CONTROL OF INTENSITIES OF HEADLAMP

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ABSTRACT

While driving at night, many drivers use high and bright beam. This high beam causes a sudden exposure of such light to driver in vehicle coming from opposite side and driver experiences glare for a small period of time. Even on curves this high headlight causes unclear vision to driver coming from opposite direction. This glare causes blindness to driver in opposite direction which sometimes result in accidents. So, to avoid accidents we have designed a prototype which can automatically vary headlight intensity based on light sensed by sensor. The headlight can be automatically controlled based on light sensed. Also, when intensity falls below clear visibility value, headlamps will switch on automatically. To avoid problem of headlights on curve, we have implemented individual movement to headlamps. The constructional details and working of prototype are explained in this paper.

Keywords: - *Headlamp, LDR sensor, Arduino, IR sensor, gear motor, MOSFET, rack and pinion, steering system*

1. INTRODUCTION:

Vehicles are of huge need to humans now-a-days. More than several million vehicles run across the globe. Every car which has been manufactured has various components such as steering systems, brakes, engines, wheels, headlamps, etc. Every component has its particular function. So, the headlamps, which are used to produce light and make the road visible to drivers while driving at night and conditions of low visibility.

The number of vehicles on roads is increasing day by day. Hence the safety of passenger and driver is a huge concern for all vehicle manufacturing industries. Headlamps which most of industries use are either high beam or low beam. While driving at night, drivers use high beam which causes glare to vehicle coming from other side. Also, at sharp curves driver faces this problem which results in less visibility of road to driver coming from other side.

These problems cause night blindness to driver coming from opposite direction for a shorter period. Due to this, number of accidents has increased over last decade. According to survey, it has been found that more than 30 % road accidents occur during night time and approximately 3-5% accidents occur due to bad weather conditions like fog, snow, etc.

So, we are designing headlamp whose intensity can be automatically controlled while travelling at evening, night or foggy conditions. The headlamp will also start automatically if the intensity falls below visibility requirement. Also, headlamp will have individual motion to have sufficient visibility for drivers while taking turn.

2. LITERATURE REVIEW:

Literature review is carried out to acquire knowledge and skills required for completing our project. We learnt various things from previous projects and thesis related to this topic and from internet from research papers. By

referring to various projects and research papers, we identified what faults are present in their work and what we can modify. Information about various researches we have taken as reference is as follows:

In [1] provide a new movable vehicle headlamp construction where headlights can be moved in same direction regardless of terrain of vehicle.
In [2] they have introduced an ultra-low latency reactive visual system that can sense, react, and adapt quickly to any environment while moving at highway speeds.
In [3] presents the hardware of movable headlight system for motor vehicles. In it, the head lamp orientation control system rotates the right and left headlights independently and keeps the beam as parallel to the curved road as possible to provide better night time visibility to driver.
In [4] they deigned a prototype circuit known as automatic headlight dimmer which allows drivers to use high beam light and it automatically switches to low beam light when a vehicle approaches from opposite side.
In [5], the problem of glare experienced is explained. It is caused due to sudden exposure of light to driver. It results in night blindness for some time to driver coming from opposite side. Most of the times it becomes main factor for accidents which occur at night.
In [6], WSN based controller is designed to modify the intensity of headlight of a vehicle to such a level that during vehicle cross over blind spot situation does not arise. This is achieved in real time while providing better vision sharpness for the driver.

3. PROBLEM DEFINITION:

Because of high beam of light coming from headlamps of vehicle, sometimes driver face problem of glare while driving at night and on turning. This causes distraction to drivers while driving. Which in turn leads to accidents at night. While taking turn on curves, the beam of light in normal headlamps is not totally in direction of wheels. So, we have also made provision to turn the headlamp of the turn side individually to have sufficient visibility whereas the other headlight will remain straight.

Production of fog occurs when damp droplets are dangled in air. When light crosses these globules, it scatters and creates contrasts and a solid white background. Hence, drivers are unable to see things clearly which result in accidents. The main reasons for problems faced by drivers while driving under fog are:

- Fog limits ability to see
- Cannot judge speed of vehicle approaching
- Cannot judge own car's speed as you cannot see surrounding
- Cannot judge whether the car surrounding is moving or at rest

Thus, to reduce number of accidents because of these problems we are making a prototype which can automatically control the headlight intensity.

