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School of Computing

Automotive Workshop Management System

Final Project Proposal

Diploma in Software Engineering 25.1F

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Chapter 1: Introduction

1.1 Introduction of the Organization

Auto M Pvt Ltd is a comprehensive automobile service station located in Colombo, Sri Lanka. They are recognized for providing high quality vehicle repair, maintenance, and servicing solutions at competitive prices.

The service station specializes in all types of vehicle services including cars, vans, and SUVs. Their experienced team of mechanics and technicians can diagnose and fix various mechanical, electrical, and body work issues using modern diagnostic equipment and tools. They are committed to delivering excellent customer service, expert technical support, and transparent pricing.

Services they offer:
- General vehicle servicing and maintenance
- Engine repairs and diagnostics
- Brake system repairs and replacement
- Oil Changes and fluid checks
- Battery replacement and electrical repairs
- Tire replacement and wheel alignment
- Body Work and painting
- Air conditioning repairs
- Transmission repairs
- Vehicle inspection services

Current Challenge: Auto M Pvt Ltd wants to reduce customer waiting times at their service

Station and expand their business operation efficiently. They recognize that long, unpredictable waiting times are causing customer dissatisfaction and limiting their service capacity.

1.2 Organization Structure
Organizational Role Hierarchy
1.Admin/Manager

- Central leadership role
- Overseas all service station operations
- Manages booking and schedules
- Strategic decision making
- Advertisement management

2.Service Staff/Technicians

- Core operational workforce
- Performs vehicle repairs and services
- Update service status
- Customer interaction

3.Customer

- End-users of services
- Primary system users
- Book time slots for services
- Receive services

4.Advertisers (Business Partners)

- External business promoting products/services
- Display advertisements in the app
- Generate additional revenue

1.3 Current Operations in the Organization

Auto M Pvt Ltd.'s operations currently involve manual, inefficient process:

Service Management:
- **Walk -in Only Service:** customers arrive without appointments, causing unpredictable queues.
- **First-Come-First-served:** No organized booking system leads to long wait times
- **Manual Job allocation**: Service jobs assigned verbally to technicians
- **Paper-based records:** All vehicle service records kept in physical files.
- **No Time Estimation:** Customers have no idea when their vehicle will be ready.

Customer experience Problems:
- Customers must physically visit and wait at the service station.
- No advance booking capability.
- Uncertain wait times cause frustration.
- Customers waste 2-4 hours waiting for simple services.
- Phone inquiries overwhelm staff

Business Limitations:
- Cannot plan daily service capacity effectively.
- Difficult to expand operations without better organization
- No digital customer database or service history
- Missing revenue opportunities from idle time slots
- No additional revenue streams

1.4 Users and Responsibilities

Admin/Manager:
- Configure available service types and estimated durations
- Manage daily time slot availability.
- View all customer bookings in Callender/dashboard view
- Approve or reject booking requests
- Assign service jobs to available technicians
- Monitor real – time service progress
- Manage advertising placements and business partnerships
- Generate reports on bookings, revenue, and service efficiency
- Handle customer complaints ans escalations
- Configure advertisement pricing and scheduling

Service Staff/Technicians:
- View assigned service jobs for the day
- Update service status (Started, In Progress, Completed)
- Add service notes and vehicle conditions updates
- Mark service completion time
- Communicate with customers about service progress

Customer:
- Register and Create account with vehicle details
- Brows available service types
- Book time slots for vehicle service in advance
- Select preferred Date and time
- View booking confirmation and details
- Receive notifications before scheduled appointment
- Track real-time service Status
- View service history and pas bookings
- Provide ratings and feedback after service
- View relevant advertisement during wait time

Advertisers (Business Partners):
- Register business profile in the system
- Submit advertisement duration and placement
- Make payments for ad placements

- View advertisement performance analytics
- Track impressions and engagement metrics

1.5 Problem Definition
Critical Problems at Auto M Pvt Ltd:

1. **Unorganized Customer Flow:** No booking system causes unpredictable customers' arrival, leading to overcrowding during peak hours and underutilization during off-peak times.

2. **Long Waiting Times:** Customers waste 2-4 hours waiting at the service station for services that take only 30-60 minutes.

3. **Lost Business Opportunities:** Potential customers avoid the service station when they see crowds, leading to lost revenue

4. **Inefficient Resource Utilization:** Service staff cannot plan their day effectively without knowing about upcoming jobs

5. **Customers Dissatisfaction:** Lack of transparency about waiting times and service progress causes frustration and complaints

6. **Limited Business Growth:** Current manual System cannot scale to handle increased customer demand.

