

Design and Analysis of IR based Upper Dipper Light Control for Vehicles

Mohit Sovale
BE Scholar
Department of Mechanical
Engineering OIST
Bhopal, M.P, India
iammohitsovale@gmail.com

Sijeth RS
BE Scholar
Department of
Mechanical
Engineering
OIST
Bhopal, M.P, India

Shishir Arse
BE Scholar
Department of
Mechanical
Engineering
OIST
Bhopal, M.P,
India

Sonu kumar
Sahu
BE Scholar
Department of
Mechanical
Engineering
OIST
Bhopal, M.P,
India

Ramu Goyal
BE Scholar
Department of
Mechanical
Engineering
OIST
Bhopal, M.P,
India

Madhvi
Sharma
Assistant
Professor
Department of
Mechanical
Engineering
OIST
Bhopal, M.P,
India

Abstract: The number of vehicles on our roads increases day by day, technology has evolved, but the safety factor must always be taken into account. Now, the vehicles are one day equipped with many security features. One of the main safety features that must be installed is the automatic control of the top bucket of the projector. This function can be used mainly during the night. The eyes of the human being are very sensitive to light, and when the eyes suddenly come into contact with the light after sunset, the cornea in the eye contracts, i. The view is empty and takes some time to restore sight. Many times, when suddenly the vehicle comes forward with the headlight in top mode, the situation blinds the driver's eyes. During this period, the vehicle covers a certain distance, in which case accidents may occur. It is lucky if the person walks quietly in this situation. To overcome this manual immersion problem, an automatic mechanism has automatically immersed the headlight when a situation occurs. This can reduce the number of accidents during the night and allow a comfortable ride. The operating principle, the mode of operation and the design of the PCB are briefly discussed in this paper.

Keyword: Bearings, Chain Drive, Dc Motor, Pinion, Rudder and Wheel

1. INTRODUCTION

Now days the no. of vehicle on road is increasing drastically

and no. of accidents on road also increases. Especially at night most of the accidents are occurred due to dazzling of headlight. While diving at night the headlight beam of oncoming vehicle is directly effects the driver's eye and eye gets blur, it takes 3 to 8 sec to recover to its normal vision. the high beam of headlight which causes blurriness on driver's eye. If at that time vehicle speed is 70km/hr, causes the vehicle goes out of road or strikes on oncoming vehicle In every vehicle dipper beam is provided in addition with the upper beam to reduce the dazzle from oncoming vehicle. Automatic dipper light control is a system which automatically changes the headlight from upper to dipper beam by sensing the headlight of oncoming vehicle [1].



Figure 1: Headlight at High Beam Intensity

1.1 Problem Associated With Manual Dipping

In current practice, to control dipper beam manually by using switch this is place on the steering column. Use of manual dipper control is not done by most of the drivers due to many reasons because the operation of dipper control switch is hundreds of times at night driving. Other reason is the driver wants to pay more attention to the steering control instead of

to dipper the head light beam. Another major cause is 'ego problem', which makes each one wait till the other person initiates dipping, which may not happen [2].

With the enormous advancement in the field of science and technology everyone is enjoying there luxurious life in 21st century. Due to this day by day number of vehicles are increasing as well as accidents are increasing. Most of the accidents are happened in night due to glaring effect to eyes due to upper mode of headlight of upcoming vehicle. To overcome this glaring effect an average human eye needs 3 to 8 sec which may be one of reason for accidents. Fig. 2 shows the high beam of headlight which causes glaring effect on driver eye and if on that time vehicle speed is more than 60km/hr causes the vehicle goes out of road or strikes on upcoming vehicle [3].



Figure 2: Glaring Effect due to Upper Mode of Headlight

1.2 Headlamps

The modern lighting system consists of switches, lamps, wiring harness, and fuses or circuit breakers. It may be mentioned that the primary purpose of the headlight design is to produce illumination over considerable distance ahead of the vehicle and enable the driver to drive at reasonable speeds at night with safety. But the provision should also be made that the drivers of other vehicles coming from the opposite direction not to experience a glare. For this purpose a dipped or meeting beam is also provided for maintaining the reasonable speed with safety without dazzling the coming driver [4]. To prevent dazzle to the oncoming driver during particularly misty or hazy conditions the light about the horizontal should be cut off. This is called dipping of the head light beam. In an average car, the lighting system consumes about 70 - 75% of electrical energy when driven at night. In terms of amperage the consumption may be from 24 - 40 A at night for al purposes including the radio, heater, and transmission controls.



