Collect Requirements

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Collect Requirements Process

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Collect Requirements Process: Self-Charging Electric Vehicle (SCEV)

1. Introduction

This document outlines the requirements collection process for the Self-Charging Electric Vehicle (SCEV) project. The process emphasizes a collaborative, iterative approach to ensure all stakeholder needs are captured and addressed effectively. The unique nature of this project, integrating multiple novel energy harvesting technologies, necessitates a robust and detailed requirements gathering methodology.

2. Project Goals and Objectives

The primary goal of the SCEV project is to develop a commercially viable electric vehicle that significantly reduces reliance on traditional charging infrastructure by harvesting ambient energy. This will be achieved through the integration of advanced photovoltaic, kinetic, and thermoelectric energy recovery systems, managed by an AI-powered Energy Management Unit (EMU). Specific objectives include:

- Reduce range anxiety by continuously charging the vehicle's battery.
- Increase EV accessibility in areas with limited charging infrastructure.
- Reduce strain on the electrical grid.
- Lower the overall cost and inconvenience associated with EV charging.

3. Stakeholders and Their Involvement

Identifying and engaging key stakeholders is crucial. This includes:

- **Engineering Team:** Responsible for the design, development, and testing of the various energy harvesting systems and the EMU.
- **Marketing & Sales Team:** Provides insights into customer needs and preferences, market trends, and competitive analysis.
- **Manufacturing Team:** Provides input on manufacturing feasibility, cost, and scalability.
- **Legal & Regulatory Team:** Ensures compliance with relevant safety and environmental regulations.
- **Potential Customers:** Their feedback will be vital through surveys, focus groups, and early adopter programs.

Stakeholder involvement will be facilitated through:

- Regular meetings and workshops.
- Surveys and questionnaires.
- Prototyping and user testing.
- Document reviews and feedback sessions.

4. Requirements Elicitation Techniques

The following techniques will be employed to elicit requirements:

- **Interviews:** Structured and unstructured interviews with stakeholders to gather detailed information.
- **Brainstorming Sessions:** Collaborative sessions to generate ideas and identify potential requirements.
- **Surveys and Questionnaires:** Used to gather quantitative and qualitative data from a wider range of stakeholders, including potential customers.
- **Document Analysis:** Reviewing existing documentation (e.g., competitor analyses, market research reports) to identify relevant information.
- **Prototyping and User Feedback:** Developing prototypes of key components and features to gather user feedback and validate requirements.
- **Use Cases:** Developing detailed scenarios illustrating how users will interact with the vehicle and its features.

5. Requirements Documentation

Requirements will be documented using a combination of techniques, including:

- **User Stories:** Short, simple descriptions of a feature told from the perspective of the person who desires the new capability, e.g., "As a driver, I want the dashboard to display real-time energy generation from each source so I can understand how the self-charging system is performing."
- **Use Case Diagrams:** Visual representations of user interactions with the system.
- **System Requirements Specification (SRS):** A comprehensive document detailing all functional and non-functional requirements. This will include detailed specifications for each energy harvesting system (photovoltaic, kinetic, thermoelectric), the EMU, and the overall vehicle integration.
- **Data Flow Diagrams:** Illustrating the flow of data within the system.

6. Requirements Validation and Verification

The collected requirements will be validated and verified through:

- **Requirements Reviews:** Formal reviews by stakeholders to ensure accuracy, completeness, and consistency.
- **Prototyping and Testing:** Building and testing prototypes to validate the feasibility and functionality of the requirements.
- **Simulation:** Using digital twins to simulate the performance of the system under various conditions.

7. Requirements Traceability

A traceability matrix will be maintained to track the relationship between requirements, design, implementation, and testing. This ensures that all requirements are addressed and that changes to requirements are properly managed.

8. Iteration and Refinement

The requirements gathering process will be iterative, with regular reviews and adjustments based on feedback and new information. This ensures that the final product meets the evolving needs of the stakeholders.

9. Specific Requirement Areas:

This section will be populated iteratively as requirements are gathered. Initial areas of focus include:

- **Performance Requirements:** Target energy generation levels from each source under various conditions (sunlight, road surface, temperature). Target range extension provided by the self-charging system. Battery life and charging efficiency.
- **Safety Requirements:** Compliance with all relevant safety standards for electric vehicles and energy harvesting systems. Fail-safe mechanisms for energy harvesting and energy management.
- **Environmental Requirements:** Compliance with environmental regulations regarding emissions and material usage.
- **Manufacturing Requirements:** Cost-effective and scalable manufacturing processes for all components. Material selection and durability.

- **User Interface Requirements:** Intuitive and informative dashboard displays showing energy generation and usage. User controls for system settings.

This document serves as a living document, updated and refined throughout the requirements gathering process. Regular communication and collaboration among stakeholders are essential for its success.
