"I declare that I have read this thesis and in my opinion, it is suitable in term of scope and quality for the purpose of awarding a Bachelor Degree in Electronic Engineering (Industrial Electronic)"

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Date : 30/3/2005

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THE DESIGN OF ULTRASONIC ALARM SYSTEM

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This Report Is Submitted In Partial Fulfillment of Requirements for the Bachelor Degree of Electronic Engineering (Industrial Electronic)

Fakulti Kejuruteraan Elektronik Dan Kejuruteraan Komputer
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March 2005

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"I hereby declared that this thesis titled "ALARM SYSTEM" is the result of my own effort except as clearly stated in references the source of reference".

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Dedicated to my beloved family especially my mother and father.

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ABSTRACT

This alarm system is created to detect an object movement in the coverage area. Alarm will trigger when object movement is detected. Nowadays, a lot of crimes happened in our life. The idea for this alarm project came out through the total of frustration when there is no other ways to stop burglary from break-in into the house, shop or car. Of course safety was the prime concern of the security system companies. However, house owners cannot rely on neighbours or police for protecting their home or warning them if a break-in has occurred in progress. To overcome this problem, an ultrasonic security system has been developed in this project. The system has a sensor that can detect an object movement in the covered area. This project consists of 6 parts of circuit which is the power supply circuit, the battery indicator circuit, the ultrasonic sensor circuit, the alarm circuit, the remote control circuit and the LCD display circuit. The power supply circuit produces and supply the 12V and 5V voltages. The battery indicator circuit is used to show the level of energy in the battery. The battery will act up if something happen to the power supply such as blackout. Ultrasonic sensor circuit has a transmitter circuit and the receiver circuit that operate at the same frequency level namely 40 kHz. When there's a movement in the area covered by the circuit, the circuit's fine balance will be disturbed, thus trigger its alarm. The circuit is very sensitive and can be adjusted automatically or to stay triggered until it is reset manually after an alarm. Actually, this project use low costs budget and it is suitable for commercial used. From this project, found that the maximum distance that ultrasonic sensor can detect the object movement is 3.5 meters and for the sensitivity, it depend the environment factors such as air and noise.

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ABSTRAK

Sistem Penggera ini direka untuk mengesan sebarang objek yang bergerak didalam kawasan yang diliputi oleh sistem ini. Penggera akan berbunyi sekiranya terdapat sebarang pergerakan objek yang dikesan. Pada masa kini, terdapat banyak kejadian jenayah yang berlaku di sekeliling kita. Idea untuk membuat projek ini terhasil apabila sudah tiada jalan untuk menyekat perompak atau pencuri daripada menceroboh rumah, kereta dan juga kedai. Oleh yang demikian, projek ini merupakan salah satu alternatif untuk mengatasi masalah berikut. Sudah semestinya, keselamatan merupakan aspek terpenting yang dititik beratkan dalam sistem keselamatan ini. Tambahan pula, pemilik rumah, kereta dan kedai tidak boleh mengharapkan jiran-jiran dan polis sahaja melindungi atau mengelakkan rumah, kereta dan kedai daripada diceroboh. Sebagai penyelesaian kepada masalah ini, sistem keselamatan ultrasonik direka dalam projek ini. Sistem ini mempunyai pengesan yang mengesan pergerakan objek dalam kawasan yang mampu diliputi oleh sistem tersebut. Projek ini mengandungi 6 bahagian litar yang terdiri daripada litar kawalan jauh, litar bekalan kuasa, litar penunjuk paras bateri, litar pengesan ultrasonik, litar penggera dan litar untuk paparan 'LCD'. Litar bekalan kuasa berfungsi untuk menghasilkan voltan pada 12V dan 5V. Litar penunjuk paras bateri pula berfungsi untuk menunjukkan paras tenaga di dalam bateri yang digunakan. Bateri ini juga bertindak sebagai bekalan kuasa simpanan jika sesuatu terjadi kepada litar bekalan kuasa tersebut seperti terputus bekalan dan sebagainya. Litar pengesan ultrasonik mempunyai litar pemancar dan penerima yang beroperasi pada frekuensi yang sama iaitu 40kHz. Apabila terdapat sebarang pergerakan yang akan menyebabkan kestabilan litar terganggu, maka sistem penggera akan dihidupkan. Litar ini sangat sensitif dan boleh dilaraskan secara automatik atau terus dipicu sehingga ia dilaraskan secara manual. Projek ini menggunakan kos yang rendah dan ia sangat sesuai untuk dipasarkan secara komersial. Selepas projek ini disiapkan dan

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melalui analisis yang dibuat terhadap sistem penggera ini didapati bahawa pengesan ultrasonik mampu mengesan objek sehingga pada jarak 3.5 meter. Selain itu, didapati juga faktor-faktor persekitaran juga memainkan peranan yang penting dalam mempengaruhi kesensitifan litar seperti udara dan hingar.

