INTELLIGENT STREET LIGHTING WITH VEHICLE DETECTION FOR OPTIMIZED ENERGY USE

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ABSTRACT
The primary goal of this project is to create an embedded system that uses vehicle detection to switch or turn on the light in order to save energy on street lights.The Arduino simply signals the street lights to turn on whenever an infrared sensor is spotted. The lights are then turned on until the car leaves, at which point they turn off on their own.Another method is to use PWM to keep the lights at a minimal intensity without turning them off entirely. It will turn the lights on to their highest intensity when it detects a vehicle. However, the circuit in this article is set up so that lights are turned off entirely and only turn on when a car is present. Depending on the weather, this gadget may also be used to switch on and off the street lights. The street lights automatically go off during the day when they detect high-intensity solar rays. The street lights automatically switch on when the sensor detects low intensity, such as at night. Using PWM, the light's brightness also changes according to intensity. Because of this, it may be used for a variety of applications with minor modifications.

I. INTRODUCTION

INTRODUCTION TO SMART STREET LIGHT BASED ON VEHICLE DETECTION

Automation is becoming more and more significant in both daily life and the global economy. Any type of manual system is being replaced by automatic systems. Another name for it is "SMART STREET LIGHT SENSING." Public street lighting that adjusts to the movements of automobiles, bikes, and pedestrians is known as intelligent light sensing. Adaptive street lighting, another name for intelligent street lighting, brightens when movement is detected and dims when no activity is observed. Traditional, fixed, illumination, or dimmable street lighting that turns off at certain periods is not the same as this kind of lighting.The study demonstrates how streetlights may be controlled automatically, which helps to conserve some electricity. Automation is a step up from mechanisation in the context of industrialisation. Automation significantly reduces the need for human sensory and mental needs, but mechanisation gave human operators tools to help them with the physical demands of their jobs. Basically, one of the key components is street lighting. As a result, street lighting are quite basic; nonetheless, as urbanisation progresses, the number of streets with heavy traffic density rapidly grows. A well-designed street lighting system must take into account a number of variables, including community members' and drivers' safety at night, cost-effective public illumination, crime reduction, and environmental impact reduction. Originally known as the first generation of the original street light, street lamps were operated manually, with a control switch installed in each one. Following that, an optical control mechanism utilising a high pressure sodium light in their system was employed. It is evident that the technique is currently widely applied throughout the nation.

By varying the street lights periodically and, under specific circumstances, turning some lights on and off in response to motion seen on the roads, smart automatic street light systems help to intelligently and automatically control the lights to minimise power consumption and reduce man-work. This phenomena lowers extra power usage by up to 50% by integrating the real-time clock (RTC) module to precisely schedule the street light. However, the suggested system makes use of an ARM controller, which has a fast clock speed. When compared to other common controllers such as Arduino, AVR, 8051, etc., all controlling procedures operate more quickly.

1.2 Block Diagram:

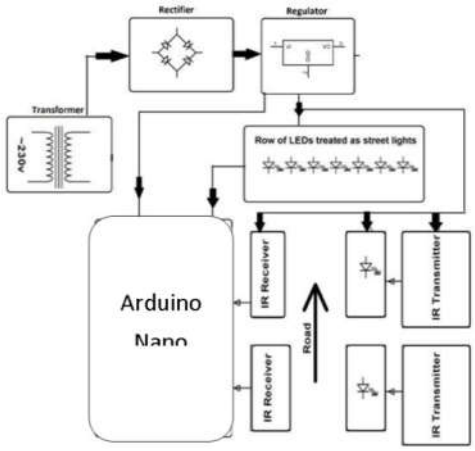

Fig.1: Block Diagram Of Smart Street Light Based On Vehicle Detection

II. HARDWARE DESCRIPTION

ARDUINO NANO

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

Arduino Nano is one type of microcontroller board, and it is designed by Arduino.cc. It can be built with a microcontroller like Atmega328. This microcontroller is also used in Arduino UNO. It is a small size board and also flexible with a wide variety of applications. Other Arduino boards mainly include Arduino Mega, Arduino Pro Mini, Arduino UNO, Arduino YUN, Arduino Lilypad, Arduino Leonardo, and Arduino Due. And other development boards are AVR Development Board, PIC Development Board, Raspberry Pi, Intel Edison, MSP430 Launchpad, and ESP32 board.

This board has many functions and features like an Arduino Duemilanove board. However, this Nano board is different in packaging. It doesn't have any DC jack so that the power supply can be given using a small USB port otherwise straightly connected to the pins like VCC & GND. This board can be supplied with 6 to 20volts using a mini USB port on the board.

III. INTRODUCTION OF IR SENSOR

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm … 50 µm. IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests.

There are two types of infrared sensors: active and passive. Active infrared sensors both emit and detect infrared radiation. Active IR sensors have two parts: a light emitting diode (LED) and a receiver. When an object comes close to the sensor, the infrared light from the LED reflects off of the object and is detected by the receiver. Active IR sensors act as proximity sensors, and they are commonly used in obstacle detection systems (such as in robots).

As next-generation electronic information systems evolve, it is critical that all people have access to the information available via these systems. Examples of developing and future information systems include interactive television, touch screen- based information kiosks, and advanced Internet programs. Infrared technology, increasingly present in mainstream applications, holds great potential for enabling people with a variety of disabilities to access a growing list of information resources. Already commonly used in remote control of TVs, VCRs and CD players, infrared technology is also being used and developed for remote control of environmental control systems, personal computers, and talking signs.

LED

A light-emitting diode (LED) is a semiconductor diode that emits incoherent narrow spectrum light when electrically biased in the forward direction of the pn- junction, as in the common LED circuit.

