Day 1 – Design Thinking & Product Failure Analysis

1. Introduction

The first day of the workshop was devoted to the exploration of Design Thinking principles and the technical analysis of product failure mechanisms in Electric Vehicles (EVs). Emphasis was placed on human-centered innovation and predictive reliability assessment of electric scooters.

The sessions were divided into two components:

- A theoretical and practical session on Design Thinking was delivered, where the design process was taught through a structured user-centered approach.
- A technical analysis session was conducted, during which the failure points of EVs—particularly electric scooters such as the OLA S1—were identified and studied.

---

2. Task 1: Design Thinking Session

Session Overview:

A comprehensive introduction to Design Thinking was provided, where the participants were guided through the phases of empathizing, defining, ideating, prototyping, and testing. A focus was placed on understanding the emotional and functional needs of users, which are considered essential for product development in the EV industry.

The methodology was explained as a non-linear, iterative process that emphasizes innovation based on real user experiences and challenges.

Phases of Design Thinking That Were Covered:

1. **Scope:**

   The main goal is to understand the boundary of the problem, what problem space to address, who the stakeholders are, and how success will be measured. This ensures the design effort is focused, relevant, and aligned with real-world needs.

2. **Empathize:**
   The user's needs were studied through interviews, observations, and the development of user journey maps. Real-life issues faced by EV users were brought into focus.

3. **Define:**
   The data that had been collected was synthesized to formulate problem statements that were framed in a user-centric manner. These statements were structured to guide ideation in the next step.

4. **Ideate:**
   Brainstorming sessions were conducted to generate a wide range of possible solutions. These were later filtered based on their feasibility, cost-effectiveness, and scalability.

5. **Prototype:**
   It was emphasized that simple, low-fidelity prototypes should be developed rapidly to validate design assumptions before large-scale deployment.
6. **Test:**
   The importance of user feedback loops was explained, with testing being viewed as a critical tool for refining and improving solutions iteratively.

Key Takeaways:

- A strong emphasis was placed on starting innovation from the user's perspective.
- It was demonstrated that correctly identifying the problem is a prerequisite for an effective solution.
- Cost-effective and scalable solutions were encouraged.
- Cross-disciplinary collaboration was promoted as a means to tackle complex design challenges.

---

3. Task 2: Product Failure Estimation – EV Scooter

Session Objective:

A focused analysis of electric two-wheeler failure points was conducted. Various critical components were reviewed, and common causes of degradation and malfunction were discussed. The purpose was to lay the foundation for a predictive maintenance system using real-time sensor data and machine learning.

Approach and Methodology:

3.1. Failure Points That Were Identified:

Key components that are susceptible to failure in EV scooters were identified. These included:

- **Battery Pack:** Issues related to overcharging, temperature rise, and aging were discussed.
- **Electric Motor:** Problems such as overheating and wear and tear were outlined.
- **Controller/Inverter:** Failures in signal processing and power delivery were studied.
- **Brake System:** Delays in brake response and mechanical wear were observed as potential hazards.
- **Chassis and Suspension:** Fatigue-induced failures were pointed out.
- **State of Charge (SoC) Sensors:** Inaccuracy and signal drift were highlighted as concerns.

3.2. Dataset Structuring and ML Integration:

To support the development of a machine learning model, a dataset structure was proposed. Sensor-based input features were to be collected over time, and failure outcomes were to be labeled for supervised learning.

- **Features:** Real-time readings from motor, battery, brake, and sensor systems
- **Labels:** Failure categories or probability scores
- **Format:** Time-series with contextual annotations

4. Outcomes and Reflections

Several important insights were gained through the sessions:

Design Thinking Outcomes:

- Empathy-driven innovation was embraced as a core principle.
- A clear understanding of iterative prototyping and solution refinement was obtained.
- The value of cross-functional teamwork was demonstrated through design challenges.

Failure Analysis Outcomes:

- Major EV components were mapped and categorized based on their failure risk.
- The need for real-time telemetry and sensor fusion was emphasized.
- The concept of predictive maintenance was reinforced through practical examples.
- A roadmap for dataset generation and ML integration was outlined for future work.

---

5. Conclusion

Day 1 was characterized by a deep exploration of both creative innovation strategies and technical failure modeling. The importance of considering user behavior, mechanical limitations, and digital analytics simultaneously was highlighted. By combining Design Thinking with Predictive Analysis, a holistic foundation was established for developing safer, smarter, and more reliable EV solutions.