" Saya akui bahawa saya telah membaca karya ini pada pandangan saya karya ini adalah memadai dari skop dan kualiti untuk tujuan penganugerahan Ijazah Sarjana Muda Kejuruteraan Elektrik (Kawalan, Instrumentasi & Automasi)

Tandatangan : ....
Nama Penyelia : Mariam Md Ghazaly.
Tarikh : 7/5/07

DEVELOPMENT OF A MANUALLY GUIDED ROBOT
WITH MINIMUM 5KG OF LOAD

CHEOK YONG SENG

This Report Is Submitted In Partial Fulfillment Of Requirement For The Degree Of
Bachelor In Electrical Engineering (Control, Instrumentation & Automation)

Fakulti Kejuruteraan Elektrik
Universiti Teknikal Malaysia Melaka

MAY 2007

"Saya akui laporan ini adalah hasil kerja saya sendiri kecuali ringkasan dan petikan yang tiap-tiap satunya saya jelaskan sumbernya."

Tandatangan : ....Yayaj........

Nama : ..CHEUK   YONG   SENG...

Tarikh : ....7 / 5 / 07............

ACKNOWLEDGEMENT

In submitting this report, I would like to thanks Cik. Mariam Bt Md Ghazaly, my supervisor Projek Sarjana Muda (PSM), for her guidance and participation in conducting my project. Her knowledge and insights were invaluable in identifying the ways to solve my problems regarding to my project. I also would like to thanks En. Fariz Bin Ali @ Ibrahim and En. Ahmad Aizan Bin Zulkefle for advise and provide me good idea and knowledge to completed my final project 1. Also I would like to thanks Prof. Madya Dr. Zulkifilie Bin Ibrahim and En. Ahmad Idil Bin Abdul Rahman for provide their knowledge and comment to improve my final project.

ABSTRAK

Robot kawalan mempunyai 4 elemen yang penting, iaitu bekalan kuasa, kawalan motor, motor DC and pencengkam robot. Kawalan motor adalah terdiri daripada micocontroller untuk mengawa pergerakan robot.

Dalam litar kawalan motor, microcontroller jenis 16F877 digunakan dalam projek ini. Penggunaan perisian mikroC untuk menulis bahasa C untuk digunakan pakai oleh microcontroller 16F877. Robot kawalan ini akan dikawal dengan menggunakan alat kawalan.

Dalam pergerakan robot, litar H-bridge digunakan disebabkan ia boleh mengawal pergerakan motor dalam kedua-dua arah samada ke depan atau kebelakang dan ia juga dapat menjana pembrekan. Dua DC motor digunakan pada bahagian tapak robot. Pencengkam robot juga akan menggunakan motor dc untuk mencengkam objek.

ABSTRACT

Manually Guided Robot basically has 4 major electrical components. There is power source, motor controller, electric DC motor and gripper / handler. Typically, the motor controller is a microcontroller device which controlled the movement of the robot.

The motor controller circuit is realized by using 16F877 PIC microcontroller. Using the mikroC software to writes the C programming for PIC microcontroller. The manually guided robot will be control by a keypad.

For robot movement, an H-bridge configuration allows the motor to run in both ways whether to move forward or reverse directions. It also allows for a simple implementation of regenerative braking. 2 DC motor will be used for the robot base. The gripper of the robot also will be controlled by the DC motor for gripped object and robot movement.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

In Malaysia, National Robofest was started in 2001 and jointly organised by Ministry Science, Technology and Environment and SIRIM Berhad. At state level, Robofest was under State, Ministry of Education (state) and SIRIM Berhad Branch. Robofest aimed at creating and stimulating interest of Malaysia at all spectrum of society from educational,industry to general public in robotics and artificial intelligence (AI) technology.

Robofest is an annual Robot Games Festival aimed at creating and stimulating interest of Malaysia at all spectrum of society from educational, industry to general public in robotics and artificial intelligence (AI) technology. To achieve this objective, the related activities such as robot contest, robot clinics, drawing contest, exhibitions and seminars are organised.

Robofest is an annual robot contest starting from 2002, just for university, college and polytechnic students in the Asia-Pacific region. Under a common set of rules, participants will compete with their peers in other countries to create a robot using their creative and technological abilities in an open competition. This contest aims to create

friendship among young people with similar interests who will leadtheir countries in the 21st Century, as well as help advance engineering and broadcasting technologies in the region. This event will be broadcast in your country through an ABU member broadcaster.

