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Adaptive Head-Light System For Vehicle

[1] Priyanka M Dubal, [2] Dr. Alam N. Shaikh
[1] Asst Professor, Department of Electronics Engineering, [2] Principal
[1] [2] Padmabhushan Vasant Dada Patil Pratishthan's College of Engineering ,Sion Maharashtra

***Abstract* - Night time driving with conventional headlamps is particularly unsafe Major road accidents are occurs during night time. About 25% of driving done at night time. About 55% of accidents are occurs during this period . The highest fatal traffic accident rate occurs on curved roads at nighttime. The existing conventional light systems do not provide illumination in the right direction on curve roads. Due to this constrain, a need to understand an alternative technology solution. The aim is to improve visibility for driver and so achieve a significant increase in safety and driving comfort. This calls for a flexible front light for automobiles to illuminate road ahead in the night at corner. Adaptive front lighting system (AFS) helps improve driver's visibility at night time hence achieving enhance safety. AFS (adaptive front-lighting system) used to detect information about corner in advance with help of sensor which detect the information send it to motor to adjust headlamps to get the lighting beam which was suitable for the corner. Through this way, it could avoid "blind spot" caused by the fixed lighting area when coming into the corner, and improve driving safety**

Index Terms— AFS (adaptive front-lighting system)

I. INTRODUCTION

In recent decades road accidents are rapidly increasing. Road accidents are human tragedy. About 70% accidents are occurs in night time and 30% accidents are occurs in day time. Road safety is an issue of national concern. Accidents have negative impacts on economy, public health and public safety. Because the static headlamp just provides certain illuminating fields for drivers in the nighttime and is insufficient to serve for curved roads and intersection, Advanced Front-lighting System (AFS), has been proposed by many researchers and is catching increasing interest.[1]

II.PRESENT THEORY AND PRACTICES

Development of an Adaptive Headlamp Systems [1] in which 8 bit microcontroller PIC16F877A used and build of steerable headlights from conventional static headlamps has been achieved. Moving the headlights from left to right or vice versa continuously corresponding to a sensor is achieved An advantage of the developed headlight system is in its high adaptability as it can be easily configured to fit within space confines of a variety of vehicle designs.

The system [2] introduces a Development and Implementation of Control Algorithm For Adaptive Front Light System of a Car based on control algorithm to tilt headlamp in both horizontal and vertical axes corresponding to steering angle , speed and suspension inputs. In this system functionality was modeled in LABVIEW and motion with stepper motor was simulated using supporting hardware. The Electronics control unit consist PIC Microprocessor which handles analog sensors, which are rotary potentiometer and outputs digital signals to stepper motor.

Study on Visibility and Discomfort Glare of Adaptive Front Lighting System (AFS) For Motorcycles Represents a simulation survey and an actual driving survey to evaluate the discomfort glare showed that when the horizontal inclination of the headlamp is adjusted by the same or smaller amount than the bank angle, the glare evaluation scores are equal to or above the just acceptable level. However, when the adjustment amount is more than the bank angle, the glare evaluation scores are below the just acceptable level [3].

T. Hacibekir [4] presented a paper of the hardware in loop simulation of an Adaptive Head Light System for Motor Vehicle. In the paper the real time vehicle and the road models are used for that and the hardware in the loop simulation setup proposed for testing adaptive headlight concept are presented. Real time simulations using simulator are used to illustrate the approach .The aim of development in active safety is to reduce the reaction time of driver by improving visibility and thus achieve a significant increase in road safety and driving comfort.

Study On Adaptive Front Lighting System Of Automobile Based On Microcontroller [5]. This system represents, when the automobile turns in curve at night, it can always appear the blind spot in the turn, for the lights are unable to adjust the illumination angle. In order to enhance safety driving at night, an adaptive front-lighting system (AFS) of automobile controlled by core of electric control unit. The AFS is based on the steering wheel angle and speed changes to adjust light axis angle to light up the road in the front, so the drivers' security vision are improved. The

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work principles of the AFS and control model and hardware circuits are particularly described which helps to avoid the blind spot at the corner.

