UNIVERSITI TEKNIKAL MALAYSIA MELAKA

AUTOMATIC SYSTEM FOR CAR HEADLAMP

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

by

AZWAN BIN MUHAMAD

B071110396

900405-01-5969

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BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **Automatic System for Car Headlamp**

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Alamat Tetap:

NO. 1311 Jalan Bakawali 1

Blok 11, Felda Maokil 1, 85300

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I hereby, declared this report entitled "Automatic System for Car Headlamp" 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 fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Industrial Electronic) (Hons.). The member of the supervisory is as follow:

……………………………………………….

TG MOHD FAISAL BIN TENGKU WOOK

(Project Supervisor)

ABSTRAK

Sistem Lampu Kereta automatik adalah sistem yang akan berfungsi secara automatik berpandukan kapasiti cahaya sekeliling, tambahan pula ia juga mempunyai automatik lampu tinggi dan automatik lampu rendah. Apabila sensor cahaya mengesan tahap pencahayaan yang dianggap tidak lagi kelihatan dan selamat, sistem secara automatik akan menghidupkan lampu semasa kereta itu bergerak. Kebanyakan pemandu hari ini menghidupkan lampu kereta mereka berdasarkan kepada pertimbangan mereka sendiri kepada tahap penglihatan di jalan raya dan kadang-kadang mereka tidak menukar lampu tinggi kepada lampu rendah apabila mereka berselisih dengan kereta lain dan bukan itu sahaja, pemandu kereta sekarang suka memasang Lampu "HID" di kereta mereka dan tindakan ini begitu berbahaya kerana ia boleh membutakan mata pemandu-pemandu lain untuk beberapa saat. Sebagai penyelesaian, kami menghasilkan projek ini. Semoga projek ini akan menyelesaikan masalah yang biasanya dihadapi oleh semua pemandu apabila mereka memandu pada waktu malam, sistem automatik untuk lampu kereta ini juga diharap dapat membantu mengurangkan jumlah kemalangan yang disebabkan oleh silau lampu tinggi. Selain itu, ia juga meningkatkan tahap kesedaran dan keselamatan di kalangan pemandu semasa mereka berada di jalan raya.

ABSTRACT

Automatic System for Car Headlamp is a system for automatically turning the car head lights on accordance with ambient light and with addition it also has automatic high beam and low beam. Once the photocells detect the level of lighting that is considered no longer visible and safe, the system will automatically turn on the headlight while the car is on the move. Basically most drivers nowadays turn on their car headlamps based on their own judgment on the level of visibility on the road and sometimes they are not turning their high beam to low beam when there is a car pass by, not even that the car drivers nowadays like to install a High Intensity Discharge (HID) Lamp on their car and this act is so dangerous because it can blind the other driver. As the solution, we come out with this project. Hopefully this project will solve the problem that usually faced by almost all driver when they drive at night, this automatic system for car headlamp help to reduce the number of accidents cause by the shining of high beam. Besides that, it also increases the awareness in safety while driving among the drivers.

DEDICATION

This final year report is dedicated to my beloved parents who have supported me all the way since the beginning of my studies.

Also, this final year report is dedicated to my special friend that always with me and close friends who have been a great source of motivation and inspiration.

Finally, this final year report is dedicated to all those who interested in the field of engineering technology and who like to make an innovation in their life.

ACKNOWLEDGEMENT

Bissmillahirrahmanirrahim,

Alhamdulillah. Thanks to Allah SWT, who with His willing had given me the opportunity to complete this Final Year Project which is Automatic System for Car Headlamp.

Firstly, I would like to express my deepest thanks to, En. Tg Mohd Faisal Bin Tengku Wook, as my supervisor who had guided and advised me a lot during this two semesters. I also want to thanks all the lecturers and staffs of Faculty of Engineering Technology UTeM for their cooperation when I needed to complete the final year project that had given valuable information, suggestions and guidance in the compilation and preparation to this final year project report.