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CONTENTS

CHAPTER	TITLE	PAGE
	PROJECT TITLE	i
	DECLARERATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	CONTENT·	viii
	LIST OF FIGURE	xii
	LIST OF TABLE	xiv
	LIST OF APPENDIX	xv
1	INTRODUCTION	
1.1	BACKGROUND	1
1.2	OBJECTIVES	2
1.3	PROJECT SCOPE	2
1.4	PROBLEM STATEMENT	3
1.5	PROJECT METHODOLOGY	3
1.5.1	Software Application	4
1.5.2	Hardware Application	5
1.6	PROJECT OVERVIEW	7

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2 LITERATURE REVIEW

2.1	INTRODUCTION		9
2.2	ULTRASONIC SENSOR		10
	2.2.1	An Introducing to Ultrasonic Sensing	10
	2.2.2	Selection of Ultrasonic Sensor	11
	2.2.3	Ultrasonic Motion Detector	12
	2.2.4	Transducer Configurations	13
	2.2.5	Beam Angles and Side Lobes	14
	2.2.6	Frequency, Wavelength and Attenuation	15
	2.2.7	Environmental Factors	17
		2.2.7.1 Temperature	17
		2.2.7.2 Air Turbulence and Convection Currents	17
		2.2.7.3 Atmospheric Pressure	18
		2.2.7.4 Humidity	18
		2.2.7:5 Acoustic Interference	19
		2.2.7.6 Radio Frequency Interference	19
		2.2.7.7 Splashing Liquids	19
	2.2.8	Target Considerations	20
		2.2.8.1 Composition	20
		2.2.8.2 Shape	21
		2.2.8.3 Target Orientation to Sensor	21
		2.2.8.4 Averaging	22
2.3	PIC MICROCONTROLLER		23
	2.3.1	What is a Microcontroller?	23
	2.3.2	Why Use a Microcontroller?	23
	2.3.3	PIC Microcontroller	25
	2.3.4	PIC16F84A Microcontrolle	25
		2.3.4.1 Memory	26
		2.3.4.2 Peripherals	28
		2.3.4.3 Power Supply	29
		2.3.4.4 Clock Oscillator	30

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2.4	BATTERY		30
	2.4.1	The Basic of Battery	30
		2.4.1.1 AGM	32
		2.4.1.2 GEL	32
	2.4.2	Battery Maintenance	33
	2.4.3	Battery Testing	34
	2.4.4	Selecting a Battery	36
	2.4.5	Battery Charging	36
3	PROJECT METHODOLOGY		
3.1	HARDWARE		38
	3.1.1	Power Supply Circuit	39
	3.1.2	Remote Control Circuit	40
		3.1.2.1 Circuit Operation	41
	3.1.3	Ultrasonic Sensor Circuit	41
		3.1.3:1 Block Diagram Explanation	42
		3.1.2.2 Circuit Operation	44
	3.1.4	Battery Indicator	45
	3.1.5	LCD Display Circuit	46
	3.1.6	Alarm Circuit	47
3.2	SOFTWARE		48
	3.2.1	The Compiler	49
	3.2.2	PIC Programming Overview	49
	3.2.3	Software and Hardware	49
	3.2.4	PIC Basic Pro Compiler	50
	3.2.5	Microcode Studio	51
	3.2.6	Step 1: Writing Code	52
	3.2.7	Step 2: Using the Compiler	55
	3.2.8	Target Processor	55
	3.2.9	Compile "F9"	55
	3.2.10	Step 3: Programming the PIC Chip	56
	3.2.11	IC-Prog Setting Procedure	58

