THE OBSTACLE AVOIDANCE MOBILE ROBOT

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For **my mother (Zurriah Binti Yassid)** and **my father (Abd. Halim Bin Abdul) t**hat provide the big support all the while

My sisters … Amira Sara,Asilaa Aizzat and Anith Raidha that provide some advice throughout my study life. My kind hearted supervisor

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ABSTRACT

The need for autonomous capability is growing as mobile robots find an increasingly large number of in term of many applications. The ability of mobile robot to move around autonomously in their environment determines the best possible applications by having design this mobile robot initiated with the aim of promoting research in autonomous wheeled mobile robot technology. This system consists of infrared sensor, motor DC and a microcontroller. For the obstacle detection it used three infrared sensor are used for left, front and right .In this robot system ,the input signal is received form the receiver sensor's signal. The infrared sensor reading is taken and processed to avoid obstacle. The 5V power supply is used to operate PIC board and sensor circuit board .The obstacle avoidance algorithm is simply evaluated on PIC 16F876A microcontroller based mobile robot. The final outcome of the mobile robot is that, the above functions by the system have three collision obstacle avoidance functions. Design of new sensory, control, power subsystem or programming new software .There are five basic command functions which are:-Forward, backward, stop, left, right turn. The obstacle avoidance mobile robot is targeted to be operated in simple maze solution

ABSTRAK

Keperluan untuk keupayaan menyeluruh semakin meningkat dengan penggunaan robot di dalam pelbagai aplikasi. Keupayaan robot ini untuk bergerak dengan sendiri di dalam persekitaran disekeliling robot itu akan menentukan aplikasi yang terbaik untuk robot itu.Dengan tercipta nya robot ini ia dapat mempromosikan pelbagai penyelidikan berkaitan penggunaan robot yang mampu bergerak dengan sendiri,sistem ini terdiri daripada sensor infrared ,DC motor dan mikropengawal.Dalam sistem ini robot ini,isyarat masukan di terima dari litar sensor dan mikropengawal ,ia beroperasi mengikut kepada isyarat isyarat penerima sensor .Bacaan infrared sensor di ambil dan di proses untuk mengelak halangan .Bagi bekalan elektrik 5V ia digunakan untuk beroperasi papan PIC (Programmable Interface Controller) dan litar papan sensor. Hasil akhir daripada penggunaan robot ini ialah sistem yang digunakan terbahagi kepada 3 fungsi iaitu fungsi untuk mengelak dari sebarang halangan dan rekaan ini mempunyai alat pengesan yang baru, kawalan, sistem kuasa sampingan. Terdapat juga lima fungsi arahan iaitu kehadapan, kebelakang, berhenti, ke kiri dan ke kanan. Sistem ini diuji dengan meletakkan robot ini didalam satu laluan pergerakkan yang mudah

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ADC	-	Analog to Digital Converter
DC	-	Direct Current
EEPROM	-	Electrical Erasable Programmable Read Only Memory
MOSFET	-	Metal Oxide Semiconductor Field Effect Transistor
RAM	-	Random Access Memory
Rx	-	Receiver
Tx	-	Transmitter
PIC	-	Programmable Interrupted Controller
DC	-	Direct Current
PCB	-	Printed Circuit Board CG
I/O	-	Input/ Output
CPU	-	Central Processing Unit
ADC	-	Analog to Digital Conversion
UV	-	Ultra Violet
LED	-	Light Emitting Diode
IR	-	Infrared
PCB	-	Print Circuit Board

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CHAPTER 1

INTRODUCTION

This thesis is about Autonomous mobile robot and can be divided into three functional elements: a sensing system, a planning system, and an execution system. This includes path planning and obstacle avoidance, which have been research topics since the beginning of robotics and in particular mobile robotics since the late sixties to early seventies. Why it is still an interesting thing to work in making these machines move? Because real world applications lead to this objectives that are not necessarily met by existing approaches. Mobile robot applications are slowly growing in number and complexity, at least in these technologically advanced countries. This mobile robot has two power supplies producing 5V. This mobile robot consists of three wheels, one is in front and two at the left and right side the robot is equipped with three sensors for the sensing capabilities to ensure the robot will be able to move around without hitting any obstacle. Beside this, a program is also made to make it go forward, backward, left and right turn for the movement. The purpose of this project is to integrate current technology in electronics and control system into this mobile robot. For control, this project implements the BASIC Language, which is very popular nowadays.