Deepest thanks and appreciation to my parents, special mate of mine, and others for their cooperation, encouragement, constructive suggestion and full of support for the report completion, from the beginning till the end. Also thanks to all of my friends that have been contributed by supporting my work and help myself during the final year project progress till it is fully completed.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

FARS	-	Fatality Analysis Reporting System
NHTSA	-	National Highway Traffic Safety Administration
LDR	-	Light Dependant Resistor
CdS	-	Cadmium Selenide (inorganic compound)
R	-	Resistor
HID	-	High Intensity Discharge
L.F.S.W	-	Low Frequency Square Wave
A.R	-	Acoustic Resonance
EM	-	Energy Multiplier
CWA	-	Constant Wattage Autotransformer
IR	-	Infra Red
fc	-	foot-candles

CHAPTER 1
INTRODUCTION

This chapter will discuss the overview process that involved for this project which is project background and specific objectives of the project, problem statements, scope of work and project significance. The end of this chapter the thesis outline will be listed.

1.1 Background of the Study

Driving the highway with our high-beam headlights can really increase our visibility, but it also can be a blinding hazard for other drivers. This automatic system for car head lamp can automatically switch ON the head lamp when the light or the ambient light is decrease. This headlight switch to provide automatic switching between high and low beam headlights when there is oncoming traffic. It does this by sensing the lights of that traffic. In this way, we can drive safely with our high-beams on without blinding other drivers.

1.2 Problem Statement

Crash statistics can shed some light on the impact that time of day has on driver risk. An analysis of the Fatality Analysis Reporting System (FARS) data such as in Figure 1.1 for 2000 reveals that, 49 percent of all fatal crashes occur at night, 81 percent of fatal crashes occur on dry pavement, both day and night, 40 percent of all fatal crashes involve alcohol as a factor, with more than 60 percent of those occurring at night, and problems with driver vision, vehicle hardware, or environmental conditions are cited as "related factors" in 15 percent of all fatal crashes. Since more than half of all fatal crashes involve only a single vehicle, the final statistic may greatly underestimate the impact of vision and visibility on driving safety.

Law Offices of Michael Pines APC, write that, 60 percent less traffic on the roads, more than 40 percent of all fatal car accidents occur at night. Then, the number of persons seriously injured increases by 50% and the number of death by 36% compared with accidents during the day. Driving either just before sunrise (dawn) or immediately after sunset (dusk) are also very dangerous time periods on the roadways, and many car accidents occur during these times.

However, the vision even of a person with normal eyes reduced at night. The associated risk factors include delayed adjustment to changes between light and dark, impaired color vision and the slow transition from day to night, through habituation effect can lure the motorist into a false of security.

Headlamps are typically controlled to alternately generate low beams and high beams. Low beams provide less illumination and are used at night to illuminate the forward path when other vehicles are present. High beams provide significantly more light and are used to illuminate the vehicle’s forward path when other vehicles are not present.

Daylight running lights have also begun to experience widespread acceptance. High beam are used for illuminating a road doesn’t have very much traffic on it. By that way the driver can see further ahead for any road obstructions. High beam is also used when a driver is one an unfamiliar road and if there isn’t much in the way of lighting such as street lamps. Automatic high beam, as explained is opposite beam detector. Another probable application of automatic high beam is our high beam response due to another high beam and automatically our high beam becoming low. Now a day there are many accidents that cause from the beam light. The Statistic from Traffic Safety Facts can be referring at Figure 1.1.

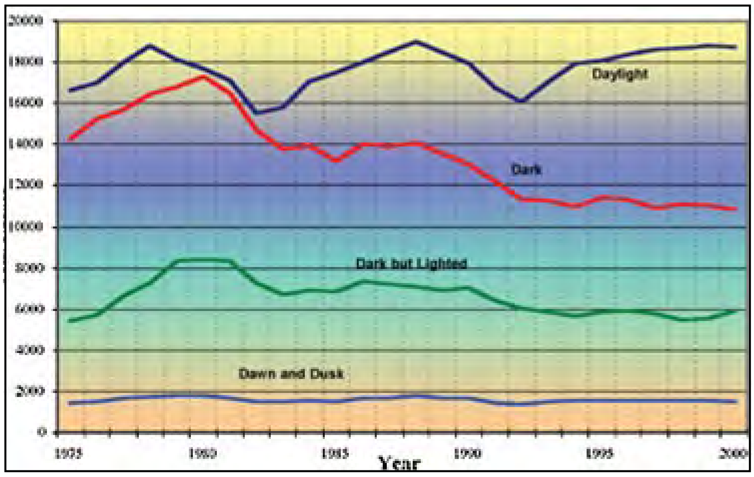

Figure 1.1: Statistic from Traffic Safety Facts 2000, NHTSA, December 2001

1.3 Objectives

The objective of the project includes:

- The objective of this project is to solve the problem that usually faced by almost all driver when they drive at night.
- To study the operation and application of light sensor.
- To analyze the performance car headlamp.

