

IOT based Automatic Street Light Control and Fault Detection

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Abstract: The IoT (Internet of Things) is a blooming technology that mainly concentrates on the interconnection of devices to one another and the people. The world is getting smarter these days, and people are drawn to the word "Smart". Given that India is one of the world's fastest-growing tech markets, we are incorporating a smart framework into the switch. The project's goal is to provide automatic control and fault detection for street light. The lights are switched ON/OFF automatically based on the intensity of sunlight using the LDR sensor. Automation helps to solve a variety of challenges in both the global economy and everyday life. The power supply which is supplied to the system is converted via Relay before supplying to the street lights. Here the system check's fault in the street light and also sends the alert message to the authorized mobile number through the GSM module. An object's motion is detected using an infrared sensor. According to the program, if there is any object comes near the IR sensor, the light will glow as bright. Otherwise, the light will glow as dim.

Keywords: IoT (Internet of Things), GSM (Global System for Mobile), LDR (Light Dependent Resistor), IR (infrared) sensors, Arduino Uno

1. Introduction

The Internet of Things (IoT) is a network of physical objects that link to each other. that enables them to connect with one another. The IoT allows for remote sensing and monitoring of machines. It is a sophisticated Artificial intelligence is used in an automation and analytics environment to deliver creative and automated products and services. These frameworks have more accountability, power, and efficiency [7]. IoT has a variety of automation applications, such as smart homes, smart parking, smart highways, and smart lighting.

In our country, the corporation street light (HID lamps) consumes more energy, most of the time street lights are switched ON when they are not in use (roads are bare) and there are chances we forget to switch them off and also, we have all seen street light turned ON during the day. However, with the increasing importance for energy conservation and well maintenance are leads to protection of the natural resources for the future.

In order to overcome this issue, A smart street light (LED Lights) system can be used to replace conventional street lamp like HID (High-intensity discharge) lamps. Power savings due to increased current luminous efficiency, lower operating costs, high color building index, accelerated start-up, and durability are all benefits of LED lights over conventional technologies. It also makes out the Fault in any of the street light. Since the resources we depend on, such as hydro, thermal, and coal, are finite. Introducing energy-saving elements such as LDR, Relays and LEDs can light up a wide area with high-intensity light whenever required is the primary goal of the device. The Relay is used as an automatic switch that eliminates almost all manual labour. Here in this project, we have also used IR (Infrared) sensors, that detect the motion of an objects, LDR (Light Dependent Resistor) is also known as photo resistor, this resistor works on the principle of photo conductivity. GSM (Global System for Mobile Communication) module is used for texting message and sending to required mobile number.

Here the street light intensity is controlled by the controller when the LDR senses the dark the lights turn ON automatically, but lights glow as dim, as soon as the IR senses the moving object the street light glow as bright, if it fails to glow, the GSM module send the message to respective authorized mobile number.

2. Related works

In the year 2016, Manish Kumar [4] published a paper on streetlight regulation using a Zigbee wireless module. A transmission module, an LDR, and a microcontroller were among the components. Wireless connectivity with the lamp module is possible thanks to Zigbee. The computer analyses day-night variations and lamp safety using two LDR sensors. After the LDR data has been read, it is transferred to the microcontroller and

then to the transmission module. The data is sent to the control center via wireless Zigbee, which monitors and manages each streetlight. The device connects to a Zigbee wireless network with a limited range. [1].

A GSM-based automatic streetlight control system was introduced by Prof. K.Y. Rajput and three other TSE Mumbai researchers to calculate different parameters, the device has a server microcontroller and sensors such as smoke sensors, noise sensors, light sensors, and so on. This device will sense ambient temperatures and noise levels and give an intervention signal to the machine. the problem is that the GSM modem must be mounted in each streetlight, which makes the unit very costly. There are also several compatibility issues. This model is more expensive because it depends heavily on hardware to control and monitor the computer [2].

M. Abhishek et al. developed a solar-powered traffic flow-based streetlight control system. They used an 8052 series microcontroller and replaced standard bulbs with LED lights, resulting in a threefold reduction in energy consumption. Sensors on either side of the road detect vehicle activity and instruct the microcontroller to turn the lights on and off as needed and when there are vehicles present or moving are the lights switched on. Otherwise, even though it's nighttime or there's bad weather, all the lights are switched off [3].

