UNIVERSITI TEKNIKAL MALAYSIA MELAKA

HIGH SPEED LINE FOLLOWING ROBOT

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

By

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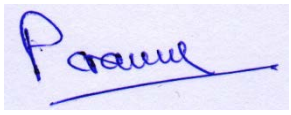

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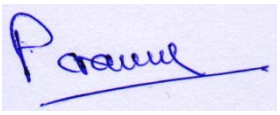
Signature : 

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Manufacturing Engineering (Robotic & Automation) with Honours. The member of the supervisory committee is as follow:

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ABSTRACT

A line following robot is part of the Automated Guided vehicle which is widely used in the industry. However most robot available today is slower than what the user wants. This project wills concentre on build high speed line following robot. The construction of the robot will be divided into three categories which are mechanical, electrical and electronic and finally programming. The robot structure will be construction properly so that it really strong and rigid to withstand the force of operation. For electrical and electronic components only best and affordable components will be use on this robot to achieve best performance. Finally the programming will do so that no matter what kind condition the robot is, it still can function properly and achieve the goal.

ABSTRAK

Robot mengikut garisan adalah tergolong dalam kategories kenderaan panduan automatik di mana ia digunakan meluas di industri. Namun robot yang terdapat dipasar kini adalah berkelajuan rendah berbanding dengan permintaan industri. Projek ini akan memfokus dalam menghasilkan robot mengikut garisan berkelajuan tinggi. Pembinaan robot ini terbahagi kepada tiga bahagian iaitu struktur mekanikal, eletrik dan elektronik dan akhir sekali pengatucaraan. Struktur robot ini akan dibina dengan kemas dan rapi supaya ia mampu beroperasi dalam keadaan teguh dan mampu menyerap daya ketika beroperasi. Untuk bahagian elektrik dan elektronik, robot ini akan menggunakan komponen yang murah dan terbaik supaya robot dapat beroperasi dengan jayanya. Akhir sekali, pengatucaraan robot ini akan dilakukan dengan baik sehingga robot ini mampu beroperasi walau apa jua keadaan yang dihadapi dan mencapai objectif.

DEDICATION

To my beloved parents

Abdul Rahman Subramaniam b. Abdullah

Asiah bt. Sawal

And my supported siblings

Parimala Devi bt. Abdul Rahman Subramaniam

Ashwani bt. Abdul Rahman Subramaniam

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LIST OF ABBREVIATIONS

PIC	-	Programmable Integrated Controller
BJT	-	Bipolar Junction Transistor
CPU	-	Centre Processing Unit
IC	-	Integrated Circuit
ISO	-	International Standard Organization
KUKA	-	Keller Und Knappich Hugsburg
ABS	-	Acrylonitrile Butadiene Styrene
PS	-	Polystyrene
PVC	-	Polyvinyl Chloride
IUPAC	-	International Union of Pure and Applied Chemistry
AC	-	Alternative Current
DC	-	Direct Current
ESC	-	Electronic Speed Controller
BLDC	-	Brushless DC Motor
PLC	-	Programmable Logic Controller
I/O	-	Input / Output
MCU	-	Microcontroller
RAM	-	Random Access Memory
PC	-	Personal Computer
PSU	-	Power Supply Unit
NiCd	-	Nickel Cadmium
NiMH	-	Nickel-Metal Hydrate
NiOOH	-	Nickel Ox Hydroxide
C	-	Capacitive
Li-ion	-	Lithium Ion
LED	-	Light Emitting Diode
LDR	-	Light Dependent Resistor
SRS	-	Seattle Robotics Society
PWM	-	Pulse Width Modulated
PID	-	Proportional/Integral/Defence
ADC	-	Analogue to Digital Converter

PCB	-	Polychlorinated Biphenyls
PSM	-	Projek Sarjana Muda
FKP	-	Fakulti Kejuruteraan Pembuatan

CHAPTER 1
INTRODUCTION

1.1 Background

In today's modern world, more and more robot has been developed. Regardless of its purposes robot has become more popular in these past new years than it was before. Robot can be defined as a machine that resembles a human and does mechanical, routine tasks on command.

