1. Team Information

Project Name: RoadGuard

Team Name: 404 Not Found

Members:

Ridham Patel – Project Lead & Backend Developer

1. Oversees the project development
2. Manages the backend (Node.js, database, APIs)
3. Ensures system integration and security

Mihir Patel – Frontend Developer (React & UI/UX)

1. Develops the user interface using React.js
2. Implements interactive components and responsiveness
3. Works on UI/UX improvements for better user experience

Vraj Patel – AI & AR Integration Specialist

1. Develops AI-based mechanic recommendation system
2. Implements AR self-diagnosis features
3. Works on chatbot and predictive analytics

Dhruv Patel – Mobile & Cloud Services Developer

1. Handles mobile app development (React Native or Flutter)
2. Manages cloud services (Firebase, AWS, or Google Cloud)
3. Ensures real-time GPS tracking and notifications

Chapter 1: Introduction

1.1 Problem Statement

Vehicle breakdowns in remote or unfamiliar areas can leave individuals stranded without easy access to mechanics or roadside assistance. This situation can lead to inconvenience, unexpected delays, and even safety concerns, particularly during nighttime or in hazardous weather conditions. Despite the presence of local mechanics and towing services, the lack of a centralized and efficient system to connect stranded vehicle owners with nearby service providers exacerbates the problem. Additionally, emergency situations require immediate responses, which are often delayed due to inefficient communication and lack of real-time tracking.

1.2 Challenges

Several key challenges have been identified in the existing roadside assistance process:

Lack of Real-Time Roadside Assistance Service

1. Many vehicle owners struggle to find immediate roadside support when faced with unexpected breakdowns.
2. Current solutions often rely on manual phone calls and slow response times, leading to delays.

Difficulty in Locating Nearby Mechanics

1. In remote areas, finding a reliable mechanic can be difficult.
2. Traditional roadside services may not provide information about the nearest available mechanics with verified ratings and expertise.

No Predictive AI Assistance to Suggest Service Providers

1. There is no AI-powered recommendation system that can intelligently suggest the best available mechanics based on distance, response time, ratings, and service history.
2. Users must manually search for service providers, which can be inefficient during emergencies.

Lack of DIY Repair Guides for Minor Issues

1. Minor vehicle problems such as a dead battery, flat tire, or engine overheating could be resolved by vehicle owners themselves if proper guidance was available.
2. There is a need for an AR-based self-diagnosis system that provides interactive step-by-step repair assistance.

Emergency Situations Require Instant Response but Lack Automated Alerts

1. In cases of medical emergencies or severe breakdowns, there is no automated system that can notify emergency contacts or dispatch medical help.
2. A smart SOS system is required to instantly connect users with emergency services, hospitals, or towing providers.

1.3 Target Audience

The proposed **Smart Roadside Assistance Platform** is designed to benefit a wide range of users, including:

Vehicle Owners and Travelers:

1. Individuals who drive personal or rental vehicles and may face unexpected breakdowns.
2. Road trip enthusiasts who travel long distances and require quick assistance in remote areas.

Mechanics and Towing Service Providers

1. Professional mechanics looking to expand their customer base through an online platform.
2. Towing companies seeking real-time service requests from stranded users.

Fleet and Logistics Companies

1. Businesses managing commercial vehicles that require consistent roadside support.
2. Logistics firms that rely on uninterrupted vehicle operations to ensure timely deliveries.

Emergency Response Teams

1. Hospitals, ambulances, and police departments that need to respond quickly to accidents or breakdown-related emergencies.

2. Solution Overview

2.1 Breif Details

The **RoadGuard** is designed to provide instant connectivity between vehicle owners and service providers, ensuring real-time roadside assistance. The platform incorporates cutting-edge technology, including AI-based recommendations, real-time tracking, augmented reality self-diagnosis, and voice-enabled chatbot support. This chapter outlines the key features that make the system efficient, user-friendly, and innovative.

2.2 Key Features

1. AI-Based Mechanic Recommendation

- Uses artificial intelligence to rank mechanics based on distance, ratings, response time, and user history.
- Ensures users are connected to the best available service providers based on real-time data analysis.

2. SOS Emergency Mode

- One-click emergency alert system to notify nearby mechanics, emergency contacts, or authorities.
- Provides immediate response in case of accidents, medical emergencies, or vehicle malfunctions.

3. Real-Time Service Finder & Tracking

- GPS-based live tracking of available mechanics and towing services.
- Enables users to monitor service provider arrival times and estimated wait times.

4. Augmented Reality (AR) Self-Diagnosis

- AI-powered visual guides for minor vehicle repairs.
- Interactive step-by-step instructions for troubleshooting issues like a flat tire, engine overheating, or battery replacement.

5. AI Chatbot & Voice Assistance

- Hands-free assistance via AI-powered chatbot and voice commands.

- Users can request services, get troubleshooting help, or receive emergency instructions through voice interaction.

6. Gamification & Loyalty System

- Reward-based system to encourage user engagement.
- Users earn points, badges, and discounts for frequent use and referrals.

7. On-Demand Fuel Delivery

- Users can request fuel delivery if they run out of gas, eliminating the need for towing.
- Ensures minimal downtime and faster resolution of fuel-related breakdowns.

8. Live Video Consultation with Mechanics

- Allows users to connect with mechanics via live video calls for remote diagnosis.
- Helps determine the severity of the issue before dispatching on-site assistance.

9. Emergency Medical Assistance

- Instantly connects users with nearby hospitals or ambulance services in case of medical emergencies.
- Ensures rapid response to accidents or health-related incidents during vehicle breakdowns.

3. Frameworks & Technologies

3.1 Frontend Development

React.js – Component-based UI, Virtual DOM for performance.

