

MINI SPY ROBOT

MUZAFFAR BIN MOHAMMAD

This Report Is Submitted In Partial Fulfillment Of The Requirements For
The Bachelor Degree of Electronic Engineering (Computer Engineering)

With Honours

Faculty of Electronic and Computer Engineering

Universiti Teknikal Malaysia Melaka

June 2013



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN

PROJEK SARJANA MUDA II

Tajuk Projek : Mini Spy Robot

Sesi Pengajian :

1	2	/	1	3
---	---	---	---	---

Saya MUZAFFAR BIN MOHAMMAD

mengaku membenarkan Laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan () :

SULIT*

*(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

TERHAD**

** (Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

TIDAK TERHAD

Disahkan oleh:

(TANDATANGAN PENULIS)

(COP DAN TANDATANGAN PENYELIA)

Tarikh:

Tarikh:

“I hereby declare that this report is the result of my own work except for quotes as cited in the references.”

Signature :

Author :

Date :

“I hereby declare that I have read this report and in my opinion this report is sufficient in terms of the scope and quality for the award of Bachelor Degree of Electronic Engineering (Computer Engineering) With Honours.”

Signature :.....

Supervisor's Name :.....

Date :.....

Specially dedicated to my beloved parents
Mohammad bin Adom and Rupiah binti Karim,
brother, sisters and all my fellow friends
who have encouraged, guided and inspired me throughout my journey of education

ACKNOWLEDGEMENT

In the name of Allah S.W.T, the most Merciful and the most Gracious

Alhamdulillah, a lot of thanks to Allah S.W.T for His blessing for me to complete my Final Year Project and this thesis is symbolic of the support and guidance that I get from all my family and friends.

First and foremost, I would like to express my heartily gratitude to my supervisor, Engr. Khairul Muzzammil bin Saipullah for the guidance and enthusiasm given throughout the progress of this project.

My appreciation also goes to my family who has been so tolerant and supports me all these years. Special thanks for their encouragement, love and emotional support that they had given to me.

I also would like to thank to those who has given the constructive comments and ideas in completing this project and I hope this project could give the advantages and knowledge for all the readers.

ABSTRACT

Mini Spy robot is the robot that has ability to spy and to survey the environment or situation at certain place using wireless camera. The visual gathering from the spy robot can be viewed by human directly. The small mini camera was used to transmit video wirelessly to PC for post analysis of the video. The robot also can be controlled wirelessly using application Personal Computer or Laptop. It is also equipped with some sensors to avoid dangerous route. The robot is powered by PIC microcontroller and Mini C-100B for camera processing in the microcontroller and application. The goal of this project is to construct a mini robot which would help to monitor all the thing through a camera and develop the movement of the robot via wirelessly control using application in computer using Bluetooth transmission. There have several processes to construct the robot which simulation, fabrication, testing and programming and it divide by two parts that is Hardware and Software. The movement of the robot controlled using windows application using visual basic. The Robot only move forward, backward or turn left and right if the windows application controller on computer transmit the signal through to the receiver of the robot and my project upgraded with Infrared Detector (IRD) sensor which used to detect obstacle in front and behind of it. When something block in front of it, the robot automatically move away to the other side without collide.

ABSTRAK

Mini Spy Robot adalah robot yang berkeupayaan untuk mengintip dan melihat persekitaran sekeliling atau situasi dengan menggunakan kamera kecil tanpa wayar. Kamera kecil ini yang dapat menghantar isyarat analog video tanpa wayar kepada komputer untuk menganalisis video tersebut. Robot ini juga boleh dikawal secara tanpa wayar menggunakan perisian sistem pada komputer riba. Ia juga dilengkapi dengan beberapa sistem pengesan yang dapat mengesan halangan atau bahaya dihadapan and dikawal oleh micropengawal serta perisian sistem bagi pemprosesan video. Kepentingan bagi projek ini adalah untuk membina sebuah robot bersaiz kecil yang dapat melihat disekelilingnya menggunakan kamera dan membangunkan perisian sistem yang boleh mengawal pergerakan robot tanpa wayar dengan menggunakan isyarat perhubungan teknologi Bluetooth. Terdapat beberapa peringkat dalam pembinaan projek ini terutama dalam proses simulasi, fabrikasi, pengujian dan pengaturcaraan serta ia dibahagikan kepada dua bahagian iaitu Perkakasan dan Perisian. Robot ini dikawal dengan menggunakan perisian aplikasi dari *visual basic* untuk bergerak ke hadapan, belakang, kiri dan kanan serta dilengkapi alat pengesan halangan yang dapat mengesan halangan dari bahagian hadapan dan belakang. Apabila halangan dapat dikesan secara automatik robot akan bertindakbalas dengan bergerak ke arah sebaliknya tanpa bersentuhan atau berlanggar dengan halangan tersebut.

