Global Journal of Engineering and Technology Advances
eISSN: 2582-5003
Cross Ref DOI: 10.30574/gjeta
Journal homepage: https://gjeta.com/

(RESEARCH ARTICLE)

Check for updates

Implementation of an Automobile Breakdown Service Provider (ABSP) Model

Oluwatofunmi O. Adetunji [1,*], Inioluwa A. Alake [1], Oluwabukola F. Ajayi [1] and Yaw A. Mensah [2]

[1] *Department of Software Engineering, Babcock University, Nigeria.*
[2] *Department of Computer Science, Babcock University, Nigeria.*

Global Journal of Engineering and Technology Advances, 2023, 17(01), 086–093

Publication history: Received on 06 August 2023; revised on 06 October 2023; accepted on 09 October 2023

Article DOI: https://doi.org/10.30574/gjeta.2023.17.1.0205

Abstract

The increasing frequency of vehicle breakdowns presents a challenge for automobile drivers, especially when faced with unexpected breakdowns in unfamiliar locations. This article addresses the need for an effective solution by proposing and implementing an Automobile Breakdown Service Provider (ABSP) model. Vehicle breakdowns, caused by factors such as poor road conditions, battery failure, or mechanical issues, often require immediate attention from certified artisans. The ABSP model aims to enhance the breakdown assistance process by incorporating driver feedback through ratings and reviews of artisan services, ensuring reliability and trustworthiness.

To develop the ABSP model, limitations of existing Road Side Assistance (RoSAS) models were analyzed and taken into account. The iterative process model was employed for implementation, allowing early software versions to accommodate evolving requirements. The system's frontend utilized Hypertext Markup Language (HTML) and Cascading Style Sheet (CSS), while the mobile application was developed using Flutter—a versatile Dart-based framework for cross-platform mobile app creation. The backend was supported by the Laravel Framework, based on Hypertext Preprocessor (PHP), with MySQL serving as the relational database for record storage.

The ABSP model's significance lies in its ability to provide drivers with verified and rated artisans, ensuring efficient breakdown resolution, payment automation, and minimizing the challenges associated with breakdowns in unfamiliar or dangerous locations. This article offers insights into the design and implementation of the ABSP model, contributing to enhanced reliability and convenience in addressing automobile breakdowns.

Keywords: Automobile Breakdown; Breakdown Service Provider; Road Side Assistance; Road Side Artisans

1. Introduction

A vehicle breakdown refers to a mechanical or electrical malfunction in an automobile that hinders its operation to the extent that it becomes challenging, nearly impossible, or potentially perilous to continue driving. These breakdowns can stem from a variety of causes. Based on the nature of the breakdown, the vehicle might require being towed to a repair shop depends on the specific issue at hand [1].

Nowadays, automobile breakdowns represent unfortunate occurrences that countless drivers encounter during their daily journeys on the road. One of the primary contributors to these breakdowns is the state of the roads. Suboptimal road conditions encompass various issues such as potholes, uneven surfaces, fractured concrete, and road fissures just to mention a few. These conditions can trigger a series of significant mechanical issues, often requiring the expertise of an automobile technician [2].

* Corresponding author: Adetunji Oluwatofunmi; Email: adetunjio@babcock.edu.ng

As stated in [3], another prevalent reason behind vehicle breakdowns is battery failure. This can be attributed to several factors, including loose terminal connections, inadvertently leaving the ignition or lights on, extended periods of vehicle inactivity, or embarking on extensive journeys, particularly in colder climates where the battery undergoes more stress than usual. Additionally, issues with the vehicle's starter motor or alternator which is responsible for recharging the battery, can also contribute to these breakdowns. A driver might be ignorant of these reasons and will need to find a nearby artisan. Also, an automobile's timing belt, which is an essential component of its engine that ensures the crankshaft and camshaft work in perfect synchronization, may occasionally break while driving on long trips. When this happens, the car breaks down immediately, and the engine experiences very serious damage that requires the attention of an artisan [4]. Once a vehicle breaks down, it is necessary to get the services of automobile artisans. This might be easy if the breakdown occurs in a location familiar to the driver. However, this is usually not the case because a vehicle can breakdown in an unknown location. This brings about the challenge of getting nearby artisans who have been certified and who will not swindle the distressed driver. Requesting for a tow truck or the service of a cab driver in an unknown location is challenging especially when the breakdown occurs in a dangerous zone. Also, the challenge of a drive waiting to pay for service rendered is a challenge especially when the fix done by the expert appears to be too quick.

