DEVELOPMENT OF NAVIGATION MOBILE ROBOT BASED ON DIGITAL COMPASS

MUHAMMAD SYAHMI BIN MOHD HASAN
B050710038

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
2011

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF NAVIGATION MOBILE ROBOT BASED ON DIGITAL COMPASS

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

By

MUHAMMAD SYAHMI BIN MOHD HASAN

FACULTY OF MANUFACTURING ENGINEERING

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **DEVELOPMENT OF NAVIGATION MOBILE ROBOT BASED ON DIGITAL COMPASS**

SESI PENGAJIAN: 2010/11 Semester 2

Saya **MUHAMMAD SYAHMI BIN MOHD HASAN**

mengakumembenarkanLaporan PSM inidisimpan di PerpustakaanUniversitiTeknikal Malaysia Melaka (UTeM) dengansyarat-syaratkegunaansepertiberikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Silatandakan (/)

☐	SULIT	(Mengandungimaklumat yang berdarjahkeselamatanataukepentingan Malaysia yang termaktub di dalam AKTA RAHSIA RASMI 1972)
☐	TERHAD	(Mengandungimaklumat TERHAD yang telahditentukanolehorganisasi/badan di manapenyelidikandijalankan)
☒	TIDAK TERHAD	

Disahkan oleh:

AlamatTetap:
No, 24 Kampung Lembah Jamuan,
33600 Enggor,
Perak Darul Ridzuan.

Tarikh: 19 MAY 2011

Tarikh: 19 MAY 2011

** Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I hereby, declared this report entitled “Development of Navigation Mobile Robot Based on Digital Compass” is the results of my own research except as cited in references.

Signature : …….

Author’s Name : ……

Date : …….

APPROVAL

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

……

Supervisor

ABSTRAK

Tujuan projek ini adalah untuk membina sebuah robot mudah alih berteraskan kompas digital. Projek ini dibuat adalah untuk mengatasi beberapa masalah yang timbul dari cara nevigasi robot yang ada pada masa sekarang. Sebagai contoh, Global Positioning Systems (GPS) adalah salah satu cara nevigasi robot mudah alih yang ada pada masa kini. Dengan menggunakan GPS, robot mudah alih dapat meneroka sesebuah kawasan walaupun laluan perjalanan tidak disetkan didalam memory robot berkenaan. Tetapi ianya ada kelemahan. GPS hanya boleh digunakan di kawasan luar yang terbuka sahaja dan tidak boleh digunakan dikawasan bertutup seperti gua dan sebagainya. Bagi mengatasi masalah ini, kompas elektronik digital akan digunakan. Dengan menggunakan kompas digital masalah seperti kawasan bertutup atau pun tidak, bukan lagi menjadi masalah kepada system nevigasi sesebuah robot mudah alih. Selain itu, apabila robot mudah alih ini berlanggar dengan sesebuah halangan, gelinciran yang berlaku pada pusingan motor tidak member kesan kepada sistem nevigasi robot berkenaan (kekurangan nevigasi berasaskan encoder). Ianya juga tidak dipengaruhi oleh kecerahan cahaya, bagi menentukan arah pergerakan motor (satu lagi kekurangan encoder). Di dalam laporan ini, saya sertakan lampiran litar, segala data yang diperoleh dan juga cara-cara yang digunakan bagi menjayakan sistem ini.

ABSTRACT

The purpose of this project is for studying and developing navigation mobile robot based on digital compass. This study and development was done because of several drawback from the current method that being used. For example Global Positioning Systems (GPS) is the most suitable navigation system for outdoor exploration for mobile robots because it communicates directly through the satellite and giving the specific coordinate of the transmitter location on the earth. But, GPS can only be used at the placed that have the GPS signal, meaning that it can only be used at the non-covered area (outdoor) and can't be used at the indoor (inside building, cave exploration). Because of those problems, I have chosen this PSM topic as a navigation alternative. By using the digital compass most of the problems that stated above could be solved. It is because by using digital compass the system can be operated indoor and outdoor (no satellite restriction). Beside that when it collides with an obstacle, it will not loss its direction because the compass always directed to north where the current location can be referenced and it can be operated during daylight and night. The light intensity did not disturb the digital compass navigation system. All the data findings, building schematic and methods had been included in this report.

DEDICATION

I dedicate this report to my beloved parents Mohd Hasan Bin Ahmad and Hamsiah Binti Sulaiman, my siblings Nor Suhailah, Nur Syafiqah, Nur Athirah, and all my fellow friends. Because of their love, help and support I successfully finished this report.

