FYP Project Proposal

Smart Electricity Bill Estimation



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## 1.1. Introduction:

In response to the evolving landscape of residential energy consumption and the increasing demand for smart and sustainable solutions, we present this proposal for the development of a cutting-edge system: the Smart Electricity Bill Estimation and Home Automation System.

### 1.1.1. Project Context:

Modern households are witnessing a paradigm shift in the way electricity is consumed and managed. Traditional approaches to electricity usage often lack transparency, real-time control, and the ability to optimize costs efficiently. Homeowners are left grappling with rising energy bills, unaware of how individual appliances contribute to consumption and cost. The need for a comprehensive, user-friendly, and technologically advanced solution to tackle these challenges has never been more pressing

### 1.1.2. Project Objective:

The primary objective of our proposed project is to empower homeowners with the tools and knowledge necessary to revolutionize the way they interact with and manage their electrical appliances. By harnessing the power of a Raspberry Pi-based microcontroller, cloud technology via Firebase, and a user-friendly mobile application, we aim to create a system that not only addresses the limitations of existing systems but also sets new standards in terms of efficiency, cost-effectiveness, and convenience.

### 1.1.3. The Vision:

Imagine a home where you can seamlessly control your appliances remotely, receive real-time insights into your electricity consumption, and effortlessly estimate your monthly bills. Our vision is to turn this imagination into a reality, making it possible for homeowners to take control of their energy usage while contributing to a more sustainable and eco-friendly future.

### 1.1.4. Project Overview:

This proposal outlines a comprehensive plan for the development and implementation of the Smart Electricity Bill Estimation and Home Automation System. We will delve into the specific functional requirements, hardware components, and software architecture, highlighting how our system stands at the forefront of smart home technology.

In the pages that follow, we will provide a detailed roadmap for project execution, addressing the problem statement, business scope, functional requirements, hardware specifications, and software components. Together, these elements will form the foundation for a transformative project that promises to redefine the way households interact with their electrical appliances, ushering in a new era of energy efficiency and control.

## 1.2. Problem Statement:

In traditional households, managing electricity consumption and understanding its impact on monthly bills can be challenging and often lacks real-time visibility and control. The absence of a system that enables users to monitor and manage their appliances efficiently leads to:

**Inefficient Energy Usage:** Users are unaware of their electricity consumption patterns, leading to inefficient usage of appliances and higher electricity bills.

**Limited Cost Transparency:** Lack of real-time cost estimation makes it difficult for users to track their electricity expenses as they accumulate, often resulting in unexpected and unmanageable bills.

**Inconvenience:** Traditional methods of manually turning appliances on and off are inconvenient and do not support remote control or automation, limiting user flexibility and convenience.

**Environmental Impact:** Inefficient energy consumption contributes to unnecessary environmental impact due to the excessive use of electricity.

**Safety Concerns:** The absence of automated safety measures can lead to potential hazards, such as appliances left on unattended or during non-optimal times.

To address these challenges, our project proposes the development of a Smart Electricity Bill Estimation and Home Automation System, leveraging Raspberry Pi, relays, sensors, and a mobile application integrated with Firebase cloud. This system aims to provide users with real-time insights into their electricity consumption, cost estimates, and remote control of appliances, offering a sustainable, cost-effective, and user-friendly solution for managing home energy consumption.

## 1.3. Business Scope:

The Smart Electricity Bill Estimation and Home Automation System project not only addresses immediate consumer needs but also presents a wide range of business opportunities and benefits that extend beyond individual households. The business scope encompasses the following aspects:

### 1.3.1. Enhanced Customer Experience:

By offering homeowners a powerful tool to monitor and manage their electricity consumption, our system enhances the overall customer experience.

Increased customer satisfaction can lead to higher customer retention rates, referrals, and brand loyalty.

### 1.3.2. Market Potential:

The market for smart home automation and energy management systems is rapidly growing. Our project positions us to tap into this burgeoning market segment.

Potential markets include residential, commercial, and industrial sectors, opening up diverse revenue streams.

### 1.3.3. Scalability:

Our system is designed with scalability in mind. It can easily be adapted for use in various contexts, such as apartment complexes, office buildings, and industrial facilities.

This scalability presents opportunities for expanding our business reach and diversifying our offerings.

### 1.3.4. Data-Driven Insights:

The system generates valuable data on electricity consumption patterns and user behavior.