4. WORKING PRINCIPLE:

In these we have used LDRs to sense intensity of light and 1 IR sensor for sensing object coming in front of vehicle. The LDRs will sense light coming from vehicle coming from opposite side and based on it light will be emitted during evening time. Also, headlamp will switch on when intensity of light falls below set value. When light will not be sensed by LDRs, even fog lights will start eliminating the problem faced by drivers during foggy conditions.

The headlamp intensity of vehicle approaching is first sensed by LDRs present on front of our prototype. LDR gives out analog voltage based on light intensity sensed. It is connected to analog pin of Arduino. Arduino converts analog voltage into digital voltage. The value is given to micro-controller which has code for working and gives output to light the headlamp. Headlamp will work automatically based on light sensed.

The second LDR is used to sense light considering for visibility under foggy conditions. When light sensed by LDR is too low, it will give input to Arduino and based on it the fog lights will switch on. Again, when sufficient light is present, fog lights will switch off.

We have also used IR sensor to detect object in front and when the distance between object/vehicle approaching is less than 4 inches, input is given to Arduino and micro-controller will close relay driver circuit. There are two relays, one for disconnecting the motor and for alarm.

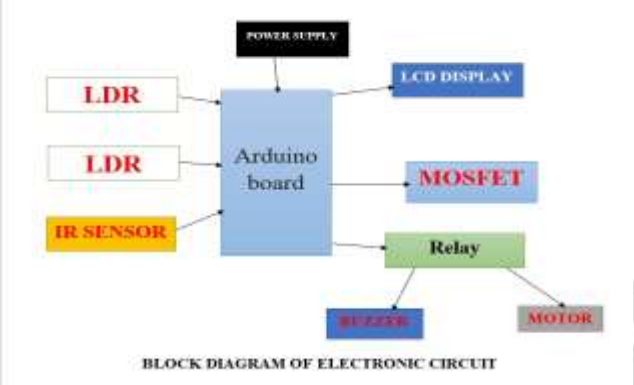

Fig. 1

Fig. 2

The entire steering system is mounted on a support. Each headlamp has individual motion to increase the visibility while taking the turn.

4.1 Components used:

A. LDR sensors:

It is a light controlled variable resistor. Its resistance increases with decrease in intensity of light fell and vice versa. It is made up of high resistance semiconductor. Its resistance can vary from several millions to several hundred ohms. We have used 2 sensors in our project, one for normal conditions and one for foggy conditions.
Its resistance can be varied manually.

Fig. 3

Specification:

- Resistance- 10K ohm
- Position: center of prototype
- Range of work: based on light coming from ahead

B. Arduino board:

Arduino board is an open source easy to use electronics platform based on easy-to-use hardware and software. **Arduino boards** are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. We can tell the board what to do by sending a set of instructions to microcontroller using software. We can do it by using Arduino programming language(APL) and Arduino software(IDE).

Specification:

- Microcontroller ATmega328
- Operating Voltage 5V
- Input Voltage (recommended) 7-12V
- Input Voltage (limits) 6-20V
- Digital I/O Pins 14 (of which 6 provide PWM output)
- Analog Input Pins 6

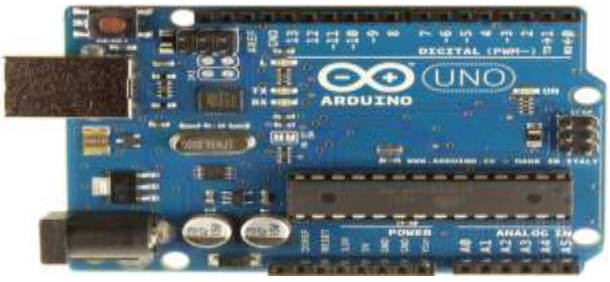

Fig. 4

- DC Current for 3.3V Pin 50 mA
- DC Current per I/O Pin 40 mA
- Flash Memory 32 KB (ATmega328) of which 0.5 KB used by bootloader.
- Clock speed: 16 MHz

C. Battery:

Automobile batteries are recyclable batteries which can be reused after charging. It is used to start engine. Once engine is started, the electrical systems are controlled by alternator.

Specification:

- Battery name: HBL optimum SMF VRLA battery
- Voltage: 12V
- Capacity: 7Ah

D. Obstacle sensor:

Obstacle sensor consists of infrared transmitter and receiver. The transmitter transmits the rays and receiver receives the rays. The rays transmitted by transmitter falls on the object/person ahead and received again by receiver. When the object/person comes ahead, it senses the distance and gives information to circuit. The timer circuit then proceeds those information to Arduino circuit. It will be fitted on front of vehicle.

