THE DEVELOPMENT OF ADAPTIVE LIGHTING SYSTEM FOR MOTORCYCLES

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Tajuk Projek : THE DEVELOPMENT OF ADAPTIVE LIGHTING SYSTEM FOR MOTORCYCLES

Sesi Pengajian : 1 0 / 1 1

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To my dearest parent

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ABSTRACT

This automatic lighting system for motorcycles needs no manual operation for switching ON and OFF to flash the high beam or low beam. It will detect light from vehicles that coming from front and automatically switch the light depend on the situation. When there is light from front coming vehicle, it automatically switches to the low beam and when the vehicle passes, it automatically switches back to high beam. This system integrated with PIC (Programmable Integrated Circuit) with LCD to display the status of the system.

ABSTRAK

Sistem pencahayaan automatik untuk motorsikal ini tidak memerlukan penunggang motorsikal menukar lampu tinggi atau rendah secara sendiri. Sistem ini akan mengesan cahaya dari kenderaan yang datang dari arah bertentangan dan secara automatiknya akan menukar lampu sama ada tinggi atau rendah bergantung kepada situasi. Jika ada cahaya dari kenderaan yang datang dari hadapan, sistem ini secara automatik akan menukar kepada lampu rendah dan apabila kenderaan tersebut sudah melepasinya, ia akan menukar kepada lampu tinggi secara automatik. Sistem ini telah digabungkan dengan Litar Bersepadu (PIC) dan Paparan hablur cecair (LCD) untuk memaparkan status dalam sistem ini.

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CHAPTER 1

INTRODUCTION

1.1 Background

A headlamp is a lamp that gives drivers more brightness of light when driving their vehicles. Drivers who are driving in the dark at night need to switch ON headlamp to improve their visual and driving in the suitable light. The performance of headlamp has improved throughout the automotive age. However, U.S. Nation Highway Traffic Safety Administration (NHTSA) states that most of the traffic accidents occur in the dark even only 25% of traffic travelling at night. It had happened due to bad visual acuity at night, bad weather and also road condition. [1]

The major purpose of using the high beam is to illuminate the road and traffic scene in front of the driver when there are no vehicles coming from the front. In this situation, if more light provided when driving, it will gives better visibility, and will lead us to a safety driving and comfort standpoint.

Thus, to improve the technology in motorcycles lighting system, an Adaptive Lighting System for Motorcycles was created. This system is a system that needs no manual operation for switching ON and OFF to flash the high beam or low beam. This lighting system will detect vehicles that coming from the front and automatically switch the light depend on the situation. When there is light from

vehicles that coming from front, it automatically switches to the low beam and when that vehicle passes, it automatically switches back to high beam. The range that needed for the light sensor to operate the system will be set accordingly.

1.2 Problem Statement

Nowadays user still uses manual light switching. Means that user still need to switch ON and OFF high beam or low beam when there is vehicle coming from front at night. This system will make it easy for all the drivers or riders who always forget to switch off the high beam when vehicles coming from the front. So, other driver from the front vehicles will feel comfort when driving with this lighting system. [2]

Help user to use the right lighting system on the right condition automatically. Some drivers do not bother about other drivers and use the wrong light when driving. By using this lighting system, it will help all the drivers using the right light on the right situation. [3]

Headlight high beams on a car are a useful tool. When used incorrectly, they can cause harm to us and to other drivers day or night. It's important to understand the rules of high beams to help prevent a serious accident, injury and possibly death. [4]

1.3 Objectives of project:

1. To investigate the lighting conventional system and mechanism in motorcycles.
2. To study the properties of an LDR sensor and its working principles.
3. To design and develop an Adaptive Lighting System to be implemented in motorcycles.
4. To propose a lighting system that can be commercialized for the types of transportation.

1.4 Scope of project

To accomplish this project successfully, there are a few things to be considered. An Adaptive Lighting System for Motorcycles is an advance lighting system for all the motorcycles. This system can help us to switches ON or OFF the headlight automatically due to the right situation especially at night. This system will use light sensor (LDR) to trace light from the front vehicles. If there is light from the front vehicles, the headlight will be turning off automatically. This system will be useful during the night because the light sensor will become more sensitive to light. So, to complete this project, the understanding of the principles of light sensor and lighting system for motorcycles is very important.

1.5 Thesis Outline

The structure of this project report was planned to provide a clear explanation about the project entirely. This thesis is divided into five chapters.

Chapter One introduces the project background, problem statements of this project, objectives and scope of work and the organization of this thesis.

Chapter Two provides the literature review on vehicles lighting system, design proposed for this lighting system, PIC Microcontroller, Combination of PIC micro, and other theory related with this project.

