



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

IMPROVEMENT OF LINE FOLLOWING AUTONOMOUS ROBOT

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Manufacturing Process) with Honours.

by

NORHALIS BIN ABDUL GHAFAR

FACULTY OF MANUFACTURING ENGINEERING

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BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: Improvement of Line Following Autonomous Robot

SESI PENGAJIAN: 2008/09 Semester 2

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirement for the degree of Bachelor of Manufacturing Engineering (Manufacturing Robotic and Automation) with Honours. The members of the supervisory committee are as follow:

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ABSTRACT

The title of this project is “Improvement of Line Following Autonomous Robot”. The aim of this project is to improve the previously developed Line Following Autonomous Robot. The development of this autonomous robot is a continuation from a final year student’s project. This project requires programming knowledge in C code in the MPLAB software environment and knowledge in creating circuit layout in Express PCB software. The main elements in this project consist of the analysis of previous robot, components selection, development of suggested improvement and robot performance testing. The improved robot is tested for two factors that are the speed and the robot’s precision to cross intersection’s of 90 degree angle. According both observation, the sensor have capability to track line such as straight line, curve line and intersection’s 90 degreee angle. Besides that, the speed of the robot during tracking was increased for the optimum operation parallel with improved sensor. As conclusion, the objectives of this project is archived and the robot is improved.

ABSTRAK

Tajuk di dalam projek ini adalah “Pembaikan Robot Automatik Mengikut Garisan”. Projek ini adalah kesinambunagn daripada projek yang telah dilakukan pelajar Fakulti Kejuruteraan Pembuatan UTeM sebelum ini. Projek ini memerlukan pengetahuan di dalam bidang memprogram kan robot seperti menggunakan pengaturcaraan kod C dan menggunakan Express PCB dalam alatan membantu mereka bentuk litar elektronik robot. Di dalam projek ini, terdapat tiga perkara yang penting seperti (a) analisis robot lama, (b) mereka bentuk, membuat pilihan terhadap komponen dan membangunkan pembaikan robot, (c) membuat ujian untuk mengenalpasti perubahan peningkatan pembaikan robot. Projek ini lebih ke arah kepada bahagian platform robot. Robot ini akan diuji melalui dua situasi iaitu kelajuan dan kebolehan ketepatan untuk menyeberangi dan melalui selingan garisan. Secara kesimpulannya, objektif projek ini tercapai apabila penambahbaikan robot berjaya dilakukan dan robot berjaya menerusi garsian dengan persis dengan peningkatan kelajuan robot.

DEDICATION

Specially dedicated to my beloved parents,
Abdul Ghafar b Hj Atan and Rabiah bt Hasan

For my supervisor, Pn Syamimi bt Shamsuddin and Co-Supervisor, En Arfauz b Ab

Rahman

(UTeM)

Lastly to my beloved friends who are encouraged, guided and inspired me. Without their patience, understanding, support and most of love, the completion of this work would not have been possible. Special thanks also to all that also contributed to complete this thesis.

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TABLE OF CONTENT

Abstract	i
Abstrak	ii
Dedication	iii
Acknowledgement	iv
Table of Content	v
List of Tables	viii
List of Figures	ix
List Abbreviations	xii
1. INTRODUCTION	1
1.1 Project Background	1
1.2 Problem Statement	3
1.3 Project Aim & Objective	3
1.3.1 Project Aim	3
1.3.1 Objectives	3
1.4 Project Scope & Project Planning	4
1.5 PSM Gant Chart	5
2. LITERATURE REVIEW	7
2.1 Overview of Autonomous Robot	7
2.1.1 Application of Autonomous Mobile Robot	8
2.1.2 Basic Navigation System and Block Diagram Autonomous Mobile Robot	11
2.2 Elements and Components that Involve for Basement/ Platform Autonomous Mobile Robot	13
2.2.1 Sensor	12
2.2.1.1 Numbers of Cell Sensor	13
2.2.1.2 Distance Between of Cell	16
2.2.1.3 Building and Types of the Sensor	18
2.2.1.4 Proportional Control Algorithm	23

