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Automated Headlight Dim-Dip Assistance by Using Sensors

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Abstract: *Headlight dim-dip system has been evolving since it was first introduced but the evolution of this system is still small compared to the evolution of engine, Global Positioning system, and audio and visual system on the vehicle especially cars. The headlight system nowadays still relies on the 'Dimmer switch' that needs to be adjusted manually by the driver. So, an automatic system that can change the dimmer switch is the answer. This paper deals with headlight that could be changed from high-beam to low-beam or vice versa and switching on and off the fog light automatically according to visibility. To make it cost-low, this system will be designed based on PIC microcontroller technology. The objective of this paper is to introduce the low-cost Automatic Headlight Dimmer System using microcontroller and also to design a sensor circuit that can monitor visibility on the road and make the dimmer switch change accordingly. After achieving the objectives only we can implement this invention into our national car industry. But before taking a big step into it, we need to start from making literature review on light sensor as it is very crucial part in this system. Without sensor performing at its best, for sure, this system cannot perform as it is required to work. This system was designed using MPLAB for the software and Proteus for the hardware simulation.*

Keywords – *Headlight, Dimmer switch, microcontroller.*

I. INTRODUCTION

This paper is really focus on the conventional headlight system that still never been revolutionized throughout the century. As one of the leading automobile company, BMW, have been developing this system since it was first introduced in it 5 series model. This idea was to develop a system that mirror to what BMW did with its headlight system but in a cheap way. Choosing the right component to build the system can bring down the cost. So, in order to do that, there will be a lot of studies regarding the component that can be used in the system without spending much money.

Headlight has been crucial parts in many moving vehicle such as car, lorry and ships as well. This system has been evolving since it first introduce but the evolution of this system are still small compared to the evolutionary of engine, Global Positioning system, and audio and visual system on the vehicle especially cars. The headlight system nowadays still relies on the 'Dimmer switch' that needs to be adjusted manually by the driver. The automatic system that can change the dimmer switch is the answer. This idea is based on BMW 'Adaptive Light system' that have been introduced a couple of years ago.

II. Current Problem Faced by Motorists

Motorists are facing a huge problem due to this high beam light which falls directly onto their eyes during driving. There are many medical facts and figures which support their problems of night driving.

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1 Troxler 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 a glare [1]. 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 [2]. 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.

2 Accidents Due to Troxler Effect

As discussed earlier, there are many accidents caused 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 [3]. 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 of him. This can be avoided if the headlight is dipped to low beam mode. According to Forbes, the statistics gives the details of the accidents that had occurred in the year 2013 in Asia due to over-bright light. It shows clearly that India tops the list [4]. 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 dimmer prototype.