ACKNOWLEDGEMENT

First of all, I would like to express my heartiest gratitude to Allah because of His faithful and graces on my life. Also, I wish to express my sincere appreciation to my main Projek Sarjana Muda supervisor, Mr. Mohd Nazrin bin Muhammad for his consistent guidance, teaching and supervising until the successful completion of this thesis. Besides that, I would also like to thank Mr. Shariman b. Abdullah for his marvelous style of teaching especially for the mechatronic and industrial automation subject when I was in second year. Beside that I would also like to thanks some of my friends in UTEM who giving a great help along the way doing the project by offering facilities and materials. Finally, I thank to my family and my best buddies who are always by my side to give me support and encouragement along the way of doing the project. Thank you all very much.

TABLE OF CONTENT

APPENDICES

A. List Of Abbreviation

B. Programming

C. HMC6352 Datasheet

LIST OF TABLES

LIST OF FIGURES

LIST OF FLOWCHARTS

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter will mainly discuss about the introduction of the robots navigation methods trough unknown terrain and also types of robots that has the intelligence to move and navigate on its own.

1.1 Background Study

Robot can be *defined as*:

a. A mechanical device that sometimes resembles a human being and is capable of performing a variety of often complex human tasks on command or by being programmed in advance. [1]

b. A machine or device that operates automatically or by remote control.

According to *Isaac Asimov's*, robots must follow *3 laws of robotics*. The laws are:

a. A robot may not injure a human being, or, through inaction, allow a human being to come to harm.

b. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.

c. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

There are a lots of robots type in this world. But they are mainly divided into six main categories. The first types are the Cartesian robot /Gantry robot. It is use for pick and place work, application of sealant, assembly operations, handling machine tools and arc welding. It's a robot whose arm has three prismatic joints, whose axes are coincident with a Cartesian coordinator.

Figure 1.0: One type of Cartesian robot [2]

Second type is mobile robot. It is use for assembly operations, handling at machine tools, have the ability to move from one place to another, portable. It's a robot whose have various type of degree of freedom. Next in the list are Spherical/Polar robot it is use for handling at machine tools, spot welding, diecasting, fettling machines, gas welding and arc welding. It's a robot whose axes form a polar coordinate system. The third type is Scara robot. It is use for picks and place work, application of sealant, assembly operations and handling machine tools. It's a robot which has two parallel rotary joints to provide compliance in a plane. Next type is Articulated robot and it is use for assembly operations, diecasting, fettling machines, gas welding, arc welding and spray painting. It's a robot whose arm has at least three rotary joints. The last type is a Parallel robot. It use is a mobile platform handling cockpit flight simulators. It's a robot whose arms have concurrent prismatic or rotary joints.

Among all of this robot type, there are *several mobile robots that have the ability to navigate itself* trough the terrain and obstacle avoiding. One of it is Sojourner ; a mobile robot that was deployed by the Mars Pathfinder spacecraft. Several NASA centers are involved in developing planetary explorers and space-based robots.

Figure 1.1: Sojourner [2]

The other robots are known as Pioneer; a mobile robot that was used for a remote reconnaissance system for structural analysis of the Chernobyl Unit 4 reactor building. Its major components are a teleported mobile robot for deploying sensor and sampling payloads, a mapper for creating photorealistic 3D models of the building interior, a core borer for cutting and retrieving samples of structural materials, and a suite of radiation and other environmental sensors.

Figure 1.2: Pioneer [2]

Dante II is also one of the mobile robot that have this ability. It was placed into the active crater of Mt. Spurr, an Alaskan volcano 90 miles west of Anchorage. Dante II's mission was to rappel and walk autonomously over rough terrain in a harsh environment; receive instructions from remote operators; demonstrate sophisticated communications and control software; and determine how much carbon dioxide, hydrogen sulfide, and sulfur dioxide exist in the steamy gas emanating from fumaroles in the crater.

Figure 1.3: Dante II [2]

Last but not least, Samsung VC-RP30W. The purpose of these mobile robots is to act as a vacuum cleaner. It can draws a 3-D map of the environment to identify its relative location, enabling faster and more efficient cleaning of a defined area. A less advanced automated vacuum cleaner navigates randomly until it faces an obstacle, blindingly crawling the area. The smarter Samsung cleaner knows which area needs to be cleaned, with a much more accurate result. A user can also program in the working time and cleaning options in advance, so that the robot cleans the area automatically when the user is away.

Figure 1.4: VC-RP30W [3]