

# **ADVERTISEMENT RUNNING LIGHT**

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SUPERVISORY VERIFICATION

“I/We hereby certify that I have read and understood the following project thesis. To my/our opinion, this thesis is sufficient in terms of scope and quality to archive partial fulfillment of the requirements of for the Degree of Bachelor in Electronic Engineering (Industrial Electronic).”

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**ADVERSTISEMENT RUNNING LIGHT**

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“Saya akui laporan ini adalah hasil kerja saya sendiri kecuali ringkasan dan petikan yang tiap-tiap satunya telah saya jelaskan sumbernya.”

Tandatangan : 

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Tarikh : *30 APRIL 2006*

## DEDICATION

This report is dedicated to all my loved, and the God above.

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My beloved, who kept me through it all,

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## ABSTRACT

This project presents the design and implementation of a prototyped stand-alone photovoltaic power system that is conceived to cater to the operations of an automatic outdoor or indoor lighting scheme. Preliminary loads include dc compact LED light for various application including garden lighting, road side lighting and interior house decoration. Due to the non-critical load, a basic regulation process suffices. To achieve this, the system uses a built-in regulator. The balance-of-system is realized with the utilization of a specially devices solar power center. It comprises a photovoltaic charge controller and low-voltage load disconnection circuit. The former deice regulates the flow rate of electricity from the photovoltaic module to the battery and the load. This combined with the latter will function to maximize the battery's service life and ultimately the system. A load switch coupled to a timer circuit and a battery low-voltage warning indicator from the final pieces of whole system. Charge controller will connected to PIC Microcontroller to program lightning pattern color under the rainbow. A linear constant current circuit will provide variable regulation current to maximize load lighting. Simulation, experimentation and the finale of hardware implementation will be included to verify the practically and feasibility of this project. From this initiative, simple power generation via photovoltaic technology can be utilized for the benefits of masses. This system requires very low maintenances and can be erected in the urban or rural for hassle free outdoor lighting or indoor lighting. With environment in mind, this small step will be significant milestone for the gradual change towards renewable energy resources.



## ABSTRAK

Projek ini melibatkan rekabentuk dan implementasi sebuah prototaip bagi sistem *photovoltaic* yang bebas. Sistem ini direka khas untuk penggunaan lampu luar yang mempunyai ciri automatik. Jenis pelampuan adalah LED yang akan digunakan dalam aplikasi bagi menggantikan jenis lampu *compact fluorescent light (CFL)* dan lampu pijar. Dari segi fungsinya, ia boleh disesuaikan kepada pelbagai kegunaan seperti lampu jalan, lampu trafik dan papan iklan atau papan arah. Disebabkan oleh beban yang tidak kritikal, maka proses regulasi voltan yang asas sudah memadai. Bagi mencapai proses ini, sistem ini menggunakan sebuah *built-in regulator* bagi tujuan pengecasan bateri dengan sempurna dengan hanya *solar panel* yang mempunyai keluaran kuasa yang rendah. Litar ini terdiri daripada bahagian pengawal cas dan cip pengawal yang mengawal perubahan warna pelangi. Bahagian pertama merupakan *step-up voltage* dimana mampu meninggikan kuasa *solar panel* yang dihendaki manakala bahagian kedua adalah pengawal cas dengan meregulasikan voltan untuk mengecas bateri pada voltan yang sesuai. Secara tidak langsung, gabungan kedua-dua litar ini akan memaksimumkan jangka hidup bateri dan menjimatkan kos dalam jangka masa yang panjang. Bahagian akhir sekali adalah mengandungi cip kawalan untuk mengawal perubahan warna pelangi di mana program adalah tersedia dalam cip (PIC). Dalam merealisasikan sistem lampu berasaskan teknologi *photovoltaic*, proses simulasi, eksperimentasi dan pemasangan akan dilaksanakan agar dapat mengesahkan praktikaliti dan feasibiliti projek ini. Inisiatif ini menggunakan secara penuh kemampuan tenaga suria dan memudahkan penjanaan kuasa rendah bagi manfaat sejagat. Pendek kata, sistem ini dapat diutilitisi di kawasan bandar atau luar bandar serta hanya memerlukan penjagaan minima. Demi kepentingan bumi kita, projek ini merupakan langkah kecil dalam usaha menggalakkan penukaran daripada sumber tenaga fosil kepada sumber boleh dikitar semula.



