**AI-BASED ROAD SAFETY SYSTEM TO CONTROL GLARE AND DETECT FOG FOR ACCIDENT PREVENTION**

**ABSTRACT**

Road safety is a growing concern across the globe, especially during night time and poor weather conditions, which are leading causes of traffic accidents. At night, the high-beam headlights of oncoming vehicles can cause glare, temporarily blinding drivers and increasing the risk of accidents. Fog is a natural phenomenon that can significantly impact daily life and various industries. In transportation, fog can reduce visibility, and danger driving conditions leading to accidents and delays. The greater numbers of accidents are caused by the less visibility during foggy weather. It has the potential to significantly improve safety and efficiency in foggy weather. The system is built using a camera, LDR sensors, fog detection sensors, and an Arduino UNO. The hardware connects the microcontroller to the vehicle’s headlight system and includes a fog detection module. On the software side, the system captures and analyses images to detect fog, adjusts headlight brightness based on surrounding light conditions, and send real-time alerts. With continued advancements in technology, this system has the potential to greatly improve safety during night driving and low-visibility conditions, ultimately helping to prevent accidents.

**INTRODUCTION**

Transportation plays a vital role in our daily lives, as most activities require travel. Ensuring safety while driving is of utmost importance, especially during night-time travel, which is more challenging due to reduced visibility. Driving in low visibility conditions such as foggy weather or during night increases the likelihood of accidents. One of the major causes of accidents is the sudden glare from the headlights of oncoming vehicles and foggy weather. To address this issue, road safety system has been developed. The system detects the intensity of light from approaching vehicles and automatically switches the headlights from high beam to low beam, thereby reducing glare it also detect the objects and give an alert to the driver that there is an object coming towards the vehicle by the buzzer sound and it also increases the intensity of LED when the sensor detects high density of fog so that the driver can drive the vehicle safely even in foggy weather. These systems use LDRs to detect whether the light from another vehicle is in high or low beam and adjust the vehicle’s headlights accordingly. Also it uses ultrasonic sensor to detect the distance between the vehicles and motion sensor to detect and sudden movements or vibrations. It detects any sudden changes it will produce a buzzer sound and alert the driver.

**PROPOSED METHODOLOGY**

The proposed system controls the high light beam of the upcoming vehicle. It also calculates distance between the vehicles using ultrasonic sensors uses motion sensors to sense the sudden movement of objects in front of the vehicles. These system helps in preventing these accidents and also alerts the driver about the other vehicle or object before itself from a certain distance by using the buzzer and increase the intensity of light with increase in density of fog and also a message will be sent if an accident is detected it will send a message to a specified number using GSM. The GSM900 module allows for remote monitoring and control of the system. This means that the system can be monitored and controlled from a central location, such as a traffic control centre, which can improve the efficiency of the system. One advantage of this system is that it can be easily installed on any vehicle. The system can also be integrated with other vehicle safety systems, such as ABS and collision avoidance systems, to further improve driving safety.

The decoder output is given to 8051 MCU which is programmed to control high beam line of the vehicle based on the input signal.

The implementation device contains simple components like:

* LDR Sensor
* Ultrasonic sensor
* Motion sensor
* Arduino
* Relay
* Transistors BC547
* Resistors
* LED lights.
* GSM
* Buzzer
* Head light

When the components are connected as per the block diagram and the power supply is given the device starts to work their respective functions and indicate the current state of the headlight. It is a very simple device there will not be any large expenses and it is easy to setup.

Materials

To achieve the design objectives of the proposed automatic headlight beam control system, several materials were employed:

1. Arduino UNO ATmega328P microcontroller: this microcontroller features 14 digital I/O pins, 6 of which are PWM-capable, along with 6 analog input pins, a 16 MHz ceramic resonator, USB connectivity, a power jack, an ICSP header, and a reset button. It typically

operates within a voltage range of 5 V.

2. Single SRD-05VDC-SL-C relay: this relay was chosen for its outstanding reliability and its compatibility with the Arduino UNO microcontroller. It allows for the effective control of high-voltage components, such as headlights, using the low-voltage signal output by the

Arduino.

3. Light-dependent resistor (LDR): the LDR is a photosensitive device utilized for detecting light presence or absence and measuring luminance intensity. Its resistance decreases as incident luminance intensity increases a phenomenon known as photoconductivity.

4. Active buzzer: selected for its ease of circuit integration and capability to produce louder sounds compared to passive buzzers, the active buzzer is integrated into the design to serve as an alert system, notifying the driver when the headlight output switches from high to low

beams upon detecting oncoming high beams.

5. Delphi radar sensor: renowned for its reliability and versatility, the Delphi radar sensor offers mid-range coverage of up to 60 m with a wide beam and extends to 174 m with a narrower beam. It can discriminate and track up to 64 targets within the vehicle’s path.

**4. Results and Discussion**

While driving during night time glare is a serious problem for drivers.It can be overcome by automatic switching of the headlight to low beam, when it senses a vehicle approaching from opposite side with high beam. The implemented result is shown in figure.3. Use of these automated headlights results in convenience to the driver while driving at night. And at the same time it reduces the accidents. Maintenance of this device is also easy.

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

a. Both the vehicles at high beam.

b. Both the vehicles in low beam.

c. After passing both the vehicles becomes high beam.

**a. Both the vehicles at high beam:**

In this state the vehicles approaching each other with high beam. Then the high beam is detected using LDR sensor.

**b. Both the vehicles in low beam:**

In this state the high beam is detected using the sensor and then it switches to low beam immediately.

**c. After passing both the vehicles becomes high beam:**

Here when the vehicles back to the track where there is no oncoming high beam vehicle it switches from low to high beam automatically.

**5. Conclusion**

This prototype is implemented which helps the driver to use headlight automatically switches the high to low beam when it senses a vehicle approaching from the opposite side. The circuit consists of simple and economical components which can be easily installed. The working and implementation of the prototype are discussed in detail. The implementation of this device in automobile field will brings safety and avoids accidents.