Siliguri Institute of Technology

Department of Electrical Engineering

DESIGN OF AUTOMATIC DIPPER/DIMMER LIGHT CONTROLLER AND MEASUREMENT OF SAFETY DISTANCE AT THE TURNING POINT OF HILL AREA

A Project Report

Submitted by

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In partial fulfilment [illegible]

of

BACHELOR OF TECHNOLOGY

IN

ELECTRICAL ENGINEERING

SILIGURI INSTITUTE OF TECHNOLOGY

SILIGURI -734009

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY

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I would like to take this opportunity to express my gratitude to the group members. The project would not have been successful without your cooperation and inputs. I would also like to thank the supporting personnel who assisted me by supplying the equipment that was essential and vital, without which I would not have been able to perform efficiently on this project.

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BONAFIDE CERTIFICATE

Certified that this project on "Design of Automatic Dipper/Dimmer light controller and measurement of safety distance at the turning point of hill area" is the bonafide work of "DIVYA BRAHMA, SAYAN BHOWMICK, RAHUL BANIK, SRIJON GHOSH, SHUBHA SARKAR" working under my supervision.

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ABSTRACT

This report deals with design and making of automatic dipper/dimmer light controller and measurement of safety distance at the turning point of hill area. As the number of vehicles are increasing day by day, many vehicle manufactures are forced to think about the extra safety instruments and electronic controls to give the users a safety in all road conditions. One of the essential safety features that need to be installed is automatic upper-dipper control of headlight, this feature can mainly be used during night time or low light driving. Many a times, there arises a situation when suddenly a vehicle approaches from the front with headlight in upper mode which causes blindness/glare to the eyes of the driver. So, to overcome this manual dipping problem an automatic mechanism has been designed to dip the headlight automatically whenever such situation occurs. This can reduce number of accidents at night and foggy times and provide a comfortable driving. In this project, an automatic headlight dimmer which uses an Ultrasonic Sensor and An Arduino UNO has been designed to dim the headlight of on-coming vehicles to avoid human eye effects and measured safety distance for the vehicle. This automatically switched the high beam into low beam, therefore reducing the glare effect by sensing the light intensity value of approaching vehicle and eliminated the requirement of manual switching by the driver which was not always done.

Keywords:
Dipper/dimmer, Ultrasonic Sensor, Arduino UNO, Safety distance, Low beam, High beam, Glare

TABLE OF CONTENTS

Chapter: 1

Introduction

1.1. Background of project

As the number of vehicles are increasing day by day, many vehicle manufactures are forced to think about the extra safety instruments and electronic controls to give the users a safety and comfortable ride in all road conditions. High beam from the headlight causes a dangerous situation during night or low light driving. It causes a temporary blindness/glare for the drivers that may lead to collision or sometimes it may lead to accident. Hence there is a need to design and construct a prototype of this device that automatically dims the headlights for on-coming vehicles using an Ultrasonic Sensor and Arduino UNO that has been designed to dim the headlight of the vehicle when on-coming vehicles come to proximity and measures safety distance for the vehicle. This prototype automatically switches the high beam into low beam, therefore reducing the glare effect by sensing the light intensity value of approaching vehicle and eliminated the requirement of manual switching by the driver which was not always done.

1.2. Problem statement

The system helps the driver to focus the headlight on correct path as the steering turns on either direction on curve roads at night. Another serious problem for drivers during night is glare effect. When the person exposes to very bright light, experiences a blurred vision. To avoid the glare effect, the headlight changes from high beam to low beam and vice-versa.

1.3. Aims and objective of the project

The prototype has been designed to reduce the problem of manual dimming by dimming down the bright headlight of our vehicle to low beam automatically when it senses a vehicle at proximity approaching from the opposite direction. The entire working of the dimmer is a simple electronic circuitry arrangement which senses and switches the headlight according to the conditions required. To prevent dazzle to the oncoming driver during particularly misty or hazy conditions the light about the horizontal should be cut off, a dipped or meeting beam is also provided for maintaining the reasonable speed with safety without dazzling the coming driver. The main aim of this paper is to avoid accidents occurring at night due to improper lightening condition especially at the cornering of road and also to design and fabricate a simple steering controlled automatic headlight system, that is related to the arrangement of the headlight. There are two kinds of light sources, the one that emits light and the other that reflects light. The filament of the electric lamp is the primary source, while the reflector is referred to as the secondary source. The intensity, colour and distribution are the important characteristics of any light source.

