

Automated Workshop System: Business Requirements Document

I. Executive Summary

This document outlines the business needs for the Automated Workshop System Project. Project objective is to transform how we service vehicles and interact with our customers with aim to use smart technology to make service operations much more efficient, give our customers a better experience, and ensure our workshops are ready for future changes, especially with new types of vehicles like Hybrids and Electric Vehicles (EVs).

This system will be built on two main pillars:

1. **Vehicle Tracking System (VTS):** This system will act as the "eyes" of the workshop, providing real-time information on where every vehicle is and what's happening to it. It will use cameras and smart technology to track vehicles accurately.
2. **Central Dashboard:** The Central Dashboard will serve as the system's "brain," aggregating all data and managing communication between its various components to ensure smooth operations and provide comprehensive reports. It will offer complete floor management information, tracking a job from the initial customer repair request through to bay and technician allocation, and providing an estimated time for completion. By analyzing historical data, the system will also understand and identify operational trends. Furthermore, the dashboard will equip workshop staff with relevant, actionable alerts and insights tailored to specific service and vehicle types (such as EV or ICE), delivering them through the staff's preferred communication medium to facilitate smooth workshop operations. Ultimately, the system is designed to act as a co-pilot for the workshop staff.
3. **360 Degree Vehicle Assessment:** This component is dedicated to the automatic, AI-based assessment of outer and underbody damages of vehicles as they transit through designated areas within the workshop.
4. **Customer Communication/Interaction (In-Workshop: + Out-Workshop):** This work item focuses on enhancing customer engagement through real-time visual interaction. It involves displaying vehicle status and information insights to customers.

By putting these systems in place, we expect to see significant improvements in how quickly and efficiently we can service vehicles, leading to improved customer experience and more prepared workshops.

II. Project Overview

2.1 Background and Business Need

Maruti Suzuki Service is committed to improving how our workshops operate and making things more convenient for our customers. Currently, tracking vehicles and ensuring they are delivered on time often relies on manual efforts or basic digital tools. While these have helped, we need a more advanced solution. Our vision is to automate and digitalize key areas of our workshops, using a highly accurate, camera-based tracking system. We want to move towards a proactive, data-driven way of managing our workshops, which will require adopting new technologies and potentially new ways of working for our staff.

2.2 Business Goals and Desired Outcomes

The main business goal is to establish an "Automated Workshop" that is essential for:

- Delivering superior customer experience.
- Optimizing vehicle service processes.
- Ensuring workshops are ready for future demands.

Specifically, we want to achieve the following:

- **Improved Customer Experience by Automated customer messages:** Send automatic appointment confirmations, reminders, and real-time vehicle updates (e.g., via WhatsApp, SMS, app notifications).
- **Enhanced Operational Efficiency:**
 - **Real-time insights:** Provide an end-to-end vehicle tracking system with real-time views of workshop operations through an easy-to-use dashboard.
 - **Automated safety warnings:** Provide warnings to workshop staff when handling Strong Hybrid and Electric Vehicles (EVs) at washing and service bays, ensuring safety.
- **Future Readiness:** Prepare workshops for integrating future technologies and customizations, especially for new vehicle types like Battery Electric Vehicles (BEVs).

2.3 Scope

The Automated Workshop System will cover a wide range of business functions to create a smart and connected service environment. This includes:

- Using cameras to track vehicle movement throughout the workshop.
- Sharing all tracking information across service records and updating customers through various channels.
- Providing a central dashboard to monitor and analyze these functions.

The project is divided into four main business areas:

1. **Vehicle Tracking System (VTS):** Focuses on automatically tracking vehicle movement and providing real-time updates to both workshop staff and customers.
2. **Customer Communication/Interaction:** Aims to improve customer engagement through real-time visual updates on displays and through external channels like SMS and WhatsApp.
3. **Central Dashboard:** This is the core component that brings together data and functions from all other areas, centralizing data flow and reporting, and managing the system's components and providing the workshop staffs with relevant

While each part has its specific focus, the Vehicle Tracking System and Central Dashboard are considered the foundational elements that enable the entire Automated Workshop vision.

