AUTOMATIC CAR HEADLIGHT CONTROLLER

A PROJECT BASED LEARNING REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certificate that this project report "**AUTOMATIC CAR HEADLIGHT CONTROLLER"** is the bonafide work of **"ARAVIND.M, GOKUL.S, KEERTHANA.R, PRADEEP.C"** who carried out the Project Based Learning work under my supervision.

SIGNATURE,

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ACKNOWLEDGEMENT

The success of a work depends on the team work and co-operation various involved either directly or indirectly.

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TITLE OF CONTENT

ABSTRACT:

Headlights of vehicles pose 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. In this project, an automatic headlight dimmer which uses a Light Dependent Resistor (LDR) sensor has been designed to dim the headlight of oncoming vehicles to avoid human eye effects. This automatically switched the high beam into low beam, therefore reducing the glare effect by sensing the light intensity value of approaching vehicle and also eliminated the requirement of manual switching by the driver which was not done at all times. Matlab software was employed in designing the project. The Keil software was also employed to program the microcontroller.

CHAPTER 1

INTRODUCTION

The automatic car headlight controller project is designed to enhance vehicle safety and convenience by utilizing a combination of sensors to automate headlight operation. A Light Dependent Resistor (LDR) serves as the primary sensor for detecting ambient light levels, automatically turning on the headlights in low-light conditions such as dusk, dawn, or tunnels. This ensures that the driver always has adequate visibility without the need for manual intervention.

Overall, the project enhances driving safety by ensuring headlights are used appropriately based on real-time environmental data, thereby reducing the risk of accidents. It also promotes energy efficiency by turning off headlights when they are not needed, and it offers greater convenience for drivers by eliminating the need for manual headlight operation. This integration of sensor technology into automotive systems exemplifies practical innovation aimed at improving everyday driving experiences.

1.1 Hardware required:

The hardware requirements are

- MSP430FR2433 Microcontroller
- Humidity Sensor
- Rain Detection Sensor
- Ultrasonic Sensor
- LDR Module
- Headlight
- Focus light

CHAPTER 2
OBJECTIVE

The primary objective of the automatic car headlight controller project is to enhance vehicle safety and driving convenience by automating headlight control using a combination of environmental sensors and the MSP430FR2433 microcontroller.

Improve Safety: Ensure optimal visibility for the driver by automatically turning on the appropriate headlight bulbs in low-light, rainy, foggy, or obstructed conditions, thereby reducing the risk of accidents.

Increase Efficiency: Conserve energy by activating headlights only when necessary, based on real-time environmental data.

Enhance Driver Convenience: Eliminate the need for manual headlight operation, allowing the driver to focus more on driving without the distraction of adjusting headlights.

Adapt to Environmental Conditions: Utilize sensors such as the LDR module, humidity sensor, rain detection sensor, and ultrasonic sensor to dynamically adjust headlight usage according to changing environmental and road conditions.

Optimize Headlight Use: Differentiate between white and yellow headlight bulbs, using white for general night driving and yellow for improved visibility in adverse weather conditions like fog or heavy rain.

By achieving these objectives, the project seeks to provide a smarter, safer, and more efficient headlight control system for modern vehicles.