Chapter: 2

2.1. Literature Survey

1. **Adaptive Headlight System for Accident Prevention Published in:** 2014 International Conference on Recent Trends in Information Technology Shreyas S, Kirthanaa Raghuraman, Padmavathy AP, S Arun Prasad, G. Devaradjane Madras Institute of Technology, Anna University Chennai, India 1.
   The work in this paper is focusing on the design and operation of a microcontroller-based Adaptive Headlight System (AHS) for automobiles is the subject of this study. The major goal of this system is to provide a cost estimate. When driving in the dark, this is an efficient strategy for illuminating blind spots. during the night and when visibility is obstructed order to make the objects visible in those dimly lit areas as a result, accidents are avoided. The concept of adaptive headlamps is not new in high end cars like Volvo, BMW, Audi etc. The components that are used to implement the adaptive headlight system are Microcontroller unit, DC Generator, Photo diode, Stepper motor etc. limitation is the maximum degree of turn achieved on the left headlamp is 37 degrees and on the right-hand side is 43 degrees.
2. **Intelligent Automatic High Beam Light Controller**
   Mohammed Alsumady and Shadi. A. Alboon Hijjawi Faculty for Engineering Technology, Electronics Engineering Department, Yarmouk University, Irbid, 21163, Jordan Published by license under the OCP Science imprint, a member of the Old City Publishing Group.
   The work in this paper focusing on an automatic high beam light controller is required to make night time driving safer and more friendly to other cars on the road. This study provides a simple, low-cost, and easy-to-implement method. Install and build an intelligent high beam light controller that turns on and off automatically. They are using simple LDR sensor, which is sense simple light intensity. The technology was developed and tested on a real car that was driven at night. The results of the experiments suggest that the system can detect incoming car lights from a distance of roughly 230 meters.
3. **Temporal Coherence Analysis for Intelligent Headlight Control**
   Antonio Lopez ′, Jorg Hilgenstock, Andreas Busses, Ramon Baldrich ′, Felipe Lumbreras, Joan Serrat. January 2008.
   The work in this paper focusing on, even when the traffic situation requires it, drivers use high lights sparingly at night. As a result, intelligent automatic regulation of vehicle headlights is critical. Because dazzling other drivers is prohibited. In this paper they are mostly studied on "Algorithm". The key problem in the application at hand is distinguishing between picture spots caused by vehicle lights and those caused by reflections in various structures.
4. **Automatic dipper light control for vehicles**
   Tejas Vijay Narkar, 2016.

To overcome manual dipping problem, an automatic mechanism has made to dip the headlight automatically whenever situation occurs. This can reduce number of accidents during night time and provide comfortable driving. Operating principle, working and design of PCB is briefly discussed in this paper.

5. **Automatic Headlight Dimmer Using Arduino and LDR Sensor**

B.Kalaimathia , Dr.M. Kasiselvanathanb , R. Swethac , R. Shobikad , S. Swethae, published in 2021.

The main objective of this paper is to design the prototype model of the Automatic headlight dimmer. While travelling during night times the head light of the upcoming vehicle hits the eyes of the driver from the opposite end. Sometimes this bright light from the opposite vehicle causes glare to the drivers and it leads to accident. The sudden glare which the driver experienced is called Troxler Effect. Many reports say that the accidents in roadways during night times are mainly caused by this Troxler Effect. In order to provide safety to the drivers and also for a comfortable travel this model is proposed. It can be achieved by using an LDR sensor. The LDR sensor which acts as a variable resistant that converts the high beam of the upcoming vehicle's headlight to low beam with the help of Arduino UNO and other components. This system will be a useful in the area of automobile and brings a new trend to ensure the safety of the drivers.

6. **Multi featured Automatic Headlight Switching System for Human Safety**

Mrs. A. Geetha, J. Pravin Balaji, M. Prakash Raj, V. Pravin Kumar. Assistant Professor, Department of Electronics and Communication Engineering, SSM Institute of Engineering and Technology, Dindigul UG Scholars, Department of Electronics and Communication Engineering, SSM Institute of Engineering and Technology.

