THE DESIGN OF DARKNESS CONTROLLED LIGHT SWITCH CIRCUIT

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"I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering

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"Saya akui bahawa saya telah membaca karya ini pada pandangan saya karya ini adalah memadai dari skop dan kualiti untuk tujuan penanugerahan Ijazah Sarjana Muda Kejuruteraan Elektrik (Kuasa Industri)."

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

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For my beloved father and mother

Hamzah Bin Shaik Ahmad Wahidudin and Nor Ashikeen Bt Saad

For all their support and understanding.

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بِسۡمِ ٱللَّهِ ٱلرَّحۡمَٰنِ ٱلرَّحِيمِ

In the name of Allah, The Beneficent, The Merciful.

Alhamdulillah, all praise is to Allah that I have been able to complete my report for my "Projek Sarjana Muda 2" that is The Designed of Darkness Controlled Light Switch.

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ABSTRACT

Most public buildings or industrial units need to be switched on at night and switched off at a specified time in the morning. The installation of ‘Darkness Controlled Light Switch’ can control the operation of buildings or industrial lights. A photocell is used as a switch to turns lights on as light levels drop (at dusk) and then turns them off again when light levels rise (at dawn). Dusk to dawn operation means that lights will be turned on an average of 12 hours each day. ‘Darkness Controlled Light Switch’ could keep lights off and simply have them turn on automatically whenever the light level rises.

ABSTRAK

Kebanyakan bangunan atau industri perlu memasang lampu pada waktu malam dan menutup lampu pada waktu siang. Pemasangan *Darkness Controlled Light Switch* dapat mengawal operasi buka dan tutup lampu pada bangunan-bangunan atau perindustrian. Sensor peka cahaya digunakan sebagai suis, iaitu membuka lampu pada waktu gelap dan menutup lampu pada waktu cerah. Biasany, perbezaan antara waktu gelap dan cerah adalah selama 12 jam. Oleh itu *Darkness Controlled Light Switch* dapat digunakan untuk memastikan lampu dapat dipasang pada waktu gelap dan ditutup pada waktu cerah secara automatik.

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AC	Alternating Current
DC	Direct Current
LDR	Light Dependent Resistance
PIC	Programmable Interface Controller
LUX	Luminousity

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CHAPTER 1

INTRODUCTION

1.1 Project Overview

The focus of this project is to design and develop a Darkness Controlled Light Switch. 6V DC battery is used to supply the rest of the circuit. DC relay that switch a 240V AC mains circuit also is used 6V DC to operate. There is a circuit need to be built and the circuit is Darkness Controlled Light Switch circuit. The function of Darkness Controlled Light Switch is to be switched on in the dark and switched off in the bright.

This project uses a light dependent resistance (LDR) as the heart of the circuit. This sensor will detect the amount of visible light that falls on it and give the signal to the controller which operates the light. Darkness Controlled Light Switch circuit use two ICs that are CD4060 and CD4040. The function of CD4060 is as a square wave generator and as a 14 stage binary counter with oscillator, while the function of CD 4040 is as a 12 stage binary counter. The final output will cause the relay to be energized. Magnetic field causes the contacts of the relay to close. Hence, AC current flows through the light. After all components have been fabricated, the analysis on the system needs to be carried out. This project is called Darkness Controlled Light Switch Circuit.

1.2 Project Objectives

- Reduces power consumption.
- Reduces electrical billing.
- Reduces energy.
- Helps safety.
- Saves time.
- Makes life easier.

1.3 Probem Satatement

Most public buildings or industrial units need to be switched on at night and switched off at a specified time in the morning. Control of lights can be done manually at the wall switch, but this way is not practical because some one has to switch on the light at the time night and switched off it again in the morning. By using the Darkness Controller Light Switch, the lights can be controlled automatically during the dark.

1.4 Scope of the Project

- To study the darkness controlled light switch circuit
- To design the circuit
- To do analysis and experiment on the circuit
- To make a full report.