III. Functional Requirements: What the System Must Do

3.1 Vehicle Tracking System (VTS)

The VTS is essential for providing automated, camera-based vehicle tracking for workshop staff and Maruti Suzuki stakeholders.

3.1.1 Vehicle Tracking and Stages

The system must track vehicles through defined stages within the workshop, using cameras at each point. These stages include:

- **Main Entry:** Capture vehicle details upon arrival.
- **Washing Entry/Exit:** Track vehicles during the washing process.
- **Floor Entry/Exit:** Track vehicles entering and leaving the main service floor.
- **Bay :** Track vehicles Bay in/out & idle time.
- **Final Washing:** Track optional final wash.
- **Exit:** Record vehicles leaving the workshop.

At each stage, the system must:

- Capture multiple vehicle images.
- Capture clear number plate images for accurate recognition.
- Identify the correct vehicle registration number.
- Record the exact date and time (DD-MM-YYYY HH:MM:SS) and direction (In/Out) of movement.
- Be configurable to add new tracking stages in the future without custom development.
- Support flexible vehicle journeys that may not follow a strict linear path (e.g., repairs without road tests, road tests before Job Card opening).
- Vehicle Stage Update progression in Customer Lounge
- Identification non-maruti vehicle using logo

3.1.2 Automatic Number Plate Recognition (ANPR)

The ANPR system must:

- Detect vehicles and accurately read number plates from camera images/videos.
- Achieve greater than 98% accuracy in number plate detection.
- Respond with minimum latency for real-time operations.
- Handle non-standard, damaged, and vernacular (local language) number plates.
- Allow manual correction of incorrectly detected or read number plates, with this corrected data used to improve the system's accuracy over time.
- Detect number plates on vehicles moving up to 30 Kmph.

- Achieve 100% vehicle detection (with agreed exceptions) and 100% accurate ANPR scanning with zero false readings.

3.1.3 Intelligent Object Tracking and Alerts

The system must:

- Identify specific objects, processes, tools, or parts (e.g., service plugs, gloves), manpower hand movement in workshop areas.
- Trigger predefined business actions or signals based on these identifications.
- Provide automated warning messages to workshop personnel for specialized vehicles (e.g., "REMOVE SERVICE PLUG" for Strong Hybrid or Electric Vehicles entering a bay, accompanied by a buzzer).
- Allow these alerts and instructions to be configurable for future changes or new vehicle types.

3.1.4 Dynamic Bay Management

The system must:

- Continuously monitor the status of service bays (occupied/vacant) using ANPR.
- Interact with other bay components like displays and buzzers based on business needs.
- Identify and manage information for different bay types (e.g., 2-Tech Bays, Express Bays, Smart Bays) and provide relevant information.
- Using AI/ML Capabilities to provide insights and actionable alerts on Bay Utilization.

3.1.6 Exception Handling

The system must handle various exceptions to ensure continuous workshop operations, including:

- Issues with number plate recognition (new vehicles without plates, vernacular plates, damaged plates).
- Identification and management of non-Maruti Suzuki vehicles in 3S setups.
- Discrepancies between job card status and vehicle position.
- Intelligently ignore non-vehicle numbers (e.g., two-wheelers, trucks) in camera feeds.

3.1.7 Key System Integrations

The VTS must integrate with other systems via secure REST APIs, providing comprehensive documentation. Key integrations include:

- **DMS (Dealer Management System):** To capture Job Card details (model, service type, advisor, JC number, open time, promised time, estimated delivery time).