Hence, there is the need to develop a system that provides a form of verification of artisans based on the feedback received from the distress drivers in form of rating and reviews of the services rendered based on the performance, efficiency, and attitude towards work among many others. Also, a system that automates payment of service providers by the artisan is necessary to avoid refusal of payment.

The objective of this research is to design an Automobile Breakdown Service Provider (ABSP) model and as well implement the designed model.

In achieving the set objectives, the Road Side Assistance (RoSAS) model was analyzed and studied to identify its limitations. These limitations were taken into consideration in coming up with the ABSP model. The implementation of the ABSP model was achieved by using the iterative process model. This model produces a working version of the software early on in the project as it invites criticism, thereby giving room for new requirements. The technologies that were used for the implementation of this proposed system are Hypertext Markup Language (HTML), Cascading Style Sheet (CSS) for the frontend. For the mobile application, Flutter, which is a widely popular Dart-based mobile application framework that enables developers to create high-performance, natively-rendered mobile applications for both iOS and Android. While for the backend, the Laravel Framework which is based on the Hypertext Preprocessor (PHP) programming language was used. My Structured Query Language (MySQL) was used as the database to store series of records.

2. Literature Review

2.1. Review of Related Works

[5] proposed an application that assists vehicle owners who just experienced a breakdown. The technology used to develop this system was Java, JavaScript, Android Studio, and MySQL Server. Users could call and message repair service professionals right from the app and get a response almost immediately. The application was supposed to provide new convenience to car owners, but the system does not have a feature to verify the authenticity of the service provider for the safety of the automobile owners especially in an unfamiliar location.

[6] introduced a system aimed at assisting individuals who find themselves unexpectedly stranded in remote areas due to vehicle breakdowns. This system serves as a valuable solution for those seeking help in such isolated locations. It operates by listing approved mechanics within the application. Through this system, users can locate mechanics based on their current location, ensuring prompt and convenient access to mechanical assistance. This approach has proven to be a time-saving boon for travellers, allowing them to swiftly address vehicle breakdowns and resume their journeys. However, a noteworthy limitation of this system is its lack of a mechanism for users (vehicle owners) to provide feedback on the service they receive from providers. This feedback feature could be invaluable in aiding future distressed drivers by offering insights into the quality of services rendered by mechanics.

In [7], a web ontology was conceived with the primary objective of identifying an appropriate mechanic. This web ontology also served as a shared platform facilitating the connection between automotive repair professionals and individuals experiencing car troubles. The user logs in with their user ID and password. GPS helps find the current location of the user. That location is communicated with the database and retrieved from the nearest mechanic who registered for this app. Admin approves the mechanic's request for their login in this application. Admins can view both

user and mechanic details. This application has a restriction when it comes to editing user details. Specifically, there are limitations imposed on the editing of user information. Users are solely permitted to modify their usernames, with no ability to make changes to their email addresses or passwords.

[8] designed a system that helped search for the nearest mechanic available to the user's location. The system allows one to trace the mechanic who provides different services to the user. The system includes local mechanics, and users can order mechanics irrespective of the vehicle manufacturer. The problem with this system is its inability to verify the registered service providers to ensure that they are certified and professionals at their jobs.

In [9], an Android-based system was introduced with the aim of assisting users in obtaining help. Users could achieve this by installing the application, which provided access to nearby mechanics and facilitated communication with them via internet connectivity. The technology used to develop this system was Java, Android Studio, and MySQL Server. The system held the promise of serving as a safeguard against the uncertainties of a vehicle breakdown, providing vehicle owners with a sense of assurance in the event of mechanical failures. However, it's important to note that this system was designed as a native application, exclusively accessible to Android users. This exclusivity left iOS users without the means to utilize the system, rendering them unable to benefit from its features.

[10] conceptualized and created a system aimed at the organized management of on-road car breakdowns. Within this system, mechanics had the capacity to provide a comprehensive range of services, including vehicle repairs at their workshops, the sale of replacement parts, and the provision of towing services. The research work made use of the waterfall methodology. Also, this system was created to be used by mechanics to lighten their burden, but, the system does not have a notification feature that notifies the mechanic when a request is made, which means they have to continuously login and logout of the system to check for requests.

