

## **IMPLEMENTING VEHICLE DETECTION IN SMART STREET LIGHTING SYSTEMS**

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### **ABSTRACT**

The main objective of this project is to develop an embedded system which switches or turn ON the light by detecting the vehicles on the road for energy saving of street light. Whenever IR sensor is detected it just indicates the Arduino to switch on the street lights. Then lights are switched on till the vehicle leaves and switches off automatically. Another way to this approach is, one can maintain minimum intensity without completely switching off the lights by using PWM and switch them on to maximum intensity whenever it detects the vehicle. But in this article the circuit is designed in such a way that lights are completely switched OFF and will be switched ON only when there is any vehicle.

This device can also be used for turning on and turning off the street lights based on the climate of the weather. When it is day the street lights automatically gets turned off by detecting the sun rays i.e High intensity. Whenever the sensor finds the low intensity i.e night time it automatically turns on the street lights. Based on the intensity the brightness of the light also varies using PWM. So it can be used for multiple purposes with the slight changes in it.

### **I. INTRODUCTION**

#### **INTRODUCTION TO SMART STREET LIGHT BASED ON VEHICLE DETECTION**

Automation plays an increasingly very important role in the world economy and in daily life. Automatic systems are being preferred over any kind of manual system. We can also call it an “SMART STREET LIGHT SENSING”. Intelligent light sensing refers to

public street lighting that adapts to movement by pedestrians, cyclists and cars. Intelligent street lighting, also referred to as adaptive street lighting, dims when no activity is detected, but brightens when movement is detected. This type of lighting is different from traditional, stationary and illumination, or dimmable street lighting that dims at pre-determined times. The research work shows automatic control of streetlights as a result of which power is saved to some extent. In the scope of industrialization, automation is a step beyond mechanization. Whereas mechanization provided human operators with machinery to assist the users with muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements as well. Basically, street lighting is one of the important parts. Therefore, the street lamps are relatively simple but with the development of urbanization, the number of streets increases rapidly with high traffic density. There are several factors need to be considered in order to design a good street lighting system such as night-time safety for community members and road users, provide public lighting at cost effective, the reduction of crime and minimizing its effect on the environment. At the beginning, street lamps were controlled by manual control where a control switch is set in each of the street lamps which is called the first generation of the original street light. After that, another method that has been used was optical control method done using high pressure sodium lamp in their system.

Nowadays, it is seen that the method is widely used in the country.

Smart automatic street light system helps in controlling the street lights intelligently and automatically to minimize power consumption and reduces man work by fluctuating the street lights time to time and in certain conditions toggling as well as turning OFF of some lights concerning the motion observed on the roads. The interfacing of the real-time clock (RTC) module is to control the street light on exact timing, so this phenomenon reduces excess power consumption by up to 50%. On the other hand, the proposed system uses an ARM controller which has a high clock speed. All controlling processes work faster as compared to all other typical controllers like arduino, Avr, 8051, etc.

### 1.2 Block Diagram:

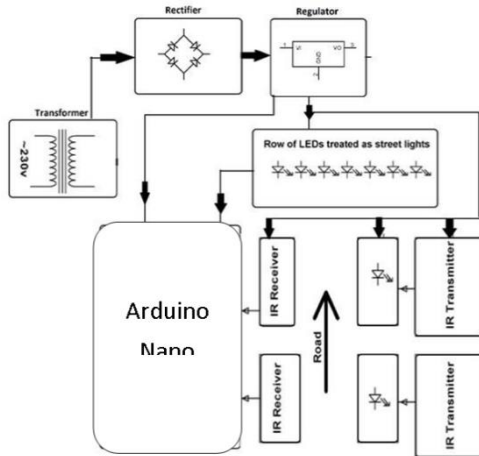


Fig.1: Block Diagram Of Smart Street Light Based On Vehicle Detection

## 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  $\mu$ m. 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.

