OMNI-DRIVES ROBOT SOCCER PROGRAMMING (3 WHEELS)

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This project and research work is dedicated to my beloved parents for their enthusiastic caring throughout my life, my loving brother and sisters also my friends for their encouragement and love.

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ABSTRACT

This project is focusing on programming architecture of an omni-wheels robot which is using three wheels. Three wheels robot could serve a single sideways motion which able to traverse the robot faster than two wheels robot. In addition, this robot is capable of moving in continuous translation and rotation in any direction and confined spaces. A wheel is used to assist the movement of this robot is used transwheel. This special wheel has multi-directional movements which contain free-turning rollers perpendicular to the axle arranged around the transwheel periphery. The movement of the robots is constructed in C programming language. This robot Flexibot is supported by industrial company, Chatanoga Sdn Bhd.

ABSTRAK

Projek ini tertumpu pada pengaturcaraan robot omni-roda yang menggunakan tiga roda. Tiga roda robot dapat melayani gerakan menyamping tunggal yang mampu melintasi robot lebih cepat daripada dua robot roda. Selain itu, robot ini mampu bergerak dalam keadaan berterusan dan putaran ke segala arah pada ruangan yang terhad. Sebuah roda digunakan untuk membantu pergerakan dinamik robot ini iaitu „transwheel". Roda khusus ini memiliki gerakan multi-arah yang mengandungi tidak-balik rol yang tegak lurus terhadap sumbu ditetapkan sekitar pinggiran „transwheel". Gerakan robot dibina dalam perisian bahasa pengaturcaraan C. Robot Flexibot dibekalkan oleh syarikat industri, Chatanoga Sdn Bhd.

TABLE OF CONTENTS

PROJECT

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

CCW	– Counter Clockwise
CMOS	– Complementary Metal Oxide Semiconductor
DC	– Direct Current
EEPROM	– Electrical Erasable Programmable Read Only Memory
ICSP	– In-Circuit Serial Programming
IDE	– Integrated Drive Electronics
LCD	– Liquid Crystal Display
LED	– Light Emitting Diode
PCB	– Print Circuit Board
PIC	– Programmable Interrupted Controller
RF	– Radio Frequency
UART	– Universal Asynchronous Receiver/Transmitter
USB	– Universal Serial Bus

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

1.1 Introduction

This project is focusing on programming architecture of an omni-wheels robot which is using three wheels. Three wheels robot could serve a single sideways motion which able to traverse the robot faster than two wheels robot. In addition, this robot is capable of moving in continuous translation and rotation in any direction and confined spaces. A wheel is used to assist the movement of this robot is used transwheel. These special wheels have multi-directional movements which contain free-turning rollers perpendicular to the axle arranged around the Transwheel periphery. The robot is capable to decide the action to be taken and motion according to current and predict situation. The behaviors and strategies of the robots are constructed in C programming language to generate the programming code in MPLAB IDE and HI-TECC C PRO software. Kinematics analysis and certain ranges of trajectories motion and methods will be represented in this paper to control the behaviors. The robot Flexibot will be used to test the coding. The hardware has been supported by industrial company, Chatanoga Sdn Bhd.

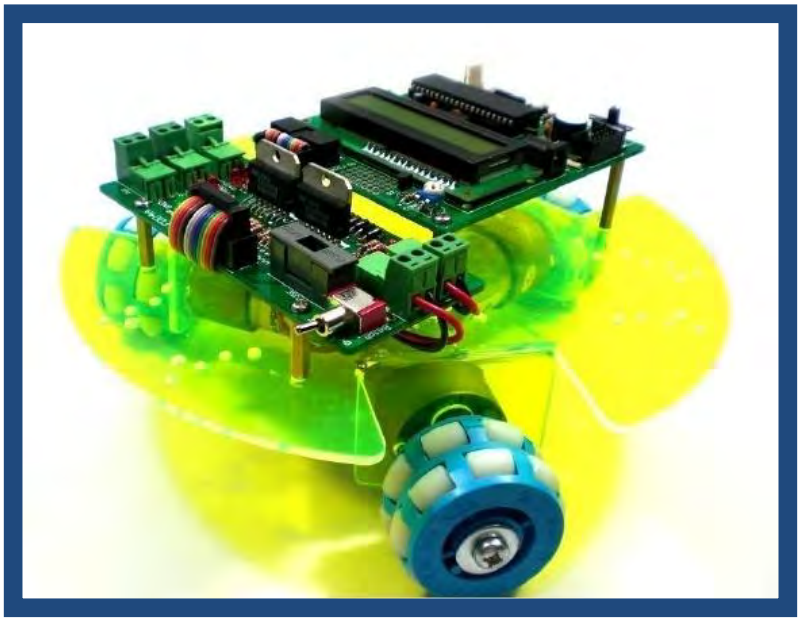


Figure 1- 1: Flexibot with three Transwheels

1.2 Problem Statement

i. Two wheels robot unable to move in single sideway motion.
ii. Two wheels robot unable to move continuously to the aim.
iii. Soccer robot unable in obstacle avoidance.

