SMART ENERGY GUARD

Project Proposal

NEXIONIX
Empowering Progress, Shaping Tomorrow

IndustryMinds
IGNITE INNOVATIONS

iCET
Connecting Intelligence

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INSTITUTE OF COMPUTER ENGINEERING TECHNOLOGY

Industry Minds iCD113 Batch

Team Name	Nexionix (Team D)
Project Name	Smart Energy Guard

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Project **Overview**

The **Smart Energy Guard** project is positioned within the rapidly evolving domain of Energy Management and Home Automation, which focuses on the efficient use of energy resources and the seamless integration of smart devices to enhance convenience, security, and sustainability in residential and commercial settings. This innovative energy management system optimizes electricity usage while prioritizing user safety and comfort. By enabling users to monitor their energy consumption in real-time, control connected devices remotely, and receive emergency notifications for potential hazards, Smart Energy Guard facilitates significant energy savings, helping users reduce their utility costs.

In addition to its core functionalities, Smart Energy Guard promotes sustainable practices by minimizing unnecessary energy waste and enhancing user satisfaction through its intuitive design. The integration of real-time monitoring and automated controls not only helps users save money on their utility bills but also contributes to broader environmental sustainability goals by encouraging responsible energy consumption. The platform supports profile management, allowing users to update their information or delete accounts as needed, while administrators can adjust calculation formulas to ensure billing accuracy in response to changing energy pricing policies.

Ultimately, the Smart Energy Guard project aims to deliver a holistic solution that combines efficiency, cost savings, and safety. By providing users with a reliable tool for managing their energy needs, the project aspires to create smarter and safer living environments. With its focus on user empowerment and sustainability, Smart Energy Guard stands out as an essential addition to modern homes, fostering a commitment to eco-friendly practices while ensuring convenience and security for all users.

Smart **Energy Guard**

Energy Management Challenges

In 2022, Sri Lanka generated approximately 12.02 billion kilowatt-hours (GWh) of electricity, with households consuming 30-35% of this total. Key challenges include:

- **Energy Wastage:** Inefficient appliances and poor management practices lead to significant energy losses.
- **Dependence on Non-Renewable Sources:** Reliance on fossil fuels increases costs and poses environmental risks.
- **Lack of Real-Time Monitoring:** The absence of systems for tracking energy consumption hampers effective management.

Proposed Solutions

The Smart Energy Guard system offers several innovative solutions:

- **Real-Time Monitoring:** Tracks energy usage to identify inefficiencies.
- **Actionable Insights:** Provides recommendations for reducing unnecessary consumption.
- **Peak Usage Alerts:** Sends notifications during high-demand periods to encourage better management.
- **Renewable Energy Integration:** Facilitates the adoption of solar and other sustainable technologies.

Home Automation Integration

The project also emphasizes home automation, enhancing user experience through:

- **Smart Appliances:** Devices that can be controlled remotely.
- **Centralized Management:** Control via voice commands or mobile applications.
- **Interconnectivity:** Seamless communication between devices using protocols like Zigbee or Z-Wave.
- **Customizable Routines:** Automation of daily tasks for improved convenience.

Benefits

The implementation of the Smart Energy Guard system is expected to deliver numerous benefits:

- **Increased Efficiency:** Significant energy savings leading to lower utility bills.
- **Environmental Conservation:** Reduced reliance on non-renewable sources supports sustainability efforts.
- **Enhanced Convenience:** Simplified management of household energy usage.
- **Improved Security:** Automated alerts enhance safety within homes.

Requirements

1. User Management

These features focus on allowing users to create and manage their accounts efficiently.

Registration:

- Users can register their details, such as name, email, or address, to create an account.
- This step ensures each user has a unique profile within the system for secure access and personalization.

Login:

- Users must log in to access the system.
- The system authenticates credentials like username/email and password.
- If authentication succeeds, the system grants access (Login Successful).
- If it fails (e.g., incorrect password), the system denies access and may prompt users to reset their credentials (Login Fail).

