MERLIN MIABOT PRO ROBOT SOCCER (2 WHEELS)

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Saya **MUHAMMAD ASYRAF BIN BADARUDDIN**

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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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Thank you.

ABSTRACT

This project is making the robot that play soccer and mostly focused on the designing the software that will command the soccer robot. The system is the combination of three functional parts: programming platform, simulation platform and physical test platform. In the soccer tournament, each team is represented by five robots, a goal keeper, two defenders, and two strikers. Basic structure for the robot soccer tournament is using a camera for detection the ball, other robots and environments. The computer was used to control the robot's motions and actions in current and predicted situations. All of the action and movement of the robot is control by a programming language, C++. This programming will be test by using Simurosot Simulator then the program will test to the hardware.

ABSTRAK

Projek ini adalah untuk membuat robot yang bermain bola sepak dan lebih difokuskan kepada perancangan perisian yang akan member arahan kepada robot bola sepak. Sistem ini adalah gabungan daripada tiga bahagian yang berfungsi sebagai: platform pengaturcaraan, platform simulasi dan platform ujian fizikal. Dalam pertandingan bola sepak, setiap pasukan diwakili oleh lima robot, satu penjaga gawang, dua pertahanan, dan dua penyerang. Struktur asas untuk perlawanan bola sepak robot ialah menggunakan kamera untuk mengesan bola, robot lain dan persekitaran. Komputer digunakan untuk mengawal pergerakan robot dan tindakan dalam situasi sekarang dan situasi dijangka. Semua tindakan dan pergerakan robot adalah dikawal oleh bahasa pengaturcaraan, C++. Program ini akan diuji dengan menggunakan *Simurosot Simulator* dan selepas itu diuji kepada robot.

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EP	– Evolutionary Programming
RF	– Radio Frequency
CPU	– Central Processing Unit
EEPROM	– Electrical Erasable Programmable Read Only Memory
SPP	– Supports Serial Port
CCD	– Charge Coupled Device
RGB	– Red Green Blue

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CHAPTER I

INTRODUCTION

1.1 Introduction

Figure 1. 1: Merlin Miabot Pro

This project is making the robot that play soccer based on the programming architecture that will be design and mostly focused on the designing the software or programming code that will give an information or command to the soccer robot. In the system that will be designed is the combination of three functional parts:

programming platform, simulation platform and physical test platform. In the soccer tournament, each team represented by five robot, a goal keeper, two defender, and two striker. Basic structure for the robot soccer tournament is using a camera for detection the ball, other robots and environments. The camera was linked to a computer and the connections between the computer and the robots are using a Bluetooth device. It is fully autonomous and incorporates bi-directional Bluetooth communications, which provides a robust frequency hopping wireless communications protocol at 2.4GHz. The computer was used to control the robot's motions and actions in current and predicted situations. While the positions of robots (teammates and opponents) and ball was determined from estimation calculations. This project needs the knowledge about kinematics analysis. It is used to control the movement of the soccer robot in term of speed, forward and reverse and turning. All of the action and movement of the robot is control by a programming language, C++. This programming will be test by using Simurosot Simulator then the program will test to the hardware.

1.2 Problem Statement

i. Speed of soccer robot is same as the speed of ball.
ii. The position of goal keeper must be retained when pushed by other robots.
iii. Detection of the opponents, members, goal and ball.

1.3 Objectives

i. To design a program for a shortest path that can be traversed by the robot faster than the ball.
ii. To create a program for the position of the goal keeper at the right angle.
iii. To apply a calculation in the program to determine the positions of opponents, members, ball and target.

1.4 Scope

i. Scope for this project covers the basic behavior for all robots that can be spin, move, kick, dash and block. Basic behavior is the command that have given to each of the players and this is according to the role behavior.
ii. Based on the role behavior of the robot, it is required to make the robot act as the goal keeper, striker and defender to control a game. Each player will be programmed according to the distribution function and point. These behavior help to carry out the duties of players smoothly and according to the strategies that have plan.
iii. It also covers in kinematic energy that uses to measure the position and angle of the soccer robot. Analysis for kinematic are focused on position and angle of a two-wheel robot. The position is known by determination of the coordinate based on the field and the angle is determined from the reference angle.
iv. The soccer robot also be programmed by using C++ programming language to follow the strategy that have been create such as to attack the opponent by kick the ball to goal, and defending ball from entering home area.
v. The interfacing between the robot and program are using Bluetooth device where it is integrated in the robot.