1.3 Objectives

i. To design a programming to estimate motion in a curved path and a straight-line path.
ii. To allow continuous translation and rotation in any direction and confined spaces.
iii. To apply a method to provide fast movement with desired posture at the target position and obstacle avoidance.

1.4 Scope

i. Scopes for these projects are covers movements of robot, kinematic analysis, and obstacle avoidance.

ii. The movements of robot is covering based on 30º, 60º, 90º, 120º, 150º, 180º, 210º, 240º, 270º, 300º, and 330º. Robot is able to move based on the degree state in one single path.

iii. Analysis for kinematic are focusing on determining the rate of each wheel to run the robot to a target. The calculation is use to control the movement and the behavioral of the robot. The movements of the robot are proving that the robot is able to traverse in a single path to a target and save certain time.

iv. The strategy of this Flexibot is avoiding obstacle. The programme is created to use another degree of movement whenever there is an obstacle in ones degree.

v. Covered in the hardware part is assembling the components in the main circuit referring the hardware sheet given.

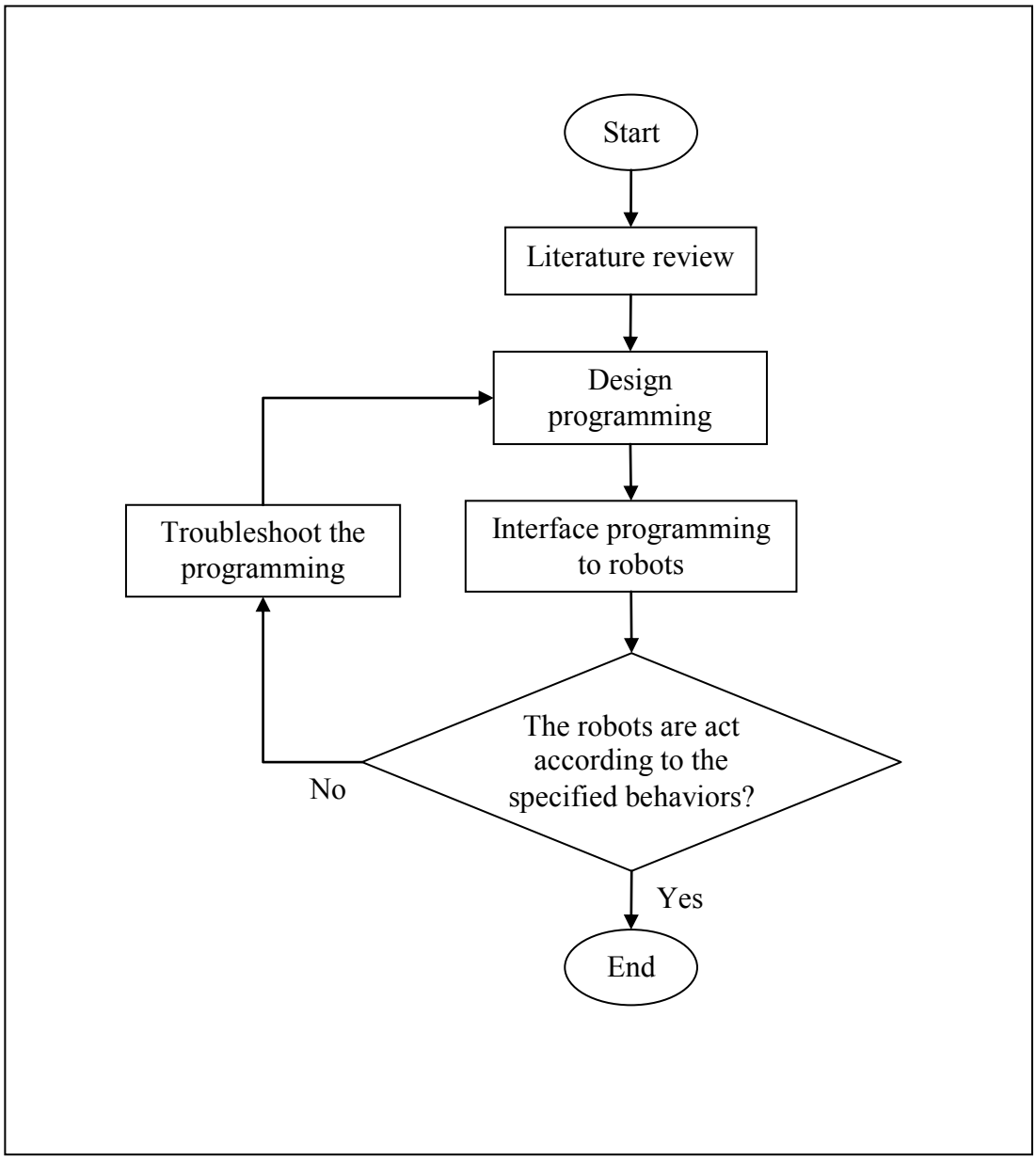
vi. Interfacing hardware and software is using MPLAB IDE and HI-TECC C PRO software to compile and a burner circuit to burn programme to main board.