- **MTAB/NPAD:** As the source for Job Card creation.
- **Central Dashboard:** To provide real-time data (vehicle status updates, alerts/triggers for stages, bay status) via push and pull mechanisms.
- **Customer Communication API:** To trigger customer updates (SMS, WhatsApp).
- **Third-Party Display APIs / Camera APIs:** For controlling displays/buzzers and receiving camera data.
- **Other Customer Facing Apps.**

3.2 Central Dashboard

The Central Dashboard is the "intelligence hub" of the Automated Workshop System. Its main business purpose is to bring together data and functions from all connected parts, ensuring a unified data flow and comprehensive reporting. It also acts as the central application for managing system components like users and displays.

3.2.1 Comprehensive API Integration

The system must provide a robust, secure, scalable, and distributed API platform for seamless data transfer and integration among all Automated Workshop components, designed to handle current and future data loads.

3.2.2 Seamless Integrations

The Aggregator must integrate with key source and destination systems:

- **Source Systems (Data Inflow):**
 - **DMS (Dealer Management System):** For core vehicle and service data.
 - **Dexc (MSIL Customer Care Management):** For customer interaction history and preferences.
 - **MTAB/NPAD:** For Job Card creation and lifecycle management.
 - **Smart Eye:** For outer and underbody vehicle damage assessments and repair costs.
- **Destination Systems (Data Outflow & Orchestration):**
 - **Customer Communication:** To send automated messages (appointment confirmations, reminders, real-time updates) via SMS, WhatsApp, email.
 - **Vehicle Tracking System (VTS):** To receive real-time vehicle movement data and operational insights.

3.2.3 Detailed Integration Parameters and Data Flows

The Aggregator must manage specific data exchanges to orchestrate workshop operations:

Operation	Source System(s)	Destination System(s)	Data Requirements
Job Card Management			
Job Card Opening	DMS/MTAB/NPAD	Central Dashboard	Job Card Details, Advisor Details, Vehicle Details, Demanded Repairs, Promise Date
	Central Dashboard	Customer Communication	Customer Messages
Job Card Closing	DMS/MTAB/NPAD	Central Dashboard	JC Closing Information, Vehicle Delivery Time
	Central Dashboard	Customer Communication	Customer Messages
Job Card Billing	DMS/MTAB/NPAD	Central Dashboard	Invoice Details
	Central Dashboard	Customer Communication	Customer Messages
Vehicle Tracking: Vehicle Entry			
Vehicle Entry to Workshop	Vehicle Tracking System	Central Dashboard	Vehicle Registration Number, Vehicle Image at Entry Gate, Date Stamp of Entry, Direction of Movement
	Central Dashboard	Customer Communication	Customer Messages
	Central Dashboard	DMS/MTAB/NPAD	Notification for Vehicle Entry with Job Cards, Notification for Walk-In Vehicles (Without Job Cards)
Walk-in Vehicles Entry for JC Opening	Vehicle Tracking System	Central Dashboard	Trigger for Vehicle entry
	Central Dashboard	DMS/MTAB/NPAD	Auto Populated details for Job card opening
	Central Dashboard	Customer Communication	Customer Messages
Vehicle Tracking: Washing Area			
Washing Entry	Vehicle Tracking System	Central Dashboard	Vehicle Registration Number, Vehicle Image at washing Entry, Date Stamp of Entry, Direction of Movement
	Central Dashboard	Customer Communication	Customer Messages
Vehicle Tracking: Inside Workshop Floor			
Workshop Floor Entry	Vehicle Tracking System	Central Dashboard	Vehicle Registration Number, Vehicle Image at washing Entry, Date Stamp of Entry, Direction of Movement
	Central Dashboard	Customer Communication	Customer Messages
Workshop Floor Entry: Bay Allocation	Vehicle Tracking System	Central Dashboard	Allocated Bay Details
Workshop Floor Exit	Vehicle Tracking System	Central Dashboard	Vehicle Registration Number, Vehicle Image at washing Entry, Date Stamp of Entry, Direction of Movement
	Central Dashboard	Customer Communication	Customer Messages

Vehicle Exit from Workshop			
Vehicle Exit from workshop	Vehicle Tracking System	Central Dashboard	Vehicle Registration Number, Vehicle Image at washing Entry, Date Stamp of Entry, Direction of Movement
	Central Dashboard	Customer Communication	Customer Messages

3.2.4 Real-time Vehicle Status Management

The Aggregator must track and manage the real-time status of each vehicle through the following stages:

- Job Card Open
- Washing Started
- Washing Completed
- Repair Started
- Completed Repair
- JC Billed
- Delivered

3.2.5 Web-Based Platform for Administration, Monitoring, and Reporting

The Aggregator's web platform will be the central point for all administration, monitoring, and reporting, with role-based access.

