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Adaptive Headlight System

Arunagiri.P
Associate Professor, Department of Electronics and Communication Engg.
Sri Manakula Vinayagar Engg. College
Pondicherry, India
E-mail: p.arunagiri@smvec.ac.in

Shankar U.T
Department of Electronics and Communication Engg.
Sri Manakula Vinayagar Engg. College
Pondicherry, India
E-mail: shkarut1998@gmail.com

Balaji.M
Department of Electronics and Communication Engg.
Sri Manakula Vinayagar Engg. College
Pondicherry,India
E-mail: bvbalaji007@gmail.com

Abstract: Adaptive Headlight System is a novel system to automate the angle of lighting based on steering angle. It also controls the low beam and high beam of the lighting system in automobiles. Nowadays accident rates are increasing which leads to loss of life and Fatigue and one among the main reasons behind accidents are improper lighting, glaring effects during Night driving. The above problems can be overcome by our proposed system. The improper lighting condition can be overcome by the Headlight Angle control with steering mechanism and the glaring effects can be overcome by Headlight Intensity Control based on the detection of oncoming vehicle. The Headlight Intensity and angle control are the main principle of Adaptive Headlight System.

Keywords: Headlight Intensity Control, Headlight Angle Control , Gyrometer, Photo detector

I. INTRODUCTION

The fatality rate caused by road accidents leads with 1.4 lakhs deaths every year .To increase the focus on safety features in vehicles, we design this driver assistant system as a prototype which has two sub-systems such as Headlight angle control, Headlight intensity control. Due to improvement in vehicle technology over the past few years the number of vehicles also increases rapidly because of its usage in our daily life. According to the survey it is proved that there will be hike of 67% in number of accidents by 2020, mostly at night time. In comparison, the percentage of major accidents occurring at day time is 1.5 times less than that of a night time and also it shows that 60% of the accidents take place on the curved roads than other roads due to improper lighting conditions. There are many technology and innovations that are available for vehicle safety. Even though there are several technological innovations for vehicle safety, the growth in number of accidents is rapidly increasing. And these accidents are due to blindspots or glare effect of the headlights accidents. These accidents occur due to mistakes done by driver or carelessness of the driver. Hence, to overcome these mistakes an Adaptive Headlight System is proposed using gyrometer, Photo detector, Electromagnetic Relay etc. As a result, numbers of accidents are reduced.

To increase the focus on safety features in vehicles, we design this adaptive headlight system as a prototype which has two sub-systems such as Headlight angle control and Headlight intensity control. This is a cost effective mechanism to address the problems of blind spots and dazzling of head lights.

II. PROPOSED SYSTEM

The Proposed System consists of following components.

A.Microcontroller Unit:

The proposed system is developed on a Arduino UNO and it has Atmega328 microcontroller, which is manufactured by Atmel and belongs to the megaAVR series. The operation of ATmega supports different type of memories such as Flash memory, RAM and EEPROM. The Atmega328 also includes I/O peripherals, timers, and PWM.It has 20 digital input/output pins in which 6 can be used as PWM outputs and 6 can be used as analog inputs, a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming header, and a reset button.

B.Gyrometer:

The gyro meter is placed along the axis of brake drum, which is used to measure the steering angle inorder to control the headlight angle. The proposed system uses MPU6050 which consist of 3-axis Gyroscope with Micro Electro Mechanical System(MEMS) technology. It is used to detect rotational velocity along the X, Y, Z axes .When the gyros are rotated about any of the sense axes, the Coriolis Effect causes a vibration that can be detected by a MPU6050 gyrometer.The resulting signal is amplified, demodulated, and filtered to produce a voltage that is proportional to the angular rate.This voltage is digitized using 16-bit ADC to sample each axis.

Figure 1:MPU6050

C.Servo Motor

The servo motor is based on assembly of four things: a DC motor, a gear reduction unit, a position-sensing device and a control circuit. The DC motor is connected to a gear mechanism which provides feedback to the position sensor which is mostly a potentiometer. The output of the motor from the gear box is delivered to the servo arm via servo spline. In standard servo motors, the gear is normally made up of plastic whereas in high power servos, the gear is made up of metal. The Servo Motor generally requires DC supply of 4.8V to 6 V. The servo motor is interfaced with the Atmega328 microcontroller and the angle of rotation is determined and fed to the servo motor. The headlamp is fixed on the servo motor and rotates according to the servo motor rotation.

Figure 2: Servo Motor

D.Relay

A relay is an **electrically operated switch**. Current which is flowing through the coil of the electromagnetic relay creates a magnetic field which attracts the lever and changes the switch contact to open or close. The coil current can be on or off, so relays have two switch positions and most have **double throw** switch contacts. It is interfaced with microcontroller so that whenever high beam is detected from oncoming vehicle, it turns off the high beam supply.

Figure 3: Relay

E.Photodetector

This **Photo Transistor Sensor** is a simple sensor that detects ambient light. In this sensor, when light hits the little chip inside, it induces current, which flow from the long pin to the short pin. This sensor has a built-in optical filter so it'll do a fair job of simulating light levels as the human eye does. This sensor determines the oncoming vehicles headlight intensity which is given to the controller for intensity control.

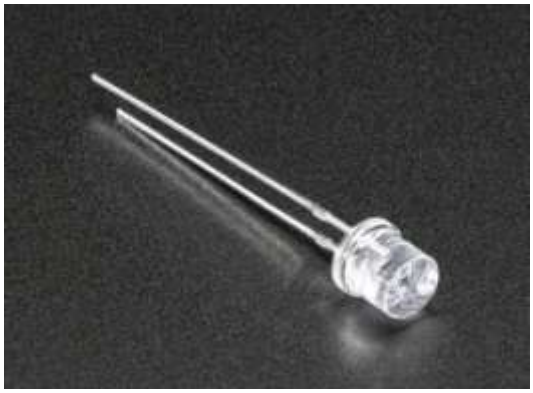

Figure 4: Phototransistor

III. WORKING

The objective of system is to overcome the the problems of blind spots and dazzling of head lights.