1.5 Project Report Outline

Generally this project report is divided into six chapters, where it consists:
Chapter 1: Introduction
Chapter 2: Literature Review / Theories
Chapter 3: Project Methodology
Chapter 4: Project Development
Chapter 5: Results and Analysis
Chapter 6: Conclusion and Recommendation

Chapter 1 is an overview of the research project as a whole, the objectives, problem statement and scope of the research project are defined. The research project that will be done are based on the objectives and scopes that been stated earlier.

Chapter 2 presents the literature review and theory background. In this chapter the theoretical and concepts of Darkness Controlled Light Switch will be explained. It is to provide the basic principals and concepts of darkness controlled light switch circuit. Studies on literature review helps in understanding the fundamental of darkness controlled light switch circuit concept.

Chapter 3 will discuss about the methodology that shall be adopted for this project work which is basically defined in the planning process flow and principles that is essential guide to produce a well planned project. Besides, selected approach or methodology will describe the activities that might be done in every stage.

Chapter 4 covers the major parts of the hardware development. The hardware implementation, hardware testing, main hardware components, and calculation will be discussed in detail in this chapter. Concept and operation circuit will be discussed with more advanced in this chapter.

Chapter 5 will be discussed the results and analysis. Where the collected data from experimental work will be gathered before the analysis will be performed. The final sections from this chapter are the discussion for the gathered data.

Chapter 6 will conclude all the works which have been presented in the previous chapters and all the results of the project. This is followed by recommendations for the future study work.

CHAPTER 2

LITERATURE REVIEW / THEORIES

2.1 Introduction

In this chapter, the principals and concepts of darkness controlled light switch circuit, its application and overview about the basic operations and theories will be identified and studied. The information is from the website, books, journals and articles. Besides that, this chapter also includes the difference between other darkness controller circuit and the design circuit.

2.2 Principals and Concepts of Darkness Controlled Light

Lighting includes both artificial light sources such as lamps from daylight. The main source of light during daytime in buildings is through the windows or skylights is often used as given its low cost. Lighting represents a major component of energy consumption, accounting for a significant part of all energy consumed worldwide. Artificial lighting is most commonly provided today by electric lights, but gas lighting, candles, or oil lamps were used in the past and still used in certain situations.

Light can be produced by nature or by humans. "Artificial" light is typically produced by lighting systems that transform electrical energy into light. Nearly all lighting systems do so either by passing an electrical current through an element that

heats until it glows, or through gases until they become excited and produce light energy.

A typical lighting system is comprised of one or more of these light sources, called the lamps. Fluorescent, HID and low-pressure sodium lamps operate with ballast, a device that starts the lamp and regulates its operation. Lamps and ballasts in turn are part of the luminaire, or light fixture, which houses the system and includes other components that distribute the light in a controlled pattern. [7]

2.2.1 Luminosity

Light can be differing in luminosity, or brightness. A table lamp emits less light than a halogen lamp, but even a halogen source cannot be compared with bright sunlight, as far as luminosity is concerned. Luminosity depends on the amount of available light. It can be measured and recorded in a numeric value. Nowadays Lux is used to express the amount of luminosity. Table 2.1 below shows Luminousity (Lux) depends on the source of lights.

Table 2.1: Luminousity (Lux) Depends On the Source of Lights

Source of Lights	**Luminousity (Lux)**
Candle light at 20 cm	10-15
Street light	10-20
Normal living room lighting	100
Office fluorescent light	300-500
Halogen lamp	750
Sunlight, 1 hour before sunset	1000
Daylight, cloudy sky	5000
Daylight, clear sky	10,000
Bright sunlight	> 20,000

2.3 Applications of Darkness Controlled Light Switch Security Lighting

Security lights are an additional safety measure homeowners can use to protect their property. Crime simply cannot occur as easily if there are no dark places for intruders to hide. Darkness controlled light switch can be used for security and eliminate wasted power consumption, waste energy, and waste money. These new lights do a better job of aiming light only where it is needed. The light will turn on during darkness and off during brightness. Darkness controlled light switch for security lighting can be installed at residential areas, walkways, shopping centers, malls, access roads, parking lots and other outdoor areas. [6]

2.4 Operation of Darkness Controlled Light Switch Circuit

Most public buildings or industrial units need to be switched on at night and switched off at a specified time in the morning. The installation of Darkness Controlled Light Switch Circuit can control the operation of buildings or industrial lights. A photocell, turns lights on as light levels drop (at dusk) and then turns them off again when light levels rise (at dawn). Dusk to dawn operation means that lights will be turned on an average of 12 hours each day. Darkness Controlled Light Switch Circuit could keep lights off and simply have them turn on automatically whenever the light level rise.

