# STREET LIGHT AUTOMATION USING ARDUINO

Mr. K. Appala Naidu *Assistant Professor, Electrical and Electronics Department Vignan's Institute of Information and Technology* Visakhapatnam, india

Dokiparthi Sunayan Raj Gupta *UG Student, Electrical and Electronics Department Vignan's Institute of Information and Technology* visakhapatnam, India

Konathala Sai Sankar *UG Student, Electrical and Electronics Department Vignan's Institute of Information and Technology* visakhapatnam, India

Boddepalli Teja *UG Student, Electrical and Electronics Department Vignan's Institute of Information and Technology* visakhapatnam, India

**Abstract: The automated system that automates the street is known as a smart street light. Manual systems are now being superseded by automatic systems. The use of records technology and verbal exchange technologies to reduce the demand for human attempt withinside the manufacturing of gadgets and services is known as automation. When there aren't any cars at the road, the maximum vital intention of Smart Street Light is to restrict power usage. When there are motors at the road, the smart street moderate will turn on; otherwise, the lighting will be turned off. The research demonstrates automatic law of streetlights, which saves energy to some extent. The Smart Avenue mild offers an energy-saving answer via the use of IR sensors for detecting a drawing near car and then turning on every one of road lights in advance and at the back of vehicle. The tail lights close up mechanically once the automobile passes past. As a result, we tend to save a widespread quantity of energy. once aren't any vehicles on the road, all of the lights are become off.**

**Keyword– Automation, Arduino board, LDR (Light dependent resistor) Sensor, IR (Infrared) sensor, LED lights, AC-DC converter**

## I. INTRODUCTION

Automation systems outperform manual ones in terms of productivity, efficiency, and dependability while also reducing the amount of time workers spend on manual tasks, thereby saving time and money. The computerized avenue light control system is no longer just the simplest but also the most advanced technology. When a moving item is detected, the system can switch to fully automated mode and regulate streetlights accordingly. The main goal of this work is to collect power from street lights in remote areas where street lights are rarely used between the hours of 10:00 p.m. and 4:00 a.m. As a result, it is decided to use a vehicle-or person-detection ON/OFF road lighting device for this particular application. The original version of the realistic street lights was manually controlled, with a control switch installed in each light fixture. After that, they used an optical manipulator with a high-pressure sodium mild. People all around the globe are now commonly using this strategy. The technology works by placing an optical control circuit, altering the resistance using a mild sensitive device and regulating street lighting fixtures to turn on mechanically at night and switch off robotically after dawn in the morning. Scientific breakthroughs have made it possible for road lights to be classified depending on

their installation location and performance, such as traffic lights, lighting fixtures for secondary roads, and lights for urban centres and public spaces, for instance. In this work, we argue for and implement a device that converts 230V AC power into 5V DC power using an AC-DC converter. This is then sent to the Arduino, LDR, and relay modules as 5V DC. An AC 230V supply is once again delivered to the LED lights to turn them on.