Fig. 5

Specification:

- Detection range: 2 cm to 20
- Operating voltage range: 3V to 5V
- Obstacle detection LED detector
- Active output level: low level output when object is detected in front

E. Two channel relays:

A relay is an electrically operated switch. Its main function is to control circuit by low power signal or when multiple signals are controlled by single signal. This module is designed to be integrated with 2 relays that it is capable of control 2 relays.

Specification:

- No. of relays: 2
- Control signal: TTL level
- Rated load: 7A/240VAC 10A/125VAC 10A/28VDC
- Contact action time: 10ms/5ms

F. MOSFET:

It is a semiconductor device used for switching and amplifying electronic signals in electronic devices. It works as a switch.

G. Motor:

DC geared motor is used to represent the engine of car. It drives a small wheel fitted on its output.

fig. 6

Specification:

- Length:80 mm
- Torque: 1.5 kg-cm
- Shaft diameter: 6 mm
- Weight: 130g

H. **LCD display**:

It is a technology used to display the output of light after processing by micro-controller and incident light on sensor in percentage. It is flat panel display.

fig. 7

Specification:

- Drive method: 1/16 duty cycle
- Display size: 16 character * 2 lines
- Character structure: 5*8 dots.
- Display data RAM: 80 characters (80*8 bits)
- Character generate ROM: 192 characters
- Character generate RAM: 8 characters (64*8 bits)
- Internal automatic reset circuit at power ON

I. Headlamp:

A headlamp is a lamp attached to front of vehicle to light the road ahead. The beam of light produced and distributed by the device is called as headlight. They are of different sizes and shapes. Headlamps are required to produce either a low beam or high beam. In our project, we have created a circuit to automatically control the light given out from headlamps.

fig. 8

Specification:

- No. of LED: 6
- No. of headlamps used: 2

J. Steering system:

Steering system consists of steering wheel, steering column, rack and pinion gear, steering arm. Steering system is used to control direction of vehicle through linkage by giving motion to front vehicles. The main functions of a steering system are:

- Changing direction of vehicle
- Providing perfect rolling of wheels
- Providing stability while going in a straight direction
- Reducing wear of tires of vehicle

A) **Steering wheel:** Steering wheel is the part of steering system which is operated directly by driver. If driver needs to take turn in any direction then he rotates steering wheel in that respective direction. In other words, it is used to give direction to wheels.

Specifications:

- Centre bore diameter: 20 mm
- External diameter: 380mm

B) **Steering shaft:** It connects steering wheel with the rack in our mechanism. It has steering wheel on its one end and pinion gear attached to its other end. It passes through pedestal bearing and has rotational motion.

Specification:

- Steering shaft length:728 mm
- Steering shaft diameter: 20 mm
- Steering shaft material: Mild steel C45
- Inclination:90 degrees

C) Rack and pinion gear:

The system consists of a pinion attached to the steering shaft, which meshes with the flat rack on the drag line.

Specification:

- Gear type: Straight type
- Axis of rotation is parallel to tooth axis
- No. of teeth on pinion: 21 teeth
- No. of teeth on rack: 38
- Module:1.82(approx. 2)
- Material used: Mild steel C45

K. Pedestal bearing:

Pedestal bearing is bearing housing used to support the rotating shaft passing through it.

Specification:

- Type: Pillow bearing
- Housing number: P204
- Bore diameter: 20 mm
- Static load:
- Dynamic load:

5. CONCLUSION:

Drivers while driving at night use high beam of light and due to it, problem of glare occurs. The main aim of our project is to design headlamps for avoiding problem of glare. We have designed headlamps whose intensity of beam varies automatically. Also, headlamp will switch on when intensity of beam falls below a proper visibility value. Fog lights will switch only to add visibility to drivers when there is almost no light around for driver to see approaching vehicle or path ahead. This will give driver in opposite vehicle a proper vision and add safety to drivers reducing number of accidents. The components in our project have been tested are performing properly. The torque, force values are calculated. The steering shaft, rack and pinion, bearing, motor torque is tested calculated properly and design is found safe for its usage. The setup has also been tested for turning light intensity variation on curves. The obstacle sensor is also performing properly, so that accidents can be minimized. The design is found cost economical as compared to conventional headlamps and system.

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