Figure 3: Filament Headlamp

The headlight vehicle is fitted with double filament bulb shown in fig.2. Here one filament is used for upper beam and another for dipper beam. While driving at night, the headlight is the only source of vision and it require essentially from evening 6.00pm to morning 6.00am. Driver can switch the headlight from upper beam to dipper beam or vice versa using manual switch. Upper beam covers the larger distance up to 70m and dipper beam covers the small distance up to 25m and at both the time intensity of head light is different. Fig.4 gives the clear idea about how much distance covered by headlight for upper beam and dipper beam [5].

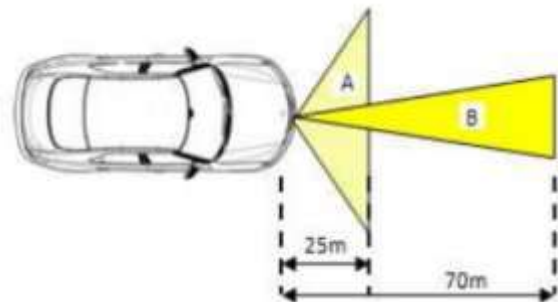


Figure 4: Range of dipper beam (A) and upper beam (B) of a vehicle

Light Source: There are two kinds of light sources, namely, the one that emits light and the other that reflects light. The filament of the electric lamp is the primary source, while the reflector is referred to as the secondary source [6]. The intensity, color and distribution are the important characteristics of any light source.

The headlight is composed of three elements:

1. The light filament that gives off light when a current flows through it.
2. The parabolic reflector that reflect the light in front: and
3. The lens that refracts of distorts the light beam into an illuminating Pattern.

The present day headlights are the outcome of a lot of

research and development. Earlier a single electric bulb of the carbon filament type was employed. The bulb was placed at the focus of a parabolic silvered reflector in order to give a parallel beam of light. The following figure shows a parabolic reflector with bulb, the lines showing light rays emitted from the filament of the bulb in all directions.

This type of headlight given a parallel light beam, that saves greater illumination nearer the axis. It may be mentioned that the bulb itself and the intensity of light fall off towards the outer portion of the beam block a small amount of light. From figure it may be seen that if the bulb filament is moved from position 'd', the focus of reflector, to a position 'a', the light beam 'abc' will no longer be a parallel one but will become divergent. On the contrary, if the filament is moved to position 'f' the beam will take the course a shown by 'fog' and will meet at a point on the axis of the bulb. It may be mentioned that by a single adjustment of the bulb, the beam can be concentrated at a pre-determined distance ahead of the vehicle in order to give a spot light effect. On the contrary, if the filament is moved to position 'f' the beam will take the course a shown by 'fog' and will meet at a point on the axis of the bulb [7].

Formerly the headlight was provided with certain means of adjusting the bulb holder with respect to the reflector along with the bulb axis in order to focus it. It had to be done up every time the bulb was changed. This was essential, otherwise it would cause increased dazzle to other motorists. The filament is encased in an airtight bulb in order to prevent burning up of the white-hot filament because of oxygen in the air. The reflector is generally of polished metal and it throws all the light rays into a cylindrical beam. The lens is made up of a number of glass prisms molded together and they bend the beam of light into an oval pattern which is aimed ahead of the vehicle and somewhat in the downward direction. A part of the light is spread out in front of the vehicle for providing local illumination, whereas the rest of it is focused into a hot spot that provides distant illumination [8].

The first major advancement in headlight Design took place with the introduction of pre-focused bulbs. It has two filaments, one for normal driving and the other for city driving or for overtaking. These days even two sets of headlights are used for the above said purposes. Generally a foot selector switch is provided, which enables the driver to select either the normal driving or the passing beam. A part of the light is spread out in front of the vehicle for providing local illumination, whereas the rest of it is focused into a hot spot that provides distant illumination.

1.3 Troxler's Effect

In the medical world, Troxler effect is used to describe a kind

of temporary blindness. It is otherwise known as the 'fading effect'. A study shows that if our eyes are exposed to a very bright light source of around 10,000 lumens, we experience glare. This glare is produced due to over exposure of the rods and cones inside our eye. Even after the source of glare is removed, an after-image remains in our eye that creates a blind spot. This phenomenon is called Troxler effect. This means that the driver's reaction time is increased by 1.4 seconds.

