IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 20, April 2026
Impact Factor: 8.2

Design and Implementation of an Streetlighting Control System Using IoT

M. Priyanka, S.Kannadhasan, A. Bhuvana, T. Ruban Dharmaraj, P.Sudharsan, S. Priyanga
Department of Electronics and Communication Engineering
Study World College of Engineering, Coimbatore, Tamilnadu, India
priyarajkumar425@gmail.com, Kannadhasan.ece@gmail.com, bhuvanaarul0526@gmail.com,
rruban948@gmail.com, saravanansudharsan084@gmail.com, ppriyanga578@gmail.com

Abstract: *This study deals with the Automation, Power optimization and cost efficiency may be done in the existing street light systems. Automation is done with the assistance of IoT (Internet of Things) by employing sensors attached to an Arduino board which will maintain the track of the operation of the complete system. By employing the correct sensors in the system and using renewable energy sources like sunshine through solar panels in this system, we can save roughly 25% of the energy usage of the existing system. Which further reduce the dependence on non-renewable energy. In this method, the loss of electricity is avoided by regulating the intensity of the lights when there is no movement or less activity on the roadways and so saving more money. LDR is used to sense the intensity of sunlight to switch ON or OFF the lights. In the absence of any movement during night periods, IR sensor helps in reducing the intensity of light to pre-selected level. Based on the speed of the motion we will boost the intensity of the light when motion is detected. So we can save up to 40% of energy. Street lights are the most important electrical system that are placed on the roadways for smooth travelling from one location to another. These street lights eat up most of the electrical energy that has to be lowered. Most of the towns and cities street lights in the current System are switched ON manually in the evenings when sun lights start to decline and they are turned OFF only in the mornings when there is appropriate quantity of sunlight. This takes human intervention and wastes lot of energy and occasionally the person may forget to switch off the lights and there by excessive wasting of electrical energy. There are several areas in India where the street lights gets switched ON and OFF at specified time interval this saves some energy but not much efficiently. In this mechanism there is still some loss of energy. Sensors enable to automate the system with the help of Internet of things.*

Keywords: LED, Street Light, ON, OFF and Sensors

I. INTRODUCTION

Street lighting system is the fundamental electrical system applied on the roadways for the safety of the people. Street lights are a vital aspect of the society and has to be enhanced for higher efficiency to conserve electricity. It is estimated that lighting consumes 20% of the world electric power of which 5% is spent in the public places as street lights. Street lights in India alone consume almost 4400MW power annually [1]-[5]. But consumption will rise as development proceeds. Currently we have automated ON or OFF of street lights at a given time (time based) which is still not adequate to conserve electricity. This project takes it one step farther. We are going to utilize LED‟s instead of fluorescent bulbs which use more power The LED has a longer life expectancy than fluorescent lamps. Here, we propose a prototype of an electric pole that detects problems and provides the information to the worker. It also aid in detection of inclination of the pole where if the pole is inclined above threshold value due to natural disasters or human action it will automatically intimate to the worry authorities. LDR and IR sensors will be used by us. LDR is used to sense the intensity of sunlight to switch ON or OFF the lights. In the absence of any movement during night periods, IR sensor helps in reducing the intensity of light to pre-selected level. Based on the speed of the motion we will boost the

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 20, April 2026
Impact Factor: 8.2

intensity of the light when motion is detected. So we can save up to 40% of energy. Street lights are the most important electrical system that are placed on the roadways for smooth travelling from one location to another. These street lights eat up most of the electrical energy that has to be lowered. Most of the towns and cities street lights in the current System are switched ON manually in the evenings when sun lights start to decline and they are turned OFF only in the mornings when there is appropriate quantity of sunlight. This takes human intervention and wastes lot of energy and occasionally the person may forget to switch off the lights and there by excessive wasting of electrical energy. There are several areas in India where the street lights gets switched ON and OFF at specified time interval this saves some energy but not much efficiently. In this mechanism there is still some loss of energy. The 1st item is a sensor circuit. It senses the ambient light to determine whether it is day or night (or evening). This gadget is equipped with two sensors. 1st sensor is to detect the sunshine; 2nd sensor is to determine the LED panel is working or not. The 2nd and the main unit are an 8-bit microcontroller which checks the state of the 1st LDR i.e. if the environment is having enough sunlight or not. If there is adequate sunshine it will do nothing but if the sunlight is low the microcontroller initiates the third unit. The 3rd item is only a relay driver circuit and the relay which is controlled by the specified IO pin of the microcontroller. If there is no sunshine, then it activates the relay driver circuit created with NPN transistor 2N2222. Collector of the transistor is linked to the 1st terminal of the relay and other terminal of the relay is connected to +12v. When activated, the relay's mechanical switch closes to allow electricity to flow to the 4th unit. The 4thunit is LED panel with 6×8 matrix. The size of the panel may be enlarged by adding more LEDs n. The panel can be controlled with a solid-state relay rather of an electromagnetic relay.

