AI- DRIVEN VEHICLE HELTH AND SERVICE INTELIGENCE SYSTEM

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Project Proposal Report

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1. Declaration

I hereby declare that this project proposal is the result of my own work carried out under the guidance of Mr. Nelum Chathuranga. The information presented here is based on my own research, analysis, and understanding, except where references have been explicitly made.

I further declare that this proposal has not been submitted, in whole or in part, for the award of any degree, diploma, or other qualification at any other institution.

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Statement of the supervisor and co-supervisor, The above candidates are carrying out research for the undergraduate dissertation under my supervision.

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Supervisor Co-supervisor

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2. Abstract

Efficient vehicle assistance is essential for ensuring road safety, enhancing convenience, and minimizing downtime, particularly in Sri Lanka, where many small garages operate without real-time coordination. This project presents an AI-driven mobile application that uses a conversational chatbot to guide vehicle owners in reporting car issues, determining whether the vehicle is drivable, and arranging repairs. Users describe problems such as “My engine is overheating” or “Brake not working,” and the chatbot, built with Rasa NLP, identifies the fault category and type. It then asks if the car can be driven, branching into two paths: if drivable, the system queries nearby garages via Google Maps API for travel distance and ETA, then applies a machine learning ranking model to suggest the best garages based on queue length, available employees, user ratings, and predicted repair time; if not drivable, the platform dispatches the nearest available mechanic with real-time ETA and location tracking. Users can book services, track repair progress, and provide feedback, while actual repair and waiting times are stored to retrain and improve the ranking and ETA models. By combining conversational AI, predictive modeling, and location-based services, this system overcomes limitations in existing Sri Lankan solutions that offer static garage listings without intelligent recommendations or dispatch support. The application enhances convenience, reduces waiting times, and fosters trust among vehicle owners, mechanics, and garages. Furthermore, the data collected enables workshops to optimize operations and improve service efficiency. Overall, this project presents the inaugural all-encompassing intelligent garage recommendation and repair time estimation platform in Sri Lanka, thereby enhancing the accessibility, efficiency, and reliability of vehicle assistance.

Keywords: Conversational AI, Natural Language Processing, Garage Recommendation System, ETA Prediction

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6. Introduction

Quick and reliable support for automotive breakdowns is essential to prevent accidents, reduce downtime, and improve convenience for vehicle owners. Traditional methods—calling helplines or visiting repair shops—can be slow, inconsistent, and often lack transparency. Recent advancements in AI and mobile technology enable smarter solutions. Globally, chatbots have been used in automotive services to provide repair estimates, schedule appointments, and guide vehicle owners through maintenance procedures (prnewswire.com). Similarly, GPS-enabled apps connect drivers to nearby mechanics (ijraset.com).

In Sri Lanka, several mobile applications exist, such as MyMec and Garage Finder, which connect users to garages or mechanics based on location. However, these systems primarily provide static listings without considering real-time repair workloads, predicted repair durations, or service quality ratings. They also lack the capability to intelligently dispatch mechanics for vehicles that are not drivable, leaving vehicle owners without timely and optimized support.

Our project addresses this gap by introducing an AI-driven mobile application with a conversational chatbot interface. Users describe their car problems in natural language (e.g., “My brakes are squealing” or “Engine overheating”). Using Rasa NLP, the chatbot identifies the fault category and type, and asks whether the car is drivable. Based on this response, the system either:

- Drivable: Recommends nearby garages by combining Google Maps API for distance and ETA with a machine-learning ranking model that accounts for queue length, available employees, predicted repair time, and user ratings.
- Not drivable: Dispatches the nearest available mechanic with real-time ETA and location tracking.

Users can book appointments, track repair progress, and provide feedback. The system records actual repair and waiting times to retrain the ML models, improving future recommendations.

Project Scope and Objectives

The proposed solution is a mobile/web application designed for Sri Lanka's automotive ecosystem. Its scope includes: capturing user-reported faults via the chatbot, classifying fault type and drivability, recommending or dispatching garages/mechanics using AI and mapping APIs, tracking repair status, and collecting user feedback. The objectives are:

1. Accurate understanding of user-described faults via NLP.
2. Robust determination of vehicle drivability.
3. Real-time mapping integration for garage selection or mechanic dispatch.
4. Intelligent ranking of garages based on predicted repair time, queue, and ratings.
5. A user-friendly conversational interface guiding vehicle owners seamlessly.