1.4 Project Scope

The concept of the system basically can be divided into two parts which is the light detection and the high beam off/on control circuit. In order to design a simple low cost control system, a simple approach is needed to detect the light of the incoming traffic or the ambient lights in the road. A light dependent resistor (LDR) is used (some literature refers to it as photo resistor) as a light sensor. The resistance value of the LDR is changing according to the impinging light on it. Typical LDR has a linear relation with the incident light such that if the light density is increased the resistance of the LDR is decreased. Other electronic components such as a transistor, operational amplifier (used as comparator), relay, diodes and resistor are used to build the electronic control circuit.

CHAPTER 2
LITERATURE REVIEW

Chapter 2 describes on the analysis and review about component and its importance in this project. This chapter discuss about the contents of the photocell sensor, definition of lux, headlight control sensor, visible spectrum and main lighting switch.

2.1 Automatic Lighting System

This automatic lighting system will immediately switch on the headlight as soon as light becomes poor and vice versa. Where and when we need this system, firstly, we will need this system when we entering the tunnel. Some tunnel have a streetlight, some does not have streetlight. After that, we need this system when we enter the underground car park. Then when the nightfall or when the weather become dark.

2.1.1 How Does It Works

An optical sensor, fitted on the windscreen, permanently detects light levels. When the light drops to less than 1,000 lux, the electronic control unit activates the vehicle's lighting automatically. When the light returns to 3,000 lux, the lights are automatically switched off in less than 20 seconds. The system can easily be switched off to return to manual mode using the on/off switch on the sensor.

2.2 Photocells

2.2.1 Description

Photocells are sensors that allow you to detect light. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they often appear in toys, gadgets and appliances. They are often referred to as CdS cells (they are made of Cadmium-Sulfide), light dependent resistors (LDR), and photo resistors.

Photocells are basically a resistor that changes its resistive value (in ohms Ω) depending on how much light is shining onto the squiggly face. They are very low cost, easy to get in many sizes and specifications, but are very inaccurate. Each photocell sensor will act a little differently than the other, even if they are from the same batch. The variations can be really large, 50% or higher! For this reason, they shouldn't be used to try to determine precise light levels in lux or millicandela. Instead, you can expect to only be able to determine basic light changes.

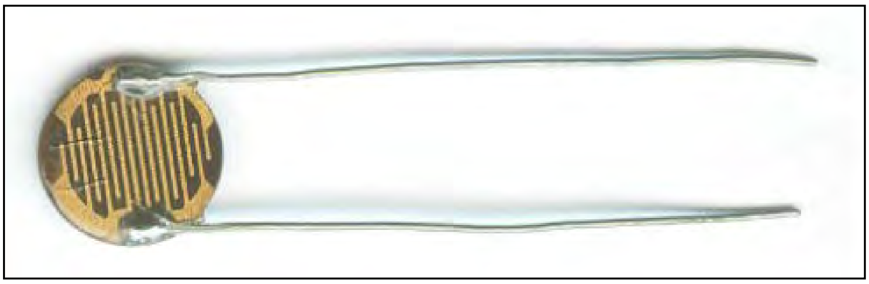

Figure 2.1: Photocells

For most light-sensitive applications like "is it light or dark out", "is there something in front of the sensor (that would block light)", "is there something interrupting a laser beam" (break-beam sensors), or "which of multiple sensors has the most light hitting it", photocells can be a good choice!