The purpose of this project was to apply principles of robotics to a real-world application. When developing a mobile robot, it becomes apparent just how complex it is to navigate freely and dynamically in space. With each new sensors or manipulator, the human body which is the ultimate mobile robot has and incredible number of sensor. To simplify this problem the designer can limit the robot to a predefined environment, such as our white paper with a black line. For some tasks this may be perfectly fine, such as a child's toy robot or perhaps a coal bucket in a mining facility or the famous automatic lawn mover except that uses a wire instead of a black line.

By developing the sensors, hardware and software from scratch, the project enabled us to get a deeper understanding of what is required in the design of a mobile robot. The logic was performed using a PIC micro-controller, and motor was control was performed with power BJT's. All the wiring was done using wire wrap. What the logic works down to is if the left sensor sees white, the car turns left; and if the right sensor sees white, it turns right. The system can be compared to a monorail, except the rail is a white line.

1.2 Problem Statement

Line following robot used to help reduce cost of manufacturing and increase efficiency in a manufacturing system. However some line following robot not suite to be used in mass product factory, because the robot move so slow that even the human operator can transfer thing faster than the robot itself. This will result inefficient work.

Some of the line following robot are not suitable to move faster because the centre of gravity of the robot is too high. When the robot tries to move faster, it will cause the robot to trip over. When the robot move faster, sometime the robot fill just keep on going out of the line. This happen because the distance between the sensor and the floor not suitable. The sensors need to be close to the floor so that the sensor than work properly.

Another critical factor that affects the efficient of the robot is the distance between the sensors cells itself. The distance between sensors cells need to be perfect. If possible there should be at least 2 sensors cells that detect the line all the time, even though the robot is at the tight corner.

With this project of high speed line following robot, all problem stated above can be reduced or eliminated. With this robot the move of the product in the production line will be much faster and safe. At the same time it can reduce labour cost, because the robot is fully automatically operated.

1.3 Objectives

The main objective of this project is to develop a high speed line following robot which can follow the line at a high speed to reach it predetermined destination. Additional objective of this projects are:-

- To develop a robot with lower centre of gravity.
- Design the position of the sensor cell.
- Develop a circuit with faster respond time.
- Built the robot from lighter and stronger material.

1.4 Scope

In order to develop a working robot that can follow line to a predetermine place, scope are required to assist and guide the development of the project. The scope should be identified and planned to achieve the objective of the project successfully on the time. The scopes for this project are:-

- To design and develop motor driver circuit that has low electrical noise level.
- To design and fabricate a solid base structure of the robot.
- To design and develop sensor arrangement which can be operated at high speed movement.

1.5 Benefits of the Project

This high speed line following robot are being developed in order to assist the movement of the product from one station to another station in a huge factory that usually done by human. The benefits of this project are:-

- Eliminating the human power to move the products around the factory.
- Preventing fatics to the operator.
- Decreasing product handling time.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction to robot

When we hear the word “robot”, we probably get a picture in our mind of a cleaver mechanical man, perhaps R2D2 or C3PO from the movie Start Wars. That is how most people think of robots, but the robots that really exist today are quite different from the robots of comic books, cartoons and science fiction films and books. Most are simply huge metal arms controlled by a computer. Others are large boxes that move along a track, perhaps carrying parts through a factory. Some are submarines that dive beneath the ocean to work on undersea pipelines or oil rigs or to search for old shipwrecks.

Robots come in many shape and sizes and have many different abilities. Basically, a robot is simply a computer with some sort of mechanical body designed to do a particular job. Usually, it is able to move and has one or more electronic senses. These senses are not nearly as powerful as our own senses of sight and hearing. However, scientists and engineers are working hard to improve robots. They are constantly coming up with ways to make them see, hear and respond to the environment around them.

Robotics is the science of studying and creating robots. It is a very broad and interesting science because like human, robots have many fascinating aspects. It is also a new science. Although people have been imagining and writing stories about robots for many years, robotics has been a real science only since the 1970’s. (Ming Xie, 2003).