The work in this paper focusing on Arduino Board, LDR and Ultrasonic Sensor. Based on the detection of On-Coming, the system intends to automatically manage a vehicle's beam condition (high beam or low beam) during nighttime driving. This project includes a reverse parking sensor, which detects when the car is approaching an object while in reverse mode and emits a sound from a specific distance. In this project there are some limitations which is When driving at night or in foggy conditions, motorists suffer a significant disadvantage due to the ray of light that falls straight upon their eyes. These phenomena have medicinal implications.

7. **Automatic Vehicle Headlight Management System to Prevent Accidents Due to Headlight Glare**

Lakshmi K, Nevetha R, Ilakkiya S N, Ganesan R. International Journal of Innovative Technology and Exploring Engineering (IJITEE), ISSN: 2278-3075, Volume-8 Issue-9, July 2019.

The work in this paper is based on headlight, vehicle, temporary blindness, LDR. During night driving, the high beam from the headlight creates a perilous condition. It causes momentary blindness in drivers, which can result in a collision or, in rare

cases, an accident. The information is supplied to the microcontroller when a high beam falls on the surface of LDR. The intensity of the microcontroller is compared.

2.2. Survey on accidents due to headlight glare

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. Some of the technologies that are used to control high beam of headlight are LDR based intensity control, Fuzzy logic-based intensity control, wireless sensor network method, IR transmitter-receiver method, and camera-based intensity control, pulse width modulation method. In this paper we used LDR based intensity control method. Almost 1,200 luminance of light intensity in case of high beam is more than enough to view the potential obstacles and also to react. But sometimes owners replace the headlight with about 2000-3000 luminance of intensity. This may lead to unavoidable crashes.

Chapter: 3

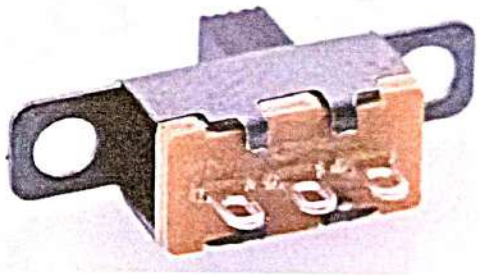
Design Procedure

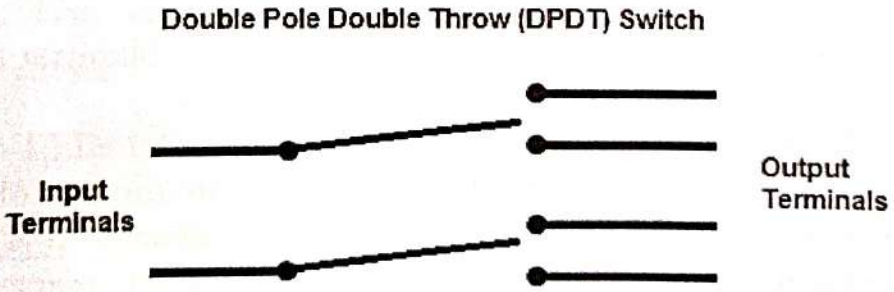
3.1. Circuit components

- DPDT Miniature Slide Switch
- 9V DC Battery
- BC547 NPN Transistor
- Arduino UNO R3
- Ultrasonic sensor
- 20K ohm, 1/4-Watt Resistor
- Breadboard
- 5mm LED
- Connecting Wires
- Glue Gun

3.2. Components description

1. **DPDT Miniature Slide Switch:** A slide switch is a mechanical switch that uses a sliding motion from the off to the on position. This allows control of a circuit's current flow without manually cutting the wire. Slide switches are mechanical switches using a slider that moves





(slides) from the open (off) position to the closed (on) position. They allow control over current flow in a circuit without having to manually cut or splice wire.