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4	RESULT AND ANALYSIS		
	4.1	INTRODUCTION	66
	4.2	ANALYSIS OF ULTRASONIC DETECTOR CIRCUIT	66
		4.2.1 Result for P1	68
		4.2.2 Result for P2	69
		4.2.3 Result for P3	70
		4.2.4 Result for P4	71
		4.2.5 Result for P5	73
		4.2.6 Result for P6	74
		4.2.7 Result for P7	75
	4.3	ANALYSIS OF DISTANCE DETECTION BY ULTRASONIC SENSOR	77
		4.3.1 Result for Analysis of Distance Detection	77
	4.4	ANALYSIS OF SIZE OBJECTS CAN BE DETECTED BY ULTRASONIC SENSOR	79
		4.4.1 Result for Analysis of Size Object	79
	4.5	ANALYSIS OF HEIGHT CAN BE DETECTED FROM FLOOR	80
		4.5.1 Result for Analysis of Height can be Detected From Flour	80
5	CONCLUSION AND SUGGESTION		
	5.1	CONCLUSION	81
	5.2	SUGGESTION	82
REFERENCE			84
APPENDIX			86

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LIST OF FIGURE

FIGURE	TITLE	PAGE
1.1	PIC Microcontroller Programming Process And Software That Used	4
1.2	Flowchart of the Process of designing the Project	6
1.3	Block Diagram of Project	7
2.1	The 40kHz Ultrasonic Sensor	10
2.2	Ultrasonic Motion Detector	12
2.3	Pin Diagram of PIC16F84A	26
2.4	Program Memory Map and Stack	27
2.5	The Timer0 Feature PIC16F84A	29
3.1	Power Supply Circuit	39
3.2	Block Diagram for Remote Control Circuit	40
3.3	Block Diagram for Ultrasonic Sensor Circuit	42
3.4	General Explanation for Each Block of Figure 3.2	43
3.5	The Difference Between Wave for Undetected and Detected	44
3.6	Circuit of Battery Indicator	46
3.7	Circuit of LCD Display	47
3.8	Alarm Circuit	48
3.9	Microcode Studio Interface	51
3.10	Write the Program Code in the Microcode Studio	53
3.11	Connection Between he PC and Hardware	57
3.12	JDM Programmer	57
3.13	Flowchart to Select Device in IC-Prog	58
3.14	IC-Prog Menu	59

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3.15	Flowchart to Select Programmer in IC-Prog	60
3.16	Programmer Setting Menu	61
3.17	Flowchart to Set the Option in IC-Prog	62
3.18	First Option Setting	63
3.19	Second Option Setting	63
3.20	Verify Programming setting	65
4.1	Ultrasonic Detector Circuit and Point of Analysis	67
4.2	Crystal Oscillator Buffered Output (P1)	68
4.3	The Actual Signal That capture From Oscilloscope	68
4.4	Transducer Driving Signal (P2)	69
4.5	No Moving Object Present	70
4.6	Moving Object Detected (P3)	70
4.7	Original Envelope signal that Extracted (P4)	72
4.8	The Actual Signal That Capture from Oscilloscope	72
4.9	Envelope Signal After Amplification (P5)	73
4.10	Envelope Signal is Converted to Square Wave (P6)	74
4.11	The Actual Signal That Capture From Oscilloscope	75
4.12	Envelope Signal is Converted to DC Voltage (P7)	76
4.13	Maximum and Minimum Distance that wave can Transmitted	78
5.1	PIC Control the Circuits	83
5.2	Use SMS to Control the Circuit	83

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LIST OF TABLE

TABLE	TITLE	PAGE
2.1	Some 8-bit Microcontroller and Their Features	24
2.2	State of Charging and Voltage	34
5.1	Distance That Detected by Ultrasonic	77
5.2	Size Object That Detected by Ultrasonic Sensor	79
5.3	Height Can Be Detected from Floor	80

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LIST OF APPENDIX

APPENDIX	TITLE	PAGE
A	Advantages of PIC Microcontroller	86
B	Data Sheet for Ultrasonic Transducer	88
C	Data Sheet for Transistor 2SC1815	94
D	Data Sheet for Transistor MPSH10	95
E	Data Sheet for IC 4069UB	97
F	Data Sheet for Crystal	99
G	Schematic Diagram	101
H	PCB Layout	105
I	Explanation for Every Stage of PCB Design Using Capture CIS	106