Importance and Relevance

Sri Lanka has high mobile penetration (over 32 million active connections, 148% of the population), creating an ideal environment for AI-powered mobile solutions (datareportal.com). By providing timely, data-driven garage recommendations and mechanic dispatch, the system improves convenience, reduces waiting times, and builds trust among users. Garages benefit from optimized workloads, better customer service, and data-driven insights, while vehicle owners gain access to reliable, intelligent support. This project delivers the first end-to-end, intelligent garage recommendation and repair time estimation platform in Sri Lanka, enhancing vehicle assistance efficiency, accessibility, and road safety.

7.Background & Literature Review

The rapid growth of intelligent systems has transformed the way industries deliver services, and the automotive sector is no exception. Existing research highlights the importance of integrating artificial intelligence, natural language processing, and location-based services to improve fault detection and vehicle assistance. For instance, several studies have explored chatbot-based fault reporting, where users describe issues in natural language and the system identifies relevant fault categories. This reduces communication gaps between vehicle owners and service providers, ensuring faster response times.

In the Sri Lankan context, most digital solutions remain limited to listing garages by location, offering static contact details without intelligent decision-making or predictive recommendations. International platforms, such as OnStar and Bosch Car Service solutions, demonstrate how advanced systems can integrate real-time vehicle diagnostics, emergency assistance, and mechanic dispatching. However, these services are not widely available in Sri Lanka due to infrastructure limitations, cost barriers, and lack of localized customization.

Scholars also emphasize the role of predictive analytics in service optimization. Machine learning models trained on historical data can estimate repair times, mechanic availability, and queue lengths, enabling both users and service providers to make informed decisions. Additionally, studies on customer-centric platforms show that incorporating user feedback and service ratings enhances trust and ensures higher adoption rates.

Despite these advancements, a clear research gap exists in the Sri Lankan automotive ecosystem. Current solutions lack real-time adaptability, data-driven recommendations, and fault-aware conversational interfaces. This project addresses these gaps by combining AI-driven chatbot fault recognition, intelligent garage matching, and predictive repair time estimation into a unified platform tailored to the Sri Lankan context.

8. Research Gap

Although digital automotive service platforms have been introduced both locally and globally, significant limitations remain in the Sri Lankan context. Most existing applications are limited to directory-style listings of garages or simple location-based searches, offering little to no intelligent decision-making support. These solutions do not help users identify the nature of vehicle faults, estimate repair times, or match with the most suitable garage based on workload, expertise, or proximity. As a result, drivers still face uncertainty in emergencies, often relying on guesswork or time-consuming phone calls.

International platforms demonstrate how artificial intelligence, real-time diagnostics, and predictive analytics can transform vehicle assistance. However, such systems are either unavailable or unsuitable for Sri Lanka due to high costs, lack of localized datasets, and infrastructure constraints. Additionally, the few applications that exist locally do not integrate chatbots or conversational interfaces, which could make fault reporting and garage booking more intuitive and accessible to non-technical users.

Therefore, there is a clear research gap in developing an AI-powered, user-friendly, and context-specific solution that not only connects users with nearby garages but also intelligently interprets faults, predicts repair timelines, and enhances overall service efficiency. Addressing this gap has the potential to modernize the Sri Lankan automotive service ecosystem and provide a reliable, scalable framework for future innovations.

9. Research Problem

In Sri Lanka, vehicle breakdowns are a common challenge faced by daily commuters, long-distance travelers, and even occasional drivers. When such issues occur, many individuals struggle to properly identify the fault in their vehicle, often leading to confusion, stress, and delays in decision-making. While some mobile applications and online platforms exist to provide garage listings or connect users with nearby mechanics, these solutions are limited in scope. They typically function only as location directories without offering meaningful guidance on the type of fault, the urgency of the situation, or whether the vehicle remains drivable.

