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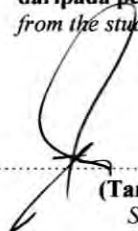
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**MOBILE ROBOT SIMULATION AND CONTROLLER DESIGN WITH
MATLAB/SIMULINK**

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**MOBILE ROBOT SIMULATION AND CONTROLLER DESIGN WITH
MATLAB/SIMULINK**

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**THIS REPORT IS SUBMITTED IN PARTIAL FULFILLMENT OF
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“I hereby declare that this thesis entitled
Mobile Robot Simulation and Controller Design with MATLAB/SIMULINK
is the result of my own research and idea except for works
that I have been clearly cited in the references.”

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To the greatest 'success recorder' in my life with love...

Father and Mother

**HAJI AEZMAN @ AZMAN BIN HAJI DAHLAN
HAJJAH HAM BTE. HAJI HASHIM**

Little Sisters

**AZNEEZA HAIRANY BTE. HAJI AEZMAN @ AZMAN
ZURAINI IZZATI BTE. HAJI AEZMAN @ AZMAN
NUR ASILAH BTE. HAJI AEZMAN @ AZMAN**

And last but never the least, all my friends.

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ABSTRACT

Robotic is a special engineering science dealing with designing, modeling, controlling and robots' utilization. Nowadays, robots accompany people in everyday life and take over their daily routine procedures. The range of robots' utilization is very wide, from toys through office and industrial robots finally to very sophisticated ones needed for space exploration. Besides it can show us on how the mobile robot works in simulation. The simulation of such mobile robots can give valuable insight to the variable behavior involved in its motion. This project will demonstrate the simulation of mobile robot motion in MATLAB/SIMULINK environment. This work consists in creating a SIMULINK mobile robot model as described in robot specification and evaluating the performance of the designed control system by simulations. The aim of this project is to build more flexible control strategy of a mobile robot model by means of PC computer. The SIMULINK®, included in the MATLAB® package will be used to accomplish and present various options of the mobile robot's model control strategies with the use of. The simulation results can be used to analyze and select components and parameters to achieve desired results and also can save costs and times before proceed into the real robot.

ABSTRAK

Robotik merupakan keistimewaan di dalam bidang sains kejuruteraan, yang mana ia melibatkan rekabentuk, model, sistem kontrol dan kegunaan robot. Pada masa sekarang, robot sebagai peneman manusia pada setiap masa dan mengambil alih setiap rutin seharian manusia. Penggunaan robot pada masa kini sangat meluas, daripada permainan ke pejabat dan robot industri, akhir sekali terdapat yang lebih canggih iaitu ia digunakan untuk penerokaan di angkasa lepas. Penggunaan simulasi di dalam robot mobil akan memberi kesan kepada pergerakan yang lebih baik. Projek ini akan menunjukkan simulasi robot mobil di dalam program MATLAB/SIMULINK. Ini termasuklah dalam merekabentuk model robot mobil di dalam program Simulink yang mana ia mengambil spesifikasi robot dan kebolehan dalam merekabentuk sistem pengawal dengan penggunaan simulasi. Tujuan utama projek ini dibina adalah untuk melihat strategi kawalan yang fleksibel melalui penggunaan komputer bagi model robot mobil. SIMULINK termasuk di dalam pakej MATLAB yang mana ia digunakan untuk menyelesaikan dan menunjukkan penggunaan strategi kawalan di dalam model robot mobil. Keputusan simulasi digunakan untuk menganalisa dan komponen yang dipilih serta parameter untuk mencapai keseluruhan keputusan dan juga pengguna simulasi dapat menjimatkan wang dan masa sebelum robot mobil dilaksanakan kepada keadaan sebenar.

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ABBREVIATIONS

MATLAB	MATrix LABoratory
VB	Visual Basic
LLWIN	Lucky Logic for Windows
RTW	Real Time Workshop
ECROBOT	Embedded Coder Robot
RCX	Robot Command System
GUI	Graphical User Interface
API	Application Program Interface
DC	Direct Current
PID	Proportional Integral Derivative
PD	Proportional Derivative
P	Proportional

CHAPTER I

CHAPTER I

INTRODUCTION TO THE PROJECT

1.1 Introduction

Robotics is a special engineering science dealing with designing, modeling, controlling and robot's utilization. Nowadays robots accompany people in everyday life and take over their daily routine procedures. The range of robot's utilization is very wide, from toys through office and industrial robots finally to very sophisticated ones needed for space exploration.

The aim of this thesis is to realize more flexible control strategies of a mobile robot model means of PC computer. In order to accomplish this I will use SIMULINK enclosed in MATLAB. Testing and the controlling realization with the use of the industrial type of robot would be very expensive. I decided to use Fisher Technik mobile robot as a model. Then I use the specification of the motor mobile robot to do the simulation by using MATLAB/SIMULINK. This simulation are use to get the best performance of the motor including the step response, controller, state space and also the frequency of the motor.

1.2 Vision

The vision for this project is to get the performance of the mobile robot. By taken the specification of the motor and use some of the theoretical and mathematical equation, the simulation are use to get the performance of the controller, movement, step response, state space and also the frequency of the motor.