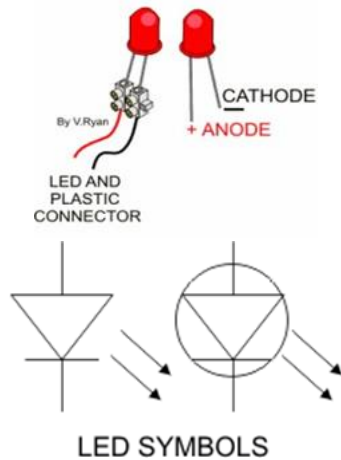


Fig.2 :LED Light and LED Symbol

#### POWER SUPPLY

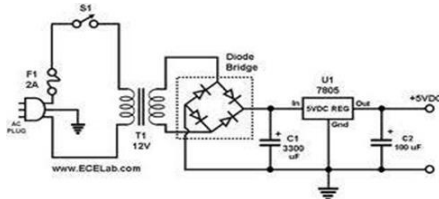


Fig.3 :Circuit Diagram of power supply

- 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

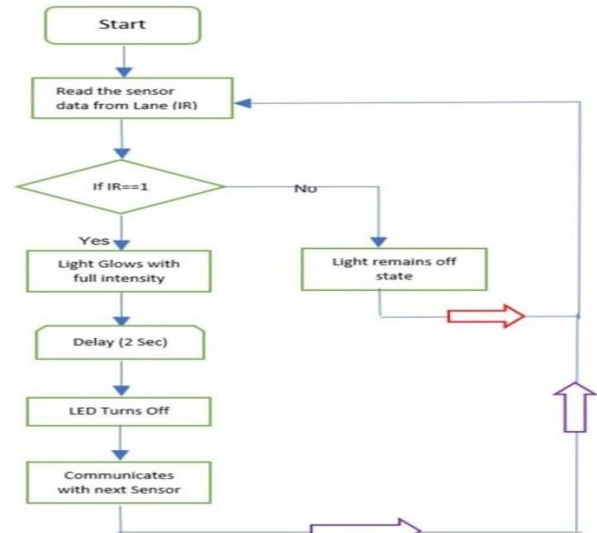


Fig 4: Flow Chart

#### V. CIRCUIT DIAGRAM AND RESULT

##### 5.1 Circuit Diagram:

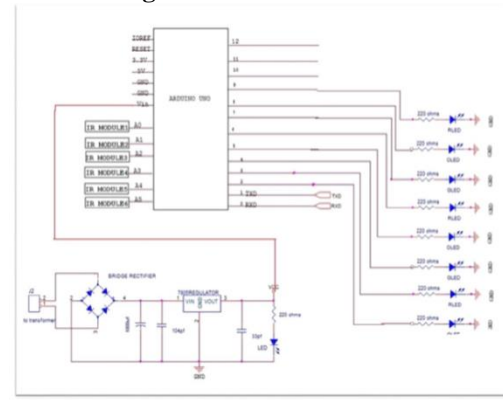


Fig 5: Circuit Diagram

##### 5.2 Result

##### 5.2.1 Without Power Supply

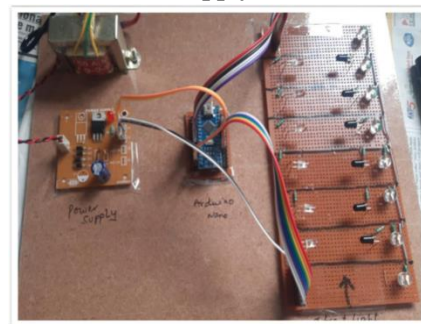


Fig.6: Without Power Supply

##### 5.2.2 With Power Supply

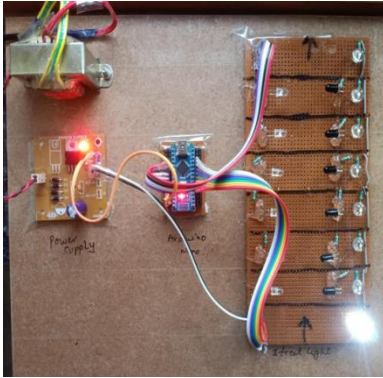


Fig.7: With Power Supply

### 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 CO<sub>2</sub> 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 AND FUTURE SCOPE

### 6.1 Conclusion

This project describes an intelligent street lighting system using LED supplied by solar energy and with a control system for efficient management. This features switching ON the lights only when necessary increasing the energy saving and Lamps lifetime. The wireless nature of the control system using ZigBee offers very less maintenance and flexible, extendable and fully adaptable user needs in rural and urban areas. The simplicity of ZigBee, the reliability of electronic components, the feature of the sensor network, the processing speed, the reduced costs, and the ease of installation are the features that characterize the proposed system, which presents

itself as an interesting engineering and commercial solution as the comparison with other technologies.

### 6.2 Future Scope

- We can add LDR (Light Dependent Resistor) as a extension to the project so that the lights maintain minimum brightness instead of completely turn off.
- We can confidently say that solar-powered lights will inevitably be the street lights of the future. It plays a major part in a clean, green environment

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