OMNI-DIRECTIONAL AUTONOMOUS VEHICLE

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With love,

I dedicate this thesis

To my beloved family

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ABSTRACT

In Malaysia, the forklift system is using the nonholomonic movement where the vehicle cannot drive in all possible directions. Most non-holomonic robots cannot drive in a directional perpendicular to their driven wheels. Besides, it is needs more time and space to change the direction. For this reason,the project is designed and developed to build an omnidirectional vehicle that can move efficiently to eight in difference directions. It is called as holomonic movement. So, the vehicles will be able to drive in any directions in the 2D plane. PIC18F452 is used to control this vehicle platform. This project also focuses on lifting mechanism that capable to lift 500g of the payload. So, this project will save the time and space for the vehicle change the directions.

ABSTRAK

Penggunaan forklift di dalam system gudang di Malaysia menggunakan pergerakkan yang tidak holomonik dimana kenderaan hanya boleh bergerak dalam arah yang terhad. Kebanyakkan robot yang bergerak secara tidak holomonik tidak mampu bergerak ke arah 90^0 dari arah rodanya. Selain itu, ia juga memerlukan lebih masa dan ruang semasa menukar arah pergerakkan. Oleh itu, projek ini dicipta dan direka untuk mencipta satu sistem yang memudahkan pergerakkan kenderaan. Projek ini menggunakan sistem yang dipanggil "omnidirectional". Kenderaan omnidirectional boleh bergerak dalam lapan arah yang berbeza. Pergerakkan ini juga dikanali sebagai pergarakan holomonik. Jadi, kenderaan mampu bergerak dalam 2D. Pada asasnya, PIC 18F452 digunakan untuk mengawal platform kenderaan. Projek ini juga lebih focus kepada bahagian jentera yang berfungsi dalam mengangkat dan mengalihkan barang. Mengikut skop projek, bahagian ini hanya blh mengangkat beban maksimum 500g.

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CHAPTER 1

INTRODUCTIONS

1.1 Background.

Many vehicles in Malaysia are using the nonholomonic movement where the vehicle cannot drive in all possible directions. Most non-holomonic robots cannot drive in a directional perpendicular to their driven wheels. Besides, it is needs more time and space to change the direction. For this reason, the project is designed and developed to build an omnidirectional vehicle that can move efficiently to eight in difference directions. It is called as holomonic movement. So, the vehicle is capable of driving in any direction in a 2D plane. PIC18F452 is used to control this vehicle platform. This

project also focuses on lifting mechanism that capable to lift 500g of the payload. So, this project will save the time and space for the vehicle change the directions.

1.2 Objectives of the Project

The objective of this project is;

1. To design and develop an omnidirectional vehicle that can move efficiently to eight in difference direction.

2. To develop a lifting mechanism that is incorporated with the vehicle platform.
3. To develop the autonomous vehicle utilizing sensors and motors for guided movement.

1.3 Problem Statement.

Nowadays, warehouse's systems in Malaysia used automatic and semi auto equipments as their main operation machinery in the warehouse. Forklift for example is being used to locate and relocate goods inside warehouse. However, as forklift is nonholomonic vehicle, it will take more times and space to perform movements such as changing turns and making u-turn. For this reason, an omnidirectional vehicle is designed to overcome the problem.

1.4 Scope Project

1) The project utilized wall following technique.
2) The program development involves c programming language with the use of PICC Compiler for write the program and PIC Kit 2 to program the PIC controller.
3) The lifting mechanism will be able to lift 500g of payload.

1.5 Thesis Layout

In this thesis, different parts of the project were written in separate chapters.Here is the outline for all the chapters. Chapter 1 is an introduction where the background, objectives, problem statement and scope of the project. In chapter 2, the literature review will be discussed. The previous project that had been done will be compared. In chapter 3, the methodology where the method that used in this project was described using flow chart, block diagram and explanation. In chapter 4,

the hardware implementation will be discussed and explained. Chapter 5 is the result and discussion. In this chapter, the result will be explained and the problem will be discussed. Chapter 6 is the conclusion and recommendations.