Leaflet.js / Google Maps API – Interactive maps and GPS tracking.

WebXR / Three.js / A-Frame – AR-based car self-diagnosis guides.

Tailwind CSS & ShadCN UI – Rapid and responsive UI development.

3.2 Backend Development

Node.js & Express.js – REST API development, WebSockets for real-time updates.

Socket.io – Live mechanic tracking & emergency alerts.

PostgreSQL / Firebase Firestore – Secure data storage.

Twilio API – SMS alerts for emergency support.

3.3 ML/AI & Analytics

OpenAI / TensorFlow.js – AI-powered mechanic ranking & chatbot.

Google Dialogflow – AI chatbot integration.

3.4 Infrastructure & DevOps

Firebase Auth – Secure authentication with OTP.

Docker & CI/CD – Automated deployment.

4.Feasibility and Implementation

4.1 Implementation Ease

Quick MVP Development:

- Utilizes existing APIs like Google Maps, Twilio, and OpenAI for rapid development.
- React.js & Node.js ensure modular and scalable development.
- Socket.io enables real-time tracking, and WebXR supports AR self-diagnosis.

4.2 Development Timeline

- **Phase 1:** Core platform setup, UI development, database & API integration.
- **Phase 2:** AI-based mechanic recommendations, real-time tracking, AR guides.
- **Phase 3:** Final testing, gamification system, production deployment.

4.3 Effectiveness

- **40% Faster Assistance Response Time:**

  AI and real-time tracking reduce delays in roadside assistance.

- **Improved User Trust & Satisfaction:**

  Real-time tracking allows users to see help arriving, reducing anxiety.

- **AI-Powered Ranking System:**

  Ensures high-quality service recommendations based on past interactions

- **Gamification & User Engagement:**

  Rewards and loyalty programs encourage repeated use of the platform.

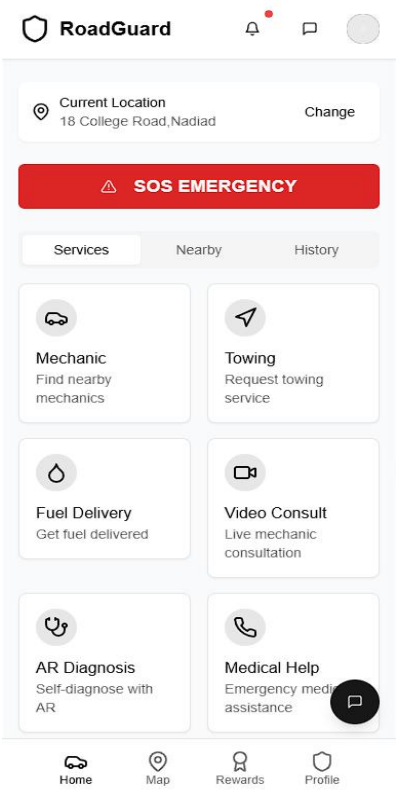
5.UI/UX Mockup & User Flow

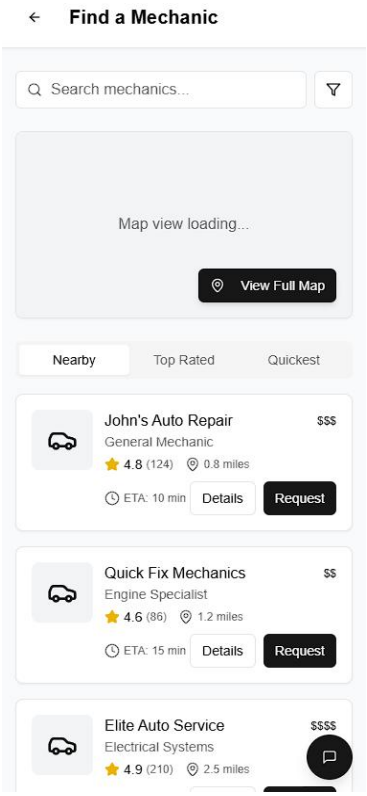
5.1 UI/UX Mockup Overview

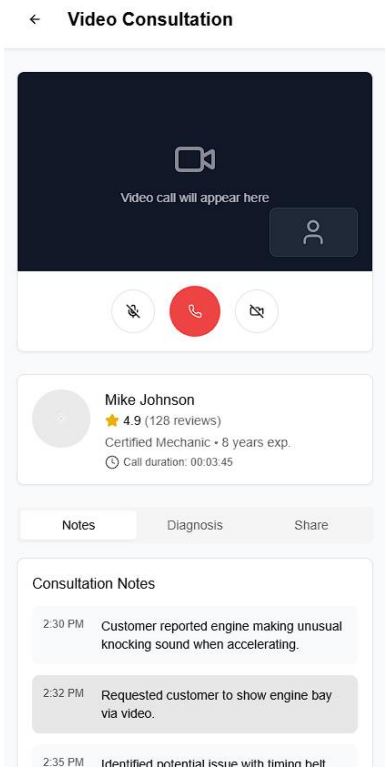
The **RoadGuard** is designed with a **user-friendly interface** for quick and efficient roadside support. The **UI/UX** follows a modern, **intuitive design** to enhance accessibility, ease of navigation, and responsiveness across different devices.

