Adaptive Headlight System for Automobiles

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***Abstract*- Now a days driving at night with conventional front luminous system is the major cause for the accidents during night. Routine drivers would know the difficulty in driving on highways, in the night, because of the glaring from vehicles coming from opposite direction. Since drivers use high beams on national and state highways, it is a lot of nuisance for the incoming traffic on the opposite direction. Furthermore, when a vehicle takes a deep turn, the headlight does not point to the direction that we are pursuing. Therefore, we propose an automation system that illuminates the headlight beam towards the concerned area when taking a steep turn. Automated headlight system using Arduino, provides way help fellow travelers from high beam glares by automatically detecting traffic from opposite direction and switching the light to low beam. This helps for the overall travelling drivers to have a better, safer driving experience and save them from trauma.**

Keywords- Automated headlights, Arduino UNO R3, LDR, Ultrasonic sensor, Potentiometer, LEDs headlight, Bread board.

I. INTRODUCTION

The main aim of this paper is to avoid accidents occurring at night due to improper lightening condition especially at the cornering of road and also to design and fabricate a simple steering controlled automatic headlight system, that is related to the arrangement of the headlight. This model is connected to the front and steering wheel system of an automobiles which helps to maintain the headlight members and the front wheels that is pointed in the same direction at all the times. So, in order to avoid poor visibility and improper illumination of the road, this prototype is designed. It is incorporated with two subsystems such as headlight angle control and headlight intensity control.

The Headlight Intensity and Headlight Angle control are the main aim of Adaptive Headlight 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. An advantage of this system is, it provides automatic switching.

Figure 1 shows the headlight control of the vehicle by Adaptive headlight system. As shown is this figure the headlamp focus is controlled according to the rotation of the steering wheel angle. This can be shown by the headlamp with Adaptive headlight system (AHS) which provides proper illumination of the roads especially at corner sides. But the headlamp that is fixed without AHS does not provide proper illumination of road as shown.

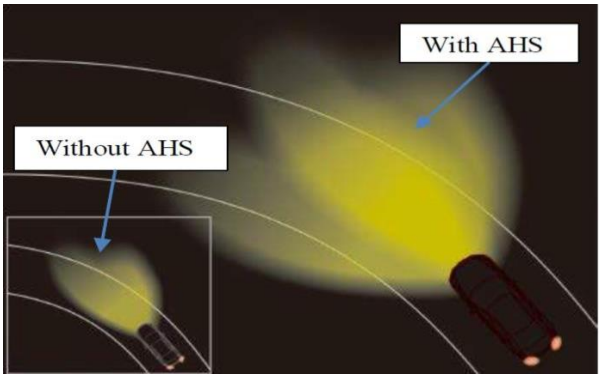

Figure 1. Headlight angle control at the corner of road

Figure 2 shows the headlight intensity control of the vehicle that avoids manual switching of headlight and provides automatic switching of headlight. That is, it switches from high beam to low beam and vice versa on sensing the vehicles coming from the opposite direction which provides improved concentration for the drivers and provides reduced driver fatigue.

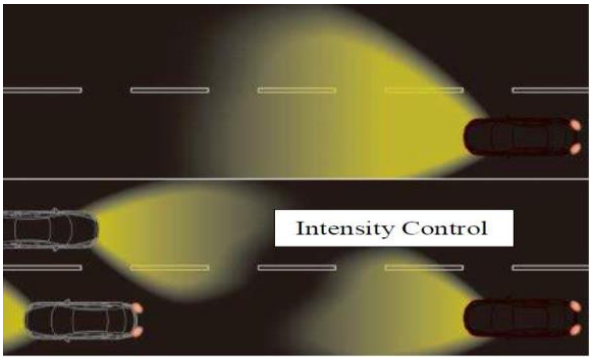

Figure 2. Control of Intensity of Headlight

II. LITERATU REREVIEW

Pablo Fernandez et al. presented a system to recognize the vehicle coming from opposite direction during night using camera and switches the headlight between low beam and high beam to avoid the glares.[3]. N Keerthi et al. 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 affecting the travelling on road.[4]. C K Chan et al. has been presented the Simulink model to estimate the function of different parts of the Advanced headlight system before building a physical model.[6]

PengfieSong et al. proposed the system to control the headlight angle based on automobile steering wheel using CAN/LIN network.[5]. Kalyani Gaikwad, Ramesh Mali proposed the system in order to improve the drivers vision to view the correct path on curve roads at night. It eradicates Troxler effect using CAN/LIN bus, steering wheel, LCD.[7]. RotarDon presented the system to achieve a correct path on curve roads by adjusting the headlight position. The automatic headlight position is controlled using microcontroller.[10]