[11] put forth the idea of the On Road Vehicle Breakdown Application (ORVBA), which offers a viable solution for individuals in need of assistance in remote areas when faced with mechanical issues in their vehicles. The user base for ORVBA comprises registered members of the public who can establish connections with specific mechanics through this reliable application system. Also, the scope of this project only covered the registration and login of the service providers and left out their verification. Verification and accreditation of service providers will help improve the confidence of the distressed drivers in the service providers. Moreso, only the automobile repairers are considered to be service provider, this should not be the case because Tow trucks and cab drivers can also come to the aid of the distressed drivers especially the car cannot be fixed on the spot.

[12] introduced the concept of a mobile and web-based system designed to monitor and record users' locations while maintaining an offline list of the closest service providers. This feature ensures that even in locations with limited internet connectivity, users can access the list of nearby service providers based on their last recorded location. This project only specified the registration of mechanics and left out their verification. While this is a good initiative, the limitation is the absence of thorough mechanic verifications; without them, it will be challenging for users to have trust in the designated mechanic.

[13] designed and developed an Android application specific to the Nigerian people. The design's primary objective was to establish a connection between vehicle drivers and a well-structured database containing skilled vehicle technicians. The application offers several ethnic languages unique to Nigerians for inclusion purposes. It was implemented using Dart and Firebase for database storage. In cases where the automobile driver has an urgent situation to attend to and is unable to wait for the repair, this system is unable to take requests to order a cab or tow truck. It will be difficult for users to tell if the service provider requested can be trusted with their automobiles, as there is no sort of rating or verification system

2.2. Review of Related Model

The model selected for the proposed system drew inspiration from the Roadside Assistance (RoSAS) model [14]. RoSAS specializes in delivering roadside assistance services to car owners.

In figure 1, motorist, RoSAS, garage service, and case officer are replaced with automobile owner, ABSPS, artisan, and agent, respectively, in the case of this project. All application users, with the exception of the administrator, will rely on a mobile application installed on their handheld devices to submit assistance requests and receive notifications. Likewise, an agent involved in verification processes will also utilize a smartphone. Consequently, the IT support system of the ABSPS business model must possess the capability to operate efficiently and coordinate the tasks of these collaborators within a distributed environment. ABSPS adopts the microservices architecture, which enhances its

scalability, allows for smaller and more agile development teams, simplifies debugging and maintenance, boosts developer productivity, ensures better fault isolation, and optimizes scaling decisions.

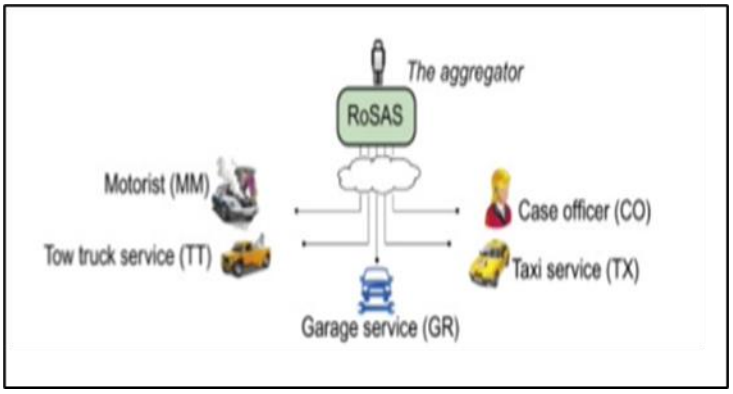

Figure 1 Roadside Assistance (RoSAS) Model [14].

Due to the well-coordinated automobile assistance, they receive, ABSPS customers benefit. Service providers, including tow trucks, cab services, and artisans, profit from the greater volume of business they receive from being linked with ABSPS as opposed to operating as business units. Agents profit from the wages they earn by performing the labor-intensive task of vetting service providers

3. Methodology

Extensive research was conducted to study existing research works and models. Gaps in these works were identified and synthesized, considering them during the design of the ABSP model.

To implement the ABSP model, the Iterative software development process model was adopted. This process model allows for client involvement in every iteration, corrections can be made and new features implemented in every stage of iteration before the final system is produced. Flutter was used for the development of the mobile applications (Android and iOS), Laravel framework based on PHP was utilized for building Backend services of this application. Material UI was integrated with Laravel Blade to enhance the visual aesthetics of the front end. MySQL, an open-source, document-oriented database program, was chosen for data storage. The Google Maps API and the Firebase Cloud Messaging API were integrated to facilitate the routing and notifications respectively. Figma, a free design tool, facilitated collaboration among designers, aiding in the creation of application screens.