- **Administration Module:** For managing users, components (cameras, displays, buzzers), masters, and workflows.
- **Real-Time Monitoring Module:** For live operational oversight by dealership and MSIL stakeholders.
 - **Vehicle Tracking Logs:** On-demand tracking of vehicle entry, showing details like facility, section, number plate, images, timestamp, and direction. Users must be able to manually edit registration numbers, with feedback for system retraining.
 - **Vehicle Tracking Ticker:** A live dashboard showing vehicle status (Reg No., Advisor, Model, Service Type, status for JC Opening, Washing, Shop Floor, Road Test, Delivery).
- **Reporting Module:** Provides comprehensive reports and KPIs for various stakeholders to monitor and improve service processes.
 - **Main Entry Reports:** ANPR dumps, time slot distribution, appointment vs. walk-in, vehicle type distribution, post-road test entries, MSIL vs. other brands.
 - **Job Card Opening Reports:** Average time to open JC, pending JCs, vehicles received vs. JCs opened. Alerts (e.g., WhatsApp to managers if JC not opened within 10 mins of ANPR detection). ¹

- **Bay Efficiency Reports:** Vehicle duration in bay, average bay efficiency.
- **Vehicle Tracking Reports:** Time spent per stage (JC Open, Shop Floor, Washing, Road Test). Alerts (e.g., WhatsApp to managers if delayed)

3.2.5 Live Alerts and Notifications

The Automated Workshop system will provide real-time alerts and notifications to workshop staff via WhatsApp and in-app pop-ups on the platform for various stages of vehicle service. These alerts are designed to ensure timely actions and efficient workflow management.

- **Vehicle Entry & Job Card Status:**
 - **Vehicle Entered but JC Not Created:** An alert will be triggered if a vehicle has entered the workshop (identified by ANPR) but a Job Card (JC) has not been opened within 10 minutes. This alert will be sent to the General Manager (GM) and Workshop Manager (WM) via WhatsApp.
 - Details to include: Vehicle Registration Number, Entry Timestamp, and a clear indication that JC creation is pending.
 - **Job Card Pending/Not Started:** If a Job Card is created but the vehicle has not moved to the next defined stage (e.g., washing, shop floor entry), alerts will be generated.
 - Details to include: Vehicle Registration Number, Job Card Number, current stage, and duration of inactivity.
- **Washing Process:**
 - **Washing Not Done:** Alert if a vehicle designated for washing has not entered the washing bay within a predefined time after JC opening.
 - Details to include: Vehicle Registration Number, Job Card Number, and elapsed time since JC opening.
 - **Washing Done but Allocation Pending:** Notification when a vehicle exits the washing bay but has not been allocated to a service bay or moved to the shop floor.
 - Details to include: Vehicle Registration Number, Washing Exit Timestamp, and status as "Allocation Pending."
- **Service Bay Operations:**
 - **Allocated but Job Not Started:** Alert if a vehicle has been allocated to a bay but the service work has not commenced within a specified timeframe.
 - Details to include: Vehicle Registration Number, Bay ID, Job Card Number, and time since bay allocation.
 - **Deviation from Promised Delivery Time:** Proactive alerts when a vehicle's progress indicates a potential delay from the Estimated Delivery Time or Promised Time.

- Details to include: Vehicle Registration Number, Job Card Number, original Promised Time/Estimated Delivery Time, and predicted delay.

IV. Strategic Business Enhancements

These enhancements focus on improving business outcomes through digital interventions.