Why do we need robots? First, they are hardworking and reliable. They can do dangerous work or work that is very boring or tiring for human. They can work around the clock without complaining and without needing rest, food and vacations.

And robots can go places that human can not, such as the surface of the Mars, deep under the ocean or inside the radioactive part of a nuclear power plant.

First, a robot must have a body of some kind. Science fiction robots are made to look human, but the appearance of the real robots today are like giant arms bolted to the floor. The robot itself stay in one place while the arms moves to perform a task, such as painting an automobile door or picking up parts moving by on a conveyor belt. Other robots, called mobile robots, move about. For example, robot arts carry materials inside a factory or delivery mail in an office building.

Like the scarecrow in the Wizard of Oz, a robot also needs a brain. This is really what sets a robot apart from all other machines used by people. A robot's brain is a computer and it controls everything the robot does.

As we may know if we have used computers, they are good at computing; that is, doing rote tasks like adding a column of numbers or processing words. However, they can't really think as a human does. For a robot to be really useful, it must have some sort of intelligent. The intelligent is contained in the program, the set of instructions that it follows. Most robots today are not very intelligent, but researchers are constantly working to make computers and therefore robots, smarter. An exciting new science has grown up in recent years around the idea of creating machines that can mimic human intelligent. This science is called artificial intelligent, or AI for short. (Stadler, W. 1995).

Just as human have sense organs such as eyes and ears, robots need sensors. A robot might have electronic eyes to find it way around and see what it is doing; electronic ears to hear commands and noises, safety touch sensors to stop it if it accidentally bumps into anything. These are some of the many types of sensors used by robots.

A robot might also need a voice to speak to its owner. Speech synthesizer chips can be programmed and controlled by a computer to speak in a voice that almost human.

Many robots need some type of hand, usually called a manipulator or gripper, to do their jobs. Sometimes different tools, such as a screwdriver or a drill, are attached directly to the robot's wrist. Other types of gripper use magnets and vacuums to pick up hold different objects.

The computer is perhaps the most important part of a robot, since it is the computer's "brain" that makes a robot different from other machine. Over the last several years, computers has become smaller and smaller. This is what has made possible the many recent advances in robotics, since robots can now carry their brains around with

them. This was not possible when computers were the size of a large room only about 25 years ago. Computers can seem like very complicated machines, but they are actually based on simple ideas.

All computers today have the same basic part or hardware. The main part, where most of the actual computing is done, is the central processing unit (CPU). It carries out the instructions of the computer program, or software and directs actions of all the other component of the computer. The CPU is made up of one or more plastic board holding lots of electrical connectors and sockets. Cables are attached to the connectors from other parts of the computer. Integrated circuit, or IC's, are plugged into the sockets. The IC's are tiny chips, so small they could fit on the tip made mostly of silicon (a common element found in sand and rocks) and contains thousands of small switches.

A second important part of computers is the memory. This is where the CPU stores the data that it needs or the answers to the problems it works on. Memory is also a small chip, usually made of silicon within a plastic covering. Computer memory is different from human memory in two main ways. A computer's memory can hold a definite limited amount of information and no more. To add new data means that come of the old data must be erased. Secondly, a computer's memory doesn't forget over time and only forgets when told to do so. Some types of memory, however, lose the information they are processing when the power is turned off.

A computer needs a way to move information in and out of its brain. One familiar input device is the keyboard. It is used by human to type information into the computer. Joysticks and paddles other inputs device.

An output device is where the computer sends information out to the user or asks questions about what it should do next. It can be the computer's monitor (screen), a printer or a storage device like a disk drive.

The basic parts of a computer are the central processing unit (CPU), memory, a keyboard or other input device and a screen or other output device. Sounds simple, doesn't it? But how does the computer know how to add and subtract, and how can its memory remember the answers it computes? We know that the computer doesn't have a real brain inside. It fact, it is made up mostly of plastic, metal and silicon. Yet, a computer acts in many ways as though it does have a real brain.

To find the answer, we must take a close look at how we understand numbers. We have ten digits in our number system: 0,1,2,3,4,5,6,7,8,9. Digit is a fancy word for a