3.1. Automobile Breakdown Service Provider (ABSP)Model

ABSPS is an automobile breakdown provider system that helps automobile owners get emergency roadside assistance when their automobile breaks down. A network of automobile owners (clients), agents, and service providers make use of this system with respect to the following:

- *Administrator:* This user in this system uses the browser platform and is in charge of all the administrative functionalities.
- *Clients:* These users are automobile owners. They make use of the mobile application platform by executing the registration module, payment module, nearby service provider module, request module, and feedback module.
- *Service providers:* These users include artisans, tow truck drivers, and cab drivers, and they make use of the mobile application platform by executing the registration module and notification module.
- *Agents:* These users make use of the mobile application platform by executing the registration module and verification module.
- *Request Module:* In this module, when a client makes a request for a service provider, their request is sent to the server, which stores the request in a database and sends a push notification using the Firebase cloud messaging tool for real-time notification to the service provider's device to confirm that their request has been received. As the request progresses, the server can send additional push notifications to the service providers to provide updates on the status of their request.

In the context of this model, the Application Programming Interface (API) is used to access the MySQL database through Hypertext Transfer Protocol Requests (HTTP). The API provides a standardized way for both mobile and web

applications to communicate with a database. HTTP is used to send requests to the API, which then communicates with the database to retrieve or modify the requested data.

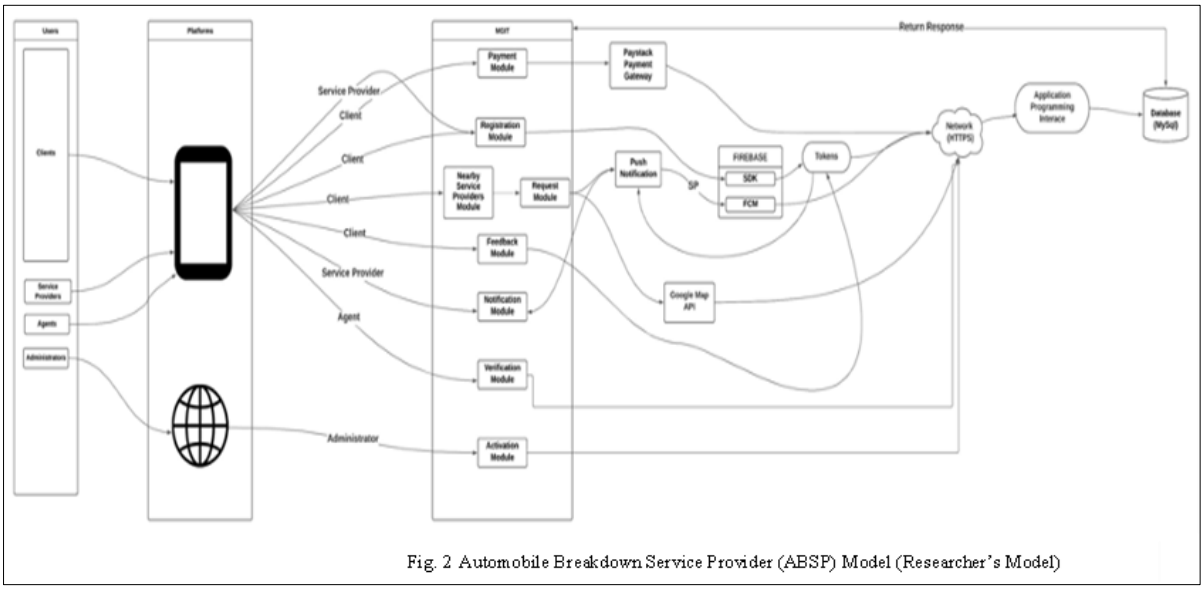

Figure 2 Automobile Breakdown Service Provider (ABSP) Model (Researcher's model)

4. Results and Discussion

Based on the designed ABSP model, in solving the problem of verification and accreditation of artisans, agents will be dispatched based on their local government area to find the registered service providers who have not yet been approved, using the system application to get their location. Figure 3 displays the interface of the list of unapproved service providers to the agent as he logs in.