CHAPTER 3

BLOCK DIAGRAM

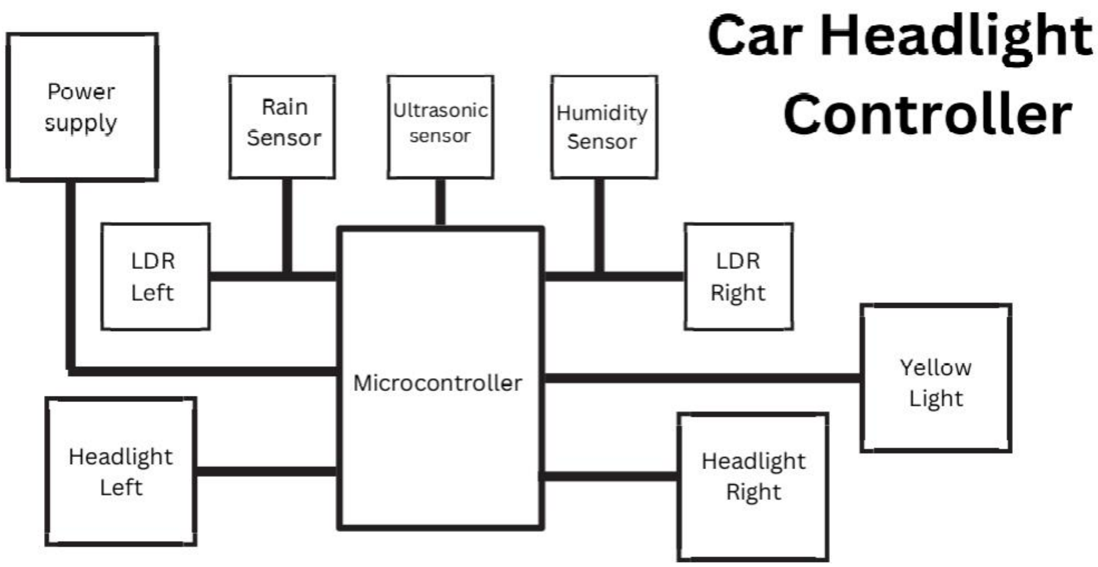


Figure 3.1 Block diagram

The automatic car headlight controller project uses the MSP430FR2433 microcontroller as the central control unit to enhance vehicle safety and convenience by automating headlight operation. The system integrates an LDR module, humidity sensor, rain detection sensor, and ultrasonic sensor to monitor environmental conditions. The LDR detects low ambient light levels, prompting the microcontroller to activate the headlights. The humidity and rain detection sensors identify adverse weather conditions like fog and rain, signaling the microcontroller to turn on the headlights for improved visibility. The ultrasonic sensor detects obstacles and adjusts the headlight beam angle or intensity accordingly, ensuring optimal illumination and reducing glare.

CHAPTER 4

CIRCUIT DIAGRAM

The circuit diagram for the automatic car headlight controller project involves connecting the MSP430FR2433 microcontroller to various sensors and headlight control components. The LDR module is connected to an analog input pin to measure ambient light levels, while the humidity sensor and rain detection sensor are connected to other analog input pins to monitor environmental conditions. The ultrasonic sensor is connected to digital input pins for obstacle detection. The microcontroller processes these inputs and sends control signals to the headlight control circuit, which includes relays or transistors to switch between white and yellow headlight bulbs. The power supply unit ensures that the microcontroller and all sensors receive stable voltage, enabling reliable operation of the system.

