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SMART VEHICLE HEADLIGHT AUTO SWITCHING AND INTENSITY CONTROL

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This abstract highlights about Vehicle headlights have long been a critical safety component, but their technology has remained relatively stagnant despite advancements in smart cars. The issue of blindingly bright headlights causing accidents persists. The intense glare from high beams poses risks, leading to temporary blindness and potentially fatal collisions.To address this, we propose an innovative automatic headlight intensity control system. Our prototype employs Light Dependent Resistors (LDR) to detect oncoming vehicles and adjust headlight intensity accordingly, dimming them to reduce glare and enhance safety. This system eliminates the need for manual adjustments by drivers, significantly reducing the risk of accidents caused by dazzling headlights. According to the regulations of the Indian Roads and Transport Council, vehicles should primarily use low-intensity lights. However, drivers often misuse high beams due to poor visibility with low beams. Our automatic dipper system intelligently manages headlight intensity, optimizing visibility while ensuring compliance with regulations. For demonstration, we've developed a Bluetooth-controlled vehicle with adjustable headlight intensity. This model showcases how technology can enhance road safety by automating headlight adjustments based on ambient light and approaching vehicles. The Bluetooth interface allows users to control the vehicle and its headlights via a mobile app, enhancing convenience and user experience.

OBJECTIVES:

- Sometimes users forget to switch on the lights before storting the car at night, which can lead to accidents
- At times avers forget to turn off headlights during day time consuming unnecessary buttery
- Also users sometime forget to turn off headlight before leaving car which drains the entire car battery
- Vehicle headlights usually glow at full intensity then turned on consuming max power
- This project bridges Android mobile technology with embedded systems, leveraging Bluetooth for seamless wireless control.

INTRODUCTION

While this project proposes a smart headlight system to address headlight misuse and glare, further exploration can strengthen your research paper. Consider including statistics on headlight-related accidents to solidify the problem's severity. delve into the limitations of current headlight technology and how yours offers improvement. Expand on the system's details with a schematic or explore different light sensor types for better performance. Imagine functionalities for the Bluetooth app beyond on/off control. What about diagnostics or customization features? Explore existing smart headlight systems or automatic dimming mechanisms to position your project within the technological landscape. Look towards the future - how might this system integrate with self-driving cars or project information onto the road? Finally, remember to cite all sources to add credibility to your research. By addressing these points, you can craft a comprehensive and impactful research paper.

Nowadays, the number of vehicles and road transportation system are increasing rapidly. Due to this, the number of road accidents also gradually raises which has been the motivation behind this project. The "ministry of road transport and highways transport research wing" reported a project called "road accidents in India (2018)" which says road accidents in India kills 1.5 lakh people annually, in which 52.02% of accidents are related to the collisions by vehicle to vehicle and more than 30% of accidents occur due to the headlight glare at night. A survey tells that 26.5% of people use dipper properly, 25.53% use it for sometime then avoid using and the remaining 48.3% drivers use high beam continuously.

LITERATURE SURVEY

Research on smart headlights is flourishing, focusing on improving safety, saving energy, and making driving better. Studies explore various sensors (light detectors, cameras) to gauge light levels and oncoming traffic. Researchers develop algorithms to adjust headlights automatically based on surroundings and even driver behavior using machine learning. Smart headlights could talk to each other (V2V communication) to optimize light settings for all vehicles. They can also be energy efficient by adjusting brightness without sacrificing visibility. User acceptance and design are considered to ensure these headlights are user-friendly and meet driver expectations. Overall, this research is paving the way for safer, more enjoyable driving experiences.

FUNCTIONAL DESCRIPTION

The functional description of the project work is explained in this chapter. For better understanding, the total module is divided into various blocks and each block explanation is provided here. The diagrams (block diagram and circuit diagram) of this project work are provided in the next chapter. The following is the description of the overall function or operation of the project work.

BLUETOOTH MODULE:

The HC-05 is a Bluetooth module that allows wireless communication between devices like smartphones and microcontrollers. It uses Bluetooth technology which operates at 2.4 GHz and is designed for low power consumption. This module is easy to use and integrates well with various devices. The project described here utilizes an HC-05 module along with an Android phone to control various appliances.

The phone sends commands through the Bluetooth module to the microcontroller, which then controls the appliances accordingly.

