ABSTRACT

The **Power Consumption Calculator** is a web-based application developed to assist users in estimating the energy consumption and associated costs of household appliances. As energy costs rise and environmental concerns grow, the need for tools that promote energy efficiency has become increasingly important. This project provides a simple interface where users can input the power ratings of their appliances and the duration of usage to calculate total energy consumption in kilowatt-hours (kWh) and the corresponding costs.

The project was executed by a multidisciplinary team divided into three groups, each focusing on distinct components: frontend development, logic implementation, and documentation/deployment. Utilizing Git and GitHub for version control and project management, the team effectively collaborated to overcome challenges such as coordination, component integration, and testing.

Through rigorous testing and iterative documentation, the team delivered a user-friendly application deployed on GitHub Pages. This project not only educates users about their energy consumption patterns but also reinforces practical coding skills, collaboration, and the application of electrical engineering concepts. The **Power Consumption Calculator** stands as a testament to the power of teamwork and innovative problem-solving in software development.

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1. Introduction

In today's world, energy efficiency is more critical than ever. With rising electricity costs and increasing environmental concerns, individuals and households are seeking ways to understand and manage their energy consumption better. The **Power Consumption Calculator** project addresses this need by providing a simple yet effective web-based tool that allows users to estimate the energy consumption of various household appliances based on their power ratings and usage time.

The calculator enables users to input the power rating (in watts) of their appliances and the duration of usage (in hours). The tool then computes the total energy consumed in kilowatt-hours (kWh) and calculates the associated cost based on a predefined rate per kWh. This not only helps users become more aware of their energy usage habits but also encourages them to make informed decisions that can lead to cost savings and a reduced carbon footprint.

The project exemplifies effective collaboration among a multidisciplinary team, combining software development skills with knowledge of electrical engineering concepts. The team consisted of three distinct groups, each responsible for specific aspects of the project:

- **Team 1** focused on developing the frontend interface using HTML and CSS to create a user-friendly experience.

- **Team 2** implemented the core functionality of the application, writing the JavaScript code for energy calculations.

- **Team 3** was responsible for documenting the project and managing its deployment on GitHub Pages.

By utilizing Git and GitHub for version control, the team maintained organized workflows and streamlined collaboration, enabling them to overcome challenges

and efficiently complete the project. This report outlines the project's objectives, design, implementation details, and collaborative efforts, highlighting the value of teamwork in achieving a common goal.

2. Problem Statement

In an era marked by increasing energy costs and environmental awareness, individuals and households often lack the tools necessary to monitor and understand their energy consumption patterns. Many people are unaware of how much energy their electrical appliances consume, leading to inflated electricity bills and wasted resources.

To address this challenge, we propose the development of a **Power Consumption Calculator**, a web-based application that allows users to:

1. **Input Power Ratings**: Users can enter the power ratings (in watts) of various household appliances.

2. **Specify Usage Time**: Users can indicate how many hours they use these appliances on a daily or weekly basis.

3. **Calculate Energy Consumption**: The tool will calculate the total energy consumed in kilowatt-hours (kWh) based on the input values.

4. **Estimate Costs**: Additionally, the application will provide an estimate of the cost associated with the energy consumed, using a predefined rate per kWh.

By providing a straightforward interface for calculating energy consumption and associated costs, the Power Consumption Calculator aims to empower users with the knowledge necessary to make informed decisions about their energy usage. This tool will promote energy efficiency, help users manage their electricity expenses, and foster a greater understanding of how individual choices impact overall energy consumption.

3. Objective

The **Power Consumption Calculator** project aims to achieve the following objectives:

1. **User Empowerment**: Provide users with an easy-to-use web application that enables them to calculate the energy consumption of their household appliances, fostering greater awareness of energy usage.

2. **Cost Estimation**: Allow users to estimate the costs associated with their energy consumption, helping them identify potential savings and budget for electricity expenses more effectively.

3. **Educational Tool**: Serve as an educational resource that informs users about the relationship between power ratings, usage time, and energy costs, promoting energy conservation and efficiency.

4. **Collaborative Development**: Facilitate teamwork among students from diverse disciplines (software development and electrical engineering) to collaboratively design and implement a functional application, enhancing skills in project management, communication, and version control.

5. **Responsive Design**: Ensure that the web application is responsive and accessible on various devices, providing a seamless user experience regardless of the platform used.

6. **Documentation and Support**: Create comprehensive documentation, including a detailed README and contribution guide, to assist users and future contributors in understanding and improving the application.

7. **Deployment**: Successfully deploy the application using GitHub Pages, allowing users to access the tool easily and providing a practical demonstration of web deployment skills.

4. Project Overview

The **Power Consumption Calculator** is a web-based application designed to assist users in estimating the energy consumption and associated costs of various household appliances. This tool empowers users to make informed decisions about their energy usage, promoting energy efficiency and cost savings.

Key Features

- **Input Functionality**: Users can input the power rating of appliances (in watts) and specify the duration of usage (in hours) directly in the user interface.
- **Cost Estimation**: The tool also computes the estimated cost of the energy consumed based on a predefined rate per kWh (e.g., $0.12).
- **User-Friendly Interface**: The frontend is developed using HTML and CSS, ensuring a clean, intuitive interface that allows users to easily navigate and utilize the tool.
- **Responsive Design**: The application is designed to be responsive, providing a seamless experience on both desktop and mobile devices.

