UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN AND DEVELOPMENT OF AUTONOMOUS ROBOT USING DIGITAL FIBER OPTIC SENSOR

This report in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Robotic and Automation) with Honour.

By

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FACULTY OF MANUFACTURING ENGINEERING

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APPROVAL

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ABSTRACT

Autonomous robot is a robot which can perform its desired tasks without continuous human guidance. The main purpose of this project is to design and develop an autonomous robot using color sensor for the ROBOCON 2010 competition. These robots were programmed to move along a white against a green background. The aim is to produce an efficient, precise and high speed robot platform to carry out the competition task within an optimum timeframe. The literature review cover all major element of the robot including the hardware and software used. Two designs are proposed. Using Pugh method, the best design will be chosen to be fabricated. After reviewing the design to be built, construction began of forming a robot base, followed by building and eventually the adoption is divided handle. After completion of the mechanical, the process continues to process the electrical and wire connections. Finally, after completion of the mechanical and electrical part, programming will take to fix and instructed the robot to move according to the strategy is to complete the task given in the competition ROBOCON 2010.

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ABSTRAK

Robot berautonomi adalah sebuah robot yang boleh melakukan tugas tanpa bimbingan daripada manusia. Tujuan utama projek ini adalah untuk merekacipta dan membina robot berautonomi dengan mengunakan penderia bewarna untuk pertandingan ROBOCON 2010. Robot ini diprogramkan supaya bergerak mengikuti garisan putih yang berlatarkan warna hijau. Sasaran utama adalah untuk menghasilkan yang cekap, tepat dan kelajuan robot yang pantas untuk melaksanakan tugas dalam jangka masa yang paling minimum. Kajian ilmiah ini meliputi komponen utama didalam robot termasuk perkakas dan perisian komputer yang digunakan dalam. Terdapat dua rekebentuk telah dibina. Dengan mengunakan kaedah Pugh, rekabentuk yang terbaik diantaranya akan dipilih untuk dibina.. Setelah selesai bahagian mekanikal,proses diteruskan ke bahagian elektrik dan proses sambungan wayar. Ini kerana setiap pemasangan yang salah boleh membawa banahay pada litar- litar yang telah siap di bina. akhir sekali, setelah siap bahagian mekanikal dan elektrikal, sistem pengaturcaraan akan mengambil alih untuk menetapkan dan memberi arahan kepada robot untuk bergerak berpandukan strategi yang dibuat untuk menyelesaikan tugas yang diberi didalam pertandigan ROBOCON 2010 .

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DEDICATION

Specially dedicated to my beloved father Yusuf Bin Shafeei and my mom Che Siah Binti Man who are very concern, understanding, patient, and supporting. Thanks for everything to my supervisor Puan Syamimi Binti Shamsudin for his constructive guidance, encouragement and patient in fulfilling our aspiration in completing this project, to my sister, my younger brother and all my friends. I also would like to say thanks for our team management En.Shariman. The work and success will never be achieved without all of you.

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LIST OF ABBREVIATION, SYMBOLS, SPECIALIZED NOMENCLATURES

LDR	-	Light Dependent Resistor
ROS	-	Robot Operating System
AC	-	Alternating Current
DC	-	Direct Current
IR	-	Infrared
NDIR	-	Non Dispersive Infrared
CPU	-	Central Processing Unit
RAM	-	Random Access Memory
I/O	-	Input/Output
RF	-	Radio Frequency
SOC	-	State Of Charge
MDOF	-	Multi degree of freedom
CAD	-	Computer Aided Design

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CHAPTER 1
INTRODUCTION

Today, robot is widely used in industrial manufacturing. It is usually an electro-mechanical system which, by its appearance or movements, conveys a sense that it has agency of its own.

1.1 Background

The word of robot can refer to both physical robots and software, but the latter are usually refer to as bots. There is no agree on which machines qualify as robots, but there is general agreement among experts and the public that robots toward to do some or all of the following move around, operate a mechanical limb, sensor and manipulate it environment, and exhibit intelligent behavior, especially behavior which like humans or other animals.

Basically, while most robots today are installing in factories or homes to perform as a labor or change our life work, there are many new types of robot are being developed in industrial in the world. It will must much of the research in robotics focuses not on specific industrial tasks, but on investigations into new types of robot, alternative ways to think about or design robots, and new ways to manufacture them. It is expected that these new types of robot will be able to solve real world problems when they are finally realized.