CHAPTER 5
COMPONENTS AND ITS DESCRIPTION

5.1 MSP430FR2433

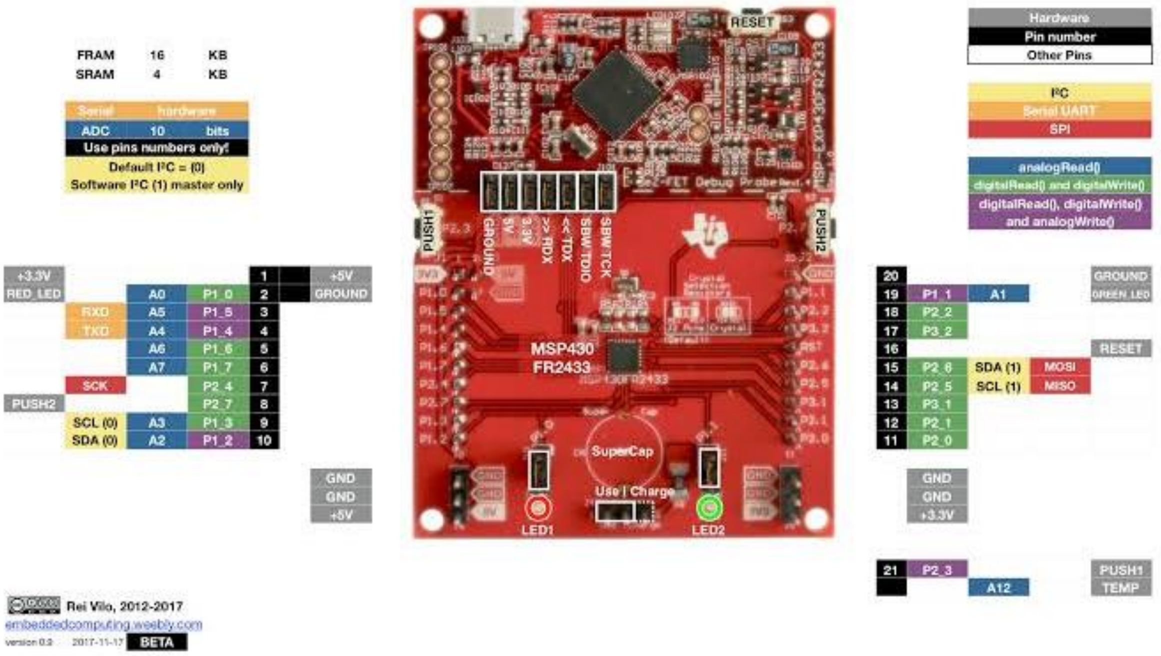


Figure 5.1 MSP430FR2433

The MSP430FR2433 microcontroller, a part of Texas Instruments' MSP430 family, is a highly integrated and ultra-low-power MCU designed for a variety of embedded applications. It features a 16-bit RISC architecture with a range of peripherals, including 15.5 KB of ferroelectric RAM (FRAM), which offers non-volatile storage with high endurance and fast write speeds. The device operates at low power, making it ideal for battery-powered applications. It includes multiple input/output ports, a 10-bit ADC, and several communication interfaces such as I2C, SPI, and UART. The MSP430FR2433's efficient power management and versatile connectivity options make it suitable for applications requiring precise sensor integration and control, such as the automatic car headlight controller project.

5.2 HUMIDITY SENSOR

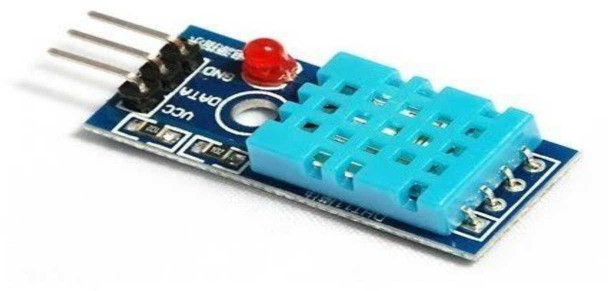


Figure 5.2 Humidity Sensor

The DHT11 humidity sensor is a popular choice for measuring temperature and relative humidity due to its simplicity and affordability. It comprises a capacitive humidity element and a thermistor for temperature sensing. Operating over a wide temperature range and with a typical accuracy of ±5% for humidity and ±2°C for temperature, the DHT11 delivers reliable performance for various applications. Its straightforward interface and reliable measurement capabilities have made it a staple component in DIY electronics projects, weather stations, environmental monitoring systems, and home automation setups.

Utilizing a single-wire communication protocol, the DHT11 sends data to the microcontroller in a timed sequence, where the digital signal represents both temperature and humidity readings. Its compact form factor and low power consumption make it suitable for battery-powered devices and remote sensing applications. While the sensor's accuracy may not be as high as more advanced alternatives, its affordability and ease of use make it an attractive option for hobbyists, students, and projects where precise measurements are not critical. Overall, the DHT11 humidity sensor offers a cost-effective solution for monitoring environmental conditions in various settings, providing valuable data for analysis and decision-making.

