DESIGN OF DAYLIGHT INTENSITY DETECOR FOR POWER SYSTEM

MOHD AZRUL BIN ABDUL TALIB

A report submitted in partial fulfillment of the requirement for the degree of Bachelor in Electrical Engineering (Industrial Power)

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“I hereby declare that I have read through this project entitle “Design of Daylight Intensity Detector for Power System” and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Industrial Power) ”

Signature	: ……………………………….
Supervisor Name	: En. Kyairul Azmi Bin Baharin
Date	: 2 July 2009

I declare that this report entitle ―Design of Daylight Intensity Detector for Power System" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any degree.

Signature :

Name : Mohd Azrul Bin Abdul Talib

Date : 2 July 2009

To my beloved mother and father

Mr. Abdul Talib Bin Kidam and Mrs. Ramlah Binti Md. Taib @ kudin

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Bissmillahirahmanirahim... In the name of Allah S.W.T, the most gracious and merciful, praise to Allah the lord of universe and may blessing and peace of Allah be upon his messenger Muhammad S.A.W. Thanksgiving to Allah because He has give me the opportunity to complete my final year project and final year report. Without His blessing, I can't complete this task in the time given.

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ABSTRACT

The aim of this project was to design an automatic daylight intensity detector for power system (electrical appliance). This project is able to detect the daylight intensity and activate the fluorescent light circuit automatically. The software for this project was designed by using Visual Basic 6.0 program to read the value of daylight intensity detected by light meter and activate the lighting system of fluorescent light. This automatic daylight intensity detector will detect the sunlight intensity detector and the software will read the detected value. After that, the designed software will compare the value between the detected values and setting value to operate the lighting system. The system will activate the lighting system if the detection value is lower than the setting value. Meanwhile that, the system will deactivate the lighting system if the detected value is higher than the setting value. This system uses an interface circuit to operate the lighting system and use parallel port to link between the computer and the lighting circuit. The lighting will be activated when there are signals transferred from the computer through this parallel port.

ABSTRAK

Matlamat utama projek ini adalah bertujuan untuk menghasilkan suatu sistem pengesan keamatan cahaya automatik yang boleh digunakan untuk peralatan elektrik di rumah mahupun di pejabat sebagai suatu sistem yang dapat mengoperasikan litar lampu kalimantang secara automatik. Sistem yang dihasilkan ini mampu digunakan sebagai suatu alat pengesan keamatan cahaya dan suis pengaktifan automatik dalam suatu masa yang sama. Sistem pengesan keamatan cahaya automatik ini dihasilkan dengan perisiannya yang tersendiri. Sistem perisian ini dapat memberi gambaran kepada pengguna mengenai bagaimana proses pengaktifan litar lampu kalimantang dilakukan secara automatik dengan bantuan perisian Visual Basic 6.0 ini. Perisian yang dihasilkan dengan menggunakan perisian Visual Basic ini bertujuan untuk membaca nilai keamatan cahaya yang dikesan dengan menggunakan meter cahaya. Seterusnya perisian ini akan membandingkan nilai yang telah dikesan dengan nilai yang telah ditetapkan untuk pengoperasian litar. Sekiranya nilai keamatan cahaya yang dikesan menggunakan meter cahaya adalah rendah daripada nilai yang telah ditetapkan, maka sistem perisian akan menghantar isyarat pengaktifan kepada litar pengantara muka untuk menyalakan lampu kalimantang dan sekiranya nilai keamatan cahaya yang dikesan oleh meter cahaya adalah tinggi, maka sistem perisian akan menghantar isyarat kepada litar pengantara muka untuk menghentikan operasi litar lampu kalimantang. Isyarat yang dihantar oleh perisian kepada litar pengantara muka adalah melalui sambunagn ‗parallel port‘ (port pada komputer).

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CHAPTER 1

INTRODUCTION

1.1 Background

Automatic daylight intensity detector is a project designed to control the lighting system automatically. The lighting system is automatically controlled by a computer based on the changes of sunlight intensity detected from data logger light meter. The automatic system also designed to introduce the new technology of automatic lighting control system.

Today, there are many improvements on lighting system to provide efficient lifestyles. The latest technology on lighting system is automatic ON/OFF lighting system which controlled by a relay. This system used to operate the lighting system at night and terminate the operation on the morning. Therefore, this automatic switching system still have some problem which is the lighting system does not operates properly on the time setting due to setting error and relay damaged.

In order to overcome such problems, the automatic daylight intensity detector is the solution to improve the technology of automatic lighting system. Automatic daylight intensity detector is the automatic lighting control system that can switch or operate the lighting system based on the different levels of daylight intensity detected by data logging light meter and setting value of daylight intensity requirement on the specified room or workspace. The weather change abruptly. It can be sunny for one minute and cloudy on the next. Daylight intensity detector function as a device that can determine when the natural lighting (i.e. daylight) in a building is too low (when it is rainy or cloudy) and turn ON the lights powered by the grid supply automatically. Otherwise, supply turned OFF when the natural lighting back to normal condition. This system also can be used for laboratory room, school, office, class room and etc.