View Profile:

- Users can view their account details (e.g., personal information, linked devices, or energy usage history).
- This feature provides transparency and convenience for managing their data.

Update Profile:

- Users can modify account details, such as updating contact information, passwords, or notification preferences.

Delete Profile:

- Allows users to permanently remove their profile and all associated data from the system.
- This ensures user privacy and compliance with data protection regulations.

2. Energy Monitoring and Usage Insights

These features empower users with detailed energy consumption data, helping them make informed decisions.

View Energy Usage:

- Provides a graphical or tabular overview of energy consumption over different time periods (daily, weekly, monthly).
- Helps users identify patterns, peak usage times, and potential areas to save energy.

Electricity Meter Reading:

- Displays real-time data from a smart electricity meter, showing current energy usage in kWh or similar units.
- Users can track their consumption as it happens, promoting better energy management.

View Electricity Bill:

- Calculates and presents an estimated or actual bill based on energy consumption.
- May include itemized costs, such as per-device or per-period usage, taxes, and any applicable penalties.

3. Device Monitoring and Control

These features are central to smart home functionality, allowing users to interact with their connected devices.

Device Monitoring and Control:

- Displays all connected devices in the user's home, such as smart lights, thermostats, or appliances.
- Users can monitor the status (e.g., ON/OFF, current usage) of these devices.
- Enables remote control, allowing users to turn devices ON/OFF or adjust settings like brightness or temperature.

Manage the Status of Devices:

- Focuses on modifying the current state of devices.
- Users can
  - Turn off appliances when not in use.
  - Schedule device operations (e.g., turn on the air conditioner at 6 PM).
  - Set device-specific thresholds to automate operations (e.g., dim lights at a specific time).

4. Emergency Notifications

Receive Emergency Notifications:

- Alerts users in case of emergencies, such as:
  - Power outages or surges.
  - System malfunctions or device failures.
  - Over-consumption or nearing energy budget limits.
- Notifications could be sent via mobile app, email, or SMS to ensure users are informed promptly and can take action to prevent damage or excessive costs.

5. Admin Functionality

These features are designed specifically for administrators to maintain and optimize the system:

Update Calculation Formula:

- Admins can modify the algorithms used to calculate energy consumption, bills, or system alerts.
- This feature might be useful if there are changes in energy pricing policies, tax rates, or billing structures.
- For example:
  - Adding support for tiered energy pricing (higher rates for excessive usage).
  - Adjusting calculations based on renewable energy contributions.

Additional Notes on the System's Structure

Use of Relationships in Diagram:

Include:

- Features like "Check Authentication" are required for "Login". The system ensures authentication happens as part of the login process.
- Similarly, "Manage the Status of Devices" is part of "Device Monitoring and Control".

Extend:

- Features like "Login Successful" or "Login Fail" are extended functionalities of "Login". They only occur based on the outcome of the login process.
- "Update Profile" and "Delete Profile" extend "View Profile" because they are optional actions users can perform after accessing their profile.

Functional **Requirements**

1. Device Monitoring and Control

- The system must enable users to monitor the status (on/off) of connected devices.
- Users must be able to remotely turn devices on or off through the app.

2. Energy Consumption Tracking

- Provide real time data updates on energy usage.

3. Emergency Notifications

- The system detects electrical hazards and send alerts users.

4. Electricity Bill Calculation

- Calculate bills based on consumption rates.

5. User Authentication

- User authentication must ensure only authorized access.

Non-Functional **Requirements**

1. Performance

- The project must provide electrical data in real-time.
- Response time for switchboard control should be fast.

2. Usability

- The app must be user-friendly and intuitive.
- Options should be easily selectable for user convenience.

3. Scalability

- The system must support additional devices for upgrades.

4. Quality

- Maintain a low error rate in app operations.