Chapter Three describes in detail the project methodology which is explained about the whole method being used for this project. This chapter contains the methods used from collecting data, processing and analyzing of data and flowchart.

Chapter 4 covers about the simulation and practical results of Hardware and Software circuit used in this project. There also have discussion for this project.

Lastly, Chapter Five is a conclusion of this project. In this chapter also expresses some recommendation towards the application for future development.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will explain and discussing about the electronics technology for automatic lighting system in general, the basic concept and related information about it. The characteristics of automatic lighting system, sensors that might be used, PIC 16F877A and LCD will be explained further towards the end of this chapter.

2.2 Fundamental of Automatic Lighting System

The lighting system of a vehicle consists of lighting and signaling devices integrated to the front, sides, rear, and in some cases the top of that vehicle itself. This system provide illumination for the driver to drive their vehicle safely in the dark, to increase the conspicuity of the vehicle, and to display information about the vehicle's presence, position, size, direction of travel, and driver's intentions regarding direction and speed of travel.

Figure 2.1 below shows the general wiring diagram for motorcycles that will be integrate with the adaptive lighting system. There will be some modification of the existing wiring diagram of motorcycle to make sure the automatic lighting system will be functioning well after integrate both circuit.

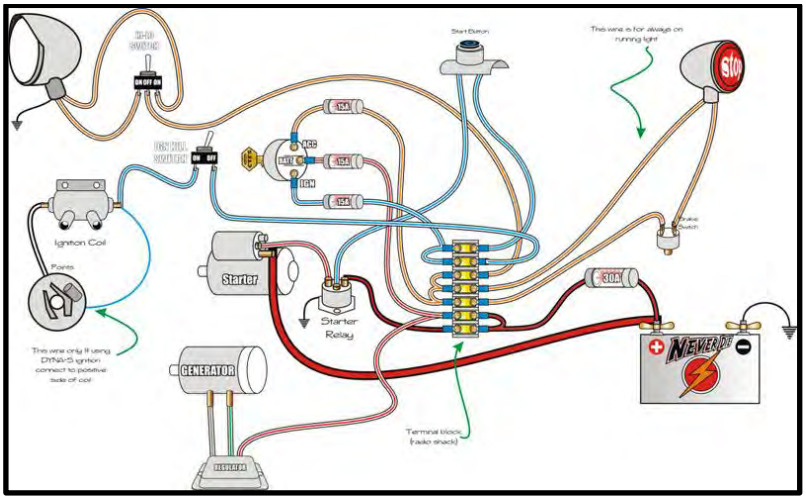

Figure 2.1: General wiring diagram of motorcycles[5]

2.3 Automatic Lighting System

This new system consists of two major parts. The first part is Automatic High/Low Beam System and the second part is HID Dimming System. These two systems are working individually on different stages.

Figure 2.2 shows that there are 3 stages in the system. The first stage represents the range of the nearest obstacles over 50 meters ahead. The second stage represents the obstacles within 5 to 50 meters range and finally the third stage represents the obstacles with 0 to 5 meters ahead.

Automatic High and Low Beam system will operates when this system detects an object which is far away (Stage 1, Figure 2.3). The headlamp control will operate when the obstacles go further (Stage 2, Figure 2.4). The HID Dimming System for low beam will take control the system when the obstacles or car are very close (Stage 3, Figure 2.5). The angle of headlamp will be carried out as compensation to the pitch angle of vehicle when the adjustment made. For this case, the pitch of the vehicle is fixed in zero velocity and horizontal position by assuming it. [6]

Figure 2.2: Stages of Advanced Headlamp System [6]

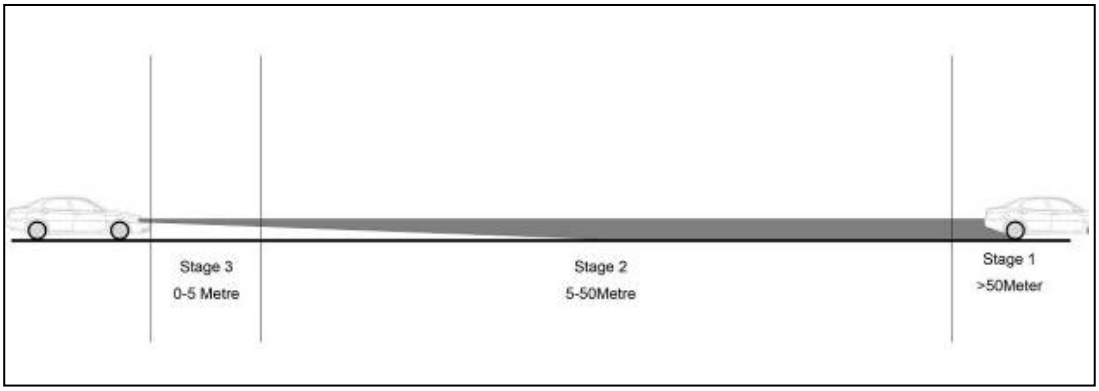

Figure 2.3: Stage 1 – Obstacle over 50 meters ahead [6]

Figure 2.3 shows that the obstacle was detected at the distance of over 50 meters. When there aren't any street lamps detected, the high beam will be automatically switched on or highest position of Low Beam will be maintained.