We can leverage this data to offer data analytics and consulting services to utility companies, helping them optimize their energy distribution and demand forecasting.

### 1.3.5. Energy Efficiency Partnerships:

Collaborations with energy efficiency and sustainability organizations can be pursued to promote our system as a means to reduce carbon footprints and encourage environmentally responsible practices.

### 1.3.6. Subscription-Based Models:

We can explore subscription-based models to monetize the mobile application and cloud services, generating recurring revenue.

Different subscription tiers can offer varying levels of functionality and support.

### 1.3.7. Integration with Smart Grids:

As the transition to smart grids accelerates, our system can seamlessly integrate with these grids, creating opportunities for partnerships with utility companies.

This integration can enable demand response programs and peak-load management.

### 1.3.8. Potential for IoT Integration:

Our project lays the foundation for broader Internet of Things (IoT) integration in smart homes.

Expansion into IoT devices and services, such as security systems and environmental sensors, can enhance our product portfolio.

### 1.3.9. Competitive Advantage:

By offering a comprehensive and user-friendly solution, we can gain a competitive edge in the market.

Continuous innovation and staying ahead of technological trends will be key to maintaining this advantage.

### 1.3.10. Environmental Impact:

- Our project aligns with sustainability goals, appealing to environmentally conscious consumers and organizations.

- This alignment can be leveraged for marketing and partnerships with green initiatives.

The business scope of the Smart Electricity Bill Estimation and Home Automation System project extends well beyond individual households. It encompasses the potential for market growth, scalability, data-driven insights, partnerships, and a competitive edge in the rapidly expanding smart home and energy management industry. By embracing these opportunities, we aim to make a lasting impact on the way energy is consumed, managed, and optimized for a sustainable future.

## 1.4. Functional Requirements:

|  |  |  |  |
| --- | --- | --- | --- |
| **Sr.No** | **Functional Requirement** | **Type** | **Status** |
| 1 | User Registration and Authentication | core | pending |
| 2 | Appliance Control | optional | pending |
| 3 | Real-time Appliance Status | core | pending |
| 4 | Electricity Consumption Monitoring | core | pending |
| 5 | Cost Estimation | core | pending |
| 6 | Historical Data Tracking | optional | pending |
| 7 | Unit Price Configuration | core | pending |
| 8 | Data Synchronization | core | pending |
| 9 | Alerts and Notifications | core | pending |
| 10 | Automation Rules | core | pending |
| 11 | Appliance Management | optional | pending |
| 12 | Energy Efficiency Recommendations | optional | pending |
| 13 | User Profiles | optional | pending |
| 14 | Secure Communication | core | pending |
| 15 | Remote Access | core | Pending |

## 1.5. Comparison of Proposed system with Existing System:

Our proposed system and existing system.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sr.No.** | **Functional Requirement** | **Our System** | **System A**  **(Efergy)** | **System B**  **(Ecoisme)** | **System C**  **(Tesla Powerwall)** |
| 1 | User Registration and Authentication | Yes | Yes | Yes | Yes |
| 2 | Appliance Control | Yes | No | No | Yes |
| 3 | Real-time Appliance Status | Yes | Yes | Yes | Yes |
| 4 | Electricity Consumption Monitoring | Yes | Yes | Yes | Yes |
| 5 | Cost Estimation | Yes | Yes | Yes |  |
| 6 | Historical Data Tracking | Yes | Yes | Yes | Yes |
| 7 | Unit Price Configuration | Yes | Yes | No | No |
| 8 | Data Synchronization | Yes | Yes | Yes | Yes |
| 9 | Alerts and Notifications | Yes | Yes | Yes | Yes |
| 10 | Automation Rules | Yes | No | No | Yes |
| 11 | Appliance Management | Yes | No | No | Yes |
| 12 | Energy Efficiency Recommendations | Yes | No | No | No |
| 13 | User Profiles | Yes | No | No | No |
| 14 | Secure Communication | Yes | Yes | Yes | Yes |
| 15 | Remote Access | Yes | Yes | Yes | Yes |

## 1.6. Hardware:

* + Raspberry Pi (model, specifications)
  + Relays (number and type)
  + Sensors (if any)
  + Electrical connections and safety measures.

## 1.7. Software:

* + Programming language (e.g., Python for Raspberry Pi)
  + Libraries and frameworks
  + Firebase for cloud storage
  + Mobile application development platform (e.g., Android Studio or Flutter)