Technology Stack

- **Frontend**: HTML for structure, CSS for styling, and JavaScript for dynamic functionality.
- **Version Control**: Git and GitHub for collaborative development and version management.
- **Deployment**: The application is hosted on GitHub Pages, making it easily accessible to users without any setup.

Collaboration

The project was executed through collaborative efforts among three teams:

- **Team 1** focused on developing the frontend using HTML and CSS, ensuring that the application is visually appealing and user-friendly.
- **Team 2** was responsible for implementing the core JavaScript functionality that handles energy calculations and user interactions.
- **Team 3** took charge of documentation and deployment, creating guides for users and contributors, and deploying the application to GitHub Pages.

Educational Value

This project serves as a practical application of electrical engineering concepts, specifically energy consumption and cost calculations, while also providing valuable experience in software development practices, including version control, code reviews, and collaborative coding.

By fostering teamwork and communication among team members from different disciplines, the **Power Consumption Calculator** not only enhances technical skills but also encourages a collaborative spirit that is essential in modern software development.

5. Roles and Contributions

The development of the Power Consumption Calculator was a collaborative effort involving three distinct teams, each contributing specific skills and expertise to ensure the project's success. Below is a breakdown of each team's roles and contributions:

Team 1: Frontend Development

HTML Structure: Designed and implemented the basic structure of the web application using HTML. This included creating input forms for power ratings and usage time, as well as sections for displaying results. CSS Styling: Developed the visual layout and styling of the application using CSS to ensure a user-friendly and visually appealing interface. This included responsive design elements to accommodate various screen sizes. User Experience: Focused on creating an intuitive user experience, making it easy for users to input their data and understand the results.

Key Contributions:

Creation of index.html for the main application layout.

Development of style.css for styling the application, ensuring aesthetic appeal and usability.

Team 2: Logic Implementation

JavaScript Logic: Developed the core functionality of the application by writing JavaScript code to handle user inputs, perform calculations, and update the user interface with results.

Energy Calculations: Implemented the formulas to calculate energy consumption (in kWh) and associated costs, ensuring accurate results based on user inputs.

Testing: Created unit tests to validate the logic and ensure the accuracy of calculations, identifying and fixing bugs before deployment.

Key Contributions:

Implementation of the script.js file, which contains all the JavaScript code for handling calculations and user interactions. Development of test cases to ensure the reliability of the application's logic.

Team 3: Documentation and Deployment

Project Documentation: Created comprehensive documentation, including the README file, contribution guidelines, and user instructions, to facilitate understanding and usage of the application. Deployment: Managed the deployment process by setting up the application on GitHub Pages, making it publicly accessible.

Collaboration Tools: Utilized GitHub Projects and Issues to track progress, assign tasks, and facilitate communication among team members.

Key Contributions:

Writing and updating the README.md file to provide clear project descriptions, usage instructions, and contribution guidelines. Successfully deploying the application on GitHub Pages and ensuring all links and resources were functional.

6. Git and GitHub Usage

The **Power Consumption Calculator** project utilized Git and GitHub extensively to facilitate collaborative development, version control, and project management. The following outlines the specific practices and features employed by the team:

1. Version Control with Git

- **Repository Initialization**: The project began by creating a new GitHub repository, which served as the central hub for all project files and documentation. An initial README.md was included to provide a project overview.
- **Branching Strategy**: To manage feature development and avoid conflicts, each team member created separate branches for their tasks. This approach allowed for parallel development without interfering with the main codebase. For example:
    - frontend-development for Team 1
    - logic-implementation for Team 2
    - documentation-and-deployment for Team 3

2. Pull Requests and Code Reviews

- **Pull Requests (PRs)**: Once a team member completed their work on a branch, they submitted a pull request to merge changes into the main branch. This process facilitated code reviews and discussions about the proposed changes.
- **Code Review Process**: Other team members reviewed the PRs, providing feedback and suggesting improvements. This collaborative review process enhanced code quality and ensured that multiple perspectives were considered before integrating new features.

3. Issue Tracking

- **Task Management**: GitHub Issues were used to track tasks, bugs, and feature requests throughout the project. Each team created specific issues to outline their work, making it easier to assign responsibilities and monitor progress.

- **Labels and Milestones**: Issues were labeled based on their status (e.g., "In Progress," "Completed") and grouped into milestones to track project phases and deadlines.

4. Documentation

- **Comprehensive README**: The README.md file provided an overview of the project, setup instructions, usage details, and contribution guidelines. This document served as the primary reference for both users and future contributors.

- **Contribution Guidelines**: Clear instructions were provided on how to contribute to the project, including coding standards, branching strategies, and the process for submitting pull requests.

5. Deployment via GitHub Pages

- **Hosting the Application**: The project was deployed using GitHub Pages, allowing easy access to the web application. The deployment process involved configuring the repository settings to enable GitHub Pages and specifying the branch to serve the application from.

- **Continuous Updates**: As new features were developed and improvements made, the application was continuously updated through GitHub, showcasing the dynamic nature of collaborative projects.

7. Conclusion

The Power Consumption Calculator project provided valuable experience in collaborative software development using Git/GitHub. Each team contributed effectively to create a functional web app that demonstrates the principles of energy consumption calculations while leveraging version control, branching, and continuous integration practices.

The successful deployment of the project via GitHub Pages shows how development workflows and web technologies can come together to solve real-world problems, all while maintaining clear documentation and structured project management.