

WIRELESS MOBILE ULTRASONIC DETECTOR

MUHAMMAD AB. BASITH B ABD. RAZAK

This thesis is submitted as partial fulfillment of the requirements for the award of the
Bachelor of Electrical Engineering (Hons.) (Electronics)

Faculty of Electrical & Electronics Engineering
Universiti Malaysia Pahang

NOVEMBER, 2008

ACKNOWLEDGEMENT

First of all, I am very grateful to God for giving me the opportunity to finish this Final Year Project that is one of the requirements for the award for a degree of Bachelor of Electronic Engineering (Electronics) and also to complete this thesis. After that, thanks a lot to my supervisor, Madam Nurulfadzilah Hasan for her concert, support and more importance thankful for her guidance until this project complete successfully. Without her guidance and advice, I cannot finish this project in time. Besides, thanks to Mr. Zamri because give me some advice about the hardware design during my supervisor leave. Without his guidance, my hardware design circuit will delay about 2 months. So his support and kindness make me impress myself. Next my appreciation to my fellow lecturer and not forgot all my friends for their sharing and helping during I completely finish this project. Last but not list, I would like to thanks to my beloved family especially my sister who give me some support and encouragement and also to all the people around that help me finish this project completely and successful. Finally I'm grateful to God and may God bless all of you. Thanks again for helping me and I do appreciate and remember everything.

ABSTRACT

Nowadays wireless data transmission has become famous method of sending data. There are several types of wireless data transmission such as Frequency Modulation (FM), Amplitude Modulation (AM), wireless data transmission, Bluetooth, satellite communication, wireless broadband and others. All the wireless data transmission used to transmit data inside space platforms. Wireless data transmission method are increasing practically and used everywhere such as video and audio data in television, security data, computer data likes client server, turn on light or in security systems. Because of that, this project is creating to improve the method where the design involves hardware and software. The microcontroller unit MC68HC11A1 is programmed using assembly language and connected to Visual Basic software using serial port DB9. In this project, the wireless system consists of transmitter and receiver module using Radio Frequency (RF) where it is connected to ultrasonic sensor. When the sensor detects the obstacle, it will send the data and receives by the receiver at microcontroller unit. From the microcontroller, the data will display at PC using Visual Basic software. Wireless FM transmitter and receiver module with operating frequency at 433.92 MHz was chose in order to achieve the objective of the wireless communication.

ABSTRAK

Pada masa sekarang penghantaran data tanpa wayar telah menjadi satu kaedah yang terkenal dan selalu digunakan dalam penghantaran data. Penghantaran data tanpa wayar ini mempunyai pelbagai kaedah yang digunakan termasuklah penghantaran data menggunakan modulasi frequency (RF), modulasi amplitude (AM), Bluetooth tanpa wayar, jalur lebar tanpa wayar, komunikasi satelit dan pelbagai kaedah lain yang digunakan sekarang. Semua data yang dihantar menggunakan kaedah penghantaran data tanpa wayar ini adalah di dalam platform angkasa. Penggunaan kaedah ini semakin meluas dikalangan masyarakat dan sering digunakan hari ke hari termasuklah menghantar audio dan video dalam media, maklumat keselamatan, membuka pintu, mengawal kamera, membuka dan menutup lampu automatik dan banyak lagi. Oleh sebab itulah, projek ini dibina bagi menambah penggunaannya, dan cara yang digunakan untuk menyelesaikan projek ini melibatkan gabungan antara rekaan perkakasan dan perisian. Pengawal mikro keluaran Motorola MC68HC11A1 diprogramkan menggunakan 'assembly program' dan disambungkan kepada perisian Visual Basic 6 menggunakan pengantaramuka pelabuhan siri DB9. Dalam projek ini juga, sistem tanpa wayar yang menggunakan modul penghantar dan penerima menggunakan frekuensi radio digunakan dimana penghantar akan disambungkan kepada pengesan ultrasonic. Apabila pengesan berjumpa sesuatu halangan, ia akan menghantar data dan penerima di pengawal mikro akan menerima data tersebut. Daripada data yang diterima, pengawal mikro yang disambungkan kepada PC menggunakan pengantaramuka siri DB9 tadi akan menyalurkan data terus kepada perisian Visual Basic 6 dan akan ditayangkan di PC. Bagi mencapai objective penghantaran data tanpa wayar ini, modul penghantar dan penerima beroperasi menggunakan frekuensi 433.92 MHz.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	TITLE PAGE	
	DECLARATION OF ORIGINALITY AND EXCLUSIVENESS	
	DEDICATION	
	ACKNOWLEDGEMENT	i
	ABSTRACT	ii
	ABSTRAK	iii
	TABLE OF CONTENTS	iv
	LIST OF TABLES	vii
	LIST OF FIGURES	viii
	LIST OF APPENDICES	x
1	INTRODUCTION	
	1.1 Background	1
	1.2 Objective	2
	1.3 Problem statement	2
	1.4 Scope of the project	3
	1.5 Project methodology	4
	1.6 Thesis Outline	4
2	LITERATURE RIVIEW	
	2.1 Air Ultrasonic Transducer 250ST/R180	6

