UMP VERSION LED BULB

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Specially dedicated to

My beloved family and those people who have guided and inspired me throughout my journey of education

- Zulkifli -

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ABSTRACT

The conventional bulb (incandescent and fluorescent) are considered as the only alternative right now to produce bright light, however bulb that use light-emitting diodes (LEDs) – which contain no mercury neither produce CO_2 - are quickly emerging as a challenger. LED is the type of lighting, which is most commonly use to illuminate signs, signals and displays but is rapidly evolving to provide light for general illumination. This project is focusing to design and build UMP version LED bulb. It consist the module of the transformer, rectifier, battery backup and LED bulb. The transformer is used to step-down the AC voltage from the main supply and the output of the transformer will be rectified to DC voltage by the rectifier. The IC voltage regulator provides the desired supply to the LED bulb by limiting the current and voltage to avoid the LED bulb from damage. When power failure is occur in the system, battery backup will act as main supply to the LED bulb. The LED bulb consist several white LED which is grouped together to produce bright light.

ABSTRAK

Pada masa ini lampu pijar dan pendarflour merupakan satu-satunya alternatif sebagai sumber pencahayaan. Walaubagaimanapun mentol yang menggunakan Diode Pemancar Cahaya atau lebih dikenali sebagai LED – yang mana tidak mengandungi gas berbahaya atau pun menghasilkan karbon dioksida (CO2) - kini muncul memberikan persaingan.Kebiasaannya LED digunakan untuk menunjukkan tanda, isyarat dan mempamerkan sesuatu tetapi kini dengan perkembangan teknologi yang pesat telah memungkinkan ianya digunakan sebagai salah satu sumber pencahayaan. Projek ini memfokuskan untuk mereka bentuk dan menghasilkan Mentol LED Versi UMP. Ianya terdiri daripada beberapa modul seperti modul penukar voltan, modul penerus, modul bateri simpanan dan modul mentol LED. Modul penukar voltan digunakan untuk menukarkan dan menurunkan voltan arus ulang alik daripada pembekal voltan utama kepada voltan arus ulang alik yang lebih rendah. Voltan arus ulang alik yang telah diturunkan kemudiannya ditukar kepada voltan arus terus oleh litar penerus. Pengehad voltan digunakan untuk membekalkan voltan yang diperlukan untuk menyalakan mentol LED dengan mengehadkan arus dan voltan kepada nilai yang telah ditetapkan agar mentol LED tidak rosak. Apabila berlaku kegagalan penyaluran sumber kuasa daripada pembekal voltan utama, bateri simpanan akan mengambil alih untuk membekalkan sumber kuasa yang diperlukan oleh mentol LED. Mentol LED pula terdiri daripada beberapa unit LED putih yang telah dihimpunkan untuk menghasilkan cahaya yang terang.

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LED	Light-Emitting Diode
VAC	Voltage Alternate Current
VDC	Voltage Direct Current

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CHAPTER 1

INTRODUCTION

1.0 Introduction

Once a symbol of Edison's creative genius and the prowess of American innovation, the Incandescent light bulb represent a mature technology. However the light bulb, the symbol of bright ideas, doesn't look like such a great idea anymore, as lawmakers in the United State and abroad are talking about banning the century-old technology because of its contribution to global warming [1] by producing the CO_2 gas during the heating process of the filament. The conventional bulb (incandescent and fluorescent) are considered as the only alternative right now to produce bright light, however bulb that use light-emitting diodes (LEDs) – which contain no mercury neither produce CO_2 - are quickly emerging as a challenger. LED is the type of lighting, which is most commonly use to illuminate signs, signals and displays but is rapidly evolving to provide light for general illumination. The solid-state lighting (SSL) such as LED has the potential to revolutionize the lighting industry and is heralded as the future of lighting thanks to its energy efficiency and low maintenance requirement [2][3][4].

Unlike incandescent or fluorescent lamps, which create light with filaments and gases incased in a glass bulb, LED consist of semiconductors that convert electricity into light. A single LED can produce only a limited amount of light, and only a single colour at a time. To produce more bright light, a cluster of LED is grouped together to form a light source. To generate white light, several methods can be used, either using the white LED or combination of several-coloured LED [2]. To avoid light leakage, lenses or reflectors is use to collect the light from the white LED modules in an effort to boost brightness without increasing power consumption. Without these measures, only half of the light output by the LED ends up illuminating the area.

This project will be focusing to produce a UMP version of bulb based on LED as the source of lighting. The light that being produce by the LED bulb then will be compared to the conventional light (in this case incandescent bulb) to proved the energy efficiency of using the LED bulb.