1.5 Methodology

1.5.1 Methodology of the Project

This project is primarily focus on the literature review which is first considered in hardware. Studies are consist of the structure of soccer robot includes main circuit, motor circuit, and types of wheel; programming language based on the processor features and specifications of robot. Next is considered in the kinematics analysis includes study the movement of the wheel. Kinematics is affected to determine the angle of the wheels, the angle between robot and target, direction of wheels and movement to achieve target. Furthermore, covering in study is the strategies of games. This task will explain the ability of Flexibot in obstacle and boundary avoidance. Besides, study a simple coding is able to facilitate understanding in the programming architecture of soccer robot. Design programming is beginning after understanding the literature review of basic learning about the robot through a simple coding. The simple coding is tested to the robot to present better understands about the wheels movements control. Next, the basic coding is edited to test several simple movements. The coding is continuously being improved and burned to main circuit to achieve the designed movement. Theoretically, movement calculation methods have been used to calculate the speed and direction of each wheel to move the robot towards the target. Robot movements are different in practically and theoretically because of various factors such as wheels friction, motor operations, and robot environments.

1.5.2 Flow Chart of the Project



CHAPTER II

LITERATURE REVIEW

2.1 Introduction

This chapter is explained and discussed the comparison between Omni-Drives Robot Soccer Programming (3 Wheels) with another two omni wheels robot, Tricycle Robot Using Omni-Wheels and Fb003 Three Omni-Wheel Robotic Platform. Moreover, this topic focused in kinematic analysis, ball position calculation, obstacle avoidance calculation, and interfacing software and hardware.

2.2 Comparison with Other Robots

Two omni wheels robot, Tricycle Robot Using Omni-Wheels and Fb003 Three Omni-Wheel Robotic Platform is chosen to compared with Omni-Drives Robot Soccer Programming (3 Wheels). These are the comparison items that being focused, types of wheels that the robot used, number of wheels for each part of tire, types of motor being used to move the robot, and types of communications for robot with others device used with the robot.

Table 2- 1: Comparison between Omni-Drives Robot Soccer Programming (3 Wheels), Tricycle Robot Using Omni-Wheels and Fb003 Three Omni-Wheel Robotic Platform

Types of Robots	**Omni-Drives Robot Soccer Programming (3 Wheels)**	**Tricycle Robot Using Omni-Wheels**	**Fb003 Three Omni-Wheel Robotic Platform**
Types of wheels	Transwheels	Omniwheel	Rotacaster
Numbers of wheels	Three double row wheel configurations	Six single row wheel configurations	Three double row wheel configurations
Types of Motor	DC Geared motor SPG30-20K	Brushless 12V DC Servo Motors	Faulhaber 12V DC Coreless Motor
Types of communications	None	Wireless Radio Frequency (RF)	Infrared rangefinders

2.2.1 Tricycle robot using omni-wheels

Markus Gritsch built this six-wheeled robot using omni-wheels. Two wheels are used on each axis in order to ensure perpendicular rotation is possible no matter where the axis rotation stops. The wheel has also been improved by soaking the elliptical to give them a layer of rubber.

The inputs of the robot are wireless commands from a separate controller unit. The controller used a teensy microcontroller board. Two analog sticks take input from the operator and transmit commands using a RF pair. The wheel movement is using three servo motors which it simplifies the electronic side of the build because do not need an H-bridge to control a servo motors.

Figure 2- 1: Tricycle Robot Using Omni-Wheels