Implication of using this automatic daylight intensity detector, lifestyle becomes more comfortable and efficient. Hence, using this daylight intensity detector system, it may help user to decrease their energy consumption.

1.2 Problem Statement

The weather changes abruptly, it can be sunny in one minute and cloudy the next. When the weather changing from bright to cloudy, users might have a problem to continue their office work or students cannot continue their study because of the lowest level of daylight intensity is at that time and they need to switch the light ON to help them in continuing their work. This situation will make user feel distracted while doing their work everyday. Therefore, ―Automatic Daylight Intensity Detector" was designed to fix this problem and make user life become more easy and comfortable. The automatic daylight intensity detector is a device that used to determine the changes of natural lighting (i.e. daylight) in a building and switch ON lighting system when environment brightness is low while switch OFF the system when natural lighting is back to normal condition.

1.3 Project Objective

Every design must have its objective to ensure the successfulness of the design or project. The objective of a design is used to identify the purpose of the project existence. The aim of this project is to design an automatic daylight intensity detector for electrical power system (lighting system). The main objectives were:

a) To design an automatic daylight intensity detector able to control the lighting system based on the daylight intensity detected by data logging light meter.

b) To conduct an analysis about sunlight intensity in FKE, UTeM.

c) To setup a proper interfacing circuitry between the hardware and software devices for automatic operation

d) To develop a Graphical User Interface (GUI) for this system using Visual Basic V6.0

e) To utilize the concept of parallel port in designing the software program to control circuit.

f) To verify whether the automatic daylight intensity detector can help to reduce daily energy consumption.

1.4 Project Scope

The scope of this project is to design automatic daylight intensity detector for power system. This project can be used for laboratory room and other workspace in FKE buildings, residential building, and etc. for example, this automatic daylight intensity detector can be used in lecture hall of FKE building to activate the lighting system automatically during the cloudy or rainy day.

The other scope of this project is to apply the uses of Visual Basic V6.0 program in building the Graphical User Interface (GUI) for automatic daylight intensity system. The software will show user about daylight intensity detection and system operations. This project is totally different from the previous automatic light switching where the lighting system automatically operates based on the timer setting.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Literature review is a body of text to review the critical points of current knowledge on a particular topic.

Most often associated with science-oriented literature. The literature review usually precedes a research proposal, methodology and results section. Its ultimate goal is to bring the reader up to date with current literature on a topic and forms the basis for another goal, such as future research that may be needed in the area.

A good literature review is characterized by a logical flow of ideas, current and relevant references with consistent, appropriate referencing style, proper use of terminology, and an unbiased and comprehensive view of the previous research on the topic.

This project is all about automatic daylight intensity detector which is can control the lighting system automatically based on the sunlight intensity detected by data logger light meter. All the following studies were reviewed to design this project. [14]

2.2 Lighting Control System

Lighting control system consists of a device, typically an embedded processor or industrial computer, the controls electric lights for a building or residence. Lighting control systems usually include one or more keypads or touch panel interfaces. These interfaces allow users the ability to toggle power to lights and fans, dim lights, and program lighting levels. **[1]**

A major advantage of a lighting control system over conventional lighting is the ability to control any device from any interface. For example, a master touch panel might allow the user the ability to control all lights in a building, not just a single room. In fact, any light might be controlled from any location.

In addition, lighting control systems provide the ability to automatically power a device based on programming events such as:

- Chronological time (time of day)
- Astronomical time (sunrise/sunset)
- Room occupancy
- Events
- Alarm conditions
- Program logic (any combination of events)

Chronological time is a time of day or offset from a time. Astronomical times includes sunrise, sunset, a day, or specific days in a month or year. Room occupancy might be determined with motion detectors or RFID tags. Events might include holidays or birthdays. Alarm conditions might include a door opening or motion detected in a protected area. Program logic can tie all of the above elements together using constructs such as if-then-else statements and logical operators.

Architectural lighting control systems integrate with a theater's dimmer system and are often used to control house lights, and sometimes work lights, rehearsal lighting, and lobby lighting. Control stations are placed in several locations around the building and range in complexity from a single button that brings up a preset look to in-wall LCD touch screens. Much of the technology is related to residential and commercial lighting control systems.

The benefit of architectural lighting control systems in the theater is the ability for theater workers to turn work lights and houselights on and off without having to use a lighting control console. On the other hand, the light designer can control these same lights with light cues from the lighting control console so that, for instance, the transition from houselights being up before a show starts and the first light cue of the show is controlled by one system.