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

This alarm system use an ultrasonic sensor to detect the object movement in the covered area. The ultrasonic sensor was chosen because it's more compatible and appropriate for this alarm system. The features are better than infra-red sensor. The main factors ultrasonic sensor was chosen is, it will not infected by any type of material and color at object that has been detected. It also able to detect the small object and not infected by dust, dirt and humidity. Thus, this is also an advantage using the ultrasonic sensor. Ultrasonic sensor also has a weakness and disadvantage that is the sensor can't be installed at area that has high air flow and high noise. Actually, the ultrasonic sensor is a main component in this alarm system. Besides that, this alarm system also combined with another circuit where this other circuit is used as supporter to the ultrasonic sensor circuit. For ultrasonic sensor, it has 2 types of frequencies in the market namely 40 kHz and 10 MHz where for 40 kHz, it can detect up to 5 meter. Where else, for 10MHz, it capable to detect until 10 meter but the price is very expensive. As a result, for this alarm system the sensor that uses 40 kHz is more effective and appropriate.

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1.2 OBJECTIVE

This project has objectives that require to achieve. At the end of project, all of objectives that list are satisfied or covered. The objectives of this project are listed as below.

a) To design an alarm system that capable of detecting movement object.

b) Understand the operation of the circuit and applications of this alarm system.

c) To know how to simulate the circuit by using the appropriate softwares.

d) To improve the skills and techniques for making or designing the hardware.

1.3 PROJECT SCOPE

The scope of this project is using an ultrasonic sensor to detect the movement object. Ultrasonic ranging and detecting devices used a high-frequency sound wave namely 40 kHz to detect the presence of an object.

Else, this project capable to detect object in distance about 5 meters. This is a maximum distance that ultrasonic sensor can detect if using 40 kHz frequency. So, in this distance, the ultrasonic sensor can detect the movement object and trigger alarm immidiately.

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1.4 PROBLEM STATEMENT.

Firstly, using the security guard is not effective and increases the cost. It cause the security guard not capable to monitor the area for 24 hours. Else, the security guard need paid the salary for every month. So, it will increase the cost for monitor the area that required.

Second, high cost required to install the security system that sophisticated. To install the security system that sophisticated, it need a high cost. So, the sophisticated security system only can install by persons that have a ability. For persons that haven't ability to install it because it need a high cost.

Third, nowadays, there have much a criminal that happen especially stealing, intrusion and something like that. The house owners usually don't know that the robbers have inside their house and not prepare to avoid them from steale.

1.5 PROJECT METHODOLOGY.

This project divided into hardware and software application.

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1.5.1 Software application.

For software application, compiler software used is The PIC Basic Pro Compiler and the programmer software used is IC-Prog. For the Code Editor, it used the Microcode Studio. So, the programs can wrote and edited in Microcode Studio. It has a few steps to get the machine code (Hex) for the data to program in the microcontroller. Figure below show the process done with the software to get the .hex file.

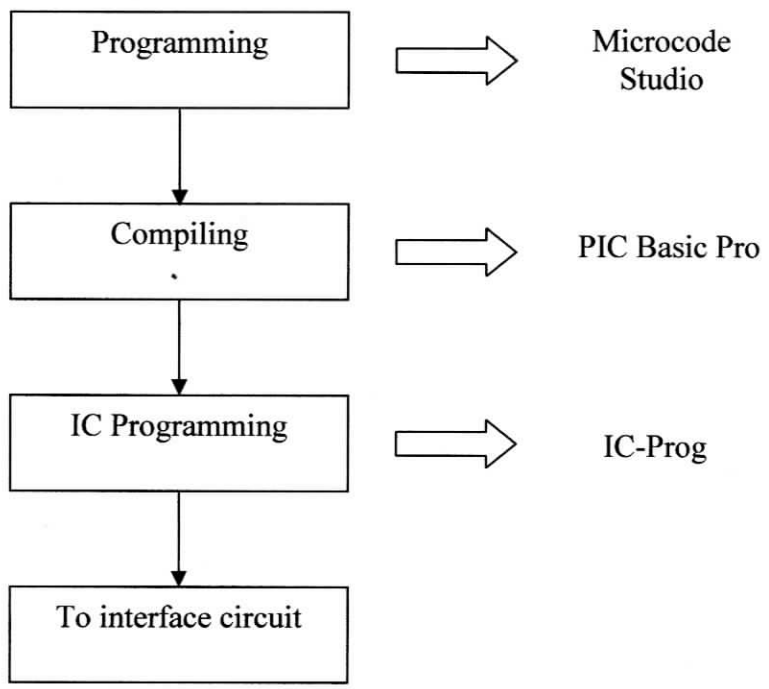

Figure 1.1: PIC microcontroller programming process and software that used.