5. Security

- Ensure the application's data is protected from unauthorized access.
- Maintain a secure connection between the IoT device and the app.

6. Reliability

- The IoT device and app should function accurately at all times.
- Provide globally accurate data on electricity flow.

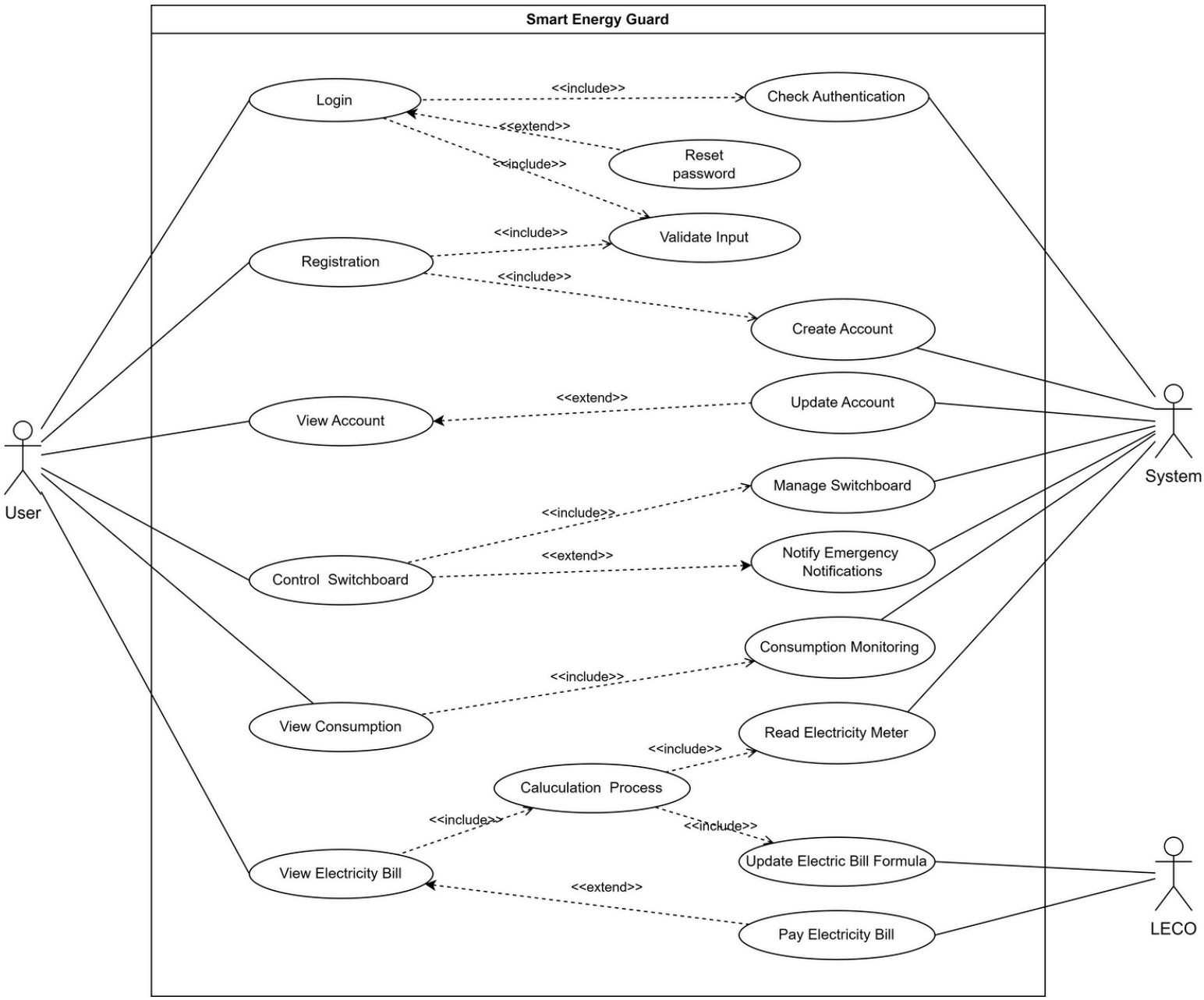
7. Compliance with Standards

- Ensure that the system complies with relevant IoT and electrical safety regulations.

