AUTOMATIC LIGHTING SYSTEM FOR CHILDREN

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BEKM

APRIL 2009

"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 (Mechatronic)"

Signature	:	
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A report submitted in partial fulfillment of requirements for the degree of Bachelor of Electrical Engineering (Mechatronic)

Faculty of Electrical Engineering
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

APRIL 2009

I hereby declared that this report “Automatic Lighting System for Children” is a result of my own work research except as cited in the references.

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Date : 22 APRIL 2009

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ABSTRACT

Lighting is very important kind of generated energy to allow people clearly doing its jobs. Lighting includes artificial light such as incandescent light and natural light which comes from the sun. Artificial light can be normally obtained inside a building or under the roof. Not only that, street also have artificial light for pedestrian and drivers at night time. For the artificial light, normally a manual switch is available for each lighting system. In this report, priority or precedence is focusing on how this artificial light can helps children at night. This artificial light project is capable of helping and guiding children by automatic on and off during necessary time, flexible to be used by everyone and everywhere and possess appropriate illuminance which not too disturbing when use. Children normally confront with high placement of the manual switch which is a difficult for them to reach. An approach to help these children, the benefits and special features of PIC and PIR will be harness and utilize to solve the problem. At the completion of the project, the children greatly having and gaining advantages through a flexible device to guide them in doing their jobs.

ABSTRAK

Cahaya merupakan sejenis bentuk tenaga yang dijanakan untuk membantu manusia untuk melakukan atau membuat sesuatu kerja. Cahaya terdiri daripada cahaya buatan seperti lampu dan cahaya semulajadi iaitu datangnya dari cahaya matahari. Cahaya buatan biasanya terdapat di dalam bangunan atau tempat yang berteduh. Selain daripada itu, cahaya buatan juga terdapat di jalan-jalan untuk membantu pemandu dan juga orang ramai pada waktu malam. Untuk cahaya buatan, biasanya terdapat suis dalam setiap sistem cahaya buatan. Projek ini memberi keutamaan dalam membantu kanak-kanak pada waktu malam. Projek cahaya buatan ini dapat membantu dan memberi petunjuk kepada kanak-kanak dengan adanya sumber cahaya automatik apabila diperlukan. Malahan ia fleksibel boleh digunakan oleh sesiapa sahaja dan dimana-mana tempat, tidak terlalu malar dan memberikan kecerahan yang sesuai supaya tidak menggangu penglihatan apabila digunakan. Kanak-kanak biasanya menghadapi masalah dalam mencapai suis lampu kerana lokasinya yang tinggi. Dalam pendekatan ini, kebaikan dan keistimewaan fungsi yang terdapat pada PIC dan PIR akan dicungkil untuk menyelesaikan masalah ini. Pada akhir projek ini, kanak-kanak dapat memanfaatkan hasil daripada alat fleksibel ini dalam membantu mereka membuat kerja mereka.

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LIST OF ABBREVIATIONS AND SYMBOLS

A	-	Ampere
AC	-	Alternating Current
ADC	-	Analog Digital Converter
C	-	Capacitor
DC	-	Direct Current
FET	-	Field Effect Transistor
Hz	-	Hertz
IR	-	Infrared
In	-	Input current
L	-	Working distance
LDR	-	Light Dependent Resistor
Op Amp	-	Operational amplifier
PIC	-	Programmable Interface Controller
PIR	-	Passive Infrared or Pyroelectric Infrared
R	-	Resistor
Rf	-	Feedback resistor
Rg	-	Input resistor
V	-	Volt
Vb	-	Velocity
Vcc	-	Power supply voltage
Vin	-	Input voltage
Vos	-	Input offset voltage
Vout	-	Output voltage
Zin	-	Input impedance
Zout	-	Output inpedence
a	-	Gain

f	-	Frequency
fb	-	Focal length
mA	-	mili Ampere
mm	-	milimeter
m/s	-	meter/second
nF	-	nano Farad
nm	-	nanometer
uF	-	micro Farad
um	-	micrometer

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Everyday human activities are leads by light inconsiderate whether during daylight or night time. Without the light as our guidance, human cannot complete their desire tasks such as finding the route to their destination. Ancient human used firewood as their tool to guide them and then slowly improve. Nowadays with latest and innovative creation human now depends alternatively on artificial lighting system whether within a covered building or an open areas. Few examples such as pilot landing the airplane by following and using guidance from the lighting system on the route track, human staying within a building can see clearly the path to their destination and do other activities even though is daylight, and vehicle using artificial lighting system to see the route at night when traveling. Without the light, many disaster and unwanted events may be happened such as car crash accident on the route at night, pedestrian suffer from hurt when they hit or kick or bang into obstacles, and most apparent is human have to live in the dark.