1.5 Methodology

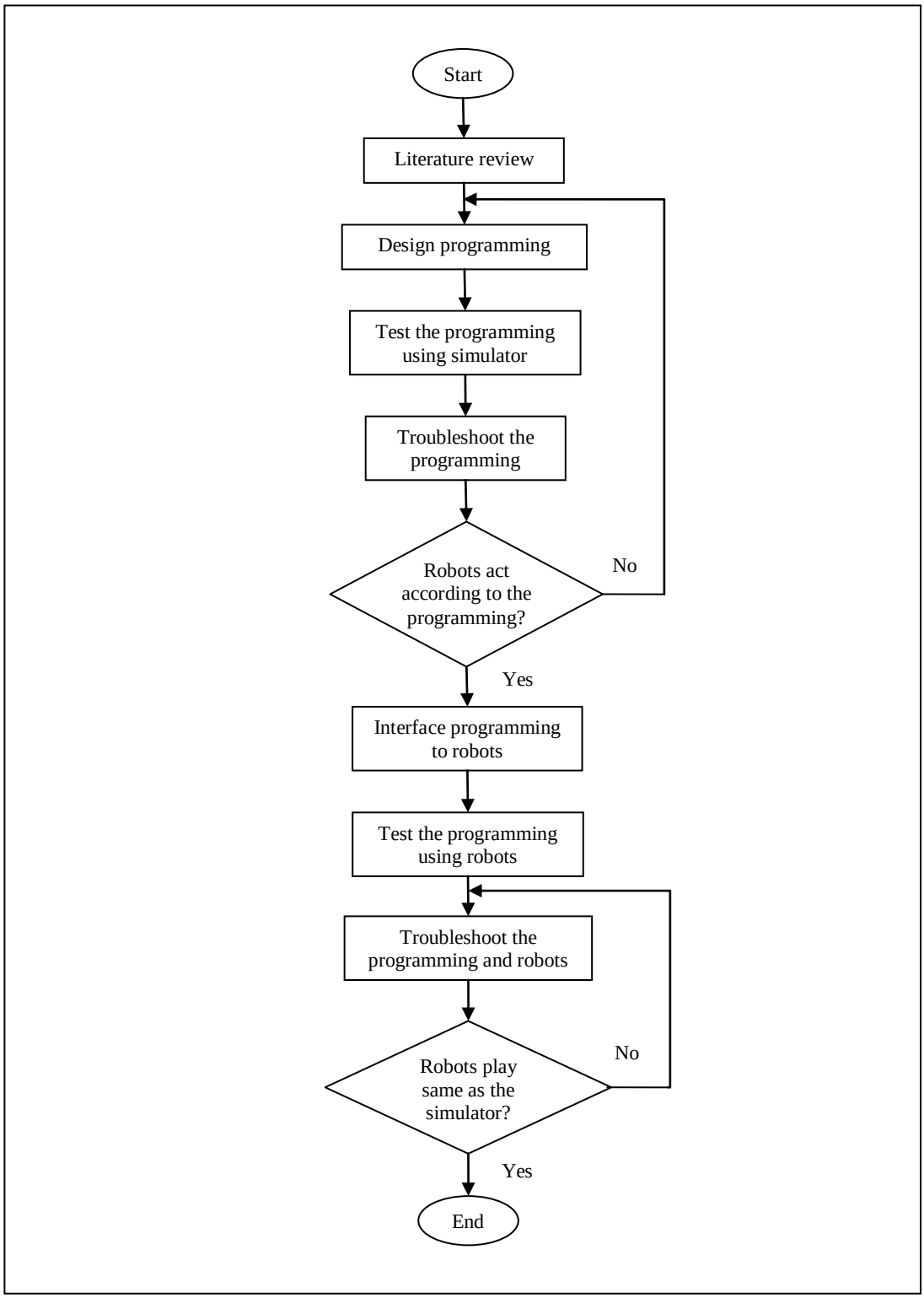
1.5.1 Methodology of the Project

This project is begin with the literature review which is the study about basic structure of soccer robot includes camera, Bluetooth, computer and battle area; programming language based on the processor features and types of robot. Here, the study is about kinematics analysis (angle and position) and the detection of robots. Kinematics is affected to estimate the angle, position and decision on the action of robots while detection is cover positions of all robots and ball. Evolutionary Programming (EP) for obstacle and boundary avoidance also covers in literature review.

