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Roadside Assistance for Vehicle Breakdown

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Android's dominant market share in the Smartphone industry makes it the ideal platform for reaching the largest audience of vehicle owners. The Android ecosystem provides robust development tools and resources, facilitating efficient and effective app creation. Additionally, Android's open-source nature and extensive API library enable seamless integration with various vehicle diagnostics and location services. The Existing roadside assistance system for vehicle breakdowns relies on service networks, insurance companies, and auto clubs, accessed via help lines or mobile apps. It provides services like minor repairs, tire changes, and towing. However, response times and service availability can vary due to factors like location, traffic, and personnel availability, with limited coverage in some areas affecting the efficiency of assistance. The Existing system has drawbacks like delays in admin approval, network dependency, limited mechanics in rural areas, platform dependence, and poor mechanic monitoring. So, we propose Dijkstra's algorithm to reduce delays, create a network-independent and platform-independent system, and improve mechanic availability and monitoring.

Keywords:
Android market share, Smartphone industry, Android ecosystem, API library, Vehicle diagnostics, Service network ,Network dependency, Platform independence, Mechanic monitoring, Dijkstra's algorithm.

I. INTRODUCTION

Roadside assistance is an essential service designed to support drivers in the event of unexpected vehicle breakdowns, ensuring both safety and convenience. Vehicle malfunctions such as engine failure, battery problems, flat tires, and other mechanical issues can occur without warning, leaving drivers stranded and vulnerable, particularly in remote or unfamiliar locations. These breakdowns can lead to significant delays, disruptions in daily life or travel plans, and, more importantly, pose serious safety risks to both drivers and passengers. Traditional roadside assistance has primarily been focused on providing immediate help, such as towing services, fuel delivery, flat tire changes, jumpstarts, and minor repairs on-site. Over the years, these services have evolved, adapting to the growing demands of modern transportation and the need for faster, more reliable assistance.

The demand for immediate and reliable assistance in vehicle breakdown situations has led to the development of mobile applications that leverage GPS-based location services and real-time connectivity. Solutions like "Visit Mechanic" and "On Road Vehicle Breakdown Assistance" illustrate the transformative role of technology in addressing vehicular emergencies. These systems are designed to connect users with a comprehensive network of certified mechanics, especially in remote or unfamiliar areas, where access to assistance may be limited. By integrating GPS and Firebase Cloud Messaging (FCM), users receive prompt notifications and can locate nearby mechanics within a specific radius[1][2]. Key features of these applications include real-time assistance, location-based service search, and user feedback mechanisms, all of which work to ensure efficient, reliable, and user-centered solutions. This is particularly beneficial for drivers encountering sudden vehicle issues, as the system provides rapid support, often reducing downtime significantly. Furthermore, these applications incorporate privacy and data protection measures to safeguard user information, while also offering features like feedback mechanisms to improve service reliability and quality over time[1][2].

II. LITERATURE OVERVIEW

Bheema Yugandhar Reddy, Boorla Sairam, R. M. Gomathi, and K. Nithya developed an Android application to track automobile service centers in *Tracking of Automobile Service Centers Using Android Application (Visit Mechanic)*. The app uses GPS and Firebase to store service center locations and notifies users of nearby shops when they enter a specific radius. Through the app, users can view service center details and get directions. The system aims to enhance user convenience by automating the process of locating and accessing vehicle repair services[1].

Prajwal Wagh, Kunal Patil, Khushboo Kosrabe, and Prof. Chetan Padole developed the "On Road Vehicle Breakdown Assistance" system to provide real-time support for vehicle emergencies in remote or unfamiliar locations. This system connects users with a network of licensed mechanics, enabling location-based searches for nearby help. It focuses on timely, reliable assistance through GPS tracking and real-time communication, promoting user convenience and confidence during breakdowns[2].

