Astute Oculus Headlight System

Ms. Shetty Nikitha Narendra, Mr. Supreeth G Rao P, Mr. Aravinda Upadhya K, Mr. Pradeepa Kumara N, Ms. Rajashree Nambiar
Dept. of ECE
SMVITM
Udupi, India
supreeth195@gmail.com

Abstract— According to traffic accident data, the maximum of severe road accidents occurs at night vision. Driving at night with existing conventional headlamps is particularly unsafe because it does not provide illumination in the right direction on roads. Due to this constrain, paper describes the development of astute oculus headlight system an alternative technology solution to improve visibility for driver at night time on road. Headlight swings in the horizontal by sensing steering angle and vertical direction along with beam strength by sensing next vehicles headlight and tail light. So, when a person turns the steering of the vehicle the reflectors of the headlight unit turn accordingly. When our vehicle is following other vehicle, headlights will turn to low beam and only right-side headlight intensity reduces when a vehicle is approaching us from the opposite direction.

Index Terms—AOHS(Astute Oculus Headlight System), Light sensor, encoder, Seromotor, AFS(Adaptive Front-light System).

1 Introduction

IT is observed that 80 percent of all road traffic accidents occur in night and bad weather condition – a compelling reason to put efforts into developing the next generation of intelligent lighting systems with multi-functional swiveling headlights. The aim is to improve visibility for the driver, thereby achieving a significant increase in road safety and driving comfort. The traditional headlights in vehicles provide illumination in tangent direction of the headlamp, without any consideration towards the turning angle of road and the distance between incoming vehicle and subject vehicle [1]. This leads to insufficient illumination and hence the driver is unable to see the complete road which causes discomfort while driving in night time. And to avoid this driver has to manually dim or deep the headlights. So, our aim is to develop an advanced headlight system that is an Astute Oculus Headlight System.

From the previous research on adaptive headlights it's known that, it increases up to 30% in the illumination of the driver's gaze point as the vehicle turns into a corner. This results in a 58% increase in the driver's ability to recognize an obstacle when the driver takes a turn over a curvy road [2].

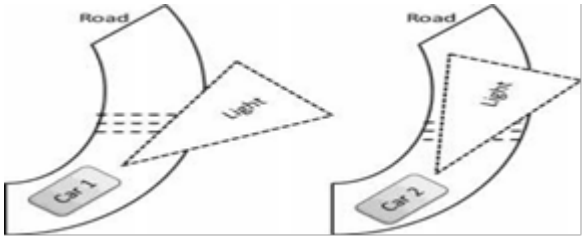

Fig.1. Car 1 without AOHS and Car 2 with AOHS [1]

AFS with steering control was developed with mechanical linkages [3]. Present systems are based on imaging cameras based on concept of image processing. It uses image recognition technology to collect the corner information from a certain distance and then it adjusts the horizontal movement of the headlamp. But analyzing images clicked at night had disadvantages [4]. AFS was developed using LDR's which had drawbacks like, the light from street light, tail lamp of vehicle also falls on LDR(Light Detecting Resistor) and caused continuous switching from high beam to low beam and vice-versa. The set value selection is a complex one.

Fig.2. Steering Controlled Headlights

Above figure shows the headlight stable or the normal condition and the headlight rotated with steering [Fig.2.].

2 Methodology

Astute Oculus Headlights System are useful when driving on curvy roads at night, during gloomy weather, or in other low-light conditions.

The general problem is to design a system which can analyze road conditions to identify situations in which adaptive road illumination system could enhance visibility, and thereby substantially improve safety and/or comfort for road users. The main goal of this proposed project is to discuss different situations like:

1. As you round a curve, your headlights temporarily blind oncoming traffic.

2. When there is a vehicle coming in the opposite direction.
3. When there is a vehicle moving in front of our vehicle in same direction.

Working of AOHS is shown in Fig.3.