CHAPTER 2

LITERATURE REVIEW

Nowadays, through the new age of advance and high technology many robots have been created. Some of the created robots had been rebuilt again to improve their ability and new research been made to get new ideas of creating higher technology robots. Robot is a machine that can do some task that a human can do and that works automatically or is controlled by a computer.

Basically, robots can be classified into two categories that are static robot and mobile robot. Both of these robots differ with each other in terms of specification, costing and purposes. For this project, a thorough research and implementation regarding to the usage of mobile robot is being done by specifically focusing it on the omniwheel operations.

Recently, there are only a few commercial study platforms for mobile robots that are capable on handling the omniwheel project. Such mobile robots are as follows:

2.1 Design of an Omnidirectional Robot For FIRA Robosot

The paper describes the design process of building an omnidirectional robot team for FIRA Robosot. The robots are designed to be omnidirectional for increased mobility and possess omnivision capabilities for effectiveness. Wheel configurations are discussed and the kinematics of the final design is derived. The vision system is described along with the basic vision processing technique including a proposed color space algorithm, the Diff RGB. The complete system architecture is presented

with components of the drive mechanisms and electronics being detailed. The final mechanical design for the omni-drive and the robot is then presented.

FIRA Robosot is an integral component of the FIRA robot-soccer championships. It was initiated with the aim of promoting research in autonomous wheeled mobile robot technology. It is a game of robot soccer played between two teams of autonomous intelligent wheeled mobile robots on a field. Robots are permitted to carry on board sensors including vision systems, however global vision systems are disallowed. Communications (if any) is allowed through wireless between the robots and a remote host computer. These restrictions present an interesting challenge for prospective teams by requiring intelligent robots which individually must possess proficient vision abilities in addition to high performance speeds, in both processing and drive mechanisms. The robots must also be capable of interacting and performing as a team.

The advantages of these robots are there are able to communicate to each other. This is important because the robots are work in group. Besides, to design and develop these robots needs low-cost devices. For the image, the controller does not need to transmit image data.

At the other hand, there are also had disadvantages for the robot. While the robot used the low-cost devices, so the sensors have to calibrate for each robot first. Besides,

using dead reckoning for position and orientation estimation in a mobile robot is that it deteriorates over time, unless the data can be update at certain reference points.

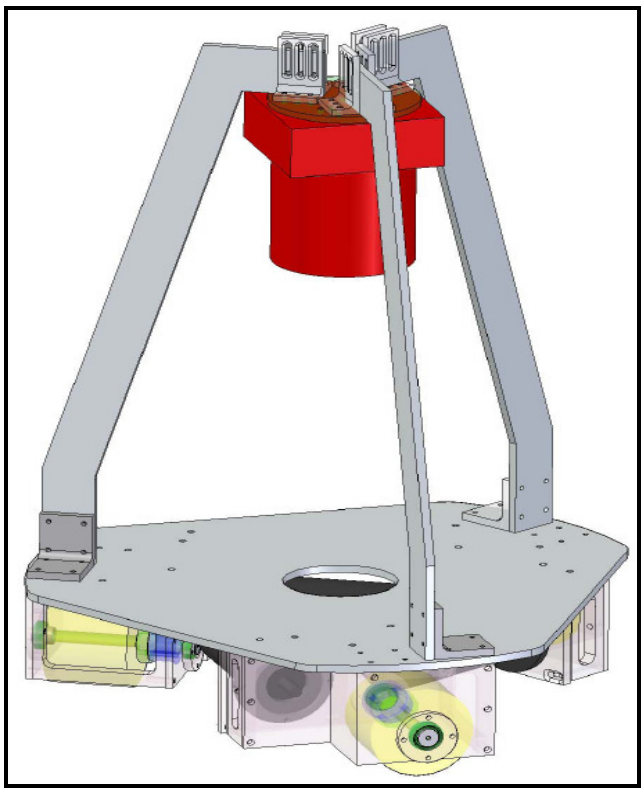

Figure 2.1: FIRA Robot

2.2 ODDSFARM: Omni-Directional Drive System for Agile Real-time Maneuvering

The project goal for ODDSFARM was to create an omni-directional robot with closed-loop velocity control. Omni-directional movement can be summarized as 360 degrees freedom of mobility with instantaneous response. Closed-loop control gives realtime feedback allowing for a constant update in the robot's state. The velocity

