International Journal For Recent Developments in Science & Technology
2581-4575
Crossref
A Peer Reviewed Research Journal

IOT BASED SMART STREET LIGHT SYSTEM

[1]MS.D SARITHA, [2]B SWATHI, [3]CH.USHA

[1]Assistant Professor**,** Department of Electronics and Communication Engineering,**MALLA REDDY ENGINEERING COLLEGE FOR WOMEN,** Maisammaguda, Dhulapally Kompally, Medchal Rd, M, Secunderabad, Telangana.

[1,2]Student, Department of Electronics and Communication Engineering,**MALLA REDDY ENGINEERING COLLEGE FOR WOMEN,** Maisammaguda, Dhulapally Kompally, Medchal Rd, M, Secunderabad, Telangana.

ABSTRACT

Imagine walking down a street at night, when suddenly the street lights begin to dim to conserve energy. We might wonder how this is possible it's all thanks to a smart street light system powered by Internet of things technology. This advanced system integrates various devices , such as sensors and cameras,to optimize and automate street lighting , offering and efficient and cost-effective solution. With IoT sensors, street lighting can be monitored and controlled remotely, allowing for dynamic adjustment based on traffic patterns and weather conditions. This technology provides numerous benefits, including energy savings, enhanced public safety, and a reduced carbon footprint, making our cities more sustainable and environmentally friendly.Overall, the smart street light system represents a significant advancement in urban development, improving infrastructure and fostering sustainable growth while enhamcing the quality of life for all residents.

I.INTRODUCTION

Smart street light systems using IoT technology are the next generation of street lighting systems that offer improved energy efficiency, reduced costs, and better control and management of street lighting. The basic concept of a smart street light system isto incorporate sensors, wireless communication, and intelligent controllers into the street light infrastructure. These smart lights can be programmed to automatically turn on and off based on the surrounding light levels, as well as other factors like pedestrian and vehicular traffic. Additionally, they can be remotely monitored and controlled using IoT technology. IoT technology allows smart street light systems to gather data and

feedback on energy consumption, maintenance needs, and other important factors. This data can then be used to optimize the system, improve energy efficiency, and reduce costs. Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. Inefficient lighting wastes significant financial resources every year and poor lighting creates unsafe conditions. Energy efficient technologies and design mechanism can reduce cost of the street lighting drastically. Manual control is prone to errors and leads to energy wastage's and manually dimming during mid-night is impracticable. Also, dynamically tracking the light level is manually impracticable. The current trend is the introduction of automation and remote management solutions to control streetlighting [9]

II.LITERATURE SURVEY

P. P. F. Dheena, G. S. Raj, G. Dutt and S. V. Jinny, "IOT based smart street light management system" 2017 IEEE International Conference on Circuits and Systems (ICCS), Thiruvananthapuram, India, 2017, pp. 368- 371, doi: 10.1109/ICCS1.2017.8326023.

The swift advancement and updating of urban lighting systems, along with the incorporation of smart and Internet of Things (IoT) infrastructure, have opened up numerous opportunities for technological progress across various facets of life. This paper offers a comprehensive overview on the development of smart public street lighting infrastructure tailored for IoT applications in smart cities. Initially, the focus lies on transitioning from conventional lighting to Light-Emitting Diodes (LEDs) technology in street lighting. Complementing this transition, the incorporation of the wireless networked sensors and controllers ensures dynamic brightness control in operational zones, envisioning substantial energy savings. Furthermore, the notion characterizing smart cities denotes incorporating modern digital infrastructures to develop innovative functionalities and connect various application, following the IoT paradigm. The key findings from the proposed study have enhanced knowledge regarding smart public street lighting application. This system integrates smart poles equipped with LEDs lamps technology, smart sensors, communication network and monitoring unit, leveraging current technological advancements in IoT applications. The