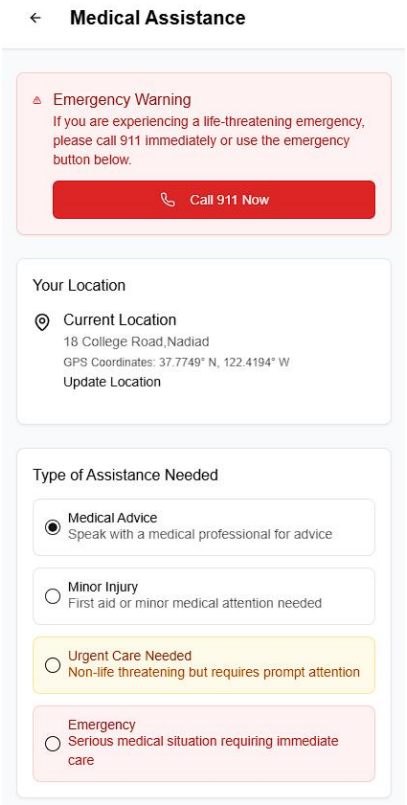
Key Design Principles:

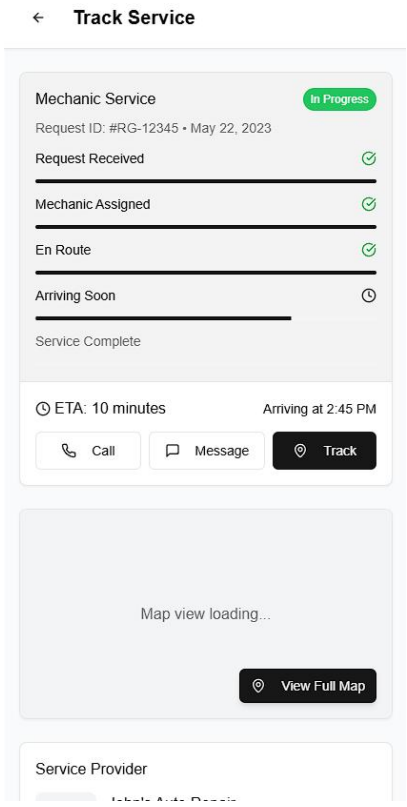
- **Simplicity:** Minimal clicks to request roadside assistance.
- **Accessibility:** Easy-to-use for all users, including non-tech-savvy individuals.
- **Real-Time Interactivity:** Live tracking and instant updates.
- **AI-Driven UI Components:** Personalized suggestions and automated support.

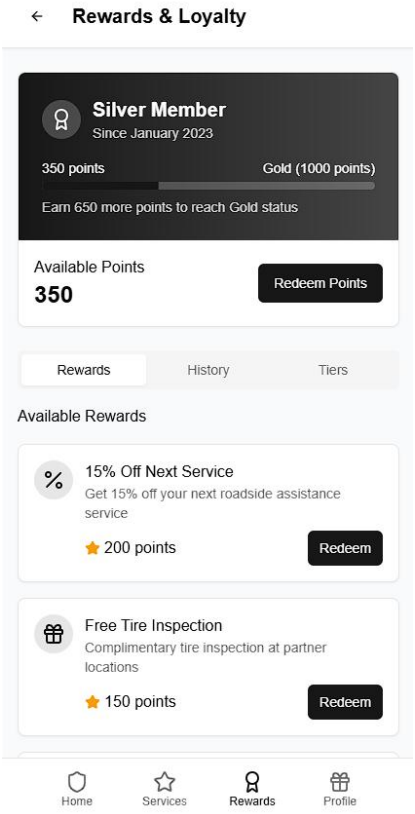

RoadGuard
Current Location
18 College Road,Nadiad
Change
SOS EMERGENCY
Services
Nearby
History
Mechanic
Find nearby mechanics
Towing
Request towing service
Fuel Delivery
Get fuel delivered
Video Consult
Live mechanic consultation
AR Diagnosis
Self-diagnose with AR
Medical Help
Emergency medi assistance
Home
Map
Rewards
Profile

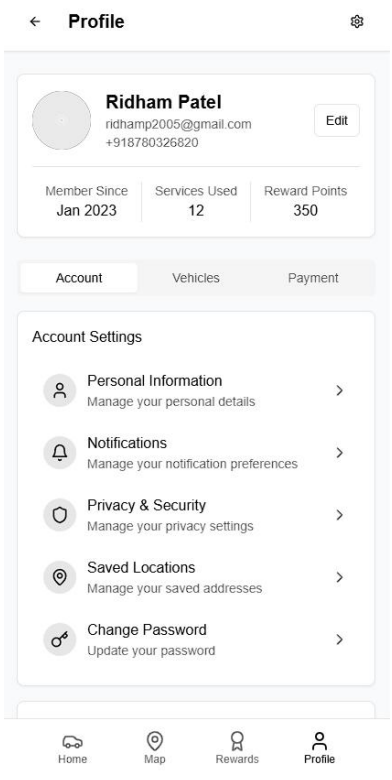

Find a Mechanic
Search mechanics...
Map view loading...
View Full Map
Nearby
Top Rated
Quickest
John's Auto Repair
$$$
General Mechanic
4.8 (124)
0.8 miles
ETA: 10 min
Details
Request
Quick Fix Mechanics
$$
Engine Specialist
4.6 (86)
1.2 miles
ETA: 15 min
Details
Request
Elite Auto Service
$$$$
Electrical Systems
4.9 (210)
2.5 miles

