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Active Headlight Steering Control with Brightness Control

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***Abstract**: Special safety features have been built into cars for years, some for the safety of the car's occupants only, and some for the safety of others. One of the choices available is designing a steering controlled headlight system with brightness control. Car safety is the avoidance of automobile accidents or the minimization of harmful effects of accidents, in particular as pertaining to human life and health. Still, more specially, this device relates to a headlight arrangement operable connected to the steering and front wheel assembly of an automobile operable to maintain headlight members and the front wheels pointed in the same direction at all times and headlights will dim/bright automatically with the opposite vehicle approaching.*

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I. INTRODUCTION

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. Daylight running lights have also begun to experience wide-spread acceptance. There are various countries with regulations to control the amount of glare experienced by drivers due to preceding vehicles (other vehicles travelling in the same direction) and oncoming vehicles (vehicles travelling in the opposite direction). These laws obligate vehicle manufacturers to build vehicles that comply with these regulations. For example, the Department of Transportation (DOT) in the USA regulates the light emissions of vehicle high beam headlamps. In accordance with the DOT regulation limits, vehicle high beam headlamp emissions provide an intensity of 40,000cd at0°, 10,000cd at3°, 250cd at6°, 1,500cd at9° and750cd at12°. Adaptive headlight control (AHC) developed by Mobil- eye. The system is intended to support the driver in using the high beam to the fullest extent possible, without inconveniencing oncoming or preceding traffic. To perform AHC Mobil eye uses an image grabber and detailed analysis of light sources appearing in the image.

II. LITERATURE SURVEY

2.1 Thomas Hohmann Jr. in his journal "Rotatable vehicle headlights" (20 July, 1982) described that this invention relates to vehicle headlights which rotate to align the light beam with the direction of the vehicle's wheels. When a vehicle is travelling a sharp curve or turning a corner, the light beam of a fixedly secured headlight does not illuminate the path over which the vehicle's speed.

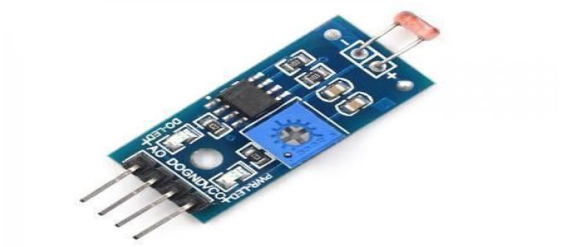
2.2 Victor Nutt et al. in the journal "Fuzzy Headlight Intensity Controller using Wireless Sensor Network" (2013) described that when both drivers are using a higher headlight intensity setting. Also, higher speed due to decreased traffic levels at night increases the severity of accidents. In order to eliminate accidents due to temporary driver blindness, a wireless sensor network (WSN) based controller is devised to quickly transmit sensor data between cars. Low latency allows quicker headlight intensity adjustment to minimize temporary blindness.

2.3 Keerthi V N et al. in the journal "Intelligent Headlight System" (2019)
have proposed a low cost solar powered automatic headlight controller depending upon the traffic density on the roads. The low beam light and high beam light are used for different conditions which affect the travelling on road.

III. MATERIALS USED

3.1 LIGHT DEPENDENT RESISTOR (LDR)

A photo resistor or light-dependent resistor (LDR) or photocell is a light-controlled variable resistor. The resistance of a photo resistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photo resistor can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits. A photo resistor is made of a high resistance semiconductor. In the dark, a photo resistor can have a resistance as high as a few mega ohms (MΩ), while in the light, a photo resistor can have a resistance as low as a few hundred ohms.



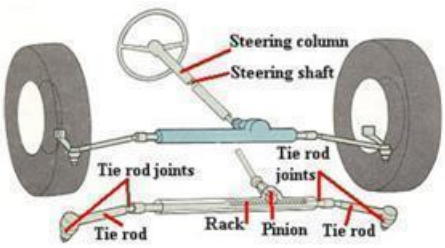
Light Dependent Resistor (LDR) is a type of semiconductor and its conductivity changes with proportional change in the intensity of light. A light dependent resistor (LDR) is a resistor whose resistance decreases with increasing incident light intensity; thus, it exhibits photoconductivity. Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000 000 ohms, but when they are illuminated with light resistance drops dramatically.

LDR is employed in the circuit to convert the intensity of the high beam headlight of the approaching vehicle into electrical signal.

The advantages of LDRs are as follows: they are cheap and are readily available in many sizes and shapes, practical LDRs are available in a variety of sizes and package styles, the most popular size having a face diameter of roughly 10mm and finally they need very small power and voltage for their operations.

3.2 Rack and pinion steering system:

The rack and pinion steering box has a pinion, connected to the steering column. This pinion runs in mesh with a rack that is connected to the steering tie rods.



