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

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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:

(Signature of Principle Supervisor)

.....

(Official Stamp of Principal Supervisor)

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(Signature of Co-Supervisor)

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(Official Stamp of Co-Supervisor)

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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I would like to thank my supervisor Pn Syamimi bt Shamsuddin and En Arfauz b Ab Rahman for they guidance throughout the execution of this project. I would also like to thank my beloved parents who has giving me support and motivation throughout my project. Last but not least, many thanks to my colleagues at Universiti Teknikal Malaysia Melaka (UTeM) and Faculty Manufacturing Engineering (FKP).

Finally, I also express my deep gratitude to those who directly or indirectly helping me in completing this PSM documentation.

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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 or 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 sees 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.