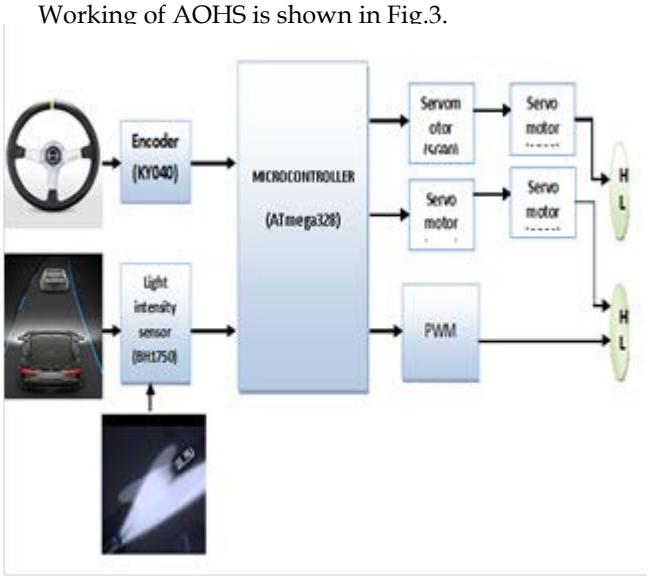

Fig.3. Block diagram of Adaptive Headlight System

2.1 Case 1:

Depending on the steering condition the reflectors of the headlight rotates certain angle. A rotary encoder is connected to the steering axis which gives the signal to the microcontroller. We are using KY-040 rotary encoder is a rotary input device (as in knob) that provides an indication of how much the knob has been rotated and what direction it is rotating in. A rotary encoder has a fixed number of positions per revolution. These positions are easily felt as small clicks you turn the encoder. When the steering is rotated to right side, the microcontroller analysis the signal received from the encoder and then sends signal according to the servo motor, which rotates the reflector of the right-side headlight with some angle where in left side remains straight. When steering is turned left side, left side reflectors rotate and right side remains idle. Block diagram of steering controlled system is shown in Fig.4. Fig.5. explains the flowchart for the same. Due to this the driver will be able to see the road better since the area count is more. This helps in curves and in sharp turns.

In normal headlights system we won't be able to see the road until and unless the vehicle enters that curve or turn. But in AFS we can see the roads before entering the turn or the curve. As soon as the steering of the vehicle is rotated driver gets a better vision of road in that direction.

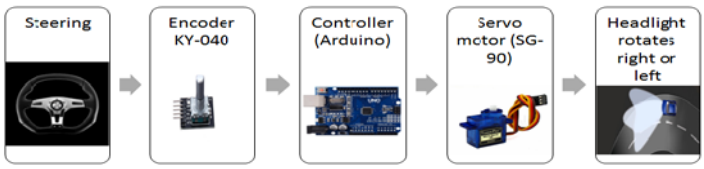

Fig.4. Block diagram of steering controlled headlight system

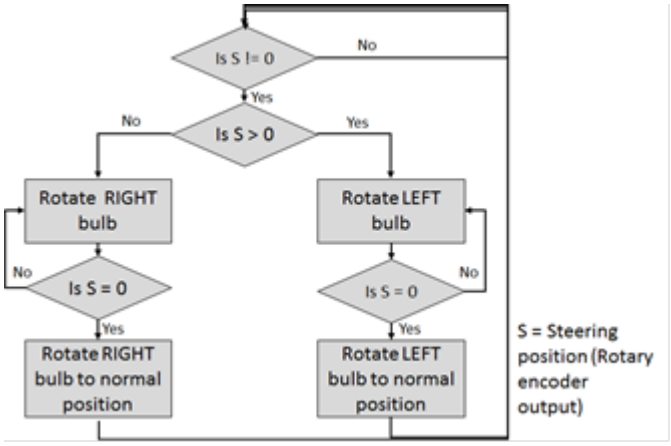

Fig.5. Flowchart of steering controlled headlight system

2.2 Case 2:

Improved automotive control systems have freed drivers from performing a number of tasks that formerly required manual operations. Such systems relieve drivers from the distractions of these auxiliary systems and often results in improved concentration as well as reduced driver fatigue. So, an automatic dimmer system is designed to help drivers. This automatically switches from high to low beam and vice versa in the presence of light from other vehicles. Headlights should be dimmed when vehicle being approached from behind when the system senses the vehicles tail light. This can be done using light detector as shown in Fig.6. We are BH1750 light intensity sensor, breakout board with a 16-bit AD(Analog to Digital) converter built-in which can directly outputs a digital signal; there is no need for complicated calculations. This is a more accurate and easier to use version of the simple LDR. As soon as the sensor detects the tail light of front vehicle it sends signal to controller and controller using servo motor, that can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller, makes low beam from high beam and automatically switches to high beam when there is no vehicle in front of our vehicle in 50 meters.

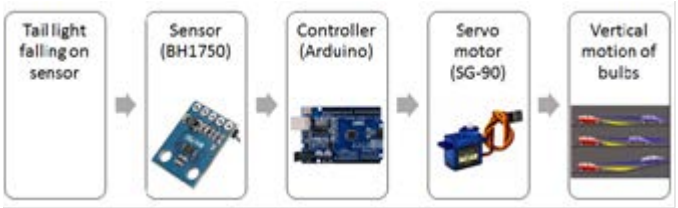

Fig.6. Block diagram of headlight dimmer system

2.2 Case 3:

During night time, when two vehicles approach each other in opposite direction the high intensity headlight creates an effect called "Troxler effect" [5]. This effect creates a temporary blindness for some seconds thus resulting in unfortunate accidents. Thus, the high beam of both the vehicles right-side

headlight must be switched to low so as to have a comfortable driving. The use of such a device in vehicles can prevent accidents at night time due to driver inattentiveness and provides an ease of driving. The light sensor takes the "lux" reading of the headlight rays from the opposing vehicle sends it to controller and checks for a threshold value assigned in the coding. Based on the threshold value the right-side headlight beam switches from high to low beam state and it partially reduces the intensity of the headlight as soon as it detects the vehicles headlight. The same process takes place in opposite vehicle too. The block diagram is shown in Fig.7. Working of dimmer system is explained through flowchart in Fig.8.