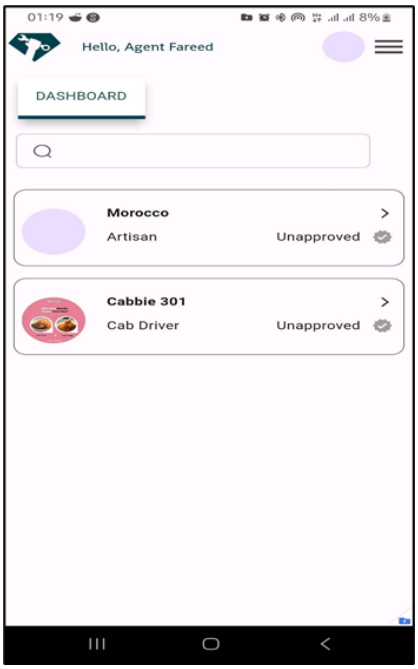

Figure 3 Agent's dashboard showing unapproved service providers

Figure 4 shows the interface of the agent trying to approve a service provider. Figure 5 displays the interface of the list of approved service providers by an authenticated agent.

In solving the challenge of feedback from vehicle owners after a fix, rating and reviewing service providers by system-registered automobile owners was implemented. Figure 6 displays the feedback form that pops up on the client's screen after completion of service by the service provider. This exhibits the feedback module of the ABSPS model.

In solving the challenge of back and forth associated with payment, a payment gateway using PayStack was implemented for the clients to fund their accounts before requesting a service provider. Figures 7 show the "Top Up+" button. Based on the review articles, it was noticed that cab/taxi/tow trucks services were not included as part of the services rendered by existing systems. This was taken into consideration using the request module of the ABSPS model. Figures 8, 9 and 10 shows the artisan, tow truck, and cab services, respectively.

Furthermore, to provide real time notification to service providers whenever their services are requested, the request module works hand in hand with the notification module. This was achieved using Firebase Cloud Messaging. Figure 11 shows the notification pop-up for the service provider to accept or reject a request and also the notification bar when the service provider is not in the application in figure 12.