The rack-and-pinion steering gear box has a pinion, connected to the steering column. This pinion runs with a rack that is connected to the steering tie rods. This gives a direct operation.

3.3 Relay

A relay can be defined as a switch. Switches are generally used to close or open the circuit manually. Relay is also a switch that connects or disconnects two circuits. But instead of manual operation a relay is applied with electrical signal, which in turn connects or disconnects another circuit.

3.4 Frame

A frame is a structural system that supports other components of a physical construction**.** Frame is used to carry the total setup of arrangement. It has to able to sustain the total weight of arrangement. It would be

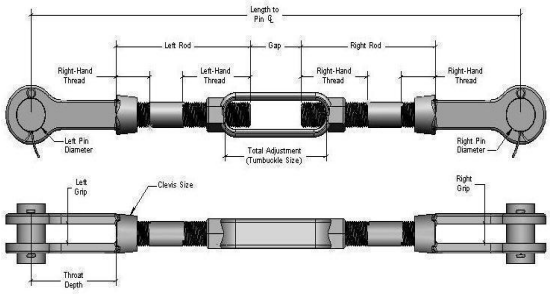
joined by arc welding to get permanent joint. Frame is very important in our project. Where all the other components are attached to it. The cross section of the mild steel columns takes the shape of the square. The rack and pinion is attached to the steering and also by using the tie rod it is attached to the wheels and to the headlights.

3.5 Control Unit

The control unit (CU) is a component of a computer's central processing unit (CPU) that directs the operation of the processor. It tells the computer's memory, arithmetic logic unit and input and output devices how to respond to the instructions that have been sent to the processor.

It directs the operation of the other units by providing timing and control signals. Most computer resources are managed by the CU. It directs the flow of data between the CPU and the other devices.

3.6 Tie rod



The tie rods are responsible for transmitting the force from the steering rack to the steering arm and moving the wheel. The recirculating ball or mechanical steering system is a little bit more complex than the rack-and-pinion system. When you turn your steering wheel, a pinion gear, which is attached to your steering shaft, will roll along the steering rack. The steering rack, attached to both front wheels, will move according to how you turn your wheel. A tie rod is a slender structural unit used as a tie and (in most applications) capable of carrying tensile loads only.

IV. PROBLEM STATEMENT

1) The system helps the driver to focus the headlight on correct path as the steering turns on either direction on curve roads at night.

2) Another serious problem for drivers during night is Glare effect. When the person exposes to very bright light, experiences a blurred vision. To avoid the glare effect, the headlight changes from high beam to low beam and vice-versa.

V. WORKING

5.1 ADAPTIVE HEADLIGHT

The operation of the adaptive headlight is the rack and pinion steering gear mechanism used for this project. When the steering wheel is rotated and rotary motion is converted to translator motion through the rack and pinion mechanism. When the front wheels are steered, the headlights follow the same path and the light is focused on a more divergent area. The steering movement is sensed and sent to the microcontroller which converts the analog signal into digital through the internal ADC and processes the data. After processing data is sent to the motor drive throughout the port. Motor drive will rotate the head light according to the steering movement. The rotation of steering will lead to the change in the output voltage across potentiometer that is from 0V to 5V this output voltage will be taken by microcontroller and as per the output of potentiometer across 2.5V either in positive (+) or in negative (-) will lead to the movement of headlight either left or in right by using a motor. Also light sensors LDR, which sense intensity of light and turn on headlight whenever intensity of light falls below the required intensity of light.

5.2 INTELLIGENT HEADLIGHT

The movement of headlight with the movement of steering wheel in the corners or on the road, giving the drivers a better look of the road at night time. Light sensor, which senses intensity of light and turns on headlight whenever intensity of light falls below a certain value. Automatic Light dimmer, which consists of two LDR based light intensity sensors. These two sensors are placed 12 apart in front of the vehicle in vertical position. If the upper sensor senses more intensity of light, it activates light in dimmer mode. If the lower sensor senses intensity of light is lower than it activates light in brighter mode.

VI. CONCLUSION

An effective steering controlled headlight mechanism was designed, based on the Ackermann Steering mechanism. Cost analysis was also done and a new mechanism at nominal cost was presented. Hence the steering angle was calculated and found to be $\varphi = 23.730$. In this project, we have presented a night-time detection computer system for driving assistance. On the one hand, the system performance is satisfactory for headlights (detection range up to 300–500m) but on the other hand, the performance for tail lights (detection range up to 50–80m) must be improved. One advantage of the system is that it works in real- time conditions. It does support the driver's vision during night-time driving. Also helps to reduce black spots while cornering and therefore reduces risk of accidents, by helping to notice persons or objects hidden in a bend earlier in advance.

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