In Development of Automotive adaptive front Lighting System, 32 bit LPC2148 an ARM7 series microcontroller is used to control the motor potentiometer is used as steering angle sensor. It is expected that the position of the headlight will change in accordance with the steering shaft. The potentiometer, attached with the steering shaft, takes input from steering shaft sends analog signal to the ADC. This helps in horizontal movement of the headlamp [6].

Research of Modeling and Simulation on Adaptive Front-Lighting System for Corner Based on CCD[8] in this system analyzed photometric characteristics of vehicle headlamps when turning the corner, and developed a new kind of AFS (adaptive front-lighting system) based on CCD (charge-coupled device) which was better than traditional AFS. This new AFS used CCD image sensor to detect information about the corner and then sent curvature radius to electronic control units in advance. Meanwhile, electronic control units would calculate accurate rotation angle of headlamps through velocity and curvature radius, and send it to motor to adjust headlamps to get the lighting beam which was suitable for the corner. Through this way, it could avoid "blind spot" caused by the fixed lighting area when coming into the corner, and improve driving safety. This paper has given modeling for horizontal rotation angle of vehicle headlamps, and simulated it with MATLAB.

III.THE DEVELOPED SYSTEM ARCHITECTURE

This is a feedback system working from two sensors camera (image sensor)and ultrasonic distance sensor to controller and controller to actuators

A. System Design:

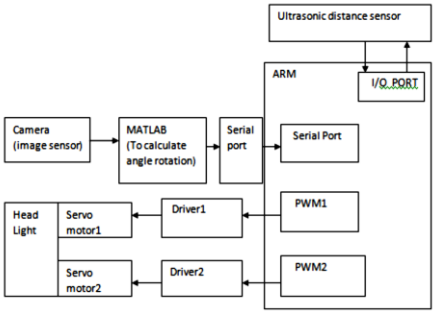

Figure1. Block Diagram of adaptive front lighting system

Figure 1 shows the block diagram of developed system. It consist of two sensor (camera and ultrasonic sensor) ,microcontroller ARM7 LPC2148 and actuator.

B. Sensor Block

In developed adaptive front lighting system, two sensors are used. The camera (image sensor) helps for horizontal rotation of headlamp and ultrasonic distance sensor helps for vertical rotation of headlamp. The developed system uses USB webcam with interpolated 8M pixels still image & 4M pixels video and HCSR04 ultrasonic distance sensor.

C. Microcontroller: LPC2148 an ARM7 series microcontroller is used to control the actuator motor. The ARM 7LPC2148 uses 16/32-Bit and it has 512KB of internal flash and 32+8K RAM. It has inbuilt 14 channel 10 bit ADC, 6 channel 10 bit PWM and high speed of 60 MHz. The choice of controller was determined by easy availability, affordable price, reliability and the fact that it permits the use of C language for its programming

D .Actuators: To facilitate movement of the headlamp based on Sensors input, the headlamp is mounted on motors. The actuator used is a servo motors for horizontal Motion and vertical Motion.

IV PRINCIPLE OF OPERATION

A. Camera with servo for horizontal turning of front lights:

To get clear visual on road and obstacles on road at night time along curved road, it is necessary to turn headlight along that direction In this system Camera (image sensor) is used to detect information about the corner and that RGB image is converted into HSV plane and from that image we are going to calculate angle of rotation for headlamp which acts as angle sensor. This information is send to the controller and controller unit processes the input and updates the PWM width. The output is feed to the servo motor and servo motor helps to rotate headlight horizontally.

B.Vertical turning of light in response to distance obtained:

Ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) work on a principle similar to radar or sonar which evaluates attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the

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sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object and achieve vertical movement of the headlamp in accordance to the distance from the incoming vehicle or object.

V.HARDWARE AND SOFTWARE REQUIRMENT

1. PC with MATLAB
2. KEIL
3. Ultrasonic distance sensor
4. ARM Controller
5 .Servo motor

VI. SOFTWARE FLOWCHART

Philips flash utility software allows uploading and execution of code. Keil tool by ARM (For ARM7 (LPC2148) µVision4 software is used for compilation purpose.Figure.2 shows the software flowchart of proposed system.