For example, let us assume a motorist travelling at 60 miles per hour takes 0.5 seconds to react to a hazard and will stop within 41 feet. Due to Troxler effect, the same person travelling under the same conditions will take 0.9 seconds longer to react and hence will come to a complete halt only at 123 feet. There is a huge difference of 82 feet. This is more than enough to cause a disaster on the road. This Troxler effect is across all ages. Any one exposed to sudden bright Light experiences this Troxler effect.

1.4 Accidents Due to Troxler Effect

Many accident reports have been witnessed where a large vehicle, hitting a slow moving smaller vehicle while the latter is trying to over-take. Though it might be obvious to blame the driver, they claim to have not seen the smaller vehicle approaching. This is the most common example of illustrating the Troxler effect in our day-to-day life. Due to excessive brightness, the driver of the large vehicle is blinded. So he is unable to notice the smaller vehicle even though it is right in front RREP. This can be avoided if the headlight is dipped to low beam mode. According to Forbes, the statistics shown in Figure below gives the details of the accidents that had occurred in the year 2013 in Asia due to over-bright light [1]. It shows clearly that India tops the list. Hence, this becomes the major concern to think of a new innovative solution that is useful and also cost effective. This had led to the development of the automatic headlight beam shifter prototype. An automatic headlight beam shifter could play a crucial role in shifting the headlights from driving beam to meeting beam and vice versa. This will improve visibility by minimizing glare, a major cause of momentary loss of vision.

2. CONSTRUCTION

The incident light coming from other vehicle is captured by the ultrasonic module. Further it is connected to compiler. The microcontroller is connected to all other sensors and relay driver. The output of compiler is connected to microcontroller. The relay driver is further connected to relay which drives the headlight lamps. RF transmitter (434 MHz RF Module) is connected to microcontroller. Power distribution board is connected to all the blocks to provide the power. The voltage regulator

is also used for regulation purpose.

Now let us see the main components of the device in above circuit diagram and their general description:

2.1 Headlamps

A headlamp is a lamp attached to the front of a vehicle to light the road ahead. Headlight is a synonym for headlamp. Headlamp performance has steadily improved throughout the automobile age, spurred by the great disparity between daytime and nighttime traffic fatalities: the US National Highway Traffic Safety Administration states that nearly half of all traffic-related fatalities occur in the dark, despite only 25% of traffic traveling during darkness [3-5].

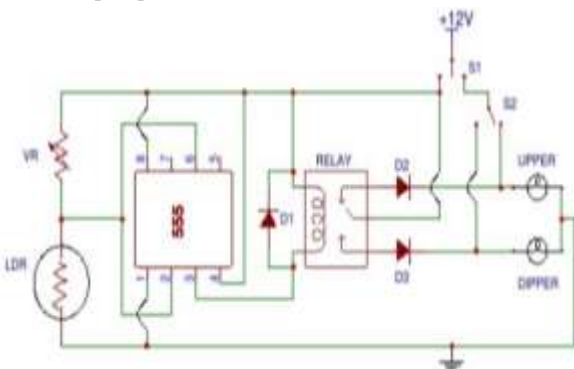


Figure 5: Circuit Diagram for dipper Controller

2.2 Battery

A supply of 12 volts is required for the circuit. It is taken from the vehicle's battery box. This is preferred for two reasons. First, it is a constant DC supply and second, there is no need for introducing a separate electrical supply source.

2.3 Relay

Relay circuit is main part of the model which is use to automatic change from high beam to low beam of head lamp. This circuit is governed by an IC (555 timer) and relay.

Rectifier Circuit

Rectifier circuit is used to safety purpose of the device mainly IC of the relay circuit it avoid the reverse connection of the input. In this project we use "full wave bridge rectifier". In which 5 diode and one capacitor are used.

2.4 IC-555

The eight pins carry out the following functions:

1. Ground, which acts as a safety measure as with electrical plugs
2. Trigger, which passes on voltage to start the timing

operations, Pin 2 is called the Trigger input as it is this input that sets the output to the high state.

