Automatic Wiper and Headlight Control for Automobiles

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Abstract: - Automated Wipers and headlights are very important in automotive to prevent accidents in unpredictable weather conditions and at night. A car wiper is a device that cleans the windshield of rain. To remove human involvement in wiper control and prevent accidents, all vehicles now have wipers as standard equipment. When the raindrops fall on the sensor, it detects its strength and automatically adjusts the wiper speed. The intensity of a vehicle's headlights creates a big risk when travelling at night. Other road users arriving from behind are put at risk by these powerful headlights, which improve the driver's night vision. The oncoming motorist is bothered by the strong light of the vehicles, which generates glare. At night to get rid of the invisibility due to glaring, the driver has to do adjustments with the headlight. We have discovered a solution to solve the above problems using Arduino-UNO. The proposed solution actuates quickly to rain drops and headlights without any delay.

Key Words: — ***Rain-Sensor, Light Dependent Resistor, Arduino Uno, Headlights.***

I. INTRODUCTION

Due to poor vision caused by heavy rain, many car accidents have happened on the roads. A wiper is used to wipe the rain droplets in rainy climates in order to retain direct view. In many present car models, these wipers are still operated manually, which may cause driver distraction. The automated wiper minimizes the need for human sensory and cerebral requirements significantly. However, a flashlight is essential when travelling at night. The same lamp that allows the motorist to see better at night causes many accidents.

The driver can change the brightness of the headlamp from high to low (dim). At times during which no light is available, high-beam can be activated, while low beam is preferred in all other cases.

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In traffic, automobiles travel on either side of the lane, causing disorientation when a bright-light travelling from other direction glares at a person for a brief moment. Due of discomfort, the driver's eyes will close involuntarily for a short period of time. This amount of distraction is responsible for many nighttime traffic accidents.

The proposed design will include a precipitation Sensor that detects rain and a light sensor that detects light, as well as an ARduino microcontroller that estimates the intensity of the rain fall signal provided by the network and the amount of light intensity to be provided based on light dependent resistor values, as well as processes to trigger the servo motor based on the intensity of the rainfall and to switch from high to low beam if a vehicle approaches in front, and vice versa.

II. LITERATURE SURVEY

As there is a progress in Sensors and the Internet-of-Things technology, gadgets will be able to behave autonomously and with minimal manual efforts. The research people are looking at a number of existing systems and trying to figure out how to improve their functionality or limits. Researchers are aiming to find technologies that are prohibitively high-cost and out of

reach for the common individual, in order to develop a more cost-effective solution for humanity's ever-growing needs.

IoT's capabilities aren't limited to a single field, and it out performs other traditional ways in a variety of life-saving applications. Health care, emergency services, and first aid are all included. A recent poll found that the number of accidents is higher between the hours of 6 p.m. and 6 a.m. than during the day. The sun causes momentary driver blindness, which is the most common cause of these collisions. A study found that risks of an injury are high compared to a typical rainy or foggy day We are primarily concerned with avoiding such blunders depending on whether or not fog lights are present. A few technologies are already available in luxury vehicles, but their implementation in mass-market vehicles is prohibitively expensive.

This study proposes an approach for making headlights intelligent, so avoiding many of the present causes of night or poor climate traffic accidents. The major goal is to create a low-cost Automatic Smart Headlight system for usage in the car industry. The second main goal is to create a two- and three-wheeler headlight system, which few researchers or automakers have considered. [1]

The major objective of this research is to develop a prototype for an automatic headlight dimmer. The headlights of approaching vehicles beam into the driver's eyes from the side when driving at night diametrically opposed. The intense light from facing automobile may cause blaze for the operators, perhaps resulting in an accident. The Troxler Effect describes the unexpected glare that the driver encountered. Many accounts claim that The Troxler Effect is primarily to blame for nocturnal traffic collisions. In order to protect people, this vehicle is designed for both drivers and passengers to have a comfortable travel. This can be accomplished with the help of a light Dependent sensor.

