Design of Anti-Glaring System for High Beam Reflection On Rear And Side View Mirrors During Night Driving

By

Abel Ayele Ademe

A Thesis Submitted to Department of Mechanical Engineering

School of Mechanical, Chemical and Materials Engineering

Presented in Partial Fulfillments of the Requirement for Master of Science in Automotive Engineering

Office of Graduate Studies

Adama Science and Technology University

Adama, Ethiopia

June, 2024

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DECLARATION

I declare that this thesis entitled “**Design of Anti Glaring System for High Beam Reflection on Rear and Side View Mirrors during Night Driving**” is my work and has not been submitted to any university for a similar purpose. The references used in this thesis are duly recognized by proper citations.

Abel Ayele Ademe	____________________	_______________
Name of student	Signature	Date

RECOMMENDATION

I, the major advisor of this thesis, hereby certify that I have closely advised/supervised the student while developing this thesis and read the draft thesis entitled "**Design of Anti Glaring System for High Beam Reflection on Rear and Side View Mirrors during Night Driving**" prepared under my guidance by Abel Ayele Ademe. Therefore, I recommend the submission of the thesis to the department for further review and evaluation.

Dr. Alemayehu Wakjira	______________________	_______________
Major Advisor	Signature	Date

APPROVAL SHEET

The advisors of the thesis entitled "**Design of Anti Glaring System for High Beam Reflection on Rear and Side View Mirrors during Night Driving**" and developed by Abel Ayele Ademe, hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis.

Major Advisor	Signature	Date

We, the undersigned, members of the Board of Examiners of the thesis by Abel Ayele Ademe have read and evaluated the thesis entitled "**Design of Anti Glaring System for High Beam Reflection on Rear and Side View Mirrors during Night Driving**" and examined the candidate during open defence. This is, therefore, to certify that the thesis is accepted for partial fulfilment of the requirement of Master of Science in Automotive Engineering.

Chairperson	Signature	Date
Reviewer 1	Signature	Date
Reviewer 2	Signature	Date

Finally, approval and acceptance of the thesis is contingent upon submission of its final Copy to the Office of Postgraduate Studies (OPGS) through the Department Graduate Council (DGC) and School Graduate Committee (SGC).

Department Head	Signature	Date
School Dean	Signature	Date
Office of Postgraduate Studies, Dean	Signature	Date

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ABSTRACT

Automobile headlamps provide illumination for driving that enables efficient lane keeping, detection of potential obstacles such as other vehicles and pedestrians, and perception of traffic signs. The bright light of high beam was the main cause for short period of time blindness of drivers (glaring), pedestrians by glaring of high beam light. In addition to that high beam reflections from other vehicles on the side view mirror and inside view mirror of a vehicle also causes similar damages. Many drivers experience such problem especially when vehicles are running in close range, the high beam from following vehicles will strike the side mirror or the rear-view mirror of the vehicle at the front, and this high beam reflection causes a discomfort or temporary blindness. Drivers become unable to see what is coming from the front, which might cause: collision of between vehicles, death of pedestrian, vehicles losing their lane, vehicle rollover during night caused by glaring of high beam. The researcher uses primary sources and drivers in which are more prone to such problems through questionnaires and interviews to assess the importance of this design. Since this thesis work focuses on the high beam glaring problems caused by following vehicle, uses primary data of the driver respondents to show the how much of a problem is happening. The objective of the study is to design anti glaring system for this high beam glaring problem that happens due to following vehicles high beam striking the side and rear view mirror. The design of anti-glaring system for side and rear-view mirror during night driving can avoid the glaring problems which might be caused by unnecessary usage of high beam from the following vehicles on the road, especially light vehicles, which is a common participant in nighttime traffic incidents. The newly designed anti glaring system for side and rear-view mirror automatically detects the light intensity of following vehicle by using a micro controller , motor controller and mirror motor. The system will automatically turn the mirror in to a position where these coming headlight will be having the list chance of strikes the driver's eye until the approaching vehicle passes.

Keywords: *High beam light, glaring, headlamps, and mirror*

CHAPTER ONE

1. INTRODUCTION

1.1 Background of the study

In daily activity of human being needs light. By enabling vision, the use of light at night delivers a number of benefits to people. Such benefits include greater safety for pedestrians and drivers, reduced fear of crime, more use of outdoor facilities after dark, enhanced economic growth and the creation of built and natural environments that are a source of beauty and entertainment (Boyce, 2019).Weather sun light or manmade or electric light for their daily work. Because at night time it’s difficult to do their activity properly because at a night time human being eye vision minimize ability to identify object easily or human eye completely does not seen object during night time. Also, human being need for daily activity also comes to night time doing their work. The most fundamental reason for using light at night is to enable people walking outdoors after dark to see obstacles on their path ahead and thereby avoid colliding with them or tripping over them (Boyce, 2019). Different jobs done by human at night time to use their time for extra income generating. Also, different job discipline needs to work at night time, form different discipline the most well-known is driving vehicle at night time because the characteristic of work also needs to work at night. Vehicles travel at night for transporting goods and passengers from one place to another place. Especially vehicles which carry goods travel place to place not only at the day time. Most of the times they travel at a night time because of some goods are perishable that lose their value if they do not reach at the market so the vehicle must be travel at night. As the result vehicle need lighting system to avoid the darkness and travel easily during night.

Light system of vehicle has a great impact for the driver to identify the road obstacle on the road and road side object. Obstacle like pedestrians, constructed road, holes on the road, road crossing animals etc. To identify such things vehicle must be install light system which is used during night time.

Lighting system of vehicle not only use for night vision but it also used for different purpose on the vehicle for example used for transferring road information for another vehicle. Also, it used for showing the direction of driver wants to go, vehicle size and height and position. Lighting system on the vehicle is of two types. These are high beam and low beam. These two lighting systems are used to increase the driver visibility during night to identify different obstacle. Also, these two light systems use at different time and place and also for different purpose.

Low beam light used when the vehicle in a city or when much more of vehicle moves in limited speed at city or congested road during night. The effect of low beam was does not show clearly the object at longer distance and decrease the driver visibility at night. Therefore, driver use another option which is increase his visibility. These lights are known as *high beam*.

The high beam light has great impact on the drive visibility as show in the above but it also has a negative impact if we do not use it properly or if we don't use it at the right time and right place. it may be cause of accident in different ways because when two vehicles move at night going in opposite direction on two-way road and one of the vehicles which uses high beam light reflect on the other oncoming vehicle, tends to minimize the visibility and causes temporary blindness. This temporary blindness is referred as *glaring* during these moments, can cause of vehicle to lose its lane, rollover, collide with each other, collide with object near road side, pedestrian lose their life. Also, pedestrian cannot see what is coming in front of them because of this high beam light effect during night. Low beams provide less illumination and are used at night to illuminate the forward path when other vehicles are present. High beams provide significantly more light and are used to illuminate the vehicle's forward path when other vehicles are not present (Asaduzzaman, Islam, Paul, Alam, & Rahman, 2013)

High beam of a vehicle is an important device which is used to identify road obstacle from far away and driver to identify obstacle and take action before reaching at the obstacle. High beam is used for illuminating a road doesn't have very much traffic on it. By that way the driver can see further ahead for any road obstructions. High beam is also used when a driver is one an unfamiliar road and if there isn't much in the way of lighting such as street lamps (Asaduzzaman et al., 2013).

In addition to that high beam reflections from other vehicles on the side view mirror and inside view mirror of a vehicle also causes similar damages. Many drivers experience such problem especially when vehicles are running in close range, the high beam from the vehicle at the backward (following vehicle) will strike the side mirror or the inside view mirror of the vehicle at the front, this high beam reflection causes a discomfort or temporary blindness. The problem is the cause of road traffic accident during night time as the result of high beam glare. High beam reflection on side view mirror and inside view mirror coming from backward are one of the types which causes such glaring. Such glaring reflections also cause similar damages like the direct high beam reflections.

1.2 Statement of the Problem

In Ethiopia during night time there is a number of road accident occurrences from day to day to year to year drastically. This problem happens due to different causes. One of the most causes of accident at night is glaring of high beam which is caused by the high coming from vehicles headlight. This high beam glare can cause accident by temporary blinding the driver which comes from the opposite direction, as a result they lose their visibility for short period of time, for that reason the driver counter act for the glare trying to turn the steering to other side at that moment they collide with other vehicle, pedestrians, un movable object like curb stone, roadside pavement, rollover which is some accident can cause of total damage and death for human being.

Survey on accidents due to headlight glare from a journal shows more than 30% percent of accidents during night time happen due to headlight glare. The visibility during night time also reduced due to fog. The correct use of dipper (low beam) during night is essential for the drivers in the presence of street light. The unwanted use of high beam may lead to unnecessary crashes. A survey says that 26.5% alone use dipper correctly out of 73.83%, remaining 48.3% continued in high beam itself and the remaining 25.53% dipped the light for a few seconds and continued to be in a high beam (Lakshmi K, Nevetha R, Ilakkiya S N, Ganesan R)

In our country, most of the time the road serves as a two-way traffic. Vehicles are plying on both sides of the road. When high beam light from the headlight of a vehicle strikes the driver eye from opposite direction, it glares him for a certain amount of time. This glaring discomforts the driver. This discomfort will result in the involuntary closing of the driver’s eyes momentarily. This fraction of distraction is the prime cause of many road accidents. In contrast to the problem of distracted driving, most drivers and popular media seem less concerned about the limitations of visibility at night. Nowadays many accidents at night are caused due to the high intensity of headlight from the opposite vehicles. So many health issues like eye problems, headaches, mental stress, etc. are caused due to high headlight intensity.

In addition to that high beam reflections from other vehicles on the side view mirror and inside view mirror of a vehicle also causes similar damages. Many drivers experience such problem especially when vehicles are running in close range, the high beam from the vehicle at the backward (following vehicle) will strike the side mirror or the inside view mirror of the vehicle at the front, this high beam reflection causes a discomfort or temporary blindness. The problem is the cause of road traffic accident during night time as the result of high beam glare.

1.3 Objectives

1.3.1 General Objective

The general objective of this thesis project is to design anti-glaring system for high beam reflection on side view mirrors and rear view mirrors during night driving.

1.3.2 Specific Objectives

The objective of this thesis is achieved through the following specific objectives:

- ✓ Study the effect of high beam reflections on the side view mirror and rear view mirror.
- ✓ Gather data by taking sample survey and preparing questionnaire to show the effect of high beam reflections on side view mirror and rear view mirror.
- ✓ Design anti glaring system for side view mirror and rear view mirror circuit diagram
- ✓ Develop a prototype for the designed anti-glare system for the side view mirror and rear view mirror.

1.4 Significance of the study

The significance of the proposed thesis work is;

- ➢ Reduce the effect of high beam glare on the driver and road user.
- ➢ To avoid short period of blindness
- ➢ Reduce accident in Ethiopia caused by high beam reflection.
- ➢ To increase safety of the driver and pedestrians
- ➢ To minimize problems which come by careless driver which are not reduce high beam

1.5 Scope of the thesis work

- ✓ The spatial scope of this thesis will to design and reduce the effect of high beam reflection on side view mirror and inside view mirror on night driving.

- ✓ Review different literatures on design of high beam glare reduction.
- ✓ Design possible anti glaring solution to avoid high beam reflection.
- ✓ Select different materials and devices for the design.
- ✓ Purchase different components which are used to for design of anti-glaring system for high beam reflection on side view mirrors and inside view mirrors during night driving from Addis A baba, if it is available.
- ✓ Check the result of the design on simulation using *Proteus professional 8.7software.*

1.6. Limitation of the study

In executing this thesis work, there were different limitations. From those limitations, the following are the major ones:

- Unavailability of material that are to be used for preparing the prototype.
- Finding the exact area on the mirror in which the reflection on the side view mirror strikes the driver and passenger eye, since the vehicle with high beam which is located at the back of the ones vehicle does not have a fixed way. This scenario makes the study hard.
- Finding articles and references on the glaring of side view mirror and rear view mirror was not easy.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Light is electromagnetic radiation within a certain portion of the electromagnetic spectrum. The word light refers to visible light, which is visible to the human eye and it is responsible for the sense of sight. Visible light has a wavelength in the range of 400- 700 anemometers (NM), between the infrared (with longer wavelengths) and the ultraviolet (with shorter wavelength). Light can be produced by nature or by humans. Artificial light is typically produced by lighting systems that transform electrical energy into light. Vehicle lighting systems are very important, particularly where road safety is concerned. If headlights were suddenly to fail at night and at high speed, the result could be catastrophic. A key point to remember with vehicle lights is that they must allow the driver to:

- See in the dark
- To be seen in the dark (or conditions of poor visibility).

Sidelights, tail lights, brake lights and others are relatively straightforward. Headlights present the most problems, namely that, on dipped beam they must provide adequate light for the driver but without dazzling other road users (Denton, 2007). Night driving is difficult for many people. Driving in the dark is very different from driving during daylight hours. The human eye’s field of vision is much smaller without the help of natural light. If a driver feels less than confident driving at night, the light from a front-lighting system will help improve his or her night vision and safely reach the destination (Chen & Chiu, 2018). Human eyes are very sensitive to light. If eyes suddenly get in contact with light after darkness, cornea present in the eyes gets contract i.e. vision gets blank and require some time to recover the vision. Much time the situation comes when suddenly vehicle approaches from front with headlight in upper mode causes blindness to the eyes of the driver, during that time vehicle cover some distance and accident may occur. This temporary blindness of eyes is called as glaring effect (Journal & Special, 2016). Head lights of vehicles are inherent for night driving. These bright headlights which assist the driver for vision, while driving at night, pose a great threat to the other road users coming in the opposite direction. The bright light of the vehicles causes a discomfort in the form of a glare to the oncoming driver (Verifikasi et al., 2005). The major causes of accidents during the night, as the opposing driver will not be able to see the road clearly due to the brightness of the oncoming vehicle's lights (Verifikasi et al., 2005). One problem that drivers experience at night when traversing a road are the headlights of another vehicle. When another vehicle approaches a driver from the rear or the front of the driver's vehicle, the headlights of the approaching car can create significant temporary vision impairment. As the driver's eyes adjust to the intense light source, the driver is at an increased risk of an accident(Data, Nigro, & Plains, 2007).

Research data from the National Highway Traffic Safety Administration (NHTSA) indicates that roughly 25 percent of automotive travel occurs at night. However, nearly 52 percent of all driver fatalities and 71 percent of all pedestrian deaths occur during dark driving times (NHTSA, 2018)

Much time the situation comes when suddenly vehicle approaches from the front with the headlight in upper mode causes blindness to the eyes of the driver, during that time vehicle cover some distance and accident may occur. This temporary blindness of the eyes is called a glaring effect (Journal & Special, 2016). Glare is the visual effect of scattering light within (or in front of) the eye caused by a relatively bright light source in the field of view. The scattered light (veiling) reduces retinal contrast across the visual field and thus reduces overall visibility (disability glare), in addition to causing distraction and annoyance (discomfort glare). If the glare is strong, it may cause total wash-out of the scene.