1.1 Objective

1.1.1 To Familiarize With The Types and Function of LED and Its Application.

Back when the only LED available offered outputs of about 1-lm, application were limited to indicators, mobile phone backlight, traffic light and a few other uses. At that time, combination of several colored LED is needed to produce white light. But thanks to the grow of technology, now there are LED that can produce Higher luminance and can generate white light. The white LEDs are beginning to be used in lighting for offices and automotives, and photographic flashes. However to do so, it is important to familiarize with the type and function of the LEDs.

1.1.2 To Design and Build a UMP Version of Bulb.

Due to the fact that the conventional light such as incandescent produces CO_2 which contribute to the global warming, people start to use LED bulb because of its energy efficiency and environmental friendly. To design and build a UMP version of LED bulb, the suitable type of LED is chosen and grouped together to produce bright light and can be compared to the incandescent bulb.

1.2 Project Scope

The main scope in this project is to design a UMP version of LED bulb and compare the brightness of the LED bulb with the incandescent bulb and proved its energy efficiency.

1.3 Thesis Overview

This thesis can be divided into five chapters. Chapter 1 introduces the objectives of the LED bulb project and it also summarizes the content of each of chapters.

Chapter 2 will discuss the modules' design of the LED bulb. All component used in the project will be discuss in this chapter.

Chapter 3 elaborates in details on the hardware of the LED bulb by referring to the block diagram of the system.

Chapter 4 focuses on the testing and the results obtained and the limitation of the project. All discussions are concentrating on the result and performance of the LED bulb.

The last chapter which is Chapter 5 includes the outcome of LED bulb project. Some recommendations are proposed to enhance the LED bulb.

CHAPTER 2

LITERITURE REVIEW

2.0 Introduction

This project focuses to build a bulb based on LED as the source of lighting and can be used to replace the conventional bulb. The Figure 2.1 shows the block diagram for the UMP version of LED bulb project. The system consists of the following modules:

- Rectifier module
- LED bulb module
- Battery backup module

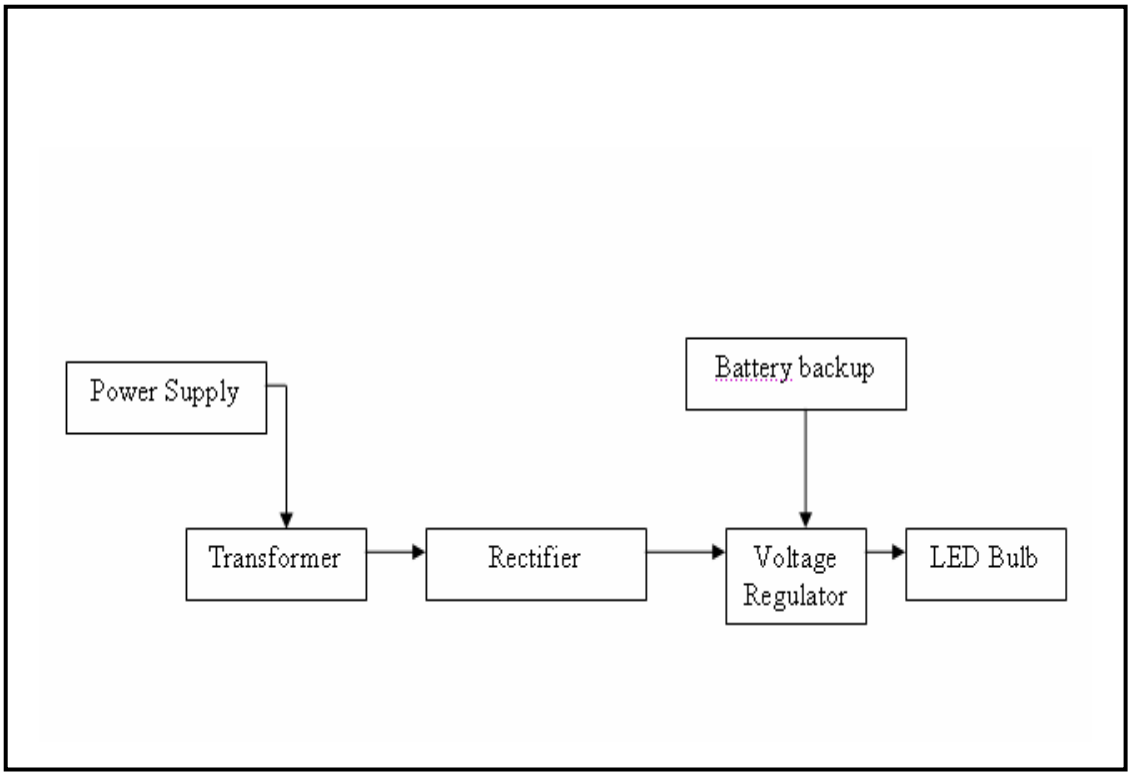

Figure 2.1: Block Diagram of LED bulb Project

2.1 Rectifier Module

A rectifier is an electrical device that converts AC to produce an output that is purely DC or to produce a voltage or current waveform that has a specified DC component. The rectifier can be divided in to two; half-wave and full-wave rectifier.

