**Progress Report**

CS640 – Computer Science Project

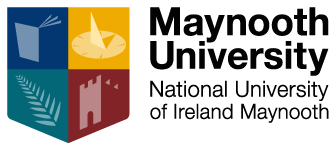
PACE: A Website for tracking and contributing to sustainable development goals.

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# Project Overview Objective:

The Personal Accounting Climate Economics (P.A.C.E.) System is a web-based platform designed to promote sustainability through user engagement, donations, volunteering, and analytics tracking. The project aims to provide individuals and corporations with tools to monitor their sustainability impact, contribute to environmental initiatives, and track their progress through data-driven insights.

The importance of this project lies in addressing the lack of accessible platforms for sustainability contributions. Many individuals and organizations want to contribute to sustainability efforts but lack a structured way to track and visualize their impact. The P.A.C.E. System solves this problem by offering a transparent and interactive platform where users can:

* Donate to sustainability projects securely.
* Participate in volunteering initiatives.
* Track their progress via dashboards and leaderboards.
* Encourage corporate accountability in sustainability efforts.

By combining sustainability metrics, the platform aims to increase user participation while ensuring data transparency and security.

# Scope:

The P.A.C.E. System is designed for both individuals and corporate entities looking to engage in sustainability practices. The core functionalities include:

1. User-side Features
   * Secure sign-up and login system.
   * Donation portal with Stripe integration.
   * Volunteering event registrations.
   * Interactive user dashboard displaying sustainability contributions.
   * Leaderboards comparing user participation and achievements.
2. Corporate-side Features (Upcoming)
   * Sustainability KPI tracking for organizations.
   * Corporate dashboard with analytics.
   * Performance comparison tools for organizations.

The system ensures that all sustainability-related interactions are stored in a database and retrieved dynamically for user analytics. The final outcome is a fully functional, scalable, and sustainability platform.

# Key Literature Considered:

The key research areas considered for this project include:

* **Sustainable Development Goals (SDGs):** Guidelines from the United Nations on sustainability practices.
* **Service Design & User Experience (UX):** Ensuring an intuitive and engaging user journey to encourage active participation.
* **Red Routes Analysis:** Identifying critical user actions that define the core functionality of the platform.
* **SCRUM Process:** Adopting an iterative and agile approach for efficient project management and feature implementation.

Additionally, I analyzed similar platforms such as GoFundMe and other sustainability-focused websites to understand:

* Best practices in donation management.
* How to increase engagement through leaderboards and Dashboards.
* Data security and transparency mechanisms in donation-based platforms.

Multiple research papers on sustainable web design, carbon-efficient development, and donation- based models were reviewed to ensure that the project follows industry best practices.

# Technologies Used:

The P.A.C.E. System utilizes a modern web technology stack for performance, scalability, and low-energy consumption. The selected technologies are:

* Frontend:
  + **React.js**: Chosen for its fast rendering, reusability, and component-based architecture.
  + **JavaScript & CSS:** For interactive and responsive UI development.
  + **Low-energy design principles:** Ensuring optimized code structure to reduce energy consumption.
* Backend:
  + **Express.js**: Lightweight and efficient Node.js framework for handling API requests.
  + **PostgreSQL:** Relational database for storing user activities, donations, and sustainability metrics.
* Payment Integration:
  + **Stripe API:** Enables secure donation processing with real-time transaction tracking.
* Hosting & Deployment:
  + **Cloud-based low-energy hosting** (to be determined) to ensure minimal carbon footprint.

This technology stack was chosen because it provides:

---High performance and scalability.

---Efficient data handling with PostgreSQL.

---Secure payment processing through Stripe.

---Optimized energy usage for sustainability.

The next step is to complete the corporate-side functionalities, further optimize performance, and conduct real-world testing before final deployment.

# Methodology

* 1. **​Primary Methodology: SCRUM Framework:**

The development of the P.A.C.E. System follows the SCRUM methodology, an iterative and agile approach to software development. This method was chosen to ensure continuous feedback, adaptability to changes, and faster delivery of functional components.