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1.5.2 Hardware application.

Such as software application, this part also has some steps that need to follow. Firstly, do the research and understand the concept of 'alarm system'. Information collected are regarding with PIC, 'alarm system' concept. Through this method, information that had collected previously is researched consistent with the objective of the project. Through this method, concept and principle for the project will be studied to produce the ideas for this project.

Second, the flow chart is build where this flow chart is used to show the steps that need to follow before the project is implemented. The flow chart is planned and built and this flow chart also consist ways for this project to operate and to controlling. Third, the circuit is designed. The circuit is design using a software of 'ORCAD 10.0'.

The fourth step is do the circuit simulation. The designed circuit is simulated by using software of 'Proteus ISIS 6 Profesional' or 'EWB Circuit Maker'. By this method, the operation of circuit can be inspect wheather the circuit has problem or not and if any, the improvement can implement.

The fifth step is build a prototype for the project. Prototype is built when the circuit simulated is function and has no problem. It's built on the 'protoboard'. This prototype is built to test wheather the circuit has a problem or not. The improvement can implement if the circuit designed has a problem.

The sixth step is design the 'PCB Layout'. If the circuit designed has no problem, next, the 'PCB Layout' is designed by using software of 'Protel' or 'Proteus ISIS 6 Profesional'. This method is did by full concentration to avoid a something mistake that will give difficulty when to assemble the component.

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The seventh step is design the 'PCB'. The completed PCB Layout will be printed on the PCB board and drilling hole on the PCB will be done. The last step is install the component on the PCB board. Component is installed on the PCB board that has completed follow the circuit that has designed previously. Pin of component is cut and soldered. Soldering equipment is required during this process.

