IOT-BASED ENERGY MANAGEMENT SYSTEM FOR COMMERCIAL BUILDINGS

वाणिज्यिक भवनों के लिए आईओटी–आधारित ऊर्जा प्रबंधन प्रणाली

A
Thesis

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By

PATANKAR SUSHRUT MADHAV
पाटणकर सुश्रुत माधव

Under the supervision of

Dr. RAJU KUMAR SWAMI
Associate Professor,
Pacific Academy of Higher
Education & Research University, Udaipur

Dr. SAMEER NANIVADEKAR
Dean Admin,
A.P. Shah Institute of Technology,
Thane

FACULTY OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING
PACIFIC ACADEMY OF HIGHER EDUCATION AND RESEARCH UNIVERSITY, UDAIPUR

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The primary objective of this study was to create and execute an Internet of Things (IoT) powered energy management system specifically designed for commercial buildings. The system aimed to maximize energy efficiency while simultaneously improving the comfort of the occupants. The research used a mixed-methods approach, combining quantitative data collected from sensors with qualitative insights obtained from analysing occupant behaviour.

The research found clear and specific patterns in energy utilization, emphasizing the substantial influence of human behaviour and ambient circumstances on energy consumption. For example, it was discovered that HVAC and lighting systems significantly contribute to the total energy consumption, which is impacted by both the external temperature and the activity of the occupants. The implementation of IoT based systems demonstrated a marked improvement in energy efficiency. Real time data collection and dynamic optimization of HVAC and lighting systems resulted in substantial energy savings without compromising occupant comfort.

Analysis of CCTV footage and occupant surveys provided valuable insights into behavioural trends. The study found that providing personalized feedback and real-time alerts effectively encouraged energy efficient behaviours among occupants. The predictive models for HVAC and lighting optimization showed high accuracy and reliability in real world settings. Validation metrics indicated that these models could significantly reduce energy wastage while maintaining optimal environmental conditions within the buildings.

5.1 Contributions to the Field

This research offers notable advances to the area of energy management in commercial buildings by integrating IoT technology with comprehensive behavioural analysis. The study delivers a comprehensive approach to energy management. This connection enables enhanced regulation and fine tuning of energy systems by using real time data and occupant behaviours. The study developed and validated advanced predictive models for optimizing HVAC and lighting systems. These models can be adopted and adapted by other researchers and practitioners to enhance energy efficiency in various commercial settings. The research provides a comprehensive framework for implementing IoT based energy management systems, including

detailed methodologies for data collection, processing, and system integration. This framework can serve as a guideline for future projects aiming to implement similar systems.

5.2 Implications for Practice

The results of this research have practical ramifications for those responsible for managing buildings and developers of technology. The report provides practical insights and tools for building managers to efficiently monitor and improve energy use. The intuitive interface and instantaneous feedback system enable managers to make well informed choices and include occupants in energy conservation activities. The proven advantages of energy management systems based on the Internet of Things (IoT) provide support for the development of rules that promote the use of intelligent technologies in commercial buildings. Policymakers may use these discoveries to further energy efficiency measures and establish standards. The study emphasizes the need of creating resilient and easy to use Internet of Things (IoT) solutions that can effortlessly merge with current building management systems. Technology developers may use the knowledge gained from this research to improve the functioning and user friendliness of their products.

5.3 Limitations and Future Research

Although the study offers vital insights, it is crucial to recognize its limits and provide avenues for further research. The study was carried out in a restricted selection of commercial buildings, perhaps failing to include the entire range of building types and use patterns. In order to improve the applicability of the results, future research should use a more extensive and varied participant pool. The study's length was quite brief, which restricted the capacity to detect long-term patterns and seasonal fluctuations. Extended research is necessary to authenticate the results and investigate the enduring effects of energy management systems based on the Internet of Things (IoT). Accurately simulating occupant behavior is challenging due of its complexity and variety. Subsequent investigations should prioritize the development of advanced models capable of comprehensively capturing and predicting a broader spectrum of behaviors and their corresponding influence on energy usage. As the usage of IoT devices continues to grow, it is crucial to prioritize data privacy and security.

Subsequent research should investigate sophisticated methods of safeguarding occupant data, while yet allowing for in depth analysis.

This study highlights the potential of Internet of Things (IoT) energy management systems to completely transform the management of energy in commercial buildings. By using up to the-minute data and sophisticated analysis, these systems may greatly improve energy efficiency and the comfort of occupants. The study's results enhance the expanding knowledge base on smart building technologies and provide a practical guide for their application. Further progress in the Internet of Things (IoT) and machine learning will augment the capabilities of these systems, leading to the development of more intelligent and environmentally friendly buildings.