

**SOLAR POWERED PERSONAL DRYER USING PIC
(ECODRYER)**

NORNAJIHAH BINTI ISMAIL

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

**Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka**

June 2012



UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : SOLAR POWERED PERSONAL DRYER USING PIC
(ECODRYER)
Sesi Pengajian : 2011/2012

Saya NORNAJIHAH BINTI ISMAIL
(HURUF BESAR)

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)

Siti Huzaimah Binti Husin
Ketua Jabatan Elektronik Industri
Fakulti Kejuruteraan Elektronik Dan Kejuruteraan Komputer
Universiti Teknikal Malaysia Melaka (UTeM)
Hang Tuah Jaya, 76100 Durian Tunggal, Melaka

Tarikh: 15 Jun 2012

Tarikh: 18 Jun 2012

“I declare that this work as the product of my own effort with the exception of excerpts cited from other works of which the sources where duly noted.”

Signature :..........
Author's Name : **NORAJIHAH BINTI ISMAIL**
Date : **15 JUNE 2012**

“ I declare that I have read this work and in my opinion is adequate in terms of scope and quality for the purpose of awarding a Bachelor Of Electronic Engineering (Industrial Electronic) With Honours.”

Signature :.....
Name of Supervisor : **PUAN SITI HUZAIMAH BT HUSIN**
Date : *18 Jun 2012*.....

Dedicated, in thankful appreciation for support, encouragement and understandings to
my beloved mother, father, brothers, sisters and fiancé

ACKNOWLEDGEMENT

Assalamualaikum Warahmatullah Wabarakatuh...

First of all, thanks to Allah The Almighty because giving me blessing, health and ideas to finish my project successfully. Hopefully, Allah always blesses me in the future.

First and foremost, I would like to express my heartily gratitude to both of my supervisor, Puan Siti Huzaimah Binti Husin and Engr. Sivakumar a/l Subramaniam for the guidance and enthusiasm given throughout the progress of this project. Without his continued support and interest, this thesis would not have been the same as presented here.

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

Nevertheless, my great appreciation dedicated to all my friends and all people who involve direct and indirect in provides assistance and co-operations at various occasions. Their view tips are useful indeed in helping me finish my thesis. Thanks you.

ABSTRACT

This Ecodryer is designed to dry wet cloth. The system is specially designed to overcome the problem faced by people during rainy day. The concept of this system is similar to the hand dryer, floor dryer, and hair dryer but for this system it applied for drying wet cloth. The system is an ideal application for office and university. The system consists of basic components used in dryer which are blower and heating element with the addition of intelligent technology that controlled by microcontroller, Programmable Integrated Circuit (PIC). The PIC16F877A is used to control the operation of this system from beginning to the end of the operation. For the switching, the Radio Frequency Identification (RFID) is used with controlled by PIC16F877A. For the power supply of the system, the dc supply is replaced with the solar energy to create a green environment and applied green technology to the system. The solar charging circuit is designed so that during the day, the solar energy can charge the lead acid battery and at the same time supplied power to the system meanwhile during the night, the battery is worked as an alternative energy to supply power to the system. The system is operated when the Identification Card (ID) is swap onto the RFID. After thirty seconds, the system will turned off. The RFID is suitable used in this system since the application of this system is for office and university. With this system, it helps people dry the wet cloth during rainy day.

ABSTRAK

Ecodryer ini direka untuk mengeringkan pakaian yang basah. Sistem ini direka khas untuk mengatasi masalah yang dihadapi oleh masyarakat semasa hari hujan. Konsep sistem ini adalah sama dengan pengering tangan, pengering lantai, dan pengering rambut tetapi sistem ini digunakan untuk mengeringkan kain basah. Sistem ini adalah amat sesuai digunakan di pejabat dan universiti. Sistem ini terdiri daripada komponen asas yang digunakan di dalam pengering iaitu peniup dan plat pemanas dengan tambahan teknologi pintar yang dikawal oleh mikropengawal, iaitu Aturan Litar Bersepadu (PIC). PIC16F877A digunakan untuk mengawal operasi sistem ini dari awal hingga akhir operasi. Untuk penukaran, Pengenalpasti Frekuensi Radio (RFID) digunakan dengan dikawal oleh PIC16F877A. Untuk bekalan kuasa sistem, bekalan Arus Terus (AT) digantikan dengan tenaga solar untuk mewujudkan persekitaran hijau dan supaya sistem menggunakan teknologi hijau. Litar pengecaj direka untuk mengecas bateri asid plumbum pada waktu siang dan dalam waktu yang masa membekalkan kuasa kepada sistem Sementara itu, pada waktu malam, bateri digunakan sebagai tenaga alternatif untuk membekalkan kuasa kepada sistem. Sistem ini beroperasi apabila kad pengenalan (ID) dilalukan pada RFID. Selepas 30 saat, sistem akan berhenti. RFID amat sesuai digunakan dalam sistem ini kerana aplikasi sistem ini sesuai di pejabat dan universiti. Dengan kewujudan sistem ini, ia dapat membantu manusia mengeringkan pakaian yang basah pada ketika hari hujan.