RoboCon Malaysia is a contest to design and construct robot that can perform certain task based on theme and rules. The winner will be representing Malaysia to the international level organized by Asia Pacific Broadcast Union (ABU).

It is within this context that SIRIM Berhad has actively promoting robotic competition to encourage and promote creative and innovative minds among the younger generation. Robofest was Robocon are robotic competition will give an opportunity to secondary school and higher education to develop creative and critical minds in Artificial Intelligence and Robotic Technology whilst providing avenue for students to display their engineering skills and capabilities.

Previously, UNIVERSITI TEKNIKAL MALAYSIA MELAKA (UTeM) has send participate in the Robocon and Robofest competition. From this competition, this final project will using creativevity, technological abilities and knowledge that have been learned in this 4 year of degree to find the realiable and stable base to create the manually guided robot with 5kg of load. In future, this project can be used and modified for all the Robocon and Robofest competition.

Manually Guided Robot basically has 4 major electrical components. There are power source, motor controller, electric DC motor and gripper / handler. The motor controller circuit is realized by using 16F877 PIC microcontroller. For robot movement, an H-bridge configuration allows the motor to run in both ways whether to move forward or reverse directions. The gripper of the robot also will be controlled by the DC motor for gripped object and robot movement.

1.1   Objectives of the Project

There are few reasons to realize this project, which is :

1) To build a reliable and stable base for manually guided robot, and can stand with minimum 5kg load.

2) To build a strong gripper which it can grip object without loosing and dropping it.

3) To build a keypad to guided the robot.

1.2   Scope of the Project

The remote control (keypad) sending the signal to the microcontroller 16F877. This signal will be process by the microcontroller 16F877 and then sending out the data signal to the base robot or manipulator. It depends whether sending a signal to control the base robot or manipulator. For base robot, the remote control can control it whether to move forward or backward and left and right. For the manipulator, it can control the manipulator to grip object or release the object. Figure 1.1 show that flow chat manually guided robot.
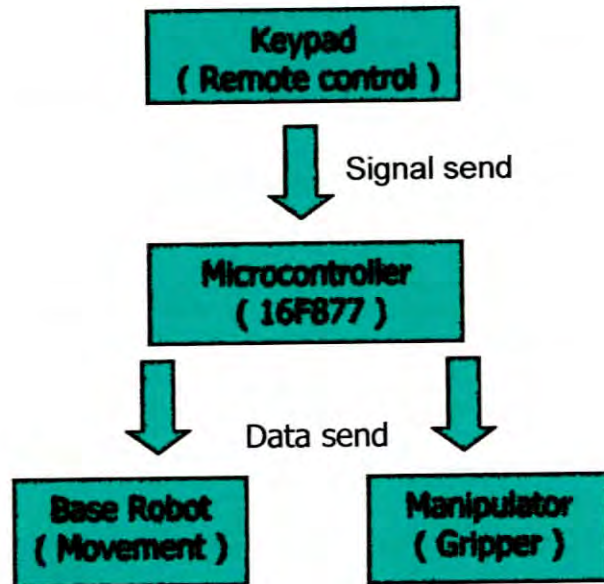
Figure 1.1 : Flow chat manually guided robot

1.3 Problem Statement

The problem statement for this project is :

1) The manually guided robot can be implement at the ROBOCON game which the robot grip the object to a mark point.

2) The robot also can implement at industrial pick & place automation.

1.4 Project Planning Schedule (Gantt Chart)

Table show that the Gantt Chart for both project PSM 1 & PSM 2

Table 1.1 : Gantt chart

PROJECT PLANNING

List major activities involved in the proposed project. Indicate duration of each activity to the related month(s).

Project's Activities	J	2006						2007					
		J	A	S	O	N	D	J	F	M	A	M	J
Report project PSM 1 & 2	X	X	X	X	X	X	X	X	X	X	X		
Research on previous ROBOCON games & robot design	X												
Search a software to design programming for PIC microcontroller	X												
Study programming PIC microcontroller	X	X											
Study Proteus 6 to design a circuit for simulation		X											
Designing and program PIC microcontroller		X	X										
Presentation PSM 1			X										
Simulation for circuit PIC microcontroller			X	X									
Search and build a programmer circuit for PIC microcontroller 16F877				X									
To build circuit for motor, power source, microcontroller & keypad and testing				X	X	X							
To build mechanical part robot body						X	X						
Combination mechanical & electrical part and testing							X	X	X				
Presentation PSM 2										X	X		

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Manually guided robot with minimum 5 kg load has 3 major parts. There are electrical part, software part and mechanical part. In the electrical part have programmer 16F877, H-bridge control circuit and keypad remote control. For software part, the mikroC programming C will be used and the Proteus Professional will be used to simulate the circuit. In the mechanical part, the movements of the robot are the base robot. It control by the remote control whether to move forward or backward and left or right side. For the manipulator, it also control by the remote control to do the pick and place at the mark point in the Robocon contest.