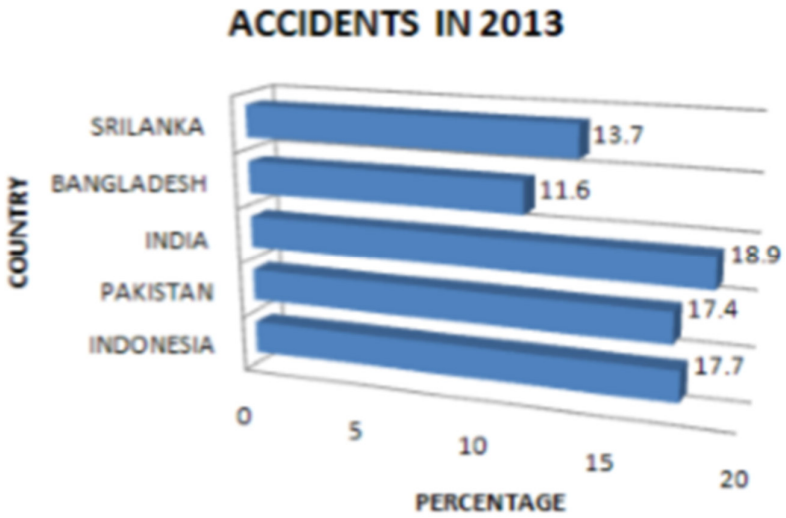

Fig 1 Accidents due to Troxler Effect in Asia In 2013

3 The Headlight Beams

The headlight of vehicles is fitted with two bulbs. One bulb is used for high beam and the other for the low beam. On an average, in India, the requirement of the headlight is essential from 6.00 pm till 5.00 am. It is most essential during late night travels. The headlight can be switched between the bright and dip modes by the driver using a switch. The bright mode is used when there are no other sources of light on the streets to aid with driving. Long highways, a pitch black street with no lights are the ideal locations where one would use a bright beam [5]. The dip or the low beam is less intense than the bright beam. It is used under normal night driving conditions. The dip beam is aimed low at the road and gives less range. The high beam has a longer range but very less field coverage. Hence, dip beam is less intense (700 lumens) and high beam has a higher brightness index (1200 lumens) when tested under a standard distance of 50 feet from the vehicle [6]. Figure.2 shows the range of the low beam and the high beam. The high beam since has a longer throw and a higher brightness index, will ultimately fall directly on the eyes of the driver coming on the other side of the traffic.

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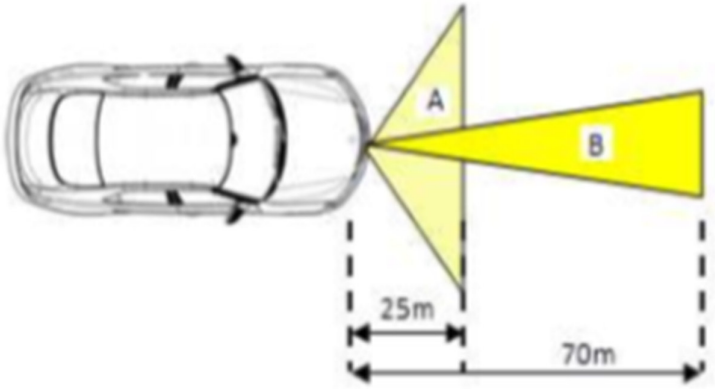

Fig 2 Range of Low beam and High beam of a car

II. Headlamps

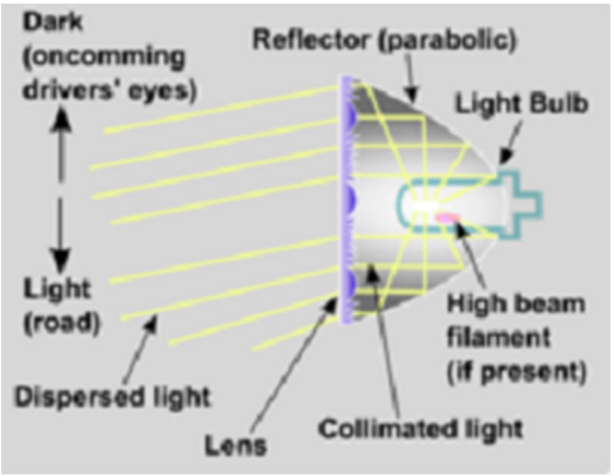

Fig3. Outlay of a Headlamp

A headlamp is a lamp attached to the front of a vehicle to light the road ahead. While it is common for the term headlight to be used interchangeably in informal discussion, *headlamp* is the term for the device itself, while *headlight* properly refers to the beam of light produced and distributed by the device.

Headlamp performance has steadily improved throughout the automobile age, spurred by the great disparity between daytime and night-time 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 travelling during darkness.

Other vehicles, such as trains and aircraft, are required to have headlamps. Bicycle headlamps are often used on bicycles, and are required in some jurisdictions. They can be powered by a battery or a miniature generator.

III. Methodology

With this cool circuit integrated to your cars headlight system, you can drive cool headed in high beam. The circuit will take over the duty of low beaming the headlight when vehicles approach against, and high beams the lights when they pass over.

The circuit is based on a photo transistor (Q1) for sensing the approaching vehicles and transistor Q2 (BC177) for switching the relays for controlling the headlight. When the light from the opposite vehicle falls on Q2, it's collector current increases and turns ON Q1.The relay will be activated and the head light will be dimmed. When the vehicle pass over the reverse will happen.

