

MAZE SOLVING BALBOT

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“I hereby declare that I have read this thesis and in my own opinion the scope and quality of this thesis is qualified for the award of the Bachelor of Electrical Engineering (Electronics)”

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ABSTRACT

This paper concerns with the development of a two wheels balancing robot as the maze solver. This is a robot that uses sensors and DC gear motors on two wheels with inverted pendulum mechanism. The basic idea for a two wheels balancing robot is simple which is drive the wheels in the direction that the upper part of the robot is falling. If the wheels can be driven in such a way as to stay under the robot's center of gravity, the robot remains balanced. The main purposes of this project are to construct a robot with the capability of balancing upright of two wheels and also as a maze solver robot. The GP2D120 IR distance sensor is used to achieve the balancing mode while the GP2D12 IR sensor is applied as the input for microcontroller in the determination of the path control algorithm. The path control algorithm will be coded in ATMEGA 32 microcontroller. The balancing robot will perform as a maze solver without losing the balancing functionality.

ABSTRAK

Project ini menitikberatkan kemajuan atau pembinaan robot seimbang beroda dua yang diaplikasikan sebagai robot solver labirin. Robot ini menggunakan pengesan dan arus terus gear motor berdasarkan mekanisma pendulum songsang. Idea asas untuk robot seimbang beroda dua ialah robot tersebut akan bergerak sama arah dengan arah robot tersebut jatuh. Jika roda boleh didorong sedemikian rupa untuk tinggal di bawah pusat graviti robot, robot tetap seimbang. Tujuan utama dari projek itu untuk membina robot dengan mampu mengimbangi tegak dua roda dan juga sebagai robot solver labirin. The GP2D120 IR sensor jarak digunakan untuk mencapai mode mengimbangi sedangkan IR sensor GP2D12 adalah sebagai masukan untuk mikrokontroler dalam penentuan algoritma kawalan jalan. Algoritma kawalan pusat akan diberi kod di mikrokontroler ATMEGA 32. Robot mengimbangi akan tampil sebagai solver labirin tanpa kehilangan fungsi keseimbangan

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LIST OF ABBREVIATIONS

Balbot	-	Balancing Robot
IR	-	Infrared
I2C	-	Inter Integrated IC
BPC	-	Balance Processor Chip
LQR	-	Linear Quadratic Regulator
PID	-	Proportional Integral Derivative
LS	-	Left Sensor
RS	-	Right Sensor
CV	-	Control Variable
SP	-	Set Point
PV	-	Process Value
LED	-	Light Emitting Diode
FR	-	Front Right
FL	-	Front Left
ISP	-	In System Programming

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CHAPTER 1

INTRODUCTION

1.1 Overview

Two-wheeled balancing robot is a robot that is capable of balancing upright on its two wheels. Two wheeled robots are one variation of robot that has become a standard topic of research and exploration for young engineers and robotic enthusiasts. They offer the opportunity to develop control systems that are capable of maintaining stability of an otherwise unstable system. This type of system is also known as an inverted pendulum. The following figure contains the physical view for the robot designed as part of this project. The process of balancing is typically referred to as stability control. The two wheels are situated below the base and allow the robot chassis to maintain an upright position by moving in the direction of tilt, either forward or backward, in an attempt to keep the centre of the mass above the wheel axles. The wheels also provide the locomotion thus allowing the robot to transverse across various terrains and environments.

This project will undertake the construction and implementation of a two-wheeled robot that is capable of balancing itself. The structural, mechanical, and electronic components of the bot will be assembled in a manner that produces an inherently unstable platform that is highly susceptible to tipping in one axis. Two wheeled self balancing platform is believed to be the best robot design platform which is able to make flexible movements among human environment. Many industries or research centre have conducted many research of using this method as their humanoid robot platform. Due to its flexibility, this two wheeled platform also to be tried in several human transporter applications. Balancing platform is not an easy structure. Moreover, the balancing process will have more uncertainty disturbances if this platform is used to bear such dynamic mechanism such like robot's body or a human passenger. The only available self balancing human transporter in the market is still very expensive because the system uses complex and high sophisticated components. Therefore, a study to develop a simpler balancing platform which uses less complicated system without losing its advantages platform needs to be conducted.