## II. LITERATURE SURVEY

According to S. Suganya and colleagues, Street Light Glow is a form of equipment that takes advantage of the most recent advancements in lighting technology, such as LED illumination, in order to monitor vehicle movements through the use of sensors. In addition to this, it can be used to adjust the sensitivity of the street lights based on the amount of light that is present, build flow-based dynamic control records using infrared detection technology, and maintain a wireless connection between lampposts and control terminals using the ZigBee Wireless protocol. Furthermore, to all of that, it comes equipped with a timer, visitors' drift magnitude statistics, photodiodes, LEDs, and power transistors. K. Santhaetal has compiled a report on Vehicle Movement-Based Street Lighting based on their findings. The equipment is going to start operating in automated mode, which controls the brightness and dimness of the streetlights based on a brightness and dimness rule as well as a lightweight intensity threshold. Seasonal fluctuations are frequently used as a guiding principle for regulation. It consists of a timed function as well as computerised sample manipulation for improved power efficiency. In the past, a PIC microcontroller was utilised in order to bring the complete scheme into action. A ZigBee-based autonomous road light device that can be managed from a distance has been proposed by Srikanth et al. ZigBee modules, which are included in the device's design, play a role in locating and repairing malfunctioning lighting. It also refers to an intelligent device that can turn itself on or off, as well as adjust its brightness, in response to the presence of a moving vehicle or pedestrian and other factors in the surrounding environment. PIR movement sensors are utilised to detect both live and non-living items in their surroundings. In order to improve the efficiency of the conversion of solar energy to usable power, C. Bhuvaneshwari and colleagues looked into the possibility of equipping a street light with an automatic tracking device. The solar monitoring sensor is a sensing machine that detects the proximity of the sun over a period of time and delivers an output to the amplifier based on the light density of the sun. LDRs are utilised as the sensors for the solar monitoring system. An amplifier unit is used to amplify the signals from the LDRs, transforming them from low-level to high-level signals. The output of the amplifier unit is then sent to a comparator. The LM324 integrated circuit is used in this system in the amplifier role. The comparator will issue an instruction to the AT89C51 CPU whenever the alerts are compared to one another. This article by Somchai Hiranvarodom et al. shows how he compared three fantastic photovoltaic (PV) street lighting systems. Each mast was outfitted with a low-pressure sodium light, a high-pressure sodium lamp, and a fluorescent bulb for the purpose of determining which high-quality solution would be best suited for deployment in a rural area typical of Thailand. At the Raja Mangala Institute of Technology in Thanyaburi, which is located in the Pathum Thani region of Thailand, all three systems were installed with the same kind of module and the same amount of watts in a variety of locations. The operation of the solar street lighting system may also be divided into two periods: the first one is from 18:00 hours IST to 22:00 hours IST, and the second is from 5:00 hours IST to 6:00 hours IST. In the course of this work, an experimental layout of a control circuit was carried out. In this video, RadhiPriyasree goes over a strategy for reducing the amount of power used by road lights by eliminating poor lighting, which is responsible for the loss of a significant amount of money on an annual basis. This is accomplished by lowering the intensity of the lights during periods of time when there is much less traffic. For this reason, a passive infrared (PIR) sensor is utilised so that any motion may be detected. This campaign also makes an effort to reduce the number of deadly crashes as well as accidents that were caused by site visitors who had been drinking. In order to do this, the breadth sensors installed in the cars and the skin sensors located

on the doors of the vehicles are utilised. If this policy is put into effect, it has the potential to significantly reduce the number of people who lose their lives as a result of drinking and driving. The prototype has been put into action, and its performance matches the expectations. It will have a very high value when it is bigger, and it will meet all of the requirements of modern society.

## III. PROPOSED MODEL

Figure 1 provides an overview of the overall functioning mechanism as well as the aspects of the proposed work in order to simplify the explanation.

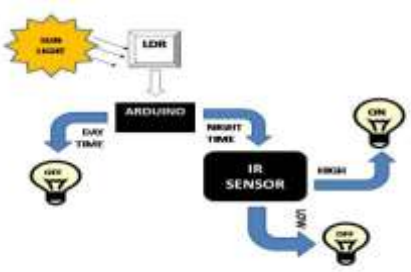


Figure 1. Street light automation using Arduino

The LDR detects the daylight light intensity before sending a signal to the Arduino. After processing the signal, Arduino converts the sign into discrete values from 0 to 1023 and decides whether or not the acquired signal fee is beneath or above the threshold price (a restricted value set primarily based on the person's utilisation of the vary 0 to 1023); it's then thought-about day or night time. If the received signal price is above the threshold price, the Arduino believes it to be daylight and the LED lights remain OFF; if the collected signal price is below the threshold price, the Arduino considers it to be night. If the cost of the IR sensor is low at night and it detects no object/vehicle, the LED lights will turn off. But if the IR sensor detects an object and the IR sensor value is high, the LED lights turn on according to the individual IR sensor, and the LED lights in front of and behind the object/vehicle also turn on so you can see the road.

## IV. METHODOLOGY

The automation of the street lights makes use of a mechanism called dynamic control. In the start of the research, when there is no light, the LDR will detect the darkness and will send a signal to the Arduino. This is according to the proposed system. Then, if an item moves in front of any infrared sensor, the IR sensor will send a signal to the Arduino, which will cause the LED light that corresponds to the IR to light up. When the item or vehicle moves in front of the infrared sensor, both the next and the previous lights come on simultaneously. This allows the driver to see both in front of and behind the object or vehicle..

## V. HARDWARE COMPOSITION

1.Arduino

A microcontroller board that operates with the assistance of an ATmega328 is presented here. Because of its ease of use and ASCII matter content file prototype platform, Arduino is ideal for usage not only by experts but also by beginners and students. The Arduino Uno has fourteen digital input/output pins (of which half are often used as PWM outputs), six analogue inputs, a quartz oscillator with a frequency of sixteen megahertz, a USB connection, an effect jack, an ICSP header, and a button. Additionally, it has a sixteen megahertz quartz oscillator. It includes everything that is necessary to direct the microcontroller, so all you need to do to get started is connect it to a portable computer with a USB connection, or provide it with power through an academic degree AC to DC converter or battery.