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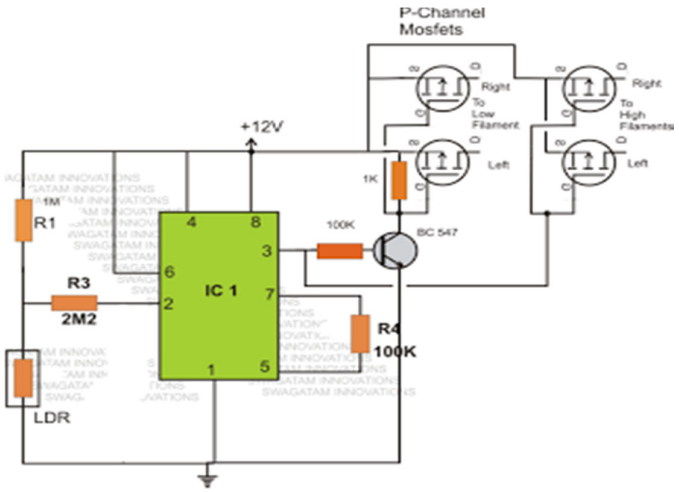

Fig 4. Circuit Diagram

To achieve the objectives mentioned earlier, the first step is to do a literature review on light sensor that includes testing and developing the sensor circuit using MPLAB and Proteus. After finish designing all parts of the system, the circuit component will be install and tested on the breadboard. If the circuit operates according to specification, then the design will be permanently transferred on the Printed Circuit Board (PCB).

IV. Requirement and Regulations

Modern headlamps are electrically operated, positioned in pairs, one or two on each side of the front of a vehicle. A headlamp system is required to produce a low and a high beam, which may be achieved either by an individual lamp for each function or by a single multifunction lamp. High beams (called "main beams" or "full beams" or "driving beams" in some countries) cast most of their light straight ahead, maximizing seeing distance, but producing too much glare for safe use when other vehicles are present on the road. Because there is no especial control of upward light, high beams also cause backdazzle from fog, rain and snow due to the retro reflection of the water droplets. Low beams (called "dipped beams" in some countries) have stricter control of upward light, and direct most of their light downward and either rightward (in right-traffic countries) or leftward (in left-traffic countries), to provide safe forward visibility without excessive glare or backdazzle.

1 Low Beam

Low beam (dipped beam, passing beam, meeting beam) headlamps provide a distribution of light designed to provide adequate forward and lateral illumination with limits on light directed towards the eyes of other road users, to control glare. This beam is intended for use whenever other vehicles are present ahead. The international ECE Regulations for filament headlamps and for high-intensity discharge headlamps specify a beam with a sharp, asymmetric cut-off preventing significant amounts of light from being cast into the eyes of drivers of preceding or oncoming cars. Control of glare is less strict in the North American SAE beam standard contained in FMVSS / CMVSS 108.

Fig 5. Low Beam

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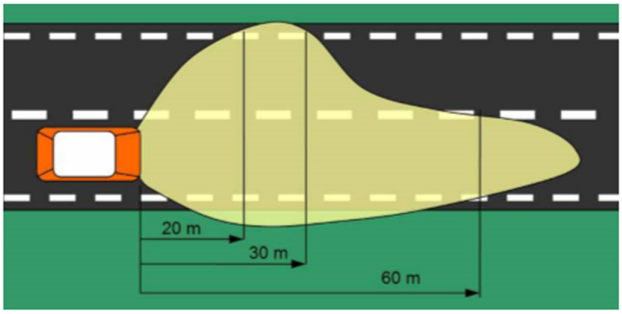

Fig 6. Cut-off in Low Beamed Headlamps

2 High Beam

High beam (main beam, driving beam, full beam) headlamps provide a bright, centre-weighted distribution of light with no particular control of light directed towards other road users eyes. As such, they are only, suitable for use when alone on the road as the glare they produce will dazzle other drivers. International ECE regulations permit higher-intensity high-beam headlamps than are allowed under North American regulations.

Fig 7. High Beam

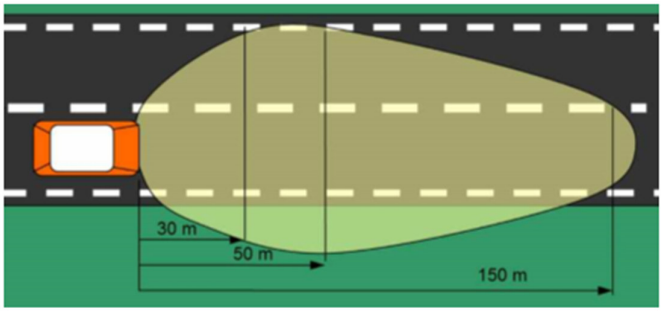

Fig 8. Illuminated view of High Beam

V. List of Abbreviations

1. **LDR** - LIGHT DEPENDENT RESISTOR
2. **HID** - HIGH INTENSITY DIODE
3. **ECE** - UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE
4. **JDM** - JAPANESE DOMESTIC MARKET
5. **DRL** - DAYTIME RUNNING LAMP
6. **RAM** - RANDOM ACCESS MEMORY
7. **ROM** - READ ONLY MEMORY