## OBJECTIVE

The objective of this project is to design and implement a controller based PV system and PIC to drive LED (Load) for advertisement signboard outdoor lighting application and achieve the following:

- ✦ Provide cost effective and hassle free lighting solution to outdoor lighting problems.
- ✦ To provide environment friendly, sustainable products to enhance the quality of life.
- ✦ To develop a greater public enthusiasm for and involvement in science and the environment with our interactive science products.
- ✦ To introduce low current and energy saving.
- ✦ Safety, DC Voltage operated.
- ✦ Running light functions are available.
- ✦ Design and pattern are available.
- ✦ Long life LED more than 100 000 hours approximate 10 years
- ✦ Minimal or no maintenance
- ✦ Solar Panels are guaranteed for 15 years and the Deep Cycle Batteries for 5 years.
- ✦ No bills to pay and Cost effective

## CONTENTS

CHAPTER	TOPIC	PAGE
	PROJECT TITLE	i
	SUPERVISORY VERIFICATION	ii
	DECLARATION	iv
	DEDICATION	v
	ACKNOWLEDGEMENT	vi
	ABSTRACT	vii
	ABSTRAK	viii
	OBJECTIVE	ix
	CONTENTS	x
	LIST OF FIGURES	xiv
	LIST OF TABLES	xvii
	LIST OF ABBREVIATIONS	xix
	LIST OF APPENDIXES	xx
<b>I</b>	<b>LITERATURE REVIEW</b>	
1.1	INTRODUCTION	1
1.2	PHOTOVOLTAIC SYSTEM	2
1.2.1	Cell Types	4

1.2.2	Photovoltaic Efficiency	8
1.2.3	Design Requirements	8
1.3	STORAGE BATTERY	10
1.3.1	Design and Construction	10
1.3.2	What Is the Best Battery	11
1.3.3	How To Charge- When to Charge Table	16
1.3.4	Charging the Sealed Lead-Acid (SLA) Battery	19
1.3.5	Calculating the Battery Runtime	23
1.3.6	The Peukert Number	25
1.3.7	The Lead –Acid Battery Compete in Modern Times	26
1.3.8	Battery care and Maintenance	30
1.4	CHARGE CONTROLLER	31
1.4.1	Overcharge Protection	31
1.4.2	Overdischarge Protection	32
1.4.3	Charge Controller Design	33
1.5	PIC MICROCONTROLLER	36
1.5.1	Migratable Memory™ Technology (MMT)	36
1.5.2	Flash (Electrically Programmable)	37
1.5.2.1	One-Time Programmable (OTP)	37
1.5.2.2	In-Circuit Programming™ (QTP)	37
1.5.2.3	Self Programming	38
1.5.2.4	Quick-Turn Programming (QTP)	38
1.5.2.5	Serialized Quick-Turn Programming	38
1.5.2.6	Masked ROM	39
1.5.3	PIC	39
1.5.3.1	Coding for PICs	40
1.5.3.2	Programming PICs	41
1.5.3.3	Word Size	42
1.5.4	Modern PICs	42
1.5.4.1	Features	42
1.5.4.2	PICs On The Internet	43