Raghavendra L R et al. works on automatic headlight angle control at sharp turns or corners, headlight intensity control and also automatic indicator on and off system. [1]. Jyotiraman De aims to control the beam angle using LED based on steering wheel rotation and it also solves glare problem. [13]. Harshal Mohite et al. provides the solutionto develop the Adaptive headlight system. Adaptive headlight system controls the headlight angle and headlight intensity using Electric Power System.[14]. As we can see in our day to day life, the cars with a stationary headlight. In some of the high end models of the car we can see a side light with the main headlight. This modern technology first appeared in 2003 on the Porsche Cayenne (fixed) and the Mercedes E-class (motorized). Soon other manufacturers followed them such as the BMW with the adaptive headlights and cornering lights. Also while taking a look at the high beam low beam switching its completely manual, the driver sometimes be negligent to switching these as required. All the existing systems in automobile industry had the following drawbacks. They do not adapt to changing environments while driving automatically. This may cause a lot of nuisance to the users.

III. PROBLEMSTATEMENT

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.

IV. PROPOSED SYSTEM

Adaptive headlights are an active safety feature designed to make driving at night or in low-light conditions safer by increasing visibility around curves and over hills. Proposed system controls two operations: One is to control the angle of the headlight and another is to control the intensity of the headlight.

When driving on the curve road, standard headlights continue to shine straight ahead, illuminating the side of the road and leaving the road ahead of you in the dark. Adaptive headlights, on the other hand, turn their beams according to your steering input so that the vehicle's actual path is lit up. This is achieved by using single turn potentiometer as steering input which senses the steering wheel position. The voltage value of the pot is read by Arduino Uno R3, a 8-bit micro-controller and thus according to the Arduino output corner and deep corner LEDs are turned ON.

Similarly during a night drive in a highway, driving right side of a one way has become too hard mainly because of the glare that is coming from a vehicle coming in the opposite direction, this may sometimes cause the driver to crash to the vehicle in front of him, switching to low beam is the solution for it but people tend to forget it. So in our project we intend to automate this by measuring the intensity values from the opposite vehicle using LDR and sensing the distance between incoming vehicle and subject vehicle using ultrasonic sensor in turn reducing accidents. The block diagram of the proposed system is shown in the Figure 3.

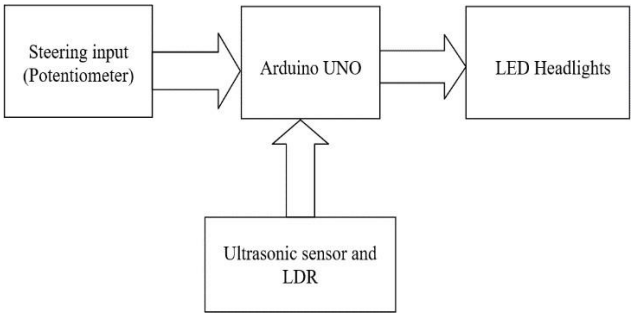

Figure 3. Block Diagram of AHS

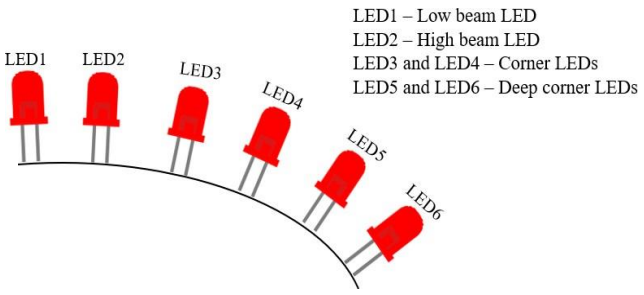

Figure 4. Right headlamp steering assembly

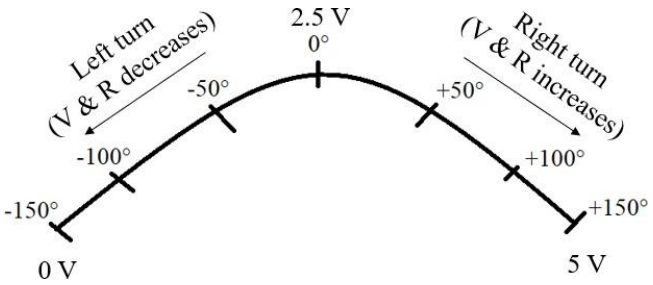

Figure 5. Angular division of Pot

A. WORKING

The working of the proposed system is explained in detail below:
Firstly the luminosity of the surrounding is sensed by the LDR present on the windshield. The headlight will be turned ON only if the luminosity value is less than the specific value. The headlight is checked whether it is in disabled state, then both the features are not ON. By this driver need not to turn ON or OFF the headlight manually. Potentiometer acts as the steering wheel input. Coming to the flow of the program, first we need to read the analog values that is given by the steering mounted in the potentiometer. Potentiometer can rotate upto 300°. The headlights LEDs work based on the increase or decrease in the potentiometer voltage value from the median value (i.e. when the steering is turned right or left).