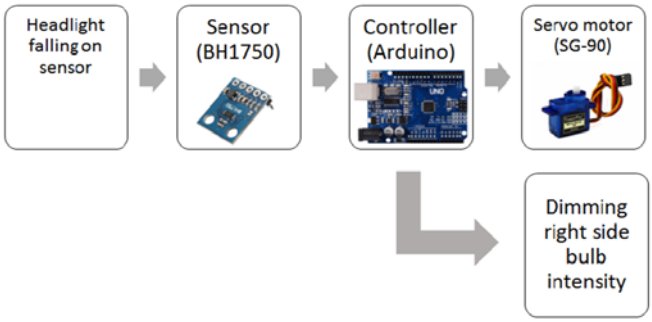

Fig.7. Block diagram of light intensity-controlled headlight system

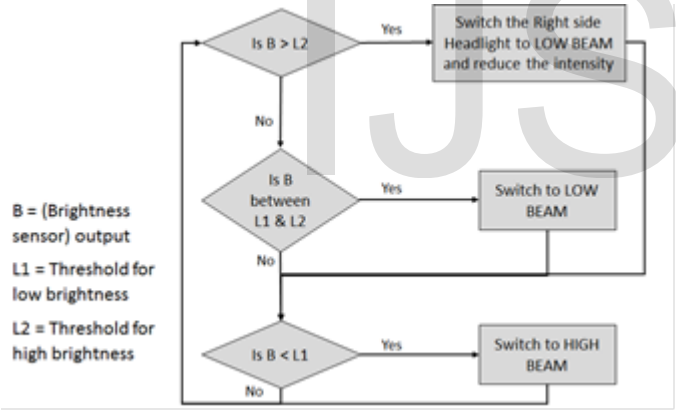

Fig.8. Flowchart of headlight dimmer system

3 Results

Astute Oculus headlights have three main features. They are,

(1) Rotating headlight with respect to the movement of the steering.

(2) Moving the headlight beam high to low or vice-versa.

(3) Varying the intensity of the headlight when there is vehicle in front closer by.

Fig.9 shows the normal headlight system. We can compare Fig.9 & Fig.10 and see the major differences between them. We have partially built the model for the first two cases where in the lights rotate right-left & up-down. When the steering is rotated, headlight makes certain angle of rotation which is required for the clear vision on the roads at the curves as well as in sharp turns as shown in Fig.10. This also helps in highways as well as off-roads. Using light intensity sensor, we have designed for high-low beam of the headlight. Very soon we shall design the model for varying the intensity as well.

Fig.9. Normal headlight system

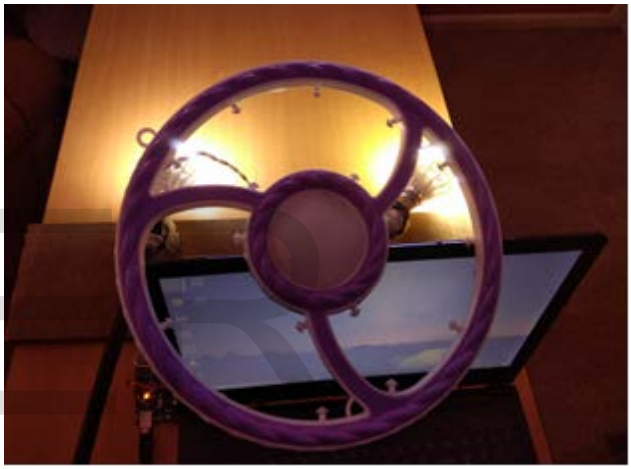

Fig.10. Astute Oculus Headlight System

4 Conclusion

From the AOHS project, we can avoid the probable accidents that might happen in our country or in the world. We will turn light when vehicle about to turn this is helpful in many situations. As the material we are using to develop this project is very low cost so this is also cost-effective project. This can be easily implemented in all vehicles in the globe. High beam headlight will be turned on initially when the system is turned on. The system switches to down light when light is sensed by the light sensor and back to high beam headlight when no light is detected by the light sensor. These Astute Oculus Headlight Systems are automatic and the driver need not put manual efforts to switch from high beam to low beam. However, vehicles employed with automatic dippers are not very often seen in cities, and it may be due to lack of information about the system and also because of giving attention to the people saying that it is not at all practicable in highways. AOHS are devices, which will attain more and more importance in the forthcoming years. In short, it is a device with a very bright future. Offering the prospect of improved vision during night-time driving, AOHS system has positive implications for road safety and driver comfort. These developed

headlight systems are highly adaptable as it can be easily configured to fit within space confines of a variety of vehicle designs. Customer demand is expected to increase across market sectors, creating opportunities and challenges for established vehicle lighting suppliers and new entrants.

5 FUTURE WORK

Real time analysis on number of accidents and mode of accidents taking place in a high way can be noted down to construct statistical model. The relationship between frequency of switching in deep curves on road and the opponent high speed and low speed vehicles velocity which affects flickering can be carefully studied and construct a resilient model. We can even make necessary variation in the intensity of the light whenever required. The same concept can be implemented on the fog lamps which will improve the driver visibility even during different weather conditions.

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