

IOT based Smart Energy Meter Monitoring with theft Alerting Detection & Energy Consumption

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ABSTRACT

The IoT based Smart Energy Meter Monitoring system is designed to efficiently measure, monitor, and manage electrical energy consumption while detecting power theft in real time. Traditional energy meters lack remote monitoring and theft detection capabilities, leading to revenue loss for utility providers. The proposed system integrates smart sensors, microcontrollers, and IoT communication to record energy usage accurately. Real-time data is transmitted to a cloud platform for storage and analysis. The system continuously monitors voltage, current, and power consumption. Energy theft is detected by identifying abnormal consumption patterns or meter tampering. Alert notifications are sent instantly to utility authorities and consumers. Users can access consumption data through a web or mobile dashboard. This improves

transparency and consumer awareness. Automated billing reduces human error. Data analytics helps optimize energy usage. The system supports load management. Remote monitoring minimizes manual inspections. Security mechanisms protect data integrity. The solution is cost-effective and scalable. It reduces power losses. The system promotes energy conservation. It supports smart grid applications. The design improves efficiency and reliability. Overall, the system modernizes energy monitoring and theft prevention.

INTRODUCTION

Energy management is a critical requirement in modern power distribution systems. Conventional energy meters require manual reading and lack real-time monitoring. Power theft and unauthorized consumption are major challenges faced by electricity boards. These issues cause

significant financial losses and energy wastage. Smart energy meters provide an effective solution by enabling automated monitoring. Internet of Things technology allows meters to communicate consumption data remotely. Real-time energy monitoring improves billing accuracy. Consumers can track their usage patterns. Theft detection mechanisms enhance grid security. Smart meters support demand-side management. Automation reduces operational cost. Cloud integration enables data analysis and visualization. Alerts notify authorities of abnormal activity. The system supports energy efficiency initiatives. Smart meters are key components of smart grids. Wireless communication improves system flexibility. Data-driven decisions improve power distribution. IoT-based monitoring enhances reliability. Energy conservation is promoted. The introduction of smart energy meters marks a major advancement in power management.

LITERATURE SURVEY

Several researchers have explored smart energy metering systems using different technologies. Early systems relied on manual meter reading. GSM-based meters enabled remote reading through SMS. Later, wireless communication technologies such as ZigBee and Wi-Fi were introduced. Researchers implemented

microcontroller-based energy meters. IoT platforms enabled cloud-based monitoring. Some studies focused on real-time energy consumption visualization. Theft detection techniques were developed using load comparison methods. Machine learning approaches were explored for anomaly detection. Researchers proposed prepaid energy meters. Smart billing systems were implemented. However, many systems lacked real-time theft alerting. Some designs had limited scalability. Data security issues were not fully addressed. High implementation cost was a concern. Accuracy varied across designs. Integration with smart grids was limited. User-friendly dashboards were missing in some systems. Literature highlights the need for a secure, scalable, and efficient smart energy monitoring system with theft detection.

EXISTING SYSTEM

Existing energy metering systems are mostly conventional and manual. Meter readings are collected physically by utility personnel. This process is time-consuming and prone to human error. Consumers have limited awareness of their energy usage. Theft detection is difficult in traditional systems. Power theft often goes unnoticed for long periods. Manual inspection increases operational cost. Billing inaccuracies occur frequently. Real-time monitoring is not supported. Data logging

is minimal. Load management is inefficient. Existing systems lack automation. Remote access is not available. Energy wastage is common. Consumer engagement is low. Maintenance cost is high. Fault detection is delayed. Existing systems are not compatible with smart grids. Scalability is limited. Security measures are weak. These drawbacks highlight the need for a smart IoT-based solution.