The LED arrangement in headlight is shown in Figure 4. This series of LED gets input from the Arduino based on which they work. The low beam LED (LED1) will always be turned ON. The high beam LED (LED2) changes according to the Arduino output which in turn changes with the LDR value, this will be explained in detail later. The Arduino gets the input value from pot, compares it with the threshold values and then send output value to the series of LEDs in headlight. The angular division of pot is shown in Figure 5. When the steering wheel input angle (pot angle) is between -50° to +50° (i.e. pot value between220 and 650) that is the steering is at center then all the corner (LED3 and LED4) and deep corner (LED5 and LED6) LEDs of both right and left headlight are switched OFF.

During Right turn, the corner and deep cornerLEDs of left headlight are switched OFF. Consider right headlight shown in Figure 4,when the pot angle isbetween +50° and +100° (i.e. pot value between 650 and 890) then corner LEDs (LED3 and LED4)are switched ON and deep corner LEDs (LED5 and LED6) are switched OFF and when steering is between +100° and +150° then both corner and deep corner LEDs are switched ON.

During Left turn, the corner and deep corner LEDs of right headlight are switched OFF. Consider left headlight, when the pot angle is between -100° and -50° (i.e. pot value between 200 and 390) then corner LEDs (LED3 and LED4) are switched ON and deep cornerLEDs (LED 5 and LED6) are switched OFF and whensteering is between -150° and-100° then both corner and deep corner LEDs are switched ON.

Now for the glare problem, to measure the intensity of the opposite vehicle we use two LDRs near each headlight and to detect the distance between the incoming vehicle and subject vehicle we use ultrasonic sensor. The low beam LED (LED1) will always be glowing. High beam LED (LED2) is turned OFF, if the intensity is more than specific value and distance measured by ultrasonic sensor is less than specific value. Once the vehicle passes by again high beam LED (LED2) will glow, this again saving driver's effort to manually switch dim-dip headlight.

Figure 6 shows the basic software flowchart of the proposed Automatic Headlight System (AHS).

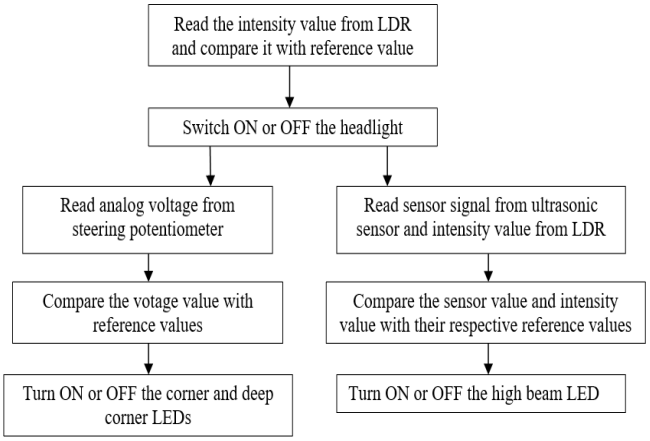

Figure 6. Flow chart of proposed AHS

Advantages

- It isa cost effective system.
- This proposed system can be easily incorporated in low and medium level cars.
- It provides safe driving for driver's andpedestrians.
- It is highly reliable and done with easily available components and it is easy toinstall.
- Human effort will be reduced and is a robust system and also provides quick response time.

Disadvantages

- It needs continuous power supply.
- It can be disturbed due to street lights.

Applications

- They allow for safer driving and avoid blinding other vehicles or pedestrians.
- They improve driving in adverse weather.
- It is also used in two wheeler vehicles like sports bike etc.,
- Smart vehicles required for smart city.

V. CONCLUSION

At night, driving a vehicle on cornering of road can

be quite challenging. The straight illumination of the headlamps makes it difficult to accommodate for sharp turns. Lack of visibility at turns in narrow roads can prove to be fatal collision of vehicle.

The system is inexpensive, simple and dependable assembly. This proposed model can be used in small and medium level cars also, which reduces the accident rate by illuminating the blind spots 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.

Adaptive headlight system thus can be used as accessory in all running vehicles for proper illumination of road according the driving situation. This ensures higher degree of active safety in vehicles and assistance to driver.

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