The light Sensitive sensor is a varying resistor, turning the heavy beam of an oncoming headlights to lighter beam with a Micro-Controller and other components. This technology is helpful in the automotive industry and will usher in a future era of driver safety. [5]

Since the turn of the century, the automobile industry has seen incredible technological developments. When 5G technology is available and the Iot sectors develops, machines would communicate with each other with V2V protocols and become significantly automatic. [8]

Without the driver needing to do anything, the autonomous rain wiper system detects rain and engages the wipers. This method allows drivers to focus on their primary responsibility of driving. Fully automated systems that modify wiper blade speed based on the rate of rainfall and the vehicle's speed are currently being researched by engineers. Luxury cars, SUVs, and other high-end vehicles all include these systems. As a result, the goal is to develop an automatic wiper system for low-cost cars that varies the fastness of the blades in response of rainfall.

A raindrop sensor that measures resistance only based on moisture, an L293D motor driver IC with a 12V motor, a pic16F877A microcontroller, and regulators make up the project. Furthermore, future development of the concept intends to use a basic wiper motor with a control system and a low budget. This method can help us achieve excellent driver and passenger safety. [14]

The headlamp is quite crucial when travelling at night. When driving, the other car's headlight beam concentrate can create an annoying situation. It can cause temporary blindness, which could result in a collision or an accident. Although changing the headlight focus manually is possible, it is challenging. This research presents an automatic headlight management system. The intensity of light from the opposite vehicle causes the car's headlight beam to dim in this example. The Light sensor is used to detect the high beam of the opposing vehicle. [7]

This research introduces the innovation of vehicle headlamp switch-system. Night driving necessitates the use of vehicle headlights. These strong headlights, which enhance the driver's night vision, pose a major risk to other road users approaching from behind. The oncoming motorist is irritated by the vehicles' bright lights, which cause glare. Every motorist will look forward to turn headlights from intensive to less-intensive brightness whenever an oncoming vehicle is approaching lea than 150m at night to avoid bizarre, however it is rarely done.

The opposing driver's inability to look at the lane properly owing to intense illumination of the incoming motive's lights is one of the most common causes of night accidents. This automated system changes the intense-bulb to low-bulb when it finds a tool approaching from the other way, then back to high beam when the cars pass each other. It employs the automobile battery's 12V Power-Supply, a LDR as a sensor, and a divider circuit as a comparator to activate an NPN transistor coupled to an SPDT relay that performs the task. [9]

This study describes an IoT-based wireless sensor automation network for headlamp control. The environment's brightness is monitored by the wireless sensor network, which takes control measures as needed. If the ambient brightness level exceeds the pre-set intensity level, the controller transmits a message. The headlight is then turned off completely. This strategy helps us to save a substantial amount of energy that could otherwise be wasted. [24]

Autos are frequently purchased for costlier rates for comfort and safety. The motive, however, do not fulfil the required specifications. We all know that when driving, the driver should utilize the vehicle's lighting system. There are two eventualities that should make us nervous. When the driver has a lot of experience, for example. If the user is unfamiliar with autos, the driver may not detect that the car lights are not turned on.

This is not an issue if there are street lights nearby. If there are no street lights or the car suddenly moves into a dark area, an accident or other severe worries may occur. The Automated Car Lightning System is the answer to the problem we just discussed. An automatic car lighting system is a simple yet effective concept. An ldr is an essential component that detects light and sends a signal to the Controller, which controls the headlight on/off. [4]

A huge percentage of accidents are caused by human mistake, especially at night when incoming traffic's headlights cause temporary blindness. Measures which informs the driver and advises safe overtakes depending on approaching traffic, can significantly reduce this. To avoid blinding oncoming vehicles, the device will automatically dim one side of the headlamp. It will lower the beam to low if the vehicle in front of you is within a specific distance. Employing cameras to detect objects, cars, animals, and humans is far more useful than using sensors. The precision of image data is substantially higher than that of sensor data. When picture and sensor data are integrated, the system can perform more efficiently. [23]

The number of people who own automobiles continues to rise. Simultaneously, the number of persons who are at risk of accidents is rising. This is because drivers are constantly distracted by many factors. To counteract this, automation was developed. The automotive industry has spent the previous two decades investigating how to incorporate trending computer and electronic technologies into body control modules to provide users with protection, dependability, comfort, and entertainment advancements.