implementation of IoT-based smart public street lighting systems presents several challenges, including integrating diverse sensors and actuators ensuring robust device communication, secure data management, and effective system scaling and maintenance. Despite these challenges, this system significantly advances smart city infrastructure by enhancing energy efficiency, safety, and sustainability. However, addressing their high initial costs, data privacy and security concerns, and ongoing maintenance are crucial in future studies to realize their full potential in smart cities. Smart cities encompass a fusion of technologies for data collection, processing, and dissemination, alongside networking, computing, and data security measures. This integration utilizes electronic tools sensors, and advanced communication methods to foster innovation across various applications, aiming to enhance the lifestyle quality for most citizens [1,2]. They strive to enhance the daily activities of its inhabitants and establishments through leveraging cutting-edge technologies to foster sustainable economic development practices [3]. This is where the Internet of Things (IoT) takes main interest. Indeed, IoT is instrumental in fostering the growth of smart cities by establishing robust connections among devices, sensors, and networks essential for their setup [4,5].

Within any IoT system, unique identifiers contribute significantly to accelerating the exchange of information across various networks [6,7]. Indeed, maintaining equilibrium in the environmental conservation and natural resource management is an essential aspect of these initiatives, reflecting a growing trend in technology-driven projects [8]. In these recent years, population progression and urbanization have seen a significant surge with more individuals seeking improved opportunities in smart cities. Indeed, smart cities leverage technology and data to enhance urban life, address environmental challenges, and boost infrastructure efficiency. By 2050, around 70 % of the global population is expected to live in urban areas, increasing the demand for smart solutions for resource management, transportation optimization, public safety, and sustainability [[9], [10], [11]]. Consequently, smart cities aim to create more liveable, resilient, and efficient environments by integrating IoT devices, data analytics, and automated systems. Various projects illustrate the diverse

approach needed, such as a plug-and-play methodology for IoT medical devices ensuring interoperability and real-time data collection was presented in [12]. The transition from Sustainable Urban Mobility Plans (SUMP) to Mobility as a Service (MaaS) to improve urban mobility and reduce emissions was explored in [13]. Additionally, the importance of inclusive technology deployment for equitable benefits was highlighted in [14].

Furthermore, as fossil fuels become increasingly scarce and their prices continue to rise due to inflation [15], there is a pressing need for improved power management and monitoring strategies to achieve significant reductions in energy consumption and transition towards a low-carbon economy by 2050 [16]. In this regard, approximately 80 % of the electricity generated is dedicated to fulfilling urban needs, with about 60 % of this energy consumed by streetlamps due to their permanent operation during nighttime. Therefore, energy saving emerges as a pivotal concern within the scope of smart cities, achievable specially through smart lighting systems implementation as alternatives to conventional incandescent/fluorescent lamps [17,18]. In this way, implementing retrofit measures for lighting systems is considered a commendable approach to significantly reducing energy consumption while enhancing visual luxury and protection [19,20]. Consequently, the upgrade of conventional lighting technologies with Light-Emitting Diodes (LEDs) technology stands out as an attractive option for retrofitting older systems, primarily owing to its great luminous efficacy [21]. Indeed, LEDs technology is widely recognized as a favourable and cost-effective option, offering advantages such as low energy utilisation, extended lifespan, decreasing maintenance expenditures [22], reduced ecological effect [23], and numerous additional profits. Consequently, the potential application of light control systems holds promise for enhancing human activity, health and safety [[24], [25], [26]]. That's why, smart cities and municipalities find themselves in need of techno-economic analysis tools and methodologies to accurately assess the feasibility of smart lighting projects, especially public street lighting [27,28].

