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Power Management Street Light by Vehicles

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ABSTRACT

Streetlights, which occasionally shine throughout the day as well, use a lot of power even when they're not in use. Therefore, in order to avoid energy loss, an autonomous vehicle control system is necessary. In this study, we provide a proposal for smart streetlights that automatically adjust their brightness in response to passing traffic by modifying a logic control circuit. This implies that in the dark, all of the streetlights will switch on automatically; when they detect no activity, they will stay dim; and when they detect a car moving, they will brighten. As the vehicle advances, each of these lights will progressively brighten. Unlike conventional or fixed lighting, this kind of light moves with the environment. To further reduce power usage, the system has an automated switch on and switch off circuit to power the lights at night and de-electrify them in the morning. Each of the four miniature streetlights in the demonstration module has a high-glow LED bulb that consumes 2.5 watts of power. The 89c51 microprocessor chip is part of an embedded system that uses relays to power these lights. With the LDR linked to a timer chip in trigger mode, the lights will only turn on when it becomes dark outside, acting as a natural light sensor. While four sets of sensors independently control four sets of streetlights, infrared sensors keep an eye on cars in motion. Turning off the street lights causes them to stay dim, but when a circuit detects a car coming, that light will switch on. The vehicle's motion causes the street lights to turn on sequentially, since each light has its own control circuit. In the demo module, four street lights are controlled independently; however, in real-time applications, each street light must be controlled individually. This is because this is a prototype module.

Introduction

Between 35 and 45 percent of a municipality's utility budget goes toward street lighting, making it one of the most costly energy expenditures. A smart lighting management system may save the price of street lighting for municipalities by as much as 70 percent. Automatically distinguishing between pedestrians, bikes, and cars, an intelligent street lighting system adjusts light output according to occupancy and use. Moving at a certain pace causes it to flash a certain number of lights in the front and less in the rear. It also takes road conditions into account while adjusting the light's brightness [3]. The advancement of a society's transportation infrastructure is a sign of its level of civilization. In order to be seen, the major parts of the transportation model—highways, roads, and streets—need adequate illumination. For automation systems, the manual mode is the way to go as it cuts down on wasteful power usage. Customers' lives are made simpler with the help of energy-saving automatic systems, which find use in deck ventilators, washing machines, and many other products. Like every other industry, streetlights may reap the benefits of automation. Regardless of the amount of traffic or pedestrian activity on the road, street lights that are manually turned on will remain on for an average of thirteen hours. Automating the formerly laborious process will allow us to save a considerable amount of energy. A smart street-light system can detect the intensity of natural light and adjust the ON/OFF status of the street lights appropriately. The device keeps the lights on because it senses motion on the road. Using smart lamps that detect when people are moving and other processes that are well-designed may lower the cost of streetlights [4]. The suggested nightly illumination of a roadway or walkway by means of a street light, also known as a street lamp or lamp standard, occurs at a certain hour. Two major benefits of street lighting are the decrease in accidents and the enhancement of safety. Studies have shown that accidents and collisions, especially those involving pedestrians, are more common when it is dark outside. Pedestrian accidents are three to six and a half times more likely to occur in the dark compared to when it is light outside. There is evidence that putting lights on the roadway may cut pedestrian accidents in half. Automated street light monitoring and control systems allow businesses to be more precise and efficient by controlling the timing of street light switching [1].

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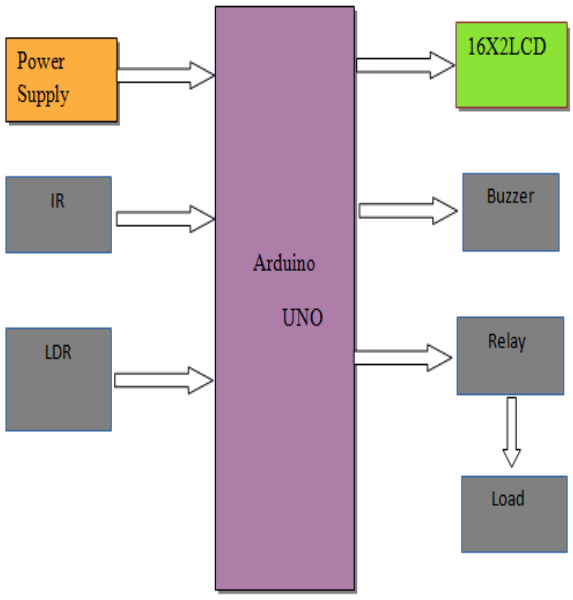
Literature review