Fig.1.HC-05 Bluetooth Module

ARDUINO NANO:

The Arduino Nano is an open source bread board friendly microcontroller board based on the Microchip ATMEGA 328P microcontroller (MCU) and developed by Arduino.cc and initially released in 2008. It offers the same connectivity and specs of the Arduino Uno board in a smaller form factor. The Arduino Nano is equipped with 30 male I/O headers, in a DIP-30-like configuration, which can be programmed using the Arduino Software integrated development environment (IDE), which is common to all Arduino boards and running both online and offline. The board can be powered through a type-B mini-USB cable or from a 9 V battery. In 2008, the Arduino Nano was released. In 2019, Arduino released the Arduino Nano Every, a pin-equivalent evolution of the Nano. It features a ATmega4809 microcontroller (MCU) with three times the RAM

Fig.2.Arduino nano board

LDR(Light Dependent Resistor):

Light Dependent Resistors (LDRs) are light sensitive resistors that decrease resistance with increasing light intensity. They are well suited for this project because they are inexpensive, rugged, and work well in outdoor environments. As light hits the LDR, its resistance drops, allowing current to flow and controlling the brightness of LEDs via Pulse Width Modulation (PWM) from a microcontroller. This way, the LED headlights can automatically adjust their intensity based on ambient light conditions

Fig.3.Light Dependent Resistor

DC MOTOR*:*

The two key parts of this project are controlling the headlights and controlling the movement of the vehicle.

For headlights, a light-dependent resistor (LDR) is used to sense ambient light. As light levels decrease, the resistance of the LDR goes up. This triggers the microcontroller to automatically turn on the headlights and adjust their brightness using a technique called Pulse Width Modulation (PWM).

For movement, the project uses two DC motors controlled by a Bluetooth app on a smartphone. The app sends commands (forward, backward, right, left) to the microcontroller. A special chip called an H-bridge is used to control the direction and speed of the motors based on the signals from the microcontroller.

L293D “H” BRIDGE IC:

The project uses an L293D H-bridge chip to control two DC motors. This chip is needed because the microcontroller's output isn't strong enough to power the motors directly.

The L293D has two sides that each control one motor. Each side can be turned on or off and the direction of the motor's rotation can be controlled by changing which side is turned on. The microcontroller sends signals to the L293D to control the motors based on the user's commands.

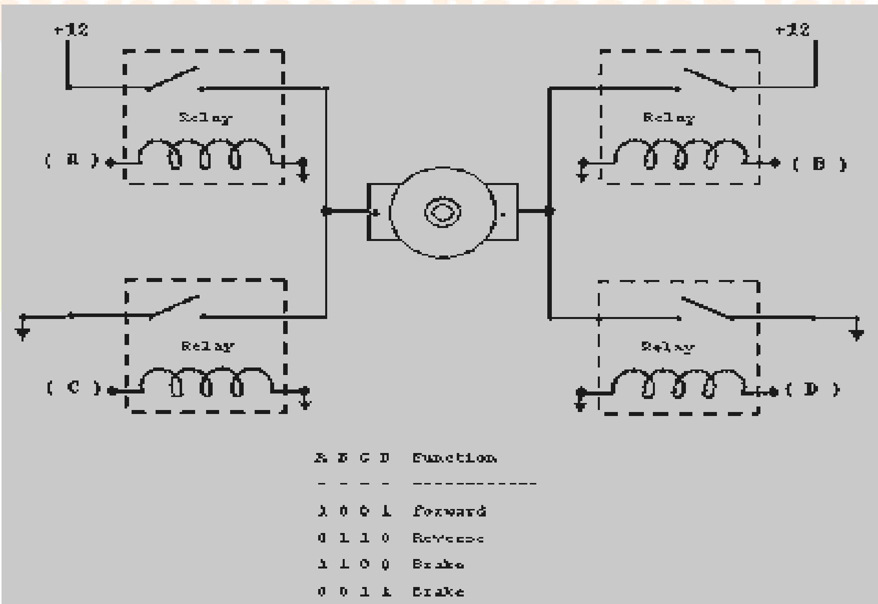

Fig.4.Relays

CONTROLING LED BRITHNESS USING PWM:

Pulse Width Modulation (PWM) is a technique used to control the brightness of LEDs with a microcontroller. A microcontroller can only turn an LED fully on or off, but by rapidly turning it on and off, we can create the illusion of different brightness levels. The key is the width of the on pulse compared to the off pulse. A wider on pulse means the LED is lit for a larger portion of time, making it appear brighter. By varying the pulse width, we can control the perceived brightness of the LED. The human eye can't detect these rapid on-off cycles, so it sees a constant light level that is dimmer or brighter depending on the pulse width.