2.2.1.5 Navigation of Through Lines and Intersections	24
2.2.2 Controller	25
2.2.2.1 Microcontroller	26
2.2.2.2 Types of Microcontroller	28
2.2.2.3 Language Programming	32
2.2.2.4 Types of Programming Language	33
2.2.2.5 In circuit Aerial Programming (ICSP)	34
2.2.2.6 Battery	35
2.2.3 Actuator	36
2.2.3.1 Types of DC Motor	37
2.2.3.2 Speed Control DC Motor	39
2.2.3.3 Control System DC Motor	41
2.2.4 Locomotion	44
2.2.4.1 Basement/Platform	44
2.2.4.2 Wheel	46
2.2.4.3 Mechanical Tool Design	50
2.2.5 Existing Projects and Research	52
2.2.5.1 Project 1, Line Following Robot by Priyank Patil	52
2.2.5.1 Project 2, Line Following Robot Over 1 Meter Per Second by Steve Hassenplug	53
3. METHODOLOGY	56
3.1 Flow Chart of the Methodology	56
3.2 Title Selection	58
3.3 Methodology of Literature Review	58
3.3.1 Internet	58
3.3.2 Books	59
3.3.3 Journal & Projects	59
3.4 Project Methodology	59
3.5 Analyze the Previous Autonomous Robot	59
3.5.1 Analyze of the Previous Speed of Autonomous Robot	59
3.5.2 Observe and Analyze of the Precision Sensor of Autonomous Robot at Intersection Line	62
3.5.3 Analyze the Previous Physical Autonomous Robot	63

3.6	Design, Material Selection and Develop the Improvement of Autonomous Robot	63
3.6.1	PCB Board Design	64
3.6.2	Develop Sensor Array	66
3.6.3	Develop of Programming of Autonomous Robot	66
3.7	Integrate the Components and Test the Autonomous Robot	71
3.7.1	Performance Speed	71
3.7.2	Performance Precision During Cross Intersection Angle and Curve Line	71
3.8	Troubleshoot the System Error	72
3.9	Observe and Discuss the Result of Project	72
3.10	Presentation	73
4.	DESIGN AND DEVELOPMENT	74
4.1	Analysis of Previous Robot	74
4.1.1	The Components of Previous Robot	74
4.1.1.1	Sensor and Comparator Board	75
4.1.1.2	Controller Board	76
4.1.1.3	Driver Motor	78
4.1.1.4	DC Motor	79
4.1.1.5	Power Supply for the Previous Robot	80
4.1.1.6	Wheel	81
4.1.1.7	Basement Properties	82
4.2.1	The Locomotion of the Previous Robot	84
4.2.2	Sensor Ability for Line Tracking	85
4.2.3	Speed of Travel Previous Robot	87
4.3	Components Selection and Develop the Improvement of Line Following Autonomous Robot	90
4.3.1	Components Selection for Improvement Line following Autonomous Robot	92
4.4	Develop Improvement Algorithm LED & LDR Sensor Array	96
4.5	Integrate All Components	100
4.6	Program Development	102
4.6.1	Program Setup	104

4.6.2	Declaration of Prototype Function, Input and Output Declaration	105
4.6.3	Setup Pin Microcontroller	107
4.6.4	Line Following and Intersection Line	108
5.	TESTING, RESULTS & DISCUSSION	109
5.1	Testing and Result the Improved of Line Following Autonomous Robot	109
5.1.1	Testing At Straight Line	110
5.1.2	Testing At Curve Line	112
5.1.3	Testing At Intersection Line	113
5.1.4	Travel Speed of Improved Line Following Autonomous Robot	115
5.2	Trouble Shooting	116
6.	CONCLUSION AND SUGGESTION FOR FUTURE WORKS	118
6.1	Conclusion	118
6.2	Future Works	119

REFERENCES

APPENDIX

- A Complete C Program Line Following Autonomous Robot

LIST OF TABLES

1.1	Gant Chart PSM 1	5
1.2	Gant Chart PSM 2	6
2.1	Basic Sensor Circuit, LDR & LED Cell and IR Cell	18
2.2	Types of microcontroller manufacture by Microchip28	29
2.3	Types batteries and its configurations	35
2.4	Types of DC motor that common in robotic use	42
2.5	Limitation and advantages of line following robot's Patil	53
2.6	Limitation and advantage Jet following line robot's Steve	55
4.1	Sensor components of previous line following autonomous robot	75
4.2	Specification of geared DC motor	80
4.3	Data analysis of time and distance of observation previous autonomous Robot	90
4.4	Replace and Preserved components	91
4.5	Components selection improve line following autonomous robot	92
4.6	Components list comparator circuit	99
4.7	Components list sensor circuit	100
4.8	Components/device selection of robot	102
5.1	Data analysis of time and distance of observation improved autonomous robot	116