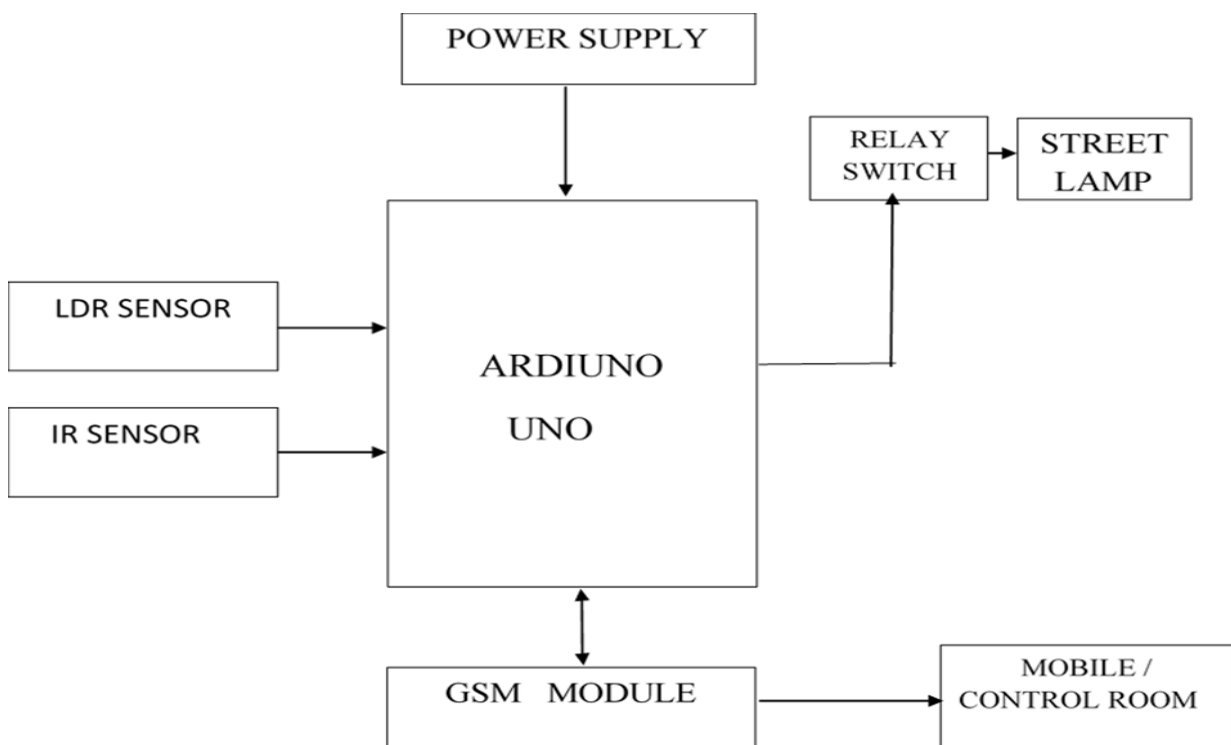
[5] A GSM-based smart street light monitoring and control system is an electronic system that uses timed operated switching of street lights to increase an industry's performance and accuracy. It is made up of two modules, one for the client and one for the server. On the client side, a GSM modem is used, which is then connected to the microcontroller. In the user side, a java-based application server is used.

[6] This approach proposes a new way of conserving electricity by using a GSM-based RFID solution for automated street lighting. With this unit, the time it takes to return from a power outage can be cut in half. GSM will manage street light repairs, load maintenance, and other power-related complaints. This device will be implemented by the Electricity Department in the future to conserve both power and time. This approach can be extended to reduce the time it takes to process any new power connection request by using RFID.

[7] Smart Street Lighting System once exploitation GSM, ancient street lighting schemes in locations with a restricted variety of passersby square measure left on for the rest of the night. As a result, a significant amount of energy is lost in vain. Quick reacting, dependable running, and power-saving street lighting systems are now a reality thanks to the widespread availability of flexible-lighting technologies such as light-emitting diode lamps and ubiquitous wireless internet access. This paper explains the Intelligent Street Lighting (ISL) scheme, which is a first step in satisfying the need for flexible public lighting systems.