CONTENTS

CHAPTER	TITLE	PAGE
	PROJECT TITLE	i
	DECLARATION	i
	DEDICATION	v
	ACKNOWLEDGEMENT	vi
	ABSTRACT	vii
	ABSTRAK	viii
	TABLE OF CONTENTS	ix
	LIST OF FIGURE	xiii
	LIST OF TABLE	xv
	LIST OF ABBREVIATIONS	xvi
	LIST OF APPENDICES	xvii
I	INTRODUCTION	
	1.0 OVERVIEW	1
	1.1 PROBLEM STATEMENTS	3
	1.2 OBJECTIVES	4
	1.3 SCOPES OF WORK	4
1.3.1	Hardware	
1.3.2	Software	
	1.4 PROJECT WORKFLOW	5
1.4.1	Literature Review	
1.4.2	Search About Material and Equipment	
1.4.3	Design Circuit	

1.4.4	Program the PIC	
1.4.5	Testing and Troubleshooting	
1.4.6	Prototyping and Cosmetic	
1.5	THESIS OUTLINE	9
II	LITERATURE REVIEW	
2.0	INTRODUCTION	10
2.1	DC MOTOR	10
2.2	HEATING ELEMENTS	11
	2.2.1 Toaster	
12		
2.3	RELATIONSHIP BETWEEN TEMPERATURE AND RESISTANCE	14
	2.3.3 Nichrome	14
2.4	RELAY	14
	2.4.1 Relay Operation	15
2.5	SEVEN DARLINGTON ARRAY	16
	2.5.1 ULN2002A, ULN2003A, ULN2003AI, ULN2004A, ULQ2003A, ULQ2004A	16
2.6	RADIO FREQUENCY IDENTIFICATION (RFID) TECHNOLOGY	17
2.7	MICROCONTROLLER	18
2.8	SOLAR ENERGY	20
	2.8.1 Photovoltaic Cell	21
	2.8.2 Solar Charger	21
III	PROJECT METHODOLOGY	
3.0	INTRODUCTION	24
3.1	HARDWARE IMPLEMENTATION	25

3.1.1	DC Motor	25
3.1.2	Heating Element	26
3.2	DESIGN CIRCUIT	27
3.2.1	Relay Circuit	27
3.2.2	Solar Charging Circuit	28
3.2.3	PIC16F877A Connection Circuit	29
3.3	PROGRAM THE PIC	29
3.3.1	Microcontroller PIC 16F877A	30
3.3.2	Software Design	30
3.4	INTERFACING WITH MICROCONTROLLER	31
3.5	TESTING AND TROUBLESHOOTING	32
3.6	PROTOTYPING	35

IV RESULT AND DISCUSSION

4.0	INTRODUCTION	36
4.1	EXPERIMENT: DETERMINE RELATIONSHIP OF RESISTANCE AND HEAT	36
4.1.1	Procedures	37
4.1.2	Experimental Result Analysis	37
4.2	SIMULATION RESULT	38
4.2.1	Relay Circuit	38
4.3	PROGRAM CODE OF PIC16F877A	39
4.4	PROJECT PROTOTYPE	41
4.5	SYSTEM DATA ANALYSIS	44