2.1 ROBOCON 2006

The aim of this contest is to design and build a team of robots comprising manual and Automatic Machines, to compete according to the rules set out. The main objective of this contest is to simulate the construction of the twin towers and its surrounding by a team of robots using polystyrene builder blocks. The first team to complete one of the twin towers and two 'skybridge' towers thus considered "SIAP" will be the winner. Duration of the game is three minutes.

2.1.1 Rules and Theme of Manually Robot

The game is played on a square Game Field, which is surrounded by a wooden fence. It consists of a Manual Area and an Automatic Area. Each team must design and construct either or both handmade Manual and Automatic Machines to compete in the contest. For each match, there is no restriction on the number of Automatic Machine(s) but only one (1) Manual Machine is allowed for each team. Figure 2.1 show that plan game field ROBOCON 2006.
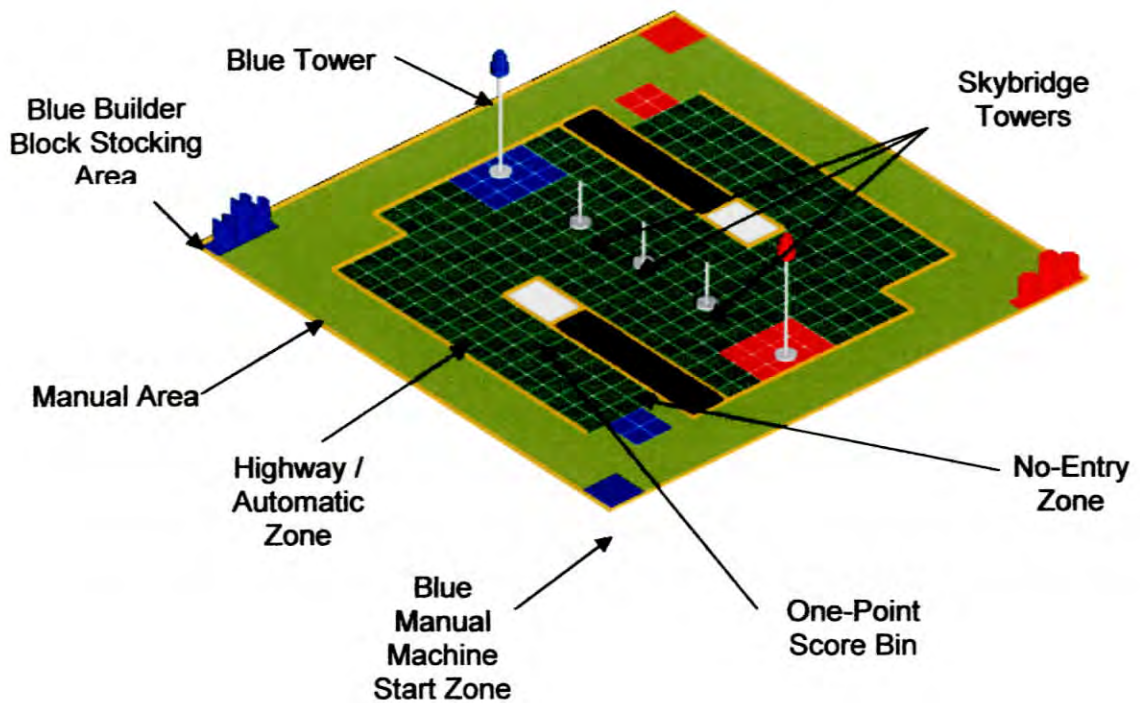
Figure 2.1 : Plan game field ROBOCON 2006

a)   Manual Area

The Manual Area surrounds the Automatic Area. Builder Blocks Stocking Areas for teams are located at the corners of the Game Field, at a forward direction from their respective Manual Start Zones. Before the start of a game, seven (7) Builder Blocks are arranged in a line in a stack of 2–3–2 formation, with the opening of the Builder Blocks facing outwards. Builder Blocks Stocking Area and the space above it is exclusively for own team's machine only.