The improper lighting condition can be overcome by the adopting Adaptive Headlight System. The proposed Adaptive Headlight System is an active safety feature designed to make driving at night or in low-light conditions in a safer way. While driving by increasing visibility in road bends, blind turns avoids accidents. When driving around a bend in the road, standard headlights continue to shine straight ahead and leaving the road ahead in the dark. The proposed headlights, on the other hand, turn their beams according to the steering input so that the vehicle's actual path is also lit up. This will possibly

reduce accidents. To provide illumination at curves, the system will illuminate the path respective to steering positions. This is achieved with help of gyro meter, by placing it in the brake drum. With respect to gyro meter output, the headlight position can be controlled by servo motors.

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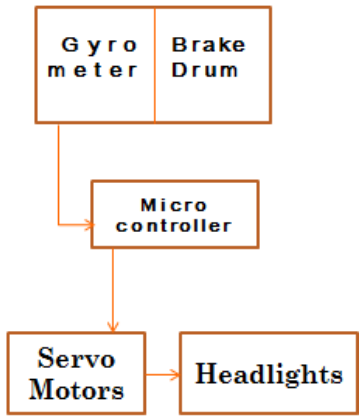

Figure 5:Headlight Angle Control

The glaring effect could be removed by following system. In this system, a sensor is placed at the front end of vehicle. The main purpose of sensor is used to identify the lighting nature (high beam or low beam)of opposite approaching vehicle. Let us consider there are two vehicles which are approaching towards each other during night time. If both the vehicles are at high beam, the drivers experience glaring effect. To avoid this, the proposed system automatically switches the head lights from high beam to low bean in both the vehicles, hence accidents could be avoided. Eventually by using this headlight system, improper lightning and glaring effects can be reduced. The high beam used during night time causes glaring effect to oncoming vehicle driver. This can be overcome by detecting the headlight brightness of oncoming vehicle. Photo detector will be placed at the windshield for detecting the brightness of oncoming vehicle. Based on the intensity levels, the high beam can be controlled using relay.

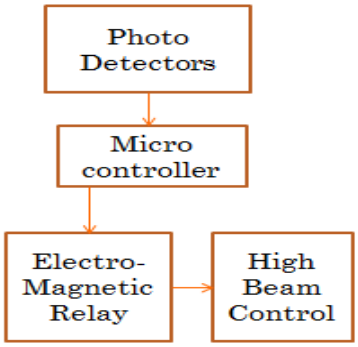

Figure 6:Headlight Intensity Control

Adaptive Headlight System is not available anywhere. Normal lighting system is only available in the market, which is not so efficient. Due to its affordable cost and not much change in design, it could be added to existing vehicles and new vehicles under manufacturing. Customers will find it helpful and there will be hike for this product in market.

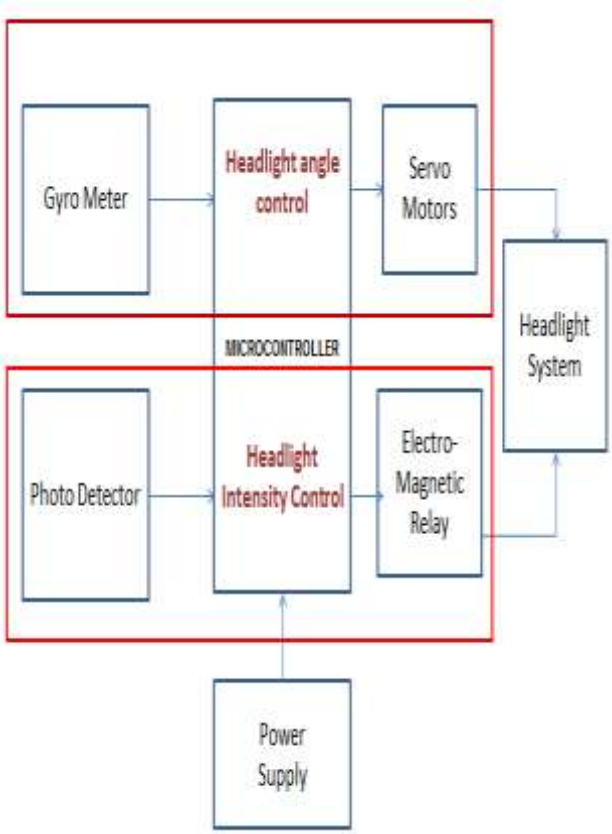

Figure 7: Overall Block Diagram

Thus, this system helps in reducing the number of accidents during night time by illuminating the blind spots and eliminating glaring effect due to high beam of oncoming vehicle.

IV. CONCLUSION

This proposed system can be used in small and medium level cars also, which reduces the accident rate by illuminating the blindspots and eliminating the glaring effects due to oncoming vehicle by headlight angle and beam control mechanisms. This system is cost efficient, and it can be proven to be even more effective as it automatically dims its light when a vehicle comes at a closer distance, and thus, providing a better vision to the person.

In future, the adaptive headlight system can be made more efficient by controlling the spread of the light beam from the head lamps using an ‘automatic range extender’ depending on the vehicle speed. The beam can be made to diverge when the

vehicle is travelling at high speeds and can be made to converge when the speed is low.

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