7. **No Additional Revenue Streams:** Missing opportunity to monetize customer waiting time through advertisements

8. **Poor Service Planning:** Cannot forecast daily workload or optimize technician allocation

9. **No Digital records:** Paper-based system makes it difficult to track customer service history and preferences.

10. **Competitive Disadvantage**: Modern service stations adopting digital booking Systems, putting Auto M ahead of competition.

1.6 Project Objectives

Primary Objectives:

Develop **SeatsLabs**- a compressive digital booking and queue management system for Auto M Pvt Ltd to eliminate waiting time uncertainty, enable advance slot booking, and create additional revenue through integrated advertisements.

Operational objectives:

1. Implement a basic online appointment booking system to digitize manual scheduling.
2. Provide admin dashboard for managing daily bookings and service capacity
3. Digitize service tracking from booking to completion
4. Enable customers to book services remotely via web/ mobile application
5. Reduce physical waiting time at the service station
6. Increase daily service capacity through better scheduling
7. Optimize technician workload distribution throughout the day

Customer Satisfaction Objectives:

1. Allow customers to book service slots days or weeks I advance
2. Provide transparent service duration estimates for each service type
3. Send automated reminders 24 hours and 01 hour before appointment
4. Enable real – time service status tracking (Started, In Progress, Competed)
5. Improve overall customer satisfaction
6. Eliminate uncertainty about when vehicle will be ready

Business Growth Objectives:

1. Increase daily service throughput from 05 to 25 vehicles
2. Create predictable daily schedules for better resource planning
3. Build Digital customer database for relationship management
4. Enable data – driven decisions on service pricing and capacity
5. Generate additional revenue through in-app advertisements.
6. Create partnership with local businesses for advertisement opportunities

Advertising Revenue Objectives:

1. Integrate advertisement display system in customer – facing app

2. Partner with local businesses.
3. Display targeted advertisements during booking and waiting periods
4. To allow the admin to display one static advertising banner as a proof of concept for future monetization Provide advertising analytics to business partners.

1.7Proposed Solution

To overcome Auto M Pvt Ltd.'s operational Challenges, we propose **SeatsLabs** – an integrated digital booking, queue management, and advertisement platform.

Core System Features:

1.Time Slot Booking System

- Customers book service appointments in advance via web/ mobile app
- Callender view showing available and booked time slots
- Service type selection (Oil change, brake repair, full service, etc.)
- Each service type has pre – configured duration (30 mins, 1 hour, 2 hours, etc.)
- Automatic slot calculation based on service duration
- Booking confirmation with unique booking reference number
- Customer can select preferred technician (if available)

2.Admin Management Dashboard

- Callender /schedule view of all bookings
- Daily, weekly, and monthly booking overview
- Approve or modify booking requests
- Block time slots for maintenance or special services
- Assign technicians to specific bookings
- Configure service types and durations
- Set maximum daily capacity
- Manage advertisement inventory and scheduling
- View booking Analytics and revenue reports

3.Customer Web application

- User registration with vehicle details(make, model, registration number)
- Browse available services with estimate duration and price
- View real-time availability calendar
- Book time slots for preferred date and time
- Receive booking confirmation via SMS/email
- Get reminder notification (24 hours and 1 hour before)
- Track real-time service status
- View service history and past bookings
- Rate and provide feedback after service completion
- View relevant advertisements while browsing /waiting

4.Service status Tracking

- Real – time status updates: Booked - >Arrived -> in Progress ->Completed
- Technicians update status via staff interface
- Customers receive notifications on each status change
- Estimated completion time displayed
- Photo upload capability for vehicle condition
- Service notes visible to customers

5.Advertisement Integration System

Display Zones: advertisements shown on booking page, waiting screen, and service history

Targeted advertising: Show relevant ads based on service type

- Car accessories during vehicle service booking
- Nearby restaurants during long service waits
- Insurance companies for vehicle owners
- Tire shops during brake/wheel services

Ad Formats: Bannar ads, video ads, interactive promotions

Ad scheduling: Advertisers select display duration and frequency

Performance Tracking: Impressions. Clicks, and engagement metrics

Revenue Sharing: Transparent pricing model for advertisement slots

6.Advertisement Management (Admin)

- Advertiser registration and approval
- Ad content upload and review system
- Schedule ad campaigns with start/end dates
- Set pricing tires (basic, featured, premium, placement)
- Monitor ad performance and analytics
- Generate advertisement invoices automatically
- Provide advertiser dashboards for self- service

7.Notification System

- SMS notifications for booking confirmations
- Email confirmations with booking details
- Reminder notifications 24 hours before appointment
- Final Reminder 1 hour before appointment
- Service status change notifications
- Completion notifications with invoice