Manual Machine Start Zone is located in the Manual Area. There are two Manual Start Zones, one for each team. These Manual Machine Start Zones are located at two corners diagonally apart from each other.

b)   Manual Machine

The Manual Machine has to be operated via remote control using a cable connected to it or remote control using infrared rays, visible rays or sound waves. Controlling using radio waves are not allowed. When operating via cable, the connecting point of the cable to the machine must be at least 1000mm from the ground. However, the length of the cable from the Manual Machine to the control box must not exceed 3000mm.

Manual Machines are permitted to enter the Manual Zone and their own Builder Block Stocking Area and Tower Zone only. They can touch the floor and space above it. The operator of the Manual Machine is only permitted to control the machine from within the Manual Area. Manual Machines are not allowed to enter or extend its parts into other areas such as Highway Zone, Building Site Zone, No-Entry Zone, One-Point Score Bin and the opponent's Builder Block Stocking Area and Tower Zone.

Team members are not allowed to touch the Manual Machine once the game begins. Operators are not allowed to ride on their Manual Machine. Manual Machines are not allowed to touch opponent's Builder Block. In the interest of fair play and competitive spirit the referee will decide on the 'right of way' for Manual Machines.

2.2   ROBOCON 2007

The rules of Robocon 2007 are built basing on this legend of Ha Long. A team of robots (symbolizing dragons) will carry the blocks having the shape of cylinder (symbolizing pearls) to build various kinds of islands symbolizing 'Ha Long'; and 'Bai Tu Long'. Red team and Green team will operate Manual Machines (symbolizing Mother Dragons) and Automatic Machines (symbolizing Child Dragons) to put the 'Pearls' on the 'Islands'. The team which puts the 'Pearl' on top of an 'Island' gets the 'Island'. The first team to complete the shape of letter V with the 'Islands' at the centre of the Game Field is considered 'VICTORY ISLANDS!' and will be the winner. In the case that neither team accomplishes 'VICTORY ISLANDS!', the team that scores more points wins.

2.2.1   Rules and Theme of Manually Robot

The game is played on a square Game Field (14000mm x 14000mm), which is surrounded by a wooden fence (100mm height-30mm thick). The floor of the Game Field is made of 20mm thick ply-wood, and is fully coated with emulsion paint. It consists of a Manual Area and an Automatic Area. Each team must design and construct by itself Manual and Automatic Machines to compete in the contest. For each match, the number of Automatic Machine(s) is no more than three (3) and only one (1) Manual Machine is allowed for each team. Figure 2.2 show that plan game field ROBOCON 2007.

Figure 2.2 : Plan game field ROBOCON 2007

The description for the manual machine are listed below :

a)   Manual Area

The Manual Area surrounds the Automatic Area, and is painted light blue with emulsion paint. There are two (2) Manual Machine Start Zones and Pearl Storages in this area.

b)   Manual Machine Start Zone

Manual Machine Start Zone is in square shape (1000mm x 1000mm) and is located in the Manual Area. There are two Manual Machine Start Zones. They are painted with emulsion paint, red for Red team and green for Green team.

c)   Pearl Storage

Pearl Storage for each team is located at the corner of the Game Field. Before the start of each match, fifteen (15) pearls are arranged available in each storage.

d)   Manual Machine

The Manual Machine has to be operated via remote control using a cable connected to it or remote control using infrared rays, visible rays or sound waves. Controlling using radio waves are also not allowed. Operators are not allowed to ride on their Manual Machine. When operating via cable, the connecting point of the cable to the machine must be at least 1000mm from the ground. However, the length of the cable from the Manual Machine to the control box must not exceed 3000mm. There is a size limit (1000mm L x 1000mm W and 1500mm H) for the Manual Machines at the Manual Machine Start Zones when the game starts. Once the game starts, The Manual Machines size and form may be changed but its height is limited to 2000mm.

Furthermore, Manual Machines are not permitted to separate during the game. Only one (1) member of each team is allowed to control the Manual Machine in the Game Field. Team members are not allowed to touch the Manual Machine once the game has begun. Manual Machines are permitted to operate in the Manual Zone and Outer Zone only. Manual Machines are not permitted to enter or extend over the Inner zone, the opponent's Automatic Machine start zone and opponent's Pearl Storage. Manual Machines are not permitted to touch its own team's Automatic Machines. Manual Machines are not permitted to touch opponent's Automatic Machines in the Automatic Area. Manual Machines are not allowed to prevent the opponent from taking the pearls at opponent's Pearl Storage. Manual Machines are prohibited to move directly / indirectly the opponent's pearls in the Automatic area, except for pearls which have been placed on the islands. When Manual Machines of both teams interfere with each other, the referee will decide the right way to go for each team.