TABLE OF CONTENTS

CHAPTER	CONTENT	PAGE
	PROJECT TITLE	i
	DECLARATION	iii
	DEDICATION	v
	ACKNOWLEDGEMENTS	vi
	ABSTRACT	vii
	ABSTRAK	viii
	TABLE OF CONTENTS	ix
	LIST OF TABLES	xiii
	LIST OF FIGURES	xiv
	LIST OF ABBREVIATIONS	xvii
	LIST OF APPENDIX	xviii
I	INTRODUCTION	
	1.1 Project Overview	1
	1.2 Problem Statement	2
	1.3 Objectives	3
	1.4 Scope	3
	1.5 Project Outline	4

II LITERATURE REVIEW

2.1 Introduction	5
2.2 Previous Review	6
2.2.1 Autonomous Robot	6
2.2.2 Mobile Operated Robot	7
2.2.3 Unmanned Robot	9
2.2.4 Obstacle Sensing Robot	9
2.2.5 Rescue Robot	10
2.3 Types of Wireless Controller	10
2.3.1 Bluetooth Technology	10
2.3.2 Zigbee Technology	11
2.3.3 Radio Frequency Technology	11
2.3.4 Infrared Technology	12
2.4 Comparison between Wireless Technologies	12
2.5 Advantages of using Bluetooth Technology	13
2.6 Conclusion	14

III PROJECT METHODOLOGY

3.1 Introduction	15
3.2 Research Methodology	16
3.2.1 Literature Review	17
3.2.2 Study and Research	17
3.2.3 Design Robot	17
3.2.4 Program and Testing	18
3.2.5 Design Windows Application Controller	18
3.2.6 Testing and Troubleshooting	18
3.2.7 Hardware Setup and Preparation	18
3.3 Methodology of Mini Spy Robot	19
3.4 Hardware Development	20
3.4.1 Design Circuit	20

3.4.2 Simulation	20
3.4.3 PCB Fabrication	27
3.4.4 Soldering	29
3.4.5 Microcontroller	30
3.4.6 Motor Controller	32
3.4.7 IR Detector Sensor	34
3.4.8 Bluetooth Module	36
3.4.8.1 Hardware System Configurations	37
3.4.8.2 System Data Flow	37
3.4.8.3 Rules of KC-21 Bluetooth Module	38
3.5 Software Development	39
3.5.1 Flow Chart to make a programmed	39
3.5.2 Microsoft Visual Basic 2010	41
3.5.3 Windows Application System Testing	42
3.5.3.1 Startup with executable file	42
3.5.3.2 Connect to KcSerial	44
3.5.3.3 Communicate using COMPORT	47
3.6 Bluetooth Robot Monitoring System Operation	48
3.7 Firmware Description	51
3.8 Run the program from Microsoft Visual Basic	53
3.9 Video Transmission	54

IV RESULT, ANALYSIS AND DISCUSSION

4.1 Introduction	56
4.2 Result	56
4.2.1 Bluetooth Robot Monitoring System v1.0	57
4.2.2 Mini Spy Robot	60
4.3 Analysis	63
4.3.1 Why I use Bluetooth Controller?	63
4.3.2 Why I use Windows Application?	64
4.4 Discussion	64

V	CONCLUSION	
	5.1 Conclusion	66
	5.2 Recommendation	67
	REFERENCES	68
	APPENDIX A	69
	APPENDIX B	73
	APPENDIX C	78
	APPENDIX D	83
	APPENDIX E	85

LIST OF TABLE

TABLE NO.	TITLE	PAGE
2.4	Comparison between Bluetooth, Zigbee, RF and IR Technology	12
3.4.5	Configuration of PIC 16F877A I/O pin	32
3.4.6 (i)	Left Motor declaration port on PIC	33
3.4.6 (ii)	Right Motor declaration port on PIC	33
3.4.6 (iii)	Condition ON/OFF motor	33
4.2.1	Keyboard Control Movement	59
4.2.2	LCD display and condition of robot	61