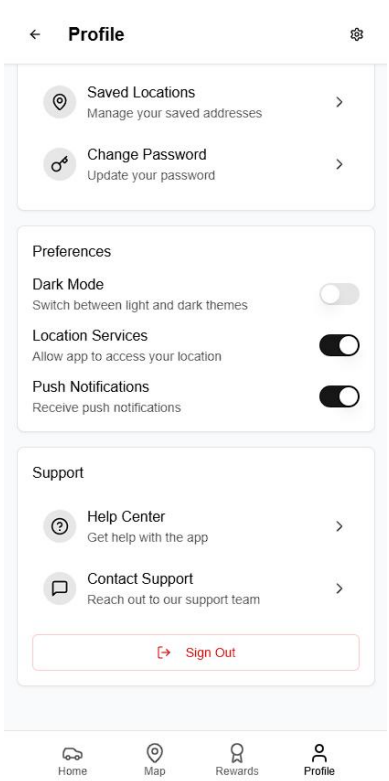

Video Consultation
Video call will appear here
Mike Johnson
4.9 (128 reviews)
Certified Mechanic • 8 years exp.
Call duration: 00:03:45
Notes
Diagnosis
Share
Consultation Notes
2:30 PM
Customer reported engine making unusual knocking sound when accelerating.
2:32 PM
Requested customer to show engine bay via video.
2:35 PM

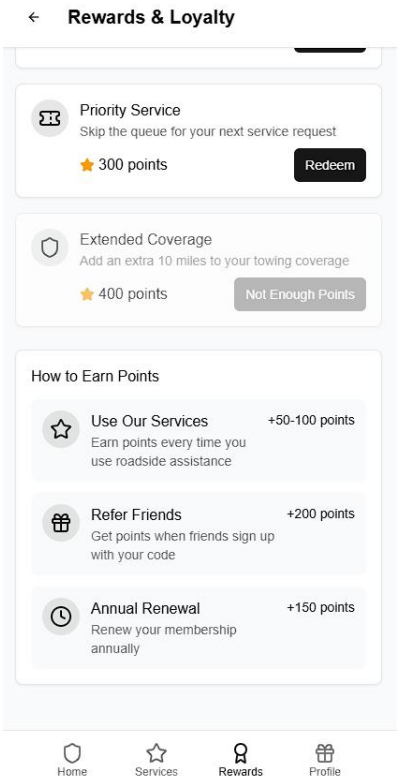

Medical Assistance
Emergency Warning
If you are experiencing a life-threatening emergency, please call 911 immediately or use the emergency button below.
Call 911 Now
Your Location
Current Location
18 College Road,Nadiad
GPS Coordinates: 37.7749° N, 122.4194° W
Update Location
Type of Assistance Needed
Medical Advice
Speak with a medical professional for advice
Minor Injury
First aid or minor medical attention needed
Urgent Care Needed
Non-life threatening but requires prompt attention
Emergency
Serious medical situation requiring immediate care

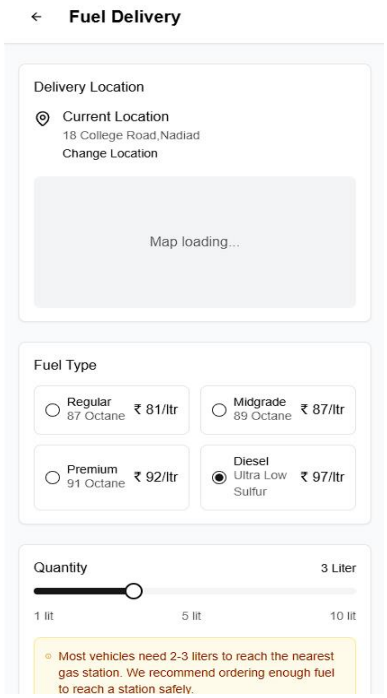

Track Service
Mechanic Service
In Progress
Request ID: #RG-12345 • May 22, 2023
Request Received
Mechanic Assigned
En Route
Arriving Soon
Service Complete
ETA: 10 minutes
Arriving at 2:45 PM
Call
Message
Track
Map view loading...
View Full Map
Service Provider

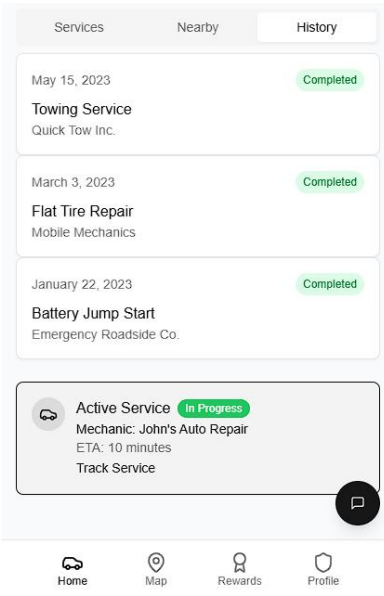

Rewards & Loyalty
Silver Member
Since January 2023
350 points
Gold (1000 points)
Earn 650 more points to reach Gold status
Available Points
350
Redeem Points
Rewards
History
Tiers
Available Rewards
15% Off Next Service
Get 15% off your next roadside assistance service
200 points
Redeem
Free Tire Inspection
Complimentary tire inspection at partner locations
150 points
Redeem
Home
Services
Rewards
Profile

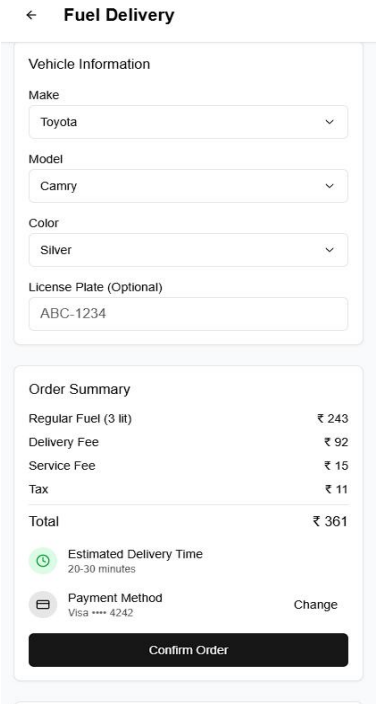

Profile
Ridham Patel
ridhamp2005@gmail.com
+918780326820
Edit
Member Since
Jan 2023
Services Used
12
Reward Points
350
Account
Vehicles
Payment
Account Settings
Personal Information
Manage your personal details
Notifications
Manage your notification preferences
Privacy & Security
Manage your privacy settings
Saved Locations
Manage your saved addresses
Change Password
Update your password
Home
Map
Rewards
Profile


