Based on last week's discussion, we have finalized a mature solution for vehicles maintenance. We have categorized maintenance scenarios into three types: Immo (critical maintenance functions), Non-Immo (non-critical maintenance functions), and Degraded Model (limited maintenance functions). For each scenario, we have proposed corresponding solutions and will illustrate them with specific use cases.

For Immo (Critical Maintenance Functions)

Process Design(five steps):

1. Issue Monitoring:

Process:

(1) Vehicle sensors continuously monitor the status of critical components (e.g., brake hydraulic pressure, brake pad thickness).

(2) When an issue is detected, the vehicle system sends a warning message to the owner.

(3) A data analysis module analyzes sensor data, determines the severity of the issue, and generates diagnostic codes.

Involved Roles in this process:

Owner: Receives warning messages and takes appropriate action.

Vehicle Sensors: Monitor the status of components for faults.

Data Analysis Module: Analyzes data and generates diagnostic reports.

2. Issue Reporting and Response:

Process:

(1) The owner reports the issue by booking a repair appointment through a mobile app or by calling the service center.

(2) The vehicle system uploads diagnostic information (e.g., insufficient brake system pressure) to the service center, enabling preparation of tools and parts in advance.

Involved Roles in this process:

Owner: Actively reports the issue.

Vehicle System: Transmits fault information.

Service Center Receptionist: Coordinates appointments and records fault information.

3. Degraded Mode and Safety Measures:

Process:

(1) Until the issue is resolved, the vehicle enters a degraded mode (e.g., speed limitation, activation of emergency braking). The owner receives safety driving reminders.

Involved Roles in this process

Vehicle System: Activates degraded mode.

Owner: Drives safely based on system recommendations.

4. Repair and Recovery:

Process:

(1) A technician replaces worn parts and completes brake system repairs based on the diagnostic report.

(2) The service center performs multiple tests on the brake system after repairs to ensure proper functioning.

Involved Roles in this process:

Technician: Executes the repair tasks.

Service Center: Provides parts and technical support.

5. Confirmation and Closure:

Process:

The service center provides a repair report to the owner and offers follow-up maintenance recommendations.

Involved Roles in this process

Owner: Confirms the completion of repairs.

Service Center: Archives the maintenance records.

Use cases: Repair Battery, Repair Brake, Repair Steering System, Monitor Tire Pressure, Repair Transmission System

Non-Immo (Non-Critical Maintenance Functions)

Process Design(four steps):

1. Issue Monitoring:

Process:

(1) Vehicle sensors monitor non-critical components (e.g., engine oil level, coolant levels).

(2) When maintenance is due (e.g., oil nearing end of life), the vehicle system sends a reminder to the owner.

(3) The data analysis module evaluates remaining service life and suggests a maintenance timeline.

Involved Roles in this process:

Owner: Receives maintenance reminders and schedules servicing.

Vehicle Sensors: Monitor the condition of components.

Data Analysis Module: Analyzes data and suggests appropriate timelines for servicing.

2. Maintenance Appointment and Preparation:

Process:

(1) The owner books a maintenance appointment via a mobile app or by contacting the service center.

(2) The vehicle system uploads relevant information (e.g., oil type, service history) to the service center.

(3) The service center confirms the required tools, consumables (e.g., oil, filters), and technician availability.

Involved Roles in this process:

Owner: Schedules the appointment.

Vehicle System: Sends service-related data to the service center.

Service Center Receptionist: Prepares for the scheduled maintenance by arranging tools and consumables.

3. Maintenance and Inspection:

Process:

(1) The technician replaces consumables (e.g., oil, filters) as required.

(2) Additional components are inspected for wear or damage (e.g., belts, spark plugs).

(3) The data analysis module updates the vehicle's maintenance log with new parameters.

Involved Roles in this process:

Technician: Executes maintenance tasks and performs inspections.

Service Center: Provides tools, consumables, and any technical assistance.

4. Completion and Recommendations:

Process:

(1) The service center generates a report summarizing the maintenance performed and provides recommendations for future servicing.