The automation system in this project focuses on the development of a body-control Modem with specialties including autonomous control of wipers, Headlamps, sun-roof, and power monitoring-window regulators with an anti-pinch feature. A PIC 16F877A μC and components like as sensors, actuators, current-drivers, and signal conditioning circuits were used to generate these characteristics. The designed automation system is tested on a general-purpose PCB with DC motors and LEDs. [10]

Every year, the number of road accidents rises as a result of rising car and driver carelessness, posing a major threat to modern civilization. Unintentional lane departure and rear-end collisions are two of the most common causes of highway accidents. This difficulty can now be alleviated to some extent thanks to the Advance driver assistance system (ADAS). This research looks at the development of a lane departure warning, adaptive-lights, and wiper system that can work in a variety of road and lighting circumstances.

The Raspberry Pi is in charge of video processing, while the ARDUINO-Mega is in charge of AHAWS. The LDWS algorithm filters video input frame by frame, detects edges using canny edge detection, and then decides on lane detection using the Hough transform in Python. The car's location within the observed lanes triggers the alert. The AHAWS algorithm takes into account the road curvature (provided by LDWS in the case of an integrated system), surrounding light intensity, and rain intensity. These inputs will make the headlight follow the curve, change the intensity of the headlight based on ambient light, and adjust the wiper frequency based on rain intensity. According to the trial results, the AHWAS responds swiftly to changes in input, with an average lane detection rate of 99.8% and a departure warning rate of 92.1 percent, respectively. At 720x1280 resolution, the average processing fastness is 22.2 frames per second. [33]

III. Problem Statement

The problem of driver's safety is essential in current industries. The lack of sufficient visibility is typically the cause of accidents during heavy rain. Manual errors, such as the driver failing to raise the wiper speed, are common causes of accidents. [3] Road accidents happen every day, but they happen more frequently at night. This is due to the fact that visibility at night is less than it is during the day. Bright headlights have the opposite impact on the opposing vehicle, demanding mitigation. Because drivers are only human, they regularly fail to switch the beams, which is a time-consuming and laborious operation. [9]

IV. Existing Systems

Every year during the rainy season, more than 2 million people die in accidents, according to the World Health Organization. People die as a result of minor mistakes. To start and manage the speed of today's car wipers, a human must be present. The driver must manually turn on the wiper as needed and modify the wiper speed as needed while using this form of manual switching. When it rains, the driver will find this inconvenient. He is unable to focus on driving or changing the wiper speed.

In this situation, there is a mishap. Intelligent wipers with Rain-Sensors are currently only seen in expensive vehicles. There have been numerous attempts to address the issues that have been highlighted. These models have their own limitations. [2]

The majority of existing automobile headlamp control systems are designed to manage illumination intensity manually in ON and OFF modes, with no medium level to change the power of the car headlights based on the surrounding environment. They do not fully utilize the advantages of current technology.

There are now two potential methods for implementing this technology into automobile lighting in a number of applications. The first method involves controlling the automobile light using a passive infrared (PIR) or ultrasonic sensor. The intensity is determined by the number of vehicles approaching from the opposite direction.

This method can be used in the desert as well as on dark interstate highways. The second method is to utilize an ARduino-Uno to control light-dependent resistors and an ultrasonic sensor to control and manage light intensity in response to ambient lighting conditions. [6]

V. PROPOSED SYSTEM

This article describes a rain-activated automatic wiper system that switches off when it stops raining. This document does not require any physical human interaction to control the wipers on the car. We have utilized a servomotor, a MICRO-controller, rain detector, and an LCD. This module is in charge of the wiper system.

