Problem Definition & Design Thinking

Title: Autonomous Vehicles and Robotics

Problem Statement:

Urbanization and industrial growth have intensified challenges in both transportation and manufacturing. In urban transportation, traffic congestion, pollution, and road accidents due to human error are major concerns. Simultaneously, industries struggle with labor shortages, inefficiency, and safety risks in repetitive tasks.

The challenge lies in developing autonomous vehicles (AVs) to improve urban mobility and robotics solutions to automate industrial processes—ensuring safety, efficiency, and adaptability without replacing the human workforce.

Target Audience:

- Urban commuters and traffic planners
- Elderly and mobility-challenged individuals
- Industrial engineers and factory workers
- Small and medium-scale manufacturers

Objectives:

- Design safe, efficient AVs that can navigate urban environments.
- Develop robotic systems to handle repetitive or hazardous tasks in manufacturing.
- Enhance human-machine collaboration.

- Reduce traffic-related accidents and increase industrial productivity.

Design Thinking Approach:

Empathize:

In urban settings, commuters demand convenience and safety while facing skepticism about AV reliability. In industries, workers fear job displacement but seek support with laborious or dangerous tasks.

Key User Concerns:

- Trust in AV decision-making in unpredictable scenarios.
- Cybersecurity and data privacy.
- Workplace safety and robot-human interaction.
- Ease of use and adaptability in industrial robotics.

Define:

For AVs: A self-navigating vehicle system equipped with AI, sensors, and real-time data processing to handle city traffic and emergencies.

For Robotics: A robotic solution capable of repetitive tasks with precision, safety features, and easy reprogramming for new workflows.

Key Features Required:

Autonomous Vehicles:

- AI-driven object detection and avoidance.
- V2X communication and predictive routing.

- Manual override and emergency protocols.

Robotics:

- Computer vision and motion control.
- User-friendly programming interface.
- Safety sensors for human interaction.

Ideate:

- Autonomous Vehicles:
- Smart ride-hailing systems using AVs.
- Integration with city traffic systems.
- Accessibility enhancements for elderly users.

Robotics:

- Cobots (collaborative robots) with task-sharing features.
- Mobile robots for warehouse logistics.
- Modular robotic arms with vision-guided capabilities.

Brainstorming Results:

- Voice-controlled AVs for personalized transport.
- AI-powered robotic arms that learn from demonstration.
- Real-time performance dashboards for monitoring.

Prototype:

- Autonomous Vehicle Prototype:
- Simulated AV navigating through an urban environment with dynamic obstacles.
- Interfaces for passenger interaction and manual control.

Robotic System Prototype:

- Robotic arm with vision system sorting objects.
- Drag-and-drop programming interface.
- Built-in safety detection.

Test:

AV Testing:

- Closed-course trials simulating urban driving.
- Feedback from users on safety and usability.

Robotics Testing:

- Factory-floor deployment for real tasks.
- Evaluation of task efficiency, precision, and user feedback.

Testing Goals:

- Build user trust in AV systems.
- Validate safety and performance of robotic solutions.
- Ensure ease of use and adaptability.