Darkness Controlled Light Switch Circuit also address another issue commonly associated with outdoor lighting, security. Many people feel that they need to keep their outdoor lights on all not long in order to keep intruders away. As such, if lighting is to be used as a security measure, Darkness Controlled Light Switch Circuit would be the most effective to be used.

2.5 Basic Operations and Theory

In this circuit, the light dependent resistance (LDR) is reacting as the switch. When there is no light falling on the LDR, the value of LDR can be as low as 80 ohm and the switch is in open condition. While the light is falling on the LDR, the value of LDR can increase to over 1M ohm and the switch is in close condition so the current is applied to a bulb causing it to light. Figure 2.1 consists of two separate circuits. One circuit is the DC part and the other is AC part.

DC relay is used to control an operation of AC circuit. When the switch is open, no current flows through the coil of the relay. As soon as the switch is closed, current start to flow through the coil causing a magnetic field to build up. This magnetic field causes the contacts of the relay to close. Hence, AC current flow through the bulb and the light of the bulb can be seen.

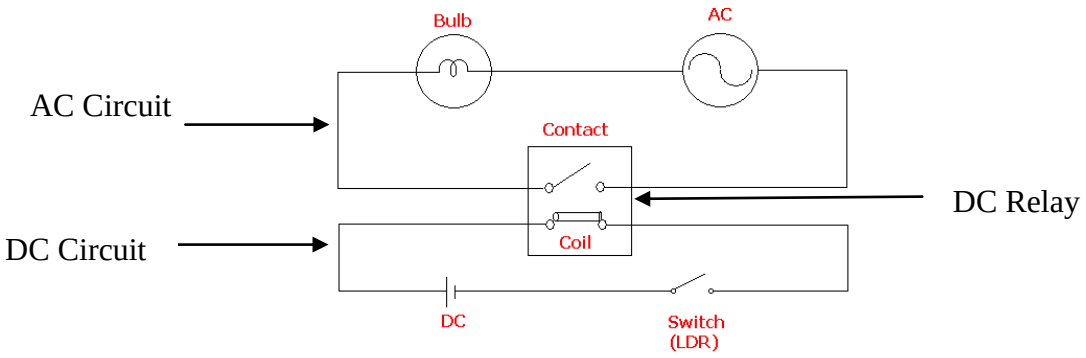

Figure 2.1: AC and DC Circuit

2.6 Circuit Operations

The light sensor used is the photocell. In bright light, the resistance of the photocell can be as low as 80 ohm. In darkness, resistance increases to over 1 M ohm. Transistor T_1 does not get sufficient forward bias current and is cut-off. This causes forward biasing of transistor T_2 and, as a result, the power supply becomes available to the rest of the circuit.

IC_1 (CD4060) functions as a square wave generator. The output waveform is initially low and goes high at 50 percent of time period at the output pin. The basic oscillator time period is given by the formula: T (time period) =2.3xC1xR2 sec. This basic clock is divided within this 14-stage binary counter. In this circuit the output of the 10th stage at pin 15 is used.

The output pulse period of IC_1 is multiplied further by IC_2 (CD4040), which is a 12-stage binary counter. Any one of the outputs (Q_2 to Q_{12}) may be selected using rotary switch S_1. Q_1 output of IC_2 has been used for LED blinking to show that circuit is functioning.

The final output, which is initially at logic low, is fed to the transistor T_3 which is thus cut-off. This results in forward biasing of transistor T_4 which causes relay RL_1 to be energised.

AC supply to the lighting load is thus connected via the contacts of this relay. The relay will remain energised till either the selected output of IC_2 goes high or the LDR resistance falls to a low value due to light. The sensitivity of transistor T_1 may be adjusted with the help of preset VR_1. Figure 2.2 shows the Darkness Controlled Light Switch circuit diagram.