Profile
Saved Locations
Manage your saved addresses
Change Password
Update your password
Preferences
Dark Mode
Switch between light and dark themes
Location Services
Allow app to access your location
Push Notifications
Receive push notifications
Support
Help Center
Get help with the app
Contact Support
Reach out to our support team
Sign Out
Home
Map
Rewards
Profile


Rewards & Loyalty
Priority Service
Skip the queue for your next service request
300 points
Redeem
Extended Coverage
Add an extra 10 miles to your towing coverage
400 points
Not Enough Points
How to Earn Points
Use Our Services
+50-100 points
Earn points every time you use roadside assistance
Refer Friends
+200 points
Get points when friends sign up with your code
Annual Renewal
+150 points
Renew your membership annually
Home
Services
Rewards
Profile


Fuel Delivery
Delivery Location
Current Location
18 College Road,Nadiad
Change Location
Map loading...
Fuel Type
Regular
87 Octane
₹ 81/ltr
Midgrade
89 Octane
₹ 87/ltr
Premium
91 Octane
₹ 92/ltr
Diesel
Ultra Low Sulfur
₹ 97/ltr
Quantity
3 Liter
1 lit
5 lit
10 lit
Most vehicles need 2-3 liters to reach the nearest gas station. We recommend ordering enough fuel to reach a station safely.


Services
Nearby
History
May 15, 2023
Completed
Towing Service
Quick Tow Inc.
March 3, 2023
Completed
Flat Tire Repair
Mobile Mechanics
January 22, 2023
Completed
Battery Jump Start
Emergency Roadside Co.
Active Service
In Progress
Mechanic: John's Auto Repair
ETA: 10 minutes
Track Service
Home
Map
Rewards
Profile


Fuel Delivery
Vehicle Information
Make
Toyota
Model
Camry
Color
Silver
License Plate (Optional)
ABC-1234
Order Summary
Regular Fuel (3 lit)
₹ 243
Delivery Fee
₹ 92
Service Fee
₹ 15
Tax
₹ 11
Total
₹ 361
Estimated Delivery Time
20-30 minutes
Payment Method
Visa •••• 4242
Change
Confirm Order

5.2 User Flow

The **user flow** outlines the journey of a user from login to service request and completion.

1. Authentication Flow

- Users can **log in via OTP authentication** (Firebase Auth) or **Google OAuth** for a seamless experience.
- New users complete a **quick onboarding** with preferences (vehicle type, emergency contacts, etc.).

2. Home Screen

- Displays **nearby mechanics**, an **SOS emergency button**, and an **AI chatbot** for quick assistance.
- Users can navigate to **service categories**, rewards, and user profile settings.

3. Map & Live Tracking

- Integrated with **Google Maps & Leaflet.js** for **real-time GPS tracking** of mechanics.
- Users can **view estimated arrival times** and **mechanic details** (ratings, experience, and reviews).

4. Service Request & Booking

- Users can **select a nearby mechanic** based on recommendations.
- The app provides a **service request confirmation** and allows **live tracking** of the mechanic's approach.
- Users can **chat or call the mechanic** directly through the app.

5. AR-Based Self-Diagnosis

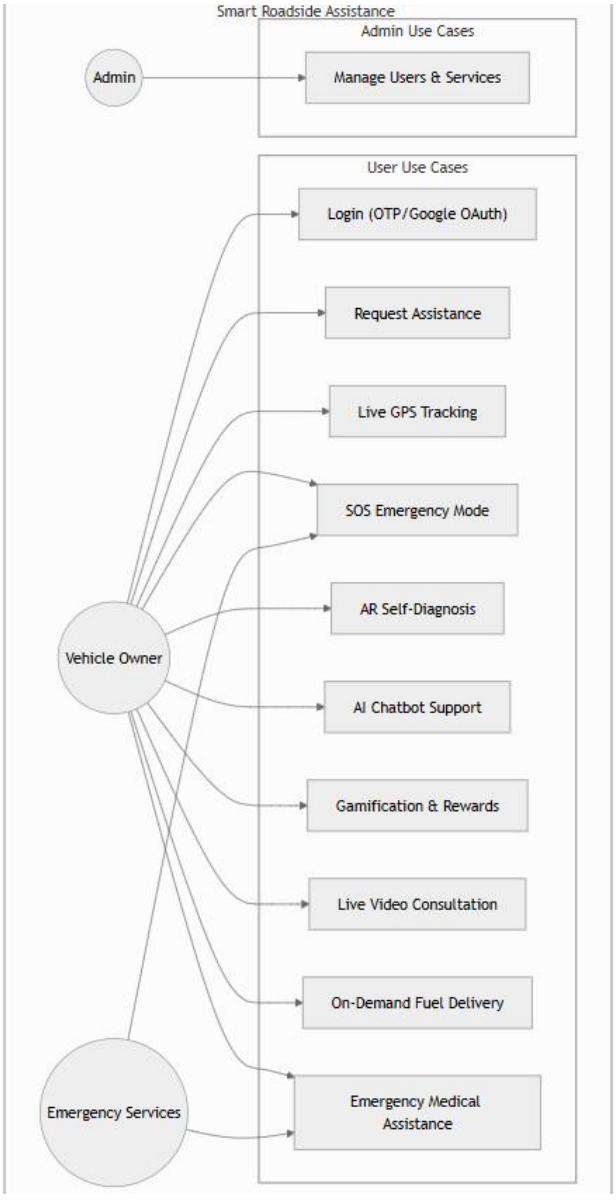
- If the issue is minor, users can **scan their vehicle** using an **AR-based interactive guide**.
- AI suggests **step-by-step repair instructions** for issues like **flat tires, battery issues, and engine overheating**.
- Users can attempt to fix the problem themselves or proceed to **request professional help**.