PROPOSED SYSTEM

The proposed IoT based smart energy meter system enables real-time monitoring and theft detection. Smart sensors measure voltage, current, and power consumption accurately. A microcontroller processes the sensor data. IoT communication modules transmit data to the cloud. Cloud platforms store and analyze energy usage information. Abnormal consumption patterns indicate possible theft. Instant alerts are generated for authorities and consumers. A web or mobile dashboard displays real-time and historical data. Automated billing improves accuracy. Remote monitoring reduces manual effort. Data analytics supports energy optimization. Load control features improve power management. Security mechanisms protect data transmission. The system supports scalability. Low-cost components reduce implementation cost. The design is reliable and efficient. Energy

conservation is promoted. The system supports smart grid integration. Theft detection improves revenue protection. The proposed system modernizes energy management.

SYSTEM ARCHITECTURE

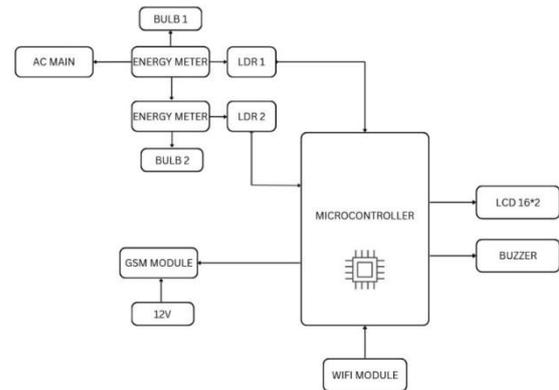


Figure: System Architecture

The system architecture of the IoT based Smart Energy Meter Monitoring with Theft Alerting Detection and Energy Consumption consists of energy sensing units, a controller, communication modules, cloud services, and user interfaces. Energy sensors continuously measure voltage, current, and power consumption in real time. A smart energy meter records and sends these parameters to a microcontroller, which processes the data and calculates total energy usage. Theft detection logic is implemented to identify abnormal consumption patterns or meter tampering. Communication modules such as Wi-Fi or GSM transmit the processed data to a cloud platform. The cloud stores and manages energy consumption records

securely. Data analytics tools analyze usage trends and detect anomalies. When theft or abnormal activity is detected, alert notifications are generated instantly. Alerts are sent to both utility authorities and consumers. A web or mobile dashboard displays real-time and historical energy data. Automated billing is generated based on recorded consumption. Security mechanisms protect data transmission and access. Load monitoring and management features improve power distribution. The system supports remote monitoring and control. Scalability allows multiple meters to be connected. Overall, this architecture ensures efficient energy monitoring, accurate billing, and effective theft detection.

RESULTS AND DISCUSSION

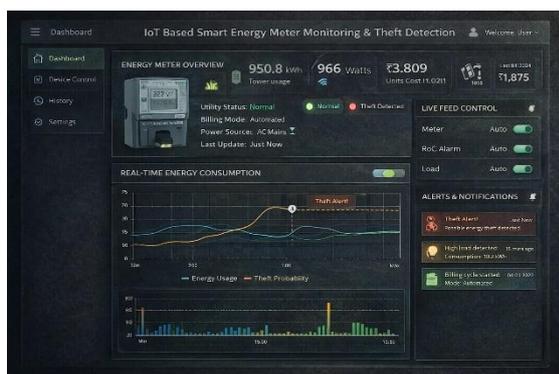


Figure: Home page

CONCLUSION

The IoT based smart energy meter monitoring system provides an efficient solution for energy management and theft detection. Real-time monitoring improves

transparency and accuracy. Automated billing reduces errors. Theft alerting mechanisms enhance grid security. Remote access improves convenience for users and authorities. Data analytics supports informed decision making. The system reduces power losses. Operational efficiency is improved. Consumer awareness increases energy conservation. The design is cost-effective and scalable. Integration with cloud platforms enhances performance. Security features protect data integrity. The system supports smart grid applications. Maintenance effort is reduced. Load management is improved. Alerts enable quick response. The system improves reliability. Energy efficiency is promoted. The proposed system addresses modern power challenges. Overall, it is a smart solution for energy monitoring and theft prevention.

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