

LIBRARY ASSISTANT ROBOT

NOOR AZLI BIN MOHD BAHARDEN

This report is submitted in partial fulfillment of the requirement for the award of
Bachelor of Electronic Engineering (Industrial Electronic) With Honours

Fakulty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka

April 2010



UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

**BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II**

Tajuk Projek : Library Assistant Robot

Sesi Pengajian : 2009/2010

Saya NOOR AZLI BIN MOHD BAHARDEN 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 (\checkmark) :

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 :.....
Name : Noor Azli bin Mohd Baharden
Date : 6 April 2010

“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 award of Bachelor of Electronic Engineering (Industrial Electronic) With Honours.”

Signature :

Name : En Ridza Azri bin Ramlee

Date :

ACKNOWLEDGEMENT

I gratefully acknowledge the assistance, support and encouragement of those individuals who have contributed either directly or indirectly in this final year project. Specifically, I wish to express my sincere gratitude and appreciation to my project supervisor, En Ridza Azri bin Ramlee for all her wisdom, guidance, critics and patience during the course of this project. For that, I am truly grateful and it's a privileged to work under her wings.

Besides that, I would like to thank Universiti Teknikal Malaysia Melaka (UTeM) for having me, to be a part of its family member although for short couple of years. I will always cherish the experienced I gain throughout this course and project. Not forget, to all my friends and course mates that have provided whether an idea or support, I tremendously acknowledge their direct or indirect supports and help.

Last but not least, my utmost thanks to my beloved parents and families who have gave me support throughout my academic years and also special thanks to all individuals who have directly or indirectly offered help, suggestions and support in bringing towards the completion of this project. Thank you so much.

PENGHARGAAN

Syukur kehadiran yang Maha Esa, dengan limpah karunia-Nya yang berterusan dari awal hinggalah ke akhir perjalanan projek ini saya dapat menyelesaikannya dengan baik dan lancar mengikut perancangan yang telah disusun sejak awalnya. Dalam ruangan yang ringkas ini, saya ingin mengucapkan jutaan terima kasih kepada mereka yang telah memberi kerjasama samada secara langsung atau sebaliknya. Ucapan terima kasih saya tujukan kepada Encik Ridza Azri bin Ramlee selaku penyelia PSM saya atas tunjuk ajar, kerjasama, nasihat dan bimbingan secara berterusan dalam memastikan PSM saya dapat disiapkan dengan baik.

Setinggi-tinggi penghargaan kepada Pihak Universiti Teknikal Malaysia Melaka, kerana memberi peluang untuk menjadi sebahagian ahli walaupun untuk masa yang singkat. Saya akan mengambil peluang dalam kelebihan yang disediakan, tidak lupa kepada sahabat dan rakan-rakan yang memberi idea dan nasihat.

Akhir sekali kepada keluarga saya yang memberi sokongan dalam akademik sepanjang tahun. Dan juga kepada sesiapa yang terlibat dalam menjayakan Projek Sarjana Muda in. Kerjasama yang diberikan amatlah saya hargai. Sekian dan Terima kasih.

ABSTRACT

The main objectives of this project are to build a design the Library Assistant Robot which has the capability to send the book at their place. This robot also can be assistance handling to send the book at high place because this robot has CCTV or camera for watching and has mechanism to transfer the books to it shelf. This robot's action will be monitoring using PS2 Wireless and Personal Computer (PC) by human's control. This robot is combining between hardware and software to control it. The purpose of Library Assistant Robot is to increase the work's management, reduce time rating and energy of worker in the library. Thus, a safety environment and journey was existed. The function of software which is the visual basic programming sixth (VB6) will be control all action of robot such as left, right, back, forward, push and pull. Then, the function of hardware will be action with provide combination mechanical system, electronic and electric system, motor system, and other system which is to guidelines for setting up Personal Computer (PC) and PS2 wireless to communicate with robot. The signal will transmit and receive by using transmitter, receiver and Bluetooth from the PS2 wireless circuit. The transmitter is located by combined between PS2 control and parallel port circuit. The receiver is located in the robot which is in PS2 Wireless circuit. The received signal is analyze and will activate the Bluetooth. Bluetooth is another part that a device an open wireless protocol for exchanging data over short distances from fixed and mobile devices, creating the wireless communication is the transfer of info over a distance without the use of electrical conductors or wires. So the Library Assistant Robot can be easy, flexible and suitable to use everywhere such as industry.