P V Sri Ram, Dr. R Prema, and Surya Prakash L N introduced a user-centric platform in *Drive Time Vehicle Breakdown Assistance*. This system integrates a chatbot for seamless communication with nearby mechanics and provides tutorials for common vehicle issues to promote user self-reliance. The platform also allows users to locate nearby petrol stations and rate mechanics to ensure transparency. It focuses on quick, reliable assistance, especially during breakdowns, enhancing both convenience and safety for drivers[3]

Heena Habib Mandal, Pournima Subhash Gawade, Sujata Bapu Neharkar, and S.Y. Mandlik examined emergency vehicle breakdown services and the challenges travelers face when their vehicles encounter unexpected problems in unknown areas in *Application Based Smart Vehicle Breakdown Assistance*. They proposed an Android application that utilizes Dijkstra's algorithm to find nearby mechanics based on the user's location. The app provides a simple, user-friendly interface for drivers to request assistance and connects them to local service providers via real-time data from Google Firebase[4].

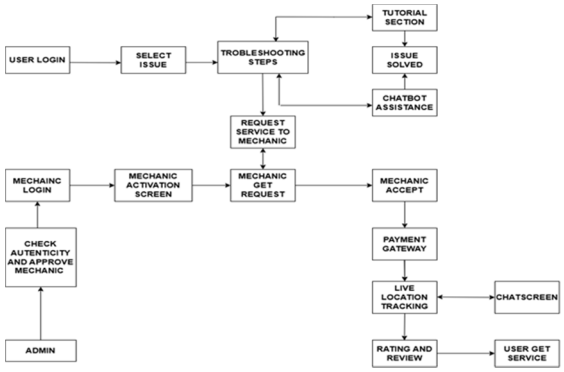
Sagar N. Udapure, Pallavi S. Goswami, Rucha V. Bhusari, Ranjana M. Donarwar, and Prof. Rahul R. Naitam explored solutions for vehicle breakdowns in *On Road Vehicle Breakdown Assistance Search (ORVBAS)*. Their work focuses on developing an application that connects users with nearby mechanics when their vehicle breaks down, ensuring trustworthy service by only enlisting approved mechanics. The system features modules for admin, user, and mechanic functions, enabling users to register, locate, and contact mechanics quickly, ultimately saving time and making the experience more convenient[5].

III. PROPOSED WORK

The proposed roadside assistance system aims to deliver swift and reliable support for vehicle breakdowns by leveraging real-time GPS technology to connect drivers with the nearest service providers. Featuring an intuitive interface accessible via mobile app, web platform, or phone call, the system ensures quick requests for help, transparent cost estimates, and real-time updates. Designed to improve response times and enhance user experience, this system will address common challenges and offer efficient solutions for drivers in need of immediate assistance.

The proposed system addresses key limitations such as delays in manual processes, network dependency, platform compatibility, and monitoring inefficiencies. By implementing automated redirection, local service centre tracking, multi-platform support, faster approvals through Dijkstra's Algorithm, and continuous mechanic monitoring, the system ensures faster, more reliable, and efficient roadside assistance. These improvements will enhance the overall user experience and reduce response times, making the system more dependable in both urban and rural settings.

In addition, the system incorporates a secure and flexible payment gateway offering multiple modes like UPI, cards, wallets, and cash on delivery to cater to user preferences. With real-time mechanic tracking and customer support integration, users are kept informed at every stage of the assistance process. The system's robust architecture and proactive communication features aim to build trust, reduce anxiety during breakdown situations, and provide a seamless, dependable roadside assistance experience.



The system architecture begins with user login, after which the user selects their issue and is guided through troubleshooting steps. If the problem persists, users can either solve it through a tutorial section or receive chatbot assistance. When further help is needed, a service request is sent to available mechanics. Mechanics, after logging in and being authenticated and approved by the admin, activate their profiles to receive service requests. Once a mechanic accepts a request, the payment process is initiated through a payment gateway. The system supports live location tracking and a chat screen for real-time communication between the user and the mechanic. After the service is completed, users can rate and review the mechanic, ensuring quality feedback. Overall, the architecture ensures a structured flow from issue identification to service completion, while also maintaining verification and real-time interaction features.