After that, proceed to design programming where the simple coding is being tested by the simulator to understand about the movements and the estimation of angle and position of robot. A simple movement will be created and test with simulator. Construction of simple movement gradually converted to the movement's that is more complex including basic behavior, role behavior and strategies. As usual, coding will be tested on the simulator so that each player moves as the programming command.

The programming that is ready will be checked and troubleshoots. If the robot does not move as expected or the robots is not followed the strategies, the coding will be reviewed and studied back. Corrections will be made after the problem had been identified. Coding will interface to the real robot after being satisfied with the behavioral players and strategic that shows in the simulator. The programming is tested to the robots and will be modified if the robot does not move exactly as in the simulator. Robot movement is differently in the hardware and simulator because of various factors such as friction and mass of the robots.

1.5.2 Flow Chart of the Project



CHAPTER II

LITERATURE REVIEW

2.1 Robot System

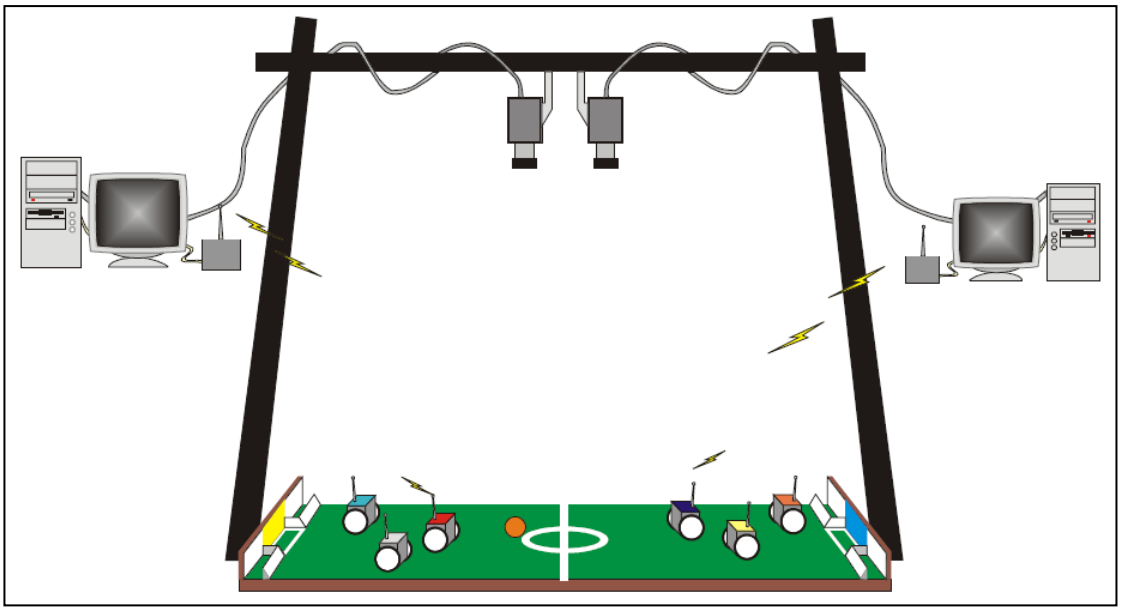


Figure 2.1(a): Robot System

As you can see in Figure 2.1(a), this drawing describes the organization of soccer robot system. On this picture, the intelligence is included in the host computer, the robots, or both of them. According to where to be embodied for the intelligence of the system, there can be divided into vision-based soccer robot system and robot-based soccer robot system.

Vision-based soccer robot system can be divided into remote-brainless soccer robot system and brain-on-board soccer robot system. As Figure, our soccer robot system is a remote-brainless soccer robot system, so the host computer has the intelligence and sends commands to the robots through the Bluetooth communication. If the robots receive the commands from the host computer, they only control the behavioral or movement and operation.

For Vision-based soccer robot system, a robot system is a part of robot soccer system. Figure 2.1(b) shows a diagram of robot system. Robot system consists of four parts; micro-controller, motor driver, communication, and power unit. The complete robot is illustrated in Figure 2.1(b). The robot has a circuit board, battery, motor, and body (including wheels). The circuit board can be separated into the lower circuit board that has power devices (voltage regulator, motor driver, etc.) and Bluetooth Communication module and the upper circuit board that has the micro-controller Atmel ATMega64.