2.1.1 Half-Wave Rectifier

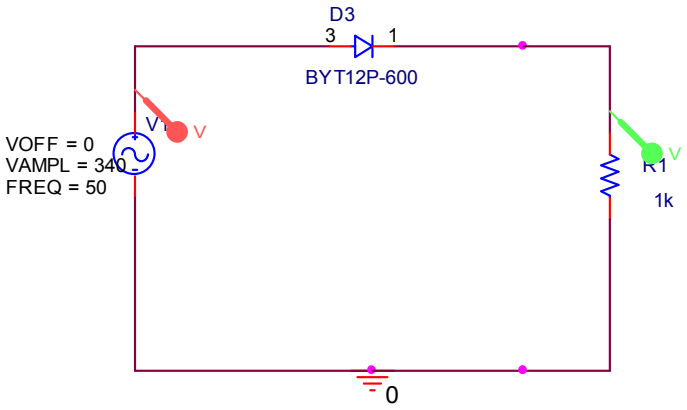

Figure 2.2: Half-wave rectifier with resistive load.

Figures 2.2 show a basic half wave rectifier with resistive load. Diode is a basic electronic switch which allows current to flow in one direction only, which is forward bias. Referring to the figure 2.3, Considering the diode is ideal, it show that the voltage at R-load during forward biased is the positive cycle of voltage source, while for negative bias the voltage is zero.

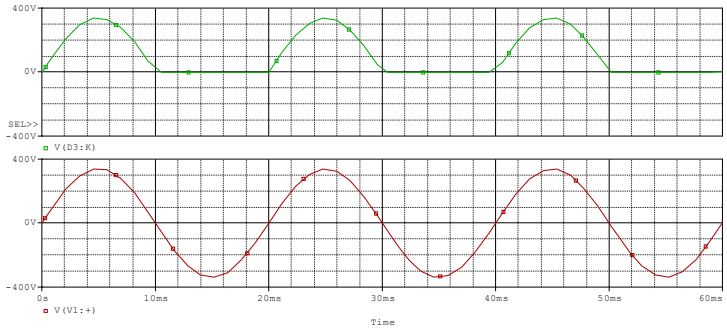

Figure 2.3: Waveform for the Half-wave rectifier.

2.1.2 Full-wave rectifier

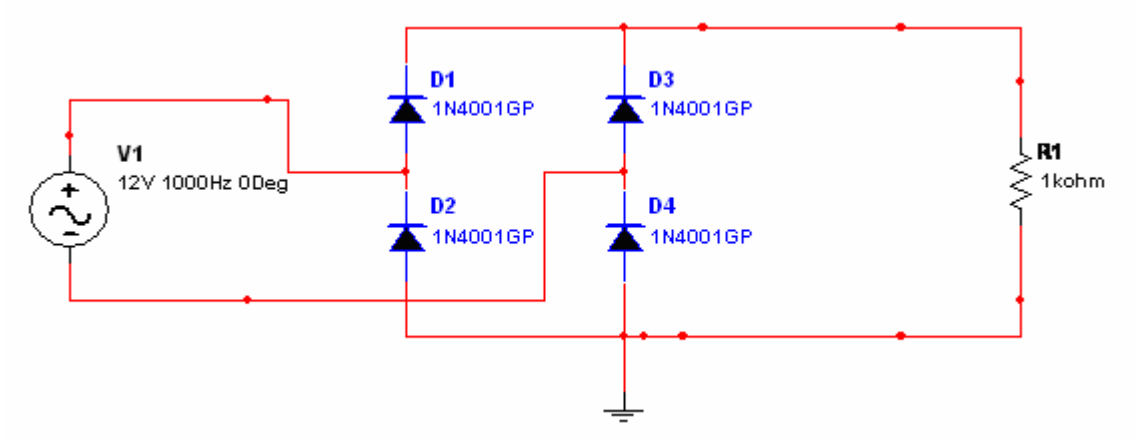

Figure 2.4: Full-wave rectifier resistive load.

A Full Wave Rectifier is a circuit, which converts an ac voltage into a pulsating dc voltage using both half cycles of the applied ac voltage. It uses four diodes as show in figure 2.4 where the D1 and D4 conducts during one half cycle while the other conducts during the other half cycle of the applied ac voltage. The waveform for the full-wave rectifier is shown in figure 2.5.