Each SCRUM cycle (Sprint) consists of the following phases:

* + 1. Sprint Planning:
       - Identify key features for the sprint.
       - Prioritize tasks based on project needs.
       - Define the scope and deliverables for the sprint.
    2. Development Phase:
       - Implement features based on priority.
       - Conduct unit testing for each component.
       - Ensure integration with backend and database systems.
    3. Sprint Review & Feedback:
       - Conduct testing and gather feedback.
       - Identify areas for improvement.
       - Document challenges and solutions.
    4. Sprint Retrospective:
       - Analyze what went well and what can be improved.
       - Optimize development strategies for the next sprint.

# ​Defining User Personas:

User personas were created based on a survey conducted with potential users. With the help of my supervisor, a focus group study was organized to gather insights on user expectations and behaviors.

Key Findings:

* Users prefer an easy-to-use sustainability platform that requires minimal effort.
* Gamification elements (leaderboards, Dashboards) increase engagement.
* Many users are hesitant about donations, so transparency in transactions is crucial.
* Volunteering opportunities need to be well-advertised to increase participation.

User Personas Developed:

* + 1. Student User Persona (Primary Audience)
       - Wants to track sustainability impact easily.
       - Prefers a simple and engaging interface.
       - More likely to participate if incentives (badges, recognition) are available.
    2. Corporate User Persona (Secondary Audience)
       - Needs detailed sustainability tracking and analytics.
       - Prefers goal-setting features to track performance.
       - Interested in how sustainability efforts align with business values.

The feedback from this study shaped the website design and features, ensuring alignment with real-world user needs.

# ​Red Routes Analysis:

A Red Route Analysis was conducted to identify critical user actions that define the platform’s core functionality. This analysis helped prioritize features that directly impact user engagement and sustainability efforts.

Key Red Routes Identified:

---User Dashboard Access: Viewing analytics and personal contributions.

---Donations: Securely processing transactions through Stripe API.

---Volunteering Sign-Up: Registering for environmental initiatives.

---Corporate Performance Tracking: Monitoring sustainability KPIs.

---Leaderboard Comparison: Encouraging competition and engagement.

# ​Layout Diagrams & Prototyping:

To ensure a clear development workflow, I created low-fidelity and high-fidelity wireframes before coding.

Low-Fidelity Wireframes (Sketches and Mockups)

* Designed basic layouts for all web pages before implementation.
* Helped in visualizing user flow and interactions.
* Provided early feedback and refinements before coding.

High-Fidelity Wireframes (Refined UI/UX Designs)

* Created using modern design tools for a polished look.
* Incorporated color schemes, branding, and UI elements.
* Ensured responsive design for mobile and desktop users.

These wireframes played a crucial role in development, allowing me to code efficiently while maintaining consistency across pages.

# ​Building the Solution:

With all planning stages completed, the development process began using:

* React.js for front-end development.
* Express.js with PostgreSQL for back-end API and database.
* Stripe integration for secure transactions.
* Dashboard implementation for real-time analytics.

The SCRUM methodology ensured that each feature was implemented, tested, and refined iteratively, leading to a functional and user-friendly sustainability platform.

Next Steps:

* Complete corporate-side development.
* Optimize UI/UX for a seamless experience.
* Conduct final testing and performance improvements.

# Detailed Progress and Challenges

* 1. **​Completed Milestones (To Date):**

The P.A.C.E. System has undergone several key development phases, with various milestones successfully achieved. Below are the completed milestones, along with a brief description of what was accomplished:

**Milestone 1:** User Authentication & Database Setup

Features Implemented:

* Developed sign-up and login system using React.js and Express.js.
* Integrated PostgreSQL database for storing user credentials.
* Ensured secure authentication using encryption techniques.

---Testing & Debugging:

* Validated database queries for efficiency.
* Conducted unit testing to verify authentication flow.

**Milestone 2:** User Dashboard & Analytics

---Features Implemented:

* Built dynamic user dashboard that tracks sustainability activities.
* Designed leaderboard system to compare user performance.
* Implemented real-time data retrieval from PostgreSQL.

---Testing & Debugging:

* Optimized database queries for faster data retrieval.
* Conducted performance testing to ensure smooth UI updates.

**Milestone 3:** Stripe Payment Integration for Donations

---Features Implemented:

* Integrated Stripe API for secure online donations.
* Enabled real-time transaction tracking to store payment details.

