User Stories

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User Stories and Requirements

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User Stories: Self-Charging Electric Vehicle (SCEV)

Project Overview

This project aims to develop a Self-Charging Electric Vehicle (SCEV) that significantly reduces reliance on traditional charging infrastructure by harvesting ambient energy. The vehicle will integrate advanced solar, kinetic, and thermal energy recovery systems, managed by an AI-powered Energy Management Unit (EMU). This addresses range anxiety, charging infrastructure gaps, grid strain, and the cost and inconvenience associated with current EV charging methods.

Epic: Energy Harvesting & Management

Theme: Successfully harvesting and managing energy from various sources.

- **US001:** As a driver, I want the vehicle to automatically harvest solar energy from sunlight while driving or parked so that I extend my vehicle's range.
    - **Acceptance Criteria:**
        - Given sufficient sunlight, When the vehicle is parked or driving, Then the solar panels generate a measurable amount of electricity that charges the battery.
        - Given varying light conditions (cloudy, sunny), When the vehicle is parked or driving, Then the system adapts and optimizes energy harvesting accordingly.
- **US002:** As a driver, I want the vehicle to capture kinetic energy from the suspension system during driving so that I increase the vehicle’s range.
    - **Acceptance Criteria:**
        - Given uneven road surfaces, When the vehicle is in motion, Then the regenerative suspension system captures kinetic energy and converts it into electricity.
        - Given different driving conditions (city driving, highway driving), When the vehicle is in motion, Then the system accurately measures and converts the kinetic energy generated.
- **US003:** As a driver, I want the vehicle to convert waste heat from the engine and battery into electricity so that I maximize energy efficiency.
    - **Acceptance Criteria:**
        - Given the vehicle is operating, When heat is generated by the engine and battery, Then the thermoelectric generators (TEGs) convert this heat into electricity.
        - Given varying operating temperatures, When the vehicle is in operation, Then the TEGs maintain efficient energy conversion across a range of temperatures.

- **US004:** As a driver, I want the EMU to intelligently manage the energy flow between energy harvesting systems and the battery, prioritizing immediate needs and optimizing battery charging.
    - **Acceptance Criteria:**
        - Given varying energy generation levels from different sources, When the vehicle is in operation, Then the EMU dynamically allocates energy to either the motor or the battery based on real-time needs and predictions.
        - Given different driving scenarios (e.g., uphill, downhill), When the vehicle is in operation, Then the EMU optimizes energy usage and charging to maximize range.
- **US005:** As a driver, I want a real-time dashboard display showing energy generation from each source (solar, kinetic, thermal) so that I understand the self-charging process.
    - **Acceptance Criteria:**
        - Given the vehicle is operating, Then the dashboard displays real-time data on energy generation from solar panels, regenerative suspension, and TEGs.
        - Given a change in energy generation from any source, Then the dashboard updates the display in real time.

Epic: System Integration & Testing

Theme: Successfully integrating the various components and testing the system's performance.

- **US006:** As an engineer, I want a simulation model of the SCEV to predict energy generation under various real-world driving conditions so that I can optimize the design.
    - **Acceptance Criteria:**
        - Given a defined set of environmental and driving parameters, When the simulation model is run, Then it accurately predicts the energy generated from each source.
        - Given different geographic locations and weather conditions, When the simulation model is run, Then it

accurately predicts the energy generated from each source.

- **US007:** As an engineer, I want to build and test functional prototypes of the solar panels, regenerative suspension system, and TEGs individually so that I can validate their performance.
    - **Acceptance Criteria:**
        - Given a prototype component, When tested under specified conditions, Then it meets pre-defined performance benchmarks.
        - Given failure in any prototype component, Then the system provides clear diagnostic information.
- **US008:** As an engineer, I want to integrate the prototype hardware into a test vehicle to collect real-world performance data so that I can refine the system design.
    - **Acceptance Criteria:**
        - Given the prototype hardware is integrated into the test vehicle, When the vehicle is driven under various conditions, Then the system collects accurate data on energy generation and usage.
        - Given collected data, Then the data is analyzed to identify areas for improvement.
- **US009:** As an engineer, I want to develop and test the EMU v1.0, focusing on data acquisition and logging so that I can lay the groundwork for future control logic.
    - **Acceptance Criteria:**
        - Given sensors are connected to the EMU, When the vehicle is operating, Then the EMU accurately collects and logs data from all sensors.
        - Given logged data, Then the data is properly formatted and stored for analysis.

Epic: User Experience & Safety

Theme: Ensuring a positive and safe user experience.

- **US010:** As a driver, I want clear and concise information about the self-charging system's status and performance so that I can confidently operate the vehicle.
- **US011:** As a driver, I want the vehicle to provide warnings and alerts in case of system malfunctions or low energy levels so that I can take appropriate action.
- **US012:** As a driver, I want the self-charging system to be safe and reliable, meeting all relevant safety standards so that I can trust the vehicle's operation.

This user story document provides a foundation for the SCEV project. Further refinement and detailing of user stories will be necessary as the project progresses. Each user story will be assigned a priority and acceptance criteria will be expanded upon during sprint planning.