5.3 RAIN DETECTION SENSOR

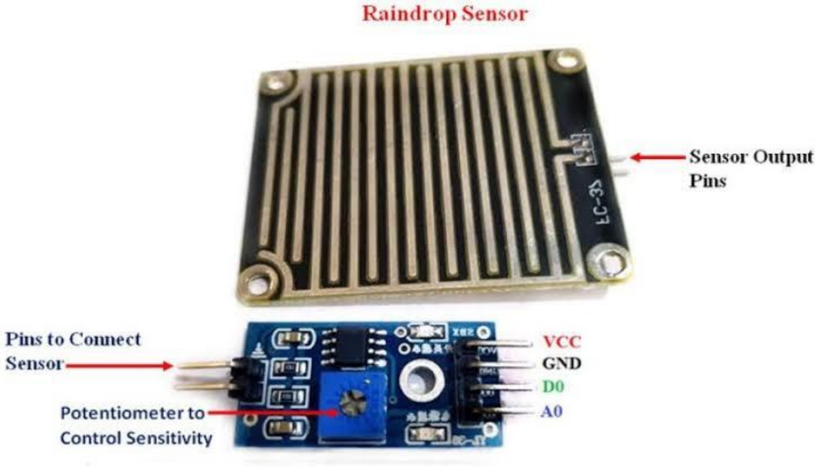


Figure 5.3 Rain Detection Sensor

The LM393 rain detection sensor is a module commonly used for rain sensing applications in electronic projects. It utilizes the LM393 dual comparator integrated circuit, which compares two analog voltages and produces a digital output based on the comparison result.

In the rain detection sensor module, the LM393 is typically configured to compare the resistance between two electrodes exposed to the environment. When raindrops fall on the electrodes, they create a conductive path, resulting in a decrease in resistance. This change in resistance is detected by the LM393, which then outputs a digital signal indicating the presence of rain.

The module often includes additional components such as resistors and potentiometers to adjust sensitivity and threshold levels. It may also feature indicator LEDs to provide visual feedback when rain is detected.

5.4 SERVO MOTORS

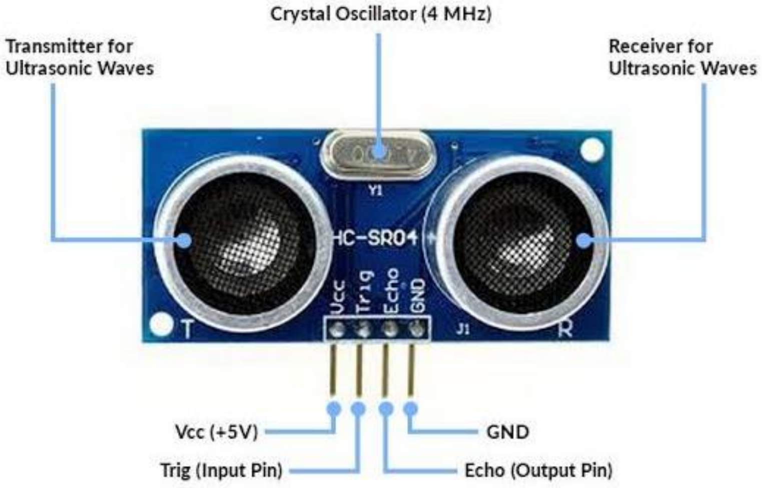


Figure 5.4 Servo motor

The HC-SR04 ultrasonic sensor is a popular choice for distance measurement in various electronic projects. It utilizes ultrasonic sound waves to determine the distance between the sensor and an object, providing accurate and reliable measurements in a wide range of applications.

The HC-SR04 sensor consists of two main components: a transmitter and a receiver. The transmitter emits ultrasonic pulses, which travel through the air until they encounter an object. Upon hitting the object, the sound waves bounce back and are detected by the receiver.

