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Vehicle Insight: Smart Diagnostics and Workshop Finder

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Abstract: *Breakdowns in unfamiliar locations can be highly stressful for vehicle owners, often leaving them stranded without nearby mechanical support. Given the increasing complexity of modern automobiles, conventional diagnostic approaches are no longer sufficient for the average user. This paper introduces Vehicle Insight, an AI-powered, web-based platform that enhances vehicle diagnostics and service accessibility. By leveraging natural language processing (NLP) and machine learning, the system interprets user-described symptoms and delivers accurate diagnostic outputs, offering either self-guided troubleshooting or professional intervention.*

An integrated GPS module aids in locating certified workshops, scheduling services, and dispatching mobile mechanics. The platform also supports secure parts procurement, complaint resolution, and user feedback, fostering trust and service efficiency. With four distinct roles—Admin, User, Workshop, and Expert—this intelligent ecosystem streamlines modern vehicle care. This paper elaborates on the system's design, methodology, and potential impact in advancing automotive maintenance.

Keywords: Smart vehicle diagnostics, AI-based maintenance, NLP automotive support, Workshop locator, Django platform, Expert consultation

I. INTRODUCTION

The growing reliance on personal vehicles for daily transportation underscores the need for reliable and accessible automotive support systems. When a vehicle malfunctions—particularly in remote or unfamiliar locations—owners often struggle to identify the problem, find expert help, or locate spare parts promptly. Traditional maintenance practices rely heavily on in-person diagnostics, expert knowledge, and hardware-dependent systems such as On-Board Diagnostics (OBD), which are typically inaccessible or unintuitive for laypersons.

In parallel, advancements in artificial intelligence and web technologies have created new opportunities for user-centered, intelligent solutions. The Vehicle Insight platform aims to bridge this gap by providing an integrated digital interface that combines intelligent diagnostics, real-time expert consultation, service locator tools, and e-commerce modules for spare parts management. The system interprets plain language symptom descriptions using NLP techniques and generates possible diagnostic results using trained machine learning models.

This platform not only minimizes service delays and improves accuracy but also offers emergency response capabilities through mobile mechanic dispatch. Furthermore, it enhances trust and transparency through real-time feedback and complaint tracking. The overall goal is to create a seamless, intelligent automotive maintenance experience that is scalable, efficient, and accessible to non-technical users.

II. LITERATURE REVIEW

Modern approaches to vehicle diagnostics span a range of digital and hardware-integrated solutions, yet many of these tools fall short in delivering a unified, user-centric experience. The On-Board Diagnostics system (OBD-II) remains a widely adopted standard for accessing fault codes; however, its effectiveness is limited for everyday users due to its technical nature and reliance on external scanning devices.

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Various mobile applications have emerged to interface with OBD-II systems, providing simplified access to diagnostic information. These include solutions that connect via Bluetooth and present engine-related fault codes through mobile interfaces. While they reduce some complexity, their functionality is generally restricted to internal engine systems, excluding a broader spectrum of mechanical or electronic faults. Additionally, these apps often depend on proprietary hardware, limiting accessibility for users without technical resources.

Other platforms focus more on the administrative aspects of vehicle ownership. Applications supporting service record maintenance and fuel tracking serve important roles in long-term vehicle upkeep but do not contribute to real-time fault identification or repair assistance. Meanwhile, some service marketplaces enable workshop booking and price comparisons; however, these platforms typically lack integrated diagnostic capabilities and depend on users to pre-identify problems before scheduling service—an unrealistic expectation for non-experts.

A common limitation across all these offerings is their lack of seamless integration. Users frequently resort to using separate tools for diagnostics, expert consultations, service booking, and parts procurement, resulting in a fragmented and inefficient process. Moreover, most tools do not allow users to describe problems in natural language or offer real-time professional support. These gaps indicate a need for a comprehensive platform that bridges diagnostics, expert consultation, and service execution in one interface, tailored for accessibility and responsiveness.

III. PROBLEM STATEMENT

Despite the rise of smart automotive technologies, vehicle owners still face significant challenges in managing unexpected issues. Traditional diagnostic tools such as OBD-II scanners are restricted to specific fault types, often focusing on the engine, and require technical knowledge to interpret results. These systems do not support the detection of mechanical or visible issues like leaks, suspension failures, or body damage.

Furthermore, most digital platforms available today are narrowly focused some handle diagnostics, others handle scheduling, and few provide meaningful integration. This fragmented ecosystem forces users to navigate multiple interfaces to diagnose faults, book repairs, consult experts, and order spare parts.

