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LAPORAN PROJEK

SARJANA MUDA

AUTOMATIC LAMP ILLUMINATION SYSTEM

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Bachelor of Electrical Engineering (Power Industry)

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" I hereby declare that I have read through this report entitle "Automatic Lamp Illumination System" and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Industrial Power)"

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AUTOMATIC LAMP ILLUMINATION SYSTEM

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A report submitted in partial fulfillment of the requirements for the degree

Of Bachelor Of Electrical Engineering (Power Industry)

Faculty of Electrical Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2013

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I declare that this report entitle “Automatic Lamp Illumination System” is the result of my own research except as cited in the reference. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : ……

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ABSTRACT

Automatic lamp illumination system is one of methods that can reduce energy consumption in household. Uncontrolled energy consumption will affect the health of earth such as global warming and have to pay more for electrical bill. By controlling the lamp illumination automatically, the lighting system becomes more efficiency to reduce the problem. The lamp system at the house is either a manual operation that used human energy to turn ON/OFF the system or others system that has manual dimming control. Thus, automatic lamp illumination system is design to reduce human energy usage. This system is operated depends on the Passive Infra Red sensor (PIR) to sense the human movement. The method that is used to control lamp illumination level is the Pulse Width Modulation (PWM). This method will control power delivered to the load by using ON/OFF digital signal. By varying the duty cycle, average DC value of the signal can be varied. The brightness of the lamp based on the surrounding illumination to perform the decreasing of the energy consumption. The surrounding brightness is detected by using Light Depending Resistor (LDR). The resulting automatic light illumination control is well suited to apply for household usage to reduce the energy consumption and make the human life easier.

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ABSTRAK

Sistem kawalam pencahayaan secara automatik merupakan salah satu langkah bagi mengurangkan penggunaan tenaga di rumah. Penggunaan tenaga yang tidak terkawal boleh memberi kesan terhadap kesihatan bumi seperti pemanasan global dan perlu membayar penggunaan tenaga setiap bulan dengan harga yang tinggi. Dengan mengawal tahap kecerahan lampu secara automatik, sistem perlampuan akan menjadi lebih cekap untuk mengurangkan masalah tersebut. Sistem perlampuan dirumah biasanya menggunakan tenaga manusia untuk mengedalikan operasi secara manual atau mempunyai sistem pelarasan kecerahan lampu secara manual. Oleh itu, sistem pencahayaan secara automatik direka khas untuk mengurangkan penggunaan tenaga manusia. Sistem ini akan beroperasi bergantung kepada penderia Pasif Infra Red (PIR) untuk mengesan pergerakan manusia. Kaedah yang digunakan untuk mengawal tahap kecerahan lampu ialah modulasi lebar denyut (PWM). Tahap kecerahan lampu akan dikawal berdasarkan pencahayaan sekeliling bagi mengurangkan penggunaan tenaga. Tahap pencahayaan sekeliling akan dikesan menggunakan penderia perintang peka cahaya (LDR). Sistem kawalan pencahayaan secara automatik ini sesuai digunakan di rumah untuk mengurangkan penggunaan tenaga dan memudahkan kehidupan manusia seharian.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter explained to project start with the project motivation and overview of "Automatic Lamp Illumination System", problem statement, project objective and scope of limitation.

1.2 Overview

Automatic Lamp Illumination System is a new design for home lighting system that can make human life easier. Currently, home lighting system has a manual switch to operate the system and only a few of house that have manual dimmer. To dim the light is the best solution that can be use to solve lighting system problem such as energy efficiency and glare but if there use a manual dimmer, its same like lighting system with manual switch.

This project is built by adding some modification in the lighting system to replace the old lighting system. The advantage of this project is it can consider all the operation is automatically operate. The automatic operation of this project is depends on two important

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component which is sensor and microcontroller. This project has use two types of sensors to operate which is Passive Infra Red sensor (PIR) and Light Dependent Resistor (LDR).

The PIR is the first part in the system that will be operated. The PIR will detect human movement that entered its range and lighting system will be operating base on the movement. In the same time, LDR will sense to read the surrounding brightness level. The data from LDR will be processed at in microcontroller (PIC 16F877A) and determine the lamp illumination level based on surrounding illumination. This project used Pulse Width Modulation (PWM) method to dim the lamp.