1.5.4.3 PIC Clones	44
1.5.4.4 Wireless PICs	44
1.5.4.5 dsPICs (Digital Signaling PICs)	44
1.5.4.6 8/16- Bit PIC Microcontroller Product Families	45
1.5.5 PIC 16F628	45
1.5.5.1 I/O Ports of PIC 16F628	49
<b>II METHODOLOGY</b>	
2.1 INTRODUCTION	51
<b>III ANALYSIS OF DESIGN ASPECTS</b>	
3.1 INTRODUCTION	54
3.2 THEORETICAL OPERATIONS	55
3.3 PART A: STEP-UP VOLTAGE	57
3.4 PART B: BATTERY CHARGER	59
3.5 PART C: RUNNING LIGHT	61
3.5.1 LED Connection	63
3.5.2 PCW C Compiler	64
3.5.2.1 Program Source Code	65
3.5.3 IC-Prog Prototype Programmer	74
3.6 PCB PROCESS	76
3.7 RESULT	78
3.7.1 Charging Battery with Power Supply	78
3.7.2 Testing Output with Solar Panel 4.5W	81
<b>IV TROUBLE SHOOTING AND COSTS</b>	
4.1 TROUBLE SHOOTING	83
4.2 COMPONENT BREAKDOWN AND COSTS	87
<b>V CONCLUSSION</b>	89



## LIST OF FIGURES

NO	TITLE	PAGE
1.1	Photovoltaic system	3
1.2	The sunlight reflect on the PV Module	3
1.3	Solar Cell in different shapes	4
1.4	From left, single crystalline silicon and multi crystalline	5
1.5	Market share of the principal photovoltaic technologies. “Other” technologies include cells for concentrator systems, cells based on cadmium telluride and silicon on low-cost substrates	7
1.6	Cell composition of basic lead-acid battery	10
1.7	Charge stages of a lead-acid battery. The battery charges at a constant current to a set voltage threshold (Stage 1). As the battery saturates, the current drops (Stage 2). The float charge compensates for the self-discharge (Stage 3).	19
1.8	Typical discharge curves of lead acid as a function of C-rate	23

1.9	The Peukert Curve. The effective cell capacity fades with increased load. An intermittent discharge improves the capacity as it allows the chemical reaction to recover.	25
1.10	Basic Shunt Controller Design	34
1.11	Basic series Controller Design	35
1.12	Structure view of PIC 16F628	46
1.13	Some of the various PICs from Microchip, 16F84, 16F627, 16F628, 16F876 and a 16F877.	47
2.1	Flow Chart of Methodology	53
3.1	Structure of Circuit Block Diagram	54
3.2	Schematic Diagram of Advertisement Running Light	56
3.3	Schematic Diagram of Step-Up Voltage Regulator Circuit	58
3.4	Schematic Diagram of Battery Charger Schematic	60
3.5	Schematic Diagram of Running Light	61
3.6	PIC Drive LED Diagram	62
3.7	LED connection	63
3.8	Example desktop of PCW C Compiler	64



3.9	Schematics- Taic Classic Programmer to build Boot loader	74
3.10	Boot loader to burn IC with IC-Prog Programmer	75
3.11	IC-Prog Programmer Software version 1.5A	75
3.12	Multilayer Composite	76
3.13	Top Layer PCB	77
3.14	Bottom Layer PCB	77
3.15	Output waveform	80
4.1	Part of Step-up Voltage Circuit	84
4.2	Current Flow Back without diode D3	85
4.3	Location of Diode D4	86

## LIST OF TABLE

<b>NO</b>	<b>TITLE</b>	<b>PAGE</b>
1.1	Characteristics of commonly used rechargeable batteries	13
1.2	Do and do not batteries	14
1.3	Basic instruction in maximizing battery performance	16-18
1.4	Effects of charge voltage on a small lead-acid battery (SLA). Cylindrical lead-acid cells have higher voltage settings but are lower for VRLA and car batteries.	21
1.5	Typical discharge times of a 10Ah lead acid battery as a function of C-rate	24
1.6	Main difference between 84A and 628 and 873	48
1.7	I/O ports	49-50
3.1	Part B- Battery Charger	78
3.2	Part A- Step-Up Voltage LM2577	78
3.3	Result of Scenario 1	81