Instead of the 8U2 found on the Uno, the Arduino Uno R3 makes use of an ATmega16U2, which can be found on the Uno R3 (or the FTDI discovered on preceding generations). This gives the go-ahead for faster switch costs and more memory. No drivers are necessary for the UNIX operating system device or watertight (but a file for Windows is required and must be written within the Arduino IDE), and in addition, the Uno has the capability of showing up as a keyboard, mouse, joystick, and other input devices. The Arduino Uno is distinct from all of the boards that came before it in this series because it does not incorporate the FTDI USB to serial driver chip. Instead, it uses a microcontroller chip called an Atmega8U2 that has been designed to function as a USB-to-serial device.

After the AREF pin, the Uno R3 has both SDA and SCL pins available for use collectively. Additionally, there are now two new pins located near the RESET button. these pins are rectangular and active. The IOREF is one example of this, since it is what enables the shields to adjust to the voltage that is supplied by the board. The contradictory information is not related and will be used for future purposes. The Uno R3 is compatible with all existing shields and has the ability to be adapted to operate with new shields that make advantage of these additional pins. Uno means "one" in Italian, and its release is widely regarded as marking the impending launch of Arduino version 1.0. desired quality and the original rectangular live were both developed in Italy. Both the Arduino Uno and the model one.0 rectangle measure working toward the goal of being the reference versions of Arduino moving ahead. The Arduino Uno is the most recent board in a series of USB Arduino boards and also serves as the standard model for the Arduino platform.


Figure 2. Arduino Uno board

2. IR sensor

The term "infrared machine" refers to a device that generates infrared radiation, which may be detected by other organisms in the surrounding environment. The existence of an item might cause an IR device to maintain the heat of the object as well as sight the motion furthermore. This is due to the real fact that the object is there as a result of an interruption or intervention. These kinds of detectors rely solely on their own emitted radiation; hence, they are classified as passive infrared (IR) devices because they do not produce this type of radiation themselves. All of the items, in general, emit some

kind of heat radiation at some point along the spectrum. These forms of radiation space devices are not visible to human senses, but they may be found using an equipment that detects infrared radiation. The conductor is simply an infrared semiconductor device (Light Emitting Diode), and accordingly the detector is only an infrared photodiode that is sensitive to infrared light of the similar wavelength as that emitted by means that of the infrared crystal rectifier. When infrared light is shone on a photodiode, the photodiode's resistances and output voltages change in direct proportion to the intensity of the IR light they have been exposed to.

The Associate in Nursing IR machine may be a device that detects IR radiation that has been incident on it. There are more than a few different kinds of infrared (IR) sensors that have been invented, and more might be designed for certain appliances. Examples of sensors that use infrared (IR) technology include proximity sensors, which are utilised in all smartphones and edge-avoidance robots, distinction sensors, which are utilised in line-following robots, and obstruction counters/sensors, which are utilised in investigational products and burglar alarms.