A Double Pole Double Throw (DPDT) switch is a switch that has 2 inputs and 4 outputs; each input has 2 corresponding outputs that it can connect to. Each of the terminals of a double pole double switch can either be in 1 of 2 positions. This makes the double pole double throw switch a very versatile switch. With 2 inputs, it can connect to 4 different outputs. It can reroute a circuit into 2 different modes of

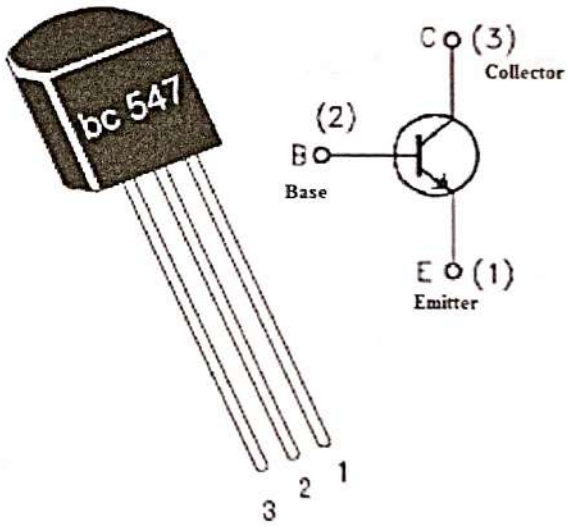
operation. A Double Pole Double Throw Switch is actually two single pole double throw (SPDT) switches.

2. **9V DC Battery:** This system utilizes 9V supply that is drawn straight from the battery of the car already present in each car. It offers steady DC supply and safe operation of the system vehicle battery Supply and no external elements are required.

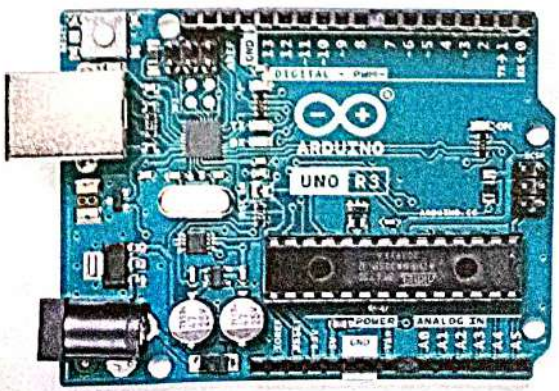
3. **BC547 NPN Transistor:** The BC547 transistor is an NPN transistor. A transistor is nothing but the transfer of resistance which is used for amplifying the current. A small current of the base terminal of this transistor will control the large current of emitter and base terminals. The main function of this transistor is to amplify as well as switching purposes. The maximum gain current of this transistor is 800A.

The BC547 transistor includes three pins which include the following:

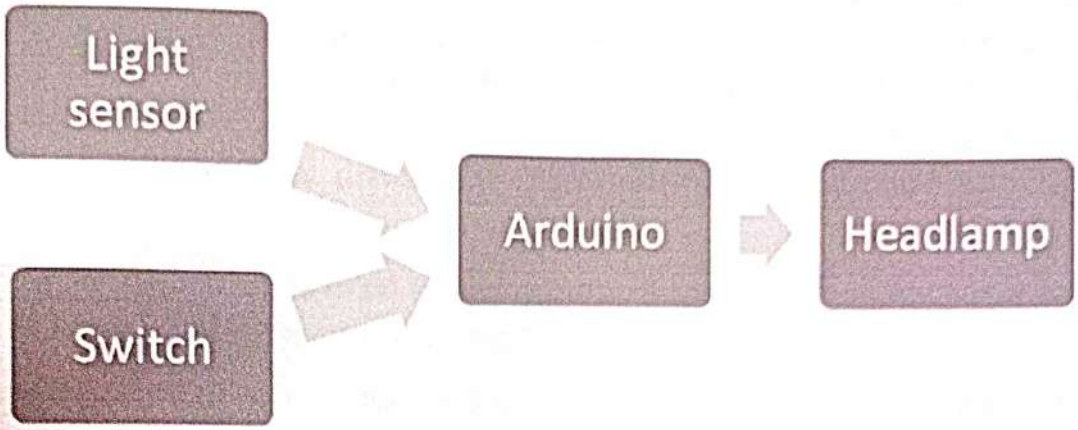
- Pin1 (Collector): This pin is denoted with symbol 'C' and the flow of current will be through the collector terminal.
- Pin2 (Base): This pin controls the transistor biasing.
- Pin3 (Emitter): The current supplies out through emitter terminal



