UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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AUTOMATIC LIGHT SWITCHER

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Electronic Engineering Technology (Telecommunication) (Hons.)

By

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BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **Automatic Light Switcher**

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I hereby, declared this report entitled "Automatic Light Switcher" is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Engineering Technology (Bachelors Degree in Electronics Engineering Technology (Telecommunications) (Hons.). The member of the supervisory is as follow:

Mr Win Adiyansyah Indra

(Project Supervisor)

ABSTRAK

Projek ini adalah sebuah aplikasi sistem kawalan pencahayaan. Lampu adalah elemen benar-benar penting dalam kehidupan kita. Satu jumlah pencahayaan yang mencukupi diperlukan untuk aktiviti-aktiviti manusia. Walau bagaimanapun, penggunaan lampu elektrik telah meningkat dengan pesat melalui tahun. Oleh itu, ia adalah perlu untuk mempunyai teknologi yang boleh menyelamatkan kelaziman lampu elektrik. Suis cahaya automatik menjimatkan elektrik lampu dengan mengawal jumlah cahaya yang dipancarkan dari komponen pencahayaan. Selain itu, Arduino Uno dan Passive Infra Red (PIR) Motion Sensor digunakan dalam projek ini untuk beroperasi dengan cekap.

ABSTRACT

This project is an application of lighting control system. Lighting is a really important element in our life. A sufficient lighting amount is needed for human's activities. However, the lighting electricity usage has been increase rapidly through years.. Thus, it is necessary to have technologies that can save the lighting electricity usages. Automatic light switchers save the lighting electricity by controlling the amount of light emitted from lighting component. Besides, Arduino Uno and Passive Infra Red (PIR) Motion Sensor is used in this project to operate efficiently.

DEDICATION

To my beloved parents:

Mohamad Bin Mokhtar and Hazilawati Binti Mohd Tahir

To my supervisor:

Mr Win Adiyansyah Indra

ACKNOWLEDGEMENT

I would like to thank to my parent for giving me support from the beginning of this project until the project is completed. Special thanks to my supervisor, Mr Win Adiyansyah Indra for guiding me along the project's progression.

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CHAPTER 1

INTRODUCTION

1.1   PROJECT BACKGROUND

A lighting control is a combination of system that controls the amount of light electricity usage in a certain areas or places. Lighting is a crucial thing in people life especially when it turns night. Lighting control has function to turns the light on, off or dimmed the light based on the control system on the lighting control.

This project will be focus on light electricity usage in residence. An automatic light control system will be design to reduce light electricity usage in residence. Small area such as bathroom, store room, hallway are major places where the light will be left turned on even there is no people use the light. Thus, this project will focus more on these areas since there is higher probability for people to left the light turned on in these areas.

Besides that, a software system will be attached in this automatic light switch project. I decided to use Arduino Uno as the software system in this project. This is because Arduino Uno is a low cost, low power and much simpler software compared

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to other software such as ZigBee Software. Since Arduino Uno use low cost, it is much easier for people to apply this project in their residence area.

Not enough than that, PIR motion sensor also is used in Automatic Light Switch's circuit. PIR motion sensor is a sensor that detect infra red radiation that produce when there is movement on human. Both equipments are combining to produce an automatic light switch system.

This project is started with analyzing the suitable equipment that can be used for this project. A lot of references had been reviewed in order to find the equipment. Arduuino Uno module and PIR Motion Sensor is especially explored as preparation for building the automatic light switch circuit. Not enough than that, the project cost is estimated and I made sure that the cost is not exceed RM 200. The implementation of this project will be done along with project's progression.

1.2 PROBLEM STATEMENT

Lighting has always been an important thing that we need especially when it turns night. However, there is always lots of wastage of electricity usage on lighting. People in residence tend to leave the empty room without switching the lights off. People always forgot to turn off the light when they leave the room. Not enough than that, some people in residences find that it is troublesome for them to turn off the light every time they leave the rooms, especially kitchen and bathroom.

Besides, there are lots of consequences from this situation. Increment of electric bill is an obvious effect that can be seen when people leave the empty room without switching the lights off. A fluorescent light consist contact pins, glass tube, electrode, inert gas, mercury and internal phosphor coating. Fluorescent light, for example depends on electric current that flowing through the gas in the glass tube to produce light. Thus, the more light produced, the more current is used. The current usage leads to increment of electric bill.