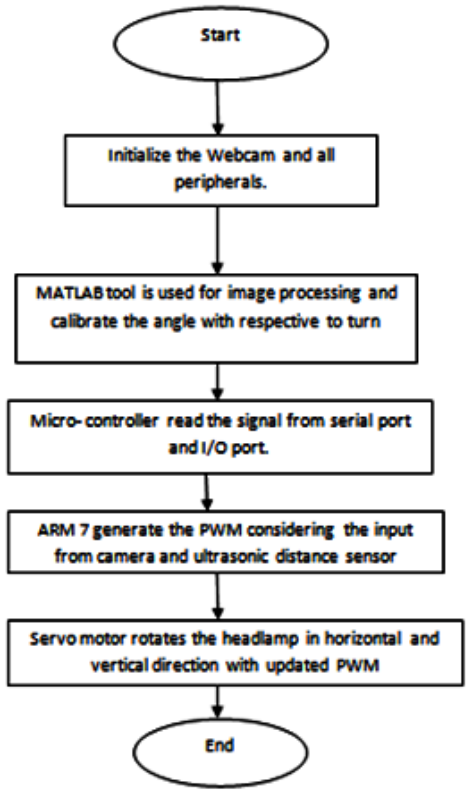

Figure 2 :Software flowchart of the system

VII.SIMULATION RESULT AND SYSTEM MODEL

In this system MATLAB tool is used to process on captured video. Figure 3 shows the simulation result of USB webcam initialization

Figure.3 .webcam initialization

With the help of MATLAB the captured image is converted to gray image and then to dilated image using standard MATLAB tool function's .As shown in figure 4 two blue lines are drown as reference to find out the x-position difference .The difference value is used to horizontal motion for headlights. The fig4 shows the MATLAB simulation result and calculated difference value.

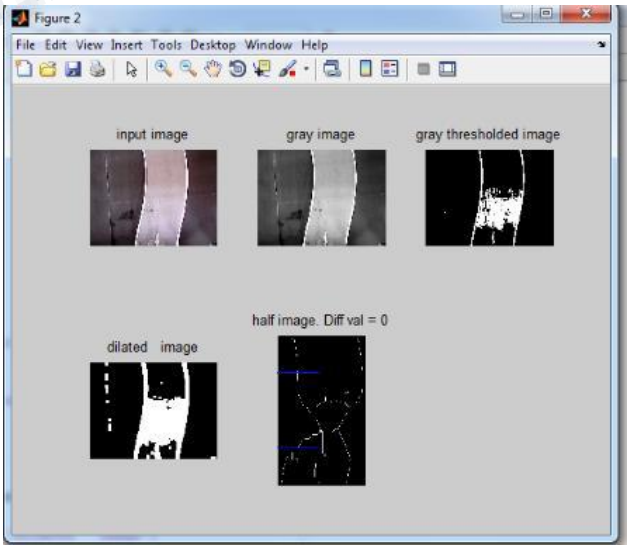

Figure.4: Simulation result

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Figure 5 shows the developed model for proposed system, In which headlamp is moving horizontally and vertically corresponding to sensors.

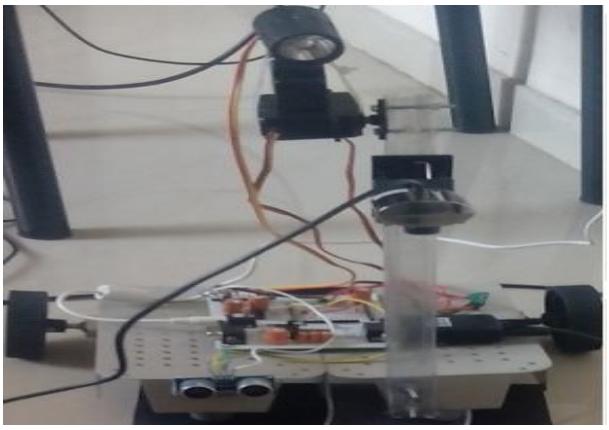

Figure.5: Developed system model

VIII.CONCLUSION

This paper presents a newly developed adaptive front lighting system for vehicle. This developed architecture help to remove "blind spot" and improve the driver's visibility at night time. Moving the Headlights horizontally and vertically achieved continuously corresponding to a sensor is achieved. An advantage of the developed headlight system is easily configured to fit in variety of vehicles. The future work mainly concentrates on to invent a comprehensive AFS system which can be suitable for complex road conditions including road surface water, corner, highway, rural road and urban road and so on.

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