4. **5mm LED:** 5mm LEDs take much less current to run than high brightness LEDs, 20mA compared to a minimum of 350mA for high-power LEDs.
5. **Arduino UNO R3:** Arduino UNO is a low-cost, flexible, and easy-to-use programmable open-source microcontroller board that can be integrated into a variety of electronic projects. This board can be interfaced with other Arduino boards, Arduino shields, Raspberry Pi boards and can control relays, LEDs, servos, and motors as an output. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the

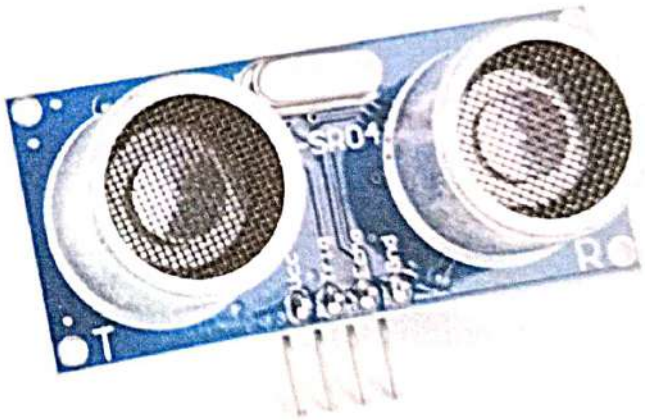


microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. It is programmed based on IDE, which

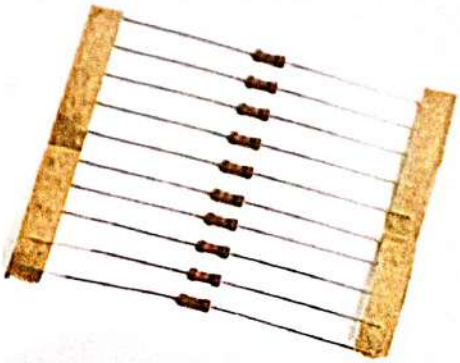


stands for Integrated Development Environment. It can run on both online and offline platforms. The IDE is common to all available boards of Arduino. The Arduino act as an intermediate, sitting between the headlight switch and the headlamp, having its own light sensor in order to decide on the output it should give. Here is a basic representation:

6. **Ultrasonic sensor:** An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound. Ultrasonic sensors mimic echolocation used by bats, transmitting high-frequency sound waves to gauge the distance between objects within close range. Ultrasonic sensors can be used to complement other vehicle sensors, including radar, cameras, and lidar, to get a full picture of the immediate surroundings of a vehicle. While ultrasonic sensors necessitate close proximity and slow speeds, advantages include the ability to be accurately used in situations with low visibility, such as in inclement weather conditions and dim areas.



7. **20K ohm, 1/4 Watt Resistor:** A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. Resistors can also be used to provide a specific voltage for an active device such as a transistor. Here we use the 20K ohm, 1/4 Watt Resistor with 1% tolerance. A resistor is a passive two-terminal electrical component that implements electrical

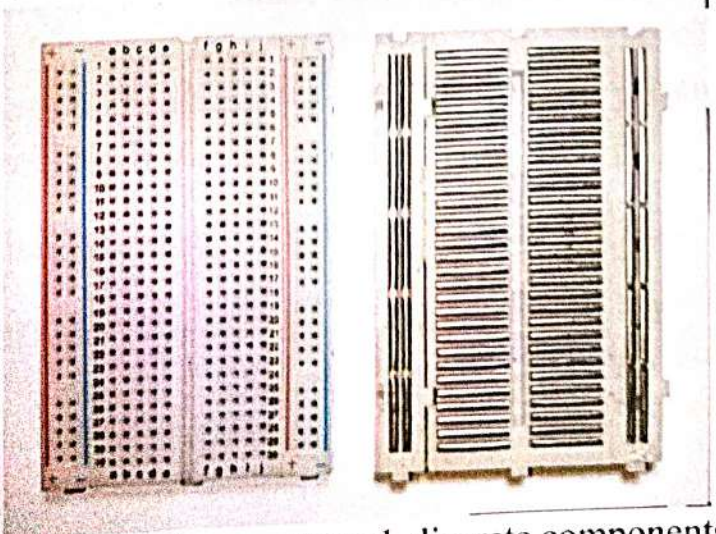


resistance as a circuit element. Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits. Resistors may have fixed resistances or variable resistances, such as those found in thermistors, varistors, trimmers, photoresistors and potentiometers. The current through a resistor is in direct proportion to the voltage across the resistor'sterminals. This relationship is represented by Ohm"s: where I is the current through the conductor in units of amperes, V is the potential difference measured across the conductor in units of volts, and R is the resistance of the conductor.