While sending a message in the form of bits such as 1,the data is sent to the receiver side correspondingly the LED glows representing the data is being received simultaneously when we send 8 as a data the LED gets off .

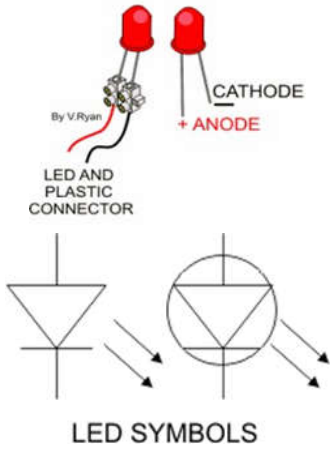

Fig.2 :LED Light and LED Symbol

POWER SUPPLY

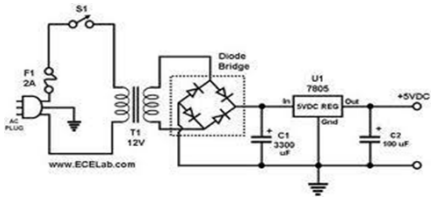

Fig.3 :Circuit Diagram of power supply

• A variable regulated power supply, also called a variable bench power supply, is one where you can continuously adjust the output voltage to your requirements. Varying the output of the power supply is the recommended way to test a project after having double checked parts placement against circuit drawings and the parts placement guide.

IV. FLOW CHART

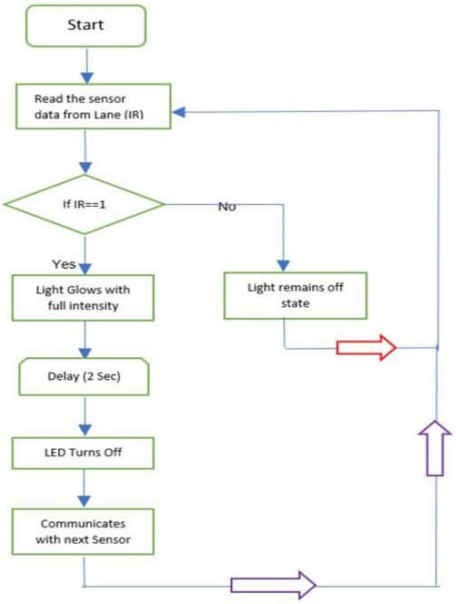

Fig 4: Flow Chart

V. CIRCUIT DIAGRAM AND RESULT

5.1 Circuit Diagram:

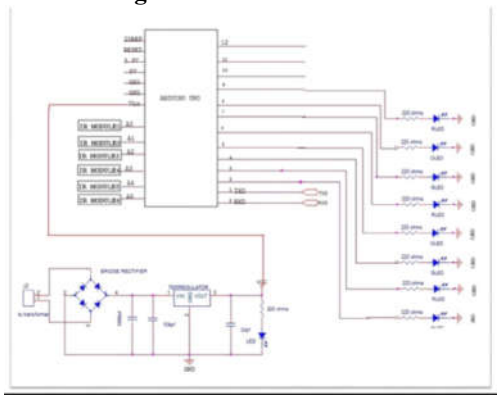

Fig 5: Circuit Diagram

5.2 Result

5.2.1 Without Power Supply

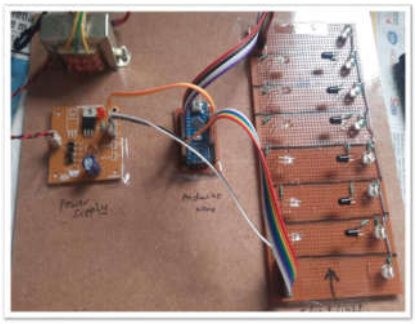

Fig.6: Without Power Supply

5.2.2 With Power Supply

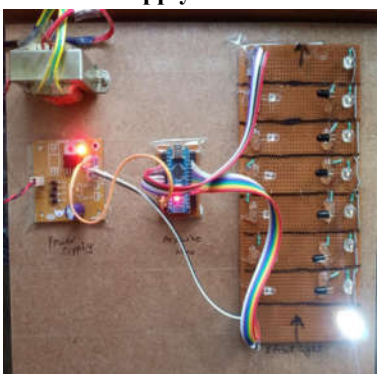

Fig.7: With Power Supply

5.3 Advantages

- Lower Consumption Of Energy
- Efficient Usage Of the Power.
- Has Predictable And Long Lifetime
- They Are Less Attractive To The Insects
- Pedestrian Crossings
- It Can Be Used For More Than 50,000 Hours

◉ These smart lights will help cities to reduce electricity costs, lower CO2 emissions, and improve maintenance.
◉ Save The Manpower and reduces accidents at night.

5.4 Disadvantages

◉ They are much expensive
◉ Risk of theft of the automatic street light system is relatively higher.
◉ LED bulbs can cause serious eye problems when used as streetlights

5.5 Applications

◉ Pedestrian Crossings
◉ Parking
◉ Highways

VI. CONCLUSION

This concept outlines an intelligent street lighting system that uses solar-powered LEDs and a control system for effective administration. This function extends the life of the lamps and saves energy by only turning on the lights when needed. The ZigBee control system's wireless nature allows for little maintenance and flexible, expandable, and completely adjustable user demands in both urban and rural settings. The features that define the suggested system are the simplicity of ZigBee, the dependability of electronic components, the sensor network feature, the processing speed, the lower costs, and the ease of installation. When compared to other technologies, the system appears to be an intriguing engineering and commercial solution.

REFERENCE

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❖ **Websites viewed:**

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