1.1 BACKGROUND PROJECT

1.1.1 What is Mobile robot

Mobile robots become very popular on universities and even in public. The need for autonomous capability is growing as mobile robots find an increasingly large number of applications in the areas of manufacturing, hazardous materials handling, fire fighting, military use, surveillance, and many others. The basic task in any such application is the perception of the environment through the uses of one or more sensors. Processing of the sensor input results in a particular representation of the environment, which can then be used for planning actions and controlling the robot. Building and programming a robot is a combination of mechanics, electronics, programming and also problem solving skills.

1.1.2 Application of Mobile Robots

The ability of mobile robot to move around autonomously in their environment determines the best possible applications of such robot tasks that involve transportation, exploration, surveillance, guidance, inspection. In particular, mobile robot are used for application in environments that are inaccessible or hostile to humans.

There is second broad area of applications of mobile robotics ,in the fields of artificial intelligence ,cognitive sciences and psychology .Autonomous mobile robots offer an excellent means of testing hypotheses about intelligent behaviors perception and cognition.

1.1.3 History of Mobile Robotics:

Table 1.1 Table below shows history of Mobile Robotics

Date	Developments
1948-1949	W. Grey Walter builds Elmer and Elsie, two autonomous robots that looked like turtles. Officially they were called Machina Speculatrix because these robots liked to explore their environment. Elmer and Elsie were equipped with a light sensor, if they found a light source they would move towards it, avoiding or moving obstacles on their way. These robots demonstrated that complex behavior could arise from a simple design, Elmer and Elsie only had the equivalent of two nerve cells. [1]
1969	Mowbot was the very first robot that would automatically mow the lawn. [2]
1970	The Stanford Cart line follower was a mobile robot that was able to follow a white line, using a camera to see. It was radio linked to a large mainframe that made the calculations. [3] At about the same time (1966-1972) the Stanford Research Institute is building and doing research on Shakey, a robot named after its jerky motion. Shakey had a camera, a rangefinder, bump sensors and a radio link. Shakey was the first robot that could reason about its actions. This means that Shakey could be given very general commands, and that the robot would figure out the necessary steps to accomplish the given task. The Soviet Union explores the surface of the Moon with Lunokhod 1, a lunar rover.

1980	The interest of the public in robots rises, resulting in robots that could be purchased for home use. These robots served entertainment or educational purposes. Examples include the RB5X [4], which still exists today and the HERO series. The Stanford Cart is now able to navigate its way through obstacle courses and make maps of its environment.
1987	Hughes Research Laboratories demonstrates the first cross-country map and sensor-based autonomous operation of a robotic vehicle. [2]
1993-1994	Dante I [5] and Dante II [6] were developed by Carnegie Mellon University. Both were walking robots used to explore live volcanoes.
2001	Start of the Swarm-bots project. Swarm bots resemble insect colonies. Typically they consist of a large number of individual simple robots, that can interact with each other and together perform complex tasks. [7]
2004	Robosapien, a biomorphic toy robot designed by Mark Tilden is commercially available. In 'The Centibots Project' 100 autonomous robots work together to make a map of an unknown environment and search for objects within the environment. [8] In the first DARPA Grand Challenge competition, fully autonomous vehicles compete against each other on a desert course.
2006	Sony stops making Aibo and HelpMate halts production, but a lower-cost PatrolBot customizable autonomous service robot system becomes available as mobile robots continue the struggle to become commercially viable. The US Department of Defense drops the MDARS-I project, but funds MDARS-E, an

