FIU Engineering & Computing

Knight Foundation School of Computer & Information Sciences

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Intelligent Home Monitoring System

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Technologies

PROBLEM

- High household energy use often goes unnoticed
- Users lack real-time visibility into device power usage
- No simple way to track energy use by device
- Hard to identify devices left on too long
- Existing solutions are complex or not user-friendly
- No intuitive system for monitoring and controlling energy use
- Low awareness leads to higher costs and wasted energy

CURRENT SYSTEM

- Energy use is tracked only at the household level
- Users rely on monthly utility bills for feedback
- No real-time view of individual device usage
- Limited ability to spot high-energy devices
- Smart devices are not unified in one system
- Existing tools are often complex or fragmented
- Limited insights lead to inefficient energy use

REQUIREMENTS

- Provide real-time energy monitoring for each device
- Display a clear and intuitive dashboard interface
- Allow users to add and manage smart outlets/devices
- Show usage trends over time (week, month, year)
- Generate alerts for overuse and unusual activity
- Support timers and automated control features
- Maintain a simple, user-friendly, and responsive design

SYSTEM DESIGN

- Built as a web-based dashboard application
- Uses a client-server architecture for scalability
- Frontend handles real-time data visualization
- Backend processes device data and user interactions
- Devices communicate through smart outlets (IoT integration)
- Modular design allows easy feature expansion
- Focus on fast, responsive, and interactive user experience

OBJECT DESIGN

- User object manages authentication and preferences
- Device object stores device name, type, and status
- Energy object tracks real-time and historical usage
- Timer object controls countdown and usage limits
- Notification object handles alerts and system messages
- Debug object simulates system behavior for testing
- Objects interact to provide a dynamic and connected system

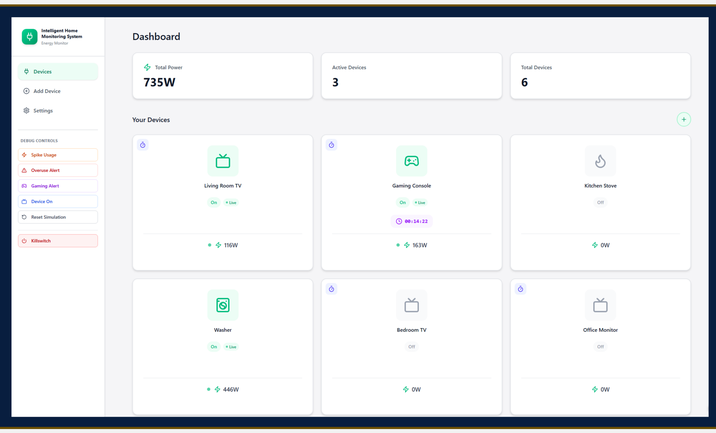
IMPLEMENTATION

- Frontend built using modern web technologies (React, Tailwind CSS)
- Backend developed with Node.js and Express
- Data managed using a relational database (PostgreSQL)
- Real-time updates simulated using state management and timers
- Interactive UI built with modals, animations, and live data updates
- System tested using debug controls and simulation features
- Designed for scalability, usability, and demo effectiveness

VERIFICATION

- Tested system using debug controls and simulations
- Verified real-time updates for device usage and timers
- Ensured accurate display of energy consumption data
- Confirmed notifications trigger for overuse and alerts
- Validated user interactions such as adding and deleting devices
- Checked UI consistency across all dashboard components
- Demonstrated system reliability through live demo scenarios

Dashboard



SUMMARY

- Developed a real-time energy monitoring dashboard
- Provides visibility into individual device energy usage
- Helps users identify and reduce energy waste
- Integrates multiple features into a single intuitive platform
- Emphasizes simplicity, usability, and responsiveness
- Demonstrates practical application of IoT and web technologies
- Delivers an engaging and interactive user experience

REFERENCES

- Florida Power & Light (FPL) – Residential energy usage data
- U.S. Energy Information Administration (EIA) – Energy consumption statistics
- U.S. Department of Energy – Energy efficiency and conservation resources
- Google Nest – Smart home device ecosystem
- Apple HomeKit – Smart home integration platform
- Sense Energy Monitor – Real-time home energy monitoring system
- TP-Link Kasa Smart Devices – Smart outlet and device control

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