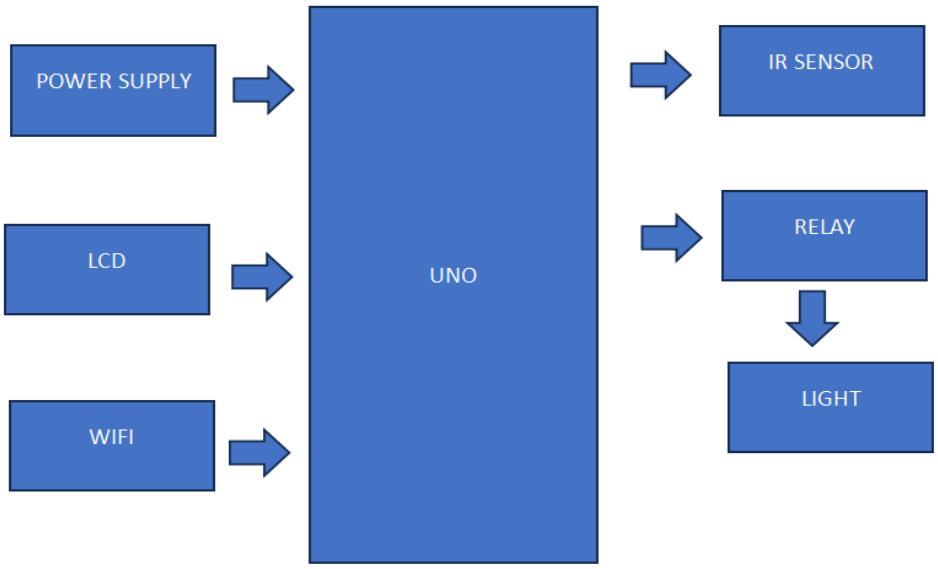
To this end, the widespread adoption of the Internet-of-Things (IoT) concept has introduced a novel network structure wherein a diverse array of objects and

International Journal For Recent Developments in Science & Technology
2581-4575
Crossref
A Peer Reviewed Research Journal

devices are equipped with software, sensors, and further technologies. These components enable devices to connect, gather data, monitor, and exchange information with other systems and devices via the internet. These advancements provide a foundation that allows numerous individuals to connect with each other. The connectivity is facilitated by communication technologies like WiFi, GSM, ZigBee, among others [[29], [30], [31]].

Potentially, the IoT technology encompasses numerous applications designed to enhance various sectors, particularly in smart cities. Accordingly, the integration of the IoT as an attractive paradigm into a smart city context holds significant appeal for public administrations on a wider scale. Indeed, smart cities harness these intelligent technologies to generate vast amounts of data in real-time across all public services as timely information is essential for enhancing public services and offering feedback to citizens.

Block diagram



III.PROPOSED SYSTEM

The proposed system aims to develop a night vision-enabled wireless robot designed for surveillance and spying purposes in war fields. This robot will be capable of operating in low-light or no-light conditions, ensuring continuous monitoring of the war zone. The system will integrate a wireless camera with night vision capability to capture and transmit live video feed to a remote

control station, allowing military personnel to monitor the battlefield from a safe distance.The robot will be equipped with multiple sensors, including infrared (IR) sensors, to navigate the environment autonomously and avoid obstacles. The wireless communication module will ensure real-time data transmission, and the robot can be controlled remotely, allowing operators to steer the robot, change its path, or adjust its camera angles as needed.

In addition, the robot will feature durable and rugged construction to handle challenging war field conditions, including rough terrains, debris, and temperature fluctuations. The system's battery will be optimized for long endurance, ensuring the robot can perform prolonged missions without frequent recharging.

This night vision wireless spying robot will serve as a valuable tool for military operations, enabling real-time surveillance and data collection without risking human lives. The robot's ability to operate in darkness and be controlled remotely will enhance its utility in critical, high-risk environments.

Proposed System for IoT Based Smart Street Light System

The proposed IoT-based smart street light system aims to optimize energy consumption by automating the control of street lights. This system will utilize an array of sensors, including light-dependent resistors (LDR) and motion sensors, to detect the surrounding light levels and the presence of vehicles or pedestrians. Based on the input from these sensors, the system will intelligently manage the switching on and off or dimming of street lights, ensuring that energy is only used when necessary.

Each street light will be equipped with an IoT module, enabling real-time communication between the lights and a centralized control unit. This central unit will collect data such as the operational status of each light, energy consumption metrics, and environmental conditions. The data will be accessible via a cloud-based platform, allowing city authorities or maintenance teams to monitor and manage the entire street light network remotely.