2.3 Light Sensor

2.3.1 Introduction

Light Sensors are used to measure the radiant energy that exists in a very narrow range of frequencies basically called "light", and which ranges in frequency from "Infrared" to "Visible" up to "Ultraviolet" light. Light sensors are passive devices that convert this "light energy" whether visible or in the infrared parts of the spectrum into an electrical signal output. Light sensors are more commonly known as "Photoelectric Devices" or "Photo sensors" which can be grouped into two main categories, those which generate electricity when illuminated, such as Photovoltaic or Photo missives etc, and those which change their electrical properties such as Photo resistors or Photoconductors. **[11]**

2.3.2 Light Dependent Resistor (LDR)

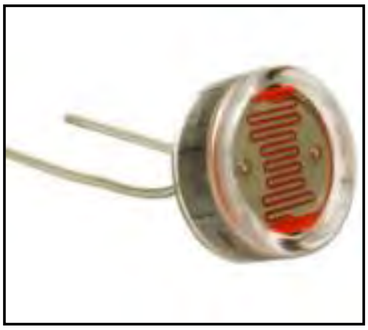

Figure 2.1: Light dependent resistor (LDR)

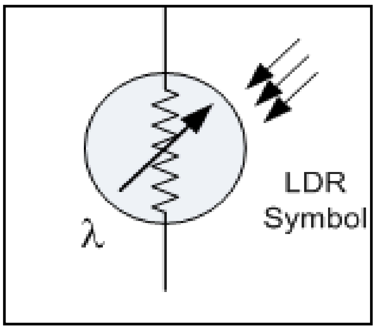

Figure 2.2: Symbol of light dependent resistor (LDR)

Light dependent resistor is one of photo conductive cell which is the light sensors change their physical properties when subjected to light energy. The most common type of photoconductive device is the Photo resistor which changes its electrical resistance in response to changes in the light intensity. Photo resistors are *Semiconductor* devices that use light energy to control the flow of electrons, and hence the current flowing through them. The commonly used Photoconductive Cell is called the Light Dependant Resistor or LDR. **[11]**

Light Dependant Resistor is a resistive light sensor that changes its electrical resistance from several thousand Ohms in the dark to only a few hundred Ohms when light falls upon it. The net effect is a decrease in resistance for an increase in illumination. Materials used as the semiconductor substrate include, Lead Sulphide, (PbS) Lead Selenide, (PbSe) Indium Antimonide, (InSb) which detect light in the INFRARED range and the most commonly used of all is **Cadmium Sulphide**

(Cds), as its spectral response curve closely matches that of the human eye and can even be controlled using a simple torch as a light source. Typically it has a peak sensitivity wavelength (λp) of about 560nm to 600nm in the visible spectral range.

The resistance of LDR may typically have the following resistances

- Daylight = 5000Ω
- Dark = 20000000 Ω

2.3.3 Photodiode

Figure 2.3: Photodiode

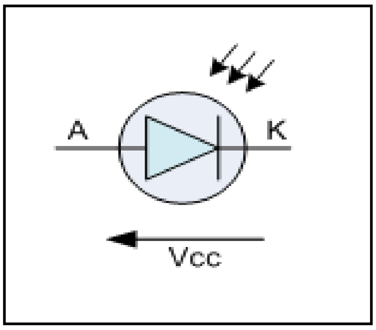

Figure 2.4: Symbol of photodiode

Photodiode is a photo junction device. Photo junction device are basically *PN-Junction* light sensors or detectors made from silicon semiconductors and which can detect both visible light and infrared light levels. These classes of photoelectric light sensors include the Photodiode and the Phototransistor. **[11]**

The construction of the **Photodiode** light sensor is similar to that of a conventional PN-junction diode except that the diodes outer casing is transparent so that light can fall upon the junction. *LED's* can also be used as photodiodes as they can both emit and detect light. All PN-junctions are light sensitive and can be used in a photoconductive (PC) mode with the PN-junction of the photodiode always "Reverse Biased" so that only the diodes leakage or dark current can flow. This reverse bias condition causes an increase of the depletion region which is the sensitive part of the junction.

The photodiodes dark current (0 lux) is about 10uA for geranium and 1uA for silicon type diodes. When light fall upon the junction more hole/electron pairs are formed and the leakage current increases. The leakage current increases as the illumination of the junction increases. Diode current is directly proportional to light intensity. One main advantage of photodiodes when used as light sensors is their fast response to changes in the light levels, but one disadvantage of this type of photo device is the relatively small current flow even when fully lit.

Photodiodes are very versatile light sensors and are commonly used in cameras, light meters, CD and DVD-ROM drives, TV remote controls, scanners, fax machines and copiers etc, and when integrated into operational amplifier circuits as infrared spectrum detectors for fiber optic communications, burglar alarm motion detection circuits and numerous imaging, laser scanning and positioning systems etc.

2.3.4 Phototransistor