1.2 Problem Statement

Conventional lighting system normally designed for adults and youngster to reach for the light. Children especially encounter problems to reach and turn on the light. This is because the location of the switch normally mounted on a place where it is easy for youngsters and adults to turn on but not for children. Some parents will taking an alternative way by modifying the switch such as changing the whole wall switch with a switch where it have a

long stick for children to pull or adding another switch parallel with the switch so that everyone can turn on the light.

Conventional lighting system has to be manually operated to turn on the light. At the night time, peoples have to search the location of the switch in the dark environment to turn on the light. Some peoples will get hurts and frustrated when searching the switch in the night time or in the dark environment.

At outside from a building or open area, light not usually available everywhere. With invention of dc power supplies such as battery, most peoples able to utilize this technology to power up their portable device. By using this portable battery, a lighting system can be carry all over the world without interruption such as have to fix at one position like ac lighting. In other way, the design is very flexible to be used everywhere and anyone.

1.3 Project Objectives

The objectives of this project are to design a portable lighting system with automatic lighting capability when it senses a motion from human when passing through the within sensing areas. The design also capable to saving electricity because it will automatically turn off after certain of time when human detection are no longer detected within sensing areas. By using this design, human lifestyle can be improve because it is no longer required to depends on the conventional manual switch and a new feature is added in that is the portability lighting system capability which allow to carry and install or place at a desire place and location. This design is focusing on helping children when no light present especially at night time or in dark area to leads them to their destination or allow then to do their activities.

1.4 Project Scopes

The scopes of this project are to design a portable device mainly to detect presence of

the children, it is running dc power supply, the design detection range is in low range, it is only used in indoor and the output is only light. Passive Infrared sensor (PIR) will be used as a motion sensor detector. On and off control of the lighting is depends on the light dependent sensor (LDR) and battery voltage 9 volt is being used in this project. Also this project used microcontroller PIC 16f8776a as the embedded controller and the language for the programming part is C language.

CHAPTER 2

LITERATURE REVIEW AND PROJECT BACKGROUND

2.1 Introduction

The overall design objective is to react with children motion and then turn on the light. This chapter will cover the discussion on the block diagram as shown in the Figure 2.1.

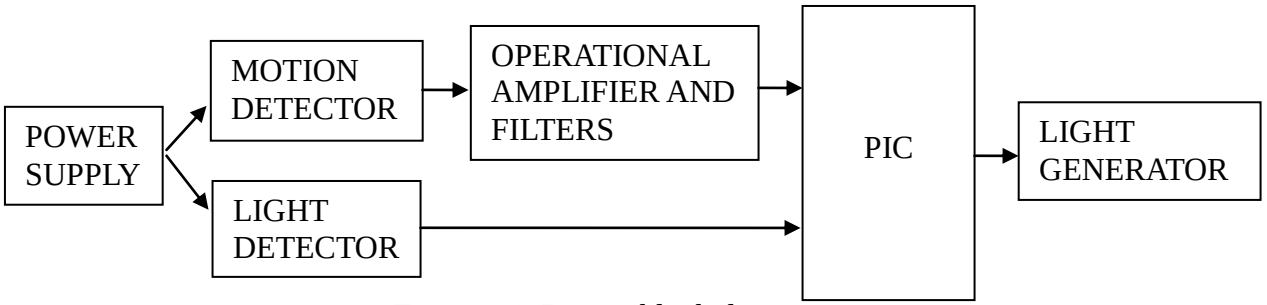

Figure 2.1: Design block diagram

2.2 Power Supply

The crucial part of any devices in the world is the power supply. Without the power supply, every device cannot operate at its behaviors. In the design, the power supply is comes from 9 volt battery. The supply voltage is then regulated to 5 volt which suit to the design operation. In this design, the voltage regulator has been use and is model name was called TS2937. This regulator will produce output current up to 500mA and it possess low drop out voltage at 0.6 volt which is the crucial parameter have to be consider when designing any portable application devices. The reason that voltage drop out is important is shown in the Figure 2.2.