Not enough than that, the lights that are used will be damaged quickly compared to average duration for lights to not broken. The average lifespan for

fluorescent light is 50,000 hours. So, the more people use the light, the quicker it will take for the lamp to be damage.

Next, light that left turned on for a long time will affect humans' health. For instant, it affects muscle strength, cancer, and a fatigue. In addition, the radio frequency radiation and emission of ultraviolet from the light is not just affect humans' health only, but it affect environment too. The heat emitted from the light operation consume to global warming. Thus, the more electricity wastage leads to a horrible global warming.

1.3   OBJECTIVES

i) To reduce light electricity wastage in residence areas.

ii) To produce and implement the existing light control system.

iii) To produce an automatic light switch controls that can be apply on residence.

iv) To produce an automatic light switch control with reasonable cost

1.4   SCOPE

This proposal will cover the identification and analysis of equipment that will be use. In addition, this proposal will give information about the light electricity used in residence. The effect of fluorescent light operation on human body is one of information that contain in this proposal. The main objective of this project is to produce an automatic light switch with Arduino Uno module. The implementation of this project will be concerned on type of equipment that will be used, the cost of this project, and the circuit design for automatic light switch control. The width and area of room model is focused more as Passive Infra Red (PIR) Motion Sensor is use as the sensor in this project. The Arduino Uno module have been analyzed and explored first before it is apply on this project.

1.5 IMPORTANCE OF THE PROJECT

There is a lot of electricity wastage occurred in residence nowadays, especially on light electricity usage. This project is really important in order to reduce light electricity wastage. In line with world modernization, people like to have things that make their life easier. Since this project is concentrated on residence usage, this project is obviously important to make their life easier. They don't even need to turn off the light as they leave any room or space. The automatic light switch can help the people in residence as it turn the light on or off automatically. Besides, it is important to reduce light usage since it affects human health. Lots of light usage makes people health worst. So it is important to make this project as automatic light switch can reduce light electricity usage.

1.6   REPORT ORGANIZATION

Chapter 1: Introduction

This chapter contain project background, problem statement, objectives of project, project's scope and the importance of this project.

Chapter 2: Literature Review

This chapter covered the literature review and citation about any information that related to this project from any references. In this chapter, the citation about analysis of equipment also is included.

Chapter 3: Methodology

This chapter covered more detailed explanation of this project. In addition, this chapter gives information of process flow in this project. Flow chart and table of data is included in this chapter.

Chapter 4: Result

This chapter discuss about the result of Arduino Uno module and circuit simulation.

Chapter 5: Discussion

This chapter discuss the project result. Any error or information from Arduino Uno coding is discussed in this chapter.

Chapter 6: Conclusion

This chapter covered the conclusion based on overall process that happened in this project from start until end of this project.

1.7   CONCLUSION

.   As a conclusion, this project applied lighting control system as the concept of automatic light switcher. In addition, the lighting is really important in human life. Thus the requirement of lighting will grow rapidly in time. Besides, the PIR Motion Sensor and Arduino Uno has been the main component in this project. The scope of this project is in residence area only. Not enough than that, this project can also be applied in large building scale such as school and factory in the future for this project's implementation. The report organization has been constructed in this chapter where chapter 1 until chapter 3 is included in Final Year Project (FYP) 1, while the remain chapters will be continues on FYP 2.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will cover a basic introduction of automatic light switcher and main equipment that will be used in this automatic light switcher project. In addition, the history of lighting control also is provided in this chapter. Besides, this chapter also explained the types of lighting control system that has been innovated and implemented through years. The application, advantage and disadvantage also is part of this chapter. Last but not least, a detail explanation about Arduino Uno module is included in this chapter.

Automatic Light Switcher is an automatic light control that control the amount of light produced from lamp. In addition, automatic light switcher is operated by turning on or off the light based on the circuit construction. Besides, there is a big advantage on automatic lighting controls application. The lighting electricity consumption can be reducing up to 70% if the users apply automatic light control.

In this project, the automatic light switcher turns off and on the light based on PIR sensor output. A PIR Sensor is a sensor that operated by sense infra red that is being emitted when a person make any movement. It is also can function as occupancy sensor as well as movement sensor (S. Panchal & M. Patel et al. 2012).

When there is infra red detected on the Fresnel lens, the chip on Fresnel lens will heat up and alert that there is occupant in the room (S. Panchal & M. Patel et al. 2012).