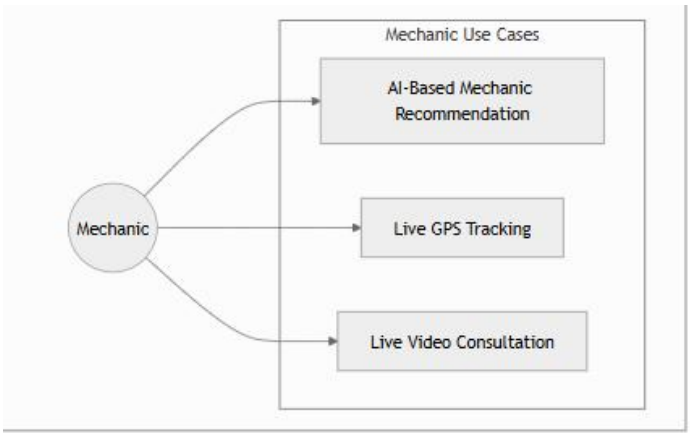
6. Gamification & Reward System

- Users earn **points, badges, and rewards** for using the app, booking mechanics, and completing AR-based repairs.
- A **dashboard displays achievements**, loyalty points, and premium service benefits.
- **Leaderboards and referral bonuses** encourage user engagement.

6. Use Case, Class And Sequence Diagram

6.1 Use Case Scenarios

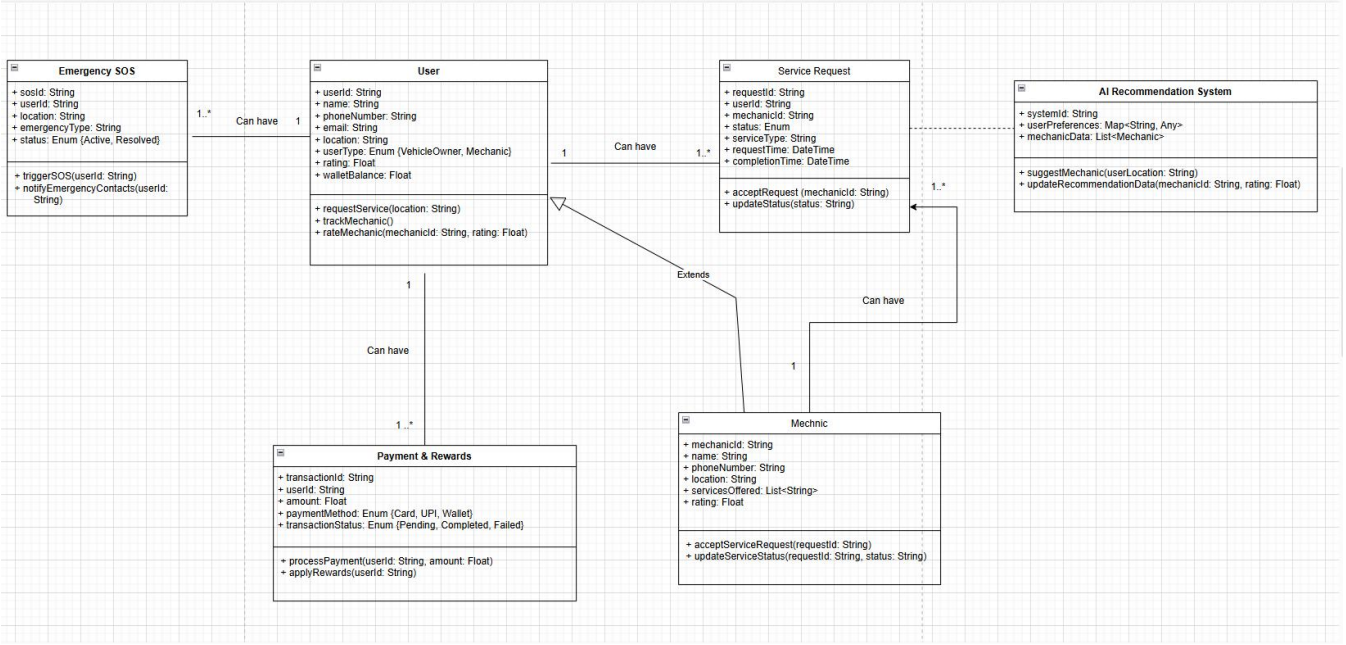




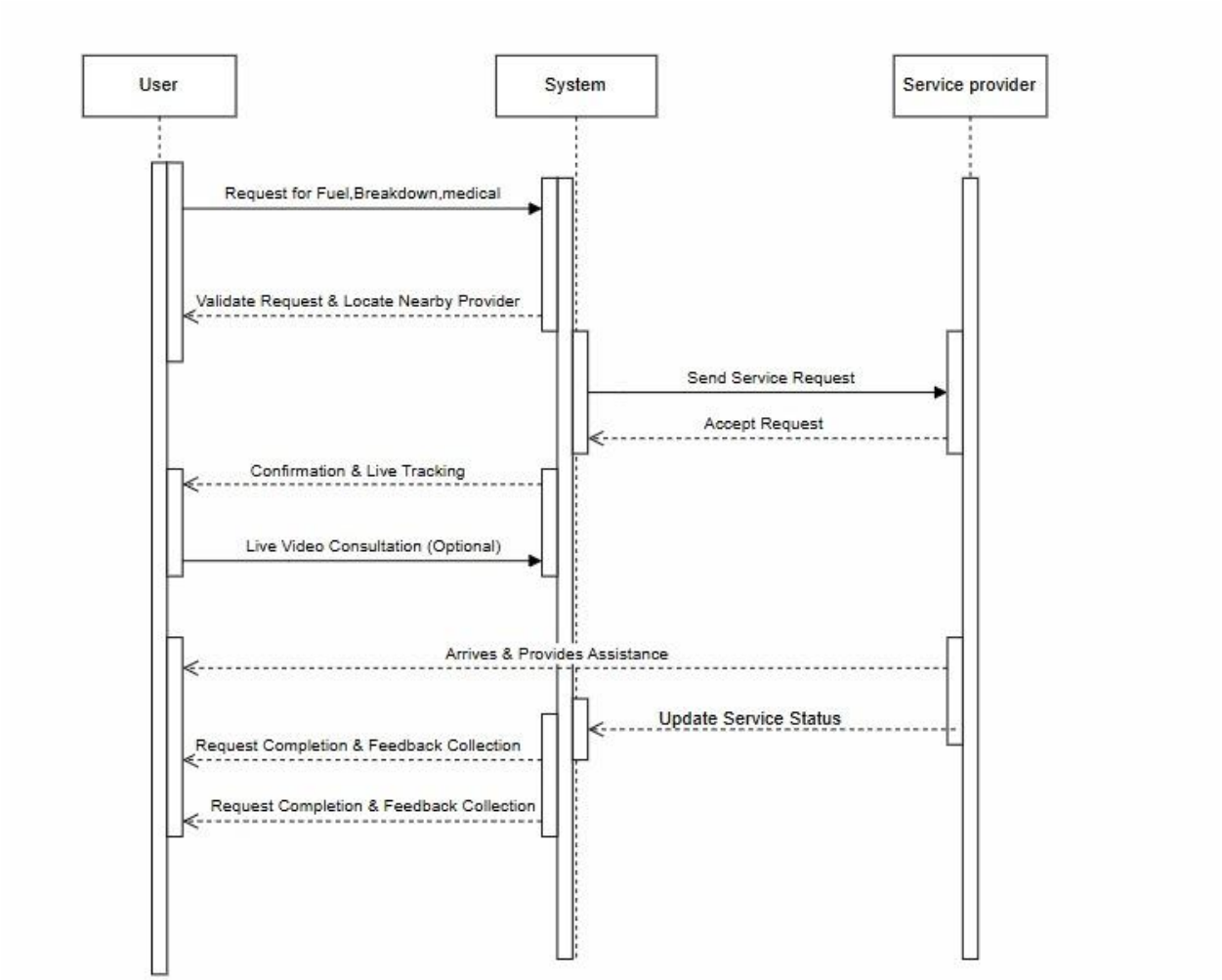
-

- **Scenario 1:** A user's car breaks down in an unknown area → AI recommends the nearest trusted mechanic → SOS alert is sent → Mechanic arrives and resolves the issue.
- **Scenario 2:** A minor car issue is detected → User scans using AR → AI suggests repair steps → Issue is resolved without a mechanic, saving time and cost.
- **Scenario 3:** A user frequently uses the app → Earns rewards & gets premium service benefits → Discounts on future repairs and priority assistance.
- **Scenario 4:** A fleet management company integrates the platform → Reduces vehicle downtime and improves operational efficiency.
- **Scenario 5:** An insurance company partners with the platform → Offers roadside assistance as part of their premium policies → Attracts more customers.

6.2 Class Diagram



6.3 Sequence Diagram



7.Market Need, Reach and Revenue Model

7.1 Market Need

- **Growing Demand:** Rapid expansion of vehicle breakdown services worldwide due to increasing vehicle ownership.
- **B2B Partnerships:** Potential collaborations with insurance companies, rental services, and fleet management firms to provide integrated roadside assistance.
