INTELLIGENT HOME AUTOMATION AND ENERGY MANAGEMENT USING IOT

ABSTRACT

With the hectic life today, efficient energy management is necessary because of fluctuating electricity demand during the day, with peak and off-peak hours. Dynamic pricing schemes help solve this by persuading users to use energy during off-peak hours. This project offers an affordable Intelligent Home Automation and Energy Management System based on the Internet of Things (IoT) for increased convenience, energy efficiency, and sustainability at home. The system is implemented with cost-effective devices such as Arduino Mega and ESP32, and relays and sensors. It has a Smart Energy Management Unit (EMU) that times high-energy appliances such as water pumps, and washing machines to run during off-peak times when electricity prices are cheap and to toggle AC when in maximum need by the system. The system also has automatic source switching between solar and the grid, optimizing energy consumption according to availability and price. By day, the system favors solar energy, minimizing its draw from the grid, and automatically turning over when solar power is low.

An easy-to-use dashboard enables homeowners to plan appliances, control them manually, and track real-time power usage. Sensors for the environment ensure devices function only when needed, avoiding wastage of energy. Overall, this home automation system encourages energy conservation, lowers electricity bills, and increases home comfort. Through the combination of IoT and renewable energy, the project inspires a more sustainable and cost-efficient lifestyle and makes home automation more accessible to the masses.

Key words: Smart Home Automation, Energy Management, Internet of Things (IoT), Dynamic Pricing, Energy Efficiency.