Figure 2.1. High beam glaring

The contrast reduction makes it difficult to perform various visual tasks related to driving, such as detecting pedestrians detecting other on-road objects, and following the lane. Disability glare as well as discomfort glare caused by oncoming headlights has been associated with nighttime traffic accidents (Hwang & Peli, 2013). Night time fatality rates have been 3 to 4 times higher than daytime rates for decades (NSC, annual; Owens, Andre, & Harvey, 2003; NHTSA, 2007).

Although the difference in road safety between day and night involves multiple factors, including increased incidence of fatigue and alcohol consumption, the entire population experiences poor visibility when driving at night (Mikoski, Zlupko, & Owens, 2019). Crash data show that poor visibility at night is the leading contributor to fatal collisions with pedestrians, cyclists, and most likely other low-contrast obstacles. Moreover, the evidence indicates that drivers do not compensate behaviorally for limited visibility at night.

Table 2.1. Glare level (Source: Int. J. Environment. Res. Public Health)

Glare level	Description
Disability glare	Intense feeling of glare, serious blinding, difficult to open eyes, cannot see the target
Interference	Slightly stronger glare feeling, dazzling, the eyes want to avoid the line of sight, can recognize the target, the outline is not clear
Acceptability	Slightly blinding, visual recognition is essentially unaffected the outline is clearer

Research has shown, for example,

- Traffic speeds are roughly the same in day and night conditions
- Most drivers do not use high-beam headlights when appropriate and
- Drivers don’t notice the deleterious effects of dirty headlights that are common in inclement winter weather.

These findings suggest that drivers are unaware of normal limitations of night vision and, therefore, they seem overconfident in their ability to drive safely (Mikoski et al., 2019). The terms isotopic, mesmeric and isotopic refer to three ranges of human vision adaptation level, which differ in anatomical response, spectrum and their effect on visual acuity. Isotopic: This term refers to cone vision and generally covers adaptation levels of 3 candela per square meter (CD/m2) and higher. Adaptation level is the overall brightness of your environment that your eyes have adjusted to. Translated into illuminance, if the average reflectance of your environment is 30%, an adaptation level of 3 CD/m2 (candela per square meter) would result from illuminance of approximately 30 lux (3 foot candles). The combined peak sensitivity of the cones is at 555 NM, in the yellow-green part of the visible spectrum. The lumen, the basic metric of visible light, is defined by the combined cone response only. Mesozoic: This term refers to a range of human vision with both rods and cones active. There is no hard-line transition at either end, but for most intents and purposes the mesmeric range is generally considered to be from 3 CD/m2 down to 0.01 CD/m2. Isotopic: This term refers to rod vision and corresponds to an adaptation level below 0.01 CD/m2. The peak sensitivity of the rods is at 507 NM, in the blue-green part of the visible spectrum. While there may be some (very little) cone activity at 0.01 CD/m2 , once the light level drops to 0.001 CD/m2 , only the rods are active. At this point, the ability to discern colors is gone. In addition, since there are no rods at the forgave and the cones there are not receiving enough light to be stimulated, the ability to discern fine details is gone. This light level is what you will find on a moonless night out in the desert, far from any town or highway illuminates. Drive out, turn off the car lights, and wait for your eyes to adapt. With light only from the stars overhead, you will be able to see large objects like boulders and shrubs and perhaps a rabbit scampering by. But no colors and you can't read the newspaper! Isotopic vision plays a major role in night vision. Human eye consist of two types of photoreceptor cells- rod cells and cone cells.Isotopic vision occurs due to rod cells. Rod cells can function in less intense of light. There are approximately about 90 million rod cells are present in a human eye. Rod cells are usually present at an outer edge of the human eye. Rod cells are usually more sensitive than cone cells so it plays a very little role in color vision. This is the main reason that the colors are not so obvious in the dim light. Isotopic vision is also called as night vision. The intensity of light is measured in lumen per radiant(lm/Sr) or candela (CD). The luminance level of isotopic vision is 10-3 to 10-6 CD/m2. It distinguishes shapes and not the colors. Isotopic vision is also known as day vision or bright light vision (Lakshmi, ET AL.2019)

Stroller's effect is also known as Stroller fading. It is an optical illusion affecting Visual perception. When a constant amount of light falls on the neuron inside the eyeball, that individual neuron gets desensitized to the stimulus and also reduces the signal strength to the brain. Thus, the view will not be clear which may lead to temporary blindness that may lead to collision or accident during night driving. In the medical world, the Stroller 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 lumen, 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 the Stroller effect. This means that the driver's reaction time is increased by 1.4 seconds. For example, let us assume a motorist traveling at 60miles per hour takes 0.5 seconds to react to a hazard and will stop within 41 feet.

Due to the Stroller effect, the same person traveling 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 (Dharma, ET AL. 2016). Due to this Stroller affects different country accident reports shows the severity of the problem. According to Forbes, the statistics shown in Figure below give the details of the accidents that had occurred in the year 2013 in Asia due to over-bright light.

Headlight of vehicles poses a great danger during night driving. The drivers of most vehicles use high, bright beam while driving at night. This causes a discomfort to the person travelling from the opposite direction and therefore experiences a sudden glare for a short period of time. This is caused due to the high intense headlight beam from the other vehicle coming towards the one from the opposite direction. (Varudharajulu & Ma, 2018).

Generally, glare of high beam reflection during night time was can cause of different road accident .so safety measure was necessary to mitigate the effect of glare of high beam. Different researcher was done their research on the effect and safety measure and able to show severity of the problem and reduced the effect the problem but when doing their research, they could not consider driver because driver must get information before the device to reduce high beam to low beam. So, driver warring device was design with the system.

Light Dependent Resistor

A Light Dependent Resistor also we call is known as a photo resistor or LDR is a device whose resistivity is a function of the incident electromagnetic radiation.it is a semiconductor material that is between conductor and non-conductor material. A semiconductor is somewhere between an insulator and a conductor. LDR is a sensor that changes its resistance according to the amount of intensity of light falling on it. Increasing the intensity of light decreases the resistance and increases the conductivity of LDR. The output of LDR is an analog output The Light-

Dependent resistor works on the principle of Photo conductivity i.e. the conductivity of the LDR increases by increasing the intensity of light falling on it. When the LDR is kept in dark, its resistance is very high that is up to 1012Ω. At the same time, when the LDR is placed in sunlight, there is a drastic fall in the resistance of LDR (Lakshmi, ET AL. 2019).

Automobile Head Light

A headlamp is a lamp attached to the front of a vehicle to illuminate the road ahead. Headlamps are also often called headlights,

Low beam

Low beam (dipped beam, passing beam, and meeting beam) headlamps provide a distribution of light designed to provide forward and lateral illumination, with limits on light directed towards

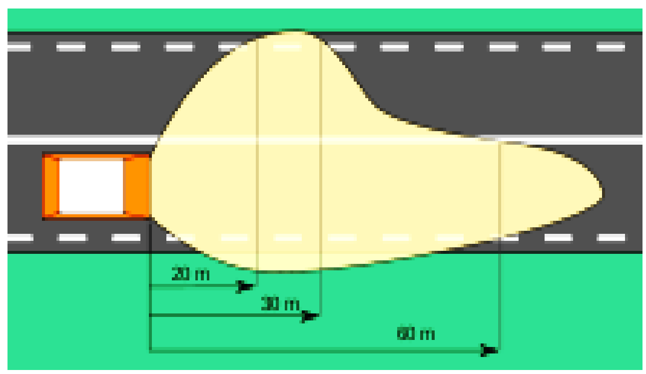

Figure 2. 2. Low beam

the eyes of other road users to control glare. This beam is intended for use whenever other vehicles are present ahead, whether oncoming or being overtaken.

High beam

High beam (main beam, driving beam, full beam) headlamps provide a bright, center-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. (Wikipedia)

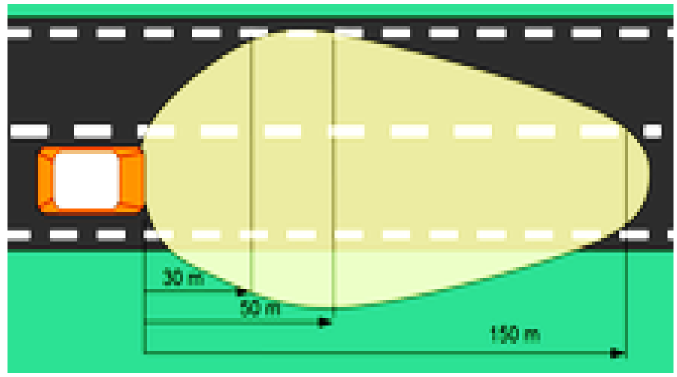

Figure 2.3. High beam

Types of Head Lights

There are four types of headlights currently used in modern era cars halogen, HID, LED and Laser. All these headlights differ on the basis of range and color of the light dispersed from them. The headlights in the vehicles have come a long way in all these years, with most of the innovation happening in the last three decades.

Following are the four types of headlights being used in the cars of the modern era:-

Halogen headlights

These are the oldest type of headlights used in the cars among the ones in this list, and are still very popular among the entry-level cars, due to their simple construction and cost-effectiveness. These headlamps have a bulb within them, which has filament in it. A mixture of gases surrounds this filament in the bulb, which allows it to burn even brighter. While they are cheap and easy to replace, they emit the least amount of light in terms of range.

HID headlights

Commonly used in high-end vehicles like premium sedans and SUV, the High-Intensity Discharge (HID) headlights employ a mixture of noble gases like xenon and argon, which emit a bright bluish-white light which is different from the yellow light emitted by halogen headlights. While these headlights do have more focused and longer range of emission as compared to halogens, they are relatively more expensive and take a slight delay of time to reach their maximum limit of emission.

LED headlights

The Light Emitting Diode (LED) headlights were once restricted to only luxury cars but now have gradually made their way into much more compact hatchbacks and sedans as well. These headlights take the use of a series of LED, which throw light as a result of energy emitted as photons. The biggest advantage of LED headlights is that there is range is even more than HID ones with the flexibility of emitting any color of light, but at the same time, they are more expensive to replace.

Laser headlights

The latest of them all, the laser headlights are currently restricted to high-end luxury cars due to their high costing and complex construction. However, they emit the best possible light range among all the types of headlights used in the past. The process of illumination of light in laser headlights start by a chemical reaction, through which laser beams are thrown passing through a chamber. This causes the phosphorus gas present in the beams to glow, and they glow very brightly, generally in white color.

Illuminance (lux)

Illuminance refers to the incidence of the light flux on a surface, per unit of surface. The flux from a luminance travel in various directions through space until it strikes a surface. The amount of light falling per unit area of the surface is called the illuminance and is measured in lumen per square meter or lux (l). If the luminance is at a reasonable distance from the surface it can be regarded as a point source, and the illuminance (lux) on a surface perpendicular to the intensity direction is simply the intensity I (CD) divided by the square of the distance D (m) (road transport lighting for developing countries, 2007). The unit of illumination is the lumen per square meter (lux). A single lux is equal to one lumen per square meter.

Luminous Flux (Lm)

The total amount of light emitted in all directions by the light source. The lumen is unit lumen (lm) gives the total luminous flux of a light source by multiplying the intensity (in candela) by the angular span over which the light is emitted. Luminous flux", which comes from a lamp, is measured in lumen (lm). This quantity allows for the fact that the sensation of "light" experienced by the human eye/brain system depends on the wavelength of the radiation entering the eye (road transport lighting for developing countries, 2007).

Luminous Intensity (Candela) or CD

Candela is the base measurement for describing luminous intensity. It tells you how bright the light source is which shows how far away from an object you can be and while still being able to see it. The luminous intensity of a candle is 1 candela. The flux emitted in a given direction within a very small solid angle "surrounding" the direction, divided by the solid angle, is the intensity in that direction. The unit of measurement, lumen per radiant, is called the candela (CD) (road transport lighting for developing countries, 2007).

Micro-controller

A micro controller refers to a single device; however, it contains the entire microcomputer on that single chip. Therefore, a micro controller will have a processor, onboard memory, and a variety of IO devices. While using a micro controller instead of a microcomputer simplifies the overall 16 design, to accomplish this it sacrifices flexibility. A microcomputer can be configured to have specific quantities of memory or devices attached.

2.2 Arduino Kano

Arduino Kano is one type of microcontroller board, and it is designed by Arduino.cc. It can be built with a micro controller like Atmega328. This micro controller is also used in Arduino UNO. It is a small size board and also flexible with a wide variety of applications. Other Arduino boards mainly include Arduino Mega, Arduino Pro Mini, Arduino UNO, Arduino YUN, Arduino Helipad, Arduino Leonardo, and Arduino Due. And other development boards are AVR Development Board, PIC Development Board, Raspberry Pi, Intel Edison, MSP430 Launchpad, and ESP32 board.

This board has many functions and features like an Arduino Hanoverian board. However, this Kano board is different in packaging. It doesn't have any DC jack so that the power supply can be given using a small USB port otherwise straightly connected to the pins like VCC & GND. This board can be supplied with 6 to 20volts using a mini USB port on the board.

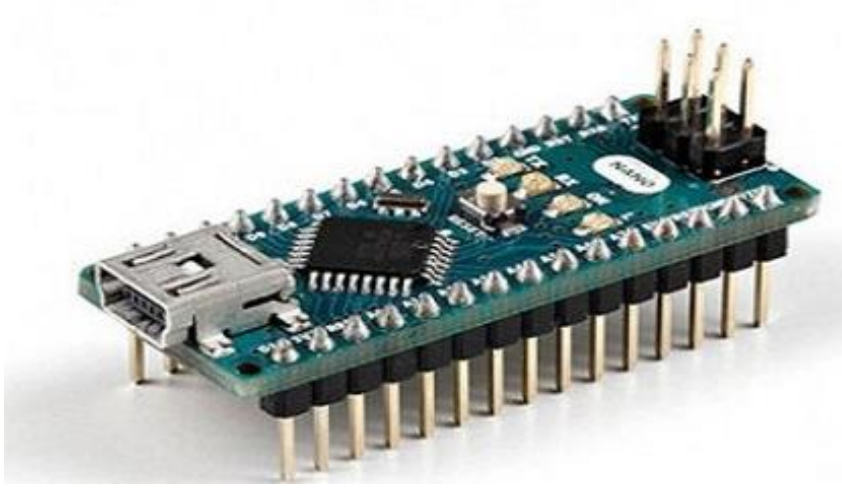

Figure 2.4. Arduino Kano

2.2 Arduino Nano Features

The features of an Arduino Kano mainly include the follower

Figure 2.5. Features of an Arduino Kano

Features of an Arduino Kano		
• ATmega328P Micro controller is from 8-bit AVR family • Operating voltage is 5V • Input voltage (Vin) is 7V to 12V • Input/output Pins are 22 • Weight-7g	• Analog i/p pins are 6 from A0 to A5 • Digital pins are 14 • Power consumption is 19 mA • I/O pins DC Current is 40 mA • Flash memory is 32 KB	• SRAM is 2 KB • EEPROM is 1 KB • CLK speed is 16 MHz • Size of the printed circuit board is 18 X 45mm • Supports three communications like SPI, IIC, & USART

Arduino Nano Pinout

Arduino nano pin configuration and each pin functionality are shown in Figure 2.6.