8. **Connecting Wires:** Wire is used to allow current to flow from one place to another. Most wires have insulation surrounding the metallic core.

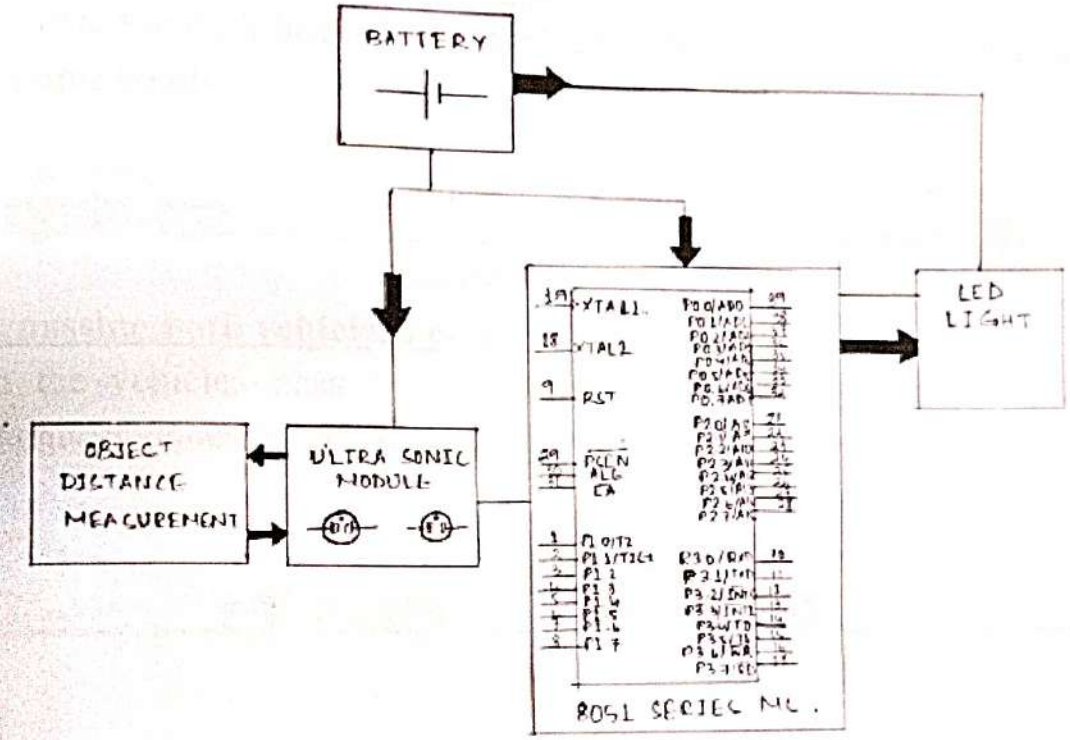
9. **Glue Gun:** The gun uses a continuous-duty heating element to melt the plastic glue, which the user pushes through the gun either with a mechanical trigger mechanism on the gun, or with direct finger pressure. The glue squeezed out of the heated nozzle is initially hot enough to burn and even blister skin.

10. **Breadboard:** A breadboard (sometimes called a plug block) is used for building temporary circuits. It is useful to designers because it allows components to be removed and replaced easily. It is useful to the person who wants to build a circuit to demonstrate its action, then to reuse the components in another circuit. A modern solderless breadboard socket consists of a perforated block of plastic with numerous tin-plated phosphor bronze or nickel silver alloy spring clips under the perforations. The clips are often called *tie points* or *contact points*. The number of tie points is often given in the specification of the breadboard. The spacing between the clips (lead pitch) is typically 0.1 inches (2.54 mm). Integrated circuits (ICs) in dual in-line packages (DIPs) can be inserted to straddle the centerline of the block. Interconnecting wires and the leads of discrete components (such as capacitors, resistors, and inductors) can be inserted into the remaining free holes



to complete the circuit. Where ICs are not used, discrete components and connecting wires may use any of the holes. Typically, the spring clips are rated for 1 ampere at 5 volts and 0.333 amperes at 15 volts (5 watts).

