**Int. j. adv. multidisc. res. stud.** 2026; 6(4):164-165

**Received:** 16-05-2026
**Accepted:** 26-06-2026

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

# Design and Development of an Internet of Things (IoT)–Based Energy Monitoring and Management System for Smart Home

**Dickson Chisompola**
Department of Information and Communications Technology, Information and Communications University (ICU), Zambia

Corresponding Author: **Dickson Chisompola**

**Abstract**
The proposed work is based on to monitor the energy consumption and energy management through Internet of Things (IoT). Electricity is one of the key factors in human life to survive on the earth. Most of our work requires electricity so it's important to save electricity. Without electricity life will be like heart without heartbeats. Energy saving is one of the main challenges in our day-to day life. Energy saving can be done only when the energy consumed by the load is monitored. Once the load is monitored, suitable control methods can be adopted to operate the load in the optimized way to save energy. Even though there are lot of technologies and solutions available to effectively monitor, control and save energy consumption of load in a house or an industry, the Internet of Things technology is proposed to monitor, control and minimize energy consumption of load. The proposal is to design and develop an Internet of Things based Energy Management System in which the data is collected from smart energy meter using GPRS network and displayed on web page. The proposed system is suitable for data collection and Professional installation can come especially in handy for those who need to retrofit older homes and can't use a control the load in the Internet of Things environment.

**Keywords:** Internet of Things (IoT), LSTM and GRU models

## Introduction
- Rapid growth in residential electricity demand
- Rising energy costs and sustainability concerns
- Limited real-time visibility of household energy consumption

## Objectives
- Traditional electricity meters provide delayed and aggregated data
- Households lack appliance-level energy consumption awareness
- Existing smart energy solutions are costly and unsuitable for developing countries

## Methodology
- Research Design : Mixed-methods approach (quantitative and qualitative) used.
- IoT sensors and smart plugs used for real-time data collection
- LSTM and GRU models applied for energy consumption prediction

System Development Method: Waterfall model
- Requirements analysis and system design Implementation, testing, and validation.

## IoT Sensors
- Analyze and gather data
- System displays current demand

**System Design & Development**
- Python Flask backend
- MySQL database
- HTML, CSS, JavaScript frontend
- Sensors

**Pilot Testing & Evaluation**
- Simulated scenarios
- Usability and efficiency assessment

**Results**
- Real-time communication significantly improves coordination
- Centralized resource tracking enhances decision-making
- Accurate real-time monitoring of household energy usage
- Improved user awareness and peak load management
- LSTM model achieved higher prediction accuracy Positive user acceptance of the system

**Key Findings**
- 80% improved agreed to answer.
- 81% reduction in response delays.
- 76% support nation wide adoption.
- 87% ease of use

**Discussion**
**Relevance to Conference theme:**
- Enables knowledge sharing through real-time energy data visualization
- Encourages innovation using IoT and machine learning
- Supports production-enabled development by reducing energy wasted.

**Applications & Recommendations**
- Integrate renewable energy sources
- Develop mobile application support
- Enhance system security and scalability

**Conclusion**
- The IoT-Based Energy Monitoring and Management System enhances real-time monitoring, intelligent control, and data-driven decision-making. It improves household energy efficiency, reduces electricity costs, and supports sustainable energy management in smart homes.

Future Work Direction
- Integration with Real-Time Data Sources, Future enhancements could focus on integrating the platform with real-time sensors, satellite imagery, and social media feeds.

**Acknowledgments**
- Zambia Research and Development Center: Scholarship support for the study.
- Information and Communications University (ICU), Zambia: Institutional support and resources.

**References**
1. Alexander D. Disaster and emergency planning. Oxford: Oxford University Press, 2015.
2. Ravindis S. Enhancing disaster response through web technologies. J. of Emergency Management. 2023; 12(3):45-58.
3. Chitondo P, *et al*. Disaster response coordination in Zambia. Afr. J. Disaster Studies. 2024; 18(1):22-37.
4. Ocal FE, Torun S. AI for disaster response coordination. Int. J. of Disaster Risk Mgmt. 2025; 7(1):235-246.
5. IASC. Improving coordination in humanitarian responses. New York: United Nations, 2020.