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IV. IMPLEMENTATION DETAILS

A. Chat Assistance

The Chat Assistant offers a simple, interactive platform for users to resolve issues quickly. It starts with a friendly greeting and a smiling emoji to create a welcoming feel. On typing "Step to resolve issue," it provides clear troubleshooting steps like checking engine oil, fuel level, and dashboard warnings. A text input field at the bottom supports easy follow-up queries. The interface is intuitive, promoting smooth and supportive conversations. Overall, it ensures a fast and user-friendly problem-solving experience.

B. Tutorial Screen

The tutorial screen provides users with a curated list of engine-related video tutorials to assist with basic troubleshooting and maintenance tasks. Each video card displays a thumbnail, title, creator's name, and the number of views, making it easy for users to choose popular and relevant tutorials. This feature empowers users to attempt simple fixes themselves by following step-by-step visual guidance before requesting professional mechanical assistance.

C. Troubleshooting Steps Screen

The Engine Troubleshooting screen offers a simple guide to help users identify and fix common engine problems. It lists essential tools like a wrench, engine oil, and an OBD scanner. Users can follow Quick Fix steps for basic checks or move to Advanced Repair for deeper diagnostics. Support options like Watch Tutorial, Search Assistance, and Open Chatbot make the process easier. Overall, the screen provides a clear and user-friendly troubleshooting experience.

D. Feedback Screen

The Leave Feedback screen allows users to rate and review the service they received. It displays the service provider's name and location clearly at the top. Users can rate their experience using a 5-star rating system and write a detailed review in the text box. A character counter helps users stay within the 300-character limit. Finally, the Submit Review button lets users easily send their feedback.

E. Assistance Details Screen

The Service Provider Details screen displays important information about the selected mechanic. It shows the provider's name, location, contact number, rating, experience, distance, and estimated arrival time. An Invoice section breaks down the service cost, travel cost, platform fee, and the total estimated fee. The interface is clean and organized for quick decision-making. At the bottom, a Request Assistance button allows users to immediately book the service.

F. Assistance Tracking Screen

This is an assistance tracking interface designed to monitor the real-time progress of a service request. It displays a map showing the user's and the service provider's locations connected by a route line, making it easy to track movement. At the bottom, a service card presents key details such as the service provider's name, location, rating, distance, and estimated time of arrival. Users are given quick options to contact the service provider through "Call" and "Chat" buttons. Additionally, a "Service Over" button is provided to mark the completion of the assistance once the service is fulfilled.

G. Chatscreen

This chat screen provides a simple and direct way for users to communicate with a service provider. At the top, it displays the provider's name, phone number, and quick access buttons for calling or returning to the previous screen. The main chat area shows the conversation history, which currently has no messages. At the bottom, users can type a message, send an image, or use a voice message option to interact. The clean and minimal design ensures smooth and efficient communication during service assistance.

H. Issue List Screen

This is the issue list screen for reporting vehicle problems. It provides a dropdown menu with options such as Engine Issue, Battery Issue, Fuel Issue, Brake Issue, Tyre Issue, and Others. Users can select the relevant issue from the list based on their vehicle's condition. After selecting an issue, the app redirects the user to a troubleshooting steps screen for further guidance. The simple and clear design helps users quickly initiate the right support for their situation.

I. Mechanic Activation Screen

This is the mechanic activation page where mechanics can set their availability for the day. They need to enter their working hours by selecting a start and end time and set the distance limit and maximum number of requests they can handle. All fields must be filled out to activate the service. Once activated, mechanics will start receiving user requests. The page is designed to make the activation process simple, quick, and efficient.

J. Assistance List Screen

This screen displays a list of nearby mechanics available to assist users. Each mechanic's card shows important details like their name, rating, distance, estimated arrival time, and estimated fee. Mechanics who are online have a green dot indicator. Users can view and compare mechanics to choose the best option for their needs. The design ensures that all key information is clearly visible for quick decision-making.