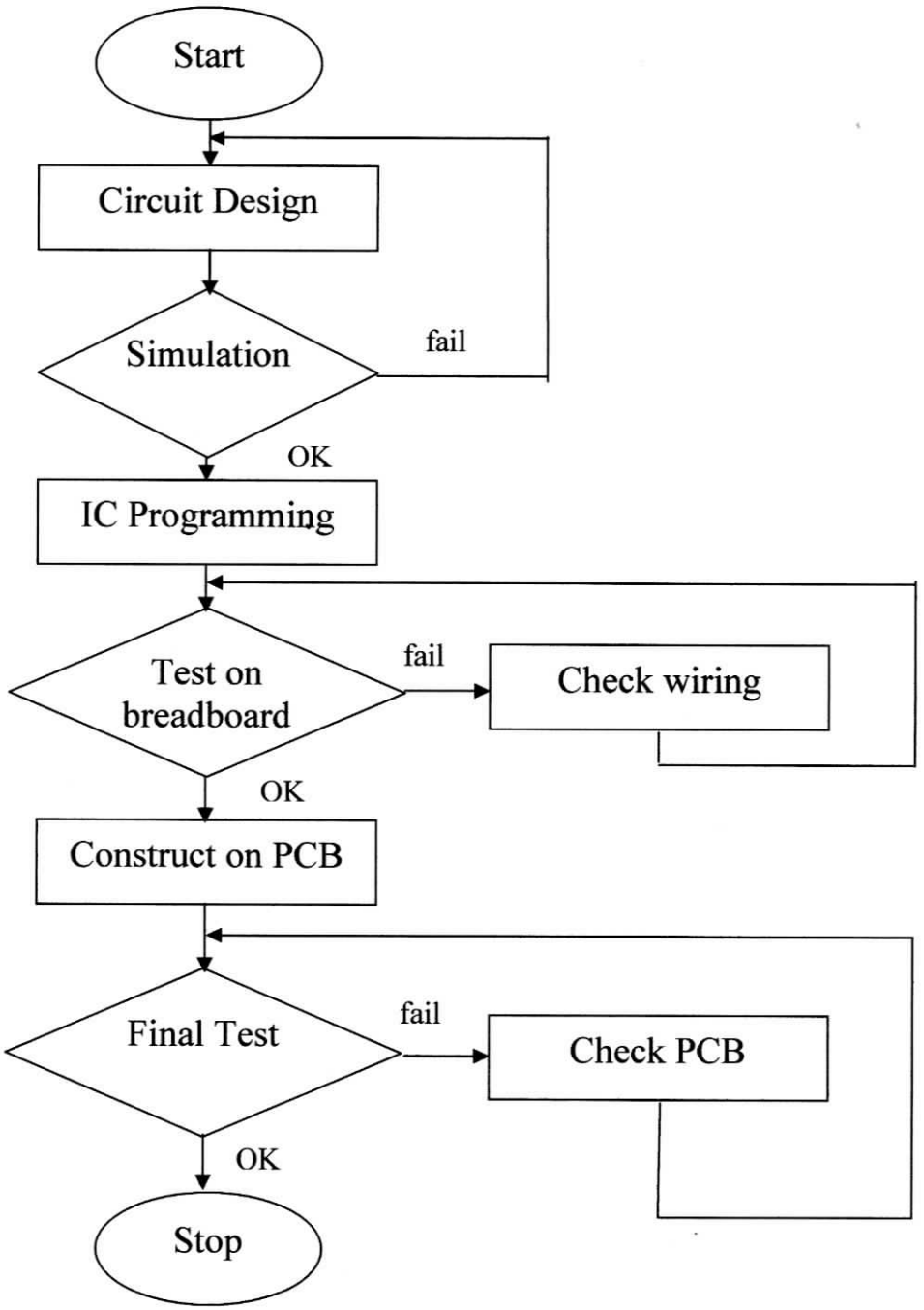

Figure 1.2 : Flowchart of the process of designing the project.

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1.6 PROJECT OVERVIEW.

Alarm System is circuits that capable to detect the moving objects as an input and the output is alarm where alarm will trigger when detect the moving object. The ultrasonic sensor is choosing because it capable to detect the moving object up to 5 meters for 40 kHz sensor and remote control is required to control this circuit. Thus, user can control the alarm system from certain distance that is about 10 meters.

Basically, this project consists of hardware and software programming, the hardware such as power supply circuit, remote control circuit, ultrasonic detector circuit, battery indicator circuit, LCD display circuit and alarm circuit.

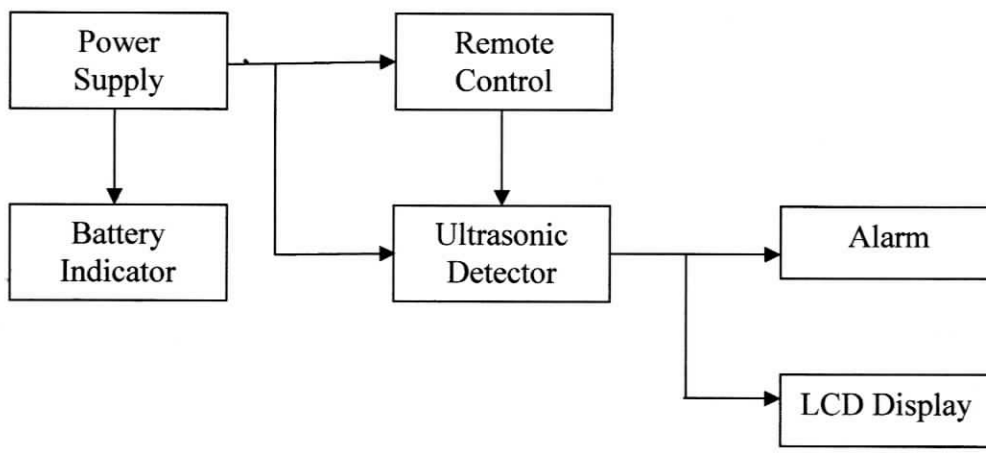

Figure 1.3: Block diagram of project.

Structurally, the circuit consists of six parts: power supply circuit, battery indicator circuit, remote control circuit, ultrasonic detector circuit alarm circuit and LCD display circuit. Power supply circuit will produce 12V and 5V where it will supply the voltage to remote control circuit and ultrasonic circuit. Battery indicator circuit will show status of the battery in the power supply. Remote control circuit will control the ultrasonic detector circuit for 'ON' and 'OFF'. Alarm circuit will

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trigger the alarm when sensor detects the moving object. LCD display circuit will display the output from ultrasonic detector circuit. So, input of this alarm system is from sensor and the output is alarm and LCD display. PIC is used to control the alarm circuit and LCD display circuit. The program is in PIC Basic Pro format. This format is used because it short and easy to build. The discussion about the program is review in next chapter.

At the last, the result from this project is the ultrasonic sensor able to detect the moving object. An alarm will trigger when moving object is detected. Else, remote control circuit able to control the ultrasonic detector circuit for 'ON' and 'OFF'.

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