Streetlights are not bendable these days. o Power is wasted due to human error. o Handling distant locations is the greatest challenge. Energy conservation is seen as a crucial weapon in the battle against climate change and is therefore one of the most essential global standards to follow. However, the electric car is designed to protect the environment. Between 10 and 38 percent of all energy usage is attributed to streetlights. Cities throughout the globe rack up enormous energy bills, putting a heavy financial and ecological strain on governments. keep running their company. The outcome was the creation of the energy-efficient street. Lighting designs have exploded in popularity as a field of study in recent years [8]. Usually, 35-400 watts are needed for street lights, however this might vary with the material. To illustrate the point, low-pressure sodium bulbs use 35–55 watts of power, which is excessive for a light source with such a poor efficiency. So, instead of depending on local gridlines, we have developed an independent system that powers the street lights using the mechanical energy that is lost by the cars that drive on the roadways every day. [5]. The Intelligent Street Lighting system (ISLs) has gained a lot of attention from scientists and has advanced rapidly thanks to developments in Light Emitting Diode (LED) and the Internet of Things (IoT). Its goal is to decrease electrical energy consumption while minimizing environmental impact. A new and exciting Smart City application is ISLs, which consist of high-tech sensors, smart gateways, and a control platform. Intelligent street lighting (ISL) systems can utilize internet of things (IoT) technology to save energy without sacrificing user experience by adjusting the brightness of streetlights in response to environmental conditions or in coordination with nearby streetlights, as opposed to conventional street lighting schemes that depend on light sensors or clocks to accomplish on/off functionality. Consequently, urban areas may reduce their street lighting electric energy costs by 20 to 70 percent by using ISLs [8]. Everyone is aware that municipal and county governments offer a vital public service by maintaining adequate street lighting. Appropriate lighting is critical for the security of urban areas, both for pedestrians and drivers. The frequency of accidents on the road is reduced when street lighting enhances visibility for drivers, cyclists, and pedestrians in low light. In a roundabout way, street illumination aids in crime prevention by making people feel safer on the streets and at home in their own neighborhoods. However, in the modern world, saving energy is of the utmost importance [6].

METHODOLOGY



Block diagram

The daytime operation may be controlled and the lights can be reciprocatedly dominated by an app that connects to the rear half. Consequently, we may drastically cut down on power waste by making use of this program [1]. In most cases, the schedule for the day dictates when street lights are switched on and off. To illustrate the point, streetlights

may be programmed to switch on at 6 p.m. and off at 6 a.m. The schedule is flexible enough to adapt to the specific requirements of each location. Scheduling events is a breeze from the main area. During sunset or darkness, the road lights may be switched on. During dawn or shine, it can be turned off. The installation of an appropriate gadget to determine the time of day has been completed [1]. A possible component in the dimming of street lights is the supported light-emitting diode's lightweight temperature. If the LED street lights have grown too hot after being on for a while, we may turn them down in motorcar mode. The light fixture's light-emitting diodes are equipped with temperature sensors to enable this dimmer feature. Electronic light-emitting diode lights will replace more conventional light sources like sodium bulbs in the system. Every single one of these lights is more efficient than anything else on the market right now, and they all have power ratings. The lights will be positioned across each other in parallel so that the system may continue to work even if one of them is damaged for any external reason.

Smart Street Lighting: In order to provide intelligent management of street lights, the suggested system integrates data collected in real-time from vehicles. Travelers may be assured of safety while energy savings are achieved.

NB-IoT and LoRa Communication: The system is able to automatically adjust streetlights depending on current traffic data since it combines NB-IoT and LoRa communication technologies.

Energy Savings: Installation of the system on Luyang Avenue in Lucheng City, Shanxi Province, China, has been completed. Compared to April 2019 and June 2018, it cut power usage by 18% and 19.7%, respectively, in June 2019.

Potential for Smart Cities: Installation of the system on Luyang Avenue in Lucheng City, Shanxi Province, China, has been completed. Compared to April 2019 and June 2018, it cut power usage by 18% and 19.7%, respectively, in June 2019.

Arduino

One such microcontroller board is the Arduino Uno, which uses the ATmega328 (datasheet). A 16 MHz crystal oscillator, 6 analogue inputs, 14 digital input/output pins (including 6 PWM outputs), 1 USB port, 1 power connector, 1 ICSP header, and 1 reset button are all part of it. All you need is a USB cable, an AC-to-DC converter, or a battery to get it going; it comes with everything you need to support the microcontroller.