K. Timeout Screen

This screen shows that the mechanic has accepted the user's request. It displays the mechanic's name, location, and the estimated service cost. A green checkmark clearly confirms the acceptance. The user can now move forward by clicking the "Proceed to Payment" button. The design ensures a smooth and quick transition for the user.

L. Payment Screen

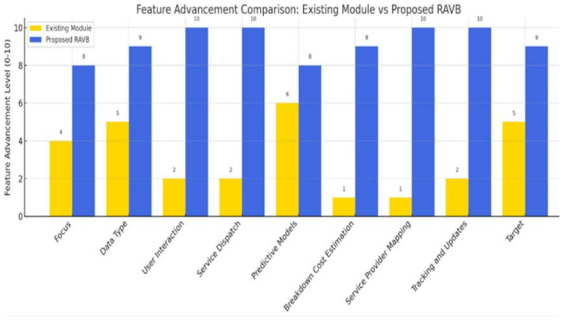
The payment methods screen provides multiple options for completing the transaction. Users can select from Credit/Debit Card, UPI, Wallet, Net Banking, QR Code, or Cash on Delivery. Each payment option is displayed with a clear and accessible button. The layout is simple and user-friendly, making the selection process easy. This screen ensures flexibility and convenience for all types of users.

V. RESULT AND DISCUSSION

The study highlights the growing need for efficient, fast, and user-friendly roadside assistance systems, especially in remote and unfamiliar areas. Existing solutions like "Visit Mechanic" and "On Road Vehicle Breakdown Assistance" primarily focus on location tracking and real-time mechanic connectivity using mobile apps and technologies like Firebase and GPS services. While these systems offer valuable services, they fall short in several critical areas, making improvements necessary to better serve users in emergency situations.

However, significant challenges were identified in the existing systems. These include delays in manual processing and approvals, heavy dependence on active network connectivity, platform limitations with support majorly restricted to Android devices, and a lack of continuous monitoring of mechanic services. These issues collectively reduce the overall efficiency, reliability, and accessibility of current roadside assistance solutions, especially for users in rural or low-network areas.

The proposed system directly addresses these shortcomings by introducing automated redirection of service requests to reduce delays, caching nearby service centres on the user's device to lessen network dependency, and supporting multiple platforms (both Android and iOS) to expand accessibility. Additionally, it employs Dijkstra's Algorithm for faster and optimized mechanic dispatch and approval processes, while ensuring continuous monitoring of mechanic services until completion. As a result, the proposed model offers better service accuracy, faster response times, multi-platform access, and reliable service supervision, representing a significant advancement over earlier models.



The graph compares the feature advancement levels between the existing roadside assistance module and the proposed RAVB project across nine key features. It clearly shows that the proposed RAVB significantly outperforms the existing system in all areas, especially in user interaction, service dispatch, service provider mapping, and tracking updates. This highlights RAVB's stronger focus on automation, predictive capabilities, and overall service enhancement. The existing module lags behind, with lower scores in most features, indicating a more traditional and less responsive system design.

In contrast, the RAVB project embraces modern technological trends, offering higher advancement levels through smart features such as predictive models and real-time updates. These improvements aim to provide faster, more efficient service delivery and a better user experience during vehicle breakdown situations. Overall, the graph emphasizes how the RAVB project is set to revolutionize roadside assistance by bridging the major gaps present in the current system and offering a far more advanced, reliable, and user-centric platform.

VI. CONCLUSION

In conclusion, the system is built to offer a seamless and accessible experience for a diverse user base. Its support for multiple languages and platforms ensures that no user feels left out. By integrating safety-focused features and dynamic pricing, the platform remains both fair and reliable in real-time situations. The clean design, with options like dark and light modes, enhances comfort across different environments. At the same time, service providers benefit from tools that help them manage their workload effectively. Overall, the platform strikes a perfect balance between user convenience, safety, and operational efficiency.