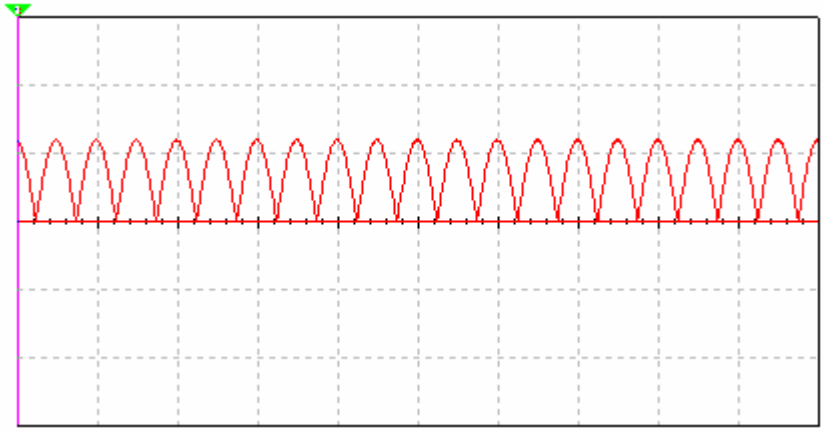

Figure 2.5: Waveform for the Full-wave rectifier

2.1.3 Transformer

A transformer is an electrical device that changes AC electric power at one voltage level into AC electric power at another voltage level through the action of a magnetic field. Basically, a transformer changes electricity from high to low voltage or vice versa using two properties of electricity. In an electric circuit, there is magnetism around it. Second, whenever a magnetic field changes (by moving or by changing strength) a voltage is made. By changing the current in the primary coil, one changes the strength of its magnetic field; since the changing magnetic field extends into the secondary coil, a voltage is induced across the secondary.

The secondary induced voltage V_S is scaled from the primary V_P by a factor ideally equal to the ratio of the number of turns of wire in their respective windings:

$$\frac{V_S}{V_P} = \frac{N_S}{N_P}$$

By appropriate selection of the numbers of turns, a transformer thus allows an alternating voltage to be stepped up — by making N_S more than N_P — or stepped down, by making it less.

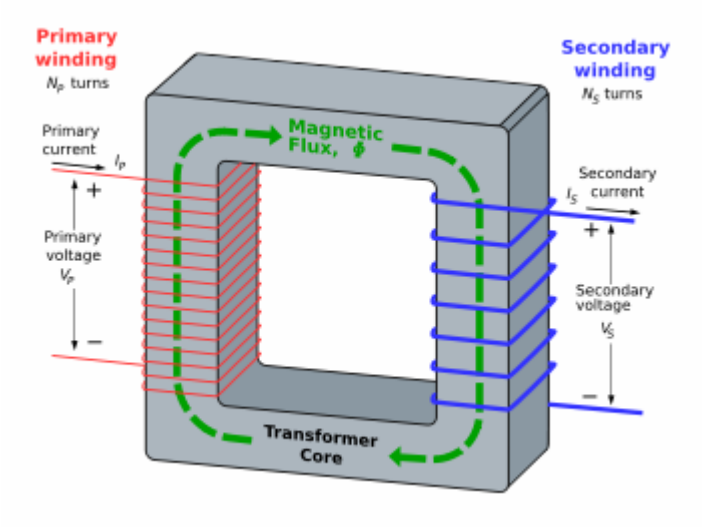

Figure 2.6: An ideal Transformer showing magnetic flux in the core.

Figure 2.6 show the simplified transformer design is. A current passing through the primary coil creates a magnetic field. The primary and secondary coils are wrapped around a core of very high magnetic permeability, such as iron; this ensures that most of the magnetic field lines produced by the primary current are within the iron and pass through the secondary coil as well as the primary coil.

Transformers are some of the most efficient electrical 'machines',[5] with some large units able to transfer 99.75% of their input power to their output. Transformers come in a range of sizes from a thumbnail-sized coupling transformer hidden inside a stage microphone to huge units weighing hundreds of tonnes and all operate with the same basic principles, though a variety of designs exist to perform specialized roles throughout home and industry.

In this project, the transformer is used to step down AC voltage to a certain level so it can be rectified to DC voltage.

2.2 Light Emitting Diode (LED) Bulb Module

2.2.1 Light Emitting Diode (LED)

'*A* light-emitting diode (LED) is a semiconductor diode that emits incoherent narrow-spectrum light when electrically biased in the forward direction of the p-n junction' [6]. Compare to the conventional bulb that create light by heating the filaments and gases encased in a glass bulb, the LED consist of semiconductor (positive and negative charge) that convert electricity into light.

LEDs will only light with positive electrical polarity that is forward biased. If the voltage is of the wrong polarity, the device is said to be reverse biased, very little current