The sensor calculates the distance to the object based on the time it takes for the ultrasonic pulses to travel to the object and back. This time is measured with high precision using the onboard electronics, typically through a microcontroller interface.

One of the key features of the HC-SR04 sensor is its ease of use. It requires only a few connections to a microcontroller or other electronic circuitry, making it suitable for beginners and advanced users alike. Additionally, it operates over a wide range of distances, typically from a few centimeters to several meters, depending on the specific model and environmental conditions.

The HC-SR04 sensor has found applications in robotics, obstacle avoidance systems, parking assistance systems, and various other projects where accurate distance measurement is essential. Its affordability, reliability, and ease of integration have made it a popular choice among hobbyists, educators, and professionals alike.

5.5 LDR MODULE

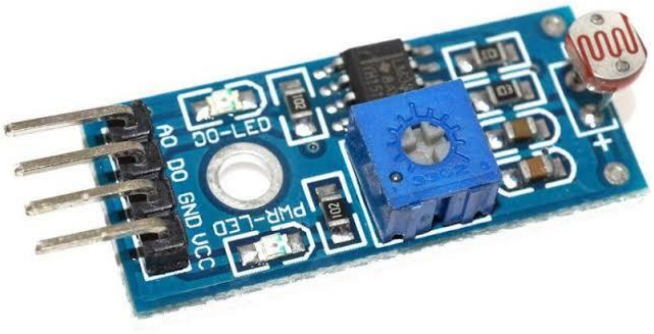


Figure 5.5 LDR Module

The LM393 LDR (Light Dependent Resistor) module combines the LM393 dual comparator integrated circuit with an LDR sensor to create a light-sensitive module commonly used in electronic projects for light detection and control applications.

The LDR sensor, also known as a photoresistor, changes its resistance based on the intensity of ambient light. When exposed to high levels of light, the resistance of the LDR decreases, and conversely, it increases in low-light conditions. This characteristic makes it suitable for detecting changes in light levels, such as those that occur during day and night cycles or in response to artificial lighting.

The LM393 comparator integrated circuit is responsible for comparing the analog voltage output of the LDR sensor with a reference voltage and producing a digital output based on this comparison. The LM393 typically includes two independent comparators, allowing the module to detect both high and low light levels.

5.6 HEADLIGHT

Figure 5.6 Headlight

Headlights are essential components of a vehicle, designed to illuminate the road ahead during low-light conditions like nighttime or inclement weather, and to make the vehicle more visible to others. They consist of several key components, including the bulb, lens, reflector, and housing.

The bulb can be halogen, xenon (HID), LED, or laser. Halogen bulbs are common due to their affordability, while xenon bulbs provide brighter, whiter light and are often found in luxury vehicles. LED bulbs are energy-efficient and long-lasting, and laser bulbs offer superior brightness and range. The lens, made from polycarbonate or glass, covers the bulb and helps focus the light beam. Reflectors, positioned behind the bulb, direct the light forward, with types including parabolic and free-form for precise light control. The housing protects these elements from environmental factors like moisture and debris.

Headlights come in two main types: sealed beam and composite. Sealed beam headlights are a single unit where the bulb, reflector, and lens are fused together, requiring the entire unit to be replaced if one component fails. Composite headlights allow for individual replacement of the bulb, making them more economical and convenient.

Lighting patterns include low beam (dipped beam) for sufficient light without blinding oncoming traffic, and high beam (main beam) for a brighter, more widespread light used in low-traffic areas or open roads. Advanced features in modern headlights include adaptive headlights that adjust direction and range based on vehicle speed and steering, automatic high beams that switch between high and low beams depending on the presence of other vehicles, cornering lights that illuminate the direction of turning, and daytime running lights (DRLs) for enhanced visibility during daylight hours.

Maintenance of headlights involves ensuring proper alignment to avoid blinding other drivers and to maximize road visibility, regular cleaning of the lens to remove dirt and grime, and timely replacement of burnt-out or dimming bulbs to maintain optimal lighting. These aspects make headlights a critical safety feature on vehicles, with continuous advancements improving their efficiency, brightness, and functionality.