8.Reporting and analytics

- Daily booking statistics
- Revenue analysis (service+ advertisement revenue)
- Peak hour identification
- Service type popularity analysis
- Advertising performance report
- Technician performance tracking
- Monthly business overview reports

1.8 Functional and Non-Functional Requirements

Functional Requirements

A. Admin/Manager

1. Authentication:

- Login: System allows Admin to log in securely using email and password
- Change Password: System allows Admin to change password securely
- Update Profile: System allows Admin to update profile information

2. Service Configuration:

 2.1 Add Service Type: Admin can add new service types (e.g., Oil Change, Brake Repair, Full Service)

 2.2 View Service Types: Admin can list down all available service types

- Update Service: Admin can update the service details, duration, and price
- Delete Service: Admin can delete service types

• 2.3 Set Service Duration: Admin can set estimated time for each service (30 min, 1 hour, 2 hours, etc.)

• 2.4 Set Service Price: Admin can set the price for each service type

3. Booking Management:

 3.1 View All Bookings: Admin sees bookings calendar/list view

 3.2 View Daily Schedule: Admin sees all the bookings for the chosen date

 3.3 Approve Booking: Admin can approve pending booking requests

3.4 Reject Booking: Admin can reject bookings with reason

3.5 Modify Booking: Admin can modify booking time or assign another technician

 3.6 Block Time Slots: Admin can block specific time slots from being booked

3.7 Set Daily Capacity: Admin can configure bookings per day maximum

4. Staff Management:

4.1 Add Technician: Admin can add staff accounts for technicians

4.2 View Technicians: Admin can view all service staff

- Update Technician: Admin can update staff details
- Delete Technician: Admin can remove staff accounts

4.3 Assign Jobs: Admin can assign bookings to specific technicians

4.4 View Staff Performance: Admin can view technician service statistics

5. Advertisement Management:

5.1 Register Advertiser: Admin can register business advertiser accounts

5.2 Review Ad Content: Admin must approve advertisement material before publishing

5.3 View Ad Performance: Admin can see impressions, clicks, and engagement

5.4 Generate Ad Invoices: System generates invoices automatically to advertisers

6. Analytics and Reporting:

- View Dashboard Analytics: Admin sees statistics of revenue and bookings
- Generate Booking Reports: Daily, weekly, monthly bookings reports
- Generate Revenue Reports: Ad revenue + service revenue analysis
- View Peak Hours: Identification of busiest time slots
- Export Reports: Download report as PDF/Excel
- View Customer Analytics: Repeat customer, satisfaction ratings

7. Customer Management:

- View Customer Database: Admin can see all registered customers
- View Customer History: Admin can view booking history of any customer
- View Customer Feedback: Admin can view ratings and reviews

B. Service Staff/Technician

1. Authentication:

- Login: Technicians log in securely with credentials
- Change Password: Technicians can reset password
- View Profile: Technicians can view own profile

2. Job Management:

- View Assigned Jobs: Techs see bookings they are assigned

- View Job Details: See customer data, vehicle, and service type
- Update Service Status: Change status (Started, In Progress, Completed)
- Add Service Notes: Document work performed and discoveries
- Upload Photos: Take photo of vehicle condition before/after
- Mark Completion: Finish service and mark completion time

3. Schedule Viewing:

- View Daily Schedule: See all jobs allocated for the day
- View Upcoming Jobs: See bookings for the next couple of days

C. Customer

1. Registration and Authentication:

1.1 Register: Customers register with:

- Personal Info: Name, email, phone number
- Vehicle Details: Make, model, year, registration number
- Password: Safe password generation

1.2 Login: Customers safely login

1.3 Update Profile: Update customer details

1.4 Change Password: Update customer password

1.5 Reset Password: Retrieve password via email/SMS

2. Service Browsing:

- View Services: Browse through various available services
- View Service Details: View description, duration, and cost of every service
- View Service History: View history of services performed on the vehicle

3. Booking Management

3.1 Book Time Slot: Customer makes new bookings:

- Select Service: Choose service type
- View Calendar: Look at dates and times available
- Select Date & Time: Choose your slot
- Add Vehicle Info: Confirm or overwrite vehicle information
- Add Special Notes: Describe special problems or requests

• 3.2 View Booking Confirmation: Look at the booking information and reference number

• 3.3 View My Bookings: View all upcoming and past bookings

• 3.4 Cancel Booking: Cancel appointment (at least 24 hours' notice)

• 3.5 Reschedule Booking: Change date/time of existing booking

4. Notification Management:

- Receive Booking Confirmation: Receive SMS/email confirmation
- Receive Reminders: Receive reminders 24 hours and 1 hour before
- Receive Status Updates: Receive notification on status update
- Set Notification Preferences: Choose SMS, email, or both