3.4. Circuit design

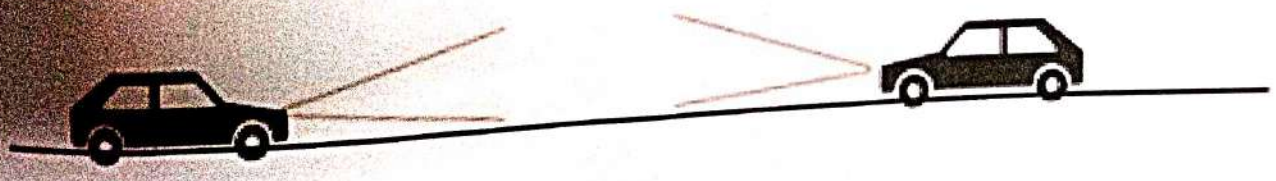


3.5. Circuit working

At first the Ultrasonic sensor senses the proximity of the oncoming vehicle and its headlights' intensity by emitting ultrasonic sound waves and converts the reflected sound into an electrical signal. Then the sensor sends the signal to the Arduino UNO which is a microcontroller programmed to measure the distance between an object coming from the opposite direction. Now when the front vehicle comes into a certain range, the Arduino UNO will send a signal to the LED to automatically dim the headlights of the vehicle. And when the oncoming vehicle passes the user vehicle the Arduino UNO sends a signal to the LED light to turn the low beam into high beam.

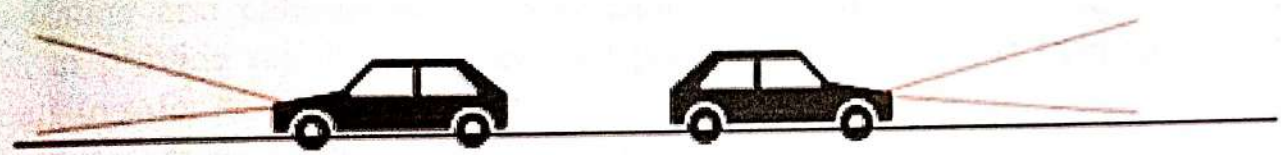
There are 3 states that describes the situation and its act:

1. **When both vehicles are at high beam:**
   In this state the vehicles approaching each other with high beam. Then the high beam and the distance between the two vehicles is detected by the ultrasonic sensor.



2. **When both vehicles are at low beam:**
In this state the high beam is detected using the sensor and then it switches to low beam immediately.

3. **After passing both vehicles become high beam:**
When the vehicles pass by and there's no oncoming high beam vehicle the headlights switches from low to high beam automatically.



3.6. Cost estimation

i. Jump wire- 45
ii. Arduino uno- 650
iii. Ultrasonic sensor-110
iv. White led- 2
v. Cable- 35
vi. 547- 20
vii. 22-ohm resistor-1
viii. Bread board-80

Chapter: 4

Tests and results

Connect the system to a vehicle's headlight circuit and test the dipper/dimmer functionality in various lighting conditions. Calibrate the system as needed to achieve optimal performance. During operation, the light sensor continuously measures the surrounding light intensity. The microcontroller reads this input and compares it to predefined thresholds. Based on the ambient light level, the microcontroller controls the relay or MOSFET to adjust the connection between the vehicle's headlight circuit and the power supply, thus regulating the headlight brightness. When the ambient light increases, indicating sufficient visibility, the controller restores the headlights to their normal brightness.

Through testing and calibration, the automatic dipper/dimmer light controller can be optimized to provide reliable and accurate performance in various lighting scenarios, contributing to safer driving experiences.