ABSTRAK

Objektif utama projek ini adalah untuk membina satu set Pembantu Robot Perpustakaan yang mampu menghantar buku-buku dan menyusun ia pada tempat yang telah disediakan. Robot ini juga boleh membantu mengawal dan menghantar buku pada tempat yang tinggi kerana robot ini mempunyai kamera tertutup untuk memerhati dan mempunyai mekanisma untuk mengangkat buku dan menolak ia pada rak-rak yang disediakan. Segala tindakan dan pengawalan robot akan dikawal oleh seseorang melalui komputer. Robot ini adalah hasil dari gabungan perkakasan dan perisian untuk mengawal ia. Tujuan Pembantu Robot Perpustakaan ini juga adalah untuk menambah pengurusan pekerjaan, mengurangkan julat masa bekerja serta tenaga kerja yang diperlukan didalam perpustakaan. Disamping itu, keselamatan suasana persekitaran juga diambil kira. Fungsi perisian iaitu “Visual Basic 6” adalah untuk mengawal segala tindakan robot seperti pergerakan ke kiri, ke kanan, ke belakang, ke hadapan, dan sebagainya. Disamping itu, fungsi perkakasan adalah untuk mengawal tindakan robot dengan menggabungkan sistem mekanikal, sistem elektronik dan elektrik, sistem motor, dan sistem lain untuk mengawal perhubungan robot dengan komputer. Isyarat akan dihantar dan diterima melalui penggunaan alat penghantaran, alat penerimaan dan alat “Bluetooth”. Isyarat penerimaan akan dikenalpasti dan akan menghidupkan “Bluetooth”. “Bluetooth” adalah bahagian lain iaitu alat perhubungan menghantar dan menerima diluar kawalan jarak tanpa menggunakan pengalir elektrik atau wayar. Jadi ia sangat mudah, fleksibel, dan sesuai diguna dimana-mana kawasan seperti di industri.

CONTENT

CHAPTER	TITLE	PAGE
	TITLE OF PROJECT	
	DECLARATION	iii
	SUPERVISOR AUTHENTICATION	iv
	ACKNOWLEDGEMENT	v
	PENGHARGAAN	vi
	ABSTRACT	vii
	ABSTRAK	viii
	CONTENTS	ix
	LIST OF TABLE	xiii
	LIST OF FIGURE	xiv
	LIST OF SHORT SIGN	xvii
	APPENDIX LIST	

CHAPTER	TITLE	PAGE
I		
INTRODUCTION		
1.1	Project Introduction	1
1.2	Project Objectives	3
1.3	Problem Statement	4
1.4	Work scope	5
1.5	Methodology	6
1.6	Report structure	8
II		
LITERATURE REVIEW		
2.0	Background Study	9
2.1	Software	
2.1.1	Desktop computer and laptop	10
2.1.2	Visual Basic Programming	10
2.1.3	Parallel port tester	14
2.1.3.1	Parallel Port Background	15
2.1.3.2	Parallel Port Overview	15
2.1.3.3	Connection of the Parallel Port	19
2.1.3.4	How the signal is send through to the Parallel Port	19

CHAPTER	TITLE	PAGE
2.2	Hardware	
2.2.1	Robot platform selection	20
2.2.2	Motor Speed Control Methods	21
2.2.3	Balancing Robot	24
2.2.4	The circuit to Control Library Robot	
2.2.4.1	First circuit: TX-2B and RX-2B	28
2.2.4.3	Second Circuit-PS2 Wireless Controller	32
2.2.5	Platform Construction	34
2.2.6	Wireless camera	37
2.2.7	Mechanism of Transfer Book (Forklift)	38
2.2.8	Power and Batteries	39
III		
METHODOLOGY		
3	Background study	41
3.1	Basic Operation	
	First Circuit:	
	(Transmitter and receiver TX-2B and RX-2B)	
3.1.1	Transmitter	45
3.1.2	Receiver	46
3.2	Circuit Design	49
3.2.1	The operation of transmitter circuit	49
3.2.2	Receiver Circuit Design	50

