

**AUTONOMOUS MOBILE ROBOT NAVIGATING TOWARDS A
PRESET TARGET**

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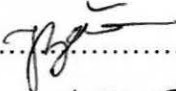
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For my mum and dad, all family members, friends

&

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May GOD bless you

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ABSTRACT

‘Autonomous mobile robot navigating towards a preset target’ is a mobile robot that avoid the obstacles along it ways to the target. It uses three IR sensors, two ultrasonic sensors, servo motors and a PIC16F877 as a central processor which will control itself. This autonomous robot is pre-programmed with C language into the PIC16F877 microcontroller by using Sourceboost IDE software. All the pins for sensors and motors must be identified first so that the robot programme can identify the activated sensor. For IR sensor, the selection of the port must be considered for analog to digital converter port because PIC cannot read analog signal. In the program, when one of the infrared sensors is activated, it then will go to the target. However, when the ultrasonic sensor is activated, the infrared sensors will temporarily halt its job to allow the ultrasonic do it task. After the ultrasonic completed it task, the IR sensor will resume it job. Priority is given to Ultrasonic sensors, because it must avoid any collision with obstacles. ‘Delay’ function is used to make the sensor stop for while to search for the target or obstacle.

ABSTRAK

Projek ini adalah merekabentuk sebuah robot yang dapat bergerak sendiri menuju ke sasaran dan pada masa yang sama dapat mengelak halangan. Robot ini menggunakan tiga IR sensor, dua infrared sensor, motor jenis servo dan juga pengawal mikro PIC16F877. Aturcara robot ini ditulis di dalam bahasa C menggunakan perisian SourceBoost IDE. Penentuan untuk setiap pin sensor dilakukan bagi memudahkan aturcara robot mengenalpasti setiap sensor yang aktif. Pemilihan pin untuk sensor infrared adalah berdasarkan kepada pin yang boleh melakukan proses pertukaran isyarat analog kepada isyarat digital. Ini kerana PIC hanya boleh membaca isyarat digital sahaja. Dalam aturcara robot, apabila sensor IR aktif, ia akan bergerak ke arah sasaran. Akan tetapi, IR sensor akan menghentikan kerjanya seketika apabila Ultrasonic sensor aktif, untuk memberi laluan kepada Ultrasonic melengkapkan tugasnya terlebih dahulu. Apabila tugas Ultrasonic telah selesai, IR sensor tadi akan menyambung semula tugasnya menuju ke arah sasaran. Keutamaan diberikan kepada Ultrasonic sensor kerana untuk mengelakkan berlakunya perlanggaran antara robot dengan halangan. Fungsi “delay” digunakan untuk memberikan masa kepada sensor mencari isyarat dari sasaran ataupun halangan.

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SHORT FORM CONTENTS

PIC	Programmable Integrated Circuit
ADC	Analog Digital Converter
RAM	Random Access Memory
I/O	Input/Output
LED	Light Emitter Diode
ROM	Read Only Memory
DC	Direct Current
A/D	Analog/ Digital
PWM	Pulse Width Modulation

CHAPTER I

PROJECT INTRODUCTION

1.1 INTRODUCTION

This project is to develop an artificial intelligence robot that can react autonomously with the environment without depending on human. A mobile robot is a very general term referring to any small toy vehicle that includes a microprocessor for making the mobile does a “smart” action, such as following a line, following an object, or avoiding an object. In this case, the team decided on a mobile that would avoid objects or obstacles and navigating towards the preset target. The mobile employed transmit and receiver infrared sensors for detection the beacon, and, later on in the design process, it included ultrasonic sensor for detection the obstacles. This mobile robot used a PIC16F877 microprocessor which was programmed in C to carry out the instructions.

The mobile is used the servo motor to control the robot movement. Servo motors are positional motors that the rotational angle of it shaft can be controlled precisely to a particular angular position but limited to a certain range within 360 degrees, therefore it

is suitable for carrying sensors (e.g. ultra-sonic radar) for pointing to different directions. It is analogous to the human neck supporting our head that it can move to a particular angle within a certain range with precision. In fact servomotors with high torque are not limited for carrying sensors; it can also be the power drive system to carry the robot around in the case of a legged robot.

1.2 OBJECTIVE

To success in this project, there are a few objectives that have to achieve:

- 1.2.1 To design and develop the robot's task planner
- 1.2.2 To design and develop a beacon as the target of robot navigation
- 1.2.3 Robot capable to navigate itself towards beacon
- 1.2.4 To design and develop sonar system (ultrasonic) for obstacle avoidance
- 1.2.5 To create an autonomous robot capable of navigating an obstacle-filled arena
- 1.2.6 Design hardware and locomotion system for the mobile robot

1.3 SCOPE

To achieve the project objective there are certain scope that must be done. The scopes are:

- 1.3.1 Language application software written in and the desired microcontroller to be used.
- 1.3.2 Flowchart of PIC controller
- 1.3.3 Developing a transmitter and receiver circuits for navigation system using IR frequencies
- 1.3.4 Beacon are the target for robot where the beacon will transmitted signal to the receiver on the robot and finally robot will navigate to the beacon autonomously
- 1.3.5 Developing obstacles avoidance systems. Robot will avoid any obstacle during the way to the target using sonar systems. The sonar systems will detect the distance between robot and objects (obstacles).
- 1.3.6 Develop the locomotion for the mobile robot
- 1.3.7 Determine the suitable motor and PIC for the locomotion system
- 1.3.8 Analyze the function of the pulse width modulation.

1.4 THESIS STRUCTURE

The contents of this thesis are all about the project that had been done. This thesis will be divided into 5 chapters to provide reader to understand the whole project.

Chapter I cover at the overview of the project.

In Chapter II, it will cover up all the project methodology, circuits and how the project going to be implemented. Also hardware technical details are explained here.

Chapter III covers the project methodology.

Chapter IV contains the development and implementation of the whole project and also the results gained.

Chapter V will be about the whole contents of this thesis and project. By the end of this chapter there are some proposal and discussion for this project.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will focus on the basic concepts and theories needed for the development and implementation of the project.

2.2 CONCEPT OF PROJECT DEVELOPMENT

Currently there are many of tools available in the market for the design of models of the elements that integrate a manufacturing cell. A good number of manufacturing process simulators, that uses these models for making "apriori" and "what if" tests in the offline planning of the processes of production, with a minimum risk are also available. However, the study of the automatization of the processes of production, has acquired new perspectives with the inclusion of Artificial Intelligence

techniques, in particular the use of autonomous agents, which are useful because they provide for self-configuring systems and fault tolerance, as well as balance, scalability and modularity.

For robots to operate autonomously in the world, they need to be able to create a plan to get from point A to point B, preferably as quickly as possible, and without running into obstacles along the way. In this project, Infrared transmitter sensor is used to transmit signal to the beacon and Infrared receiver sensor used to receive signal to the beacon. Ultrasonic sensor used to detect any obstacle along the way of mobile robot when go to the beacon. The mobile robot will avoid the obstacle when it detect any obstacle along it ways. Therefore, the mobile robot can moved to the beacon and avoided the obstacles autonomously using these types of sensor.

2.3.0 MICROCONTROLLER

2.3.1 Introduction

A microcontroller (or MCU) is a computer-on-a-chip. It is a type of microprocessor emphasizing self-sufficiency and cost-effectiveness, in contrast to a general-purpose microprocessor (the kind used in a PC). Microcontroller used to control electronic devices. A typical microcontroller contains all the memory and interfaces needed for a simple application, whereas a general purpose microcontroller requires additional chips to provide these functions. Microcontroller drastically reduces the number of chips and the amount of wiring.