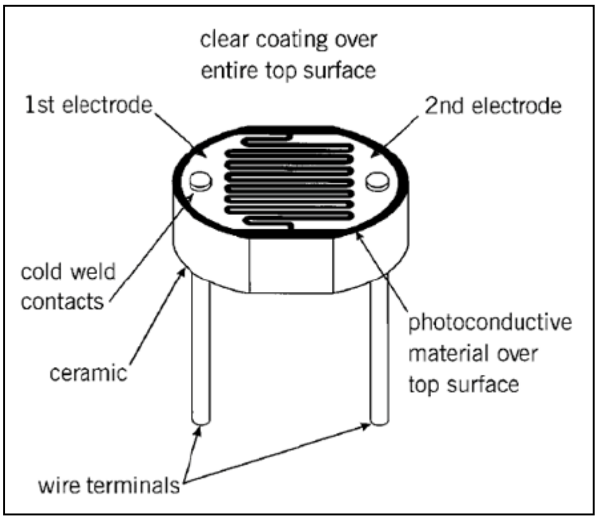

Figure 2.2: Typical Construction of a Plastic Coated Photocell

2.2.2 Measuring Light

A photocell's resistance changes as the face is exposed to more light. When its dark, the sensor looks like a large resistor up to 10MΩ, as the light level increases, the resistance goes down. This graph indicates approximately the resistance of the sensor at different light levels.

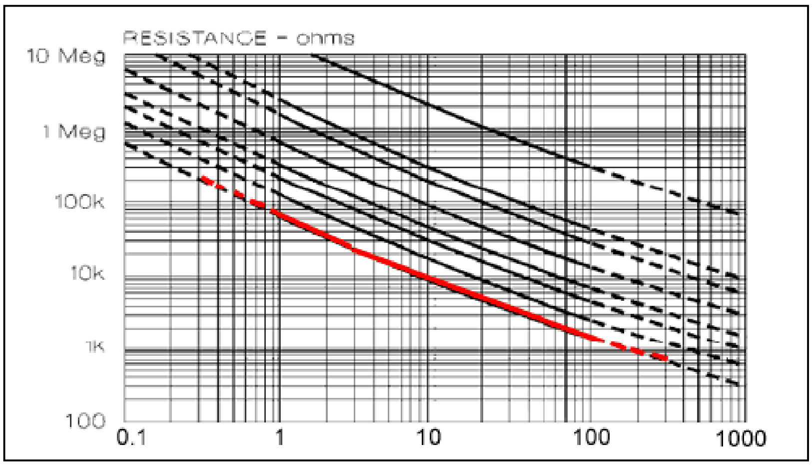

Figure 2.3: Resistance VS Illumination

2.2.3 Using a Photocell

The way this works is that as the resistance of the photocell decreases, the total resistance of the photocell and the pull down resistor decreases from over 600KΩ to 10KΩ. That means that the current flowing through both resistors increases which in turn causes the voltage across the fixed 10KΩ resistor to increase.

2.2.4 Basic Statistic

Nearly all photocells will have slightly different specifications, although they all pretty much work the same. This range of photocells includes three different size designs with different spectral sensitivity. The smallest in physical size is our A 9950 range with spectral sensitivity at max. 530 nm.

- Size: Round, 5mm (0.2") diameter. (Other photocells can get up to 11mm/0.4" diameter!)
- Resistance range: 200K ohm (dark) to 10K ohm (10 lux brightness)
- Sensitivity range: CdS cells respond to light between 400nm (violet) and 600nm (orange) wavelengths, peaking at about 520nm (green).
- Power supply: pretty much anything up to 100V, uses less than 1mA of current on average (depends on power supply voltage)

Table 2.1: The approximate analog voltage based on the sensor light/resistance w/a 5V supply and 10KΩ pull down resistor.

Type of Ambient Light	Ambient Light (lux)	Photo cell resistance (Ω)	LDR+ R (Ω)	Current through LDR +R	Voltage across R
Moonlit Night	1 lux	70 KΩ	80 KΩ	0.07 mA	0.6V
Dark Room	10 lux	10 KΩ	20 KΩ	0.25 mA	2.5V
Dark Overcast Day/ Bright Room	100 lux	1.5 KΩ	11.5 KΩ	0.43 mA	4.3V
Overcast day	1000 lux	300Ω	10.03 KΩ	0.5 mA	5V

We can also use the "Axel Benz" formula by first measuring the minimum and maximum resistance value with the multimeter and then finding the resistor value with: Pull-Down-Resistor = square root (Rmin * Rmax), this will give you slightly better range calculations.