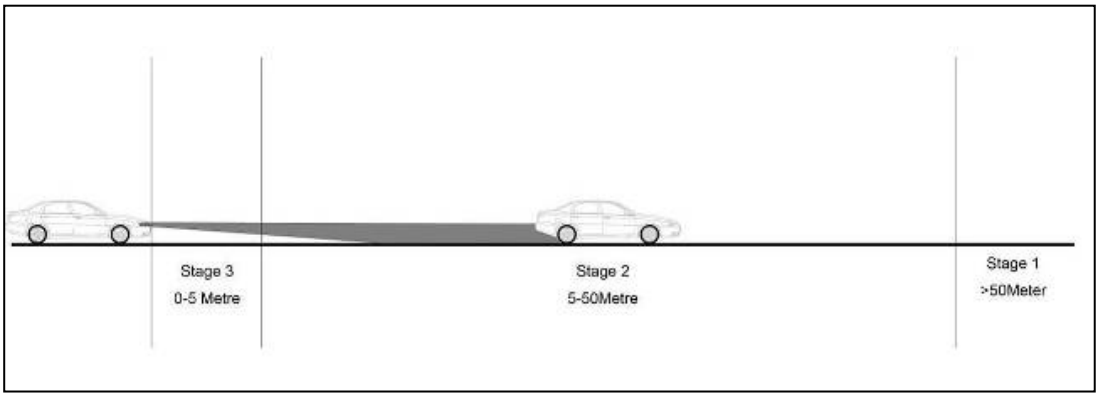

Figure 2.4: Stage 2 – Obstacle within 5 to 50meters [6]

In Stage 2 (Figure 2.4), the obstacle was detected in 5-50 meters area. The angle of the Low Beam will be adjusted automatically according to the actual distance and it will be turned on. It means that the voltage output by the Ultrasonic Sensor, ***v*** is inversely proportional to the distance l_1.

$$l1 = kuL\frac{1}{v} \quad (1)$$

where k_{uL}: is a coefficient of the ultrasonic sensor. The beam angle of headlamp θ is described by the tangent.

$$\frac{h}{l1} = \tan \quad (2)$$

and h is the depressed height.[6] The angle of head lights is adjusted according to the distance in the above cases.

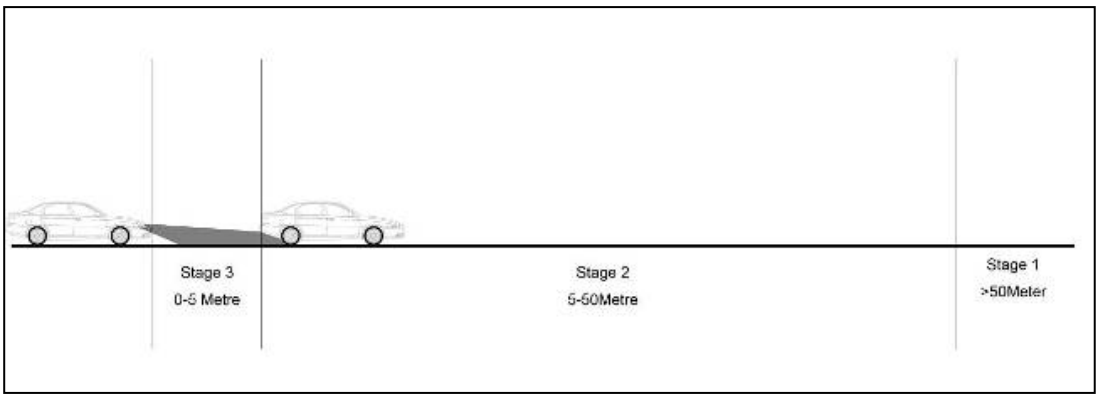

Figure 2.5: Stage 3 – Obstacles with 5 meters[6]

2.3.1 Light Dimming

Light sensors will detect the light reflected by other obstacles in the front of the vehicle and light from the coming vehicle from the front. The HID lamp will decrease the brightness until it becomes a comfortable level if the level of brightness is too high and may glare the driver inside the vehicle. The headlamp will be automatically switched off if the dimming level cannot be met. [6]

2.3.2 Automatic High/Low Beam System

By using high beam on rods with poor visibility may help driver but also can cause glare to the vehicles coming from front. Hence, any automatic lighting system for switches the high beam ON and OFF depend on surrounding light would be helpful for the driver.

