Florida International University

Fall 2025 Senior Design Project

Intelligent Home Monitoring System

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PROBLEM

New homeowners often struggle to figure out why their electric bills are suddenly so high. There is no simple, centralized way to see what appliance, room, or system is causing the unexpected increase.

CURRENT SYSTEM

Homeowners often rely on guesswork, manual checks, or costly technician visits to understand rising energy bills. Electricity providers usually offer only broad, generalized usage metrics, which makes it hard to pinpoint the exact source of high consumption. Without detailed insights, issues take longer to identify, costs remain high, and users are left uncertain about what's causing the spike.

SYSTEM DESIGN

The system is composed of three main components:

- User Interface (Frontend)
  - Provides homeowners with a clear dashboard to view energy usage, alerts, and appliance-level consumption.
  - Built to help users quickly navigate and identify unusual spikes or patterns.
- Backend Server
  - Handles data processing, device communication, and computation of usage statistics.
  - Manages requests from the frontend and stores all collected data securely.
- Data Integration Layer
  - Receives data from sensors, smart plugs, uploaded bills, or utility API sources.
  - Converts raw usage data into structured, analyzable information for the system.

VERIFICATION

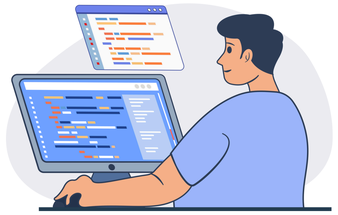
Functional Testing

- Confirm that the system correctly receives and processes energy-usage data from all inputs.
- Test that each dashboard component (charts, tables, alerts) loads and updates as expected.
- Verify that filtering by day, week, month, or appliance returns accurate results.
- Ensure the system correctly identifies and highlights unusual spikes in usage.

Integration Testing

- Validate communication between the frontend, backend, and all data sources.
- Confirm that uploaded bills or utility data are stored, parsed, and displayed correctly.
- Test the complete flow from data input to backend processing to visual output.

REQUIREMENTS



Functional Requirements:

- Display total home energy usage in a clear dashboard.
- Provide appliance-level or room-level usage breakdowns.
- Allow users to upload bills or connect supported data sources.
- Detect and flag unusual or high energy spikes.
- Update usage data in real time or near real time.
- Store historical usage for long-term comparisons.

Non-Functional Requirements:

- UI must be simple, responsive, and easy to navigate.
- Dashboards and charts should load quickly.
- Backend should process multiple inputs reliably.
- System must scale for more devices and users.
- Usage data must be accurate and trustworthy.
- User data must be stored and handled securely.

SUMMARY

This project gives homeowners a clearer understanding of their energy usage by providing detailed, device-level insights that traditional electricity providers do not offer. By collecting data from bills, sensors, and connected devices and displaying it in an intuitive dashboard, the system helps users identify unusual spikes, track patterns, and pinpoint the sources of rising costs. The goal is to reduce guesswork, increase awareness, and make it easier for users to take control of their consumption, while also offering broad potential to grow into a solution that helps entire communities save energy and money.

IMPLEMENTATION

- Developed the frontend interface using React to provide an intuitive dashboard for energy-usage visualization. (Emre, Juan)
- Built the backend server to handle data processing, usage calculations, and communication with all connected devices and APIs. (Carlos, David, Henry)
- Integrated data sources such as sensors, smart plugs, and utility uploads to supply real-time or historical usage information. (Emre, Juan)
- Implemented database structures for storing user profiles, device data, and long-term energy-usage history. (Carlos, David, Henry)
- Created logic to detect abnormal consumption patterns and prepare the system for alert generation. (Emre, Juan)
- Conducted initial testing to confirm proper routing, data flow, and frontend-backend communication. (Emre, Juan, Carlos, David, Henry)

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