When the microcontroller activates the LED panel, the second LDR senses the light from the panel. If the second LDR receives enough light, it is assumed that the panel is working properly. However, if the panel is not functioning (the second LDR is not receiving enough light). The 5th unit provides information to the web server from the microcontroller. The 5th unit is a WIFI modem, based on ESP 8266. THE microcontroller is connecting with ESP 8266 using serial communication. We are utilizing ESP8266 in AT command mode, that is, the microcontroller is sending AT commands to ESP8266 and controlling it.

The 6th unit i.e. a web server processes the sent data. Unlike many ESP8266 based system where ESP8266 itself is utilizing web server, here ESP8266 is used as client, so that it may sent the data to web server and we do not have to assign any IP address of the ESP8266.It includes communicates with the web server which create the system as a centralized moving system i.e. all such devices would be in contact with a single web server.

In web server area it has a collection of web sites where we may monitor and modify the street light [6]-[10].

In order to make this paper happen there was a lot of pre learning has been done in order to know about the present technology that is being implemented in street light system and the energy that is being consumed by the street lights with the present technology per day, per month and per year. Various power saving techniques has been studied and how can that be implemented is also known. In order to gain this knowledge, we have referred a lot of IEEE papers that we mentioned in the References section. In each paper a wide variety of techniques have been used ton make street lights smarter, different papers used different sensors to implement a function in street light system also used different kind of approaches to solve the problems that is being faced in the present system. By reading all those papers we came to a simple solution where automation, power saving and reducing human interaction can be implemented on a single system easily. Finally, we came to a conclusion that using LED‟s LDR sensors and solar panels we can reduce the power consumption and also varying the intensity of the LED‟s when there is motion with the help of IR sensors. By using accelerometer we can know the faults in the pole whether the pole is about to fall or not due to heavy rains or winds. And also, we make use of the renewable energy by using solar panels. This total system is automated by using Node MCU which is a Wi-Fi module to send alert messages to the concerned authorities whose phone numbers can be stored in a cloud. In the last few years, there has been a major boost in the need for energy efficient and sustainable infrastructure, particularly in cities. The conventional street lighting system lacks automation, causing wasted power usage and increased maintenance requirements. In an attempt to meet these needs, the installation of smart street lighting systems with the aid of Internet of Things (IoT) technology has come into vogue. This essay suggests an

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 20, April 2026 Impact Factor: 8.2

automatic street lighting system that utilizes sensors and microcontrollers to switch ON/OFF street lights according to environmental conditions and human activity. The system automatically switches ON the lights during darkness or when motion is sensed and switches them OFF during daylight or when there is no activity. This automation saves energy, apart from generating cost savings and helping in environmental sustainability. The suggested system fits into the country's vision of creating smart cities and complements the engineers' role in bringing about sustainable development. It presents a low-cost, scalable solution that can be readily implemented in urban and rural areas to update public infrastructure [11]-[15].

II. PROPOSED WORK

Now a days, the individuals have changed to be unreasonably interested, and did not, make it incomprehensible to find time truly to switch on the lights at whatever point basically. Smart Street light is the robotic system. different framework for the streetlight don't consume more power planning This saved electricity may be used in several different applications, for instance, in the water system, settlements, and many other sectors. We may use Arduino to control a power of road lights to describe smart frameworks. In this task road lights are designed in such a way that it switches ON and OFF in response of Light Dependent Resistor (LDR) sensor. Also, the LDR sensor controls the power of light naturally in the development of vehicle it darkens and brightens up. The evolution of the vehicle is differentiated by the Passive Infrared (PIR) sensor. The proposed framework incorporates the latest innovation LED lights rather than general lighting. The LED innovation is liked over different lights because the LED light spare the vitality because of the high current radiant and up maintain cost is cheap, the existence of LED is lengthy and so on. The gas release determines the lighting we use by and by.