V CONCLUSION AND RECOMMENDATION

5.0	INTRODUCTION	46
5.1	CONCLUSION	46
5.2	PROBLEM	47

5.3	RECOMMENDATION	48
-----	----------------	----

REFERENCES	50
------------	----

LIST OF FIGURES

NO	TITLE	PAGE
1.0	Pedestrian Used Black Rubbish Plastic To Protect Him From Rain	2
1.1	Pedestrian Used Umbrella During Rainy Day	2
1.2	Motorcyclists Used Raincoat To Protect Them From Rain	2
1.4	Block Diagram Of Ecodyrer	3
1.5	Wet Carpet When People Step On The Carpet	4
1.6	Flowchart Of The Project	6
2.0	Toaster	12
2.1	Nichrome Heating Element	13
2.2	Relay Symbol	15
2.3	Seven Darlington Array	16
2.4	ULN 2003	17
2.5	Transmission of Reader And Tags	18
2.6	Photovoltaic Cell	22
3.0	Flowchart of The Project	24
3.1	Block Diagram Of Ecodyrer System	25
3.2	12V DC Motor With Fan	26
3.3	Heating Element	26
3.4	Relay Circuit	27

3.5	Solar Charging Circuit	28
3.6	PIC16F877A Connection Circuit	29
3.7	Flow Chart of Programming	31
3.8	Relay circuit interface with PIC16F877A	32
3.9	PCB Layout For Relay Circuit	32
3.10	PCB Layout For Solar Charging Controller Circuit	33
3.11	Printed Transparency Film	33
3.12	Complete Assembled Component On Circuit Board	35
3.13	Prototype of Ecodryer	35
4.0	Experiment Between Resistance And Current	36
4.1	Relay Circuit Interface with PIC16F877A	38
4.2	Programming For The PIC16F877A	39
4.3	Program Code	40
4.4	Solar Charging Circuit	42
4.5	Relay Circuit	43
4.6	RFID ON	43
4.7	System ON	44
4.8	Relationship Between Time And Temperature	45
5.0	Selection Button	48
5.1	Vending Machine	49

LIST OF TABLE

NO	TITLE	PAGE
2.2	Advantages and Disadvantages of Various Type of DC Motor	11
4.0	Relationship Between Resistance And Current	37
4.2	Relationship Between Time And Temperature	44

LIST OF ABBREVIATIONS

PIC	-	Programmable Integrated Circuit
RFID	-	Radio Frequency Identification
ID	-	Identification
PCB	-	Printed Circuit Board

LIST OF APPENDICES

NO	TITLE	PAGE
A	Datasheet ULN2001A-ULN2004A	51
B	Datasheet 16F87A	52

CHAPTER I

INTRODUCTION

1.0 Overview

Malaysia is a country that located in equatorial zone. The rate of rainfall in Malaysia is in normal rate [1]. Therefore, during rainy day, people had difficulties to go through the rain to go to work, school, shopping mall, and so on especially pedestrians and motorcyclists. At this time, people will use umbrellas or raincoats for protection of self and clothing from contact with rain. Nevertheless, the use of umbrellas and raincoats cannot fully protect people from the wet clothing, especially from the waist to down. For examples, the situation happened as shown below. In Figure 1.0, the pedestrian used the black rubbish plastic to cover his cloth from rain. Meanwhile, in Figure 1.2, the pedestrian used umbrella to cover the cloth from rain and in Figure 1.3, the motorcyclist used raincoat to protect from rain. All the situations shown, all the materials used to cover from rain cannot fully cover cloths from getting wet.



Figure 1.0: Pedestrian used black rubbish plastic to protect him from rain



Figure 1.2: Pedestrian used umbrella during rainy day



Figure 1.3: Motorcyclists used raincoat to protect them from rain

These situations will make people feel uncomfortable wearing wet clothes. Plus, this situation also can produce unpleasant odor especially people who inside air-conditioning building. Therefore, to help reduce discomfort and prevent musty smells, EcoDryer is produced to dry the wet clothes. The architecture of the EcoDryer is build to suit with the level of the wet clothes which is from waist to down. EcoDryer will use solar energy to supply power to on the system with RFID attach with the system for the public use. The overall system as shown in Figure 1.4.

