

DISENGAGING SWITCHING SYSTEM FOR LOAD CAPACITOR

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ABSTRACT

An electrical power source is a necessity in human daily life. Due to this, many things can be done with the source of electrical power, and will cause problems if there is no source of electricity. Actually, much electricity has been wasted and causes the hike in electricity bills. Much can be also saved if the right techniques and methods to reduce the wastage or saving electricity are applied. Hence, this proposal discusses the idea to develop an auto triggered current cut-off system for energy saving device which currently is not present in an ordinary energy saving device. Statistically the ordinary energy saving device can save electricity up to 10% - 20% only during peak hours or when electrical equipment utilization rate is high or maximized. Apart from that, it also depends on the equipment and utilization of the equipment. If there is minimal electricity utilization, energy saving devices will operate as common electrical appliances. This will cause of increment in the cost of utility bills as compared to the rate of the maximum electrical appliances. This is caused due to the device starts to absorb the electrical energy. Therefore, to reduce the increment of the absorbed cost utility by the energy saving device, it should always ON when maximum load is utilizing the electricity and OFF state when minimal load is in use or no load is not in use. Thus, the idea of this invention is to automatically switch ON and OFF the electricity energy saving device based on the actual present conditions of the connected loads. Hence, indirectly it will help the consumers to reduce their utility bills when this device is plugged to perform electricity energy saving.

ABSTRAK

Sumber kuasa elektrik adalah satu keperluan asas dalam kehidupan seharian manusia. Oleh itu, banyak perkara yang boleh dilakukan dengan sumber kuasa elektrik, dan akan menyebabkan masalah jika tidak ada bekalan elektrik. Sebenarnya, elektrik telah banyak di sia-sia dan menyebabkan kenaikan dalam bil elektrik. Banyak juga yang boleh diselamatkan jika teknik-teknik dan kaedah yang betul untuk mengurangkan pembaziran atau penjimatan elektrik digunakan. Oleh itu, cadangan ini membincangkan tentang idea untuk membangunkan Pemotong Arus Automatik bagi peranti penjimatan tenaga yang kini tidak hadir dalam peranti penjimatan tenaga biasa. Statistik peranti penjimat tenaga biasa boleh menjimatkan elektrik sehingga 10% - 20% pada waktu puncak sahaja atau apabila kadar peralatan elektrik penggunaan yang tinggi atau maksimum. Selain daripada itu, ia juga bergantung kepada peralatan dan cara penggunaan peralatan. Jika terdapat penggunaan elektrik yang minimum, alat penjimatan tenaga ini akan beroperasi sebagai alat elektrik biasa. Ini akan menyebabkan kenaikan dalam kos bil pengguna berbanding dengan kadar penggunaan peralatan elektrik yang maksimum. Ini disebabkan kerana peranti ini mula menyerap tenaga elektrik. Oleh itu, untuk mengurangkan kenaikan kos bil yang diserap oleh peranti penjimatan tenaga ini, ia perlu sentiasa dihidupkan apabila menggunakan beban elektrik yang maksimum dan mematikan apabila menggunakan beban elektrik yang minimum iaitu apabila beban tidak digunakan. Oleh itu, idea ciptaan ini adalah untuk menaiktarafkan sistem kepada fungsi automatik untuk membuka dan menutup suis keatas peranti penjimat tenaga ini mengikut keadaan sebenar hasil daripada beban yang digunakan. Oleh itu, secara tidak langsung akan membantu pengguna untuk mengurangkan bil mereka apabila peranti ini dipasang untuk melaksanakan penjimatan tenaga elektrik.

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LIST OF ABBREVIATIONS

ESD	-	Energy Saving Device
PIC	-	Peripheral Interface Controller
TNB	-	Tenaga Nasional Berhad
IEEE	-	Institute of Electrical and Electronics Engineers
pF	-	Pico Farads
kW	-	Kilowatts
kVA	-	Kilowatts Ampere
AC	-	Alternative Current
DC	-	Direct Current
APFC	-	Automatic Power Factor Correction
HP	-	Horse Power
ADC	-	Analogue Digital Converter
SCM	-	Single Chip Microcomputer
PLD	-	Programmable Logic Device
PWM	-	Pulse Width Modulation
EMF	-	Electromotive Force
LCD	-	Liquid Crystal Display
COM	-	Common
NC	-	Normally Close
NO	-	Normally Open
SCR	-	Silicon Controlled Rectifier

CHAPTER 1

INTRODUCTION

1.1 Background

Electric is a basic part of nature and it is one of most important used from energy. The major sources of energy in the world produced from is a secondary energy source is from the conversion of other sources of energy are oil, coal, natural gas, hydro energy, nuclear energy, renewable combustible wastes and other energy sources. Combustible wastes include animal products, biomass and industrial wastes [1].