So the force of these lights is not controllable." This structure is guaranteed to deliver the right amount of light where and when it is needed. Bad illumination can lead to mis-chances. Utilizing Energy savvy advancements may decrease the expense of the road lighting unquestionably and also supply amazing productivity. Exhibit design is representation of computerization and inaccessible organizing answers for control road lights. There are specific total of control technologies and strategies in controlling the road light framework, for occasion, format and execution of CPLD based daylight based control saving system for street lights and modified action controller plan and fabricate of customized street light control framework, customized road light control and street thriving module utilizing inserted structure, customized road light control structure, Brilliantly Road Lighting Framework Utilizing Gsm, imperativeness utilization sparing courses of action in point of view of careful road lighting control structure and A Novel Plan of a Programmed Lighting Control Framework for a Remote Sensor Organize with Expanded Sensor Lifetime and Decreased Sensor Numbers. In this work for the most part we are utilizing two sorts of sensor LDR which moves as per the degree of light falling on its surface, this offers affirmations for whether it is a day evening. IR sensor is put for the street, which can be controlled by microcontroller. The IR sensor will be induced fair on the night. moment the challenge passes the IR column, a certain light will generally be ON. This may be used as an important control. The clever framework can be organized for the idealize utilization of streetlights in anywhere. Thusly, the evaluation job incorporates the viability proficient arrangement of the road lighting framework utilizing LED lights with IR sensor interface for regulating and monitoring. We are using LEDs instead of HID lamps while the HID is not smart and powerful too. Because it has a lengthy life duration and affordable cost.

In the field of gadgets, which are really founded on electrical related advancements, the manufacturing of roadway lamping structures are speedily expanded and display the included rapid improvement of production and urban groups. Restriction systems and unique street lamps are created to keep them up and restrict them in a complicated street lighting structure over a financially. These are designed to check and minimize the essentialness utilization of a town's open fulmination structure employing special innovations which employs Infrared development sensors to identify the motor improvement after which the street lighting start to glimmer. As the engine steps, the street lamp was glittering goes out and then going with lights begins to shine. IR sensor for capturing serial port value up to 0 to 9600. The IR sensor works in the range of this value. LDR sensor operates de-pending upon the resistance of light In the evening

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 20, April 2026
Impact Factor: 8.2

more traffic is there therefore the intensity of light is increased or decreased based on resistance light. We can conserve electricity to some extent (45%). Traffic fewer in midnight time therefore we may save more power comparison to evening time (60%). Also may control street light via mobile app. Alternate street light may ON when there is no traffic so that we can conserve electricity. The procedure is performed when there is traffic as normal. We are using Ar-duino programming language here, since it is easier comparing to rasp-berry pi board. Below is short explanation regarding Arduino Uno board IR and LDR sensor.

Street light, lamppost, street lamp A elevated light source by the side of a road or path. It is switched on, or illuminated, at a specific time each night. The primary advantages of street illumination are accident prevention and increased safety. Studies have revealed that darkness causes numerous collisions and fatalities notably those involving pedestrians. Pedestrian fatalities are over 7 times more common in the dark than in the daylight. Street illumination can cut pedestrian accidents by nearly 50%, according to research. In order to regulate and minimize the energy usage of a town's public lighting system, a street light control system is needed. This includes control of a circuit of street lights and/or individual lights with specialized ballasts and network operating protocols. This can include transmitting and receiving instructions via other data networks, at a high frequency over the top of the low voltage supply or wirelessly. Development of many protocols . Development of suitable hardware for most forms of lights . The control centre will process the data to know the status of each streetlight. According to the outcome, the control center sends commands to each streetlight to regulate the switch status and the lighting of them.