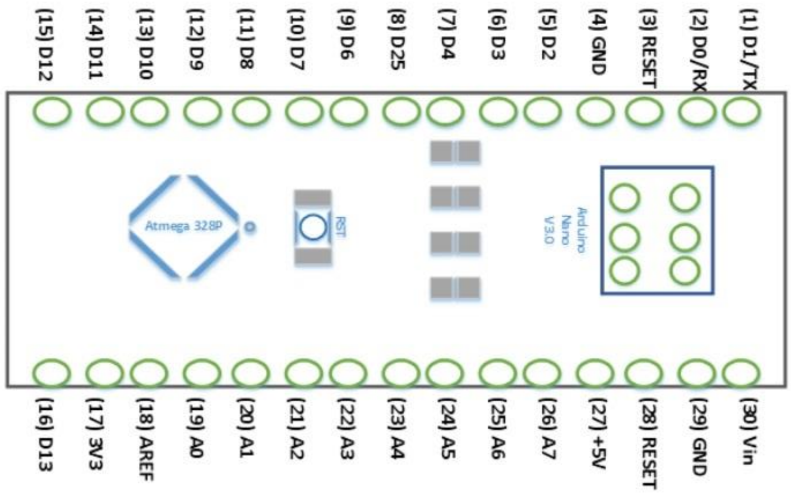

Figure 2.6. Arduino Nano pin

Power Pin (V in, 3.3V, 5V, GND): These pins are power pins

- V in is the input voltage of the board, and it is used when an external power source is used from 7V to 12V.
- 5V is the regulated power supply voltage of the Nano board and it is used to give the supply to the board as well as components.
- 3.3V is the minimum voltage which is generated from the voltage regulator on the board.
- GND is the ground pin of the board
- RST Pin (Reset): This pin is used to reset the micro controller
- Analog Pins (A0-A7): These pins are used to calculate the analog voltage of the board within the range of 0V to 5V
- I/O Pins (Digital Pins from D0 – D13): These pins are used as an i/p otherwise o/p pins. 0V & 5V
- Serial Pins (T, Rx): These pins are used to transmit & receive TTL serial data.
- External Interrupts (2, 3): These pins are used to activate an interrupt.
- PWM (3, 5, 6, 9, 11): These pins are used to provide 8-bit of PWM output.

SPI (10, 11, 12, & 13): These pins are used for supporting SPI communication.

Inbuilt LED (13): This pin is used to activate the LED.

IIC (A4, A5): These pins are used for supporting TWI communication.

AREF: This pin is used to give reference voltage to the input voltage

Arduino Nano Communication

The communication of an Arduino Nano board can be done using different sources like using an additional Arduino board, a computer, otherwise usingE. The micro controller using in Na no board (ATmega328) offers serial communication (UART TTL). This can be accessible at digital pins like TX, and RX. The Arduino software comprises of a serial monitor to allow easy textual information to transmit and receive from the board.

The TX & RX LED on the Na no board will blink whenever information is being sent out through the FTDI & USB link in the direction of the computer. The library-like Software Serial allows serial communication on any of the digital pins on the board. The micro controller also supports SPI & I2C (TWI) communication.

Arduino Na no Programming

The programming of an Arduino nano can be done using the Arduino software. Click the Tools option and select the nano board. Micro controller ATmega328 over the Nano board comes with programmed with a boot loader. This boot loader lets to upload new code without using an exterior hardware programmer. The communication of this can be done with the STK500 protocol. Here the boot loader can also be avoided & the micro controller program can be done using the header of in-circuit serial programming or ICSP with an Arduino ISP.

2.3 Applications of Arduino Nano

These boards are used to build Arduino Nano projects by reading inputs of a sensor, a button, or a finger and gives an output by turning motor or LED ON, or and some of the applications are listed below.

- Samples of electronic systems & products
- Automation
- Several DIY projects
- Control Systems
- Embedded Systems
- Robotics

- Instrumentation

Thus, this is all about an overview of Arduino nano datasheet. From the above information finally, we can conclude that for the beginners who are new to electronics, this Nano board is extremely suggested to go for this board due to its features like low cost and very simple to use in different applications. This board can simply connect to any computer throughout its mini USB port.

Side-View Mirrors

The automobile side-view mirror is a device for indirect vision that facilitates observance the traffic area adjacent to the vehicle which cannot be observed by direct vision. Being able to see what is behind the car is vital when reversing or changing lanes. The mirrors are often situated on, just in front of, the driver's and front passenger's doors. Due to legislation, today's cars have two mirrors. There are many regulations and laws when it comes to mirrors, mainly due to safety factors. Today's mirrors are made up of more than a reflective glass. The mirror housing often holds the indicators, illumination features and a blind spot alarm. (***Designing and Optimizing Side-View Mirrors***)

A **side-view mirror** (or **side mirror**), also known as a **wing mirror**, is a mirror placed on the exterior of motor vehicles for the purposes of helping the driver see areas behind and to the sides of the vehicle, outside the driver's peripheral vision (in the "blind spot").

Almost all modern cars mount their side mirrors on the doors—normally at the A-pillar—rather than the wings (the portion of the body above the wheel well).

The side mirror is equipped for manual or remote vertical and horizontal adjustment so as to provide adequate coverage to drivers of differing height and seated position. Remote adjustment may be mechanical by means of Bowden cables, or may be electric by means of geared motors. The mirror glass may also be electrically heated and may include electro chromic dimming to reduce glare to the driver from the headlamps of following vehicles. Increasingly, the side mirror incorporates the vehicle's turn signal repeaters. There is evidence to suggest that mirror-mounted repeaters may be more effective than repeaters mounted in the previously predominant fender side location.

REAR VIEW MIRROR

A rear-view mirror (or rearview mirror) is a flat mirror in automobiles and other vehicles, designed to allow the driver to see rearward through the vehicle's rear window (rear windshield).In cars, the rear-view mirror is usually affixed to the top of the windshield on a double-swivel mount allowing it to be adjusted to suit the height and viewing angle of any driver and to swing harmlessly out of the way if impacted by a vehicle occupant in a collision.

The rear-view mirror is augmented by one or more side-view mirrors, which serve as the only rear-vision mirrors on trucks, motorcycles. A prismatic rear-view mirror—sometimes called a "day/night mirror"—can be tilted to reduce the brightness and glare of lights, mostly for high-beam headlights of vehicles behind which would otherwise be reflected directly into the driver's eyes at night. This type of mirror is made of a piece of glass that is wedge-shaped in cross-section—its front and rear surfaces are not parallel.

On manual tilt versions, a tab is used to adjust the mirror between "day" and "night" positions. In the day view position, the front surface is tilted and the reflective back side gives a strong reflection. When the mirror is moved to the night view position, its reflecting rear surface is tilted out of line with the driver's view. This view is actually a reflection of the low-reflection front surface; only a much-reduced amount of light is reflected in the driver's eyes. "Manual tilt" day/night mirrors first began appearing in the 1930s and became standard equipment on most passenger cars and trucks by the early 1970s. Current systems usually use photo sensors mounted in the rear-view mirror to detect light and dim the mirror by means of electro chromism. This electro chromic feature has also been incorporated into side-view mirrors allowing them to dim and reduce glare as well.

Rear View Mirror

Rear view mirror is a flat mirror in automobiles and other vehicles, designed to allow the driver to see rearward through the vehicle's rear windshield. The rear-view mirror is usually affixed to the top of the windshield on a double-swivel mount allowing it to be adjusted to suit the height and viewing angle of any driver and to swing harmlessly out of the way if impacted by a vehicle occupant in a collision.

In more recent model vehicles, rear-view video cameras have been built into many new model cars, this was partially in response to the rear-view mirrors' inability to show the road directly behind the car, due to the rear deck or trunk obscuring as much as 3–5 meters (10–15 feet) of road behind the car. As many as 50 small children are killed by SUVs every year in the USA because the driver cannot see them in their rear-view mirrors. Camera systems are usually mounted to the rear bumper or lower parts of the car, allowing for better rear visibility

Anti-Glare on Rear View Mirror

Glare from a following vehicle's headlamps in a rear view mirror

A prismatic rear-view mirror sometimes called a "day/night mirror" can be tilted to reduce the brightness and glare of lights, mostly for high-beam headlights of vehicles behind which would otherwise be reflected directly into the driver's eyes at night. This type of mirror is made of a piece of glass that is wedge-shaped in cross-section its front and rear surfaces are not parallel.

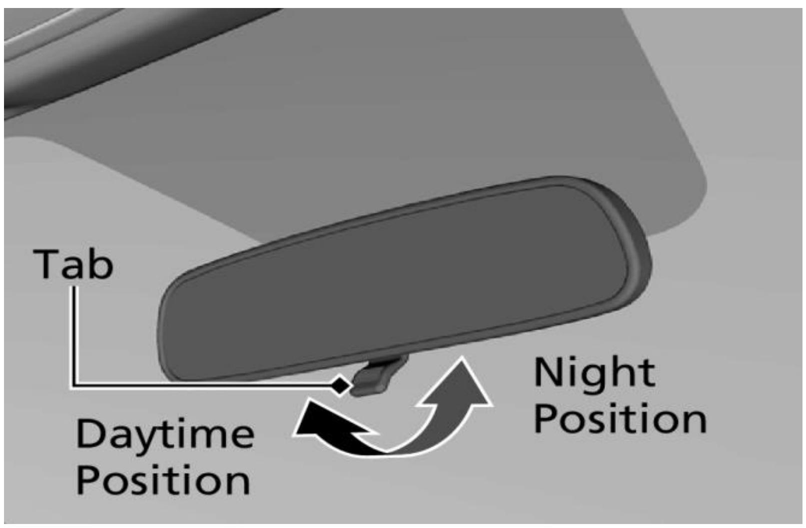

Figure 2.7. Rear view mirror

On manual tilt versions, a tab is used to adjust the mirror between "day" and "night" positions. In the day view position, the front surface is tilted and the reflective back side gives a strong reflection. When the mirror is moved to the night view position, its reflecting rear surface is tilted out of line with the driver's view. This view is actually a reflection of the low-reflection front surface; only a much-reduced amount of light is reflected in the driver's eyes. "Manual tilt" day/night mirrors first began appearing in the 1930s and became standard equipment on most passenger cars and trucks by the early 1970s.

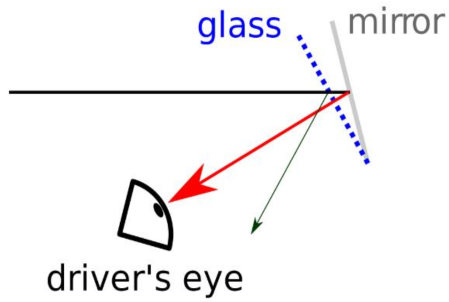

Figure 2.8. Prismatic wedge type rear view mirror

Prismatic Rear-View Mirror

Rear-view mirror works on the principle of prismatic wedge. Rear view mirror has two reflective surfaces. One of them, labeled "***mirror***" in this diagram is silvered, so that it reflects most of the light that hits it. The other surface is shown in this diagram as a sheet of "***glass***". The "glass" shown in the above diagram is the outer surface of the transparent material, and the "mirror" is a reflective coating, or "silvering", on the inner surface of the material. Looking at the reflection from the silvered surface, one sees the scene behind in full brightness. The intervening, transparent, tapered material has little effect on the image. It is not known that a transparent surface also functions as a reflective surface, because we can see our reflections in a window, even if it is not silvered. However, we see a reflection in the window only when there is not too much light coming through the window from the other side, because the transparent surface of a transparent medium only reflects a small part of the light that hits it.

The tab on the bottom of the mirror positions the mirror at either of two angles, which differ by the same angle as the angle between the two surfaces of the transparent material. This switch between two angles is independent of the ball-joint adjustment by which the driver adjusts the mirror to show the appropriate field of view. At one of those two tabbed positions, the silvered surface is at the angle selected by the ball-joint adjustment. At the other tabbed position, the transparent surface is at the same angle. Thus, the driver chooses between viewing the selected scene behind through either the mirror surface or the transparent surface. The mirror surface shows the scene in nearly full brightness. The transparent surface shows the scene in greatly reduced brightness. "Dimmer" scene may be created directly by reflection from the transparent surface, or by reflection twice through the silvered surface and once from the *inner* side of the transparent surface. Consequently, the driver may select either position of the tab to be the “bright” setting, and the other position will be the “dim” setting.

In principle, there is a whole series of progressively dimmer images at multiples of the selection angle, but they are too dim to be visible.

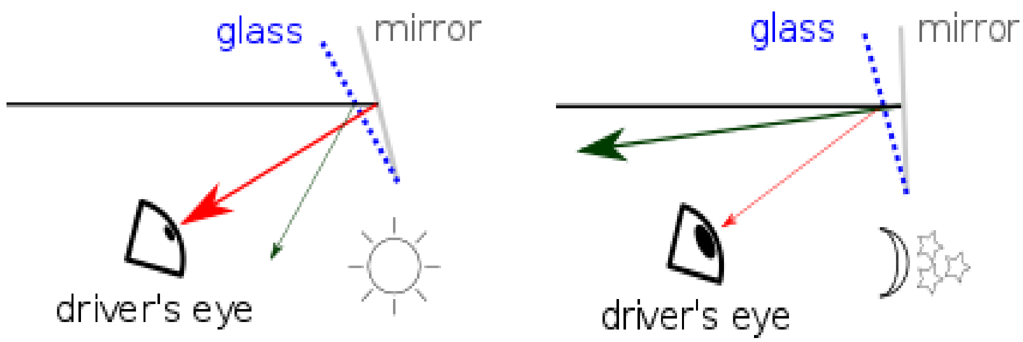

Figure 2.9. Prismatic Rear-View Mirror

In this situation, the observer will see a bright patch of light reflected from the silvered surface, either on the ceiling of the cabin or somewhat below the mirror, maybe on the driver’s chin or chest. (With the mirror adjusted to the bright position, this bright spot is centered on the driver’s eyes of course.)

2.4 Automatic dimming

Auto dimming mirrors are the latest and one of the most common rear-view mirrors now a days. Auto dimming mirrors usually use photo sensors mounted in the rear-view mirror to detect light and dim the mirror by means of electro chromism.

Figure 2. 10. Auto dimming rear view mirror

This electro chromic feature has also been incorporated into side-view mirrors allowing them to dim and reduce glare as well. The automatic anti-dazzle interior mirror improves your comfort and safety while driving at night by preventing glare from cars behind you. It consists of a mirror and an electronic control with two photo-sensors. By means of the photo-sensors, the electronics detect light entering from the front and rear. If the light from behind is greater than that from the front, the mirror dims accordingly.

Polarized coated Glass

Polarized coatings on side mirrors are designed to reduce glare and improve visibility. These coatings work by filtering out horizontally polarized light, which is the type of light that typically causes glare when it reflects off surfaces like water, snow, or other vehicles.