BLOCK DAIGRAM

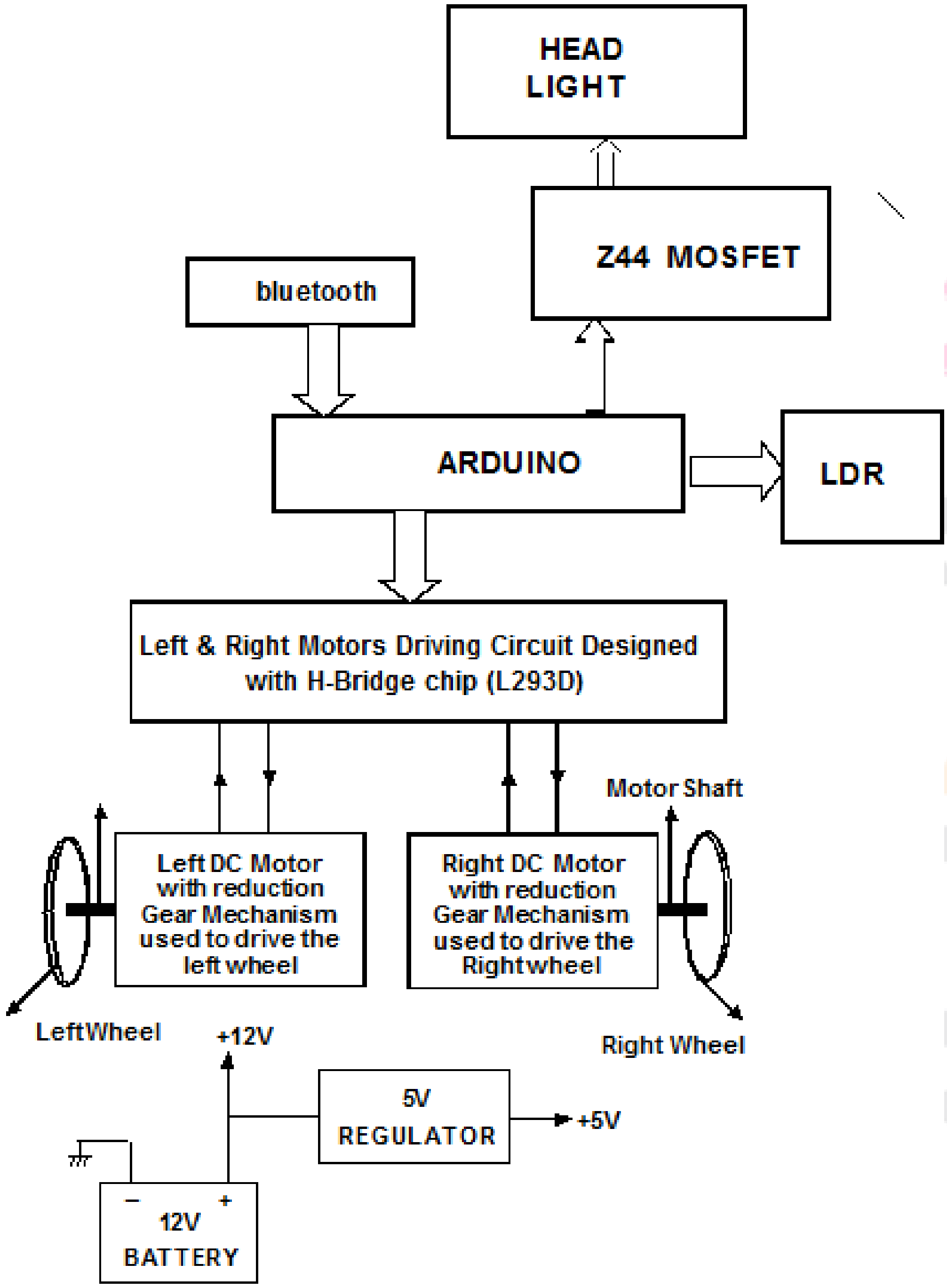

Fig.5.Block Daigram

This smart headlight system automatically adjusts based on its surroundings to optimize visibility and avoid blinding oncoming traffic. Light sensors and detectors continuously monitor ambient light levels and approaching vehicles.

A microcontroller analyzes this data and determines when to switch between high and low beams or adjust the intensity of the headlights. This control system then communicates with the vehicle's electrical system to make the necessary adjustments. By automatically adapting to the environment, this system improves nighttime driving safety for both the driver and others on the road.

SOFTWARE DESCRIPTION

The software details for a smart vehicle headlight auto-switching and intensity control system involve programming the microcontroller to effectively manage the operation of the headlights based on sensor inputs and user preferences. Here's an overview of the software components and functionalities:

Microcontroller Programming:

The heart of the system is the microcontroller (e.g., Arduino, Raspberry Pi), which requires custom software programming to implement the desired functionalities.

Sensor Data Acquisition: Writing code to read analog sensor inputs (from LDRs or other light sensors) to determine the ambient light levels.

Decision Making Algorithms: Implementing algorithms to analyze the sensor data and determine when to switch between high and low beam modes based on predefined thresholds or conditions (e.g., detecting oncoming headlights).

PWM Signal Generation: Writing code to generate Pulse Width Modulation (PWM) signals to control the intensity of the headlights. This involves adjusting the duty cycle of the PWM signal to vary the brightness of the headlights.