control acts like cruise control, correcting wheel velocity for changes in direction and terrain. User control is manipulated through a hand-held joystick, which is tethered to the robot. The structure and layout of the robot is an original design. The team completed every aspect of the process, from research and design to fabrication and programming. Omni- directional maneuvering is a new concept to Santa Clara Engineering.

The advantages of this project are this robot may also be used in the classroom, educating future students on such aspects as control systems, dynamics, and kinematics. This robot is controlled wirelessly which is using joystick. This project is simpler and easier to understand.

Figure 2.2: ODDSFARM omni-bot

CHAPTER 3

METHODOLOGY

In this chapter, the methodology of the project will be discussed. It will be represented by flow chart, and block diagram to describe the whole methodology of the project. In this chapter also will explain about the components and the functions of the components that use in the project.

3.1 Block Diagram

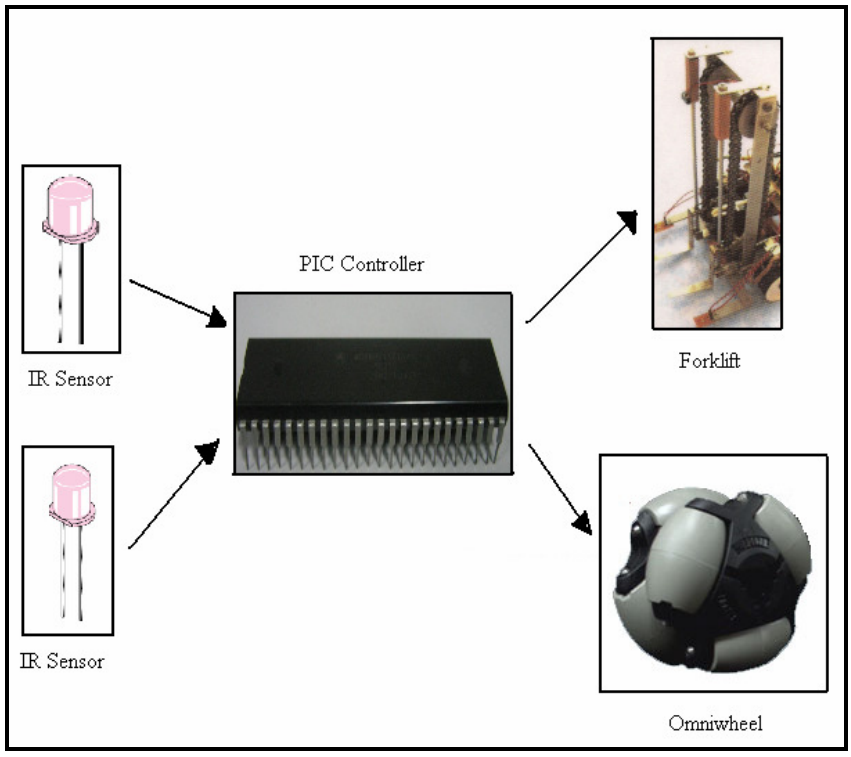

Figure 3.1: Block diagram

Basically, this project consists of IR sensors, PIC controller, and motors as a platform. Based on the flow chart above, input1 and input2 will send the data to the controller which is PIC controller. The controller will send the data to the motor output. The motor will execute the instruction that received from the controller. If the data does not detected by the output, the data should be sent again by the input. The input1 will send the data for the motor (wheel) and the input2 will send the data for the motor (forklift)

3.2 Hardware Modeling

The hardware modeling shows that the illustration about the model of the project. This modeling consists of IR sensors, Motors, Forklift and the Platform of the vehicle.