In this system, the street lights will automatically turn on when the ambient light levels drop below a certain threshold, such as during the evening or in cloudy conditions. The motion sensors will detect movement in the vicinity, and if no activity is detected for a certain period, the lights will either dim or turn off to conserve energy. This system also allows for manual override and scheduling options through a mobile or web-based application.

The smart street light system offers numerous benefits, including significant energy savings, reduced maintenance costs, and improved operational efficiency. By leveraging IoT technology, the system ensures a sustainable and cost-effective solution for urban lighting, while enhancing safety and convenience for pedestrians and drivers.

IV.CONCLUSION

Adequate street lighting is essential for enhancing visibility, reducing accidents, and increasing safety for drivers, pedestrians, and cyclists. Effective lighting not only deters criminal activity, making

neighborhoods safer, but also utilizes energy-efficient LED bulbs that lower both energy consumption and maintenance costs. This reduction in energy use translates to a smaller carbon footprint, contributing to a more sustainable environment. Furthermore, well-lit areas are more visually appealing, attracting businesses and boosting economic activity. In summary, a smart street lighting system is crucial for improving safety, security, and quality of life in urban areas. By replacing sodium vapor lamps with LEDs and incorporating automated features like IR sensors, energy wastage is minimized, and the system can adapt to user needs, resulting in significant reductions in energy consumption and costs.

V.REFERENCES

[1]. P. P. F. Dheena, G. S. Raj, G. Dutt and S. V. Jinny, "IOT based smart street light management system" 2017 IEEE International Conference on Circuits and Systems (ICCS), Thiruvananthapuram, India, 2017, pp. 368- 371, doi: 10.1109/ICCS1.2017.8326023.

[2]. O. Rudrawar, S. Daga, J. R. Chadha and P. S. Kulkami, "Smart Street lighting system with light intensity control using power electronics," 2018 Technologies for Smart-City Energy Security and Power (ICSESP), Bhubaneswar, India, 2018, pp. 1-5, doi: 10.1109/ICSESP.2018.8376692.

[3]. P. Arjun, S. Stephenraj, N. N. Kumar and K. N. Kumar, "A Study on IoT based Smart Street Light Systems," 2019 IEEE International Conference on System, Computation, Automation and Networking (ICSCAN), Pondicherry, India, 2019, pp. 1-7, doi: 10.1109/ICSCAN.2019.8878770.

[4]. Vaishali Gupta, Krutika Thakur, Ritesh Thakur, “Based Smart Street Lights” International Journal of Research (IJR), Volume 2, Issue 10, October Volume 2, Issue 10, October 2015.

[5]. Snehal Bhosale, Komal Gaware, Pradnya Phalke, Dipali Wadekar, Pallavi Ahire,“IoT based Dynamic Control of Street Lights for Smart City”,International Research Journal of Engineering and Technology (IRJET), Vol. 4, No. 5, 2017, pp.1181-1183

[6]. B. Abinaya, S. Gurupriya and M. Pooja, "Iot based smart and adaptive lighting in street lights," 2017 2nd International Conference on Computing and Communications Technologies (ICCCT), Chennai, India, 2017, pp. 195-198

[7]. Sindhu.A.M, Jerin George, Sumit Roy, Chandra J, “Smart Streetlight Using IR Sensors” IOSR Journal of Mobile Computing & Application (IOSR-JMCA) e-ISSN: 2394- 0050, P-ISSN: 2394-0042.Volume 3, Issue 2.

[8]. Manish Kumar, Ravinder, Ritula, “Zigbee Based Smart Street Light Control System Using Lab VIEW” International Journal of Innovative Research in Science, Engineering and Technology Vol. 5, Issue 4, April 2016

[9]. J. Mohlnikova, Electric Energy Savings and Light Guides, Energy& Environment, 3rd IASME/WSEAS International Conference on, Cambridge, UK, February 2008, pp.470-474