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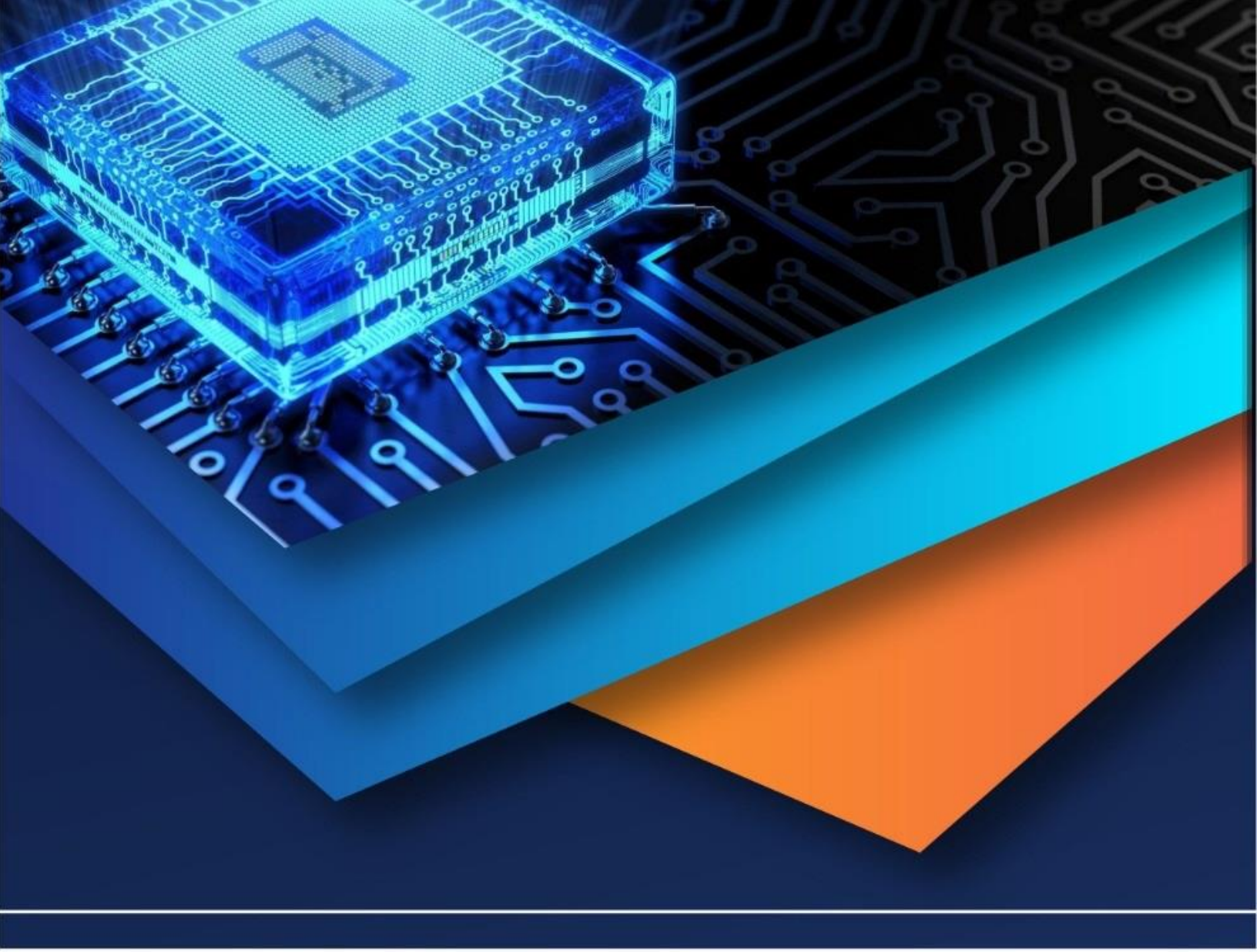

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