5. Service Tracking:

- Track Real-time Status: View current service progress
- View Service Notes: View technician comments about service
- View Service Photos: View before/after photos uploaded by technician
- View Estimated Completion: View expected time of completion

6. Feedback and Rating:

- Rate Service: Provide 1–5-star rating upon completion
- Rate Technician: Rate specific technician who has serviced vehicle
- Submit Written Feedback: Offer detailed review
- View Past Ratings: View own previous ratings and feedback

7. Advertisement Interaction:

- View Advertisements: View ads when browsing and when booking
- Click Advertisements: Visit advertiser website or details
- View Promotional Offers: View special offers by advertisers
- Save Favorite Ads: Bookmark enticing offers for later reference

D. Advertiser (Business Partners)

1. Authentication and Profile:

- Register Business: Sign up advertiser account with business information
- Login: Secure login using credentials
- Update Business Profile: Update company information, logo, contact details
- Change Password: Update account password

2. Advertisement Campaign Management:

 2.1 Create Ad Campaign: Input advertisement details:

- Upload Ad Content: Images, videos, or banner materials
- Set Campaign Duration: Pick start and end dates
- Target Audience: Pick applicable service types
- Choose Pricing Plan: Pick basic, featured, or premium placement

• 2.2 View Ad Campaigns: View all previous and current campaigns

• 2.3 Pause Campaign: Suspend and display temporarily

• 2.4 Extend Campaign: Prolong campaign life

• 2.5 Submit Ad for Review: Send ad copy to admin for approval

3. Payment Management:

- View Pricing Plans: Check advertisement pricing plans
- Make Payment: Online payment for ad campaigns
- View Invoices: Check billing history
- Download Receipts: Download payment receipts

4. Analytics and Performance:

- View Performance: Check impressions and click stats
- View Engagement Metrics: Track ad engagement by customers
- Generate Performance Reports: Download data for performance comparison
- Compare Campaigns: Measure performance across different campaigns

Non-Functional Requirements

1. Performance:

- Response Time: System loads pages within 2 seconds
- Booking Speed: Booking time slot completed within 3 seconds
- Calendar Loading: Availability calendar loaded within 1 second
- Concurrent Users: Support 200+ concurrent users
- Database Queries: All queries executed within 500 milliseconds
- Ad Loading: Ads load within 1.5 seconds without blocking core functionality

2. Security:

- Authentication: crypt/hash encryption of password for user authentication
- Authorization: Admin, Staff, Customer, Advertiser role-based authorization
- Data Encryption: All data transmission through HTTPS/TLS encryption
- Payment Security: PCI-DSS compliant payment processing of advertisement fees

- Session Management: Session timeout when idle for 30 minutes with secure handling
- Data Privacy: Segmentation and protection of customer and advertiser data

3. Usability:

- Booking Ease: Customers book in 5 clicks
- Intuitive Interface: Users can navigate without training
- Error Messages: Actionable and clear error messages
- Language Support: English and Sinhala languages supported
- Mobile Responsiveness: Smooth on all screen sizes
- Accessibility: Adherence to basic accessibility standards

4. Reliability:

- System Uptime: 99.5% business hours uptime (7 AM - 7 PM)
- Data Backup: Nightly automatic backups at midnight
- Error Recovery: System recovers from errors gracefully without data loss
- Booking Integrity: No double-booking scenarios

5. Compatibility:

- Browser Support: Supports Chrome, Firefox, Safari, Edge (latest 2 versions)
- Mobile Support: Supports iOS 12+ and Android 8+
- Device Support: Responsive design for mobile, tablet, and desktop
- Database Compatibility PostgreSQL or greater

6. Scalability:

- Booking Capacity: Handle bookings in a day
- User Growth: Support up to 5,000 registered users
- Advertisement Load: Show and track live ads
- Data Growth: Efficiently handle 2+ years of booking data

7. Maintainability

- Code Quality: Well-documented, modular code following best practices
- Deployment: Hot deployment with no downtime support
- Logging: Time-stamped error logging with good coverage
- Monitoring: Monitoring of health system using admin tools

8. Advertisement System Requirements:

- Ad Display Speed: Ads must not affect core booking performance
- Ad Tracking Accuracy: Normal accuracy for impression and click tracking

- Ad Quality: Provide JPG, PNG, MP4, and GIF support for support images, videos, and GIFs
- Ad Size Limits: With a maximum of 5MB per ad file

1.9 Chapter Summary

Auto M Pvt Ltd is an end-to-end automobile service center located in Colombo, Sri Lanka, currently plagued by manual processes resulting in long customer waiting times, unpredictable service flow, and limited business expansion. Customers must go physically

and must wait 2-4 hours without any knowledge of when their vehicle will be ready, which leads to dissatisfaction and lost business.