3. Implementation

Figure 1: System Architecture

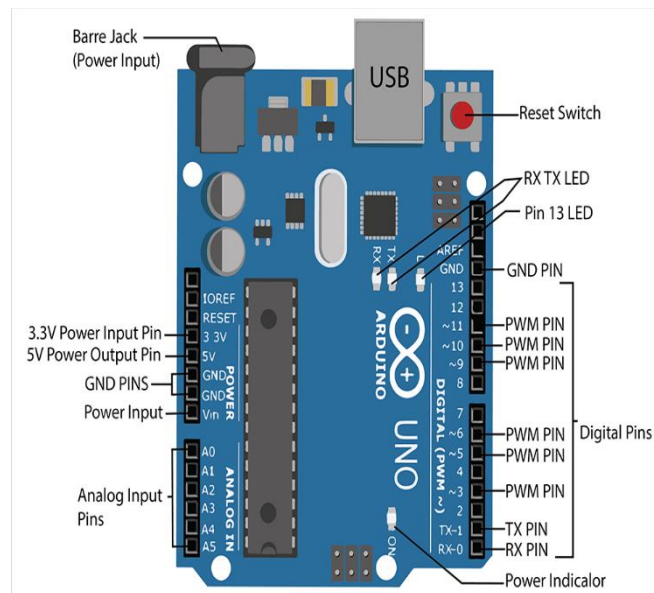


A. Arduino uno:

The ATmega328P microcontroller is used in the Arduino Uno microcontroller module (datasheet). 14 optical input/output pins, 6 analogue inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button are among the 14 optical input/output pins, 6 analogue inputs, a USB connection, a power jack, an ICSP header, and a reset button on this frame. It has anything you'll need to get going. Simply connect the microcontroller to a computer via USB, or power it with an Alternating Current-to-Direct Current converter or a battery. It uses SRAM for memory, Flash and EEPROM for storage. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language C and C++.

The following are some of the most significant applications created with Arduino UNO.

- Embedded platforms
- Robotics
- Motion control of an objects
- Parking lot counter



B. Light dependent resistor (LDR):

LDR Stands for (Light dependent resistor) and it is also known as photoresistor which is a passive component. The resistance of a photoresistor will decrease with increase in incident light intensity. The working principle of LDR is photoconductivity. A photoelectric device can be either intrinsic or extrinsic Photoresistors can be placed in streetlights to control when the light is ON. Ambient light falling on the photoresistor causes the streetlight to turn OFF. Thus, energy is saved by ensuring the light is only ON during hours of darkness.



C. RELAY:

The traditional type of a relay relies on an electromagnet to close or open the contacts, but other operating principles have been developed, such as solid-state relays, which control without the use of moving parts. To protect electrical circuits from overload or faults, relays with measured operating characteristics and often multiple operating coils are used; in modern electric power systems, these functions are performed by digital

instruments still referred to as protective relays.



Relays are like remote control switches. It is highly used due to its simplicity, long life, and reliability. Relays can take electrical inputs and gives mechanical output or vice versa. It is normally an electromechanical device that is actuated by an electric current.

The following are some of the applications:

- Relays are used for isolating a low voltage circuit from high voltage circuit.
- They are used for controlling multiple circuits.
- They are also used as automatic change over.
- Microprocessors use relays to control a heavy electrical load.

D.GSM:



Global System for Mobile Communications (GSM) module, SIM900A Modem is based on SIMCOM's Dual Band GSM SIM900A modem. It operates on the 900MHz band. SIM900A will automatically scan these two bands. AT Commands may also be used to adjust the frequency bands. The baud rate can be adjusted from 1200-115200 using the AT button. SIM900A is a wireless, ultra-compact module. The modem is an interface that allows you to connect your PC to a microcontroller that has an RS232 chip (MAX232). In M2M it is suitable for SMS, Voice, and DATA transfer applications. You can link a broad range unregulated power supply to the onboard Controlled Power Supply. You can use this modem to make audio calls, send and receive SMS, and answer incoming calls. Applications: Cellular Communication, Robotics, Mobile Phone Accessories, Servers, Automobile.