5.7 FOCUS LIGHT

Figure 5.7 Focus Light

A focus light, or spotlight, is designed to project a concentrated beam of light onto a specific area or object. This type of lighting is commonly used in theater, photography, architecture, and vehicle headlights due to its ability to direct light precisely, providing high-intensity illumination on targeted spots.

These lights employ lenses, reflectors, and sometimes shutters or barn doors to shape and control the light beam, ensuring it hits the intended area without unnecessary spread. The intensity of focus lights allows them to highlight specific subjects or features effectively, and many come with adjustable beam angles, allowing users to change the width of the light beam as needed through manual adjustments or motorized controls.

Focus lights are available in various color temperatures, from warm to cool white, and can often be fitted with color filters or gels to achieve specific effects. Spotlights, a common type of focus light, are extensively used in theater and stage productions to create sharp, intense beams of light that can be directed precisely. These lights can be manually or remotely controlled and are often mounted on stands or overhead rigs.

In photography, focus lights are used to highlight subjects, create shadows, and enhance textures, often coming with diffusers and reflectors to control the quality and direction of the light. Architectural lighting uses focus lights to highlight features such as columns, statues, and building facades, enhancing the visual appeal of structures with dynamic lighting effects. In vehicles, focused beams are used in high-beam headlights and fog lights to improve visibility, and modern adaptive headlights use this technology to adjust the beam direction based on driving conditions.

Many focus lights include features like dimming and brightness control, allowing users to adjust the light level to suit different environments. High-end focus lights can be controlled remotely and integrated into automated systems for synchronized lighting effects. LED technology is commonly used in these lights for its energy efficiency, long lifespan, and ability to produce a strong, focused beam without generating excessive heat.

Overall, focus lights provide precise, high-intensity illumination for a variety of professional and practical applications, making them essential tools in fields that require detailed and dynamic lighting solutions.

CHAPTER 6

ADVANTAGES AND APPLICATIONS

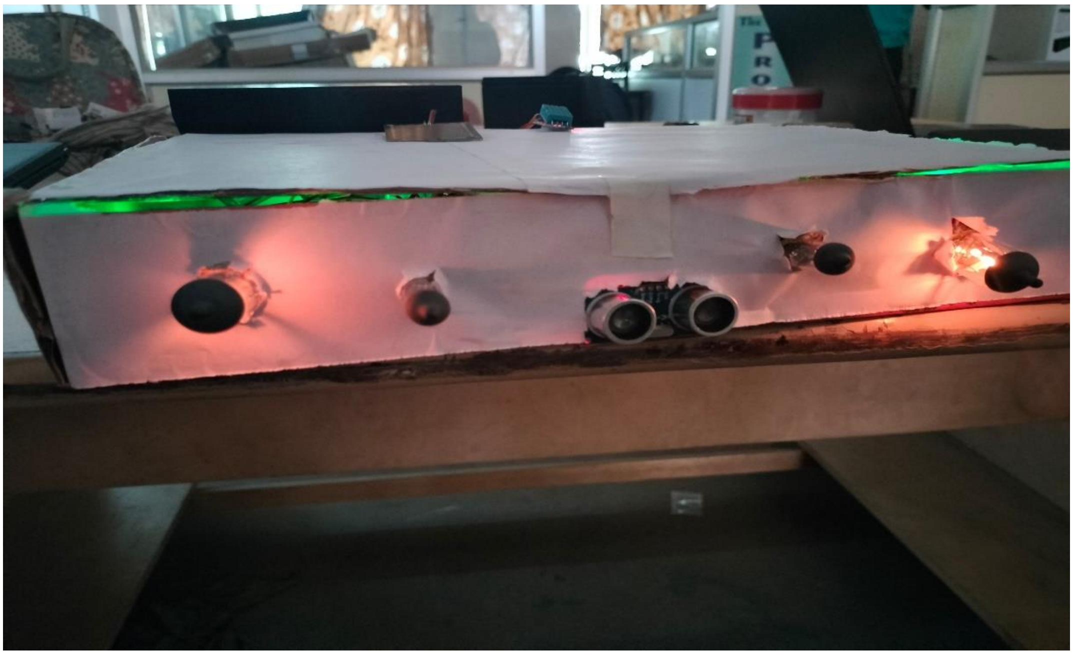
- Enhanced Safety
- Convenience
- Energy Efficiency
- Adaptability
- Compliance with Regulations
- Customization Options
- Improved Visibility