Figure below shows an example of PIR Motion Sensor that is used in automatic light switcher circuit (S. Panchal & M. Patel et al. 2012).
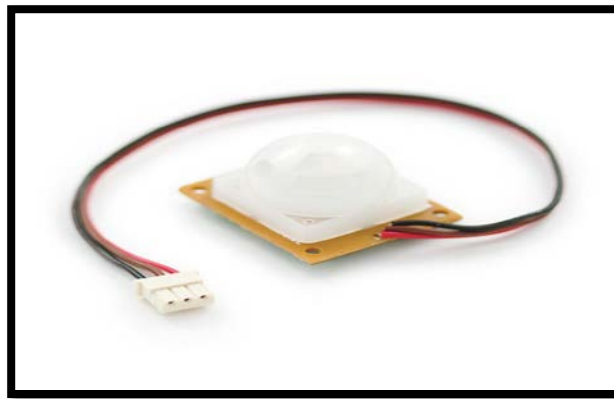

Figure 2.0: PIR Motion Sensor (S. Panchal & M. Patel et al. 2012).

Not enough than that, this project will included Arduino Uno module in order to control the instructions to automatic light switcher.

In addition, (S. Luitel et al. 2013) stated that busy lifestyle nowadays makes it more necessary for people to control the component in home by using remotely. Microcontroller has been the major element that is needed in every nowadays technology innovation. Microcontroller is a single chip that consist integrated circuit with processor core, memory and programmable input/output peripherals (A. Smith et al. 2011). An Arduino Uno board is a board that consist Atmel's ATmega328 microcontroller with hardware and software features. Not enough than that, Arduino Uno have a function to simplify the circuit. A simple circuit is needed to reduce the damage possibility and reducing installation cost.

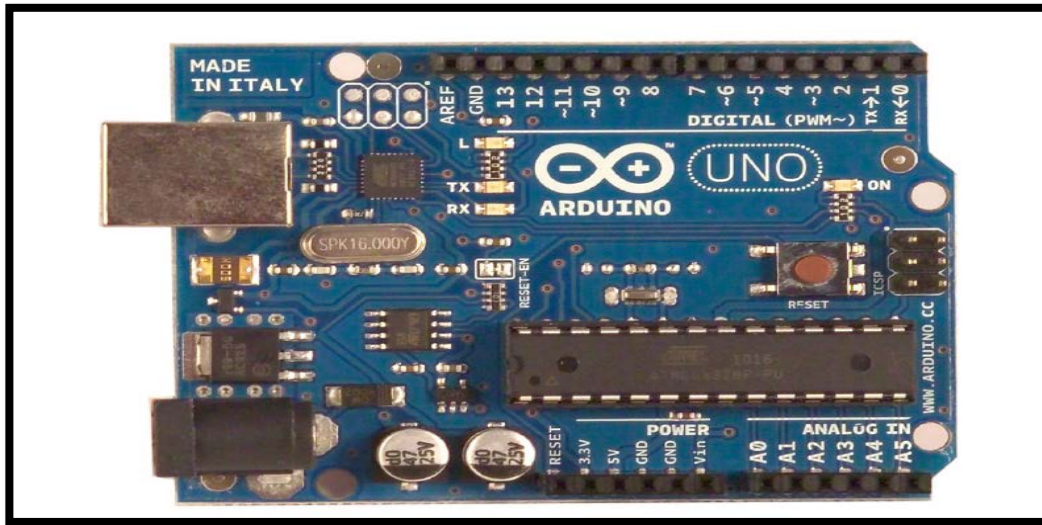Figure below shows Arduino Uno board (S. Luitel et al. 2013).

Figure 2.1: Arduino Uno Board (S. Luitel et al. 2013)

This project will be focused on residence area only. Residence area is the focused area since regular houses have smaller area that can be easily control. Not enough than that, residence area is a good starter for automatic light switcher application compared to larger area such as factory area. In United States, the light electricity that is consumed by residence area is estimated around 36% from total electricity that is used by them (Aries & Newsham et al. 2008).. In addition, Arduino software can be read by using C language (A. Elshafee, K. Hamed et al. 2012).