**LIST OF ABBREVIATIONS**

A-Si	Amorphous Silicon Cells
CIS	Copper Indium Disedline
CdTe	Cadmium Telluride
DC	Direct Current
GaAS	Gallium Arsenide
Ge	Germanium
IC	Integrated Circuit
ICSP	In-Circuit Serial Programming
I/O	Input or Output
Li-ion	Lithium-ion
LVD	Low Voltage Regulated Load Disconnect
LVP	Low Voltage Programming
MAC	Multiply-Accumulate
MMT	Migratable Memory Technology
NiCd	Nickel-Cadmium
NiMH	Nickel-Metal Hydride
OTP	On-Time Programmable
SLA	Sealed Lead Acid
SQTP	Serialized Quick-Turn Programming
SW	Switch Button
UHF	Ultra High Frequency
VR	Voltage Regulation
VRLA	Valve-Regulated-Lead-Acid

**LIST OF APPENDIXES**

<b>NO</b>	<b>TITLE</b>
A1	Datasheet IRFZ34N
A2	Datasheet KA7805
A3	Datasheet PIC 16F628
A4	Datasheet BC547
A5	Datasheet LM1577 / LM 2577
A6	Datasheet LM350
B1	Picture



## **CHAPTER I**

### **LITERATURE STUDY**

#### **1.1 INTRODUCTION**

This chapter discusses about literature discourse and review of a stand alone photovoltaic lighting system control by PIC microcontroller. Throughout the world, there have been many researches about the concept and implementation of this system which is deemed suitable for all types of lighting application such as road side lighting, garden lighting, advertisement and interior house decoration.

Literature reviews are based in information obtained from valid sources such as books, articles of relevance, published paper or any other source deemed appropriate. One of the more famous sources for literature reviews from IEEE, denoting the Institute of Electrical and Electronics Engineers which is based in New York, USA. The forms of literature include standards of practice, proceeding paper or conference papers such as those from the Power Engineering Conference.



## 1.2 PHOTOVOLTAIC SYSTEM

Photovoltaic system can be categorized in three main types; they being stand alone, utility-interactive system and bi-modal systems. The first operate independent of the utility grid and includes hybrid systems. The second is connected to the grid while the third has an ability to function like the first two but not simultaneously, in a book by author Jenny Nelson in year 2003, entitled “The Physics of Solar Cell”, a solar photovoltaic energy conversion is a one step conversion process which generates electrical energy from light energy. The effectiveness of a photovoltaic device depends upon the choice of light absorbing materials and the way in which they are connected to the external circuit.

In other definition given by Richard D. Dorf, Editor-In-Chief of “The Engineering Handbook”, solar power system are usually classified by technology- solar thermal and photovoltaic systems are the principal types. Photovoltaic usually use the energy in sunlight directly to produce electricity; in solar thermal power systems, the sun heats the transfer medium such oil, by technology- solar thermal and photovoltaic systems are the principal types. Photovoltaic usually use the energy in sunlight directly to produce electricity; in solar thermal power systems, the sun heats the transfer medium such oil, by technology- solar thermal and photovoltaic systems are the principal types. Photovoltaic usually use the energy in sunlight directly to produce electricity. [16]

A photovoltaic system consists of solar cell electrically connected to each other in support structure to form a module. Modules are designed to supply electricity at the certain voltage, at 12 volts. The current produced is directly dependent on how much light strikes the module. In general, the larger area of a module or array is, the more electricity will be produced. Photovoltaic modules and array reduces DC electricity. They can be connected in both series and parallel to produce any required voltage and current combinations.