The main purpose of this project is to design a two wheels balancing maze solving robot. The robot is able to move in and move out from a maze at the same time achieve the balancing purpose. The wheels of the robot are capable of independent rotation in two directions, each driven by a servo motor. Information about the angle of the device relative to the ground (i.e. tilt) will be obtained from sensors on the device. The precise type of sensor that will be used is yet to be specified. The GP2D120 IR distance sensors used to measure distance to the ground for balancing purpose. Information from the sensors will be fed back to the PIC controller, which will process the feedback using a crude proportional, integral, derivative (PID) algorithm to generate compensating position control signals to the servo motors in order to balance the device. While the GP2D12 IR sensor is used as an input for the balancing robot to does the maze solving purpose using the obstacles avoidance concept.

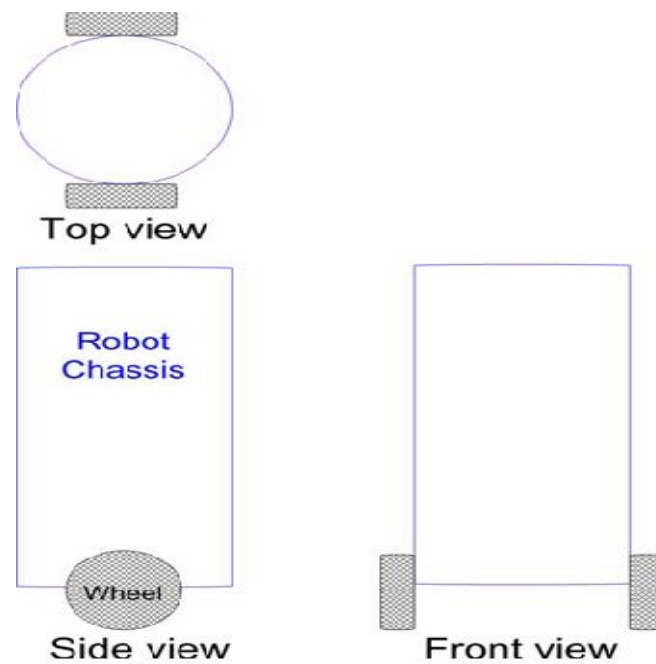


Figure 1.1 Views of the two wheeled balancing robot

1.2 Problem Statement

The problem statement for this project is stated as below:

“To design the path control algorithm and hence implement the path control algorithm in path position control of Two Wheeled Balancing Robot to construct a maze solving robot.”

1.3 Objective of Project

The objectives of this project being carried out are stated as below:

1. To design a path control algorithm for the purpose of maze solving Balbot
2. To control the navigation of the Two-wheels Balbot in stable condition.

1.4 Scope of Project

In order to achieve the objective of this project, there are several scopes have been outlined which are involves hardware and software:

- I. Focus on the development of small scale modeling of two wheels Balbot.
- II. Developed a path control algorithm for the purpose of position control of two wheel balbot.
- III. Implement the obstacles avoidance concept in order for designing the maze solving two wheels balbot.
- IV. To design and program a microcontroller to make an IR sensor as input for the obstacles avoidance purpose

1.5 Thesis Overview

This project focused on the balancing the robot and also develop the robot to become a maze solver robot. This thesis consists of five chapters. Each of the chapters elaborates details regarding different aspects. The included aspects are Introduction, Literature Review, Methodology, Result and Discussion, and Conclusion.

Chapter 1: Basic introduction of the this project

Chapter 2: Literature Review for the development of this project

Chapter 3: Method used throughout the development of the whole project and the hardware and also software that had been used in this project.

Chapter 4: Results and Discussion on the performance of this project.

Chapter 5: Conclusion of this project

1.6 Project summary

The progress flow on the implementation of the project can be shown in the flow chart as illustrated in figure 1.2. It summarized all the work had been done throughout the implementation of the project on two-wheeled balancing robot with remote control from the project planning till the hardware interfacing. Furthermore, the Gantt charts in table 1.1 and table 1.2 show that the detailed of progress flow.