SeatsLabs - complete digital book, queue

Core Booking Features:

• Pre-book time slot advance booking mechanism (weeks or days ahead)

• Calendar-based display of availability

• Choosing service type with duration and price

• Automated reminders and booking confirmations

• Real-time service status tracking

Advertisement Revenue System:

• In-app advertisement display as part of customer app

• Targeted advertisement by type of service

• Advertiser self-service portal

• Performance analytics and reporting

• Additional income source

Expected Business Impact:

• Reduce physical waiting time

• Increase Day-to-day service capacity

• Reduce customer complaints

• Improved customer satisfaction

• New revenue stream through advertisements

• Better resource planning and technician deployment

The system will transform Auto M Pvt Ltd into a contemporary, technologically advanced company that honors customer time, operates effectively, and derives multiple sources of income.

Chapter 2: Methodology

2.1 Introduction

This chapter identifies the methodology towards developing SeatsLabs for Auto M Pvt Ltd. It discusses data collection methods that are used to understand existing operations and requirements, the software development model which has been chosen, technology stack and tools, intensive testing strategies, and the rollout plan in phases for effective implementation.

2.2 Data Collection Method(s)

1. Interviews

• Conducted structured interviews with Auto M management to know:

- Current operational issues
- Business goals for expansion
- Budget constraints
- Advertisement revenue projections

• Conducted interviews with service technicians to know:

- Day-to-day workflow and job distribution
- Communication breakdown with customers
- Time management challenges

• Interviewed 25 customers to seek feedback on:

- Current waiting experience and frustrations
- Desire to utilize advance booking system
- Channel of preferred notifications
- Expectations from tracking

2. Observations

• Spent 5 consecutive business days observing Auto M operations

• Documented customer arrival trends and peak hours (9 AM-11 AM, 2 PM-4 PM)

• Observations of different services' duration:

- Oil Change: 30-45 minutes
- Brake Repair: 1-2 hours
- Full Service: 2-3 hours

• Captured customer frustration points and exit behavior

• Identified bottlenecks in booking procedure

• Observed communication styles of staff

3. Surveys

• Distributed questionnaires by hand to 25 customers for information on:

- How often customers visit service centers
- What is the average waiting time experienced
- Advance booking willingness
- Preferred booking channel (web vs mobile app)
- Interest in viewing similar ads while booking

• Examined survey findings indicating:

- 85% willing to make use of advance booking
- 70% prefer web application
- 60% are interested in seeing promotional offers by local merchants

2.3 Software Process Model

Agile Scrum Model shall be used for SeatsLabs development.

Why Agile Scrum:

- **Iterative Development**: Build and demonstrate features in 1-week sprints
- **Flexibility:** Adaptability in changing requirements as Auto M learns new requirements
- **Regular Stakeholder Feedback**: Management sees working features every sprint
- **Risk Mitigation:** Detection of defects early with continuous testing
- **Prioritized Delivery:** Critical booking features developed first, adverts added afterwards
- **User-Centric:** Continuous customer and employee involvement guarantees usability

Scrum Implementation:

- **Sprint Duration:** 1 week/sprint (still not fully confirmed due to unapproved proposal)
- **Sprint Planning:** Set goals and select features for upcoming sprint
- **Daily Standups**: 15-minute team synchronization sessions
- **Sprint Review:** Display finished features to Auto M management
- **Sprint Retrospective:** Team identifies process improvement
- **Product Backlog**: All the features in order of priority
- **Sprint Backlog:** Activities selected for near sprint

Development Phases:

- Phase 1 (Sprints 1-2): Booking system core and admin dashboard
- Phase 2 (Sprints 3-4): Customer application and alerts
- Phase 3 (Sprints 5-6): Advert system and advertiser gateway
- Phase 4 (Sprint 7-8): Testing, tuning, and release

2.4 Software Development Tools

The following are tools and technologies to be used:

- Design and Planning Tools: Figma and Jira
- Frontend Technologies: React.js, Tailwind CSS
- Backend Technologies: Node.js + Express.js
- Database: PostgreSQL
- Payments: Stripe
- Testing Tools: Postman, Supertest, pg-mem
- Version Control: Git, GitHub
- Containerization: Docker
- IDE: VS Code

2.5 Testing Strategies

1. Unit Testing

- Test express routes, middleware, service individually in isolation
- Test React components separately
- Verify booking logic and slot available calculation
- Verify advertisement display rotation algorithmic testing
- Verify notification sending functions
- Test time slot conflict detection
- Target: 80%+ code coverage of significant business logic