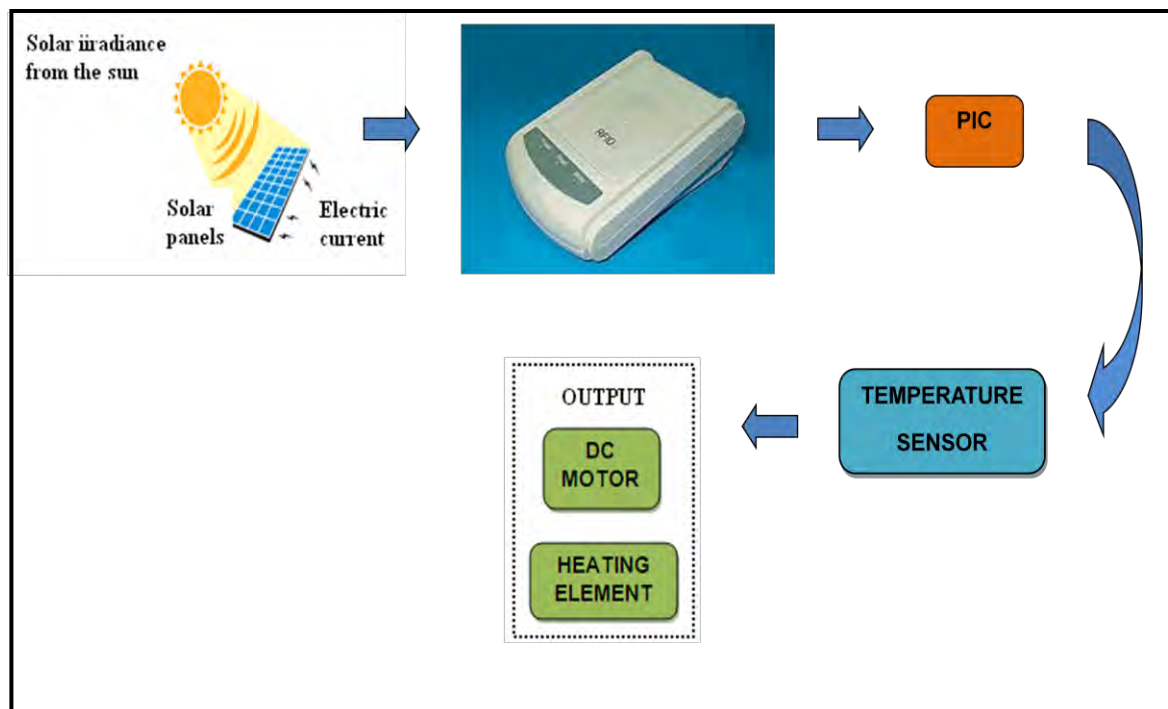


Figure 1.4: Block diagram of Ecodryer

1.1 Problem Statement

During the rainy day, people will use umbrellas or raincoats to protect the cloth from wet. Unfortunately, only half of clothes can be protected from the wet which from the waist and above. In addition, it becomes worse when the person step into the office which the carpet get wet and cause unpleasant odor to the surrounding as shown in Figure 1.5.



Figure 1.5: Wet carpet when people step on the carpet

1.2 Objectives

The main objective of this project is to design motor circuit that spins the fan to blow hot air. Another objectives are to design heating element circuit to produce heat, to design temperature sensor circuit for controlling the temperature and trace overheating and to design solar charging circuit as an alternative energy to supply power. In addition, the other objective is to interface all the circuits with embedded circuit and Radio Frequency Identification (RFID).

1.3 Scope of Work

To achieve the objective of the project, there are several scope will be focused on which divided into hardware and software.

1.3.1 Hardware

For the hardware part, the electronic circuitry will be designed for operating the system in the EcoDryer. In this circuit, the DC motor and heating elements are use. The

heating element is functioning to produce heat and then the DC motor will blow hot air out from the system. The temperature sensor circuit also designs to control temperature produce from heating element and trace overheating occurs during the operation so that the power source will cut off automatically. Besides, the solar charging circuit is design as an alternative energy for the power source. Otherwise, all the circuits will interface with the embedded controller and RFID.

1.3.2 Software

For the programming part, PIC16F877A is use as a programmer tool. The software use in design the programming is CCS Compiler. The programming is focuses on to designing a programming that gives the option to user to control the temperature itself by referring to the types of clothes they wear. Otherwise, the program focuses on to cut off the supply when the temperature exceeds the maximum level of temperature so that the short circuit can be avoided.

1.4 Project Workflow

The overall workflow for this project is shown in Figure 1.6.