1.3 The Project Motivation

In recent years, energy crisis is become a problem that the whole world must face. The largest part of energy consumption in the world is the home power consumption. Generally, the power consumption of lamps in household cannot be ignored. Usually, people have implemented program to reduce lighting energy requirement by installing more efficient light source and luminaries. In daylight, a different lamp illumination is needed for different place. Sometimes the sunlight is sufficient to light up the area, thus do not need to turn on any lamp. However, in some cases the glare problem will occur when there have two source of light which is sunlight and uncontrolled lamplight.

Lamp systems are usually controlled by on/off switch. Sometimes the user leaves their home and forgets to turn off the light. These will increase the energy waste. By replacing the old lamp with efficiency lamp like compact fluorescent lamp (CFL) also can decreased energy consumption. However, this is not sufficient. This project will provide a new lighting system that can performed energy efficiency. This project will control automatically the operation of light in term of its illumination and motion of human detected.

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1.4 Problem Statement

During daylight, the sunlight is the main source that can give good illumination. Sufficient illumination is according to the standard illumination level in Malaysia. The sunlight is limit for certain space such as in the house. So, lamp is a good appliance to replace the sunlight. The illumination of the sun will be add by lamp illumination without consider the glare. Most of the users prefer dimmer light setting in daylight to prevent glare.

By adding lamp illumination, the space will become brighter and not follows the standard illumination level. Uncontrolled lamp illumination will increase the electrical energy consumption. More electrical energy be used, more money is needed to pay for the electricity cost.

Most of the lamp switches and dimmer are using manual control of human energy. It looks easy if the area is small, but if the large area it requires more human energy to turn ON/OFF and to adjust the brightness of the lights. By using the automatic lamp illumination system all the lighting problem will be reduce.

1.5 Objective

The key objectives for Automatic Lamp Illumination Control project are:-

1) To design and develop a prototype of lighting system that can automatically adjust brightness according to its surrounding.
2) To evaluate the performance of the automatic lamp illumination system in terms of reducing the energy consumption.

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1.6 Scope

The scopes of this project are:-

1. This project used LED 5 volts as testing light
2. Lamp illumination can be controlled automatically based on the brightness level of the surrounding

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will discuss the previous research theory related to this project. The research is focus on to control lamp illumination method that can perform the energy efficiency and the component that might be used

.

2.2 Energy Consumption

The unplanned Energy consumption can affect the health of the earth. In most developed countries, the use of fuel in producing electricity is increasing. This situation is cause by lack of public awareness on the impact of energy consumption on the health of the earth. Study done in Florida Solar Energy Center, conclude that "one method to reduce energy consumption is to make an observation on the use of energy at home. By using energy viewer, users can control the energy consumption programs."[1]

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Table 2.1: Average power consumed by several home appliances [2]

Appliance	**Watt**	**Appliance**	**Watt**
Central air conditioner	5000	Electric clothes dryer	3400
Oven	3000	Hair dryer	1538
Microwave	500-1500	Water heater	479
Computer	120	Ceiling fan	100
Laptop	60-250	Blender	300
50watt incandescent bulb	50	25watt compact fluor bulb	28
CFL bulb (100watt equivalent)	30	100watt incandescent bulb	100

Table 2.1 shows the power consumption for normal appliance that usually use at home. This project focused on lighting which takes the lowest place of energy consumption. However, by reducing the lighting energy consumption, the whole home energy consumption will definitely reduced.

There are several previous researches on intelligent lighting system that can be discussed such as research conducted by A.A.Nippun Kumaar, Kiran.G and Sudarshan TSB. The research is focused on controlling the lighting system by using wireless sensor network. They are use three kinds of node which is Master Node (MN), Sensor Node (SN) and Light Control Node (LCN). The infrastructure of the nodes is shows in Figure 2.1. Master node is a base station that acts like a brain system. Sensor node will detect the surrounding illumination level and send the data to Master node. Light control node will respond the data that receive from master node and decide to increase or decrease lamp brightness level. The project used LDR sensor as a Sensor Node, D/A converter as a Light Control Node and PIC 16F877A as a Master Node. By using that method, energy consumption reduces from 2400 Wh/Day to 1920 Wh/Day as shows in Table 2.2 [3].