2. Integration Testing

- Test interaction between React frontend and Express API
- Verify database operations with Entity Framework Core
- Test notification services (Twilio SMS, email) integration
- Ensure payment gateway integration for ad charges
- Interrogate Socket.IO real-time updates between parts
- Ensure end-to-end functioning of booking flow from UI to database

3. System Testing

• Test complete user workflows:

- Customer books slot → gets confirmation → reminders received → service monitored → completion
- Admin views bookings → assigns tech → monitors progress
- Advertiser constructs campaign → admin ok → ads are shown → analytics tracked

• Make sure all user roles act as intended

• Test system behavior for typical run

• Test timing and targeting of ad display

4. Performance Testing

- Load Testing: Simulate 100+ simultaneous users booking slots
- Stress Testing: Stress system boundaries with 200+ concurrent users
- Database Performance: Make sure queries execute within 500ms
- Booking Speed: Complete was booking in 3 seconds

- Ad Loading: Load ads in 1.5 seconds without slowing down core functionality
- Calendar Performance: Test availability calendar for 3 months data

5. Security Testing

- Penetration Testing: Attempt to find vulnerabilities
- Authentication Testing: Validate login security and password encryption
- Authorization Testing: Validate role-based access control working properly
- SQL Injection Prevention: Test input validation and parameterized queries
- XSS Prevention: Validate output encoding and sanitization
- Payment Security: Ensure secure payment processing for advertisement fees

6. Usability Testing

• Test with 15 real Auto M customers

• Watch users complete key tasks:

- First-time booking
- Viewing availability calendar
- Checking service status
- Responding to notifications

• Time taken to finish task and success rate

• Feedback regarding clarity of the interface

• Test with technical users as well as non-technical users

• Examine confusing aspects and improve

7. Compatibility Testing

• Browser Testing:

- Chrome, Firefox, Safari, Edge (latest versions)
- Mobile browsers (Chrome Mobile, Safari Mobile)

• Device Testing:

- Desktop computers (Windows, Mac)
- Tablets (iPad, Android tablets)
- Mobile devices (different screen resolutions)

• Operating System Testing:

- Windows 10/11
- macOS
- Android 8+

- iOS 12+

8. Advertisement System Testing

- Test ad display logic and targeting
- Test impression and click tracking accuracy
- Test running multiple ad campaigns at the same time
- Test ad scheduling (start/end dates)
- Test advertiser dashboard analytics
- Test ads not disrupting booking functionality

9. Acceptance Testing (UAT)

- Management Testing: Auto M management tests admin features
- Staff Testing: Technicians test job assignment and status updates
- Customer Testing: Real customers test booking and tracking
- Advertiser Testing: Business partners test ad campaign creation
- Ensure all functional requirements are met
- Get sign-off from stakeholders before deployment

10. Regression Testing

- Re-test existing features after addition of new functionality
- Avoid bug fixes from destroying other components
- Automated test suite runs after each code commit
- Verify features of past sprints still work as desired

2.6 Implementation Strategy

SeatsLabs implementation will be completed in a four-phase structure with ensured smooth transition with minimum disturbance to the day-to-day operations of Auto M Pvt Ltd.

Phase 1: System Installation and Configuration

Infrastructure Installation:

- Configure Node.js deployment web server and set up
- Deploy PostgreSQL database server
- Configure Node.js runtime environment
- Install SSL certificates for HTTPS

System Configuration:

- Deploy backend Web API and verify connectivity
- Configure database schema using Entity Framework migrations
- Configure notification services (Twilio, Email SMTP)
- Configure payment gateway for advert fee
- Create first admin account for Auto M management

Service Type Configuration:

• Assign all service types in the system:

- Oil Change (30 minutes, Rs. 2,500)
- Brake Repair (1 hour, Rs. 5,000)
- Full Service (2 hours, Rs. 8,000)
- Engine Diagnostics (45 minutes, Rs. 3,500)
- Tire Replacement (1 hour, Rs. 4,000)
- Battery Replacement (30 minutes, Rs. 3,000)
- AC Repair (1.5 hours, Rs. 6,000)
- no Body Work/Painting (4 hours, Rs. 15,000)

Advertisement Setup:

• Establish advertisement display areas

• Establish impression and click tracking

Testing:

- Perform system integration testing
- Verify all components of the system talk to each other correctly
- Test booking slot calculations
- Test notification delivery

Phase 2: Initial Setup of Data and Training of Staff

Management Training (2 days):

• Admin dashboard training in depth:

- View and manage bookings calendar
- Approve/reject booking requests
- Assign technicians to jobs
- Configuration of service types and pricing
- Management of advertising campaigns
- Create reports and analytics

• Advertisement management training:

- Reviewing advertising applications
- Approval of advertisement content
- Scheduling ad campaigns
- Monitoring ad performance

• Create admin user guide and quick reference cards

Technician Training (1 day):

• Staff interface training:

- Viewing assigned jobs
- Updating service status
- Adding service notes
- Uploading vehicle photos
- Marking completion

• Hands-on practice with dummy bookings

• Create technician quick-start guide

Data Preparation:

• Migrate existing customer data from paper records:

- Customer contact and information
- Registration details of vehicle (make, model, registration)
- Service history (if available)

• Set up initial technician accounts (5 staff members)

• Import service history data for data analysis

Marketing Material Preparation:

- Create customer onboarding brochures
- Create in-shop signage outlining new booking system
- Set up SMS templates for sending customer invitations
- Create social media announcements for new system

Phase 3: Pilot Testing Limited Users

Soft Launch:

- Deploy system in "pilot mode" with limited features
- Invite 30 regular customers to sign up and try it out
- Send personalized SMS invitations with sign-up instructions
- Provide step-by-step guide for first-time booking

Parallel Operation:

- Run both manual and digital bookings in parallel
- Staff manually process walk-ins while piloting digital bookings
- Manual vs digital efficiency comparison
- Identification of workflow conflict, if any

Advertisement Pilot:

• Onboard 3-5 founding advertiser partners:

- Local diner (lunch specials waiting in line)
- Car part store (add-on discount)
- Insurance company (auto insurance offers)

• Launch initial ad campaigns

• Monitoring ad performance and customer response

Monitoring and Feedback:

• Daily review sessions with Auto M management

• Collect feedback from pilot customers:

- What does work well?
- What is confusing or hard?
- What are missing features?

• Monitor system performance metrics

• Monitor booking completion rates

• Monitor advertisement impression and click through rates

Changes:

- Fix bugs discovered during pilot
- Fine-tune booking flow based on customer feedback
- Determine time slot durations based on true service times
- Maximum advertisement targeting and display frequency
- Update notification time according to customer preference

Phase 4: Rollout and Support

Public Rollout:

- Announcing entire system launch to all customers
- Mail bulk SMS/email to customer database
- Post announcements through social media
- Display attractive signage at service station entrance
- Offer launch offer (10% discount for first online booking)

Walk-in Customer Onboarding:

- Dedicated staff member assists walk-ins with registration
- Express registration kiosks at the front desk
- Sequence of step-by-step posters showing booking process
- Incentive for online registration (free car wash)

Advertisement Expansion:

- Onboard additional advertisers
- Roll out full advertisement packages
- Promote advertising opportunities with neighborhood businesses
- Create advertiser success stories for promotion

On-site Technical Support:

- Full-time technical support staff at Auto M
- Assist customers with application usage and bookings
- Support employees with any system issue
- Fix problems in real-time
- Monitor recurrent issues and create FAQ

Shift from Manual to Digital:

- Take walk-ins and online bookings
- Encourage all customers to book online
- Predominantly online bookings

Performance Monitoring:

- Daily system health checks
- Monitor number and pattern of bookings
- Customer satisfaction scores monitored
- Ad revenue from ads
- Technician workload allocation examined

Feedback Collection:

- First two weeks' daily surveys
- Weekly customer feedback reports
- Monthly advertiser satisfaction surveys
- Employee feedback sessions every week

Post-Implementation Support

Ongoing Support:

- Remote technical support via phone/email (9 AM - 6 PM)
- Weekly review of system performance
- Review of business analytics by management monthly
- Planning of feature development quarterly

Continuous Improvement:

- Monthly system updates with increased features
- Optimize according to usage patterns
- Install requested features based on customer feedback
- Improve advertisement targeting features

Training Refreshers:

- Monthly training refreshers for employees
- Advanced feature training for management on a monthly basis
- Webinars on advertising campaign optimization for advertisers

Business Development:

- Advertiser partnership meetings monthly
- Investigate new ad formats (interactive, video)
- Investigate revenue patterns and optimization potential

2.7 Chapter Summary

The technology stack includes React.js with Tailwind CSS for responsive frontend interfaces, Node.js with Express.js for backend RESTful APIs, PostgreSQL for relational database storage, and Socket.IO for real-time updates, and Signal for live updates. Notification services include Twilio for SMS and SMTP for email. Development tools include VS Code for backend, VS Code for frontend, Git/GitHub for version control, and Docker for containerization.

A rigorous ten-strategy testing framework ensures quality: Unit Testing, Integration Testing (API-frontend), System Testing (end-to-end processes), Performance Testing (100+ simultaneous users), Security Testing (penetration and encryption), Usability Testing (15 real customers), Compatibility Testing (browsers and devices), Advertisement System Testing (proper tracking), User Acceptance Testing (stakeholder sign-off), and Regression Testing (stable).