---Testing & Debugging:

* Conducted sandbox transactions to verify payment flow.
* Implemented error handling for failed transactions.

**Milestone 4:** Volunteering & Community Engagement Features

---Features Implemented:

* Developed volunteer registration system for sustainability events.
* Stored user participation records in the database.

---Testing & Debugging:

* Ensured registration process runs smoothly across devices.
* Verified data consistency in user profiles.

**Milestone 5:** Website Optimization & UI Improvements

---Features Implemented:

* Optimized React components for faster rendering.
* Applied CSS refinements for a better user experience.
* Ensured mobile responsiveness across different screen sizes.

---Testing & Debugging:

* Conducted cross-browser testing.
* Resolved UI bugs affecting responsiveness.

**Next Steps:** Begin corporate-side development and implement sustainability KPIs.

# ​Timeline Status:

---Current Status:

The project is on track with the original timeline for the user-side functionalities, with a fully functional platform available for users. However, the corporate-side features have not yet been developed.

---Expected Adjustments:

* User-side optimizations will be completed within 2 weeks.
* Corporate portal development will start immediately after and is expected to take 4 weeks.
* Final testing, KPI integration, and bug fixes will be conducted before the final project deadline.

Goal: Deliver a fully functional, scalable, and optimized web platform within the planned timeline.

# ​Challenges Encountered:

**Problem 1:** Lack of Backend Development Experience

Issue:

* Developing secure API endpoints, managing database queries, and handling server-side logic were new challenges.

Solution & Action Taken:

* Referred to documentation for Express.js and PostgreSQL best practices.
* Implemented incremental testing to ensure backend logic worked correctly.

Outcome: Successfully developed backend services, allowing seamless user authentication, data storage, and API integration.

**Problem 2:** Implementing Dynamic Data Visualization in Dashboard

Issue:

* Creating real-time, interactive dashboards to track user progress and donations was difficult.
* Needed to fetch and update sustainability KPIs dynamically.

Solution & Action Taken:

* Researched React.js charting libraries (e.g., Chart.js, Recharts).
* Optimized data fetching using asynchronous API requests.
* Used state management techniques (React Context API) for real-time updates.

Outcome: Successfully implemented a user-friendly dashboard that displays real-time progress, leaderboards, and contributions.

**Problem 3:** Stripe Payment Integration for Secure Donations

Issue:

* Ensuring secure online transactions using Stripe API.
* Handling transaction errors and failed payments.

Solution & Action Taken:

* Followed Stripe API documentation for best integration practices.
* Implemented error-handling mechanisms for payment failures.
* Conducted sandbox testing before going live.

Outcome: Users can now donate securely through the platform, and payments are processed in real-time.

**Problem 4:** Balancing Project Development with Master's Studies

Issue:

* Managing coursework, assignments, and project development simultaneously was challenging.
* Required effective time management to meet deadlines.

Solution & Action Taken:

* Created a weekly work plan to allocate dedicated time slots for development.
* Prioritized high-impact tasks first (e.g., database setup, API integration).
* Took breaks to avoid burnout and maintain consistent progress.

Outcome: The project remains on track, and progress is being made without compromising academic responsibilities.

# Summary of Progress & Challenges

* User-side functionalities are fully operational (Dashboard, Donations, Volunteering, Analytics).

**Next Focus:** Develop the corporate portal, integrate sustainability KPIs, and perform final optimizations.

With continuous progress and structured development, the P.A.C.E. System remains on track for successful completion.

# Future Work / Next Steps

This section outlines the remaining tasks, upcoming integrations, and estimated completion dates for the P.A.C.E. System. The focus will now shift towards optimizing existing features, developing the corporate-side functionalities, and ensuring final testing before deployment.

# Next Steps for the Coming Weeks

The development plan follows an agile backlog structure, prioritizing tasks based on importance and feasibility.

---Feature Development & Enhancements

**Task 1:** Complete the Organizational Portal (High Priority – 4 Weeks)

* Implement corporate sign-up and authentication system.
* Develop corporate dashboards with sustainability KPIs.
* Allow companies to set sustainability goals and track progress.