This lack of intelligent support creates significant inconvenience for users. A driver may be uncertain whether an overheating engine requires immediate towing, or if a weak battery can still allow short-distance driving. Without clear direction, vehicle owners are left to rely on guesswork, which may result in costly mistakes, safety risks, and wasted time. Furthermore, the absence of an integrated system that connects fault detection with repair recommendations reduces trust in the effectiveness of existing platforms.

Therefore, the research problem lies in the absence of a comprehensive, AI-driven solution that can interpret user-described vehicle symptoms, determine the drivability of the vehicle, and intelligently match the issue with the most suitable garage. Addressing this problem is crucial to improving user experience, reducing delays, and creating a more reliable automotive support system for Sri Lankan drivers.

10. Main and Sub Objectives

10.1Main Objective

The primary objective of this research is to design and develop an intelligent garage recommendation system tailored to the needs of Sri Lankan drivers. Unlike existing applications that only provide basic garage listings or mechanic contact details, this system aims to go beyond by offering a complete solution. It will identify possible faults based on user inputs, determine whether the vehicle can still be driven safely, and then recommend the most suitable nearby garage based on expertise, availability, and estimated repair time. The ultimate purpose of this objective is to reduce the stress and uncertainty faced by drivers during sudden breakdowns, enhance road safety by preventing risky driving decisions, and provide a convenient platform for booking and tracking garage services.

10.2 Sub-Objectives

1. **To study the common challenges faced by drivers in Sri Lanka when dealing with vehicle breakdowns** and identify recurring pain points, such as difficulty in fault recognition, uncertainty about drivability, and lack of trust in garage selection.

2. **To develop a natural-language chatbot interface** that allows users to explain their vehicle symptoms in simple everyday terms, without requiring technical automotive knowledge. This will make the system accessible to a wider range of users.

3. **To design and integrate a drivability-checking feature** that advises whether a vehicle can be safely driven to a garage or requires immediate towing, helping drivers make informed and safe decisions on the road.

4. **To build a garage recommendation engine** that matches users with the most suitable garages by analyzing fault type, location, repair expertise, availability, and estimated service time, ensuring drivers receive quick and reliable assistance.

5. **To implement a booking and job-tracking system** that allows users to reserve services at selected garages and monitor the repair progress, reducing uncertainty and improving transparency in service delivery.

6. **To create a user-friendly interface with strong usability and accessibility** so that drivers of all backgrounds can benefit from the system without facing technological barriers.

7. **To conduct user testing and collect feedback** in order to evaluate the system's effectiveness, usability, and practicality, and refine it into a reliable real-world solution thatgenuinely improves the driver experience.

11. Methodologies

11.1 Overall System

The proposed system, *Humaize Garage Recommendation System*, will be developed as a web-based and mobile-accessible application, enabling users to receive real-time assistance during vehicle breakdowns. The overall methodology will follow a **layered development approach**, ensuring each feature is designed, tested, and integrated progressively.

The process begins with a **requirement analysis phase**, where user needs (drivers, garages, and mechanics) are studied to clearly identify system functionalities. This will be followed by **system design**, where architectural diagrams, data flow diagrams (DFD), and interface prototypes will be prepared.

Next, the **development phase** will adopt an **Agile methodology**, dividing work into small iterations to continuously refine features such as the chatbot, drivability check, and garage recommendation engine. Agile ensures that feedback from users and supervisors can be incorporated regularly.

The **testing phase** will include both **unit testing** (to test individual modules like the chatbot and booking system) and **system testing** (to evaluate performance, accuracy, and usability). Finally, the system will be deployed in a controlled environment, and feedback from real drivers and garage owners will be collected to validate its effectiveness.