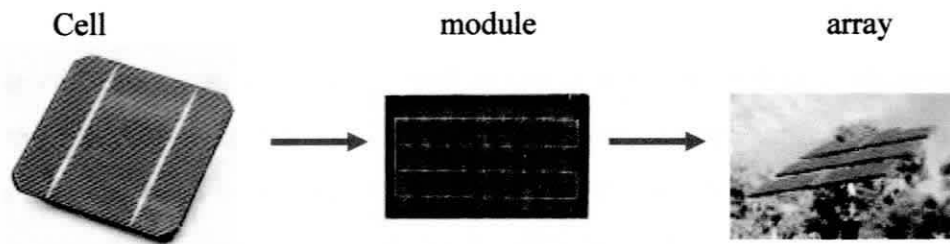


Figure 1.1: Photovoltaic system

A photovoltaic involves an array combined with number of other components, collectively known as balance of system. These components vary according to the type of service required and whether the system is needed only during hours of sunlight or also at night. Some form of energy storage is needed for the system operate at night.

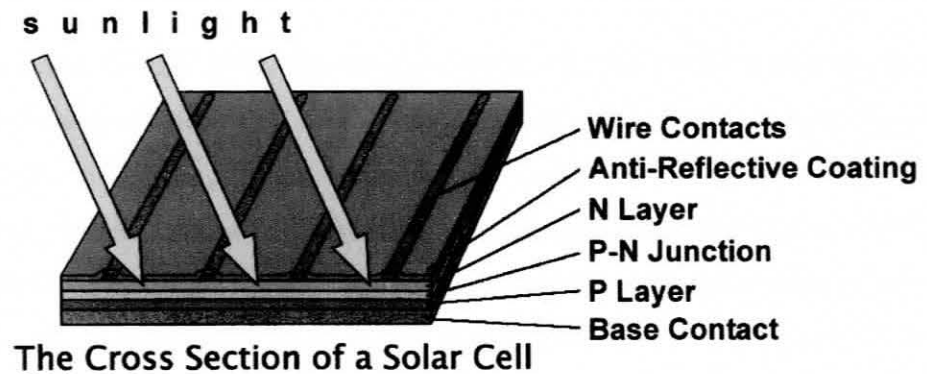


Figure 1.2: The sunlight reflect on the PV Module

### 1.2.1 Cell Types

Solar cell represents the fundamental power conversion unit of a photovoltaic system. Many types of solar cell are now available on the market, through the bulk of the material and structures in the quest to extract maximum power from the device while keeping the cost to minimum. Devices with efficiency exceeding 30% have been demonstrated in the laboratory. The efficiency of commercial devices however is usually less than half this value.

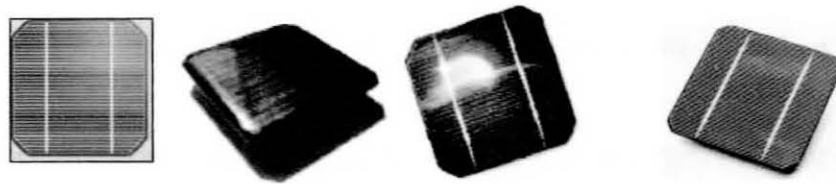


Figure 1.3: Solar Cell in different shapes

Crystalline silicone holds the largest market. Monocrystalline silicone cells are the oldest and most efficiency type of photovoltaic cell. They are produced by slowly extracting large, pear-shaped crystal from a liquid silicon bath. This crystal is sliced into extremely thin “wafers” about thickness of fingernail, and processed into solar cells. As the wafers are nearly identical in structure, they yield highly efficiency cells of over 15%; nevertheless, its robustness is marred by the production process which is energy extensive, slow, and expensive.

To reduce the cost, these cells are now often made from multi or polycrystalline silicon. As opposed to extracting a single crystal from silicon bath, these cells are formed by pouring hot, liquid silicon into molds or casts. Once cooled, and hardened, the silicon blocks are sliced in a similar fashion to the single crystal described above. Compare to single crystalline cells, polycrystalline cells are less expensive to produce because their manufacturing process does not require many careful hours of rotating silicon material. However, they are less efficient than single crystalline cells, averaging