Polarization: Polarized coatings contain a special chemical film that is applied to the surface of the mirror. This film allows only vertically polarized light passing through while blocking horizontally polarized light, which is responsible for the glare. By filtering out the horizontal light, these coatings significantly reduce the glare from the sun or headlights, which can be blinding and dangerous, especially when driving. With reduced glare, drivers experience less eye strain and have a clearer view of their surroundings, which enhances safety on the road. In essence, polarized coatings act like a selective filter for your side mirrors, allowing you to see more clearly and drive more safely by avoiding the blinding effects of glare. It's similar to wearing polarized sunglasses, which provide clearer vision in bright conditions by eliminating glare.

Research Gap:

There are different researches done to overcome the glaring problem due to high beam. But most of the researches are focused on the glaring problem which happens due to oncoming vehicles (when there is vehicle coming in opposite direction with the high beams). On this aspect different researcher have done different researches for example, Adaptive Driving Beam Headlights, Automatic Vehicle High-Beam Headlamp Control System, etc. have done their researches focusing only on the oncoming vehicles to sense and switch it from high beam to lower one.

Appreciating these whole researches for their hard work to overcome this glaring problem from oncoming vehicles (vehicles coming on the opposite direction's high beam which directly strikes the opposite vehicle's driver eye) high beam, but there are not many researches done regarding high beam reflections on the side view mirror and inside view mirror of a vehicle due to vehicles at the back (following vehicles) high beam. Some researches design anti glaring glass and stickers which can detect the high beam reflections. One of these is, when the high beam reflection strikes the side view mirror the area in which on the side view mirror which is strike by the high beam automatically dim the light to make it look like fogged. But further this I have not seen real design to be a solution for this glaring problem due to high beam reflection on the side view mirror of a vehicle.

CHAPTER THREE

MATERIALS AND METHODS

3.1. Materials

The design of anti-glaring system for high beam reflection on side view mirrors and rear-view mirrors during night driving system needs a number of electrical components to execute the design. Starting from receiving the input data with the light dependent resistor LDR to analyzing and taking the action with the side view mirror and rear-view mirror, the design uses many electrical components. The utilized materials are listed in Table 3.1.

Table 3.1. List of material for the system

S. no	Items	Quantity
1.	Arduino nano	1
2.	12 V Battery	1
3.	Light Dependent Resistor, LDR	3
4.	Transistor BC327	2
5.	LED	2
6.	Diode	2
7.	Variable Resistor	1
8.	Electrical breadboard	1
9.	Jumper wire	30
10.	Voltage regulator	2
11.	Motor driver IC (L293D)	2

3.2. Methods

To show the general and specific objectives of design of anti-glaring system for high beam reflection on side view mirrors and rear view mirrors during night driving, methodology will be followed,as shown on Figure 3.1.

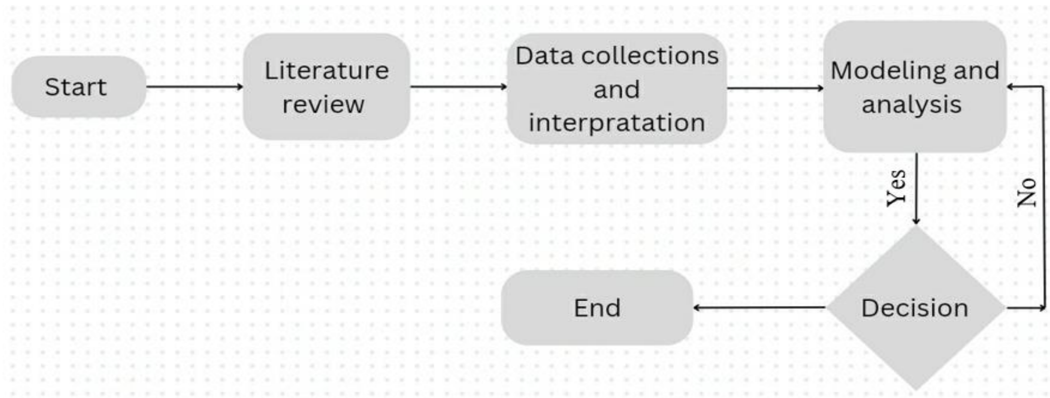

Figure 3.1.Methodology

The researcher goes to the field and observes how much serious problem can a vehicle high beam reflection on side view mirror and rear-view mirror causes. Researcher read different literature on the issue of vehicle headlight reflections and their impact. After that, identifying the targeted population and drivers who are affected by this high beam reflection has been done. So the researcher decided on the population and sample for the study. The population for these study vehicle drivers who drive at night time, long and short distance were purposively selected and prepared questionnaires for heavy and light duty freight vehicle and public transport drivers that drive through the city and also outside the city.

The questionnaires were distributed to different company vehicle drivers, and collect primary data collected through questionnaires and field observation. The collected data analysed using SPSS 22.v software and interpreted to meaningful results.

3.3. Population and Sampling

3.3.1. Target population

Target population means the total number of subjects under the study. So, target populations of the study will be vehicle driver’s especially heavy and light duty freight vehicle drivers and public transport drivers. The researcher used both probability sampling (simple random sampling) and non-probability sampling (purposive) techniques that are applied to select representatives of a vehicle driver. In the non-probability sampling, the heavy and light duty freight vehicle drivers were purposively is selected for research questionnaires. The questionnaires were consisting of both closed-ended and open-ended questions.

3.3.2. Sample frame

A list containing all such sampling units is known as a sampling frame. Thus, sampling frame consists of a list of items from which the sample is to be drawn (Kothari, 2004). To confirm the generalization and validity of the study, taking sufficient sample size and utilizing sample technique special concern will be given. The list of heavy and light-duty freight vehicle drivers will be considered as a sample frame.

3.3.3. Sample Unit

The elementary units or the group or cluster of such units may form the basis of the sampling process in which case they are called sampling units. Therefore, the sampling units will be the sample of all heavy and light duty freight vehicle drivers.

3.3.4. Sampling Technique

In this study, a probability sampling method was used. Simple random sampling and purposive sample techniques are employed to select units. Simple random sampling can be used for small populations that contain more than 1000 sampling units.

3.3.5 Sample Size

The size of the sample should neither be excessively large, nor too small. It should be optimum. To take the appropriate and representative sample size the researcher decided on the following statistical calculation. For this study, the statistical formula uses for sample size N≥ 10,000 set by Kothari (2004), is used and applied as follows by considering the level of acceptable margins of error at 5%. Therefore, sample size:

$n = \frac{z^2pq}{e^2}$ For $N \geq 10,000$

Where,

N = population size

n = the desired sample size

z = standard normal variable at the required level of confidence at 95%=1.96

p = the proportion in the target population estimated to have characteristic being measured

q = 1-p the probability of failure

$e+$ Is the acceptable margin of error for proportion being estimated it will be 5%. Expecting to produce an accuracy level of 95%, e= (100% - 95%) =1-0.95 =0.05,

z=1.96 and since there is no estimate available of the proportion in the target population assumed to have the characteristic of interest, it is possible to predict the proportion of target population ‘p’ to be 0.5 and ’q’ 0.5 will be taken (Sataloff et al., n.d.) Therefore: assuming that the size of the population greater or equal to 10,000, the sample size of the study is:

Where : Z = 1.96, p = 0.5, q = $(1-p)$= 1-0.5 = 0.5, and e = 0.05

3.3.5 Sample Size

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assuming that the size of the population greater or equal to 10,000, the sample size of the study is:

Where Z = 1.96, p = 0.5, q = 1-0.5 = 0.5, and e = 0.05

$$n = \frac{1.96^2(0.5)(1-0.5)}{0.05^2} = 384.16$$

The sample size of this study will be 384 personal vehicles, heavy duty vehicle drivers and public transport vehicles with the total population at a 95% confidence interval. Therefore, the sample size is summarized in the following Table.

Table 3. 2. Sample size summary

No.	Type of driver/respondent/	Population size	Percentage	Sample size
1	Personal vehicle drivers	118	30.7 %	0.307*384=118
2	Heavy duty vehicle drivers	97	25.3 %	0.253*384=97
3	Public transport vehicle drivers	169	44 %	0.44*384=169
	Total	**384**	100 %	384

3.4. Sources of Data

To achieve the objectives of this study, both primary and secondary data will be used. The primary data will obtain through questionnaires from respondent drivers. and other empirical researches in the area, and any other relevant document from the libraries and internet.

3.4.1 Primary data collection

The data collection tools to gather primary data in this study were questionnaires, and field observation. The questionnaires were prepared for the respondents who are selected from personal, heavy duty and public transport vehicle drivers. The questionnaires were consisted of closed-ended questions.

3.4.2 Secondary data's: Online sources

Vehicle Specification

The researcher chooses light vehicle for the research which is a property of Toyota Company.

Table 3.3. Vehicle Specification

Vehicle Specification and Dimensions		Engine Specification	
Length	4,385 mm	Power	81 kW
Width	1,710 mm	Horsepower	110 hp (109 bhp)
Height	1,470 mm	Rev. at Max Power	6,000 rpm
Track, Front	1,490 mm	Torque	150 Nm
Track, Rear	1,470 mm	Displacement	1,598 cc / 1.6 l
Wheel Base	2,600 mm	Cylinders	4 Cyl. / 4 V per Cyl.
Turning Circle	10.2 m	Bore	79 mm
Ground Clearance	155 mm	Stroke	81.5 mm
Rear Lights	Halogen	Compression Ratio	10.5 :1
Rear Lights	Halogen	Ignition Type	Spark Plug
Side Mirrors		Rear-view Mirror	
Mirror Type	Conventional	Adjustments	Mechanical
Adjustments	Electrical	Rear-view Mirror: Mirror Type	Standard
Folding	Manual		
Mirror Shape, Driver side	Aspheric		
Mirror Shape, Passenger side	Aspheric		

The vehicle which is chosen for this research is Toyota corolla model, with manufacturing year of 2003 G.C. The following is the vehicles specification.

3.5 Data Analysis and Interpretation

The data was analyzed according to their type either quantitative or qualitative data. The collected data enter into SPSS 22 software and Microsoft excels analysis. Due to the nature of the data, different statistical tools such as percentage, graphs was used and interpreted with meaningful explanations.

3.6 Arduino Nano Microcontroller Programming

The programming is done by ARDUINO NANO commercial software which is called as Arduino Integrated development environment (IDE). In Arduino IDE there are two have two setups () and void loop (), each containing statements that do specific actions performed in order from top to bottom.

```
Void setup () {
}
Void loop () {
}
```

Statements inside the void setup will be used to configure the state of input and output pins, as well as other actions that we only need to run once. Conversely, loop () will perform whatever actions are inside of it over and over again for eternity, assuming limitless power as a pre-requisite.

Since the language that the Arduino microcontroller used is case sensitive a letter is uppercase or lowercase must match exactly between what is entered and the syntax of the function, variable, or other statement being used.

A variable declared inside the loop or another function is called a local variable but if it is declared before the setup function it is known as a global variable. Arithmetic Operators: +, -, *, /, Compound Operators: ++, --, +=, -=, *=, /= and Comparative Operators are available in the program.

Table 3.4. Operator and their description

Description	Symbol	Examples

<table>
<tr><td>Parenthesis</td><td>( )</td><td>(x+ y) *z</td></tr>
<tr><td>Increment, decrement</td><td>++ -- , ,</td><td>x++, y--</td></tr>
<tr><td>Multiplication, division, modulus</td><td>* / %</td><td>x * 1.5</td></tr>
<tr><td>Addition, subtraction</td><td>+ -</td><td>y + 10</td></tr>
<tr><td>Less than, greater than comparisons</td><td>< > <= >=</td><td>if (x < 255)</td></tr>
<tr><td>Is, is not equal to</td><td>== !=</td><td>if (x == HIGH)</td></tr>
<tr><td>Logical AND</td><td>&&</td><td>if (x == HIGH && x > y)</td></tr>
<tr><td>Logical OR</td><td>||</td><td>if (x == HIGH || x > y)</td></tr>
<tr><td>Assignment and compound assignments</td><td>= += -= *= /=</td><td>x = y</td></tr>
</table>

Source of the table (Ciffee et al., 2021)

Table 3.5. Data types and their size and range

Name	**Size**	**Range**
Boolean	1 bit	true or false
Byte	8 bits	0 to 255
Char	8 bits	-128 to 127
Int	16 bits	-32,768 to 32,767
Long	32 bits	-2,147,483,648 to 2,147,483,647
Float	32 bits	3.4028235E+38 to 3.4028235E+38
unsigned char	8 bits	0 to 255
Unsigned int	16 bits	0 to 65,535
unsigned long	32 bits	0 to 4,294,967,295

3.6.1 Controlling Statements

The "if statement" checks for a condition and executes the following statement or set of statements if the condition is 'true. If statement is the simplest of the control structures and is among the most prominent method for Arduino decision making. It will perform a block of code if a specific condition is met. The basic syntax for an "if statement" looks as follows:

```
If (condition)
{Statements
}
```

The fore statement is used to repeat a block of statements enclosed in curly braces. An increment counter is usually used to increment and terminate the loop. The "for statement" is useful for any repetitive operation and is often used in combination with arrays to operate on collections of data/pins.

The "for statement", or for loop, is an iterative statement that allows the Arduino to repeatedly perform lines of code in a loop a specified number of times. The basic syntax of a for loop follows:

```
For (initialization (declaration); condition; increment)
{
Statements
}
```

The "while statement" is a substitute for loops. Even if for statement is fairly common to Arduino programmers, but there are other ways to structure iterative loops. Where the "if statement" executed a statement once if a condition was met, and the for- loop cycles through a specified number of times, the while statement, or while loop, is used to continuously execute a statement so long as the condition remains true. The basic syntax of a while statement looks like the following:

```
While (condition)
{
Statements
}
```

Like if statements, switch case controls the flow of programs by allowing programmers to specify different code that should be executed in various conditions.

In particular, a switch statement compares the value of a variable to the values specified in case statements. When a case statement is found whose value matches that of the variable, the code in that case statement is run. The basic syntax of the switch statement is as follows:

```
Switch (expression)
  {
Case constant:
  Statements;
     Default:
     }
```

Map () function will take the value from the variable analog value with expected values that begin at 0 and go up to a maximum of 1023, and map these values to the new values of 0 to 255(2^8-1). This statement effectively converts a range of values from 0 to1023 (2^{10}-1) to 0 to 255(2^8-1). The beginning and ending values can be changed accordingly. The basic syntax of the map () function is:

- Map (value, from Low, from High to Low, to High)
- Delay () function: is used to create a short pause in the middle of a program. The syntax for the function follows.
- Delay (time): Inside the microcontroller on the Arduino board, three onboard hardware timers work in the background to handle repetitive tasks like incrementing counters or keeping track of program operations.
- Attach Interrupt (interrupt, function, and mode): enables hardware interrupts and links a hardware pin to an ISR to be called when the interrupt is triggered. This function also specifies the type of state change that will trigger the interrupt.

3.6.2 Analog and Digital Functions

In digital functions, the writing and reading of signals are only HIGH and LOW which is equal to 5V and 0V. The analog write ranges from 0 up to 255(2^8-1) and the reading range is from 0- 1023(2^{10}-1).

3.6.3 Flowchart of the program

A flowchart is an illustrative representation of an algorithm. The flowchart can be helpful for both writing programs and explaining the program.