Whenever it rains, the sensor monitors and transmits the amount of rain falling information on the µcontroller. The mc processes the data from the precipitator detector before passing it to the servo motor, which performs the desired action. The digital-to-analog output pins of the rain module calculate rainfall intensity. The wiper speed is controlled by the information given to the microcontroller, which is based on the intensity of the rain.

The suggested method employs an ARDUINO-MC to autonomously regulate a car's headlight system based on illumination conditions. The surrounding lights and the oncoming car from the opposite direction of the street are detected using a light dependent resistor (LDR) sensor and an ultrasonic sensor. More advanced systems, such as car headlight control, street lighting, general park lighting, and house illumination, could all benefit from this technology.

VI. EXISTING SYSTEM VS PROPOSED SYSTEM

Wiper is only switching ON and OFF, but it is not based on the intensity of rainfall. [2] But in our paper, based on the amount of rainfall, the wiper speed changes. In our project, if it is drizzling, the servo motor will rotate slowly and it will rotate with high speed if the rainfall is more.

Our project is better as this paper is using piezo electric and then again extra power and hardware and it might not be reliable. Raindrops cause electricity to be generated, which is then stored in a capacitor until the needed voltage is reached to close the relay system and start the wiper motor. [3] Whereas using UNO version of Arduino-Controller, power saving option is there.

The prototype has a severe flaw when one of the two vehicles approaching from opposite directions has its high beam on and the other has its low beam on. Although this reduces the distance between switches, it may still cause glare for low-beam drivers. Furthermore, this prototype does not solve the problem of rear glare, which is caused by vehicles following closely behind another vehicle with high beam lights. But in our prototype, we have reduced the glare caused when two vehicles come close to each other from opposite sides. [33]

A USB webcam and a Raspberry Pi are used in the suggested system for real-time processing. [34] So Camera and Raspberry Pi increase the cost of the system and also the complexity of the system. Also, the camera must be of high speed otherwise it will lead to delay.

VII. BLOCK DIAGRAM

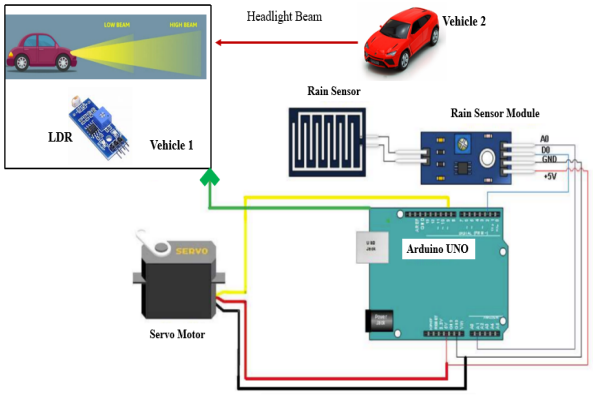

Fig.1. Block Diagram of Proposed Design

An ARDUINO-UNO board, a Rain Sensor, a servomotor, LEDs, and a Light Dependent sensor are all included in the

system. The approach proposed aims to address current system issues.

VIII. METHODOLOGY

The suggested system use an Arduino µc to manage a car's headlights and wipers automatically in response to lighting and rain intensity. The surrounding lights, oncoming car from the opposite direction of the roadway, and rain fall intensity are detected by a light dependent Sensor and a rain-finder, respectively.

For auto wiper control, man's physical interaction will be unnecessary. The wiper mechanism in this project is controlled by a servo motor and an µc based detector.

When it rains, the Rain finder detects the amount of rain and transmits the information to MC. The controller processes the data from the rain gauge and sends it to the servo motor, which then performs the prescribed operation.