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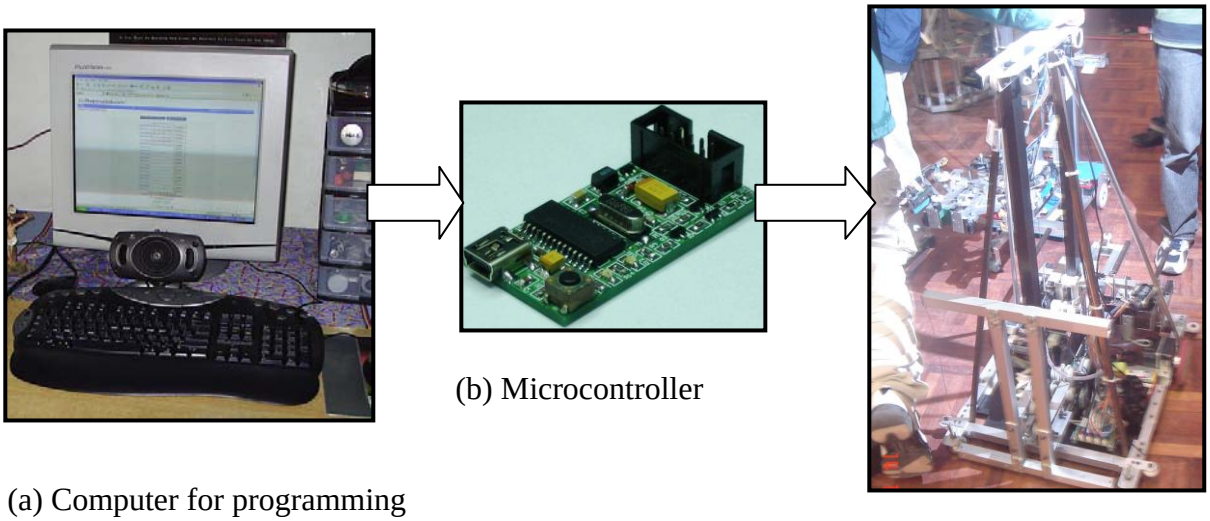
Autonomous robots are robots which can perform by following tasks and complete it without human control and workforce. Autonomous robot many advantages more than manual robot and it ability to get information about the environment and things, and it can work extended period without human, it also can avoid situations that are harmful to people, property, or itself and work danger situation that human cannot be perform and complete it more fast than human.



(a) Computer for programming

(b) Microcontroller

(c) Autonomous Robot

Figure 1.1: Basic Idea of the Project.

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1.2 Problem Statement

The idea to design and develop comes from when task was given in ROBOCON 2010. One must have strong basic in three main aspects of engineering like mechanical, electrical and electronics, and programming in order to complete this project. The autonomous robot use LDR sensor and it need to adapt to low contrast situation and it will to pick up the reflect light but slower to respond. That problem can be solved by using digital fiber optic sensor for autonomous robot to produce an efficient, precise and high speed robot platform to carry out the competition tasks within an optimum timeframe.

1.3 Project Aim and Objectives

The aim of this project is to produce an efficient, precise and high speed an autonomous robot platform to carry out the competition tasks within an optimum timeframe. In order to verify the aim and project as a success, these three objectives must be achieved:-

a) To design and develop mechanical structure of an autonomous robot and that will utilize fiber optic sensor to carry out its line following task.
b) To develop electrical, electronic circuit and programming using PIC microcontroller.
c) To design and develop interface between circuit and mechanical system for the robot to perform its specified tasks for ROBOCON 2010.

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1.4 Scope

Project scopes are important in order to help in the development and the progress of the project. This project will focus on the design and develop of an autonomous robot using color sensor and PIC microcontroller in order to perform its specified task. Not only those, scopes also help in deciding the path and secure the flow of the project.

This project will focus on design and development an autonomous robot using color sensor to perform its specific tasks. To design and develop mechanical structure it has to select the superior material to make a light and secure robot. Then, the robot is in motion by programming to develop electronic circuit using microcontroller and it also focus on interfacing between mechanical system and electronic circuit.

1.5 Robot Technology

While most robots today are installed in factories or homes, performing labor or life saving jobs, many new types of robot are being developed in laboratories around the world. Much of the research in robotics focuses not on specific industrial tasks, but on investigations into new types of robot, alternative ways to think about or design robots, and new ways to manufacture them

1.5.1 Definition of Robot

Robots have much definition. The Robot Institute of America (1979) uses the following as a widely accept industry standard. " A robot is a re programmable, multifunction manipulator design to move material, part, or focus devices through variable program motions for performance of a variety of task"(Groover 2001).

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The definition is very limiting in that includes neither mobile robot type of science fiction character that would call an android. Perhaps a comprehensive definition would be McKerrow's (1986) and robotics is the discipline that involves:-

a. The design, manufacture, control and programming of robots.
b. To use of robot to solve problems.
c. The study of the control processes, sensor, and algorithms used in humans, animals, and machine.
d. The application of these control processes and algorithms to the design of robots.

1.5.2 History of robot

The word 'Robot' entered the English language through a Czechoslovakian play title Rossum's Universal Robot, written by Karel Capek in the early 1920s. The Czech word" Robota" means forced worker. In the English translation, the word was converting to "Robot". The story line of the play centered on a scientist name Rossum who invent a chemical material similar and used it to produce robots. The scientist goal is for robots to serve humans and perform physical labor. Rossum continues to make improvement in his invention, ultimately perfecting it. These perfect beings begin to resent their passive role in society and turn against their masters (Groover 2001).

Rossum invention was pure science at least in the 1920, however, advances in the modern field of biotechnology may ultimately be capable producing such robotic beings. The short history of robotic must also include mention of two real inventors who made original contribution to the technology of industrial robotics. The first was Cyrill W. kenward a british inventor who devices a manipulator that move on an x-y-z axiz system. 1954, kenward applied for british patent for his robot device and patent was issued in 1957 (Groover 2001).

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