DESIGN AND DEVELOP ELECTRONIC BALLAST

FOR LIGHTING SYSTEM

MOHAMED REDZA BIN ABU TALIB

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"I admit that I/we have read this literature work through my/our observation which has fulfilled the scope and quality in order to be qualified for the conferment of Bachelor Degree in Electrical Engineering (Industry Power)."

Signature : .....

Supervisor's name : MAASPALIZA AZRI

Date : 21/11/2005

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MOHAMED REDZA BIN ABU TALIB

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Fakulti Kejuruteraan Elektrik
Kolej Universiti Teknikal Kebangsaan Malaysia

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"I admitted that this thesis is written by me and is my own effort except as cited in references."

Signature : .....

Author's name : Mohamed Redza bin Abu Talib

Date : 21/11/2005

To my dearest parent

For continuous love, motivation, support and encouragement.

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ABSTRACT

The lighting system that currently being implemented by the TNB supply. This project proposed the design and developed lighting system with two supplies. The two supplies consist of TNB supply and the battery .The battery is design when the black out and drop voltage from the TNB supply. The application of the proposed system is for the consumer and industrial lighting system. The proposed system is also design with electronic lamp ballast to produce equivalent light with lower losses. The electronic ballast operate lamp at higher frequency, eliminating flicker and increasing energy efficiency.

ABSTRAK

Sistem pencahayaan telah dilaksanakan oleh sumber dari TNB.cadangan projek adalah mereka dan menghasilkan system pencahayaan dangan menggunakan dua sumber voltan. Dua sumber voltan tersebut adalah sumber dari TNB dan bateri. Bateri disambungkan apabila berlakunya kegagalan voltan dari TNB. Cadangan projek ini adalah untuk domestic dan industri. Cadangan projek ini adalah untuk mereka dan menghasilkan ballast elektronik yang menghasilkan lampu yang mempunyai tenaga kehilangan yang rendah.Elektronik ballast ini juga berfungsi dalam frequensi yang tinggi,menghapuskan getaran dan meningkatkan tenaga kecekapan.

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LIST OF ABBREVIATIONS

AC	Alternating Current
APOD	Alternative Phase Opposition Disposition
CISDCS	Cascaded Inverter with Separated DC Sources
CMI	Cascaded Multilevel Inverter
DC	Direct Current
DCMI	Diode Clamped Multilevel Inverter
FCMI	Flying Capacitor Multilevel Inverter
IC	Integrated Circuit
IGBT	Insulated Gate Bipolar Transistor
MOSFET	Metal Oxide Silicon Field Effect Transistor
Op-amp	Operational Amplifier
PCB	Printed Circuit Board
PD	Phase Disposition
PIC	Programmable Interrupt Control
POD	Phase Opposition Disposition
PWM	Pulse Width Modulation
SPWM	Sinusoidal Pulse Width Modulation
UPS	Uninterruptible Power Supply

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CHAPTER 1

INTRODUCTION

The problems of lighting system have several drawbacks such as the system is unreliable. The system is unreliable with the environment condition, such as unstable weather[12].Almost all factory in this country have to add machine to simplify their works every day, or every month maybe every year and also the voltage consumption must be maintain at 0.85(TNB needed).

The fluorescent lamp electronic ballast had long been in the market but had not created any great impact in the lighting industry due to its high initial cost of venture as compared to the conventional magnetic ballast. With the progression in power electronics and utilization of power semiconductor commercially available today, it is now able to implement almost every type of desired conversion of current, voltage or frequency and availability of electronic components with higher power ratings. Thus, it is now possible to manufacture an economically priced, light-weight, lower watt loss and high quality with maximum performance electronic ballast, which is compatible with all types of fluorescent luminaries.

Fluorescent lamp are usually 36W/40W (4 feet long) or 18/20w (2 feet long). Conventional fluorescent lighting systems operate from the 240V, 50 Hz ac mains using simple series choke coil as the ballast, whose function is to create enough voltage to start the lamp (using an auto-disconnecting glow starter) and also to limit the lamp current once it has started. Such a system is simple and economical but suffers from several

disadvantages like low input power factor, additional loss in the choke delayed start flicker and stroboscopic effect.

Electronic ballasts for high frequency operation of fluorescent lamps have been increase adopted as an energy efficiency solution in residential commercial and industrial lighting application. The advantages of using electronic ballast nowadays are improved efficiency of the whole system, higher brightness and can also last long. Electronic ballast is basically switched mode power electronic circuits.

The basic concept is to utilize the resonant voltage across the resonant voltage across the resonant capacitor Cr to cause the lamp arc to strike at high frequency, typically from 25 kHz to 50 kHz. The lamp is essentially in a continuous on-state, therefore providing high quality illuminating by eliminating the flickering effect.

The designed electronic ballast was to bring significant performance enhancements to every aspect of lighting systems, with greater energy efficiency, more consistent lamp color and maximized lumen maintenance and lamp life. Low frequency electronic ballasts help ceramic lamps maintain consistent, superior color properties, while high frequency ballasts deliver significantly improved lumen maintenance throughout a lamp's life.