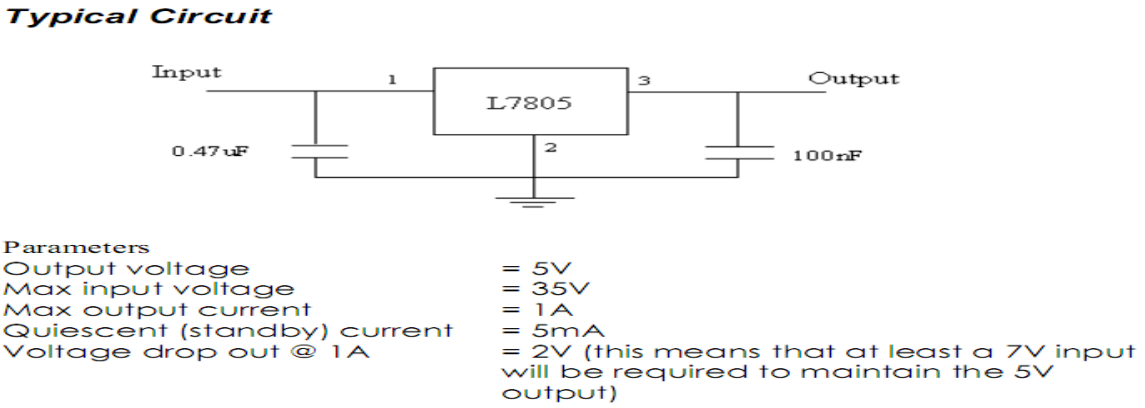

Figure 2.2: Typical circuit of voltage regulator

As seen from the Figure 2.2 if the voltage is less than 7 volt, the output voltage will decrease with respect to the input voltage. The explanation on the input and output capacitor is covered in the TS2937 data sheet along with others related information that have been attached in the Appendix B.

2.3 Motion Detector

Motion sensor in this design is using Pyroelectric Infrared sensor or Passive Infrared sensor or PIR in brief term. To apply motion sensor in the design, several parameter need to be considered and understand which are infrared radiation, PIR construction, Fresnel lens, frequency range, amplification circuit, disturbances and comparator circuit. All these parameter need to be considered in order to design a motion detector. The detail of the PIR sensor used in the design can be referring in the Appendix A.

2.3.1 Infrared Radiation [1]

To understand how infrared detector works, it is important to understand electromagnetic spectrum. Visible emission is the light that all human can see and it is only a small portion out of total of light spectrum. The wavelength of the visible spectrum is range from 400nm to 800nm. The infrared spectrum is range from 800nm to 1mm which is longer than visible light.

Object that generate heat, also generate infrared radiation and those objects include animals and the human body, whose radiation is strongest at 9.4um. Figure 2.3 shows the electromagnetic spectrum:

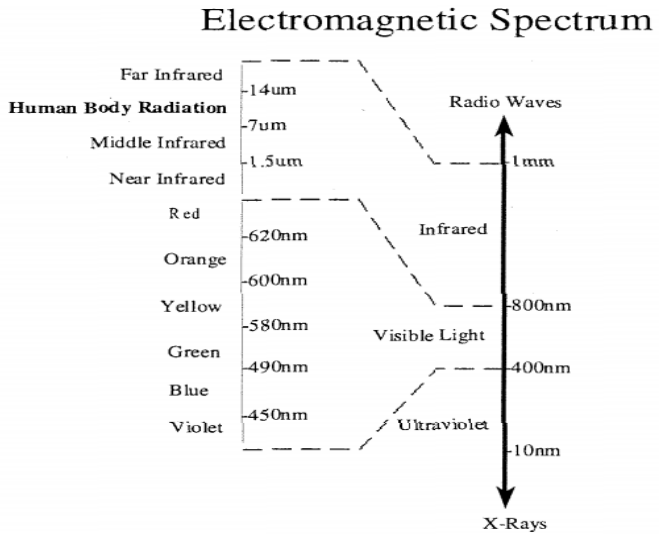

Figure 2.3: Electromagnetic spectrum

From the Figure 2.3, it is shown that human body emits Infrared radiation at approximately 10um. To detect this signal, a transducer is required to convert the infrared signal to a detectable form with conventional circuitry.

2.3.2 PIR Sensor [2][3]

PIR sensor is made from a crystalline material that generates a surface electric charge when exposed to heat in the form of infrared radiation. PIR sensor are passive device, it do not emit or radiate any energy or beam. When the amount of radiation striking the crystal changes, the amount of charge also changes and can then be measured with a sensitive FET device built into the sensor. The sensor elements are sensitive to radiation over a wide range so a filter window is added to the TO5 package to limit incoming radiation to the 8um to 14um range which is the most sensitive to human body radiation. Figure 2.4 shows the PIR internal construction.