The overall system workflow can be summarized as:

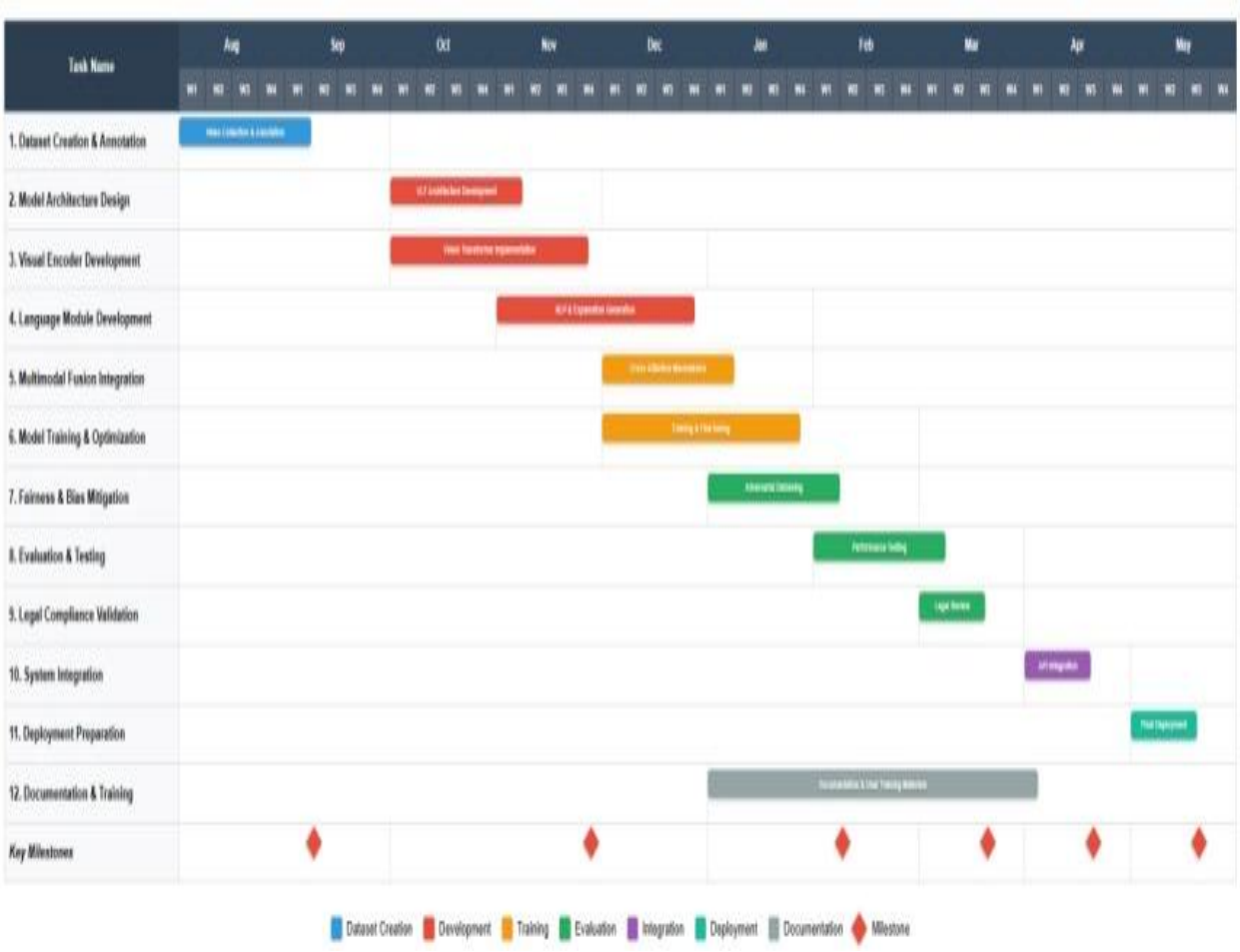
1. **Fault Detection → Drivability Check → Garage Recommendation → Booking → Tracking → Feedback**

11.2 Individual System Components

The system is divided into the following major components:

1. **Chatbot Module**
    - Uses Natural Language Processing (NLP) to allow users to describe vehicle symptoms in simple terms.
    - Maps user inputs to likely vehicle faults using a predefined knowledge base.
    - Provides immediate guidance without requiring technical knowledge from the driver.
2. **Drivability Assessment Module**
    - Analyzes fault type and severity to determine if the vehicle can be driven safely or requires immediate towing.
    - Prevents accidents and ensures user safety during breakdown situations.
3. **Garage Recommendation Engine**
    - Uses algorithms to recommend the most suitable garages based on location, fault expertise, garage availability, and estimated repair time.
    - Prioritizes efficiency, reliability, and customer satisfaction.
4. **Booking & Scheduling System**
    - Allows users to make real-time bookings with garages.
    - Manages garage schedules and ensures service requests are handled in order of priority.
5. **Tracking & Notification System**
    - Provides real-time updates on repair progress, estimated completion time, and job status.
    - Improves transparency and reduces driver stress.
6. **Feedback & Review Module**
    - Enables drivers to share experiences after garage visits.
    - Helps improve service quality and builds trust within the system.