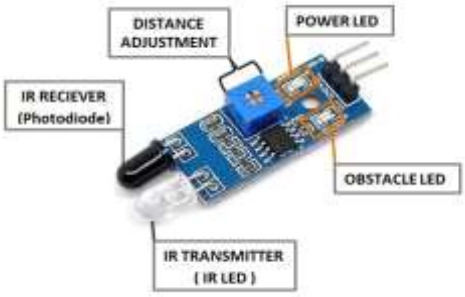


Figure 3. IR sensor

3. LDR

Light-sensitive resistors, sometimes known as LDRs, are a very important component, particularly in light-dark system circuits. Sometimes the resistance of an LDR is quite high, generally as high as several million ohms. However, as soon as the LDR is illuminated with light, the resistance reduces drastically. Electronic sensors are made up of the individual components that, when exposed to visible or invisible light, cause a change in their electrical properties. The light-dependent resistance (LDR), the subject diode, and the phototransistors are the well-known devices that belong to this category of gadgets. Light-dependent resistance is a type of resistance that, as the name implies, is dependent on light for its version. The LDR area unit is made by depositing a film of compound or atomic wide variety forty-eight selenide on a substrate of ceramic containing no or solely many free electrons as quickly as possible. The LDR region units are made from atomic variety forty-eight selenide. The greater the length of the strip, the greater the accumulation of the cost of resistance. After light has been cast upon the strip, the resistance begins to drop. In conditions when there is insufficient light, the resistance can range anywhere from 10K ohms to 15K ohms; this range is referred to as the dark resistance. The resistance might drop to a well-worth of five hundred ohms while staring out at the subject matter of sunshine. The power ratings are often on the lower end, falling between 50 milliwatts and half a watt. Because of these two factors, the shift time is quite excessive, and as a result, it cannot be used for applications requiring high frequency. Chopper amplifiers make use of them in various capacities. Units of lightweight structured resistors are available as discs ranging from 0.5 cm to 2.5 cm in diameter. Under dark conditions, the resistance can reach several mega ohms in magnitude. The system is made up of a combination of antimonial film contacts that are separated by a curved track of compound film. This arrangement was chosen so that the maximum amount of contact space could be obtained with both of the metallic films. The shape is protected by a very transparent casing made of

plastic or rosin, which allows for unrestricted access to the ambient light outside. The most popular LDR design has a face diameter of around 10 mm and is available in a wide variety of sizes and programming designs. Excellent LDRs are available in a wide variety of sizes and programme designs.

The resistance does not extend in real time to the dark value once the LDR has been moved from a single lighting level into darkness. The convalescence price is expressed as a number of kilo-ohms per second, and for modern LDR kinds, this number is well over 200 kilo-ohms per second. The pace of recovery is significantly faster in the opposite direction; for instance, going from complete darkness to an illumination stage of 300 lx, it takes just 10 milliseconds to achieve a resistance that corresponds to a light level of 400 lx. An LDR should also be linked for every talent round, and there is no requirement for any kind of safeguards throughout the bonding process itself.

4. LED

It's possible that a light-emitting diode, or LED, is a semiconductor light with two leads. After being energised, it transforms into a contact diode that radiates light. Both the long and short terminals have a positive charge, whereas the short terminal has a negative charge. As soon as a sufficient current is sent through the leads, leptons are able to recombine with the holes in the device that are occupied by negatrons, releasing photons that are charged with emotional energy. This effect is known as electroluminescence, and the colour of the sunlight (which corresponds to the energy of the photon) is governed by the energy band gap of the semiconductor. LEDs are generally rather small (less than one $mm^2$), and integrated optical components are used in order to shape the graph.

Even if the intensity of the light produced by LEDs isn't particularly strong, it is still important to exercise caution to protect your eyes from the light. Two LEDs provide a centred light. During the process of testing the LEDs, it is necessary to provide some resistance to them. Also, because they are made of semiconductors, they are vulnerable to static charges because of how they are built.

5. Relay

A relay is an electrically operated switch. Relays are used in many different applications. Input terminals for a single or several administration signals are grouped together, and operative contact terminals are arranged in a series. Together, these two types of terminals make up the system. The update might also contain a big selection of contacts in numerous contact types, such as combination contacts, built-in contacts, or broken contacts.

Relays are employed in any situation in which it is necessary to control a circuit by a free, low-power signal or in any circumstance in which several circuits need to be controlled by a single signal. Relays may also be used to control multiple circuits simultaneously. Relays were initially used on long-distance telegraph lines as signal repeaters. This means that they would refresh the signal that was coming in from one circuit by transmitting it to the other circuit.

The relay provides isolation by being sandwiched between the controller and the device; as was mentioned previously, units can function both on direct current (DC) and alternating current (AC), but the microcontroller can operate solely on direct current, making it the fundamental controller of the circuit. They require relay in order to bridge the gap. It's vital as well as helpful for dominating large quantities of current or voltage by way of the minor electrical signal.

VI. WORKING

The software of the Good Avenue light-weight IR sensors is outlined below. The following are the quiet steps in building an honest street light.

Step 1. Output of the LDR pin is coupled to the use of the excellent quality light-weight IR sensors. This will be detailed further down in this article. The following is a list of quite a few stages that need to be completed in order to create an honest street light.

In the first step, you connect the LDR pin's output to the analogue port (A0) on the Arduino Uno board.

Step 2: Connect each of the IR sensor's outputs, in order, to the respective port numbers D1, D2, D3, D4, D5, and D6 on the Arduino board. These port numbers correspond to the board's inputs.