- **Subscription Model:** Increasing preference for on-demand and subscription-based roadside assistance services for long-term vehicle support.
- **User Safety & Trust:** The need for reliable, AI-powered recommendations to ensure quick and trusted vehicle repairs, improving user safety.
- **Technological Advancements:** AI, AR, and GPS-enabled solutions revolutionizing the roadside assistance industry, making services faster and more efficient.
- **Competitive Advantage:** The platform's combination of AI recommendations, AR diagnostics, and gamification offers a unique approach compared to traditional services.

7.2 Market Reach

The **RoadGuard** aims to reach a wide audience by addressing the needs of different user segments.

User Segmentation:

Young Professionals:

1. **Age Group:** 22-35 years
2. **Key Needs:** Quick roadside assistance, transparent pricing, and digital payment options.
3. **Behavioral Traits:** Prefers app-based solutions, values efficiency and reliability.

College Students:

1. **Age Group:** 18-24 years
2. **Key Needs:** Affordable roadside assistance, emergency support, and DIY repair guides.
3. **Behavioral Traits:** Active on digital platforms, interested in learning basic vehicle maintenance.

Low-to-Middle Income Vehicle Owners:

1. **Key Needs:** Cost-effective roadside assistance without subscription burdens.
2. **Behavioral Traits:** Prioritizes emergency assistance over premium services, values transparency in service pricing.

Fleet & Commercial Vehicle Owners:

1. **Key Needs:** Predictive vehicle maintenance, bulk roadside assistance plans, and driver tracking.
2. **Behavioral Traits:** Businesses looking to reduce downtime and optimize vehicle operations.