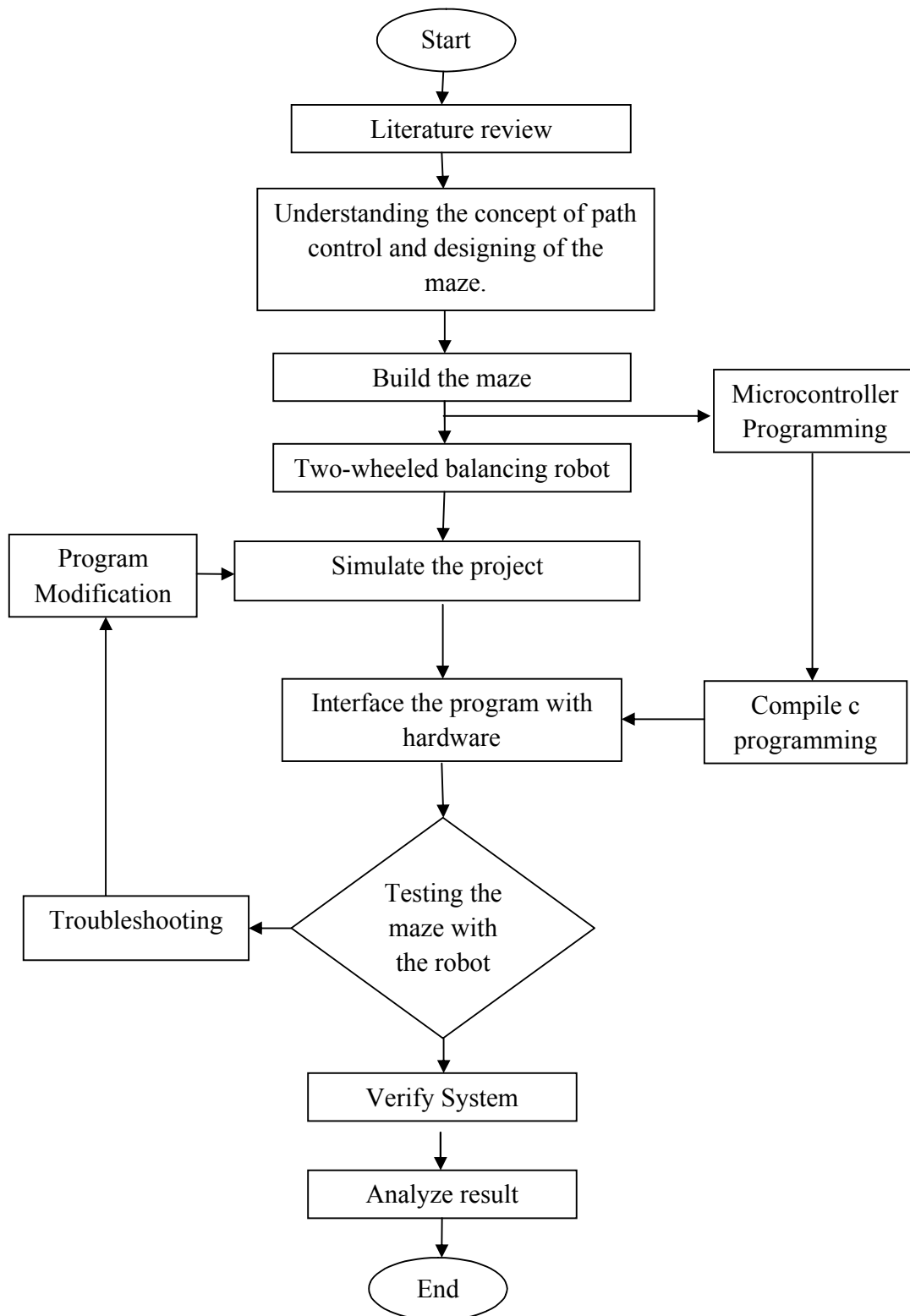


Figure 1.2: Project Flow Chart

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The two wheel balancing robot is a very popular project in the fields of robotics and control engineering. A two wheeled balancing robot consists of a robot chassis and two wheels. The two wheels balancing robot has the ability of maintaining an upright “balanced” position which is referred to as its stability.

This chapter reviews the literature that is available in an attempt to gain an understanding and appreciation of two wheeled balancing robots. It gives insight on how to go about solving the problem at hand and provides information on available technologies and tools for solving the problem.