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Table 2.2: Intelligent Lighting System Using Wireless Sensor Network result [3]

Normal System	Day	Power	Hrs Used	No. of Light	Energy Consumed Per Day	Total Energy Consumption
		40W	6	5	1200Wh	2400Wh/Day
	Night	40W	6	5	1200Wh	72000Wh/Month
Proposed System	Day	20W	6	4	480Wh	1920Wh/Day
		40W	6	1	240Wh	
	Night	40W	6	5	1200Wh	57600Wh/Month

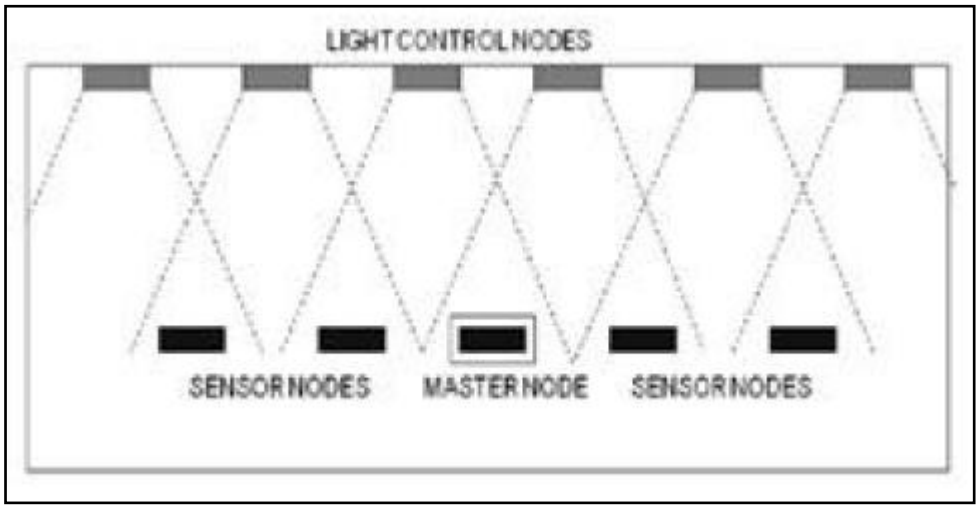

Figure 2.1: Project Infrastructure [3]

John L. Fetters has done his research about energy efficiency. The research state that by controlling the lighting system, cost and energy consumption can be reduced. The occupancy sensor is used to control the lighting system. Designed developed by John L. Fetters used the occupancy sensor which can reduce kilowatt hours of use during peak demand period, either automatically dimming lights or turning them off when they are not needed.

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There are several occupancy sensors that need to consider such as ultrasonic, passive infra red, sound or a combination of dual technology [4].

Others previous research, Ying-Wen Bai and Yi-Te Ku has developed Home Light Control Module (HLCM). Their design is based on two sensors which is passive infrared (PIR) sensor and light sensor. The circuit diagram is shown in Figure 2.2. The PIR sensor will detect either there are human movement or not. If there is no human movement, all control light is turned off. If there is human movement, the light sensor will detects the light intensity of the environment and maintains sufficient light by controlling the numbers of lights turn on. The research is based on three different places which is living room, bathroom and study room. The result shows that the total power consumption can be reduced as shows in Table 2.3 [5].

Table 2.3: Home Light Control Module (HLCM) result [5]

Room	**Living Room**	**Bathroom**	**Study Room**
Sufficient Light Intensity	150 Lux	200 lux	500 Lux
Number of Lights Switch on by HLCM	1	2	3
Power Consumption	80 Watts	160 Watts	240 Watts
Power Saving (Watt,%)	320 Watts, 80%	240 Watts, 60%	160 Watts, 40%