CHAPTER	TITLE	PAGE
3.3	Several component descriptions:	
3.3.1	Transmitter TX-2B	52
3.3.2	Receiver RX-2B	53
3.3.3	Relay controlling Circuit	54
3.3.4	Transistor	57
3.3.5	Application on both relay and transistor in circuit	59
3.3.6	Capacitor	59
3.3.7	Resistor	60
3.3.8	Inductor	61
3.3.9	XTAL oscillator	62
3.3.10	Diode	63
3.4	Simulation Test (First circuit- TX-2B and RX-2B)	64
3.4.1	Testing the circuit on board	65
3.4.2	Testing circuit	66
3.4.3	Troubleshooting	66
3.5	The second Circuit: (PS2 Wireless Controller)	67
3.5.1	The Function and Description of Port Assignment	69
3.5.2	Test the circuit	74
3.6	Hardware Test	75
3.6.1	Mechanical test	75
3.7	Structure of Methodology	77

CHAPTER	TITLE	PAGE
IV		
RESULT AND ANALYSIS		
4	Introduction	79
4.1	Final Software result	79
4.2	Results for Robot Movement	80
4.3	Hardware Test	81
V		
DISCUSSION		83
CONCLUSION		85
RECOMMENDATION		86
REFERENCES		87

LIST OF TABLE

TABLE	TITLE	PAGE
1.1	The time working of librarian to transfer books to it shelf	3
2.1	Operation motor	15
2.2	Parallel Port Overview	16
2.3	Parallel Port Pins	18
2.4	Data Pin and Value (Decimal, Binary)	21
2.5	Electrical characteristic of TX-2B and RX-2B	33
2.6	Function and Description of Port Assignment of PS2	72
2.7	I/O Terminal JP9	74
2.8	I/O Terminal JP10	74
2.9	Power Terminal JP14	74
2.10	PWM Terminal (TBPWM)	75
2.11	PS2 Interface (PS2CON)	75
2.12	Pins Assignment	75

LIST OF FIGURE

FIGURE	TITLE	PAGE
1.1	Block Diagram of Robot System	2
1.2	The flow chart of general process in developed this project	7
2.1	Model of Laptop	10
2.2	The examples of visual basic programming	11
2.3	If/Else/Then flowchart	14
2.4	Parallel Port Tester	17
2.5	SNES - Parallel Port Interface	19
2.6	Robot Controller	21
2.7	The Drive's Assembly	22
2.8	Set of Power Windows	23
2.9	Structure of H-Bridge Circuit	24
2.1	The Two Basic Stage of The H-Bridge Circuit	24
2.11	Sample of Balancing Two Wheels to Robot	25
2.12	Balancing Two wheels of Library Robot by using power Window	25
2.13	Balancing Two wheels of Library Robot	26
2.14	The Inverted Pendulum on Cart System and The External Forces Acting on The System	27
2.15	Free-Body Diagram of The Cart	28
2.16	The Type of IC Transmitter TX-2B	30
2.17	The IC of Transmitter TX-2B (node)	30
2.18	The type of IC Receiver RX-2B	32

2.19	The IC of Receiver RX-2B (node)	32
2.2	The PS2 Wireless Board	34
2.21	PS2 Wireless Controller Interface Board	35
2.22	Example of Prototype with 3 tires	36
2.23	Platform Construction of Library Robot	36
2.24	The Drawing of Library Robot	37
2.25	The Wireless Camera	38
2.26	Examples of Mechanism of Transfer Book (Forklift)	40
2.27	Mechanism to Transfer Book (Forklift) of Library Robot	40
2.28	Example of Battery (12Volt)	41
2.29	The Battery (12Volt) Connect to Circuit Board	41
3.1	The flow operation of Robot	44
3.2	Methodologies Drawing to Produce Result	45
3.3	Detail Methodologies Drawing to Design and Develop This Project	46
3.4	Transmitter Process	47
3.5	Receiver Process	48
3.6	Transmitter Circuit	50
3.7	The Receiver Circuit	53
3.8	Transmitter TX-2B	54
3.9	The RX-2B Receiver	55
3.1	The Example of Relay	56
3.11	Schematic Circuit of Relay Position	57
3.12	Operation of Relay	58
3.13	The Transistor's Operation	61
3.14	The example capacitor	63
3.16	The Simple Circuit Diagram, Calculation and Resistor	64
3.17	The Simple Circuit diagram, Calculation and the example of Inductor	65