LIST OF FIGURES

2.1	Example of an autonomous mobile robot climbing the stairs	7
2.2	Types of robot that use in indoor	8
2.3	Types of robot that use in outdoor	9
2.4	The flow chart the relationship of control scheme autonomous mobile robot	11
2.5a	Three main elements basement of autonomous mobile robot	12
2.5b	Feedback control system basement of autonomous robot	13
2.6	Basic principle of line tracking sensor	14
2.7	Situation of robot during following the track line	17
2.8	One cell implementation IR-LEDs sensor	18
2.9	One cell implementation LDR and LED sensor	18
2.10	IR sensor	19
2.11	IR sensor work principle	20
2.12	LED & LDR sensor with 8 cells	21
2.13	Phototransistor	21
2.14	Schematic of phototransistor works	21
2.15	Full dimension of phototransistor	22
2.16	Robot crosses at intersection from any angle	24
2.17	Example of Microcontroller	26
2.18	The flow of connection of ICSP and PC	34
2.19	ICSP Devise	34
2.20	Example zinc AAA batteries	35
2.21	Example alkaline AAA batteries	35
2.22	Example battery of laptop using the nickel metal hydride	36
2.23	Sony lithium battery	36
2.24	Example, 12 volt 26 A lead acid battery	36
2.25	Connection from microcontroller to the actuator	37
2.26	Example brushless DC motor	38
2.27	Different size of stepper motor	38
2.28	Example geared DC motor	38

2.29	Example DC servo motor	39
2.30	Connection speed control to the DC motor	39
2.31	Conceptual working of a H-Bridge	40
2.32	Example H-Bridge circuit	41
2.33	Example H-Bridge circuit	41
2.34a	Open loop control speed system	42
2.34b	Close loop control speed system	42
2.35a	Shaft or disk encoder	43
2.35b	Disk encoder that attached at motor	43
2.36	The sensor is attached at the top of disc encoder to give the feedback of the system	43
2.37	Plywood	45
2.38	Extrude aluminums	46
2.39	Cross platform	46
2.40	Ball caster	47
2.41	Narrow wheel	47
2.42	Sport wheel	48
2.43	Nylon wheel	48
2.44	OMNI wheel	49
2.45	Transwheel	49
2.46	Interface of SolidWorks	50
2.47	Interface of AutoCAD	51
2.48	Interface of Inventor	52
2.49	Block diagram line following robot	52
2.50	Sensor array	53
2.51	Locomotion of jet line following robot	54
2.52	Sensor array jet following robot	54
3.1	Flow chart methodology of PSM	57
3.2a	Internet Explorer	58
3.2b	Mozilla Firefox	58
3.2c	Yahoo	58
3.2d	Google	58
3.3	Rotary motion sensor	60

2.29	Example DC servo motor	39
2.30	Connection speed control to the DC motor	39
2.31	Conceptual working of a H-Bridge	40
2.32	Example H-Bridge circuit	41
2.33	Example H-Bridge circuit	41
2.34a	Open loop control speed system	42
2.34b	Close loop control speed system	42
2.35a	Shaft or disk encoder	43
2.35b	Disk encoder that attached at motor	43
2.36	The sensor is attached at the top of disc encoder to give the feedback of the system	43
2.37	Plywood	45
2.38	Extrude aluminums	46
2.39	Cross platform	46
2.40	Ball caster	47
2.41	Narrow wheel	47
2.42	Sport wheel	48
2.43	Nylon wheel	48
2.44	OMNI wheel	49
2.45	Transwheel	49
2.46	Interface of SolidWorks	50
2.47	Interface of AutoCAD	51
2.48	Interface of Inventor	52
2.49	Block diagram line following robot	52
2.50	Sensor array	53
2.51	Locomotion of jet line following robot	54
2.52	Sensor array jet following robot	54
3.1	Flow chart methodology of PSM	57
3.2a	Internet Explorer	58
3.2b	Mozilla Firefox	58
3.2c	Yahoo	58
3.2d	Google	58
3.3	Rotary motion sensor	60