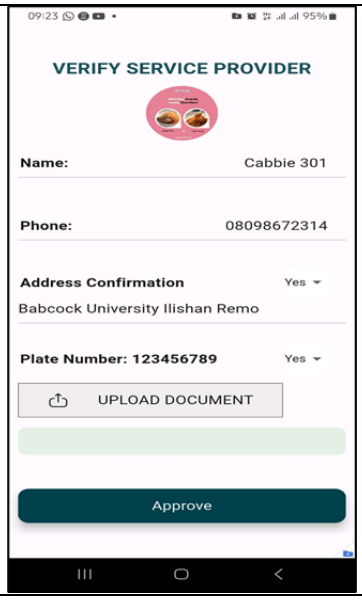

Figure 4 Agent's dashboard approving service providers

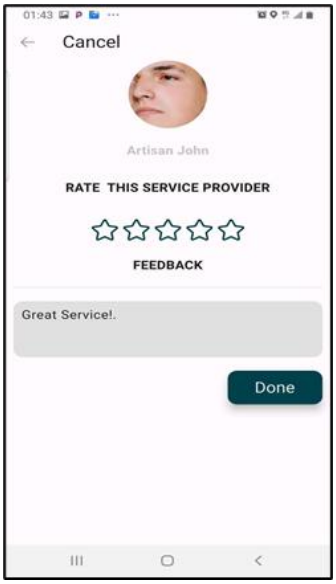

Figure 5 Agent's dashboard showing approved service providers

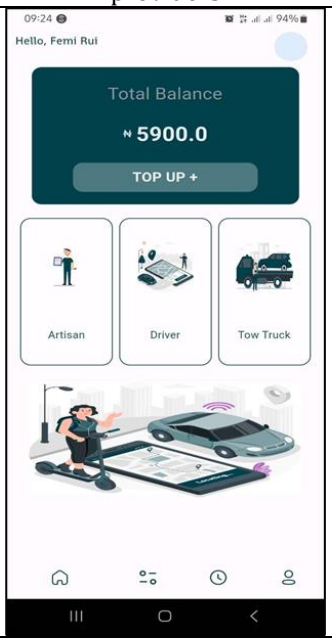

Figure 6 Client's feedback screen for rating Service Providers

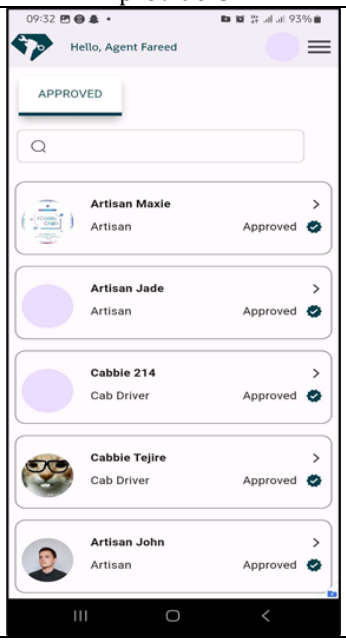

Figure 7 Client's Top UP+ Page to fund account

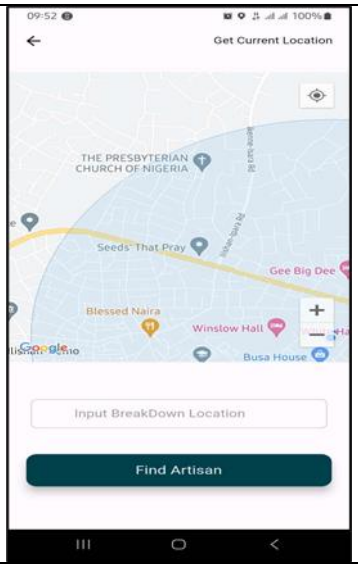

Figure 8 Client's search for nearby Artisans

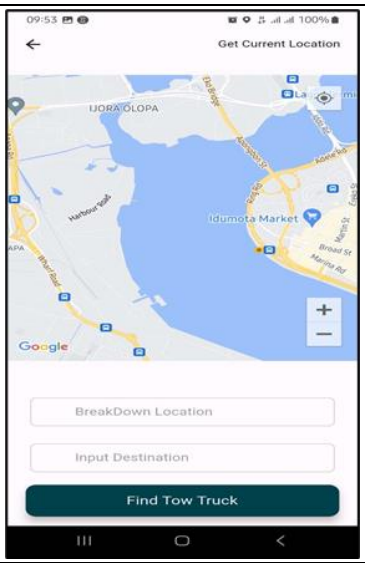

Figure 9 Client's search for nearby Tow Trucks

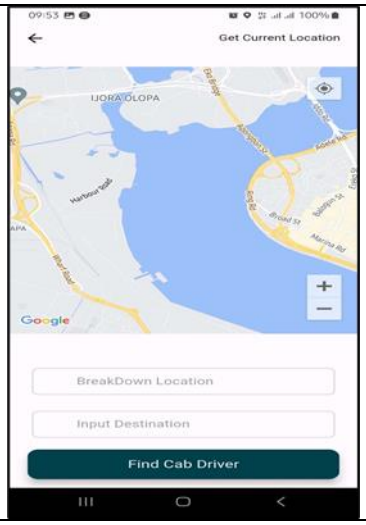

Figure 10 Client's search for nearby Cab Drivers

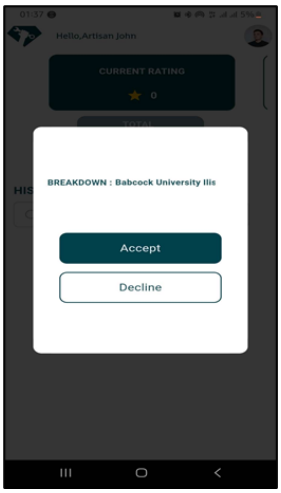

Figure 11 Service provider notification pop up.

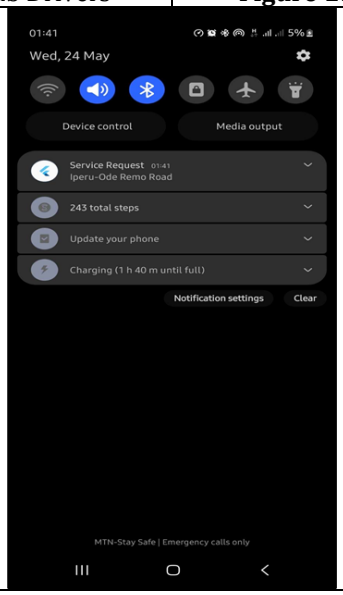

Figure 12 Service provider notification bar

5. Conclusion

The design and implementation of this research exemplify how technology can ease the burden and stress of human activities. The success of this project is a proof that technology has the potential to revolutionize and enhance various human endeavours, making them more efficient, convenient, and effective. Therefore, connecting service providers with clients is a powerful testament to the transformative potential of technology. By leveraging digital platforms and tools, businesses can expand their reach, optimize their operations, and offer better services to their clients.