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8. **EEPROM**- ELECTICAL ERASEABLE PROGRAMMABLE READ ONLY MEMORY
9. **ADC** - ANALOG TO DIGITAL
10. **A/D** - ANALOG TO DIGITAL
11. **D/A** - DIGITAL TO ANALOG
12. **CPU** - CENTRAL PROCESSING UNIT
13. **I/O** - INPUT/OUTPUT
14. **LED** - LIGHT EMITTING DIODE
15. **MOSFET** - METAL OXIDE SEMICONDUCTOR FIELD EFFECT TRANSISTOR.

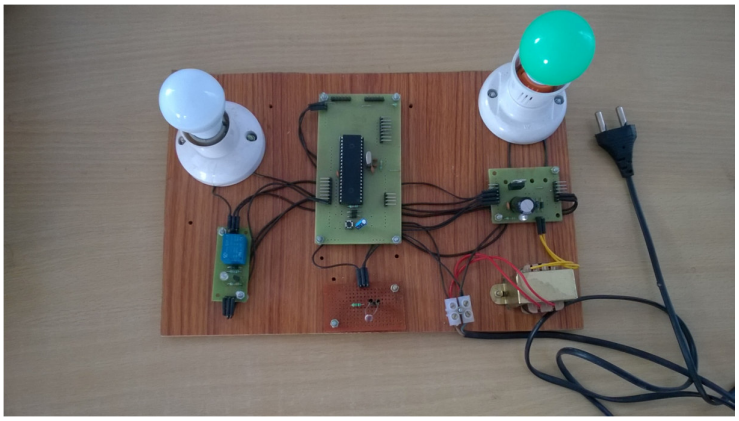

Fig 9. Assembled Lay-out for Automated Headlight Dim-Dip Assistance.

VI. Conclusion

Glare during driving is a serious problem for drivers. 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. Eventually this becomes the major reason for night accidents. The driver should actually turn down the bright lights immediately to avoid glare to the other person which is not happening. Hence, is the idea for the design and development of a prototype circuit called the automatic headlight dim-dip circuit. It gives the driver to use high beam light when required. But it automatically switches the headlight to low beam when it senses a vehicle approaching from the opposite side.

The circuit consists of simple and economical components which can be easily installed. The working and implementation of the prototype are discussed in detail. The effects of bright light on the human eye are also studied. Thus the implementation of this device in every vehicle in future will not only avoid accidents but also provide a safe and a comfortable driving.

Based on the prototype, an actual working model of the same circuit has been constructed. The exact same components have been used in its construction.

References

1. C.Susana Martinez, S.L.Macknik and D.H.Hubel, "The role of fixational eye movements in visual perception", Journal of Nature Reviews and Neuroscience, No 5, pp 229 – 240, 2004.
2. Ryota Kanai, Yukiyasu Kamitani, "Time-locked perceptual fading Induced by visual Transients", Journal of Cognitive Neuroscience, Vol 15, No 5, pp 664 – 672, 2006.
3. S.Aishwarya, "Bright Headlights a major cause of accidents", The Hindu, Online edition, 2006.
4. C.Guttman, "High intensity headlights could cause road accidents by dazzling oncoming drivers", British Journal of Ophthalmology, No 87, pp 113 – 117, 2003.
5. James J. Fazzalaro, "Limitations on Headlight brightness", Traffic Regulations and Traffic Safety, 2006.
6. Hawkins Jr, H G, Carlson, P J, McCaleb, J B and McIlroy, "Impacts of Minimum Retroreflectivity values on sign Replacement Practices", The national Acadamies for Science and Engineering, pp 188, 1996.
7. "Lighting the future standard and high performance automotive halogen bulbs" - Hella.com.
8. Aditi Majumder and Sandy Irani, "Contrast Enhancement of Images using Human Contrast Sensitivity", Proceedings of the 3rd symposium on Applied perception in graphics and visualization, pp 69 – 76, 2006.
9. A.B.Watson, "Temporal sensitivity of the human visual system to sinusoidal gratings", Journal for optical society of America, Vol 70, No 6, pp 711 – 716, 1980.

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