Nevertheless, the Arduino Software also has a function to assemble the information from sensor that is connected to Arduino Uno microcontroller. Besides, it is also give command in the server and record all the history in the server DB. However, the isolating interface is necessary to protect Arduino microcontroller so that it can be connected directly to any sensors (A. Elshafee, K. Hamed et al. 2012).

Lighting system is an important thing in each building. But an enough amount of lighting is always needed in any building. There are some characteristics that a lighting system need. The lighting system needs to have an enough amount of

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luminance, colour temperature, and colour rendering index (CDI). CDI is functioned as indicator of the accuracy of lights from the lamp compared to natural light sources (Osram, et al. n.d).

There is a lot of lighting control systems that have been used nowadays. There are a lot of factors that affect the choice of lighting control systems that users might apply. Figure below shows major factors of lighting control systems that can produce maximum energy saving ((B. Roisin, M. Bodart, A. Deneyer, P. D'Herdt et al. 2008)).
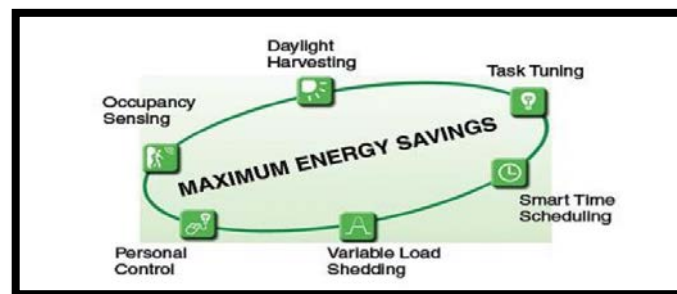

Figure 2.2: Lighting Control Factors (B. Roisin, M. Bodart, A. Deneyer, P. D'Herdt et al. 2008)

ROCS use occupancy sensors in order to detect occupancy in certain area. There are two main occupancy sensors that have been widely used in ROCS, which is infrared and ultrasonic sensor. Infrared sensors sense any temperature changes in a room.

While ultrasonic sensor uses high frequency sound to detect any motion occurs in a room (E.Tar et al. 2000). The concept that is used in ROCS is to limit the use of light when the system detects no occupancy on that specific area. A studied test shows that ROCS can reduce the light consumption up to 20% (B. Roisin, M. Bodart, A. Deneyer, P. D'Herdt et al. 2008).

Not enough than that, time scheduling can save the light consumption from 9.0 to 14.6% with average of about 10% (J.Jennings, N.Colak, F.Rubinstein et al. 2001).

In addition, besides having lighting control systems that just turn on and off the lights, there is also manual dimming and automatic daylight dimming control

(E.Tar et al. 2000). Manual dimming controls used manually operated dimming controls to dim the lights to certain amount without turned the lights off. Manual dimming controls is widely applied in meeting room or private office. The lights can be dimmed by using remote control or dimmer (E.Tar et al. 2000) .

While an automatic daylight dimming use light sensor to detects the amount of lighting in a specific area. When the sensor detects amount of lighting reach a specific level, the lights will be dimmed until the right amount of lighting is reached. This automatic daylight dimming control is widely installed on hallway, corridor and balcony. However, this control system may have poorly calibrated sensor that may lead to lighting wastage consumption (E.Tar et al. 2000).

Not enough than that, automatic light switcher improved human's health by controlling the amount of lights that human body received. For information, there are non-visual receptors in our eyes that respond to light that our eyes received. These non-visual receptor controls the amount of hormones that will be produced in our body, which are melatonin and serotonin.

Melatonin is a hormone that will helps us to sleep. High levels of melatonin production in our body make us sleepy. However, low level melatonin hormone causes insomnia to human. Thus, automatic light switcher helps us by controlling the amount of light that received by our body. While serotonin hormones help to increase the happiness in our body. High level of lights that received by our body increase the serotonin hormones emitted by our body (F.Breu, S. Guggenbichler, J. Wollman et al. 2011). Studies also proved that the amount of lights received by our body affect our mood and productivity (Y.Wen, J.Bonnell, A.Agogino et al. 2008).

In addition, automatic light switcher does make life easier for people especially the user in residence area. In this modern world, the people life becomes more comfortable with the application of advanced technologies. Automatic light switchers apply the home automation concept in order to function. This innovation of this technology produces more accurate technology. Not enough than that, automatic light switcher also can be apply and contribute with other technologies to make a better innovation in the future (N.Kumar, R.Singal, G.Singh et al. 2011) .