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
2.2.2(i)	Mobile Operated Robot Flow	7
2.2.2 (ii)	Mobile application to control the robot	8
3.2	Project Methodology Flow Chart	16
3.3	Process flow of Mini Spy Robot	19
3.4.2 (i)	Microcontroller Schematic Design	21
3.4.2 (ii)	Microcontroller PCB Layout	22
3.4.2 (iii)	Microcontroller Positive Artwork	22
3.4.2 (iv)	Dual IRD Sensor Schematic Design	23
3.4.2 (v)	Dual IRD Sensor PCB Layout	23
3.4.2 (vi)	Dual IRD Sensor Positive Artwork	24
3.4.2 (vii)	IRD Sensor Schematic Design	24
3.4.2 (viii)	IRD Sensor PCB Layout	24
3.4.2 (ix)	IR Sensor Positive Artwork	25
3.4.2 (x)	Motor Control Schematic Design	25
3.4.2 (xi)	Motor Control PCB Layout	26
3.4.2 (xii)	Motor Control Positive Artwork	26
3.4.3 (i)	PCB Fabrication Process	28
3.4.3 (ii)	Drilling Process	28
3.4.4	Soldering Process	29

3.4.5 (i)	Microcontroller Board	30
3.4.5 (ii)	Figure of Micro Controller PIC 16F877A	31
3.4.6	Motor Controller Board	32
3.4.7 (i)	IRD Sensor board	34
3.4.7 (ii)	IR Detector Sensor	35
3.4.8 (i)	KcSerial v1.2 Bluetooth Module	36
3.4.8.1	Physical Connection Connection between Host Platform and Wirefree Serial Interface	37
3.4.8.2	Data Flow between KcSerial, Host, and Remote Bluetooth Device	38
3.5.1	Mini Spy Robot Program Flow Chart	39
3.5.2	Bluetooth Robot Monitoring System v1.0 Design	41
3.5.3	The executable file “BluetoothRobotControl.exe”	42
3.5.3.1 (i)	Installation using setup.exe	43
3.5.3.1 (ii)	Comport detail in Device Manager	43
3.5.3.2 (i)	Searching for available device	44
3.5.3.2 (ii)	Select KcSerial Bluetooth Device	45
3.5.3.2 (iii)	The Comport prompt on the screen.	45
3.5.3.2 (iv)	Successive connect the wireless KcSerial	46
3.5.3.3 (i)	Installing KcSerial with Comport	47
3.5.3.3 (ii)	Comport number installed	47
3.6 (i)	Offline Bluetooth Robot Monitoring System v1.0	48
3.6 (ii)	Selecting interface comport in Bluetooth Robot Monitoring System v1.0	48
3.6 (iii)	Back Sensor detected	49
3.6 (iv)	Right Sensor detected	49
3.6 (v)	Left Sensor detected	50
3.6 (vi)	When the button forward was been clicked	51
3.7 (i)	Firmware Description of Bluetooth Robot Control	52
3.7 (ii)	Firmware description of Bluetooth Robot Monitoring System v1.0	52
3.8	Debug and compile all codes in Visual Basic	53
3.9 (i)	Radio AV Receiver for Mini C-100B Camera	54

3.9(ii)	Mini C-100B Camera	55
4.2.1 (i)	Bluetooth Robot Monitoring System v1.0 with Offline Mode	57
4.2.1 (ii)	Bluetooth Robot Monitoring System v1.0 with Online Mode	58
4.2.1 (iii)	Bluetooth read serial characters system	58
4.2.2 (i)	Mini Spy Robot	60
4.2.2 (ii)	Flow Chart of Bluetooth Connection of Mini Spy Robot	62

LIST OF ABBREVIATIONS

PC	-	Personal Computer
IRD	-	Infrared Detector Sensor
PCB	-	Printed circuit board
DTMF	-	Dual Tone Multi Frequency
I/O	-	Input/output
UAV	-	Unmanned Aerial Vehicle
RTS	-	Request to Send line (hardware flow control output on UART that stops receiving data)
CTS	-	Clear to Send line (hardware flow control input on UART that allows data)
AT	-	Text based command standard commonly used for modems
BD	-	Bluetooth Device
Bps	-	Bits Per Second
RxD	-	Receive Data line (on UART)
SPP	-	Serial Port Profile
TxD	-	Transmit Data line (on UART)
UART	-	Universal Asynchronous Receiver-Transmitter
PAL	-	Phase Alternating Line
LED	-	Light Emitting Diode

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Mini Spy Robot Figure and Bluetooth Robot Monitoring System V1.0	69
B	Mini Spy Robot Coding	73
C	Bluetooth Robot Monitoring System Coding	78
D	Poster during seminar PSM 2	83
E	Gantt chart for PSM	85

CHAPTER I

INTRODUCTION

1.1 Project Overview

Robot there had many types of robot develop each year. Robot can be defined as a mechanical device that sometimes resembles a human and is capable of performing a variety of often complex human tasks on command or by being programmed in advance. A machine that operates automatically or by remote control also can be classified as a robot. This project is a about develop a Mini Spy Robot; it is a mini robot that can see all things in the world using its small mini camera that can be transmitted wirelessly to PC for post analysis of the video. The robot also can be controlled wirelessly using application Personal Computer or Laptop. It is also equipped with some sensors to avoid dangerous route. The important task for this robot used as a spying purposes or replace it as human eyes in difficult situation.