E. IR Sensor:

An infrared sensor is an electronic system that emits light in order to detect objects in the environment. This sensor includes an IR, LED & an IR Photodiode, so by combining these two can be formed as a photo-coupler



Figure 2: Working flow chart

otherwise optocoupler. An infrared sensor can both sense motion and measure an object's heat. Almost all objects emit some kind of thermal radiation in the infrared spectrum. These types of radiations are harmless to our eyes, but an infrared sensor will identify them.

4. Flow chart

The Working flow chart in figure 2, outline the functioning of Smart street light control system Initially the method begins with reading the value of the IR sensor, then reading the value of LDR if IR value is equal to 1. Otherwise take the IR reading again. If the LDR value is greater than 400lux subsequently light will not illuminate. If the LDR value is less than 400lux, it reads previous IR value, if it is equal to 1 the light glows with higher intensity. If the value is not equal to 1 the lamp glows dim. If the lamp intensity does not reach meet the target value, a message is sends to authorized mobile number through GSM module, if lamp working properly then it continues its process.

5. Results and discussion

As a result, this IoT-based automated streetlight infrastructure is highly cost-effective. The aim of the project is to save electricity by replacing LED lights with HID (high-intensity discharge) lamps. Since the status is regularly checked, the system does not require staff or periodic inspections. As a result, we get precise results from a particular field.

6. Conclusion

So, we've come to the conclusion that this project's hardware and software architecture fulfil the design target. The Arduino Uno was used to successfully create a working prototype of a street lighting automation scheme. Usage of LDR and IR sensor as the input, gives energy saving to the system since LED turn ON only when there is a dark and movement of objects, thus, the usage of power consumption by street light decreases. An automated street light control and fault detecting system that automatically turns on and off-street lights based on input conditions. We can quickly distinguish light faults in this system, and the system even sends a warning message to the controller.

References

1. Kumar, Manish, Ravinder Kumar, and Ritula Thakur. "Zigbee Based Smart Street Light Control System Using Lab VIEW." *Int. Journal of Innovative Research in Science, Engineering and Technology* 5.4 (2016).
2. Abhishek, M., K. Chetan, and K. Arun Kumar. "Design and implementation of traffic flowbased street light control system with effective utilization of solar energy." *Int. J. Sci. Eng. Adv. Technol* 3.9 (2015): 195-499.
3. Mohamed, Samir A. Elsayegh. "Smart street lighting control and monitoring system for electrical power saving by using VANET." *Int'l J. of Communications, Network and System Sciences* 6.08 (2013): 351.
4. Amin, Chaitanya, Paridhi Holani AshutoshNerkar, and Rahul Kaul. "GSM based autonomous street illumination system for efficient power management." *International Journal of Engineering Trends and Technology* 4.1 (2013): 54-60.
5. K.Y.Rajput, GargeyeeKhatav, Monica Pujari and Priyanka Yadav" Intelligent Street Lighting System Using Gsm" *International Journal of Engineering Science Invention* Volume 2 Issue 3 , March, 2013.
6. J.Arthi, W.Lydiapreethi, B. Gunasundari," IOT BASED SMART LED STREET LIGHTING SYSTEM" *IJRTI* | Volume 2, Issue 4 | ISSN: 2456-3315.
7. Mohmmad Ashaq Sofi, Anima Nanda, Gulzar Ahmed Rather , Mohd Abass Sofi, "IN VITRO ANTIMICROBIAL ACTIVITY OF METHANOLIC LEAF EXTRACT OF CYNARA SCOLYMUS (ARTICHOKE) AGAINST SELECTED HUMAN PATHOGENS" , *International Journal Of Advance Research In Science And Engineering* <http://www.ijarse.com> IJARSE, Volume No. 10, Issue No. 04, April 2021 ISSN-2319-8354(E).
8. Salvi, Ritisha, et al. "Smart street light using arduino uno microcontroller." *Int. J. Innov. Res. Comput. Commun. Eng* 5 (2017): 5203-5206.
9. Velaga, Nagendra R., and Amit Kumar. "Techno-economic evaluation of the feasibility of a smart street light system: a case study of rural India." *Procedia-Social and Behavioral Sciences* 62 (2012): 1220-1224.