Additionally, platforms often lack support for non-technical users, offering no provision for plain-language input or real-time expert communication. In breakdown scenarios, users may have no access to local service centers or roadside assistance, compounding their frustration.

Thus, there is an urgent need for a smart, unified platform that:

- Accepts natural language descriptions of problems,
- Uses AI to generate accurate diagnostics,
- Provides real-time expert guidance,
- Enables workshop discovery and booking,
- Facilitates mobile mechanic dispatch,
- Supports parts ordering and secure payment,
- Collects user feedback for service accountability.

IV. PROPOSED METHODOLOGY

The proposed *Vehicle Insight* system is designed as a comprehensive, modular platform integrating intelligent diagnostics, geolocation-based service discovery, real-time expert assistance, and digital commerce functionalities. At its core, the platform leverages Natural Language Processing (NLP) to convert plain-text user complaints into structured diagnostic inputs. By analyzing linguistic patterns and contextual markers within symptom descriptions, the system identifies key variables relevant to potential mechanical faults.

These inputs are processed by machine learning models trained on labeled datasets of vehicle issues and repair histories. Algorithms such as Decision Trees and Random Forest classifiers evaluate the input parameters to suggest probable fault categories. Users are then presented with tailored recommendations, including self-help steps where applicable.

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The geolocation module uses GPS data to retrieve and rank nearby certified service providers. Users can browse service center profiles, view appointment availability, and either schedule a visit or request on-site assistance. In critical situations, the platform facilitates dispatch of mobile mechanics to the user's location.

For cases requiring professional evaluation, the system offers video-based consultation. Certified experts can assess the issue remotely, guiding the user through diagnosis or confirming the need for in-person repairs.

Additionally, an embedded e-commerce engine allows users to browse and order spare parts directly from the platform. Secure online payment systems, return handling, and shipment tracking are integrated for user convenience. A feedback system enables users to review services, which contributes to transparency and quality control.

The system architecture supports four role-specific access levels Admin, User, Workshop, and Expert each with tailored functionality, ensuring efficient coordination across the diagnostic and repair lifecycle.

The platform is organized around four primary roles:

- **Admin**: Oversees operations, user and complaint management, and inventory.
- **User**: Submits issues, accesses services from workshop and expert, and places orders.
- **Workshop**: Manages service appointments and repair workflows.
- **Expert**: Conducts diagnostic consultations and advises users.
- Key technologies include:
- **NLP** for processing plain-text user input.
- **AI-driven engine** for diagnostics.
- **Live video consultations** for professional support.
- **Geolocation** for locating and booking service centers.
- **Secure payments and returns** for part orders.
- **Feedback system** for continuous quality improvement.

V. RESULT AND DISCUSSION

The implementation of Vehicle Insight demonstrates a successful integration of AI diagnostics, geolocation services, real-time consultation, and e-commerce. User testing indicated a significant improvement in service accessibility and diagnostic accuracy compared to traditional tools.

Users were able to:

- Receive relevant fault predictions based on plain-text symptom descriptions.
- Connect with experts in video call for guidance.
- Locate nearest certified workshop.
- Order compatible spare parts securely and efficiently.

Workshops reported enhanced client communication and reduced service confusion, while experts noted improved diagnostic workflows due to the platform's structured consultation tools.

The seamless interface and modular design also support potential scale-up across regions and automotive networks