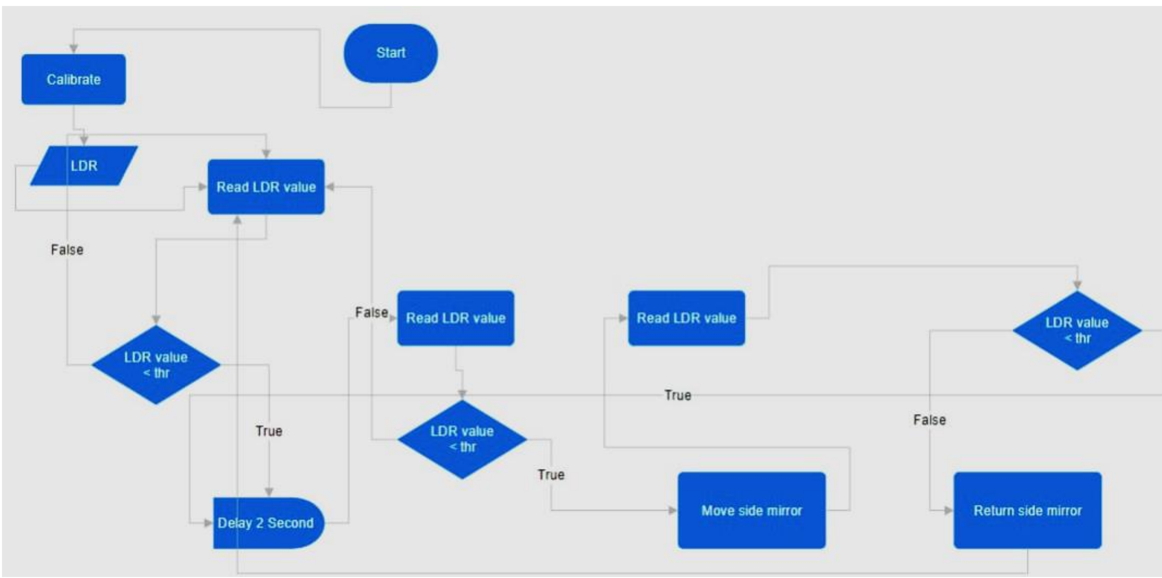


Figure 3. 2. Program flow chart

3.6.4. Simulation and Prototype construction

Simulation is done for the design of anti-glaring system for high beam reflection on side view mirrors and rear view mirrors during night driving system using simulating software. After demonstrating the system by simulation the final job will constructing the prototype for understanding the design and the purpose in addition to that to demonstrate how it works and how it can help to avoid the glaring problem and help to improve the driver's visibility.

3.6.5 Process Description

In the project, the light dependent resistor LDR sensor which is located on the mirror senses the head light and according to the light that strikes, it generates a voltage signal which is directly proportional to the light intensity. The LDR senses the high beam from the following vehicle and send signal to the micro controller, based on the signal that comes from the LDR, the micro controller analyses the data and dictate the side view mirror and rear view mirror to deviate or turn its direction in order that can avoid the glaring reflection.

When the following vehicles headlight moves on or goes away or changes its high beam into low beam (the high beam that is striking the light dependent resistor LDR goes away) the LDR signals to the micro controller that the high beam goes away then the micro controller dictate the side view mirror or the rear view mirror to go back to the normal position (driver’s pre settled position).

3.6.6. A Procedure and work flow for side view mirror

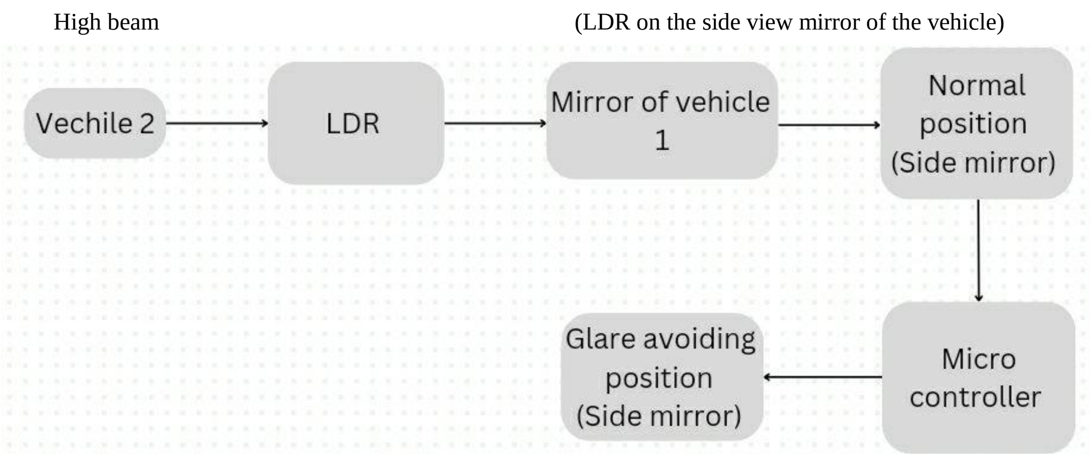


Figure 3.3. Block diagram of the design of anti-glaring system (side view mirror)

3.6.6. b Procedure and work flow for the rear-view mirror

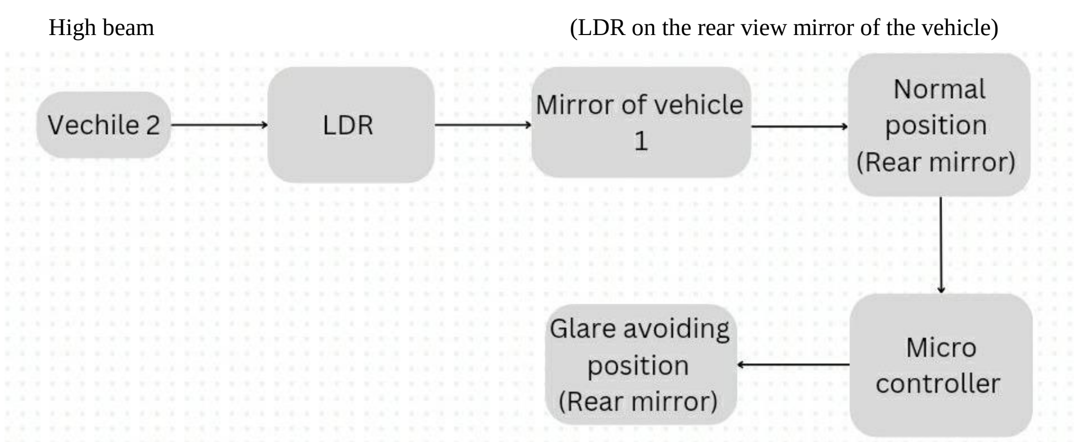


Figure 3.4. Block diagram of the design of anti-glaring system (rear view mirror)

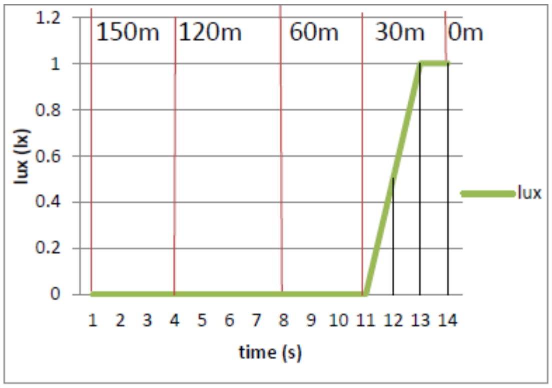
Design of Anti glaring system for the rear and side view mirror during night driving

High beam headlights typically have a higher lux value compared to low beam headlights. The lux value for high beam headlights can range from around 30,000 lux to 100,000 lux or even higher, depending on the type of headlight, its wattage, and the distance at which the measurement is taken. High beam headlights are designed to provide intense illumination over a longer distance, resulting in a higher lux value compared to low beams. Low beam headlights have a lower lux value compared to high beams. The lux value for low beam headlights can vary widely, but it generally ranges from around 1,000 lux to 4,000 lux or more, depending on the specific headlight model and the distance at which the measurement is taken. Low beam headlights are designed to provide a more focused and less intense light pattern to illuminate the immediate area in front of the vehicle without blinding other drivers.

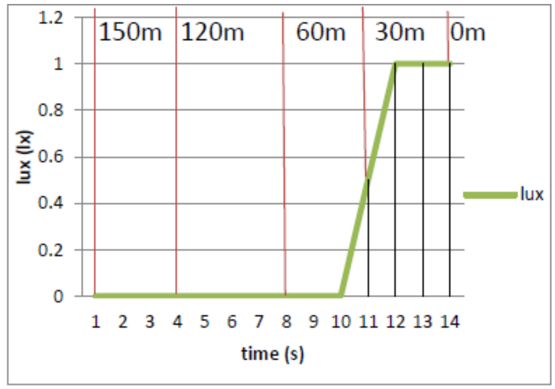
It's important to note that the lux values mentioned above are approximate and can vary based on the specific make and model of the vehicle, the type of headlight bulbs or units used, as well as environmental conditions and the distance at which the lux measurements are taken.

In summary, high beam headlights typically produce a higher lux value due to their intense and long-distance illumination, while low beam headlights have a lower lux value as they are focused on providing adequate visibility for driving in urban or populated areas without causing glare to other road users.

The low beam headlight registered different values due to the different patterns of light distribution. This was due to the low beam being designed with its headlamp and bulb type producing low light. The findings also found the average lux value for the low beam at the distance of 0m, 30m, 60m, 120m, and 150m to be 1.0, 0, 0, 0, and 0 for Proton Prevé; while the Perodua Myvi had 1.0, 0.5, 0, 0, and 0. Lux increased along with the distance as shown figure below. (Prasetijo et al., 2018)



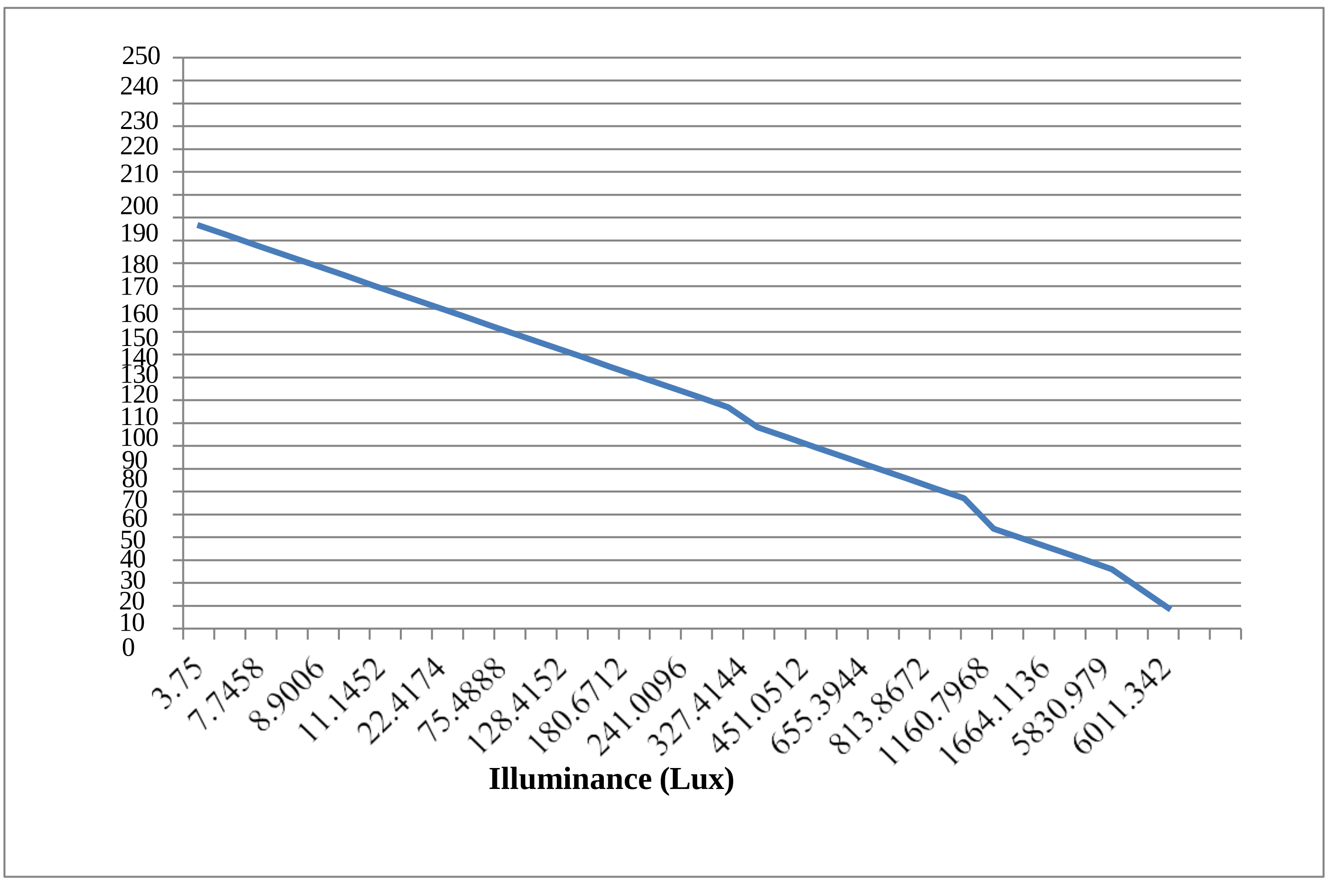
(a)



(b)

Figures 3.5. lux vs time

Illuminance (Lux) Vs Distance (m)



Figures 3.6. Lux vs distance

Figure above shows that the relationship between distance and Illuminance intensity of vehicle light. Low illumination intensity indicates that the vehicle headlight is located at a longer distance. When the vehicle approach and the distance getting relatively shorter, the vehicle light intensity becomes very high. From the above figure vehicle at 200 meter, it releases about 3.75 lux, and when the distance becomes shorter, the value of the vehicle's light intensity will be about 6011.342 lux.

Vehicle Light Lumen vs. LDR Resistance

LDR changes its resistance according to the light which falls on it from the opposite vehicle or car. The relation between the intensity of light and resistance of LDR is:

$$RL = \frac{500}{LUX}$$

If we take halogen 9005 HB3 Halogen Car Headlight Bulb which is commonly used in automobile headlight, the high beam and low beam settings in halogen HB3 bulbs might vary. Approximately the lumen output for low beams is generally lower than high beams and can range from 700 to 1,000 lumens. While high beams are designed to illuminate long distances and typically have higher lumen output. While the exact value can vary, high beams can range from 1,200 to 1,600 lumens or more.

Lux is a measure of illumination that takes into account the area over which the light is spread. It can be defined as one lumen per square meter.

Using these bulbs and explain it in terms of lux, with specified distance and beam width and other constraints, The lux values for low beams are lower than for high beams and are more spread out. They might be in the range of 1,000 to 3,000 lux at a specified distance in front of the vehicle. Whereas the high beam has greater values, they have a higher lux value at the center of the beam, often exceeding 15,000 lux at a specified distance directly in front of the vehicle.