If we're planning to have the sensor in a bright area and use a 10KΩ pull down, it will quickly saturate. That means that it will hit the 'ceiling' of 5V and not be able to differentiate between bright and really bright. In that case, we should replace the 10KΩ pull down with a 1KΩ pull down. In this case, it will not be able to detect dark level differences as well but it will be able to detect bright light differences better.

Table 2.2: The approximate analog voltage based on the sensor light/resistance

Type of Ambient Light	Ambient Light (lux)	Photo cell resistance (Ω)	LDR+ R (Ω)	Current through LDR+R	Voltage across R
Moonlit Night	1 lux	70 KΩ	71 KΩ	0.07 mA	0.1V
Dark Room	10 lux	10 KΩ	11 KΩ	0.45 mA	0.5V
Dark Overcast Day/ Bright Room	100 lux	1.5 KΩ	2.5 KΩ	2.0 mA	2.0V
Overcast day	1000 lux	300Ω	1.3 KΩ	3.8 mA	3.8V
Full Daylight	10,000 lux	100 Ω	1.1K Ω	4.5mA	4.5V

2.3 Definition of Lux

Most datasheets use to indicate the resistance at certain light levels. It's not a method we tend to use to describe brightness so it's tough to gauge. Lux is the amount of light you actually see. One lux is equal to one lumen per square meter. It is the amount of light cast on a surface. This is the most practical measurement of light. See the Table 2.2 below for examples.

In Engineering Definition the lux (symbol: lx) is the unit of illuminance and luminous emittance. It is used in photometry as a measure of the intensity of light, with wavelengths weighted according to the luminosity function, a standardized model of human brightness perception. It is used as a measure of the intensity of light. In English, "lux" is used in both singular and plural. 1 lux = 1 lumen/sq. meter.

Table 2.3: Brightness Description

Illuminance	Example
0.002 lux	Moonless clear night sky
0.2 lux	Design minimum for emergency lighting (AS2293).
0.27 - 1 lux	Full moon on a clear night
3.4 lux	Dark limit of civil twilight under a clear sky
50 lux	Family living room
80 lux	Hallway/toilet
100 lux	Very dark overcast day
300 - 500	lux Sunrise or sunset on a clear day. Well-lit office area.
1,000 lux	Overcast day; typical TV studio lighting
10,000 - 25,000	lux Full daylight (not direct sun)
32,000 - 130,000	lux Direct sunlight

2.4 Headlight Control Sensor

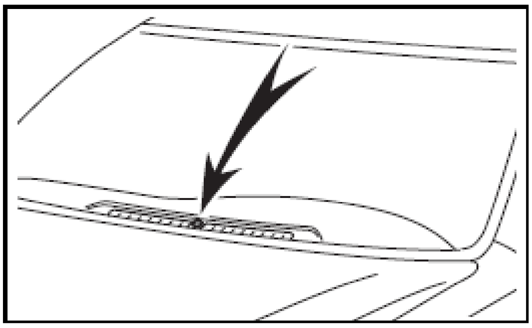

Figure 2.4: Place the control sensor

Based on Figure 2.4, the suitable place to put the sensor is below the windshield. The sensor may not function properly if an object is placed on the sensor, or anything that blocks the sensor is affixed to the windshield. Doing so interferes with the sensor detecting the level of ambient light and may cause the automatic headlight control system to malfunction.

Modern automotive vehicles include a variety of different lamps to provide illumination under different operating conditions. Headlamps are typically controlled to alternately generate low beams and high beams. Low beams provide less illumination and are used at night to illuminate the forward path when other vehicles are present. High beams provide significantly more light and are used to illuminate the vehicle's forward path when other vehicles are not present.

Normally drivers do not switch properly between low and high beams or vice versa. Instead, drivers keep low beams on in order to avoid frequent switching and often forget to turn high beams off or switch beams too late. In fact, this can contribute to accidents due to excessive glares. Moreover, driving under or with low beams reduces the drivers visibility range which reduces the ability of response to possible traffic events ahead such as pedestrians.

Under night-time driving conditions the more confident visual information for detecting vehicles are their head lights and tail lights. Some researchers have been working on the development of systems for night-time vehicle detection and they are based mainly in the detection of head lights and tail lights.