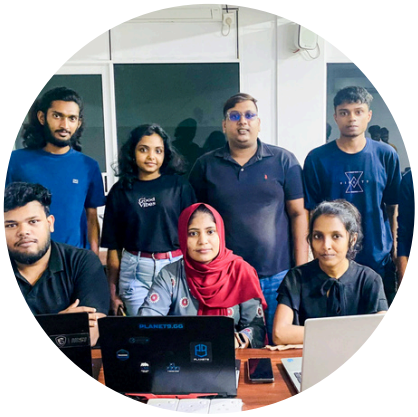
8. Interoperability

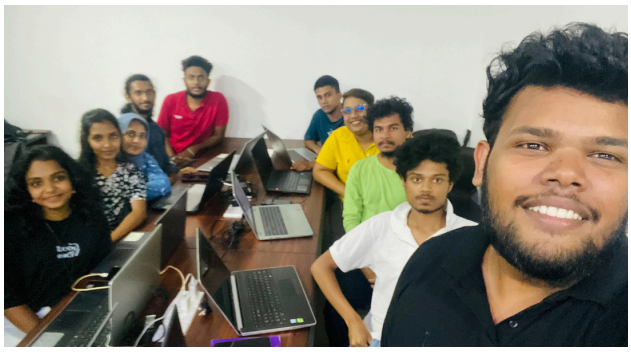
- The system should work seamlessly with various IoT devices and electrical systems in homes.

Smart Energy Guard
UseCase Diagram



Team Nexionix





Guided Collaboration for **Project Excellence**

On 2024/11/29, we had the opportunity to collaborate with our seniors to make significant progress on our project document. Their guidance and experience were invaluable as we worked together to refine the content, structure, and presentation of the document. It was a productive session where ideas were shared, feedback was exchanged, and solutions were developed to address challenges. With their support, we were able to ensure that the project document meets high standards and is aligned with our objectives. This teamwork has brought us one step closer to a successful project outcome.

INSTITUTE OF COMPUTER ENGINEERING TECHNOLOGY

Industry Minds iCD113 Batch

TEAM NAME	**Nexionix (Team D)**		
PROJECT NAME	**Smart Energy Guard**		
SUMMARY	The Smart Energy Guard is an energy management system designed to optimize electricity usage and enhance user convenience. It allows users to register, log in, monitor energy consumption, control devices, view electricity bills, and receive emergency notifications. The system also supports profile management, including updates and deletion, while administrators can update calculation formulas to maintain accuracy. By integrating real-time monitoring and control, the system promotes efficient energy usage, cost savings, and sustainability.		
DESIRED OUTCO`ME	The desired outcome of the Smart Energy Guard is to reduce electricity consumption, lower energy costs, and promote sustainable energy usage. By providing real-time monitoring, automated control of devices, and actionable insights into energy consumption, the system aims to help users manage their energy efficiently while ensuring convenience, reliability, and environmental responsibility.		
BENEFITS OF PROJECT	**Energy Efficiency:** Reduces electricity consumption through automated device control and realtime monitoring. **Cost Savings:** Helps users manage energy usage and bills effectively, minimizing unnecessary expenses. **Convenience:** Provides easy access to energy data, device management, and emergency notifications from one platform. **Sustainability:** Promotes eco-friendly energy practices, contributing to a greener environment. **Customization:** Allows users to update profiles and admins to adjust calculation formulas for energy solutions. **Emergency Readiness:** Alerts users to critical situations, ensuring safety and preparedness.		
ACCEPTANCE OF PROJECT PROPOSAL			
Comment			
Signature		**Date of Acceptance**	