So from the above formula,

$$R_L = \frac{500}{LUX}$$

If we see the values of the R_{LDR} for for longer distance of around 200m, R_{LDR} 500/3.75 lux which becomes 133.3 Ω, while if we check for the shorter distance of 10m and high beam, 500/6,011 lux which becomes 0.08 Ω. This shows the inverse relationship between vehicle luminous intensity and the light dependent resistors resistance.

Light Dependent Resistor and Voltage Output Analysis

The photoresist is a highly light-sensitive device most often used to indicate the presence or absence of light or to measure the light intensity. It acts like a variable resistor. To calculate the voltage across the light dependent resister LDR, we have to use voltage divider network. Therefore the amount of voltage drop across the series resistor, R_V is determined by the resistive value of the light-dependent resistor, R_{LDR}. This ability to generate different voltages produces a very handy circuit called a "Potential Divider".

The current through a series circuit is common and as the LDR changes its resistive value due to the light intensity, the voltage present at V_{out} will be determined by the voltage divider formula. An LDR's resistance, R_{LDR} can vary from about 100Ω in the sunlight to over 10MΩ in absolute darkness with this variation of resistance being converted into a voltage variation at V_{OUT}.

Voltage Divider Network

From the above calculation, we see that the values of the RLDR for for longer distance of around 200m, RLDR 500/3.75 lux which becomes 133.3 Ω, while if we check for the shorter distance of 10m and high beam, 500/6,011 lux which becomes 0.08 Ω.

$$V_{out} = V_{in} * R_V / (R_{LDR} + R_V)$$

By using the above equation, one can calculate the values of voltage across the LDR. Therefore in distance of 200m, with light intensity of 3.75 lux, the resistance becomes 133.3 Ω so when we calculate for V_{out} = 5.14V, while when we check for the high beam light intensity of 6,011.34 lux, we have 0.08 Ω, accordingly the V_{out} for the high beam at a distance of 10m will be 11.99 V.

As we can see from the above calculation, when the light source is far away, having bigger values of resistance on the other case, the resistance suddenly drops as the light source gets nearer. In addition to that we understand when the resistance of LDR is very high, the voltage output will be low which input for the micro controller. Since the aurdino gets initial feedback from the LDR.

Simulation of the design

The researcher simulates the project by using software. First we give the declare code and try to simulate the newly uploaded program. The simulation is demonstrated by two ways one shows simply the graph while the other simulation shows by using LED light.

Fig 3.7: Simulation of the design by using graph

The simulation shows when the light intensity changes or increase or decrease, as shown in the above graph, when there is no light (darker surrounding) the line lies down relatively. When the light intensity increases the value suddenly peaks up and has larger value.

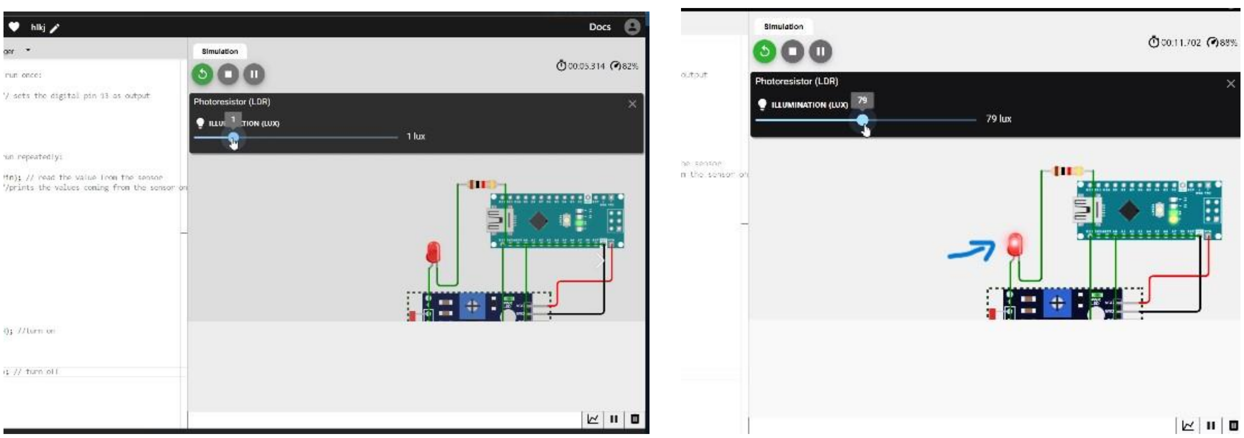
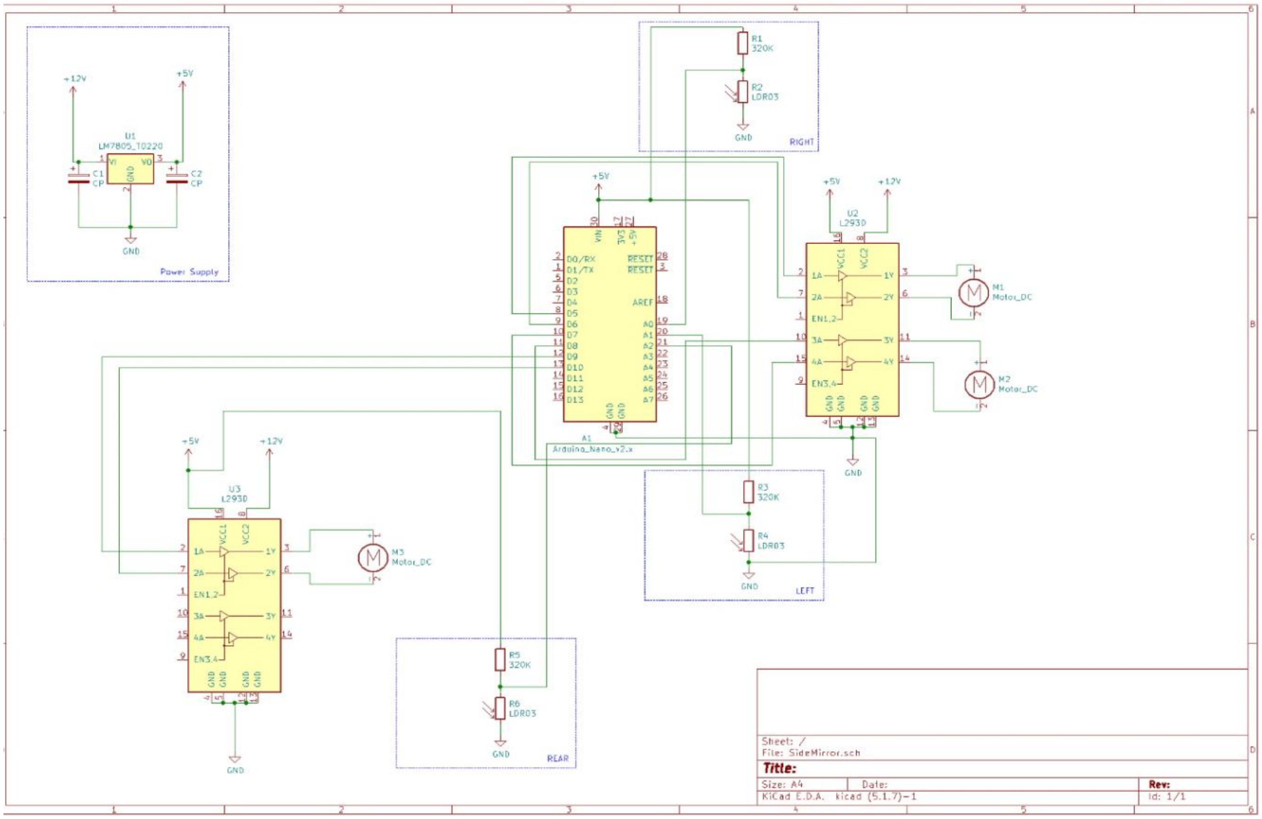


Figure 3.8: Simulation by using LED light

In the simulation, there are Auridino and light emitting diode with resistor in the circuit. As shown in the picture on left hand side shows that the illumination is smaller, meaning there is lower light intensity. So the LED light does not illuminate. As the light intensity increases and gets in to the threshold value, the LED light starts to illuminate. The right hand side picture clearly shows the LED in the simulation light up.



Figures 3.9. Design of anti-glaring system for high beam reflection on side view mirrors and rear-view mirrors during night driving

The design of anti-glaring system for side and rear-view mirror works on the basics of a micro-controller, sensor and a motor which is inside the side view mirror and newly added DC motor for the rear view mirror. When a vehicle from behind strike the LDR which is located at the base of the side mirror the LDR induces an output voltage which is inversely related with the light intensity that strikes it. When the following vehicle with a light intensity which is measured to be less than 6000 lux with a distance of around 10m, the LDR will have 0.08 Ohm resistance, correspondingly 11.9 V output voltages. This value is taken as a threshold value for the light to be dangerous or not. So when a light intensity of more than 6011 strikes, the resulting resistance drop will put the induced voltage to get higher than 11.9 V. since the LDR is connected with the auridino Nano which operates the side and rear view motors to let the mirror avoid the high beam without affecting or restricting the drivers field of view in a way that causes a danger.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1. Characteristics of Respondents

A total of 384 questionnaires were distributed and collected from May, 2023 to August, 2023. From 384 total samples, 384 questionnaires were distributed to vehicle driver profiles are tabulated. During the data collection, from the total of 384 drivers who responded, 312 were males which covers (81.2%) of the 100%, while the 72were females which stands for (18.8%) of the total 100%. When observed, it is obvious that males have way more numbers than females since public transport, going outside city, driving at night and heavy duty driving environment is not more suitable for females.

When we observe the age of the drivers having 35.9% of the total respondent are from 31-40 years old, secondly 32%of the respondents with 41-50 year sold respondents. The rest are 20.6% with age 20-30 and 11.5% with age 51-60 respondents.

4.2 Demographic Characteristics of Respondents

Table 4.1. Demographic characteristics of the respondent

Demographic	Item	Frequency	Present (%)
Gender of driver	Male	312	81.2%
	Female	72	18.8%
	Total	**384**	**100%**
Age of driver	20-30	79	20.6%
	31-40	138	35.9%
	41-50	123	32%
	51-60	44	11.5%
	Total	**384**	**100%**

According to the data there are different types of vehicles under which respondents drive from the total, 30.7 % means 118 of the 384 were driving personal vehicle, 25.3 % meaning about 97 of the 384 were heavy duty drivers while the 44% were public transport drivers having a number of 169 from the total of 384 respondents.

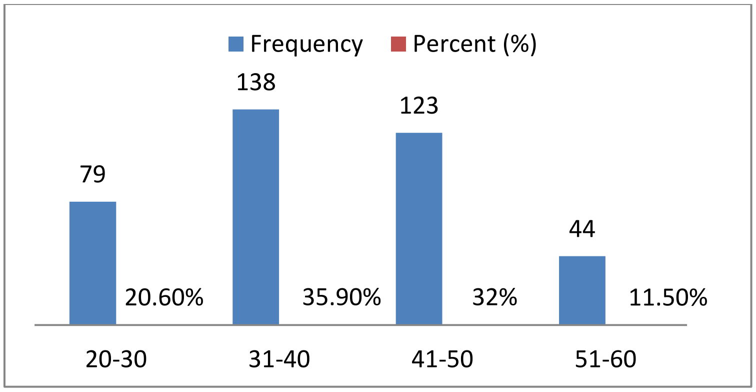


Figure 4.1. Driver Categories

When we see how many years the respondents have been driving, there are about 71 respondents which looks junior having limited experience of less than two years which accounts for 18.5 % of the total on the other hand majority of the drivers were 3-5 year of driving experience which have a percentage of 47.4% while there are around 26% of respondents who have 6-10 years driving experience. In addition to that there are 31 respondents who have a rich 11-20 years of experience which accounts for 8.1 % percentage from the total respondents.

Daily kilo meter coverage and driving areas

From the figure below we can understand that more than half of the respondents drive in the city and outside of the city, in this context city referring to Addis Ababa, if we can express it in terms of figure there are 206 drivers which accounts for 53.6% who drive in and outside of the city, where there are 36 which have 9.4 % from the total who drive only outside the city, the remaining are who only drives at city having 37% from the total counted 142 respondents.

When we go to the daily driving range which is measured in daily covered kilometres, there are 36.2% of the respondents which covers 51-100 km per day, where as 21% which cover 100-150 km per day, the remaining are 16% with 151-300 daily km coverage. Lastly there are around 10% who covers more than 300 km per day.

Table 4.2. Daily kilo meter coverage

Daily kilo meter coverage	No of respondents	Percent (%)
20-50	63	16.4
51-100	139	36.2
100-150	81	21.1
151-300	62	16.1
>300	39	10.2
Total	**384**	**100**

Table 4.3. Driving area

Driving area	No of respondents	Percent (%)
In the city	142	37
Outside the city	36	9.4
both in the city and outside the city	206	53.6
Total	**384**	**100**

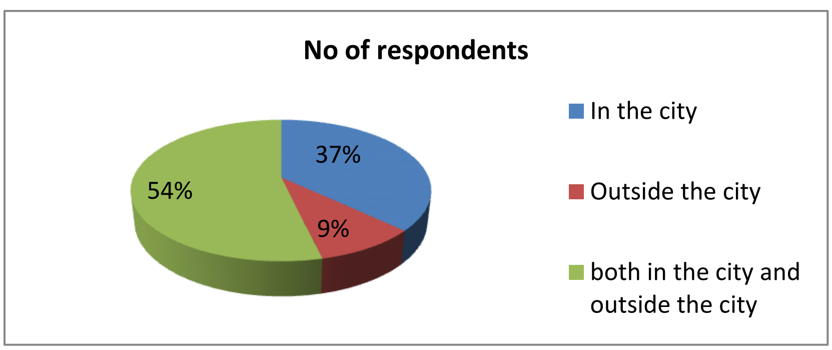


Figure 4.2. No of respondents

Night Driving and Glaring

These constraints shows the extent into which the respondents being affected by night time high beam glaring and their respective time that show how much time do the drivers drive at night time. From the survey it is observed that almost all drivers drive at night, proceeding to check for the time the drivers drive at night, around 53% percentage of the total respondents drive from 1-3 hours, others around 43.2% drive for 4-6 hours.

Table 4.4. Night Driving and Glaring

When driving at night, does the headlight (high beam) from other vehicles coming in front impair your vision?	No of respondents	Percent (%)
Yes	320	83.3
No	64	16.7
Total	384	100

Once the researcher surveyed the driving time at night, next was to check whether the glaring problem from the oncoming vehicles or from the following vehicles. From the data it is shown that almost 84% of the respondent answered that high beam from oncoming vehicles impairs their vision and affects their driving visibility. This gives a great hint and already been proven by many researchers that during night time one of the main problem is glaring problem which happens when oncoming vehicles come with high beam, restrict or even disables the driver coming on the opposite direction. Recently even in our country, Ethiopia, also have a clear direction and legislations that restricts and fines vehicles that drive with their light on high beam and impair other vehicles coming to their way.