The data transmitted to the microcontroller is utilized to regulate the wiper speed and intensity based on the amount of rain falling.

The goal of the project is to employ the controlling apparatus to create an advanced vehicle lighting control system that receives data from a light-dependent resistor that is impacted by the intensity of surrounding illumination from the opposite side of the road.

As a result, the system will regulate the vehicle headlight intensity and set an appropriate vehicle headlight intensity level throughout the night based on the surrounding lighting intensity of a vehicle approaching from the opposite direction.

IX. COMPONENTS USED

9.1 Microcontroller Used

Fig.2. Arduino UNO

It's a low-cost, adaptable, and user-friendly open-source programmable microcontroller board. It is suitable for a wide range of electronic projects. This board's outputs include relays, LEDs, servos, and motors, as well as communication with other boards and RASPBERRI-PI boards.

9.2 Rain Sensor module and Rain Sensor

When it rains, a rain sensor, also called a rain switch, activates. Rain sensors have two purposes. The first is a water-saving device that connects to an autonomous irrigation system and turns it off when it rains. The next is a rain-shielding device that allows windscreen wipers to run in automatic mode while protecting the interior of the car from rain. The sensor is a variable resistance that changes state depending on how much rain falls.

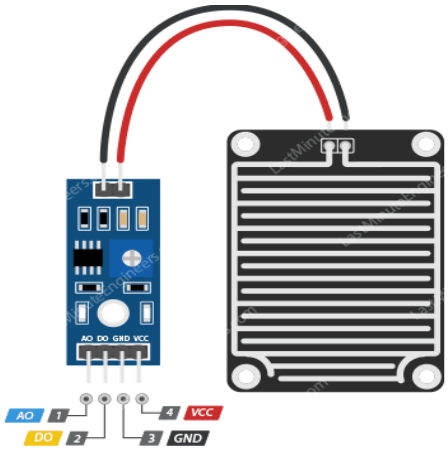

Fig.3. Rain-sensor with its module

The rain-sensor is coupled to two comparator outputs: a digital (0/1) and an analogue output (0 to 1023).

9.2.1 Principle of Operation:

The operation of the Rain Detection Sensor is basic, as shown in the diagram below. On the PCB, multiple exposed log conductive plates are layered in a grid pattern. The resistivity of the conductive plates changes when rain falls on top of the sensor, and we can determine the strength of the rainfall by monitoring the variations in resistance. The stronger the downpour, the weaker the resistance.

9.3 Light Dependent Resistor

Any semiconductor material with a high resistance can be used to construct a photo resistor. Because there are few free electrons that can transport, it has a high resistance. The resistance of the semiconductor reduces when light falls on it.

Fig.4. Light Dependent Resistor

LDRs are used to detect the amount of light in automatic security lights. As the light intensity increases, their resistance decreases: an LDR's resistance is high in the dark and at low light levels, and little current can flow through it.

9.4 Servo Motor

Fig.5. Servo Motor

The device is made comprised of a motor and a position feedback sensor. A servo drive is required to complete the system. The feedback sensor is used by the drive to accurately control the motor's rotational position.

9.5 Breadboard

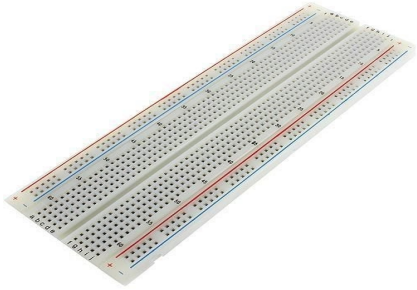

Fig.6. Bread board

Building temporary electronic circuits or conducting circuit design experiments is straightforward and quick with a breadboard. Breadboards use rows and columns of internally connected spring clips behind a perforated plastic covering to allow developers to quickly attach components or wires.