Therefore, since the recent years the price of oil was dramatically increased in the international market, it does not exception give an impact of our country from experiencing this problem. The problem from the increased of oil prices in the domestic market also give the effect because the gas prices pegged to the oil prices and also give the effect to the price of coal on the world market. Because gas and

coal is the main fuel for electricity generation in the country, any increase in the price of both fuels will affect the cost of electricity generation and also to electricity tariff [2] [3].

Following the increased of tariff rates has raised awareness among the consumers about the need to save electricity, the person of Malaysia are urged to save their electricity but with the sophistication and technological advancement has now been able to provide an alternative to consumers with the creation of tool for the purpose of energy saving devices. Lately, in the local market has found a lot of energy saving device that used to save the electricity. However, exposures on energy saving devices to consumers are still less widespread because information about it is limited and functions in saving electricity also still low [4].

Generally, the domestic consumer is the third largest consumer after the industrial and commercial sectors. In the industrial sector to achieve the limits of power factor have set by the electricity supplier and to avoid penalty they used the capacitor bank as a correction of the power factor. The effectiveness of the capacitor bank as devices for the power factor correction has given the innovation to produce the capacitor banks for domestic use. In context the usage of electrical power, the power factor of user is the main role as a measuring instrument to usage electrical energy efficiency of a system. The energy that must be supplied is increased when indicates the low power factor [3] [4] [5].

The electricity wastage is a big problem faced by domestic consumers. The cause contributed of this problem is when usage the low-efficiency of equipment. In order to overcome this disadvantage, the product of energy saving device have been introduced in the market right now. This product is manually function and require special observation to ON and OFF the switch. The product of energy saving device can help to reduce the wastage energy when the consumer used the electrical equipment which low efficiency. Statistically the ordinary energy saving device can save electricity only during peak hours or when electrical equipment utilization rate is high or maximized. Apart from that, it also depends on the equipment and utilization of the equipment. If there is minimal electricity utilization, energy saving

devices will operate as common electrical appliances. This will cause of increment in the cost of utility bills as compared to the rate of the maximum electrical appliances. This is caused due to the device starts to absorb the electrical energy. Therefore, to reduce the increment of the absorbed cost utility by the energy saving device, it should always switch ON when use the electrical equipment rate is high and switch OFF when the use the minimal load or not in use.

In order to overcome the problem, an idea to integrate the switching system automatic for energy saving device which currently is not present in an ordinary energy saving device (ESD) was produced. The purpose of this project is to function automatically to switch ON and switch OFF the electricity energy saving device based on the actual present conditions of the current flow depend on the load are used. Hence, this product indirectly will help the consumers to reduce the wastage energy when this device is plugged to perform electricity energy saving with power factor correction and when the consumer used the electrical equipment which low efficiency. Therefore, the Disengaging Switching System is to develop and integrated into energy saving device to function automatically switch ON and switch OFF when due to electrical equipment utilization rate is high and when the electrical equipment utilization rate is low based on the measured current through the current sensing circuit

1.2 Problem Statement

Following with the increased of electricity tariffs, the consumer tried various ways to find a solution to reduce and conserve electricity. There are many ways to save on electricity consumption but creation is "immediately" does not make the equipment more economical but it only increases the efficiency of the local electric grid systems such as electrical circuits of a house or building.

Basically, the project purpose is an idea to integrate a "Disengaging Switching System for Capacitor for Energy Saving Device" as a whole developed to

provide additional options to the user in order to help them reduce electricity bills burden arising from the use of low-efficiency electrical appliances. This project is also easy to use and operates automatically without need of a regular maintenance. The ordinary energy saver can save the electricity during only peak hours or when the electrical equipment utilization rate is high or maximized. But, if there is minimal electricity utilization, energy saver does not operate as an energy saving device, it will increase the power consumption indeed. This shortfall causes cost increment in the electricity billing. Therefore, the development of the product a disengaging switching into ordinary energy saver is to function automatically switch ON and switch Off when the electrical equipment utilization rate is high and low. The targeted group for this product is to the home consumers and offices which utilize more electrical supply every month.

1.3 Objective

The main objectives of this project are to develop a system which will optimize and minimize power consumption and improve the energy saver functionality with automatic switching when the device is under-utilized. There are several objectives that were selected for company and also for our system before development of project commenced.

Among the objective for project of Disengaging Switching System for Load Capacitor in Energy Saving Device are developed to achieve the following are:

1. To design a simple, small and low cost for disengaging switching system for energy saving device.
2. To implement the disengaging switching system into energy saving device.