Control Logic: Developing logic to interface with external components like transistors or relay modules to physically switch the headlights between different modes based on the decision-making process.

DESCRIPTION OF "H" BRIDGE

This passage talks about how to control DC motors with a microcontroller. It discusses H-bridges, which are circuits that allow you to control the direction of a DC motor. There are three ways to build an H-bridge: with relays, transistors, or an L293D motor driver chip.

- Relays are the simplest way to build an H-bridge, but they are not very efficient and can break easily.
- Transistors are more efficient than relays, but they can get hot if they are controlling a large motor.
- L293D motor driver chips are the easiest and safest way to control DC motors. They can control two DC motors at the same time.

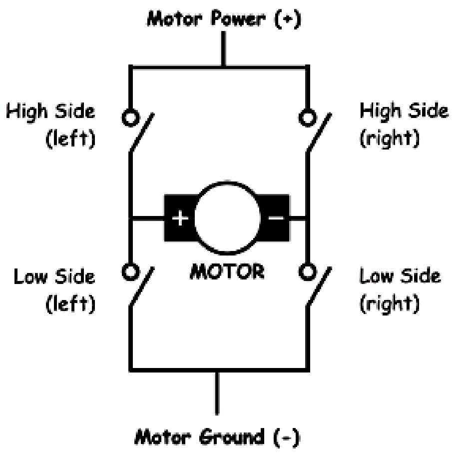

Fig.6.H-Bridge

RESULTS AND DISCUSSION

Automatic headlight systems improve road safety by automatically adjusting brightness and beam mode based on surroundings. This reduces glare for oncoming drivers and improves visibility for the driver, especially at night. It also frees the driver from manually adjusting headlights, reducing the risk of errors and improving compliance with regulations.

However, there are challenges. Light sensors need to be accurate and reliable in detecting light levels and oncoming vehicles. The system's decision-making software needs to be well-tested to ensure it switches beams appropriately in different environments (city vs highway).

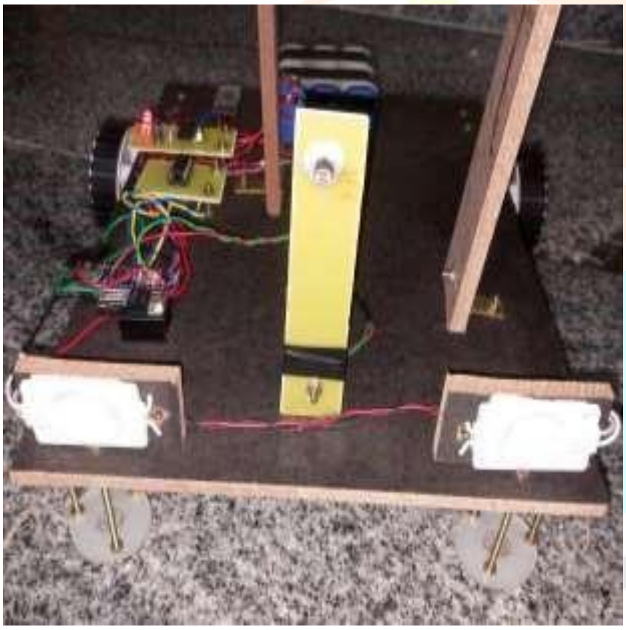

Fig.7.Smart vehicle headlight in environmental at light position and dark position

Smart headlight systems automatically adjust brightness and beam mode based on surroundings, significantly improving road safety. This reduces glare for oncoming drivers and improves visibility for the driver, especially at night. While sensor accuracy, software testing, and user acceptance require attention, these systems offer potential benefits in energy efficiency, reliability, and durability. Despite challenges in cost, component availability, and system integration, ongoing research on advanced sensors and communication technologies promises further advancements in automotive safety and technology.

CONCLUSION

The authors built a prototype automatic headlight dimmer system. This system automatically switches headlights to low beam when it detects an oncoming vehicle, reducing glare and improving safety. It is designed to be simple, compact, and easy to install in most cars.

The project was successful in demonstrating the concept. They built a basic prototype to show how it would work in a real car. They also considered future improvements like adding a camera for better control. However, there are some limitations to the current design, like the Bluetooth range being limited, especially in buildings.

FUTURE SCOPE

Automatic headlight systems are a significant improvement over manual controls. They eliminate human error and allow drivers to focus on the road. These systems have a bright future with potential for even greater safety benefits.

Future advancements include advanced sensors like cameras and radar that can provide a more detailed picture of the surroundings. This would allow the system to make even more precise adjustments based on complex driving scenarios. Additionally, car-to-car communication could enable headlights to talk to each other, preventing drivers from blinding one another. Artificial intelligence and machine learning could personalize headlight control based on individual driving styles and conditions. Smart headlights could also be integrated with self- driving cars and even smart city infrastructure to further enhance safety and efficiency on the roads.

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