Table 4.5. Effects of high beam in night

When driving at night, does the headlight (high beam) from other vehicles coming in front impair your vision? If yes, then put your answer on degree?	No of respondents	Percent (%)
it has high impact	156	40.6
it has mild impact	124	32.3
it has low impact	85	22.1
it has no impact	19	4.9
Total	384	100%

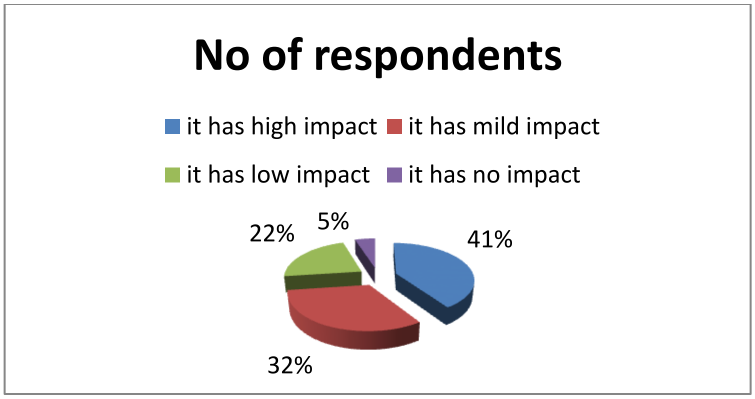


Figure 4. 3. No of respondent

Our main concern in this research was to check that whether high beam reflection from following vehicles striking the vehicles rear view mirror and side mirror affects the driver's visibility. When we see, the results tell that the above discussed glaring problem affects the driver visibilities. Even if this type of glaring problem is not as common as glaring from oncoming vehicles, it still affects drivers with a serious glaring problem that might lead to an accident.

As discussed above high beam that comes from following vehicles and striking the side mirror of one's vehicle is the first we checked, from the results we observe that the high beam glare from the headlights of the vehicles behind (following vehicles) reflect on the side view mirror of the car and disturbs the driver visibility, even disables the drivers visibility. 19% of the respondent votes for this type of reflection affect their driving visibility with high impact. While 45% votes as mild impact will be there that it affects their driving visibility with a medium impact. Others accounting for 13% choose that such type of glaring reflection on side mirror only causes low impact. From the above result we see that glaring due to reflection on side mirror is still there, causing a serious impact on driver's visibility.

Table 4.6. High beam glare from the headlights

Does the high beam glare from the headlights of the following vehicles reflect on the side view mirror of the car and disturb vision? If your answer is yes, then put your answer on degree?	No of respondents	Percent (%)
it has high impact	73	19
it has mild impact	173	45.1
it has low impact	89	23.2
it has no impact	49	12.8
Total	384	100%

The second case was to check whether the high beam glare from the headlights of the vehicles behind (following vehicle) reflect on the rear view mirror of the car and affects the driver visibility. A result from the data also shows that this type of glaring reflection has an impact which cannot be ignored. Around 18% of the respondents vote it has a high impact on impairing driver's visibility, other 31.3% calls for mild impact with disturbing the vision. The rest 42% has voted that it might affect their visibility but with minimal effector impact. Only 13% of the respondents which might be assumed to be heavy duty and public bus drivers can ignore such glaring due to their vehicles height. Special attention to be given to glaring reflection due to reflection on rear view mirror since it happens only on personal vehicles or vehicles which has smaller size like automobile, pickup, mini vans and so on. But not on heavy duty trucks, buses, and vehicle with bigger height. So the impact of this type of reflection is higher only for personal vehicles, but with having greater no of automobiles in our country, it should be taken seriously.

Table 4.7. head lights and mirrors

Does the high beam glare from the headlights of the following vehicles reflect on the rear-view mirror of the car and disturb vision? If your answer is yes, then put your answer on degree?	No of respondents	Percent (%)
it has high impact	70	18.2
it has mild impact	120	31.3
it has low impact	162	42.2
it has no impact	32	8.3
Total	384	100%

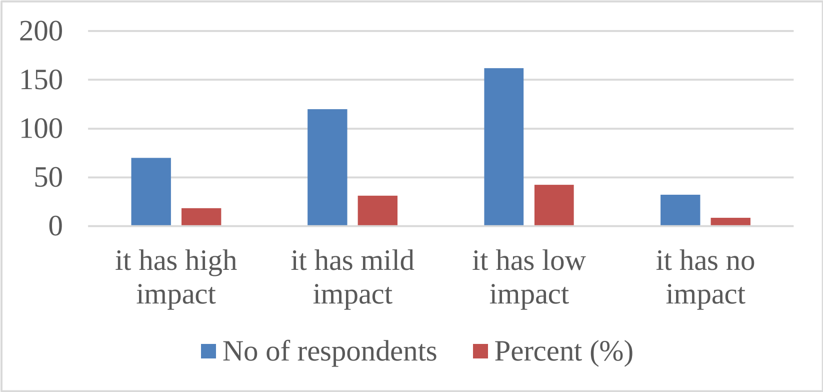


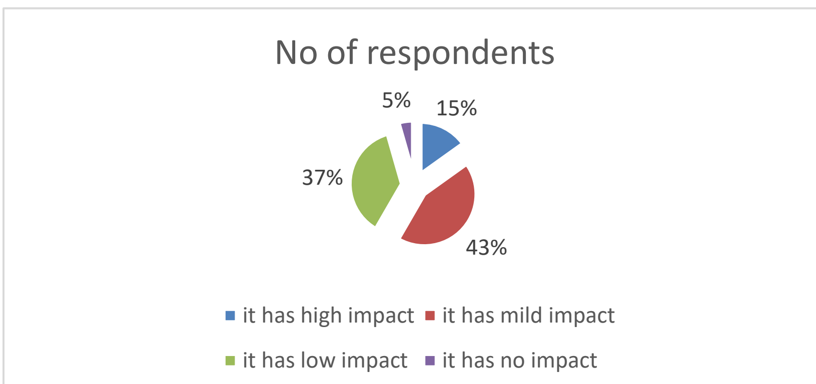
Figure 4.4 Glaring reflection in percentages

When summarizing the above questions which discuss about glaring reflection from following vehicles on the vehicle's side view mirror and rear view mirror hinder the driver's vision and ability to monitor the scene in front of the vehicle and also the overall driving performance is the last constraint to check how much this research is necessary.

The result shows that there are 15.1% respondents are who find these types of glaring reflection to be having high impact in disturbing and disabling their visibility, other respondents who account about 43% from the total answered that these glaring reflections on side view mirror and rear view mirror causes a mild problem or impact by obstructing and disturbing the drivers visibility. From such results, one can understand that almost half of the respondents believes that these glaring reflection lights obstruct the driver causing a serious danger in the life of the driver, passenger and any also pedestrian. On the other hand around 37% of the respondents votes that the glaring reflection on side and rear view mirror of a vehicle have minimal effect in affecting, and distracting the driver's visibility. In general, we can conclude that these reflections on side and rear-view mirror cause a serious danger on the drivers visibility and safety which might be a cause of an accident.

Table 4.8. Light reflection on the side view mirror and rear-view mirror

When driving at night, does the light reflection on the side view mirror and rear-view mirror hinder driver's vision, ability to monitor the scene in front of the vehicle and the overall driving performance? If your answer is yes for the previous question	No of respondents	Percent (%)
it has high impact	58	15.1
it has mild impact	166	43.2
it has low impact	143	37.2
it has no impact	17	4.4
Total	384	100.0



Figures 4.5 Light reflection in percentage

Generally, the above discussed responses and summarized data shows that these glaring problems do exist and also at which extent this problem prevails through our roads. Though enough attention has not been given to avoid such glaring problem and to enhance driver's visibility and safety, problems or accidents due to such glaring problems have happened. What Numbers are telling us might not show us the exact extent how these problems are affecting the drivers safety and visibility. Respondents have also shared if there is a problem or accident they have encountered due to glaring reflection caused by following vehicles high which reflects on one's side and rear view mirror. From the total of 384 respondents, almost 50 respondents who have 13 % from the total respondent have encountered such problems or accidents due to glaring reflection and related issues.

Table 4.9. Accident data

Have you had any accidents (problems/impairments) due to light reflection on the side mirror and rear-view mirror listed above?	No of respondents	Percent (%)
Yes	49	12.8
No	335	87.2
Total	**384**	**100%**

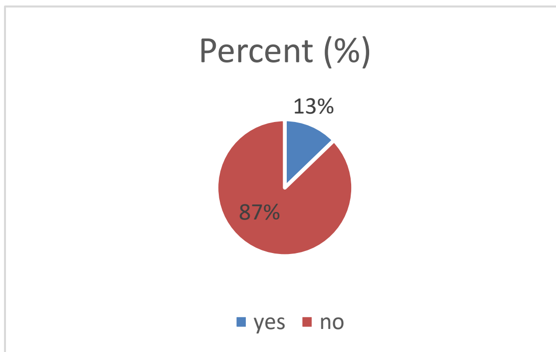


Figure 4.6 Accident percentages

DRIVERS ACTION TO COUNTER GLARING

Drivers encounter glaring problems day by day. These glaring problems cause accidents or at least exposed an eye injury which might come from the continuous exposure to the high beam coming from oncoming vehicles or following. Driver instantly or deliberately takes some acts to stop the glaring high beams from striking their eyes by acting different ways. Especially concerning on the glaring which come from the following vehicles, respondents try to explain some of the ways to encounter these high beams. Some of the respondents try to slow their speed or even stop and let these following vehicles to pass, while some other drivers give signs by their hand to signal the following vehicle to lower the high beam, other drivers try to fold and unfold the side mirror trying the following vehicles high beam reflected back to the side mirror got back to the following vehicles driver, other simply change their lanes. Generally when we try to see these responses from the respondents, many of the drivers try to avoid these high beams by the above discussed ways.

Characteristics of Vehicle Head Light Reflection on Side Mirror

Vehicle head light has its own characteristics and types and also the automobile side mirrors have their own characteristics. When dealing with the high beams reflecting on one's side mirror different cases should be considered. The angle depends on the specific height difference between the two vehicles, the distance between them, the exact angle of the headlights, the curvature of the side mirror, and the precise positioning of the driver's eyes. Headlights aren't single points of light: They emit a cone of light, meaning multiple rays can hit the mirror from slightly different angles.

Especially In practical terms the angle is likely to be quite shallow: Since the head light comes from behind, bounce off the mirror, and then reach to the driver's eyes, the angle of incidence and reflection will be small. The other one is the perceived brightness is more important than the exact angle. Even a shallow angle can cause significant glare if the headlights are powerful. Angling a side mirror slightly downward can deflect the most intense part of the reflected light away from your eyes.

The other cases, it is important to consider how the glaring comes and how it is reflected on side view mirror and strikes the drivers eye. When trying to focus on which portion of the area of the side mirror does these high beam reflections comes and glares the drivers, in more cases, the high beams from the following vehicle strikes the outermost portion of the side mirror. This is because the light is coming from behind and slightly to the side. Reflection Point: Due to the convex shape of most side mirrors, the high beams are then reflected inward and slightly upward due to the height difference between the side mirror and head light considering vehicle with same height. The exact angle of reflection depends on the mirror's curvature and the vehicles positioning.

Drivers' physique and drivers positioning

The other constraint to consider is driver's eye in which the reflected light is most likely to strike the driver's eye when it hits the inner lower portion of the side mirror. This area is closest to the driver's line of sight when looking ahead.

Taller drivers sit higher, potentially raising their eye level above the point where most of the reflected glare is directed. They might experience less glares. On the other hand shorter drivers sit lower, putting their eyes closer to the path of reflected glare. They are more likely to be directly affected. Different seating Position also may affect drivers exposure to glaring. Driver who normally seat distant from Mirror are less likely to have the reflected glare hit their eyes directly while leaning forward brings the driver's eyes closer to the mirror, increasing the chance of experiencing glare. More surprisingly even a slight head tilt /*head position*/ can also change the angle at which glare enters the eyes. Inherent factors like Eye Sensitivity in which some drivers are naturally more sensitive to glare than others. Or even wearing glasses or contacts can sometimes influence how glare is perceived and focused on the eye.

Mirror types and adjustments

Mirror Adjustment: Angling the side mirror slightly downwards can shift the reflection point further down, minimizing the chance of it hitting the driver's eye directly.

Mirror Convex Shape: The convex shape of the mirror helps provide a wider field of view but also makes it more susceptible to glare as it reflects light from a broader range of angles.

Other significant factors are *driver's physique* like *driver's height*, *Drivers seating positions*, and *head tilt* and eye levels can all influence where the reflected glare ultimately lands.

When trying to summarize it is important to consider all the above discussed factors when discussing about glaring which comes from behind.

Vehicles luminous intensity

The lux meter, also known as a light meter, is a device used to measure the illuminance level in lux. Lux is the SI unit of illuminance, which measures the amount of light falling on a surface. When comparing the lux values of high beam and low beam headlights of a vehicle, the measurements can vary significantly based on the specific characteristics of the headlights and the distance at which the measurements are taken.

PROTOTYPE MODEL DEVELOPMENT

Components for designing the anti-glaring system for side and rear view mirror during night driving

To prepare the prototype of the design, a micro-controller, LDR sensor and a motor which is inside the side view mirror and newly added DC motor for the rear view mirror is needed.

Figure 4.7: Design of anti-glaring system on side and rear-view mirror

For the prototype wise only, the researcher uses a 9V Battery to supply power for the system, there is a variable resistor which is used to adjust the sensitivity of the light dependent resistor in accordance with the environment ambient light. When the sensitivity of the variable resistor increases, the LDR senses the lightest change in light sources. The more the sensitivity increases the more it senses the smaller changes in the surrounding light intensity.

Figure 4.8: Side mirror motor and LDR sensor

The light dependent resistor (LDR) is fixed just below the side mirror in the housing which is positioned to be stricken by the oncoming rays from following vehicles. The LDR is connected with the Auridino, constantly communicating the aurdino every two second for the changes in light intensity. When light source come and strikes it, constantly gives signal to the auridino and the auridino checks whether the light intensity is high enough to actuate the mirror and turn it into a direction which causes minimum glaring risk.

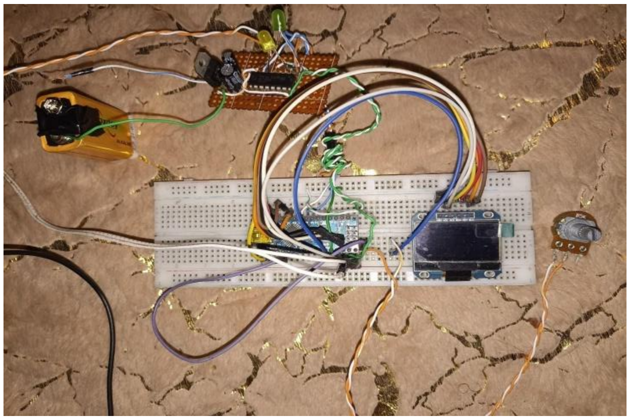


Figure 4.9 Electrical Circuit Auridino with display

First the system will be "ON" and automatically calibrates the side mirrors. This helps the auridino to understand and adjust the position of the side mirrors. Then the system will be waiting for the input from the LDR, as the LDR gets a significant amount of light like discussed above, the LDR gives signal to the auridino (micro-controller) that there is a high beam or strong light intensity.