The project design was started with a research and studying about past project development, theory and steps to construct the robot. Then a proper methodology was created as a path to build the project with the right procedure. The project contains in two parts which is hardware development and software development. Each part as there are own process and design. After completed each parts, the result will be combined both parts as a one project called Mini Spy Robot.

1.2 Problem Statement

In the event of explosion, earthquake that made the building collapse or fire broke in the building, people faces several constraints in variety of aspect such as the difficulties in entering the building, and make through several obstacles with small size of hole. Besides that, a bomb is any of a range of explosive weapons that only rely on the exothermic reaction of an explosive material to provide an extremely sudden and violent release of energy (an explosive device). In this situation it hard for us as human to come in to the building that consist of explosive material it can risk our life. When people cannot enter the building, they also cannot see what happened inside the building and know the source or type of explosion material used or trapped people inside.

Others else, nowadays it seems in recent years being busy has become the rule rather than the exception. Busy lifestyle parents in taking care of baby or other things to watch every moment it is hard to do. Lifestyle working from both mom and dad has become trend in metropolis city. Monitoring camera device display can help the busy parent or others in monitor the situation in a baby room, living hall or private room in a short distance control used only on the laptop.

1.3 Objectives

The objectives of this project are:

- i. To design and construct a mini robot which would help to monitor all the things through a camera.
- ii. To develop the movements of the robot via wirelessly control using application in computer.
- iii. To design a robot that is controlled using Windows application.

1.4 Scope

The scope of this project is to design a mini spy robot and it is divided into two parts which is hardware and software. Hardware part consists of motor, microcontroller, communication, visual, and sensor. Software consists of Embedded Programming and Windows Programming. Embedded Programming is for microcontroller that needs to be program for control all the connection input and output circuit. Windows Programming is a part of to develop the wireless windows controller using visual basic software. The motor that i used are servo motor to control the movement of the robot. The communication is Bluetooth Technology that controls the signal of movement between robot and application. Hardware visual is part of camera that sends analog video in radio frequency through the personal computer application as output. There has there IR Detector sensor were used to detect obstacle from being collide.

1.5 Project Outline

This thesis comprises of five chapters. The first chapter briefly discusses the overviews about the project such as introduction, objectives, problem statements and scope of this project.

Chapter 2 describes about the research and information about the project. Every facts and information, which found through by any references had been selected. This literature review has been explained about the mini spy robot.

Chapter 3 will discuss about the project methodology used in this project such as hardware process, programming, and software. All these methodology should be followed for a better performance.

Chapter 4, describe about the discussion and project finding such as the result and analysis. The result is presented by simulation of software and hardware. The software from visual basic that has been designed and hardware that completely connected presented in this chapter.

Finally the conclusion has been made and recommendation for the future works. The recommendation is added to give an opinion and also an improvement on how the future works should have done.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

Conducting the literature review is done prior to undertaking the project. This will critically provide as much information as needed on the technology available and methodologies used by other research counterparts around the world on the topic. This chapter provides the summary of literature reviews on topics related to spy robot or robot that has capability to survey the environment via wireless vision system including robot with obstacle sensor, autonomous robot, mobile robot, unmanned robot and comparison between wireless controller technologies.

2.2 Previous Review

2.2.1 Autonomous Robot

Based on my researches, “Autonomous Robot” is a robot which can perform desired tasks in unstructured environments without continuous human guidance. Many kinds of robots have some degree of autonomy. Different robots can be autonomous in different ways. A high degree of autonomy is particularly desirable in fields such as space exploration, where communication delays and interruptions are unavoidable. Other more mundane uses benefit from having some level of autonomy, like cleaning floors, mowing lawns, and waste water treatment.

Some modern factory robots are “autonomous” within the strict confines of their direct environment. Maybe not every degree of freedom exists in their surrounding environment but the work place if the factory robots is challenging and can often be unpredictable or even chaotic. The exact orientation and position of the next project of work and (in the more advanced factories) even the type of project and the required task must be determined. This can vary unpredictably (at least from the robot’s point of view) [1].

One important area of robotics research is to enable the robot to cope with this environment whether this is on land, underwater in the air, underground, or in space.

A fully autonomous robot has the ability to:-

- i. Gain information about the environment.
- ii. Work for an extended period without human intervention.
- iii. Move either all or part of itself throughout its operating environment without human assistance.
- iv. Avoid situations that are harmful to people, property, or itself.