**SMART ENERGY MONITORING SYSTEM USING ESP32**

EMBEDDED SYSTEM AUTOMATION (23SDEC02)

**MAJOR PROJECT**

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**ABSTRACT**

The Smart Energy Monitoring System (SEMS) using ESP32 is an advanced, cost-effective solution designed to enhance energy management and promote sustainability. Powered by the ESP32 microcontroller, the system leverages its built-in Wi-Fi and Bluetooth capabilities to enable seamless communication between sensors, devices, and cloud platforms. SEMS monitors electricity, water, and gas consumption in real-time, providing users with detailed insights through mobile and web-based dashboards.

The system integrates smart sensors and actuators to measure energy usage accurately, enabling anomaly detection, energy-saving recommendations, and automated device control. Machine learning algorithms further enhance its functionality by predicting energy demands and optimizing consumption patterns. Users can set energy-saving goals, receive alerts for abnormal usage, and track their progress toward efficiency targets. Additionally, SEMS supports renewable energy sources, such as solar panels, allowing users to monitor production and usage effectively.

With its low-cost and energy-efficient architecture, the ESP32-based SEMS is ideal for residential, commercial, and industrial applications. The system not only helps users reduce utility bills but also contributes to environmental conservation by minimizing energy waste and carbon footprints. Furthermore, utility providers can benefit from improved grid management and demand forecasting using aggregated data from SEMS.

By offering real-time insights, automation, and control, SEMS empowers users to make informed decisions about energy usage. This innovative system underscores the potential of IoT and microcontroller technology, such as ESP32, in addressing global energy challenges. The SEMS represents a step forward in achieving sustainable energy practices and supports the transition to a greener, more efficient future.