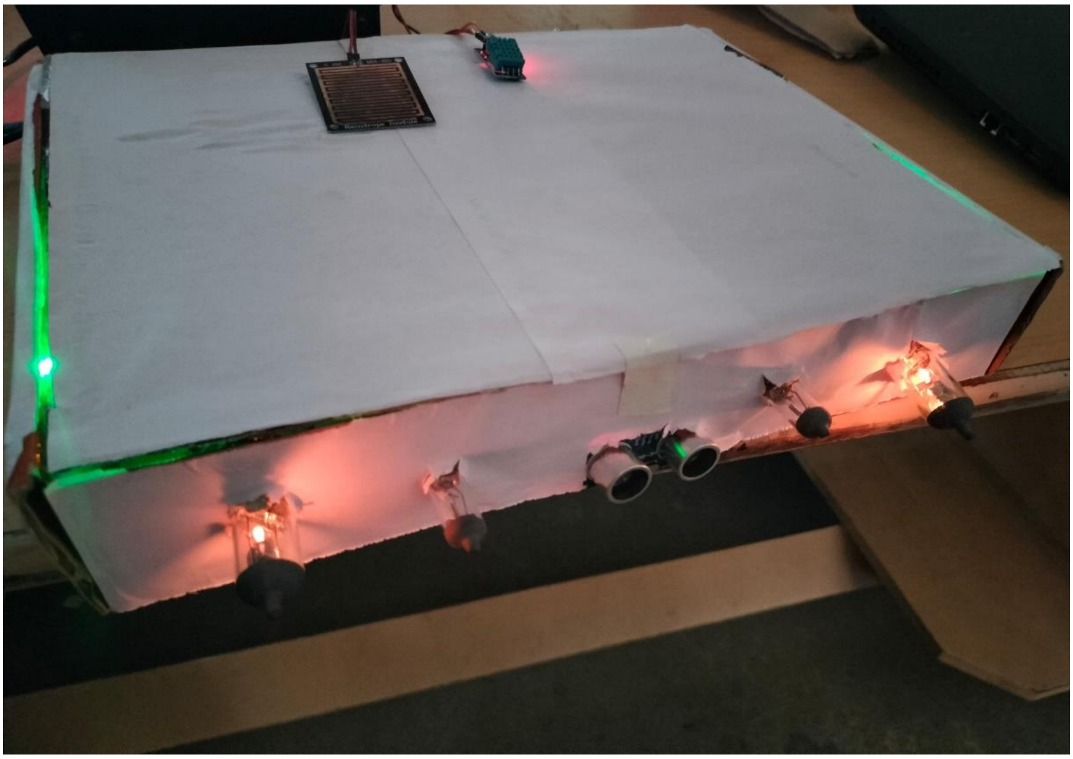
Applications

- Automotive Vehicles
- Fleet Vehicles
- Emergency Vehicles
- Public Transportation
- Off-Road Vehicles

CHAPTER 7

RESULT





CHAPTER 8

CONCLUSION

In conclusion, the automatic car headlight controller project offers a comprehensive solution for enhancing vehicle safety, convenience, and energy efficiency. By automatically adjusting headlight activation based on ambient light levels and weather conditions, this system ensures optimal visibility for drivers and other road users in various driving scenarios.