	autonomous field robot. TALON-Sword, the first commercially available robot with grenade launcher and other integrated weapons options, is released. [9]. Honda's Asimo learns to run and climb stairs.
2007	History is made with the DARPA Urban Grand Challenge, with six vehicles autonomously completing a complex course involving manned vehicles and obstacles. [3] Kiva Systems clever robots proliferate in distribution operations; these smart shelving units sort themselves according to the popularity of their contents. The Tug becomes a popular means for hospitals to move large cabinets of stock from place to place, while the Speci-Minder [10] with MOBILEROBOTSinside begins carrying blood and other patient samples from nurses' stations to various labs. Seekur, the first widely available, non-military outdoor service robot, pulls a 3-ton vehicle across a parking lot [11], drives autonomously indoors and begins learning how to navigate itself outside. Meanwhile, PatrolBot learns to follow people and detect doors that are ajar.

1.2 OBJECTIVE

The objective of project is to make sure that the project following on the right plan and what the project really want to achieves within the required period.. Besides than it also to ensure the positive progress of the development system and also to ensure that the main objective will be realized. Below are the objectives of the project:-

1. The aim of the designing and constructing the circuit is to fulfilled several objectives that need to be achieved. The mobile robot had to be able to:
   i. Move around the maze
   ii. Sense its location and movements
   iii. Power source to power components

2. To develop the autonomous vehicle utilizing sensors and motors for guided movement.
3. To be operated in maze solution will successfully move forward and backward, left and right turn. Initially, the aim of this project was to design and fabricate a robot capable of small three wheel robot that avoids obstacles which it senses with its active infrared sensors

1.3 PROBLEM STATEMENT

Statement below is the problem that might occur during developing the mobile robot problem will delay and slow the development progress of the project.

Mobile robot applications are slowly growing in number and complexity, at least in technologically advanced countries because nowadays humans want to do an easier thing in their life. This mobile robot has a various application in human life such as housecleaning appliances and other types of robots, to adjust their trajectory according to their surroundings. This mobile robot will help and replacing human energy in our daily life

1.4 SCOPE OF WORK

This involves both hardware and software and requires integration of three elements. The scope of this project is:

1. Design and construction of the hardware part of this robot that fits all motors, controlling and interfacing circuitry, mechanical, electrical and electronics parts

and also sensing devices. The robot structure, locomotion and mechanism are designed and implemented in real hardware.

2. This project also involves the design and construction of a microcontroller board in bootstrap mode using the PIC 16F876A embedded microcontroller and construction of the interfacing circuitry.

3. Software writing for the PIC 16F876A embedded controllers used in this project is also included. The software will be written in BASIC language programming

1.5 METHODOLOGY BRIEFING

Figure 1.1 below illustrates the project methodology:-

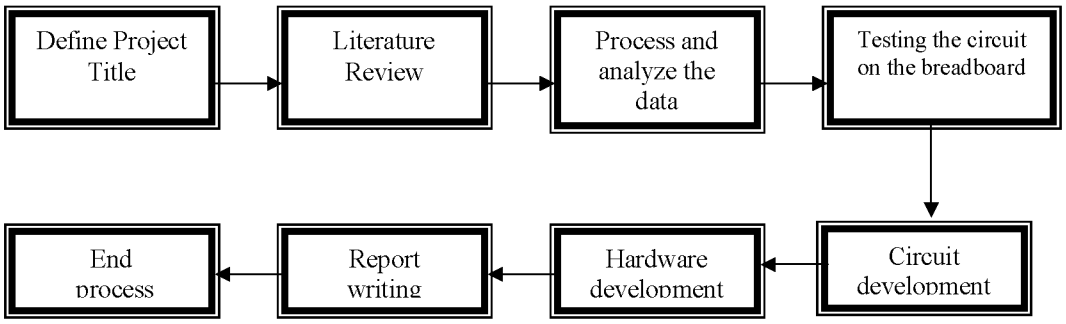

Figure 1.1 Methodology Flowchart

There are few steps used in the project. That include:

1. literature and review

   Study on existing microcontroller programmer is done to design the obstacle avoidance mobile robot. Those materials are searched from journal, articles, application notes and books. The main topic is about the procedure on