Street lighting is an important component of every growing neighborhood. You find them on all the main roads and in the suburbs as well. The streetlights burn at full brightness from sunset to sunrise every night, even if no one is nearby. Millions of dollars are spent every day throughout the world to provide these street lights with the needed electrical energy. This article provides the best remedy to wasting of electrical power. Also the manual operation of the lighting system is totally removed. Population expansion and economic development are boosting energy demand at the quickest rates in the entire world yet the supply of energy sources remains miserably restricted. We use the phrase 'smart' since the system not only provides electricity to the street lights, but also assists in identifying the direction of movement of the pedestrian and aids him by means of illuminating the path of movement till the close next street light. The block diagram is shown in Figure 1. A simple and practical option would be to lower the lights during off peak hours. If there is presence, the lights nearby will shine at the regular (bright) mode. This would save a lot of energy and also cut cost of running of street lights. Using IOT (Internet of things) we may monitor status of street light on internet from anywhere in real time and address the issues if occurs throughout the process is shown in Figure 2.

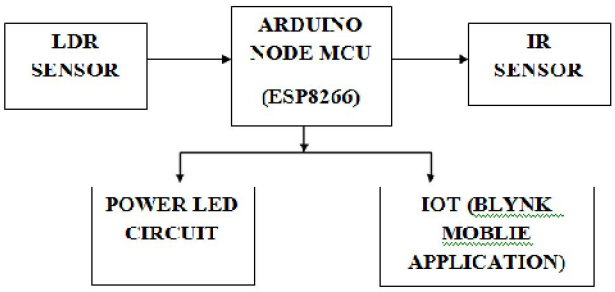

Figure.1. Block Diagram of the Proposed Work

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 20, April 2026
Impact Factor: 8.2

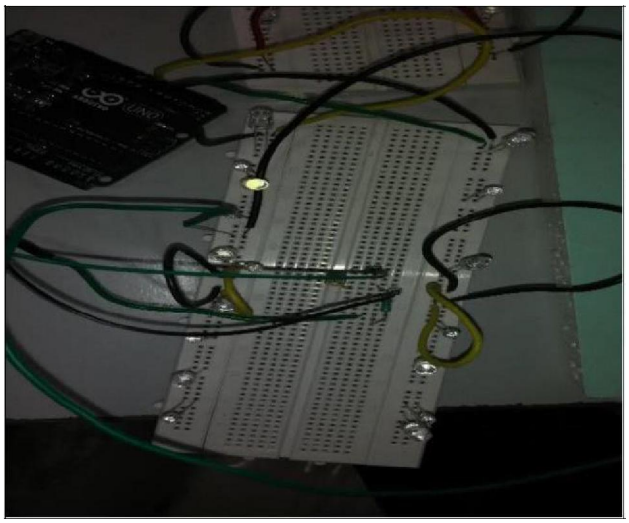

Figure.2. Hardware Model

III. CONCLUSION

This project IoT Based Smart Intelligent Lighting System for Smart City is a cost efficient practical eco-friendly and the safest approach to conserve energy with this system the light status information can be viewed at anytime and anywhere. It solves the two problems extremely efficiently that the world is experiencing today, saving of energy and also disposal of incandescent bulbs. The initial cost and maintenance can be the draw backs of this project however with the improvements in technology and solid resource planning the cost of the project can be cut down and also with the usage of good equipment the maintenance can also be decreased in terms of periodic inspections. The LEDs have long life, cool light emission, do not have any harmful ingredient and may be utilized for quick switching For these reasons, many more advantages are there in our idea, which might eclipse the current constraints. Considering the long-term benefits, investment return time is extremely minimal therefore initial cost would never be a concern. The project has possibilities in several additional applications including for supplying illumination in enterprises, universities and parking lots of major shopping malls. This may also be utilized for monitoring at corporate campus and enterprises. This research provides an Intelligent and Manageable IoT-based Smart Street Lighting System. In conclusion, this system implementation reduces the power usage by 70% to 85% power over the conventional Methyl halide streetlights. This is the greatest option for the current street lighting system. We can also power these lamps for free by adding efficient solar panels and batteries. The smart solar LED streetlight system delivers better lighting, optimizes power consumption and cuts down on operating and maintenance costs after installation, in comparison to Methyl halide lamps and comparable alternatives. Wireless sensor based street light control We can regulate the number of streetlights.

REFERENCES

[1]. Sutopo, W.; Mardikaningsih, I.S.; Zakaria, R.; Ali, A. A Model to Improve the Implementation Standards of Street Lighting Based on Solar Energy: A Case Study. *Energies* 2020, *13*, 630.