Rental & Ride-Sharing Companies:

1. **Key Needs:** On-demand vehicle support, automated service allocation, and integration with fleet management systems.
2. **Behavioral Traits:** Companies seeking third-party partnerships for seamless customer support.

7.3 Revenue Model

The platform operates on a **multi-stream revenue model**, offering a combination of freemium services, premium subscriptions, and additional monetization methods.

1. Freemium Model

- **Free Features:**
  - Basic roadside assistance requests.
  - Chatbot for common vehicle issues.
  - Limited access to self-repair guides.
- **Premium Subscription Features:**
  - AI-based mechanic ranking for faster and quality assistance.
  - Priority response & tracking for real-time updates.
  - AR-based troubleshooting for minor car issues.
- **Subscription Pricing:**
  - **Monthly:** ₹199/month
  - **Annual:** ₹1999/year (discounted for long-term users)

2. On-Demand Service Payments

- **Emergency Roadside Assistance:**
    - Users can request instant services like towing, fuel delivery, and tire replacement at fixed rates.
- **Mechanic Video Consultation:**
    - One-time consultation fee for direct expert guidance.
- **AI-Powered Predictive Maintenance Subscription:**
    - Proactive alerts for potential vehicle failures based on AI analysis.

3. Advertising & Brand Partnerships

- **Automotive Service Advertisements:**
    - Partnering with car insurance companies, tire manufacturers, and fuel providers for sponsored promotions.
- **Insurance-Integrated Assistance Plans:**
    - Collaborations with insurance providers to bundle roadside assistance in their policies.

4. Gamification & In-App Purchases

- **Earning Points for Engagement:**
    - Users earn points by using the service, writing reviews, or referring friends.
    - Coins can be redeemed for premium features or discounts.
- **Direct Coin Purchases:**
    - Users can buy in-app currency for premium services.
    - **Pricing Example:**
        - 100 Points = ₹199
        - 500 Points = ₹999

8.Coding Approach

8.1 Development Strategy

Agile Implementation

The development follows an **Agile methodology** to ensure flexibility, iterative improvements, and rapid delivery.

Sprint Structure:

- **Sprint Duration:** 2 weeks
- **Key Ceremonies:**
    1. **Sprint Planning (Monday, Week 1):** Define objectives, assign tasks, and set deliverables.
    2. **Daily Stand-ups:** 15-minute team meetings to discuss progress, challenges, and upcoming tasks.
    3. **Sprint Review (Friday, Week 2):** Demonstrate completed features and collect feedback.
    4. **Sprint Retrospective (Friday, Week 3):** Analyze successes, identify areas for improvement, and refine the development process.

8.2 Development Phases

Phase 1: Core Platform Development

- **User Authentication & Security:**
    - **Firebase Auth** for secure user login, OTP verification, and role-based access.
    - Encrypted user data storage to maintain privacy and security.
- **Real-Time Assistance System:**
    - **Socket.io** for real-time mechanic tracking and emergency alerts.
    - **Google Maps API / Leaflet.js** for live GPS tracking of assistance providers.
- **Service Request Module:**
    - Users can request roadside assistance, fuel delivery, towing, or emergency support.
    - Mechanics and service providers receive instant notifications.

Phase 2: AI & AR Feature Implementation

- **AI-Based Mechanic Recommendations:**
    - **OpenAI / TensorFlow.js** for ranking mechanics based on distance, ratings, response time, and user history.
- **Augmented Reality (AR) Self-Diagnosis:**
    - **WebXR / Three.js / A-Frame** for interactive car self-diagnosis guides.
    - Users can scan their vehicles and get AI-powered troubleshooting suggestions.
- **AI Chatbot & Voice Assistance:**
    - **Google Dialogflow** chatbot for booking assistance via text or voice commands.

Phase 3: Enhancement & Optimization

- **Advanced Analytics & Reporting:**
    - Users can track their roadside assistance requests and receive predictive maintenance alerts.
    - AI-powered insights for fuel efficiency and vehicle health monitoring.
- **Gamification & Rewards System:**
    - Users earn loyalty points for repeat usage and referrals.
    - Discounts and premium features unlock based on engagement levels.
- **Mobile & Cross-Platform Support:**
    - **React Native** for mobile app compatibility (Android & iOS).
    - Progressive Web App (PWA) support for seamless access across devices.

8.3 Code Quality & Best Practices

- **Version Control:**
    - **GitHub** for collaborative development and version tracking.
- **Code Reviews & Documentation:**
    - Regular peer reviews to ensure maintainable and high-quality code.
    - Well-documented APIs and feature modules for easy future scaling.
- **Testing & CI/CD Deployment:**

- **Unit Tests:** Automated testing for core functionalities.
- **CI/CD Pipelines: Docker-based deployment** to streamline development-to-production transitions.
- Automated error monitoring for early issue detection and fixes.

9. Conclusion

RoadGuard is a smart roadside assistance platform designed to provide immediate help to vehicle owners in distress. By integrating **AI-based mechanic recommendations, real-time GPS tracking, AR self-diagnosis, and emergency response features**, RoadGuard ensures a seamless and efficient solution for vehicle breakdowns.

The platform tackles key challenges such as **difficulty in locating nearby mechanics, lack of predictive assistance, and delayed emergency responses** by offering **on-demand fuel delivery, live video consultations, and SOS emergency alerts**. With an AI-powered chatbot and gamification rewards, RoadGuard enhances user engagement while making roadside assistance more accessible and reliable.

By leveraging advanced technologies, **RoadGuard** transforms traditional roadside services into a modern, automated, and intelligent experience, ensuring safety, convenience, and efficiency for vehicle owners, fleet companies, and emergency responders.