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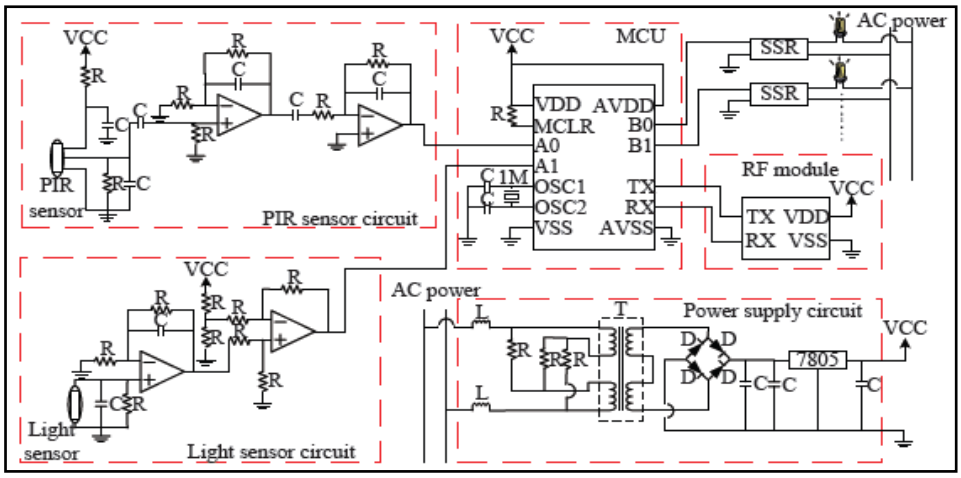

Figure 2.2: The circuit diagram of HLCM [5]

LED can be dimmed in two ways which is analog and pulse width modulation (PWM) dimming. Analog dimming changes LED light output by simply adjusting the DC current in the string. While PWM dimming achieves the same effect by varying the duty cycle of a constant current in the string to effectively change the average current in the string. Analog dimming is not efficiency because there lost the dimming accuracy around 25% while by using PWM is more accurate for dimming. Figure 2.3 shows the graph of PWM method that consists of four different dim levels [6].

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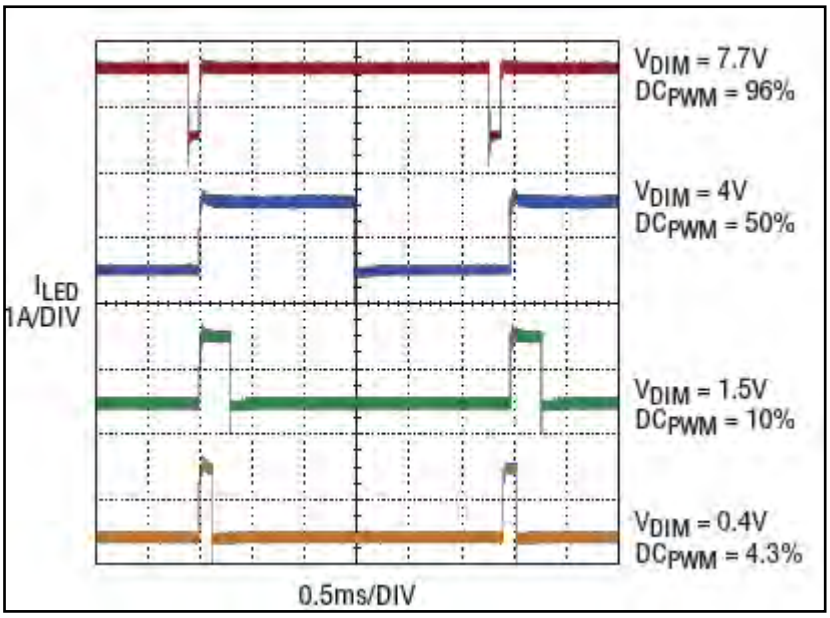

Figure 2.3: Pulse Width Modulation graph view [6]

There is another research about the dimming method. The research is to test which methods is better for dimming either pulse width modulation (PWM) or continuous current dimming method. From the research result, pulse width modulation (PWM) has the ability to achieve lower intensity levels and more linear control of light intensity compared to continuous current dimming method [7].

2.3 Sensor

Sensor is the most important component that is used in this project. Two types of sensor is used which is motion sensor to detect human movement and light sensor to detect surrounding illumination.

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2.3.1 Motion Detection

There are several sensor that can detect human movement which are :-

i. Passive Infra Red Sensor (PIR)

Passive Infra Red sensor (PIR) is used to detect motion around their range. The range that can be detected for PIR is around 20 feet. There have elements that can generate electric charge when exposed to infrared radiation that made of a crystalline material. To make the PIR function properly, PIR needed the „warm-up" time around 10 to 60 seconds. There are manual setting for sensitivity and time delay at the circuit itself. There are 3 pin which are ground, supply and output pin [8]. The physical of Passive Infra Red sensor (PIR) shows in Figure 2.4 and the characteristic of PIR are shown in Table 2.4.

Figure 2.4: Passive Infra-Red (PIR)

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