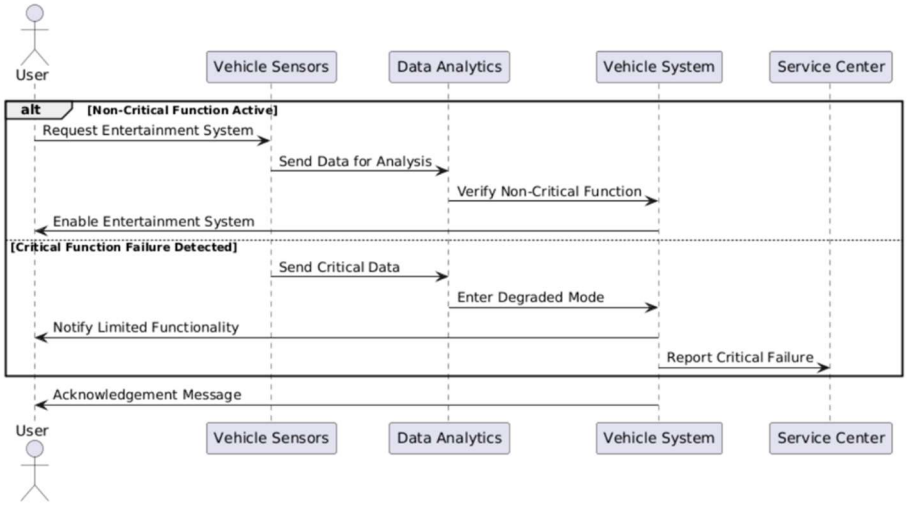
(2) The owner confirms the service is complete and reviews the report.

Involved Roles in this process:

Owner: Reviews the maintenance report and confirms task completion.

Service Center: Archives maintenance details for future reference.

Use Cases: Scheduled Engine Oil Replacement, Coolant Top-Up, Air Filter Cleaning/Replacement, Cabin Air Filter Replacement Spark Plug Inspection and Replacement



Degraded Model (Limited Maintenance Functions)

Process Design(four steps):

1. **Issue Monitoring:**

   (1) Vehicle sensors continuously monitor critical subsystems for faults (e.g., battery modules, fuel pump).

   (2) Upon detecting significant degradation, the vehicle system sends a warning to the owner.

   (3) The data analysis module evaluates the severity of the degradation and recommends an appropriate course of action (e.g., urgent repair or temporary usage with functionality).

Involved Roles in this process:

Owner: Receives warnings and decides on immediate action.

Vehicle Sensors: Detect and log system degradation.

Data Analysis Module: Evaluates fault severity and provides recommendations.

2. **Activation of Degraded Mode:**

Process:

(1) The vehicle enters a degraded mode to ensure safe operation (e.g., reduced power output, limited speed, restricted features).

(2) The owner receives notifications regarding safe usage and the need for prompt servicing.

Involved Roles in this process:

Vehicle System: Activates degraded mode and ensures minimal operability.

Owner: Operates the vehicle safely within the degraded limits.

3. **Emergency Repair or Component Replacement:**

Process:

(1) The owner schedules an appointment with the service center.

(2) The vehicle system transmits diagnostic data to the service center for component replacement preparation.

(3) The technician repairs or replaces the degraded component to restore functionality.

Involved Roles in this process:

Owner: Schedules the repair appointment and delivers the vehicle for servicing.

Vehicle System: Sends diagnostic data to the service center.

Technician: Performs repairs or replaces components.

4. Post-Repair Testing and System Recovery:

Process:

(1) The technician performs post-repair diagnostics to ensure the system functions correctly.

(2) The service center provides a detailed report to the owner and updates the system logs.

(3) The vehicle exits degraded mode and resumes normal functionality.

Involved Roles in this process:

Technician: Conducts post-repair diagnostics and validates the system.

Service Center: Documents the repair details and updates the vehicle's records.

Owner: Confirms the system recovery and reviews the report.

Use Cases: Faulty Battery Module Repair**,** Fuel Pump Replacement**,**

Limited Transmission Operation Repair, Electric Vehicle Charging System Repair, Drive Motor Degradation Repair