Compliance with ethical standards

Acknowledgments

Special thanks to the School of Computing and Engineering Sciences, Babcock University for providing the platform for implementing this work.

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] K. Kandasamy, B. Babu, J. D. Nallasivam, and G. Padmanaban, "Vehicle Breakdown Recovery System," International Journal of Production Technology and Management (IJPTM), vol. 7, no. 2, pp. 50–64, 2016.

[2] L. Steven, "A Hole Lot of Risk: How and Why Potholes are Hazardous to Your Road Safety," Attorney Steve Lee, 2021. https://www.attorneystevelee.com/our-library/a-pothole-can-damage-your-vehicle-your-passengers-and-you/ (accessed Jun. 21, 2023)..

[3] H. Gareth, "Top 10 Most Common Causes of Car Breakdowns," Admiral, Jan. 30, 2023. https://www.admiral.com/magazine/guides/motor/top-10-most-common-causes-of-car-breakdowns (accessed Jun. 21, 2023).

[4] K. Mark, "What Happens When A Timing Belt Breaks While Driving?," Professional Automotive Repair, 2021. https://www.professionalautorepair.com/what-happens-when-a-timing-belt-breaks-while-driving (accessed Jun. 21, 2023).

[5] A. Vibhavi and N. Dhanuka, "On-Road vehicle Breakdown Assistance," University of Bedfordshire, Bedfordshire, United Kingdom, 2020. doi: 10.13140/RG.2.2.11833.39521.

[6] M. Nivetha, S. Sujtha, and V. Abinaya, " 2021. 'Vehicle Breakdown Assistance.' ," International Journal on Cybernetics & Informatics, vol. 10, no. 2, pp. 193–202, 2021.

[7] G. Surya and S. Barath, "On-Road Vehicle Breakdown Assistance," International Journal of Research Publication and Reviews, vol. 2, no. 4, pp. 103–105, 2021, Accessed: Jun. 21, 2023. [Online]. Available: https://patents.google.com/patent/US6973387B2/en

[8] *S. N. Devendra, D. Ankush, G. Nisarg, B. Mayank, G. Shubham, and K. Mubbshir, "Survey on Vehicle Tracking Services," J Inf Technol Softw Eng, vol. 8, no. 1, pp. 1–3, 2018, doi: 10.4172/2175-7866.1000224*.

[9] D. A. Kumaar, S. B. S. Subha, and K. Harin, "On Road Vehicle Service Finder," International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), vol. 5, no. 2, pp. 929–936, 2019.

[10] H. Aman and M. A. Zainodin, "On-Road Car Breakdown Assistant Finder," Applied Information Technology And Computer Science, vol. 1, no. 1, pp. 210–231, 2020, doi: 10.30880/aitcs.2020.01.01.021.

[11] R. Elakkiya and M. Bavithra, "On Road Vehicle Breakdown Services," International Journal of Creative Research Thoughts, vol. 8, no. 5, pp. 2320–2882, 2020, Accessed: Jun. 21, 2023.

[12] M. P. P. Deshmukh, M. Y. S. Puraswani, M. A. D. Attal, and M. P. G. Murhekar, "Review Paper On 'On Road Vehicle Breakdown Assistance System,'" International Journal of Engineering Applied Sciences and Technology, vol. 4, no. 11, pp. 199–202, 2020, doi: 10.1063/1.5012394.

[13] S. C. Olisa, W. C. Agbo, O. V. Onyishi, R. C. Omeje, N. C. Asiegbu, and J. E. Olisa, "Unified Emergency Auto-Service Mobile App," in International Conference: Technological Innovation for Holistic Sustainable Development, Nsuka, 2020, pp. 63–69. Accessed: Jun. 21, 2023.

[14] V. Balasubramanian, P. Lade, H. Venkateswara, E. Smirnov, and S. Panchanathan, "Roadside Assistance," pp. 167–185, 2014.