As we know supply voltage from TNB(Tenaga Nasional Berhad) suffers from unstable voltage supply that can cause damage to the electronics component. The design also to have back up system when black-out happen or there is no voltage from TNB supplying the system and to regulate proper current and voltage to the system.

1.1 Problem statement

The current system is without the back up condition. The proposed system design and develop the electronic ballast and the back up system using the battery. The proposed project is to design and develop the back up system with maintain the power factor of 0.85(TNB spec240 Vac(-5%,+10%)) The current system is unreliable with temperature condition (unstable temperature).Electronic component is too sensitive with temperature (Limit the amount of the component with better performance) of voltage supply (TNB).

1.2 The objective

The objective of the system is to design and developing electronic ballast with back up system when black out happen in sudden. Design and develop electronic ballast. Tested the proposed system. (TNB and the battery).

1.3 The advantage of the electronic ballast

The electronic ballast is designed that offer;

1. Although this electronic ballast uses dc as a supply voltage, there is no power factor in dc but if it uses ac, there is power factor and must be correct to reduce losses.
2. Power saving (efficiency)
3. Normally if the ballast is 'on', there is a buzzing sound. This ballast is flicker free operation.
4. This ballast is smaller than before and it used few components.

5. The proposed system is designed to reduce the problem stated.
6. This ballast has high frequency that also helping in lighting up the lamp.
7. The system is also having the back up happen.
8. More reliable system

CHAPTER 2

LITERATURE REVIEW

2.1 Electronic fluorescent lamp ballast

Fluorescent lamp have applications in most areas of lighting , where they give longer lifetime and lower power consumption for equivalent light output compared to filament bulbs, with the disadvantage of higher initial cost .Some form of limiter must be added to prevent the current increasing to a level where the lamp is destroyed. The current limiter is the **ballast.** The conventional lamp ballast used magnetic supervise to produce inductance. Problems with conventional ballasts is when the current in the tube falls to zero in each 50 Hz cycle, the gas in the tube de-ionizes and stops emitting light, resulting in a 50 Hz flickers.[1]

2.2 Starting performance of high-frequency electronic ballasts for four-foot fluorescent lamps

The tested lamp starting characteristics of 17 different electronic ballasts on 2-F40T12 lamps showed that the starting performance of electronics ballast varied; some met ANSI's(American National Standards Institute) requirements but some did not. The results also showed that using electrode voltage can better define preheat time and glow current, which can better characterize the starting performance of electronic ballasts and ensure reliable testing procedures. [7]

2.3 Modeling of a high-frequency operated fluorescent lamp in an electronic ballast environment.

The fluorescent lamp model for high frequency operation has been developed and implemented. Predictions for the lamp system operation generally agree very well with measurements obtained from a 33 kHz electronic ballast-fluorescent lamp system. The use of model for the designing the ballast components is illustrated. This model is simple and can be employed in existing simulation packages for computer aided electronic ballast designs. [8]

2.4 Performance analysis of electronic ballasts for compact fluorescent lamp.

A detail performance analysis in the most common electronic ballasts for compact fluorescent lamps. Electronic ballast characteristics are presented, as following: power factor, input current THD, crest factor and ballast efficiency. This analysis is done to the electronic ballasts using both drivers: self-oscillating circuit and dedicated integrated circuit (IR 2151). Electronic ballast topologies present: no power factor correction, PFC using the valley-fill filter and PFC with boost converter. Therefore, is presented a detailed losses analysis and how to minimize these losses. [3]

2.5 Effect of high efficiency lighting on power quality in public buildings.

The use of electronic ballast can have an adverse effect on power quality. To determine the effects that the electronic ballasts have on the power quality of the buildings being retrofit, studies are being performed at three buildings scheduled for the retrofit program. Power quality measurements throughout the buildings are being made

before, during and after the lighting retrofits. The results will be analyzed and simulations performed to identify and predict power quality problems that might occur with these and future retrofits. The effect of electronic ballasts on sensitive electronic devices is under investigation. Electronic ballasts are attributed with causing interference in a hearing aid worn by a student in an elementary school and interference with a book detector in a library. The effects are being studied to determine and understand the mechanism and recommend solutions to rectify the problems. [5]

2.6 Inverters- dynamic load responses as a result of the impressed inverter output waveform.

Inverters have been on the market since a need arouse to produce AC to DC source, probably long before the beginning of PV systems. With growth in the PV industry, the need for better, more effective inverters covering a wide range of power and applications are becoming a salient issue. Currently there are various types of inverters on the market, ranging from square wave, modified sinewave, pure sinewave , lightweight high frequency inverters(sine and modified sine), heavy 50hz transformer topology inverter. The purpose of this study is to investigate the dynamic response of various types of inverter waveforms. [9]

2.7 Improvements in design of local fluorescent electronic ballasts in compliance with the related local and international standards.

The advantages and disadvantages of electronic ballasts, their operation and performance characteristics and problems encountered during their normal operations, for instance, surges, starting current , power factor, watt-losses, ambient temperature and environmental effects, lamp/premature failure, harmonics and electromagnetic(EM)