Implementation plan for four phases:

1. System Setup (phase 1): Deployment of infrastructure, setup of services, advertisement pricing setup, and integration testing

2. Staff Training (phase 2): In-depth management and technician training, data

migration, and marketing material preparation

3. Pilot Test (phase 3): 30-customer pilot, simultaneous operation with manual

system, 3-5 advertiser partners, feedback collection and system refinement

4. Full Launch (phase 4): Public launch, on-site support, elimination of printed

advertising expansion to 10+ partners

Post-implementation includes remote support, monthly reports, quarterly training refresher, and continuous business development to add advertisement partnerships and maximize revenue streams.

This structured methodology ensures SeatsLabs will successfully transform Auto M Pvt Ltd from a traditional walk-in service station to a modern, efficiently scheduled business with dual revenue streams from services and advertisements, reducing customer wait times and increasing daily capacity.

Expected Deliverables

Technical Deliverables:

1. Customer Web Application (React.js)

- Service browsing and details
- Interactive booking calendar
- Real-time slot availability
- Booking management interface
- Service status tracking
- Advertising display integration
- Responsive design for all devices

2. Admin Dashboard (React.js)

- Booking calendar and schedule management
- Service type configuration
- Staff/technician management
- Advertisement campaign management
- Analytics and reporting interface
- Customer database management

3. Advertiser Portal (React.js)

- Business registration and profile
- Ad campaign creation and management
- Performance analytics dashboard
- Invoice and payment management

4. Back-end Web API (Node.js + Express.js)

- RESTful API endpoints for all operations
- Entity Framework Core data access layer
- JWT authentication and authorization
- Socket.IO hubs for real-time updates
- Payment processing integration
- Notification service integration

5. Database Schema (PostgreSQL)

Normalized relational database design

Optimized indexes for performance

Stored procedures for complex operations

- Database backup and recovery procedures

6. Deployment Package

- Production-ready application builds

- Node.js deployment configuration scripts
- Database migration scripts
- Environment configuration files
- SSL certificate setup

Documentation Deliverables:

1. System Design Documentation:

- Use Case Diagrams (Current vs Proposed System)
- Class Diagram showing system architecture
- Sequence Diagrams for key workflows:
    - Customer booking process
    - Admin booking approval
    - Advertisement campaign lifecycle
    - Service status updates
- ER Diagram for database structure
- System Architecture Diagram

2. UI/UX Documentation:

- Wireframes and mockups (Figma)
- User interface design specifications
- Responsive design guidelines

3. API Documentation:

- Swagger/open API documentation
- Endpoint descriptions and examples
- Request/response formats
- Authentication requirements

4. User Manuals:

- Customer User Guide (booking and tracking)
- Admin Manual (system management)
- Technician Quick Reference Guide
- Advertiser Portal Guide

5. Technical Documentation:

- System installation guide
- Configuration and deployment manual
- Database schema documentation
- API integration guide

- Troubleshooting and maintenance guide

Testing Deliverables:

1. Test Documentation:

- Comprehensive test cases document
- Test execution results and reports
- Bug tracking and resolution log
- Performance test results (load, stress, speed)
- Security audit report
- User Acceptance Testing (UAT) report

2. Quality Assurance:

- Code review reports
- Code coverage reports

Training Deliverables:

1. Training Materials:

- start guides
- FAQ documents

2. Marketing Materials:

- Customer onboarding brochures
- In-shop promotional posters
- Social media announcement templates
- Advertiser tie-up packages

Conclusion

SeatsLabs is a comprehensive digital transformation for Auto M Pvt Ltd, addressing key operational challenges while creating new sources of revenue. By implementing an intelligent time slot booking system with a targeted advertising platform, the solution will: Change Customer Experience:

- Make service timing uncertain no more with pre-booking
- Save waiting time - customers arrive exactly when needed
- Gain transparency by monitoring real-time service status
- Bring customer satisfaction
- Increase daily capacity using schedule optimization
- Enhance utilization of resources with predictability of daily workload
- Reduce customer complaints through better communication
- Enable business growth with scalable digital platform Generate More Revenue
- Build advertiser network with business partners

Operational Improvements:

- Enhanced technician utilization with balanced workload
- Electronic service history for improved customer relationship management

Success Metrics

The system's effectiveness will be measured by:

- 70% decrease in physical waiting time
- 30% increase in volume per day of service
- 55% reduction in customer complaints
- 3.5/5 customer satisfaction
- Rs. 8,000+ monthly advertisement revenue
- 65% online booking uptake