3.18	The example of XTAL Oscillator	66
3.19	The example of Diode	67
3.2	Receiver testing	68
3.21	PS2 Interface Board (Model: AD_PS2_INT V1)	71
3.22	Example of Loads Wiring	76
3.23	The Testing Hardware with using PS2 Wireless Controller	77
3.24	Power window and wheel	78
3.25	Mechanism to Transfer the Book	79
4.1	Interface Visual Basic	82
4.2	Flow chart for Robot Movement	83
4.3	The Testing of the component	84
4.4	Robot from top view	85
4.5	Robot from side view	85

LIST OF SHORT SIGN

USB	- Universal Serial Bus
SIT	- Static Induction Transistor
ROM	- Read Only Memory
ROBOCON	- Robot Contest
RISC	- Reduced Instruction Set Computer
RAM	- Random Access Memory
PWM	- Pulse Width Modulation
PSM	- Projek Sarjana Muda
PROM	- Programmable Read-Only Memory
PIC	- Peripheral Interface Controller
MOSFET	- Metal Oxide Semiconductor Field Effect Transistor
LED	- Light Emitter Diode
LCD	- Liquid Crystal Display
IC	- Integrated Circuit
GPS	- Global Positioning System
EPROM	- Erasable Programmable Read-Only Memory
EEPROM	- Electrically-Erasable Programmable Read-Only Memory
DC Motor	- Direct Current Motor
BJT	- Bipolar Junction Transistor
PCB	- Printed Circuit Board

CHAPTER I

INTRODUCTION

The main purpose of producing this document is to precisely report the simulation and design a Library Assistant robot. For this chapter is included about project introduction, objectives, problem statement, scope, methodology, and report structure of the project.

1.1 Project Introduction

At the library, some of problem will happen such as decrease of librarian. We know the librarian will send, arrange and put the book at their place. This project is to design the robot which has the capability to send the book at their place. This robot also can be assistance handling to send the book at high place because this robot has CCTV or camera for watching and has mechanism to transfer the books to it shelf. This robot's action will be monitor using PC by human's control. This robot combined between hardware and software to control it. The methodologies of this

project are divided into two parts. The first part is software. This project is designed for use with Visual Basic programming (VB6). This programming will control all actions of the robot such as left, right, back, forward and so on. The signal will be transmitted and received by using a transmitter, receiver and Bluetooth. The second part is hardware. This robot will be constructed with a combination of mechanical, electronic and electric systems, motor system, and platform system which are guidelines for setting up a PC to communicate with the robot.

There are two basic parts in the process of the robot:

- 1) The first part is software. This project is designed for use with Visual Basic programming (VB6) and Bluetooth.
- 2) The second part is hardware such as system platform, system communication, system mechanical, system electronic and system electric, motor and so on.

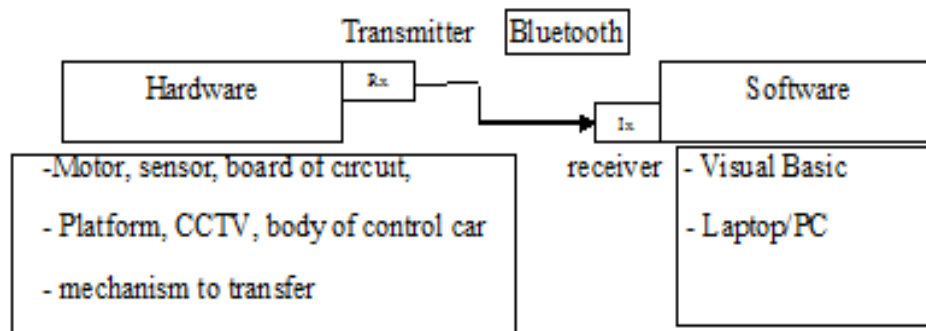


Figure 1.1: Block Diagram of Robot System

1.2 Project Objectives

This main objective of this project is to study the technique concept, performance, and process a Library Assistant robot. So, it must be design a robot which has the capability to take the book and send it at their place. Besides that, it can be assisting handling to send the book at high place. This project is to design a robot has CCTV or camera for watching and has mechanism to transfer the books to it shelf for transfer the book by Personal Computer's (PC) handling.