1.3 Objectives

This project is one of the requirements to obtain a degree in Bachelor of Electronic (Electronic Industry). My project is to design a mobile robot by using MATLAB/SIMULINK programming for the simulation. The objectives for my project are:-

- 1.3.1 To design and analyze a mobile robot simulation.
- 1.3.2 To study the performance of mobile robot.
- 1.3.3 To learn and understand MATLAB / SIMULINK programming
- 1.3.4 To design the controller with MATLAB / SIMULINK.
- 1.3.5 To implement a mobile robot by using MATLAB / SIMULINK.
- 1.3.6 To develop movement of mobile robot by using MATLAB / SIMULINK

1.4 Scope Of Project

The Scope of the project is:

- 1.4.1 Only MATLAB / SIMULINK are used for this project.
- 1.4.2 SIMULINK is used for modeling the robot dynamics.
- 1.4.3 MATLAB is used for designing the control and recognition system.
- 1.4.4 Improve the design of movement, controller and performance of mobile robot.

There are many various type of simulation that can be done for simulation of mobile robot such as Visual C++ programming, Visual Basic (VB), Multisim and many type of software that can be done for the mobile robot simulation. But in this project I only use the MATLAB/SIMULINK programming for the simulation of the mobile robot simulation.

1.5 Background Project

1.5.1 Fischer Technik Mobile Robot

Building machines and robots, writing control software for them on a PC, and setting the final product in motion appears, at first glance, to be a highly complex and technical task. However, Fischer Technik turns it into a fascinating and creative hobby.

A Fischer Technik mobile robot, construction kit has been supplied with an intelligent interface for home and semi-professional applications. By using Windows software, LLWIN (Lucky Logic for Windows), on a PC, programs can be created for mobile robot models. These programs are then loaded via the serial port to the new

“intelligent interface” with its own microprocessor. The interface, built into the model, can then be disconnected from the PC and is capable of autonomously controlling the models. There is no longer an annoying cable running between the model and the PC to limit the model’s freedom of motion. Models can now react to obstacles and changes in brightness just as “real” robots do.

1.5.2 The Kit

The kit contains a number of Fischer Technik parts, motors, and sensors that can be used to build a total of eight different models. Three stationary starter models - a sliding door, pulse counter, and a stamp - provide an introduction to the uses of the components, the software, and the “intelligent interface”. These models are simple and easy to build and their application programs are uncomplicated and easily understood.

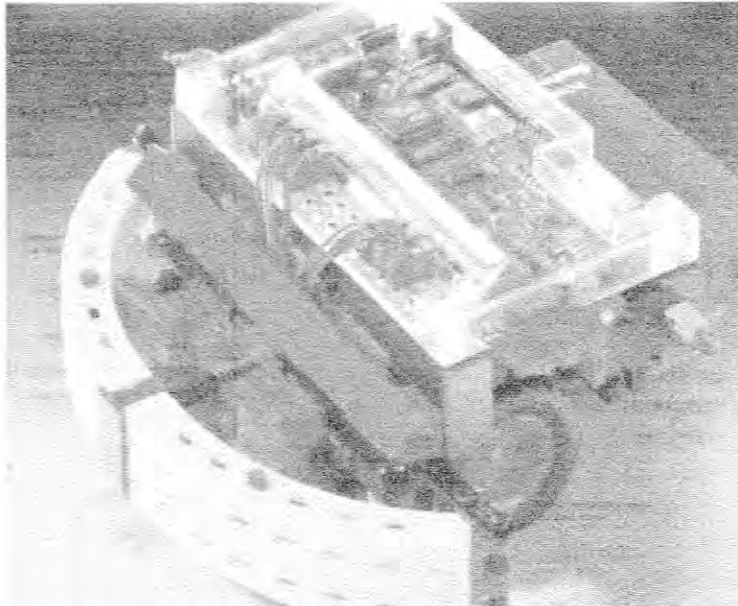


Figure 1.5 (a): Fischer Technik Mobile Robot

For this project, I used a Fisher Technik mobile robot as a model (Refer Figure 1.5 (a)) to get the performance of the motor. The specification of the motor of mobile robot has been taken for the simulation by using MATLAB/SIMULINK. This simulation are use to get the best performance of the motor including the step response, controller, state space and also the frequency of the motor.

1.6 Knowledge Gains

From the project, I gain more knowledge about mobile robot simulation. The knowledge is such as a mobile robot simulation can save cost also this simulation can improve the performance of the mobile robot that include the frequency, state space, time response and controller before it can proceed to real mobile robot.

Other else the application from Fischer Technik mobile robot as a model to get the specification of motor to do the simulation and also from the project, I have learned the program of MATLAB/SIMULINK and the tools of MATLAB.

1.7 Organization Of Report

This thesis consists of four chapters. Chapter 1 explained about the introduction of the project where the vision, objectives, scope of project, background project and knowledge gain from the project. Chapter 2 is mainly about the past project and MATLAB/SIMULINK program. It tells about the performance of the mobile robot simulation that has been done in the past project also about the MATLAB/SIMULINK program and how to use it.

Methodology is explained in Chapter 3 where all the process in finding the required result was shown. All the parameter used for this project was also described in full presentation. It includes the all the steps of the project until it successful.

Then in Chapter 4 shows all the result of this project and discussion. The result was explained with the aid of graph and all simulation's result and brief discussion. And lastly this project was concluded in Chapter 5. In this chapter all the suggestion were interpreted thoroughly besides presenting the conclusion. The suggestion is mainly for the purpose for future research.

1.8 Summary

Overall this chapter explains about an introduction to the project. Introduction consists of the vision, objectives, project scope and background. Vision is the project target that should be achieved while the objectives are what is project finding or what the capability of the project is. Project background explains about the project that will be done. Knowledge that have been gained from this project also include in this chapter.

CHAPTER II