[2]. Khayam, U.; Zaeni, A.; Banjar-Nahor, K.M.; Hamdani, D.; Sinisuka, N.I.; Dupuis, P.; Zissis, G.; Canale, L. Status of Lighting Technology Application in Indonesia. *Sustainability* 2023, *15*, 6283.

[3]. Bachanek, K.H.; Tundys, B.; Wiśniewski, T.; Puzio, E.; Marouškova, A. Intelligent Street Lighting in a Smart City Concepts—A Direction to Energy Saving in Cities: An Overview and Case Study. *Energies* 2021, *14*, 3018.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 20, April 2026
Impact Factor: 8.2

[4]. Bellido-Outeiriño, F.J.; Quiles-Latorre, F.J.; Moreno-Moreno, C.D.; Flores-Arias, J.M.; Moreno-García, I.; Ortiz-López, M. Streetlight Control System Based on Wireless Communication over DALI Protocol. *Sensors* 2016, *16*, 597.

[5]. Deepaisarn, S.; Yiwsiw, P.; Chaisawat, S.; Lerttomolsakul, T.; Cheewakriengkrai, L.; Tantiwattanapaibul, C.; Buaruk, S.; Sornlertlamvanich, V. Automated Street Light Adjustment System on Campus with AI-Assisted Data Analytics. *Sensors* 2023, *23*, 1853.

[6]. Hannan, S.; Milton, G.B.; Kabir, M.H.; Uddin, M.J. A Case Study on a Proposed Adaptive and Energy Efficient Street Lighting System for Chittagong City. In Proceedings of the 2019 1st International Conference on Advances in Science, Engineering and Robotics Technology (ICASERT), Dhaka, Bangladesh, 3–5 May 2019; pp. 1–5.

[7]. Quattrocchi, A.; Martella, F.; Lukaj, V.; De Leo, R.; Villari, M.; Montanini, R. Designing a Low-Cost System to Monitor the Structural Behavior of Street Lighting Poles in Smart Cities. *Sensors* 2023, *23*, 6993.

[8]. Gagliardi, G.; Lupia, M.; Cario, G.; Tedesco, F.; Cicchello Gaccio, F.; Lo Scudo, F.; Casavola, A. Advanced Adaptive Street Lighting Systems for Smart Cities. *Smart Cities* 2020, *3*, 1495–1512.

[9]. Modibbo, U.M.; Raghav, S.Y.; Hassan, M.; Mijinyawa, M. A Critical Review on the Applications of Optimization Techniques in the UN Sustainable Development Goals. In Proceedings of the 2021 2nd International Conference on Intelligent Engineering and Management (ICIEM), London, UK, 28–30 April 2021; IEEE: New York, NY, USA, 2021; Volume 572.

[10]. Zissis, G.; Bertoldi, P. A Review of Advances in Lighting Systems' Technology—The Way Toward Lighting 4.0 Era. *IEEE Open J. Ind. Appl.* 2023, *4*, 111.

[11]. Yovchev, M.; Tsankov, P.; Stoyanov, I. Measurement and Analysis of Photometric Characteristics and Efficacy of LED Luminaires for Indoor, Industrial and Street Lighting With and Without an Optical System. In Proceedings of the Eight Junior Conference on Lighting (Lighting), Sozopol, Bulgaria, 23–25 September 2023; IEEE: New York, NY, USA, 2023; Volume 1.

[12]. Boucif, O.H.; Lahouaou, A.M.; Boubiche, D.E.; Toral-Cruz, H. Artificial Intelligence of Things for Solar Energy Monitoring and Control. *Appl. Sci.* 2025, *15*, 6019.

[13]. Akindipe, D.; Olawale, O.W.; Bujko, R. Techno-Economic and Social Aspects of Smart Street Lighting for Small Cities–A Case Study. *Sustain. Cities Soc.* 2022, *84*, 03989.

[14]. Khemakhem, S.; Krichen, L. A comprehensive survey on an IoT-based smart public street lighting system application for smart cities. *Frankl. Open* 2024, *8*, 100142.

[15]. Mishra, P.; Singh, G. Energy Management of Sustainable Smart Cities Using Internet-of-Energy. In *Sustainable Smart Cities*; Springer: Cham, Switzerland, 2023.