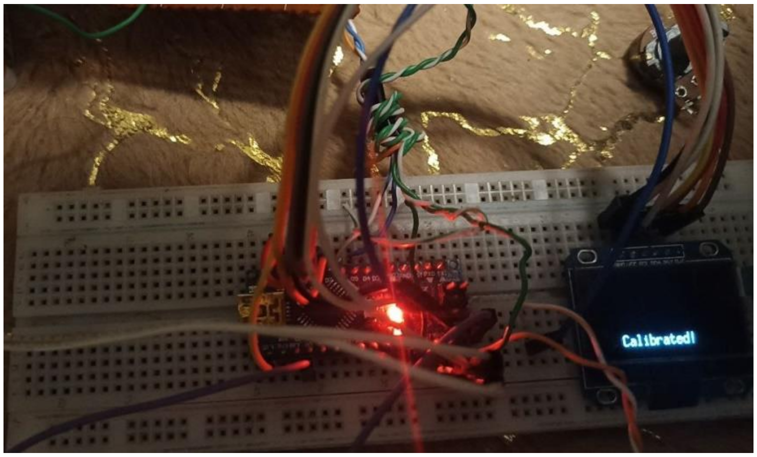


Figure 4.10: system starting and side mirror motor calibrating

The system checks the LDR input every two second waiting for input changes which refers change in the light sources meaning that the LDR senses light which is above the threshold value. The system has a two second delay to check whether the light just passes over or stays on striking the mirror.

Then the auridino checks the signal after two second if the light still persists or not. If the light still persists the auridino will be actuating the mirror. Then the system checks if the light source is no longer striking and when the light source passes over, the LDR voltage output will drop. As the LDR voltage drops, which means the high beam is no longer striking the mirror, the auridino will command the mirror motors to act in opposite direction to turn it into the original position.

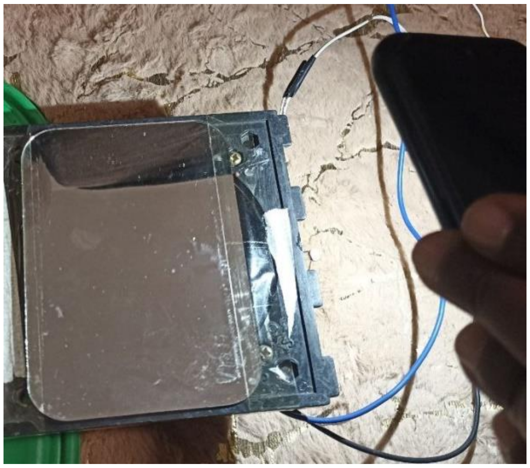


Figure 4.11: figure shows light source striking the LDR

When the horizontal (left to right moving) actuating motor actuates for nearly 1.5 second and stops, the mirror turns to the outer side of the vehicle. When the light source is no longer striking the mirror, the auridino commands the motor to go back to the calibrated position.

Figure 4.12 Driver motor with LED light

For further elaboration the researcher used LED light and display to show when system starts and calibrates and again when the mirror moves. To clearly show the movement and direction of the motor in the prototype, there are LED lights in addition to the LED display which help to see the direction of movement. There are also yellow and green LED lights which show the direction of the movement. The Yellow light shows the anti-glaring position movement in which mirror is turning to low risk glare position. While the green light shows the movement of the mirror in the direction of original mirror position.

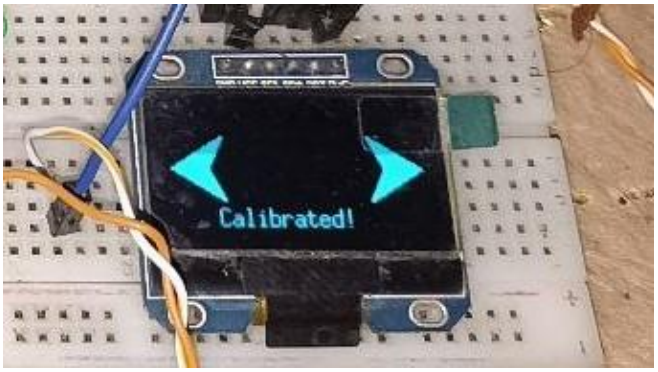


Fig 4.13: LED display showing the movement of the side mirror

The design of anti-glaring system for side and rear-view mirror during night driving can avoid the glaring problems which might be caused by unnecessary usage of high beam from the following vehicles on the road, especially light vehicles, which is a common participant in nighttime traffic incidents. The anti-glaring system for side and rear view mirror automatically detects the light intensity of following vehicle and the system will automatically deviate or turn the mirror in to a position where these coming headlight will be having the list chance of strikes the driver’s eye until the approaching vehicle passes. Once the system checks the high beam is no longer striking the mirror, will return the mirror to its initial/calibrated position checking if there is a high beam sustaining for more than 2 seconds.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1. Conclusion

The design of anti-glaring system for side and rear-view mirror during night driving designed in order to avoid glaring problem which can be caused by the excessive and unnecessary usage of high beam from following vehicles. This design avoids these high beam glaring problems by using a system which accompanies LDR, microcontroller and mirror motor. The LDR uses as a sensor and gives feedback whether there is a high beam which might cause glaring reflecting on side and rear view mirror. The micro controller uses the initial feedback from the LDR and command the mirror motor to deviate or turn the mirror into a position where the high beam might not cause glaring problem. Once the high beam is no longer striking, the mirror automatically turns to the previous position.

5.2. Recommendation

- In our country, there is no abiding law that regulates the intensity of lights in the vehicle, though there are some policies which are on the way to check the unnecessary usage of high beam light.
- Glaring problem which are caused due to reflection on side and rear view mirror from following vehicles high beam is not given enough attention and understanding. Many drivers in our country do not understand this type of problem may be the cause of serious accidents, does not see such problems as serious as it is. So briefing such kinds of glaring problems and there consequences should be done.
- Researchers who are interested in anti-glaring design on side and rear view mirrors can do further studies in modifying the system to have a better designs and better efficiency.

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Appendix

Questionaries

በአዳማሳይንስ እና ቴክኖሎጂ ዩኒቨርሲቲ

የሜካኒካል ሲስተምእና ቬህክል ኢንጂነሪንግ ትምህርት ክፍል

ለሁለተኛ ዲግሪ ማሟያ ጽሑፍ የተዘጋጀ ማጠይቅ

<u>የተከበራችሁ አሽከርካሪዎች</u>

አቤል አየለ እባላለሁ በአዳማሳይንስ እና ቴክኖሎጂ ዩኒቨርሲቲ የሜካኒካል ሲስተምእና ቬህክል ኢንጂነሪንግ ትምህርት ክፍል የሁለተኛ ዲግሪ ተማሪ ስሆን የመመረቂያ ጽሑፌን በተሽከርካሪዎች የጎን ማስታወት (ከተሽካርካሪው ጀርባ ያለውን ትዕይንት ለማየት የሚረዳ ማስታወት) ላይ ተንጸባርቆ የሚመጣ የሌላ ተሽከርካሪ የመብራት ጨረርን ሊያስወግድ ወይም ሊቀንስ የሚችል ሲስተም **DESIGN OF ANTI GLARING SYSTEM FOR HIGH BEAM REFLECTION ON REAR AND SIDE VIEW MIRRORS DURING NIGHT DRIVING/** በሚል ርዕስ እየሠራሁ የምገኝ ሲሆን ለጥናቱ ማካካት የእርስዎን ድጋፍ እና እገዛ እፈልጋለሁ፡ ፡

የዚህ ጥናት ዋና ዓላማበተሽከርካሪዎች የጎን ማስታወት (ከተሽካርካሪው ጀርባ እና በጎን በኩል ያለውን ትዕይንት ለማየት የሚረዳ ማስታወት) ተንጸባርቆ የሚመጣከጀርባ የሚገኝ የሌላ ተሽከርካሪ የግንባር መብራት ጨረር የሚያደርሰውን ጉዳት እና በአሽከርካሪዎች ላይ የሚያደርሰውን ተጽእኖ ማሳየትና በዚህ የግንባር መብራት ነጸብራቅ አማካኝነት በተሽከርካሪዎች ላይ የሚደርሱ አደጋዎች እንዳሉ ማስገንዘብ ነው፡ ፡ ለዚህ ማጠይቅ የምትሰጡት ምላሽ ለጥናቱ ውጤታማነት ከፍተኛ አስተዋጽኦ ያለውመሆኑን በማሰብ ማጠየቁን በቅንነት እና በሚካምፈቃደኝነት ምላሻችሁን እንድትሰጡእየጠቅሁ በዚህ ጥናት የተሠጡት ሚረጃዎች ለጥናቱ ዓላማ ብቻ የሚውሉ በመሆናቸው በተዓሚኒነት ሚልሳችሁን እንድትሰጡኝ እጠይቃለሁ፡ ፡ *የማላሾች ምሥጢራዊነት የተጠበቀ ነው፡*

ማንኛውምዓይነት ጥያቄ ወይምአስተያየት ካለዎት፡ -

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ስለሚያደርጉልኝ ሚልካምትብብር በቅድሚያ አማሰግናለሁ!!!

መጠይቅ፡ **በማሽከርከር ሞያ ላይ ለተሠማሩ**

ከዚህ መጠይቅ የሚገኘዉ መረጃ ለትምህረት ጥናት እና ምርምር የሚያገለግል ብቻ ሲሆን መልስዎትን ከአማራጮቹ ፊት ለፊት ባለዉ የሳጥን ምልክት ዉስጥ “ √ ” እና በተሰጠዉ ክፍት ቦታ ☐ ላይ እንዲያሰፍሩ በአክብሮት እጠይቃልሁ፡ ፡

ይህን መጠይቅ ለመሙላት ጊዜዎትን ስለሠጡኝ በቅድሚያ አመሰግናልሁ፡ ፡

1) ጾታ፡ ወንድ ☐ ሴት ☐

2) ዕድሜ፡ 1. 20 - 30 ☐ 2. 31 - 40 ☐ 3. 41 - 50 ☐ 4. 51-60 ☐

3) የምን አይነት ተሽከርካሪ ሾፌር ኖት?

1) የከባድ ጭነት ተሽከርካሪ ☐ 2) የቀላል ጭነት ተሽከርካሪ ☐

4) በአሽከርካሪነት ለምን ያህል ግዜ አገለገሉ? (በዓመት)

1. 1 – 3 ዓመት ☐ 2. 2-5 ☐ 3. 6-10 ☐ 4. 11-20 ☐ 5. 20 ዓመት በላይ ☐

5) የብዛት የሚያሽከረክሩበት ቦታ

1. በከተማዉስጥ ☐ 2. ከከተማዉጪ ☐ 3. በሁለቱምቦታ ☐

6) በቀን ምን ያህል ርቀት ያሽከረክራሉ? (በኪ.ሜ)

1. 20-50 ☐ 2. 51-100 ☐ 3. 100-150 ☐ 4. 151-200 ☐

5. 201-270 ☐ 6. ከ270 በላይ ☐

7. በምሽት/ ሌሊት ያሽከረክራሉ? 1. አዎ ☐ 2. አይደለም/አላሽከረክርም ☐

በጥያቄ ተራ ቁጥር 7 መልስዎ “አዎ” ከሆነ በቀን ለምን ያክል ሰዓት ያሽከረክራሉ? (በሰዓት)

1. 1-3 ሰዓት ☐ 2. 3-5 ☐ 3. 5-8 ☐ 4. 8 ሰዓት በላይ ☐

8. በሌሊት / በምሽት በሚያሽከረክሩበት ወቅት ከፊት ለፊትዎ ከሚመጡ ሌሎች ተሽከርካሪዎች የሚመጣ የግንባር መብራት (ረጅም መብራት) ብርሃን/ጨረር ለዕይታዎ እክል ይፈጥርብዎታል?

1. አዎ ☐ 2. አይደለም/እክል አይፈጥርብኝም ☐

መልስዎ አዎ ከሆነ የፈጠረብዎትን እክል በደረጃ ያስቀምጡ

ሀ. ከፍተኛ እክል ☐ ለ. መጠነኛ እክል ☐ ሐ. ዝቅተኛ እክል ☐ መ. ምንም እክል አልፈጠረብኝም ☐

8.1 በሌሊት /በምሽት በሚያሽከረክሩበት ወቅት ከጀርባዎ/ከኋላዎ ከሚንቀሳቀሱ ተሽከርካሪዎች የሚመጣ የግንባር መብራት (ረጅም) ነጸብራቅ እርስዎ በሚያሽከረክሩት መኪና የጎን ማሳታወት (ስፖኪዮ) ተንጸባርቆ ዕይታዎን ይረብሻል?

መልስዎ አዎ ከሆነ የፈጠረብዎትን እክል በደረጃ ያስቀምጡ

ሀ. ከፍተኛ እክል ☐ ለ. መጠነኛ እክል ☐ ሐ. ዝቅተኛ እክል ☐ መ. ምንም እክል አልፈጠረብኝም ☐

8.2 በሌሊት /በምሽት በሚያሽከረክሩበት ወቅት ከጀርባዎ/ከኋላዎ ከሚንቀሳቀሱ ተሽከርካሪዎች የሚመጣ የግንባር መብራት (ረጅም) ነጸብራቅ እርስዎ በሚያሽከረክሩት መኪና የውስጥ ማሳታወት (ከጀርባ ያለውን ትዕይንት የሚያሳይ ማሳታወት) ተንጸባርቆ ዕይታዎን ይረብሻል?

መልስዎ አዎ ከሆነ የፈጠረብዎትን እክል በደረጃ ያስቀምጡ

ሀ. ከፍተኛ እክል ☐ ለ. መጠነኛ እክል ☐ ሐ. ዝቅተኛ እክል ☐ መ. ምንም እክል አልፈጠረብኝም ☐

9. በሌሊት /በምሽት በሚያሽከረክሩበት ወቅት በጎን ማሳታወት(ስፖኪዮ) እና በውስጥ ማሳታወት (የውስጥ የኋላ ትዕይንት ማካታተያ ማሳታወት) ላይ በሚመጣ የመብራት ነጸብራቅ ምክንያት በዕይታዎ እንዲሁም በተሽከርካሪዎ ፊት ለፊት ያለውን ትዕይነት ለመከታተል እንዲሁምበአጠቃላይ በማሽከርከር ሥራዎ ላይ እንቅፋት ፈጥረብዎታል?

ሀ. ከፍተኛ እክል ☐ ለ. መጠነኛ እክል ☐ ሐ. ዝቅተኛ እክል ☐ መ. ምንም እክል አልፈጠረብኝም ☐

10. እነዚህን ከላይ የተዘረዘሩትን ችግሮች/ እክሎች ሲያጋጥምዎ በምን መንገድ ይቋቋሙታል/ምን በማድረግ ያስወግዱታል?

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11. በነዚህ ከላይ በተዘረዘሩት በጎን ማስታወት (ስፖኪዮ) እና በውስጥ ማስታወት (የውስጥ የኋላ ትዕይንት ማካታተያ ማስታወት) ላይ በሚመጣ የመብራት ነጸብራቅ ምክንያት ያጋጠምዎት / የደረሰብዎት አደጋ (ችግር/እክል) አለ?

ስለ ሜልካምትብብርዎ እጅግ አድርጌ አማሰግናለሁ!!!