Automatic High and Low beam system is a system which can switch between high and low beam automatically due to the detection of light from the front vehicles or surrounding light. A block diagram of this system is shown in Figure 2.6. In this system, light sensors on the car will detect light either from the oncoming vehicle or surrounding light will generate a signal to initiate switching over to low-beam driving. It will change back to high-beam after no light is detected. [6]

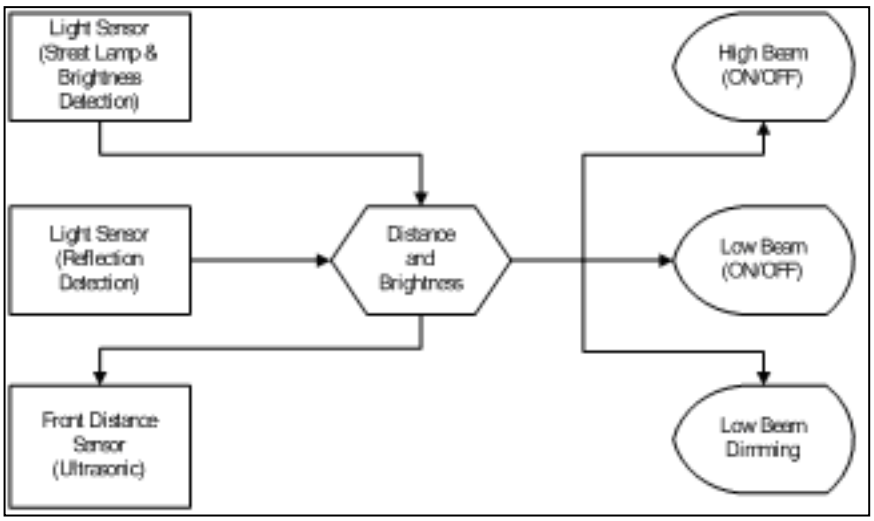

Figure 2.6: Automatic Hi/Low Beam System with speed control[6]

Recently, all vehicles' lighting system using manual operation to turn OFF or ON the high beam. For advanced technology in automotive field, we need to make it easy for all drivers by creating automatic lighting system. The wide variety of sensors currently on the market differs from one another in their mounting configurations, environmental sealing, and electronic features. There are 2 sensors that can be use to build this project.

- 1. Light sensor (LDR)
- 2. Distance sensor (Ultrasonic)

2.4 Light Sensor (LDR)

Light Dependent Resistors or LDR are very useful especially in light sensor circuits. The resistance of an LDR is very high, but when it not detects light, resistance drops dramatically and allowing current to pass through it.

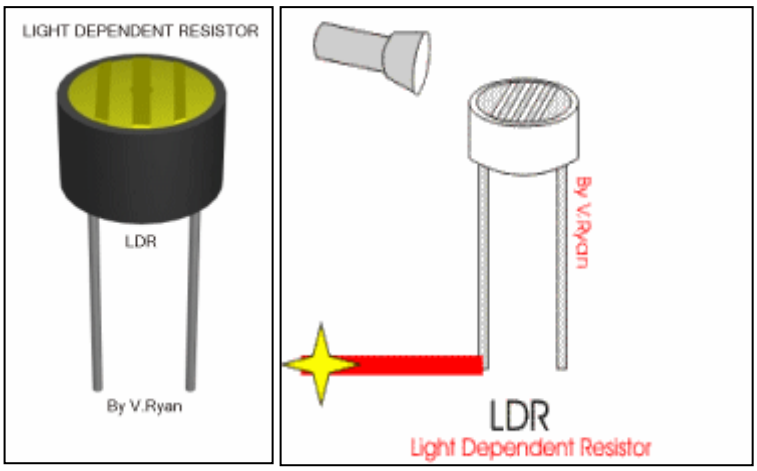

Figure 2.7: Light Dependent Resistor [7]

When the light level is low, the resistance of the LDR will be high. This will prevents current from flowing to the transistor base. Consequently the LED will not light. But, when light LDR detect lights, its resistance falls down dramatically and current flows into the base of the first transistor and then the second transistor. The LED lights will turn ON and the variable resistor can be turned up or down to increase or decrease resistance, in this way it can make the circuit more or less sensitive.