The tortoise robot is made autonomous by having a light sensor. When the robot senses a light, the robot automatically moves toward it. When is no light, the robot remains stationary.

The Robot configuration is shown in fig 1.1.

The robot platform is made in a triangular configuration moving on 3 wheels. The single front wheel determines the direction the robot moves and moves the robot forward while the two rear wheels are free wheel.

Two motors control the robot movement. One motor controls the front wheel i.e the direction the robot moves. The second motor moves the rear wheels, i.e the forward movement of the robot.

Both motors are connected to the output of a PIC. The PIC acts as an interface between the robot and the light sensor.

The light sensor detects light intensity and stimulates the PIC to respond to a given Program.

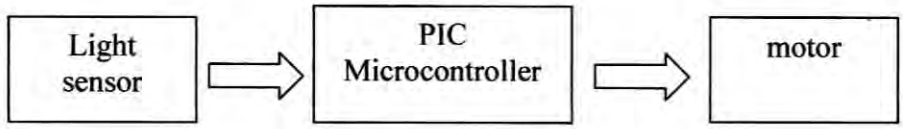

Figure 1.1 : Robot configuration

1.3 Scope of Project

The scope of the project is to build a mechanical structure for the robot, driving the motors and hence the robot, constructing the light sensor circuit and programming of the microcontroller

The mechanical construction of the *Tortoise Robot* was designed according triangle configuration. This is described in Chapter 2 of the thesis.

The motors used were DC servomotors and driven by H-bridges. This is described in Chapter 3.

A light sensitive circuit was constructed to detect light intensity. The light-sensitive resistors used are Cadmium Sulfide (CdS) and circuit design and construction are described in Chapter 3. The response to light intensity was fed as input to a microcontroller.

The micro controller used is PIC16F84A. The input from the light sensor should enable the PIC to move towards the light as required based on the intensity. The PIC would therefore be programmed to the required modes of movement. The use of the PIC is to make the robot more versatile. The suitable program arrangement needs to be programmed to ensure the movement of the robot and able to respond sensitively to the sensor.

Compatibility between torque delivered by the motors and speed of robot movement can be achieved by means of a gearing mechanism.

1.4 Expected Output

At the end of the project, the *Tortoise robot* can sense light, a light-resistive resistor give signal to PIC microcontroller and give pulse motor to drive motor toward the light.

CHAPTER 2

MECHANICAL DESIGN

2.1 Building a Tortoise Robot

This chapter will include ways to construct a *Tortoise Robot*. What we have discussed here is to fabricate the chassis of the robot. We need to do a little metalwork to develop the base body of robot.

The emphasized things that consist to create the base robot such as steering motors, shell, counterbalance of the robot, finding the center of gravity, attaching bumper to robot base.

2.2 Steering Motor

There are three pieces of sheet metal want need to fabricate. The first metal that needs to fabricate is U channel wheel mount detail. Secondly is L bracket for mounting servo motor to U channel. Next. the robot base cutout with servo motor hole and the rear axle of the robot base. Lastly, to combination for all part of fabricate items.

(a) U channel mount wheel

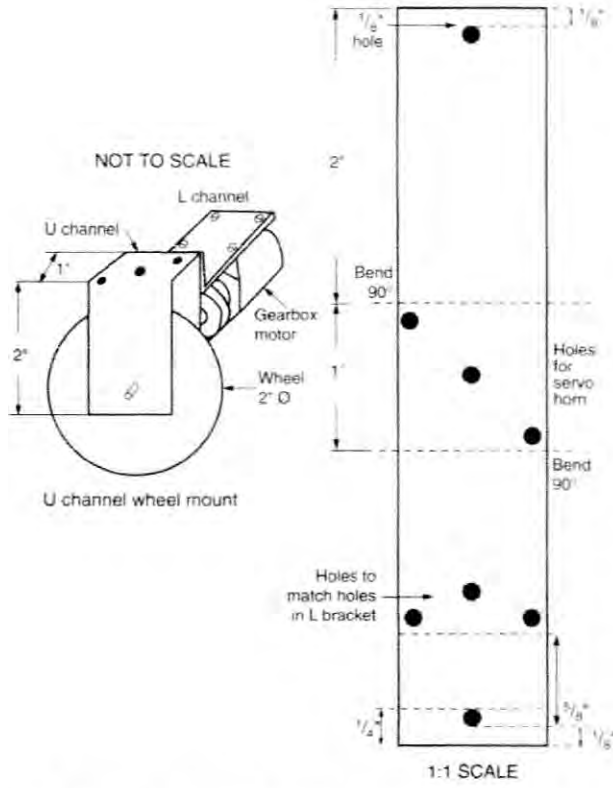

Figure 2.1 : U channel mount wheel detail

- The U channel that shown at figure 2.1 is to holds the front wheel and drive motor. The U bracket is fabricated from 22-gauge, 1''x5'' sheet metal. Three holes in the center area are drilled to mount the servo horn from the servo motor. The center drill hole (1/8'') is larger than the two outer holes (1/16'')

- Remove the servo motor horn from the servo motor by unscrewing the center screw and pulling straight up on the horn.

- Line up the servo motor horn on the bracket and mark the center and two outer holes. Then drill the three holes.

- Mount the servo horn, using the center servo motor screw.

- For outer holes use two 0-80 machine screws and nuts. Drill three 1/8'' holes for mounting the L bracket to the side.

- Drill the two axle holes for the front wheel with use 1/8'' holes.

(b) L bracket for mounting servo motor to U channel

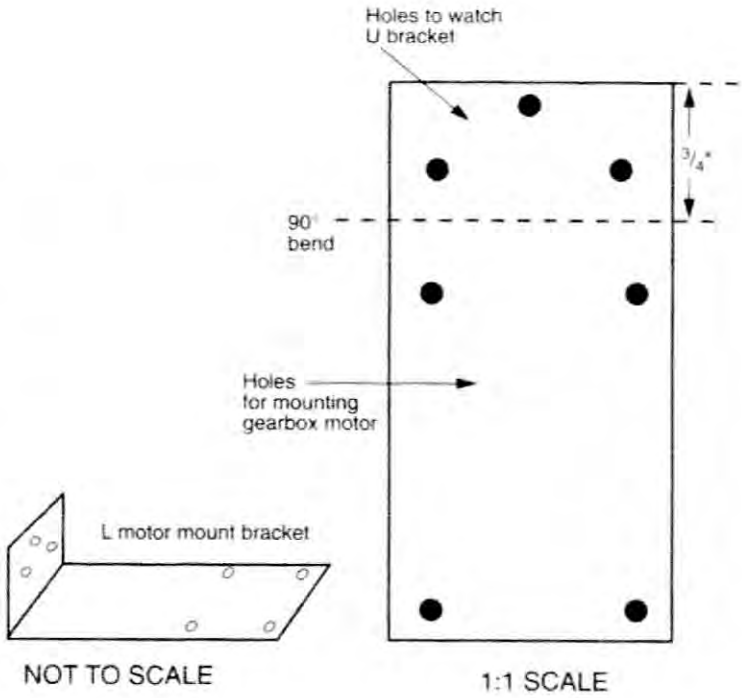

Figure 2.2 : L bracket for mounting servo motor to U channel

- Use the L bracket to mount the drive motor to the U channel as shown at figure 2.2. The L bracket is 1.5" x 3"\. Make sure the three holes in the L bracket for mounting to the U bracket match the mating holes in the U bracket.