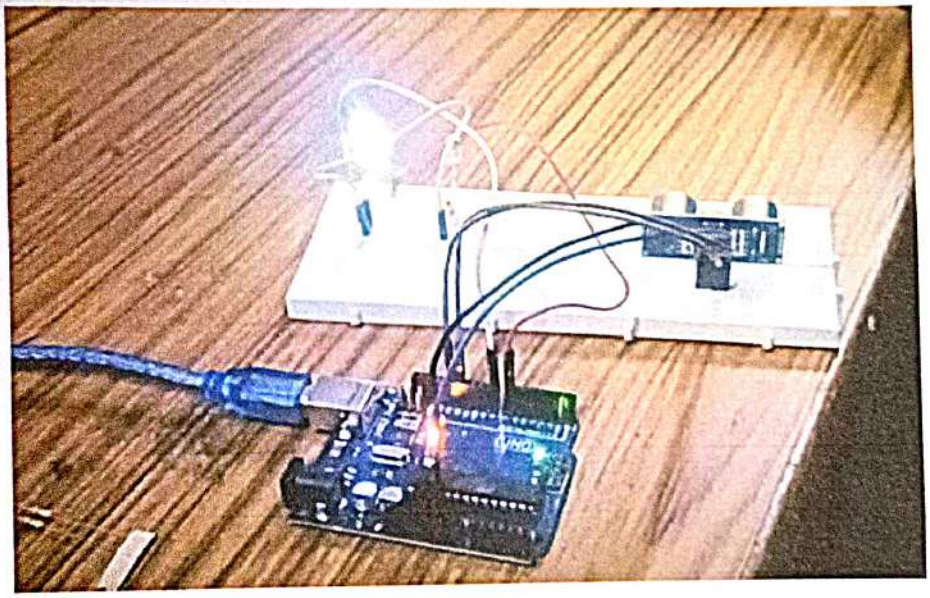


Fig: working of the project

4.1. Programming involved in arduino

```
const int trig = 12;
const int echo = 13;

const int LED1 = 8;
const int LED2 = 7;

int duration = 0;
int distance = 0;
```

```
void setup()
{
 pinMode(trig , OUTPUT);
 pinMode(echo , INPUT);

 pinMode(LED1 , OUTPUT);
 pinMode(LED2 , OUTPUT);

 Serial.begin(9600);

}

void loop()
{
 digitalWrite(trig , HIGH);
 delayMicroseconds(1000);
 digitalWrite(trig , LOW);
duration = pulseIn(echo , HIGH);
 distance = (duration/2) / 28.5 ;
 Serial.println(distance);


 if ( distance <= 10 )
 {
  digitalWrite(LED1, HIGH);
 }
 else
 {
  digitalWrite(LED1, LOW);
 }
 if ( distance >= 15 )
 {
  digitalWrite(LED2, HIGH);
 }
 else
 {
  digitalWrite(LED2, LOW);
 }
}
```

Chapter: 6

Conclusion

The idea for the design and development of a prototype circuit called the automatic headlight dipper/dimmer enables the driver to use high beam light when required and automatically switches the headlight to low beam when it senses a vehicle approaching from the opposite side. Main components help to run the circuit are easily available and are also cheap. The circuit is compatible with any vehicle and does not require any other supply; it can efficiently work on battery fitted in the vehicles

Sensing the opposite vehicles bright headlights automatically and after giving them a notification and according to their response whether they dips their headlight or not our circuit decides whether our headlight should be in upper mode or dipper mode. The extent to which glare is a problem for night driving is not easily quantified. the statistical data of accidental report of Asia due to troxler effect or glaring effect. By using this circuit our driving will result in smooth and happy driving with negligible risk of accidents. Glare during driving is a serious problem for drivers and therefore caused by the sudden exposure of our eyes to a very bright light of the headlights of vehicles. This causes a temporary blindness called the Troxler effect. Eventually this has become the reason for accidents occurring at night and also during bad conditions such as rainy or foggy conditions. The driver should have turned down the bright lights immediately to avoid glare to the other person, however they find it difficult to do. Hence, the idea for the design and development of a prototype circuit called the automatically switches the headlight to low beam when it senses a vehicle approaching from the opposite side. Thus, the implementation of this device in every vehicle does not only avoid accidents but also provides a safe and comfortable driving.

Chapter: 7

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