12. Gantt Chart



13. Project Requirements

The project requirements are divided into **functional requirements**, **non-functional requirements**, and **technical requirements**.

13.1 Functional Requirements

- The system must allow users to input vehicle problems using natural language.
- The chatbot must identify possible faults based on symptoms.
- The system must check if the vehicle is drivable or requires towing.
- The system must recommend suitable garages based on location, expertise, and availability.
- The system must allow garage booking and display estimated repair times.
- The system must provide real-time notifications and updates to users.
- The system must allow users to rate and review garages after service.

13.2 Non-Functional Requirements

- **Usability**: The interface must be simple, intuitive, and accessible to users with minimal technical knowledge.
- **Reliability**: The system must provide accurate recommendations and function with minimal downtime.
- **Performance**: The system should provide responses (chatbot answers, recommendations) within 3–5 seconds.
- **Security**: User data, including personal details and location, must be securely stored and transmitted.
- **Scalability**: The system should handle increasing numbers of users and garages without performance issues.

13.3 Technical Requirements

- **Frontend**: React.js (for web) / React Native (for mobile app).
- **Backend**: Node.js with Express framework.
- **Database**: MySQL or MongoDB for storing user, garage, and booking data.
- **NLP/Chatbot**: Integration with Dialogflow or a custom-trained NLP model.
- **Hosting**: Cloud deployment (e.g., AWS / Firebase / Her

14. Commercialization

14.1 Budget

The following costs are estimates for the initial deployment and ongoing operation of the mobile audio-based vehicle fault detection system. These values may vary based on actual usage, market fluctuations, and scaling needs.

Description	Estimated Cost	Notes
Server Hosting	LKR 10,000 / Month	To run backend services and host machine learning models.
App Store Hosting	LKR 8,000 (One-Time)	Apple Developer account fees for iOS app release.
Play Store Hosting	LKR 32,000 / Year	Google Developer account fees for Android app.
Cloud Storage (AWS S3)	USD 0.023 per GB / Month	For storing audio data and diagnostic reports securely.
Initial Development & Testing	LKR 250,000 (Approx.)	Covers app development, ML model training, and pilot testing.

14.2 Commercialization Methods

Sri Lanka's mobile market is experiencing robust growth, driven by increasing smartphone penetration, expanding high-speed data networks, and a growing digital economy valued at over $1.4 billion. This creates a fertile landscape for digital solutions targeted at vehicle diagnostics [4].

Target Users: The solution will focus on individual vehicle owners, mechanics, small workshops, and automotive service centers throughout Sri Lanka.

Product Offering:

- Mobile Application: Enables vehicle owners to record vehicle sounds, run fault diagnostics, and receive real-time actionable reports on their mobile devices.
- Web Dashboard: Designed for mechanics and service providers to access detailed fault analyses, historical diagnostics, and maintenance trend insights.

Revenue Model:

- Freemium Tier: Basic features such as audio recording and preliminary fault detection will be free to encourage widespread adoption.
- Premium Subscription: Subscription plans will provide access to advanced diagnostics, fault history logs, cloud storage, and priority customer support.

Marketing Strategy:

- Forge partnerships with automotive service centers, dealerships, and insurance companies to boost reach and credibility.
- Digital campaigns leveraging social media, app stores, automotive forums, and online communities popular in Sri Lanka.
- On-site demonstrations at auto service events and expos to build trust and user familiarity.

Scalability:
Initially launching in Sri Lanka, the system is designed for seamless expansion into other South Asian markets with similar vehicle maintenance demands and high smartphone usage.

Risk Considerations:
Challenges include overcoming skepticism about mobile-based diagnostics, competition from traditional ECU systems, and compliance with stringent data privacy and security requirements. Proactive mitigation of these risks is essential for long-term sustainability.

15. References

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