Step 3: Connect the ground wires of all of the IR sensors to the GND connector on the controller.

Step 4: The output from the LED is related to port ranges 7, 8, 9, 10, 11, and 12 accordingly.

Step 5: Once more, it involves connecting all of the negative terminals of the LEDs to the GND port.

Step 6: The power is then sent over to the Arduino UNO, which is around 7-12V on the A0 (analogy) port of the Arduino Uno board.

Step 2. Connect all the outputs of the IR sensors to port numbers D1, D2, D3, D4, D5 and D6 severally. That is the input signal to the Arduino board.

Step 3. Connect the ground of all the IR sensors to the GND port.

Step 4: The LED output is associated with port ranges 7, 8, 9, 10, 11, and 12.

Step 5. Again, connect all the negative terminals of the LEDs to the GND port.

Step 6. Power is handed to the Arduino UNO is about (7–12V).

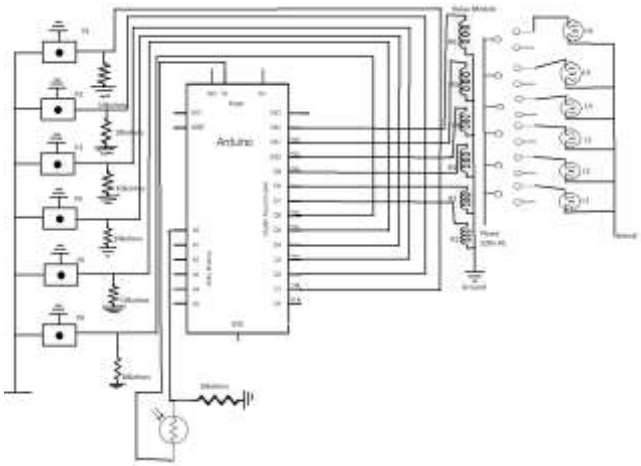

Figure 4. Circuit Diagram of street light automation using Arduino

VII. RESULTS

Figure 5. Operation Phase 1 of street light automation

In Figure 5, the LDR is closed by a piece of cardboard so as to create an illusion of darkness around the LDR. Figure 5 shows that when an object is detected by the IR sensor 1, the LED light corresponding to the IR sensor 1 and the next LED light both turn on.

Figure 6. Operation Phase 2 of street light automation

In Figure 6, we can observe that when the object moves from the IR sensor 1 to IR sensor 2, the LED light corresponding to IR sensor 2 is turned ON. The next and the previous LED lights are also turned on in order to have a view of the way ahead and behind the object/vehicle.

Figure 7. Operation phase 3 of street light automation

When we look at figure 7, we can see that the LED light that corresponds to the IR sensor 2 becomes active when the item moves from the IR sensor 5 to the IR sensor 6. In order to see what is happening behind the item or vehicle, the LED light that was used previously has also been switched on.

## VIII. CONCLUSION

In this article, we exhibited a design scheme that can be used to operate a street lighting system by utilising Arduino, LDR, IR sensors, and relays. The concept that has been suggested includes two distinct modes of operation. The first of these is designed to regulate the street light according to the natural light conditions and the identification of objects or vehicles. The second mode, which turns the LED light ON only when an object or vehicle is identified, was designed using the same system that was used to build the first mode.

## IX. REFERENCES

[1]. Archana. G, Aishwarya N, Anitha J "Intelligent Street Light System" International Journal of Recent Advances in Engineering & Technology, Vol-3, Issue-4, 2015.

[2]. Omkar Rudrawar, Siddharth Daga, Janak Raj Chadha and P.S. Kulkami, "Smart Street light system with light intensity control using Power electronics". IEEE conference 2018 Technologies for Smart-City Energy Security and Power (ICESP), 28-30 March 2018.

[3]. "Smart Lighting Solution using Clusters of Sensors (Problems with Limited Sensors) and Analysing Networks for Smart Lighting Solution", Pinak Desai, Nilesh Modi, Volume-8 Issue-6S, April 2019

[4]. T. Santhi Sri, Rajesh Varma, V VS. Hari Krishna, K. Varun Chowdary "International Journal of Innovative Technology Automated Street Lighting System" and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-7 May, 2019

[5]. Shivam Verma1, Prashant Choudhary2 , Raj Harsh3 , Lalit Kumar4 , Mahesh Kamthe5 Professor4, 5 "Smart Street Light Based on IR Sensor" 2020 IJESC Volume 10 Issue No.5