With features such as adaptability to changing environmental conditions, compliance with regulations, and customization options, the automatic headlight controller provides a versatile solution suitable for a wide range of vehicles and applications.

Overall, this project represents a significant advancement in automotive technology, contributing to safer and more comfortable driving experiences for drivers worldwide. Its integration into modern vehicles and compatibility with emerging technologies such as autonomous driving systems further solidify its importance in the automotive industry.

CHAPTER 9

SOURCE CODE

```
const int trigPin = 3;

const int echoPin = 6;

const int rh = 19;

const int rl = 13;

const int lh = 10;

const int ll = 17;

const int y = 18;

const int r = 12;

double duration, distance;


void setup() {


  pinMode(trigPin, OUTPUT);

  pinMode(echoPin, INPUT);

  pinMode(rh, OUTPUT);

  pinMode(rl, OUTPUT);

  pinMode(lh, OUTPUT);
```

```
  pinMode(ll, OUTPUT);
  pinMode(y, OUTPUT);
  pinMode(5, INPUT);
  pinMode(11, INPUT);
  pinMode(9, INPUT);
  pinMode(4, INPUT);
  digitalWrite(rh,LOW);
  digitalWrite(rl,LOW);
  digitalWrite(lh,LOW);
  digitalWrite(ll,LOW);
  digitalWrite(y,LOW);
  digitalWrite(r,LOW);
}

void loop() {
  float a=analogRead(5);
  float b=analogRead(11);
  float R=(a/1023)*100;
  float H=(b/1023)*100;
  float e=analogRead(9);
```

```
float f=analogRead(4);
float r=(e/1023)*100;
float l=(f/1023)*100;
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
distance = (duration*.0343)/2;
float D=(distance/1023)*100;

if((R>50)&&(H>50)){
digitalWrite(rh,LOW);
digitalWrite(rl,LOW);
digitalWrite(lh,LOW);
digitalWrite(ll,LOW);
digitalWrite(y,HIGH);
digitalWrite(r,LOW);
//("Yellow Light High");
```

```
}
else if((l<50)&&(r<50)){
digitalWrite(rh,LOW);
digitalWrite(rl,HIGH);
digitalWrite(lh,LOW);
digitalWrite(ll,HIGH);
digitalWrite(y,LOW);
digitalWrite(r,LOW);
//("R Light Low");
//("L Light Low");
}
else if(r<50){
digitalWrite(rh,LOW);
digitalWrite(rl,HIGH);
digitalWrite(lh,HIGH);
digitalWrite(ll,LOW);
digitalWrite(y,LOW);
digitalWrite(r,LOW);
//("R Light Low");
//("L Light High");
```

```
}
else if(l<50){
 digitalWrite(rh,HIGH);
 digitalWrite(rl,LOW);
 digitalWrite(lh,LOW);
 digitalWrite(ll,HIGH);
 digitalWrite(y,LOW);
 digitalWrite(r,LOW);
 //("R Light High");
 //("L Light Low");
}
else if(D<10){
 digitalWrite(rh,LOW);
 digitalWrite(rl,LOW);
 digitalWrite(lh,LOW);
 digitalWrite(ll,LOW);
 digitalWrite(y,LOW);
 digitalWrite(r,HIGH);
 //("Red Light High");
}
```

```
 else{
  digitalWrite(rh,HIGH);
  digitalWrite(rl,LOW);
  digitalWrite(lh,HIGH);
  digitalWrite(ll,LOW);
  digitalWrite(y,LOW);
  digitalWrite(r,LOW);
  //("R Light High");
  //("L Light High");
 }
}
```

CHAPTER 11

REFERENCE

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- https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://turcomat.org/index.php/turkbilmat/article/download/1730/1476/3233&ved=2ahUKEwiiiaS3wdOGAxXwR2wGHSIhB_wQFnoECBEQAQ&usg=AOvVaw0DvNtZjZh3n2i1Sy0rrhIJ
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