3.4	Example the graph show the result of speed of rotary motion	60
3.5	Icon Logger Pro 3.6.0	61
3.6	Data collection	61
3.7	Icon data collection	62
3.8a	Intersection line	62
3.8b	Curve line	62
3.9	Logo Express PCB software	64
3.10	Express PCB software icon	64
3.11	Express PCB software interface	65
3.12	Component manager Express PCB	65
3.13	Component list and diagram Express PCB	66
3.14	Logo MPLAB	67
3.15	MPLAB	67
3.16	New project	67
3.17	Choose PIC device	68
3.18	Select a language toolsuite	69
3.19	Project name	69
3.20	Existing files	70
3.21	Workspace	70
3.22a	Intersection angle	71
3.22b	Curve line	71
3.22c	Three different colors cross by tracking the white line	71
4.1a	Top view of the sensor	76
4.1b	Bottom view of the sensor	76
4.2a	Overall view of microcontroller	77
4.2b	Microchip PIC 16F877A IC	77
4.3	Schematic diagram Microchip PIC16F877A	78
4.4	MD10A driver motor	79
4.5	Geared DC motor	80
4.6	Two unit batteries	81
4.7	Lead acid battery	81
4.8	Wheel	82
4.9	Drive train mechanism of previous robot	83

4.10	Acrylic material for the basement of previous robot	83
4.11a	Isometric view	84
4.11b	Plan view locomotion previous autonomous robot	85
4.12a	Straight line	86
4.12b	Curve line	86
4.12c	Intersection line	86
4.13a	During testing previous robot for straight line	87
4.13b	During testing previous robot for curve line	87
4.13c	During testing previous robot for intersection line	87
4.14	Distance white line	89
4.15	Stop watch	89
4.16	Measuring tape	89
4.17	Acrylic base	93
4.18	Wheel	93
4.19	Ball caster	93
4.20	Controller Board	94
4.21	MD10A driver motor	94
4.22	MD308A driver motor	95
4.23	45 RPM DC motor	95
4.24	225 RPM DC motor	95
4.25	LED & LDR sensor	96
4.26a	Center of the sensor is split	96
4.26b	Sensor is mounting with combination pair of sensor	96
4.26c	Sensor is located nearly each cell	97
4.27	Schematic LM 324N comparator	98
4.28	Schematic LM 324N comparator and its connection by using PCB Express software	98
4.29	Complete connection circuit LM 324N	99
4.30	Complete design connection circuit LM 324N	100
4.31	Complete circuit with 6 cells LED & LDR sensor	101
4.32	Complete set line following autonomous robot	102
4.33	Flowchart symbol	103
4.34	Program flowchart	104
4.35	Interface of programming with C language	105

4.36	33 I/O ports of PIC 16F877A	106
4.37	Connection driver motor to the microcontroller	107
4.38	Value pin setup	108
4.39	Line following and intersection line program	109
5.1	Straight line	111
5.2	Robot at the start up line	111
5.3	Indicator LED show the position of robot	112
5.4	Setting the robot at the curve line	113
5.5	Indicator LED at the curve line	113
5.6	Intersection line	114
5.7	Robot make a turn 90 degree for intersection line	115
5.8	Indicator LED for intersection line	115

LIST OF ABBREVIATIONS

PSM	-	Projek Sarjana Muda
FKP	-	Fakulti Kejuruteraan Pembuatan
ROBOCON	-	Robot Competition
FMS	-	Flexible Manufacturing System
IR	-	Infra Red
LDR	-	Light Dependent Resistor
LED	-	Light Emitting Diode
D	-	Diode
R	-	Resistance
DC	-	Direct Current
MCU	-	Micro Controller Unit
IC	-	Integrated Circuit
PLC	-	Programmable Logic Circuit
VLSI	-	Very Large Scale Integrated
RAM	-	Random Access Memory
ROM	-	Read Only Memory
PWM	-	Pulse Width Modulation
ADC	-	Analog - to - Digital Converter
CPU	-	Central Processing Unit
DAC	-	Digital - to - Analog Converter
I/O	-	Input/Output
UART	-	Universal Asynchronous Receiver/Transmitter
PIC	-	Programmable Internal Circuit
AC	-	Alternating Current
RPM	-	Revolution Per Minute
CW	-	Clock Wise
CCW	-	Counter Clock Wise

CHAPTER 1

INTRODUCTION

Chapter 1 is the first part on this report. This chapter explains about the background problem statement, objectives and also the scope of this project.