**Task 2:** KPI Integration & Sustainability Metrics (High Priority – 3 Weeks)

* Define corporate sustainability KPIs based on real-world business standards.
* Integrate KPI tracking into corporate dashboards.
* Store and visualize data on company contributions.

**Task 3:** Optimize User-Side Code & UI Improvements (Medium Priority – 2 Weeks)

* Refactor existing React.js components for improved performance.
* Optimize database queries to reduce response times.
* Apply final UI/UX adjustments, including CSS touch-ups for a polished look.

**Task 4:** Implement Notification System (Medium Priority – 2 Weeks)

* Develop email notifications for donation confirmations and volunteer sign-ups.
* Enable dashboard alerts for user milestones.

**Task 5:** Develop Sustainability Scoring System (Low Priority – 3 Weeks)

* Create a scoring model for users based on donations, volunteering, and engagement.
* Display scores on leaderboards and user profiles.

**Task 6:** Deploy Website to a Live Server (Final Stage – 2 Weeks)

* Select an energy-efficient hosting provider.
* Perform server-side optimizations for sustainability.
* Ensure secure deployment with SSL encryption and database backups.

# Upcoming Testing & Integrations

**Phase 1:** Corporate Dashboard Testing (In 3 Weeks)

* Test corporate account creation & login workflows.
* Validate corporate data storage and retrieval.

**Phase 2:** KPI & Analytics Testing (In 4 Weeks)

* Conduct data validation checks to ensure accurate sustainability reporting.
* Compare expected vs. actual KPI calculations.

**Phase 3:** Security & Performance Testing (Final Month)

* Conduct penetration testing to identify security vulnerabilities.
* Perform load testing to ensure website scalability.
* Optimize API calls and database queries for maximum efficiency.

**Phase 4:** Beta Testing & User Feedback (Before Final Submission)

* Release a test version of the website for a select group of users.
* Gather feedback on usability, performance, and engagement.
* Apply necessary improvements based on user input.

# Estimated Completion Dates

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Milestone** | **Task Description** | **Expected Completion** |  |
|  | User-Side Final Optimizations | Improve UI, fix minor bugs, and refine dashboard. | Within 2 weeks |  |
|  | Organizational Portal Development | Build corporate accounts, dashboards, and KPI tracking. | 4 weeks |  |
|  | KPI Integration | Implement sustainability performance metrics. | 3 weeks |  |
|  | Notification System | Add email & dashboard alerts. | 2 weeks |  |
|  | Sustainability Scoring System | Develop user sustainability ranking. | 3 weeks |  |
|  | Deployment & Hosting | Deploy final version on live server. | Final 2 weeks |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Security & Performance Testing | Load testing, security checks, and optimizations. | Final Month |  |
|  | Beta Testing & Feedback Implementation | Collect user feedback and make final adjustments. | Before Project Deadline |  |

## Summary of Next Steps

---The next major development focus is on corporate-side functionalities and KPI integration.

---Final testing and optimizations will ensure a polished, scalable, and sustainable platform.

---Deployment will be completed in the final phase, followed by user testing and feedback collection.

**Final Goal:** Deliver a fully functional, energy-efficient sustainability platform before the project deadline.

# Conclusion

The P.A.C.E. System has made significant progress, with core user-side functionalities fully developed and operational. The platform currently supports secure authentication, donation processing, user dashboards, volunteering event registrations, and real-time analytics tracking. The Stripe payment gateway integration ensures secure financial transactions, while the dashboard feature allows users to track their contributions toward sustainability goals.

Despite challenges such as learning backend development from scratch, implementing a real- time data visualization system, and managing project development alongside master's coursework, these obstacles were successfully overcome through self-learning, structured problem-solving, and iterative improvements.

At this stage, the platform is fully functional for individual users, but work remains on developing the corporate portal. The next phase will focus on:

---Building corporate dashboards with KPI tracking.

---Refining the UI/UX for better engagement.

---Enhancing database performance and sustainability scoring metrics.

---Final security and performance testing before deployment.

With the SCRUM development approach, the project remains on track for completion within the planned timeline. The final goal is to deliver a fully functional, scalable, and user-friendly sustainability platform that not only engages users but also contributes meaningfully to global sustainability efforts.