3. Output, which carries voltage to the device using the timer, Pin 3 is the digital output of the 555. It can be connected directly to the inputs of other digital ICs, or it can control other devices with the help of a few extra components.
4. Reset, this is used to end the timing operation
5. Control voltage, an optional pin used for controlling the timer from outside the main circuit set-up
6. Threshold, which determines how long the timer should output voltage in each on/off cycle – in other words, how long the timing interval should be.
7. Discharge, connected to a capacitor which also influences the timing interval
8. V+, which is the voltage input, Pin 8 is where you connect the positive power supply (Vs) to the 555. This can be any voltage between 3V and 15V DC, but 5V DC when working with digital ICs. Pin 1 is the 0V connection to the power supply.

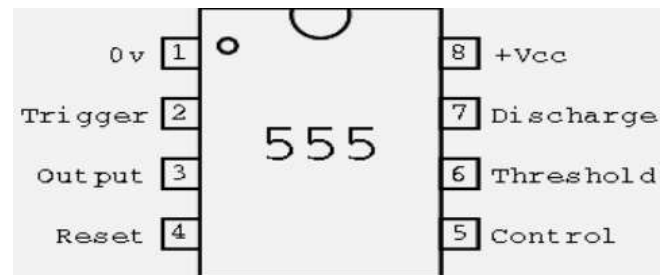


Figure 6: Pin out Diagram of IC555 timer

2.5 Capacitor

Capacitors Store electrical energy by separating positive and negative charges. They store electrons by attracting them to a positive voltage. When the voltage is reduced or removed the electrons move off as well. When the capacitor removes or adds electrons to the circuit it can work to smooth out voltage fluctuations. Capacitor passes AC signal and blocks DC signal.

2.6 Resistor

Resistors limit the amount of current that reaches a component such as an LED. In some circuits different voltages need to be supplied to different parts of a circuit which can be done with resistors. H. Diodes Diodes are two terminal devices that exhibit low resistance to current flow in one direction and high resistance to current flow in the other. The direction in which the current flow is often referred to as the forward direction while in the negligible current flows is known as the reverse direction. When the diode is conducting a small

voltage is dropped across it and this is known as the forward voltage drop. The diode is one of the simplest forms of semiconductor and it is used to control the flow of electrons [9].

2.7 LDR-1,2

It is nothing but a photo sensor or photo resistor i.e. when the light falls on these LDR's then the resistance of the circuit changes accordingly with the change in intensity of the light.

3. WORKING

Voltage Regulation using 7805

The first capacitor, the 100nF ceramic capacitor, is hooked up after the voltage source, in this case the 12-volt car battery, and before the input of the LM7805 regulator. This capacitor is there to filter out any noise coming from the voltage source (the battery). The voltage regulator works best and will be most efficient when a clean DC signal is fed into it. We don't want any ac noise (ripple) imposed on the DC line voltage. The capacitor, in essence, acts as a bypass capacitor. It shorts the AC signal of the voltage signal (which is noise on the voltage signal) to ground and only the DC portion of the signal goes into the regulator.

In electronics, a comparator is a device that compares two voltages or currents and outputs a digital signal indicating which is larger. It has two analog input terminals and one binary digital output. The output is ideally So in this case when ultrasonic distance greater than 50cm falls on ultrasonic then the voltage V_x increases hence crosses the 4.76 Volts which is threshold voltage for comparator IC and thus the output of comparator is high that is logic 1. But the output of comparator is sink and not source type hence cannot drive load.

4. CONCLUSION

Headlamp glare is an issue that has grown in terms of public awareness over the past decade. This is caused due to the sudden exposure of our eyes to a very bright light; the bright headlights of vehicles in this case. This causes a temporary blindness called the Troxler effect. However too much light or improper lighting can result in glare. Glare occurs when visual field brightness is greater than the luminance to which the eyes are adapted. Glare is caused by both direct and indirect light Sources. Disability glare can be a major problem both in terms of the ability to see and visual comfort. Also it leads to annoyance, and fatigue.

The driver should actually turn down the bright lights immediately to avoid glare to the other person which is not happening. Due to which over five lakh accidents take place

in the country out of which, 41% are due to road mishaps during night, and 18% are due to the vehicle headlight glare. In the Current Scenario, most of the Automobile manufacturers in India are zero in on only on the Mass Production of their cars in order to fulfill their economic and financial goals without considering the accidental factors arising from the situation mentioned above. There is almost no provision for switching the headlight beam of the vehicle, automatically. Hence an Automatic Headlight Beam Shifter could play a crucial role in shifting the headlights from driving beam to meeting beam and vice versa. In the current tentative implementation of the Automatic Headlight Beam Shifter, we plan to include some improvements.

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