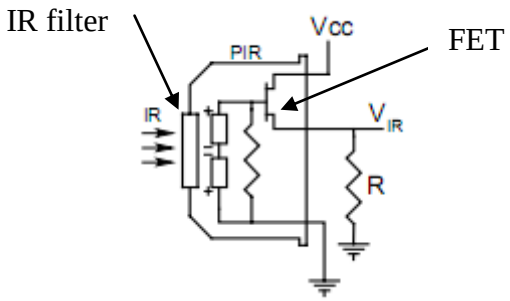

Figure 2.4: PIR dual element construction

The external resistor as shown in Figure 2.4 is function as to convert the FET current to a voltage. The output voltage is a function of the amount infrared radiation sensed at the input. Unfortunately the output is also affected by vibration, radio interference and sunlight. Motion sensor can be improved by using dual element. The sensing elements are connected such that one subtracts from the other. The arrangement causes any signal common to both elements to be canceled. A body passing in front of the sensor activates first one and then the other element while vibration and the other background signals, affect both elements simultaneously and are cancelled. Figure 2.5 shows the operation of the sensor when a human body is passing in front of the sensor.

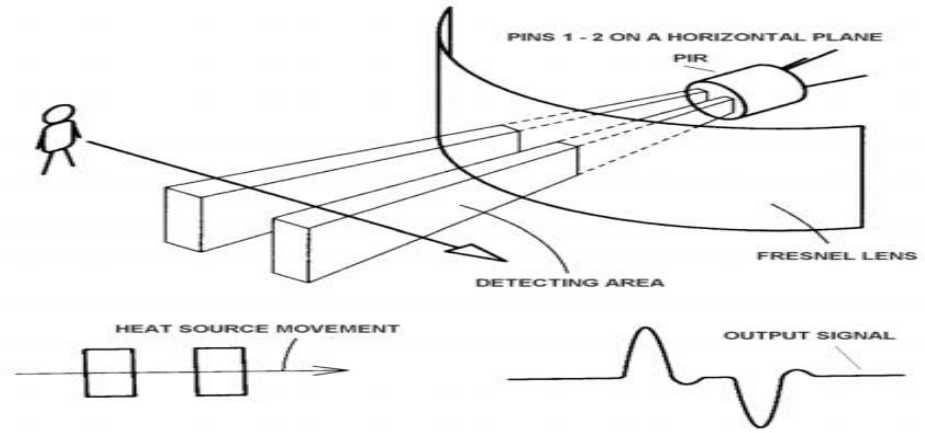

Figure 2.5: Operation of PIR sensor when motion detected

2.3.3 Fresnel Lens [3]

To enable detection few feet away, Fresnel lens is required. Beside that the PIR sensor itself is inefficient if it does not have a lens to focus the radiation. A Fresnel lens is a Plano Convex lens that has been collapsed on it to form a flat lens that retains its optical characteristics but is much smaller in thickness and therefore has less absorption losses. Figure 2.6 shows the Plano Convex lens and Fresnel lens.

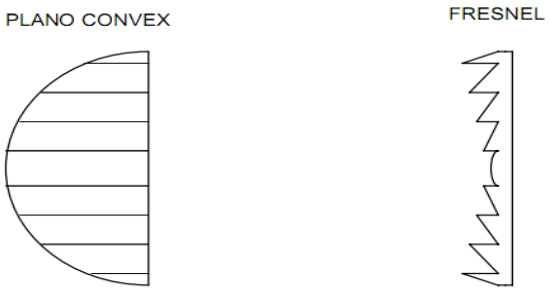

Figure 2.6: Plano Convex lens and Fresnel lens

Fresnel lens is normally made of an infrared transmitting material that has IR transmission range of 8um to 14um that is most sensitive to human body radiation. It is designed to have its grooves facing the IR sensing element so that a smooth surface is presented to the subject side of the lens which is normally the outside of an enclosure that houses the sensor. Figure 2.7 shows the arrangement of the Fresnel lens with the PIR sensor.

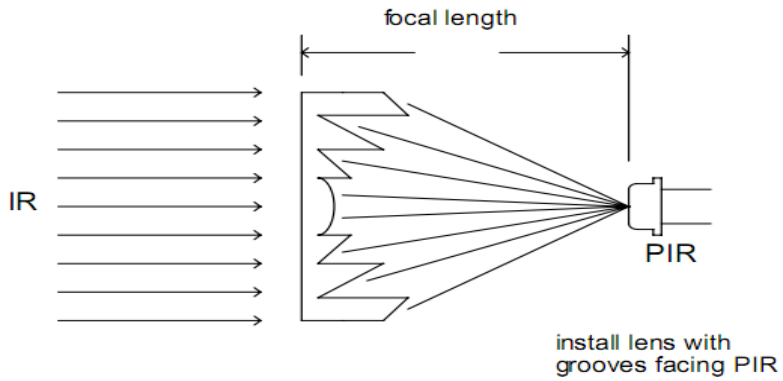

Figure 2.7: Arrangement of Fresnel lens and the PIR sensor