1.1 Project Background

Manufacturing can be defined as the application of physical and chemical process to alter the geometry, properties, or appearance of a given starting material to make parts or products. To apply the manufacturing study in Bachelor Program of Manufacturing Automation and Robotics, Universiti Teknikal Malaysia Melaka, the world of robotics is generally widely learn and utilize according to the course of the program. As the single word of robot, the robots can be found in the manufacturing industry, the military, space exploration, transportation, and medical applications. The worlds of robots are widely used in the application of human life. The Merriam-Webster Online Dictionary state that and gives the following definitions of the word robot:

- (a) A machine that looks like a human being and performs various complex acts (as walking or talking) of a human being; also a similar but fictional machine whose lack of capacity for human emotions is often emphasized; and also an efficient insensitive person who functions automatically.
- (b) A devise that automatically performs complicated often repetitive task.
- (c) A mechanism guided by automatic controls.

In today's world, the first two definitions will probably be considered archaic (the third interpretation in the first definition notwithstanding). It was generally the case that robots were initially conceived as human-like entities, real or fictional, devoid of emotions, that performed tasks that were repetitive or full of drudgery. Today's robots come in all kinds of shapes and sizes and take on all kinds of tasks. Robots today are capable of doing a lot more than implied by the first two definitions above

The third definition is more abstract and perhaps more appropriate. A robot is a mechanism, an artificial entity that can be guided by automatic controls. The last part of the definition, guided by automatic controls, and considered focusing on in this course.

According to Lewis L *et al* (2004), the history of the word 'robot' was introduced by the Czech playwright Karel Capek in his 1920 play Rossum's Universal Robots. The word 'robota' in Czech means simply 'work'. Although the word robot has many different definitions as seen in different dictionaries and encyclopedias. The following definition from the Robot Institute of America may reflect main features of modern robot system, "A robot is a re-programmable multifunction manipulator designed to move material, arts, tools, or specialized device through variables programmed motions for performance of a variety of tasks". (Zhihong, 2002)

A new robot type, third generation robot are autonomous robot system that can perform their task in unknown environment. World or robotics today has moved from the structure factory floors to the unpredictable human environment. There fore, traditional manipulator controlled robots are being replaced by the emerging autonomous intelligent mobile robots. The word autonomous actually is having autonomy, no subject to control from outside or independent. The autonomous robot refers to the agents capable of executing the specified task without human intervention by adjusting their behavior based on the real environment.

To become more intelligent in robot navigation system, an autonomous robot should be able to sense its surroundings and respond to a changing environment promptly and properly. One of the types of autonomous robot is the line following autonomous robot. In this project, there is focuses on the design and development for improvement the previous Projek Sarjana Muda (PSM) project of line following

autonomous robot which was also made for Robot Competition (ROBOCON) in the year 2008.

1.2 Problem Statement

The line following autonomous robot is the one of the types of autonomous mobile robot. One of them was build by previous Fakulti Kejuruteraan Pembuatan (FKP) student. However, there is still weakness to develop it. The major issues are the navigation system. The navigation system of the previous robot was unable to precisely tracking any angle intersection of line mapping. In this project, the navigation system of line following autonomous robot will be improved where it can track any angle intersection of line mapping smoothly. Besides that, the previous robot does not move fast enough. Perhaps the speed of autonomous robot need to be improved to acquire high speed motion.

1.3 Project Aim & Objective

The aim of this project is to improve the previous develop of Line Following Autonomous Robot.

There are three main objectives to achieve the project aim:

- (a) To analyze and suggest improvements for the previous autonomous robot.
- (b) To design and develop a highly efficient, precise and high speed line following autonomous robot.
- (c) To test and analyze of the performance of line following autonomous robot after improvement.