

ABSTRACT

Urban street lighting systems play a crucial role in ensuring public safety and security, yet they are often plagued by inefficiencies and maintenance challenges. Traditional reactive maintenance approaches result in prolonged downtime, energy waste, and safety risks. To address these issues, we propose a novel predictive fault detection system driven by the Internet of Things (IoT) technology. This system leverages Arduino sensors, including voltage/current sensors and Light Dependent Resistors (LDRs), along with NodeMCU for data transmission, to continuously monitor streetlight performance in real-time. Python-based predictive models employing machine learning techniques, such as Naïve Bayes, analyze historical sensor data to identify patterns indicative of potential faults or inefficiencies. When anomalies are detected, notifications are sent to maintenance staff via the Blynk app, enabling prompt preventive maintenance actions to be taken. By combining IoT technology with predictive analytics, our system offers a proactive approach to street lighting management, enhancing efficiency, reliability, and safety in urban environments. The implementation details of the system, including scalability considerations and mechanisms for continuous improvement, are also discussed. Evaluation results demonstrate the effectiveness of the proposed system in detecting and addressing streetlight faults, paving the way for smarter and more sustainable urban infrastructure management. By integrating IoT and predictive analytics, our technology offers a comprehensive solution for optimizing urban infrastructure management and enhancing overall efficiency.