2.2	Radio Frequency	9
2.3	Transmission medium	10
2.4	Transmitter & Receiver module	13
2.4.1	RCT-433-AS transmitter module	13
2.4.2	RCR-433-RP receiver module	15
2.5	Serial Port Interfacing	17
2.5.1	Serial port pins and wires	18
2.6	Microcontroller M68HC11A1	18

3

SYSTEM DESIGN

3.1	Introduction	22
3.2	Hardware design	23
3.2.1	Air Ultrasonic Ceramic	
	Transducers 250ST/R180	24
	Ultrasonic transducer, TX1.	24
	Transistor	25
	CMOS timer IC 7555	26
	Ultrasonic transducer, RX1	27
	IC2 (N1-N3), LM324N –	
	Quadruple operational amplifiers	28
	D1- IN4148 Silicon Epitaxial	
	Planar switching diode	29
3.2.2	Transmitter and Receiver design circuit	
3.2.2.1	The transmitter module	
	with encoder	30
3.2.2.2	The receiver module	
	with decoder	35
3.2.2.3	Antenna design	39
3.2.3	Designing the microcontroller	

	MC68HC11A1P circuit	41
	3.2.3.1 Designing the microcontroller	
	MC68HC11A1P	43
	3.2.3.2 Clock Circuit	44
	3.2.3.3 Reset Circuit	45
	3.2.3.4 Serial communication with	
	Microcontroller	46
	3.2.3.5 WP11 software	48
	3.2.3.6 THRSim 11 Software	49
4	RESULT AND DISCUSSION	
	4.1 Introduction	50
	4.2 Visual Basic (VB) display	51
	4.3 Overall hardware system	52
	4.3.1 Ultrasonic transducer	54
	4.3.2 Transmitter part	55
	4.3.3 Receiver part	56
	4.3.4 Microcontroller part	57
5	CONCLUSION AND RECOMMENDATION	
	5.1 Conclusion	59
	5.2 Problem and solution	60
	5.3 Future Recommendation of this project	61
	5.4 Costing and Commercialization	61
	REFERENCES	63-64
	APPENDICES	65-95

LIST OF TABLE

TABLE NO.	TITLE	PAGE
1.	Selection table of encoder	14
2.	Selection table of decoders.	16
3.	Modes of operation for microcontroller	21
4.	Components Price List for Commercialization Purpose	62

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
2.0	Functional how sonar sensor works	8
2.1	Radio communication system	11
2.2	Radio wave propagation method	12
2.3	The intended circuit diagrams on the connections of the chips	13
2.4	Types of encoder	15
2.5	Type of decoder 2^{12} series available	17
2.6	DB9 connector	18
2.7	Microcontroller MC68HC11A8	19
3.0	Block diagram of the system	22
3.1	Transmitter circuit design	24
3.2	Pin description for PNP and NPN transistor	25
3.3	IC 7555 timer and the internal schematic of the IC	26
3.4	Receiver circuit design	28
3.5	Top view of the LM324N	29
3.6	TWS-BS-3 pin assignment	30
3.7	HT12E 18-DIP Pin assignment	31
3.8	Encoder, HT12E output	32
3.9	Address or data bit waveform for HT12E	32
3.10	Flow chart of operation in HT12E	33
3.11	Circuit for transmitter module with encoder	34

3.12	Receiver pin assignment	35
3.13	HT12D 18-DIP pin assignment	36
3.14	HT12D timing diagram	37
3.15	Flow chart of the operating HT12D	38
3.16	Receiver module with decoder	39
3.17	Bootstrap mode for microcontroller	41
3.18	Output waveform at pin 27 (E pin) of the MCU	42
3.19	IC LM7805	43
3.20	Power supply circuit	43
3.21	Clocking circuit module	44
3.22	Reset module	45
3.23	Connections between DB9 female serial ports, MAX233 and microcontroller MC68HC11A1P	46
3.24	Combination of all the module circuit	47
3.25	WP11.exe software	48
3.26	THRSim11 Software simulator	49
4.1	The output display at PC using VB6	51
4.2	Input connection between ultrasonic transducer	52
4.3	Output connection between receiver and microcontroller	54
4.4	Ultrasonic transducer	55
4.5	Transmitter module	56
4.6	Receiver module	57
4.7	Microcontroller MC68HC11A1P	58

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Technical data	64
B	Flow Chart and Project Schedule	92
C	Program in Microcontroller MC68HC11A1	94
D	Basic connection of Bootstrap Mode	95