For software, this project will be development a programming of Visual Basic (VB6) to control all action of the robot. This program will be control all action of robot such as left, right, back, forward and so on. The other objective is to apply the electronic and electric system such as wiring; mechanical system such as motor; communication system such as transmitter, receiver and Bluetooth. The signal will transmit and receive by using transmitter, receiver and Bluetooth. It will combine to system robot's action.

So, this project can help the librarians or someone to spend the time, energy and easy to do work with effective. Besides that, this project can use any application in our life.

1.3 Problem Statement

Person	Distance (meter)	Time (second)	Quantity (Book)
Librarian 1	30m	60s	4 pcs
Librarian 2	30m	120s	8 pcs
Librarian 3	30m	240s	12 pcs
Librarian 4	30m	360s	16 pcs

Table 1.1: The time working of librarian to transfer books to it shelf

Table 1.1, show the time working of librarian to transfer books to it shelf in the Library University of Technical Malaysia Melaka. From the table, number of librarian,

distance from staff's office to the place of book or shelf, time that taken, and the quantity of book. At the same distance, every librarians have been taken different time with different quantity of book. So, from this table we know the librarians have a problem in their work. When the librarian take more book to transfer at it shelf, the more time will be take. Maybe the weight of book will give some effect to their work.

The other problem is decrease of librarian in library can give bad effect to the student. For examples, if the student want borrow book and other student want to use internet, print, and Photostats, but at the same time the librarian want to transfer book at shelf, so this environment can give more problem to both of them, especially in time of service. So, according to this surveyed and researched, the idea to solve this problem was by with this project, the librarian can handle their work by laptop or personal computer to transfer the book. At the same time they can do other service to student. So, it can give more easily, effectives and improve the performance.

The designing goals for this project:

1. To design a programming of robot by using visual Basic .
2. To design a base of robot, a body of robot, a mechanism for transfer book, a mechanism for pushes books.
3. To setup the camera or CCTV of robot that can watch with clear.
4. To create and setup the transmitter, receiver and Bluetooth to communicate between PC and robot's action
5. To simulate and test the all function of software and hardware
6. To minimize system complexity, computational load and system cost

However, the goals in design a robot are clearly in conflict when there are several constraints and theoretical limitations that seem to be very hard to avert. To carry out this project, the knowledge requirements are basic knowledge of Visual Basic software. Besides that, the knowledge and theoretical of robot must be learn and study. In this project, an interaction between software and hardware the system performance is presented and considered.

1.4 Work Scope

In order to ensure that the project can be implemented successfully, the following scopes are listed. The final result of this project is fully based on the listed scope. The work scope of this project is to design a robot which has the capability to take the book and send it at their place. Then, this robot can be assisting handling to send the book at high place. It also to design a robot has CCTV or camera for watching and has a mechanism for transfer the book at it shelf by Personal Computer's (PC) handling. The first scope of this project is, their definition, characteristic, function, application, and how to design a Library Assistant robot are finding out by doing several researches on literature review. The system electric and electronic, system mechanical, system motor, transmitter and receiver, Bluetooth must be study and understand. After that, a programming of Visual Basic (VB6) is design to control all action of the robot such as right, left, forward, and back. Besides that, the suitable transmitter and receiver are selected to communicate between robot and PC. The programming must be testing on the simulation. Researched is done to gained knowledge about the system robot. After that, the circuit is designed base on function of robot. The main component to build and design that robot must be choose and locate at their body. Then, the circuit is tested on the test board in order to get the required result. The circuit and software must be analyze the simulation result and examine the relationship of software's function and hardware's function. The last part is fabrication of the circuit through etching process and soldered of component on PCB. The testing of robot is done experimentally in laboratory.

1.5 Methodology

This project flow will be documented starting July 2009 until the completion of the project in 30 April 2010. Figure 1.1 shows the flow chart of general process in developed this project. This project is carried out step by step. Firstly, the literature review must be study. All the information and suitable input that describes of robot techniques characteristic, application are researched from books journal, articles, technical report and internet online. After understood all the related concepts, innovation of previous system Library Assistant Robot is design. Then, the circuit of robot is designed. After all the designing process is done, the circuit test on test board is done by laboratory test. Simulation process cannot be done for these circuits because of there are several components that not included in the circuit software. After the test is satisfied, the circuit is fabricated. Lastly, the prototype is tested and measured in laboratory.