4.1 Accelerated Service Times

The system will use real-time insights and digital tools to reduce service times:

- **Automated Job Card Opening:** ANPR auto-fill will reduce Job Card opening time from 10-15 minutes to under 5 minutes.
- **Smart Bay Allocation & Alerts:** Real-time bay occupancy monitoring and intelligent alerts will reduce idle time during repairs.

The Central Dashboard's monitoring and reporting will provide immediate feedback and KPIs for continuous improvement.

4.2 AI-Enabled Workflow Automation: Job Allocation for Floorsupervisor and Service Advisor

The provided Scope of Work documents do not explicitly detail "AI-enabled Job Allocation for Floorsupervisor" or "Automatic Job Allocation of the vehicle to service advisor AI based". However, the system's foundational capabilities lay a robust groundwork for such sophisticated future enhancements. The current system primarily supports *descriptive* analytics (understanding what is happening) and *diagnostic* analytics (understanding why it is happening via alerts and KPIs). However, the presence of such rich, interconnected data, combined with the system's inherent capability for "intelligent business logics", creates the essential prerequisites for advancing to *predictive* (forecasting future states) and *prescriptive* (recommending optimal actions) capabilities.

The existing capabilities that are crucial enablers for future AI-driven job allocation include: Real-time Vehicle Tracking, Bay Management, Object Tracking, Job Card Details & Configurable Business Logic.

Building on these robust capabilities, AI-enabled job allocation could be a powerful future enhancement, transforming operational efficiency:

- For Floor supervisors: AI could analyze real-time data to recommend optimal vehicle movement and bay allocation, thereby minimizing idle time and maximizing throughput. This would involve processing information on:
 - Available bays (type, current occupancy, and readiness).
 - Real-time vehicle status and its next required service stage.
 - Allocation based on Technician skill sets and current availability
 - Job complexity and estimated time (derived from Job Card details and historical data).

- Historical data on bay utilization, technician performance, and average repair times for various service types.
- For Service Advisors: AI could significantly streamline the initial customer interaction and job assignment process:
 - Automatically assigning walk-in vehicles to the most suitable available service advisor based on current workload, specific expertise, or customer history (contingent on integration with customer relationship management systems).
 - Pre-populating Job Card details for walk-in vehicles based on ANPR data, thereby expediting the Job Card opening process.¹
 - Optimizing appointment scheduling by providing intelligent recommendations based on forecasted bay availability and technician capacity.

This advancement from descriptive and diagnostic analytics to predictive and prescriptive capabilities is a natural progression given the rich, interconnected data available. It signifies a shift from merely understanding past and present states to actively recommending optimal actions for future efficiency.

For Floor Supervisors: A real-time dashboard will show live bay status, technician productivity, and AI-driven recommendations for vehicle movement and bay allocation, minimizing idle time.

For Service Advisors: Vehicle arrival (via ANPR) will trigger automatic Job Card creation and notification to the most suitable available service advisor, balancing workload and speeding up intake.

Adaptive Manpower Allocation: The system will dynamically assign staff based on real-time workload and bay type, ensuring continuous service flow.

4.3 Enhanced Job Card Information Visibility for Technicians

Technicians will receive complete, real-time job card details before starting work:

- **Comprehensive Display:** Key information (Reg No., Model, JC No., Service Type, Demanded Repairs, Promised Delivery Time, Assigned Bay) will be shown.
- **Real-time Data Access:** Technicians will have instant access to digital repair manuals, diagnostic videos, customer history, and vehicle-specific data via handheld devices or workstations.

4.4 Hardware-Agnostic Solution Design

The system is designed to be flexible and compatible with various hardware:

- **Universal Camera Compatibility:** Support any IP camera, avoiding dependency on specific brands.
- **Flexible Computation:** Efficiently perform tasks on both cloud or edge devices, optimizing speed and processing power.

- **Adaptable ANPR:** Support standard and non-standard number plates, with software models continuously learning.
- **Scalability for Future Requirements**