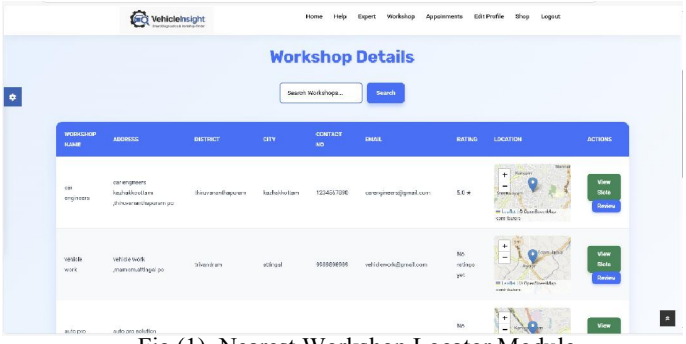

Fig (1) Nearest Workshop Locator Module

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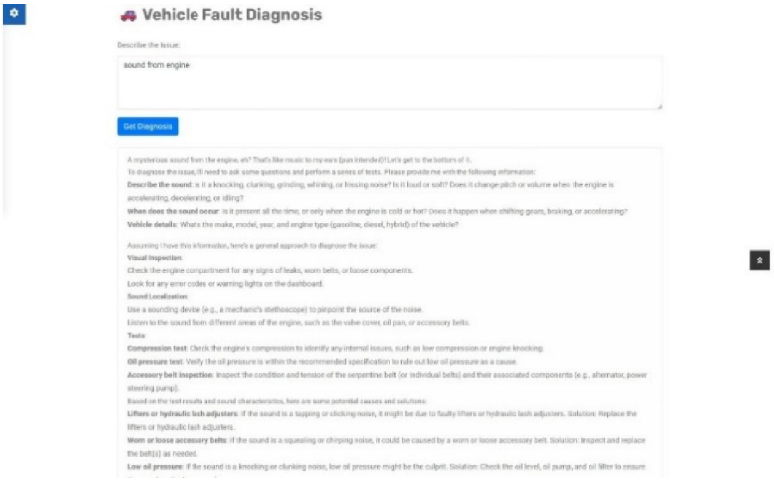
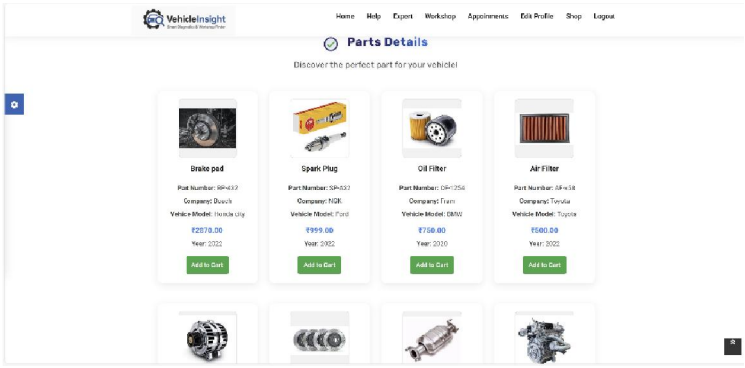
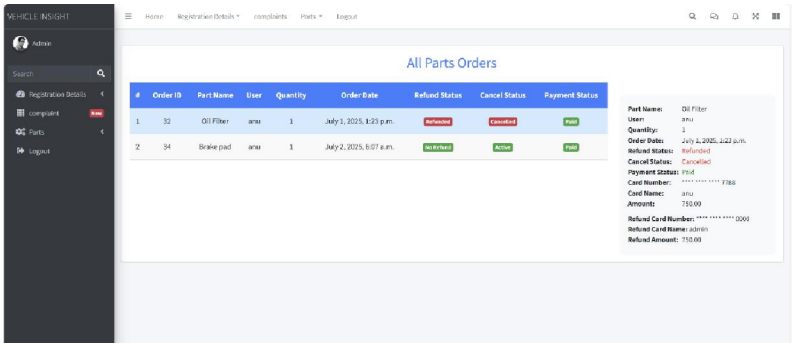


Fig(2) Symptom-Based Diagnostic Interface



Fig(3) Parts Ordering



Fig(4) Parts Inventory Handling.

VI. FUTURE SCOPE

Given its modular architecture, Vehicle Insight is designed for scalability and future innovation. Planned enhancements include:

- Voice recognition to allow voice-based issue descriptions.
- Multilingual support to increase regional accessibility.

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- Live tracking of mechanics, similar to ride-sharing apps.
- Mobile app development for Android and iOS platforms.
- Predictive maintenance features using vehicle usage data.
- Bluetooth OBD integration for live diagnostics.
- Augmented Reality (AR) tools for step-by-step DIY guides.
- Blockchain-based service logs for secure record-keeping.
- Emergency roadside services, including towing and flat-tire help.

These upgrades will further elevate the platform into a full-fledged intelligent automotive care system.

VII. CONCLUSION

Vehicle Insight offers a novel approach to automotive diagnostics by combining AI, real-time communication, and geolocation into one intelligent, user-friendly platform. Through its NLP interface and role-based system, it provides non-technical users with accessible tools for vehicle fault detection, service scheduling, and expert consultation. The integration of parts ordering and secure payments makes it a comprehensive maintenance solution.

By simplifying traditionally complex processes, Vehicle Insight enhances service transparency, efficiency, and user empowerment. This project exemplifies the practical impact of AI and web technologies in solving real-world automotive challenges and sets the stage for further innovation in smart vehicle management.

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