1.4 Scope

The project is implemented to develop a device that could save electricity consumption after the government announced the increased of electricity tariff. This project divided into two main sections, which is switching system and level testing security. The first part, the designers will study about switching system for disengaging switching system for load capacitor for energy saving device in saving electricity next improve the performance of these device. The second part, is explain the effect the safety aspects for consumer and devices also. This aspect should not be underestimated because it involves the safety of life and property. Designers of project will ensure that this device safe to use in order to avoid any accident. This aspect is also important to convince consumers to use this device.

The two parts are an important to ensure that this device is able to function effectively, thereby ensuring the safety of consumers. In this study, designers more focused with the first part about the disengaging switching system. This project aimed to develop a switching system that would automatically switch ON and switch OFF the energy saving device during peak hours and off-peak hours based on the current consumption is when the current sensor circuit detect current flow at more than 1 Ampere and less than 1 Ampere.

This project integrates current sensor used to capture and detect changes in the current input signal according to the load demand as a component into the proposed automated system to control the energy saving device switching. The current input are captured will be sampled and converted into input analogue to digital converter and the sample data will send to the microcontroller (PIC). The Peripheral Interface Controller (PIC) is used as a centred control system to receive or send information in regards to the current signal that has been detected to relay switching command for control the energy saving device automatic switching.

1.5 Important of Project

The Disengaging Switching System for Load Capacitor in energy saving device was undertaken to handle the problem of increasing in the electricity tariffs currently affecting consumers and also to integrate the new system, which currently is not present in the ordinary energy saving device. Here is the importance of the project to be implemented:

- Saves the costs of electricity consumption.

The Government's decision to raise the electricity tariffs has forced consumers to act smart in managing the electricity consumption at home. Most conventional action is reducing to use of electricity as austerity measures. However, it is difficult for consumers to implement. Therefore, an energy saving device was invented and improved to overcome this problem.

- To diversify the electricity saving products.

There are a variety of electricity-saving products in the market now in tandem with needs of consumers. Thus, the implementation of this project is expected to diversify the energy saving devices products in the local market and also give options to users.

- To ensure the safety of consumers.

The consumer safety is very important because it involves the use of power device electricity. If this aspect is neglected, it can cause loss of life and property of thing. Therefore, to ensure the safety of consumer, need to do testing for this device.

- To give benefit for the consumers.

To improve this device by taking to the aspect of the user-friendly for ensure comfort of the consumers. The designing of this project is to minimize

the size of device without interfere with other electrical appliances. In addition, the design of housing (casing) for this project that does not use long wires and portability. Besides that, this project also functions automatically to switch ON and switch OFF the device according to the current consumption without need regulation maintenance and easy to use.

1.6 Summary of The Thesis

The first chapter focuses on the introduction, which is background, problem statement, objectives, scope and the important of project. For background and problem statement explains about introduction of this project and the necessary to implement this project. The main factor to choose the title of project and tells the project purpose has described under the objectives. The brief operation of this project is explained under scope of study.

The second chapter, describes about the literature review in which this literature review is on research that was done before the start of the project based on review by reading such theses, journals, books, newspapers, internet, lecturer notes and so on to get more clear information about the types of energy saving device, the method and technique to control the energy saving device and identify the improvements to the energy saving device methods used in handling this problem. It is a more detailed description about keywords of the project and also to guide the students to make the project. In this chapter, the information is obtained merely through to reading only. For information and achieve the objectives described in the study, the researchers will determine the appropriated methodology to carried out of this project.

The third chapter covers the methodology of the project. This chapter is about a process or steps are used for a development of project or research of the project. In developing this project, some of the methodology or approach has been identified as a guideline for the flow of the project. This chapter is also including hardware development and software development of this project. The detail from the research methods is in producing an Disengaging Switching System. In creating this

disengaging switching circuit, the analysis is done to find a solution in this problem. There are three methods of the research which is designing the circuit, making the circuit simulation and hardware installation. Each analysis and function in the power circuit and control circuit is explained in more detail.

The fourth chapter describes about the result and analysis. In this chapter, discusses about the result from the data analysis and the testing of the project. In addition, this section also discusses the observation made during the development of this project.

Finally, for the last chapter of the report covers the conclusion and suggestions for improvement of this project are discussed. This chapter describes the conclusion for development of this project and the suggestion of project for the future. This section is a whole summary of the project development.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter describes the results from the research has been done to develop the Disengaging Switching System for Load Capacitor in energy saving device to improve power factor of the system and discuss about the projects backgrounds. It's also includes some specifications about the product ready in the market which is related to this project. The research was carried out using a number of reference materials such as books and journals from Institute of Electrical and Electronics Engineers (IEEE) and also including the website to assist this study. From the paper of IEEE will be reviewed and discussed. The research conducted to obtain scientific information, analyses and reviews of the concept and weaknesses of existing methods to be improved through to develop this project. The research has been made before this as a reference and guide to make this project. From previous researches, it explains parameters in electrical power systems and electronics such as power factor,