LIQUID CRYSTAL DISPLAY

In front of a light source or reflector, a thin, flat display device called a liquid crystal display (LCD) arrays a large number of color or monochrome pixels. Pile of liquid crystal molecules held aloft by two transparent electrodes and two polarizing filters, whose polarity axes orthogonal to one another, make up each pixel. If there weren't liquid crystals interposed, one would block the other from light. Light that enters one filter is able to pass through the other because the liquid crystal bends its polarity.
A program's ability to communicate with the outside world depends on its input and output devices, which in turn rely on human communication. An LCD display is a typical accessory for controllers. The 16x1, 16x2, and 20x2 LCDs are among the most popular types of displays that are attached to the controllers. This equates to sixteen characters on a single line. The first set has 16 characters on each line while the second set has 20 characters on each line.

INFRARED TECHNOLOGY (IR)

Located on the other end of the electromagnetic spectrum from ultraviolet light, infrared light (sometimes called "infrared radiation") is visible light that is just below the red region. Although infrared cannot be seen, it is physically identical to visible light and may thus be reflected or transmitted through transparent materials like glass. The infrared receivers found on the front of most home entertainment systems allow infrared remote controllers to communicate with one another using this invisible light. A tiny infrared diode on the front of the remote sends out rapid pulses of light to all of your devices every time you push a button on the remote. In order for the machinery to

obey the order, it must first identify the signal as coming from within. However, infrared light may be narrowed or broadened, and it can be either faint or bright, much like a flashlight. The range and angle of your remote control are affected by the kind and quantity of emitters. One can use a high-quality remote control from almost any angle and up to thirty feet away, whereas a low-quality one requires precise targeting of the item.

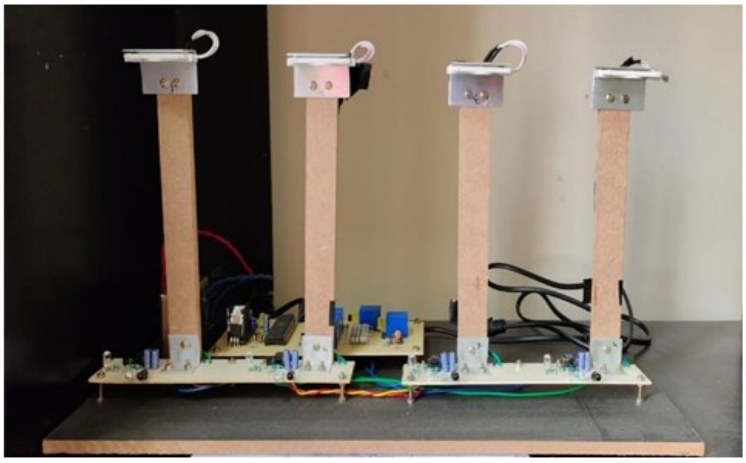
Light Dependent Resistor:

Particularly in circuits including light or dark sensors, light-dependent resistors are very important. Although light-dependent resistors (LDRs) sometimes have large protection values—up to 1,000,000 ohms—their protection values decrease dramatically when illuminated. Therefore, LDR anticipates playing a fundamental role in this attempt by trading on the lights based on the power of light; that is, the lights will be turned off during the day if the power of light is greater. In addition, the lights will be switched off throughout the night when the light intensity is lower.

RELAYS:

Many household and commercial equipment, as well as industrial control systems, make use of electrically controlled switches called relays. By using a relay, two independent voltage sources may be isolated from one another; in other words, a little quantity of voltage or current on one side can manage a big amount of current or voltage on the other side, and vice versa.

RESULTS



Output

Vehicle Detection

CONCLUSION

In order to identify the time of day, the presence or absence of vehicles, and environmental factors, the contemporary street light system that has been suggested makes use of pulse width modulation (PWM) technology in light-emitting diode (LED) lights. Using an LED's dimming and brightening functions significantly reduces power consumption. Therefore, communities may save a lot of energy by using this new street light system. Critics may find them wanting. It would be expensive, therefore we need to think about the benefits: Although there is a little increase in lamppost prices, the savings in maintenance, availability of a power network, and the scarcity of costly wire more than make up for it. Consequently, less energy use and harmful pollution are the end goals. The present system may be modified and expanded to meet the needs of its users.

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