X. WORKING PRINCIPLE

When it starts to rain, an automatic car wiper system engages and shuts off on its own. Man's physical interaction will be unneeded for auto wiper control. We use a servo motor and a rain-Sensor to control the wiper mechanism in this project. When it rains, the Rain Finder detects the amount of rain and sends the information to the Micro-Controller. The controlling device processes the data from the precipitation measurer and sends it to the servo motor, which then performs the desired operation. The rain sensors are made up of digital analogue output pins that are used to calculate the intensity of the rain. The wiper speed and intensity are controlled by the data given to the microcontroller in accordance to the amount of rain falling. The purpose of this project is to create an advanced automotive lighting control system utilizing an Arduino board and data from a light-dependent resistor that is affected by the intensity of surrounding lights coming from the opposite direction of the road. As a result, based on the surrounding lighting intensity of a vehicle approaching from the opposite direction, the system will automatically control the vehicle headlight intensity and set an appropriate vehicle headlight intensity level throughout the night.

XI. RESULTS AND DISCUSSION

When it begins to rain, the device detects it and sends a signal to the serial monitor, which displays the rain intensity on a scale of low to high. The Rain-sensor monitors changes in precipitation intensity and delivers a signal to the servo motor, which causes it to accelerate up. When the ambient light is dim at night, the dim-dip headlights shine brightly in comparison to when light falls on it from a vehicle approaching from the following direction.

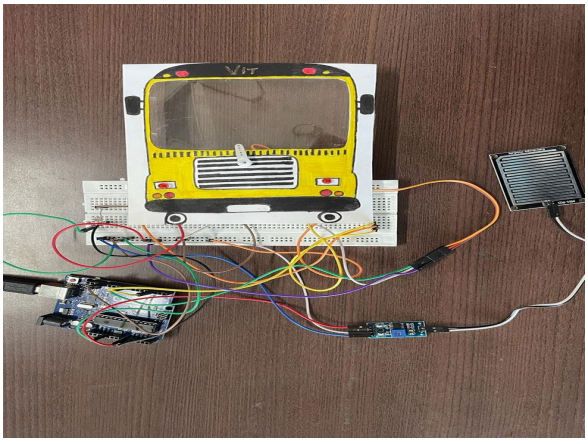

Fig.7. Hardware Setup

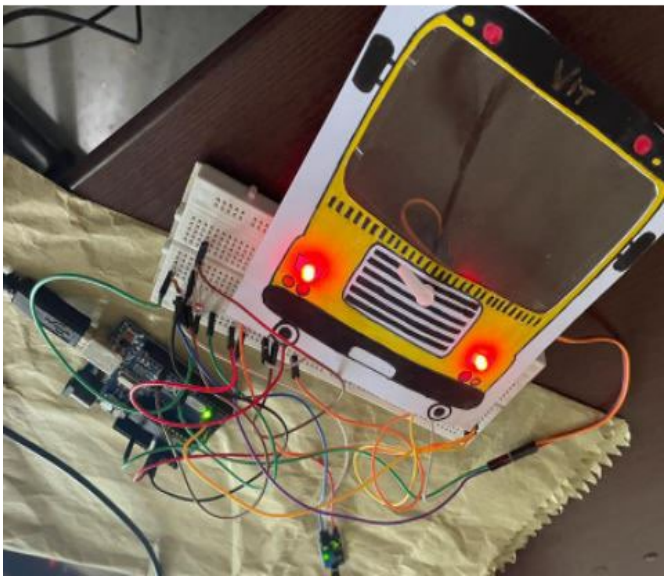

Fig.8. Working Model

XII. CONCLUSION

We have developed a model that detects rain and activates the wiper, varying the speed based on the severity of the rain. We have also used a Light-Dependent Sensors that switches from Low Beam to High Beam when light intensity is low and from High Beam to Low Beam when light intensity is high. We have used open source – Arduino-IDE for coding. This circuit is made up of simple, low-cost components that are straightforward to put together. The usage of this invention in the automotive industry will improve safety and reduce collisions.

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