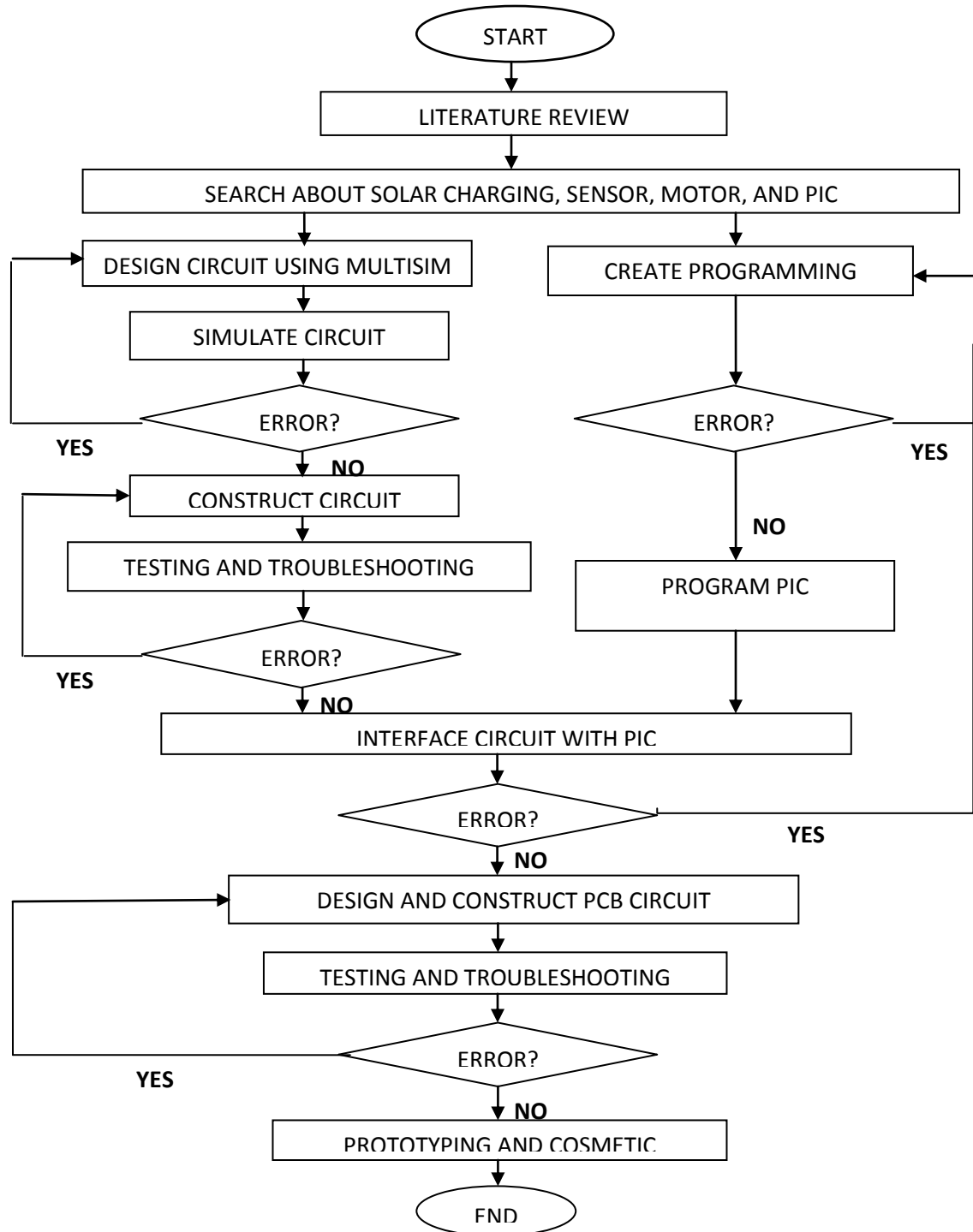


Figure 1.6: Flowchart of the project

1.4.1 Literature Review

In this project, the literature review must be done in order to get the information regarding to the project. The research about conventional technology that looks similar to the technology in this project must be done to make a comparison for example floor dryer, hand dryer, and hair dryer. The review will refer to journals, reference books, and reports to compare this project with other related projects.

1.4.2 Search about material and equipment

In this part, it is all about research on the materials and equipment that will be used in the project. The motor is the first material to be considered on in searching the material and equipment. Next, it is follow with heating element for functioning in produce heat. The temperature sensor also will be used in this project so that a research about the purpose of the sensor, how it works, circuit, and where can find it are important before the project start. Same with the temperature sensor, the study about motor, solar charging and PIC are required before the project start.

1.4.3 Design Circuit

In design circuit, there are four types of circuits that will be designed which motor circuit, heating element circuit, temperature sensor circuit, and solar charging circuit. Next, all the circuits will be simulated by using Multisim and Proteus ISIS 7 Professional software. If no errors occur, the circuit can be constructed using bread board and interface with the PIC. Otherwise repeat the design circuit step.