NATIONAL ENGITECH DIGEST

VOL. 3 ISSUE 1

e-ISSN: 3030-5969

MyPomen: An Integrated Mobile and IoT-Based Roadside Assistance and Emergency Alert System

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Abstract

Vehicle users may find themselves in unsafe situations when a vehicle breaks down or an accident occurs on the road, especially if it takes a while to get help. Phone calls, online searches, or direct contact with workshops are the traditional methods to find available mechanics for roadside assistance, and these can cause delays. The project proposes a unified roadside assistance solution, MyPomen, designed to enable vehicle owners and passengers to communicate with mechanics via a mobile application and have a single point of control via a web-based platform. Users of the application can locate themselves, find nearby mechanics, request roadside assistance, search for nearby mechanics, view the status of the service, etc., and pay for the service post completion. Requests from mechanics can be received and accepted via the app, and mechanics can manage users, payments, service requests, and system activities via the web-based platform. The payment module will facilitate the splitting of the finished service's payment between the mechanic and the MyPomen platform according to a predetermined payment model. Moreover, MyPomen includes an IoT-based crash detection module using an ESP32 microcontroller and a vibration sensor. If a large impact is detected, then the proposed system is designed to send an SOS message via WhatsApp to a predefined emergency contact. The proposed system is designed to enhance the coordination of roadside assistance, payment management, and emergency communication using a mobile application, a web-based platform, location-based services, payment, and an IoT module in one platform.

Keywords: roadside assistance; vehicle crash detection; Internet of Things; GPS; online payment; SOS alert

Introduction

Road transport plays a significant role in daily travel, facilitating transport for work, school, business, and for personal reasons. Unfortunately, vehicle breakdowns and road accidents can happen at any time, and if assistance isn't immediately available, vehicle users may find themselves in a precarious position. Road traffic accidents are still a significant safety issue, as every year, about 1.19 million people die from road traffic crashes worldwide (World Health Organization, 2023). So it's crucial to be able to get quick, reliable help if your vehicle breaks down or you are involved in an accident.

A common problem experienced by vehicle users is the inability to locate a mechanic when needed, especially in an unfamiliar area. Typical methods include searching online for workshops, making phone calls, or directly contacting mechanics. These methods may be time-consuming and cannot be used to get instant information on if mechanics are available. Users can also have to enter their location manually, which can further slow down the assistance process (Sulaiman et al., 2024; Ariff et al., 2025).

Mobile and location-based technologies offer a chance to enhance roadside assistance. GPS can locate the vehicle user and ease the search for nearby mechanics, and a mobile application could be used to communicate directly with the vehicle user and the mechanics (Ariff et al., 2025; Sulaiman et al., 2024). A web-based platform can also enable the central management of service requests, users, mechanics, and payments.

MyPomen is proposed as an integrated roadside assistance system that makes it possible to link users of vehicles with mechanics using a mobile application. If a breakdown happens, the application will identify the user's location and enable sending a request for roadside assistance. Registered mechanics can be granted access and accept the request prior to their arrival at the user's site. Once the service is over, payment can be made within the app and the mechanic and administrator can check the payment status. A platform commission model is also suggested, where a portion of every transaction is distributed to MyPomen, and the rest is paid to the mechanic.

Furthermore, an IoT module using an ESP32 microcontroller and vibration sensor is integrated into MyPomen. To date, vehicle accident detection using a microcontroller, sensor, GPS, and communication modules has been proven by previous research that automatically transmits vehicle accident information to pre-defined contacts or emergency systems (Aslam et al., 2024; Mat Desa, 2024). In case a major impact is detected, the system should provide an SOS signal and send a WhatsApp message to a predefined emergency contact. MyPomen is therefore dedicated to offering a more convenient, coordinated roadside assistance service and making automated emergency communication possible by combining the technologies of mobile, web-based platform, GPS, payment, and IoT module.

Methodology

MyPomen adopts an Agile development approach based on the Scrum framework. The approach enables iterative development, testing, and improvement throughout the project (Edison et al., 2022). The development process includes requirement analysis, planning, system design, development, testing, review, and deployment.

The requirements are organised around three groups of users, namely vehicle users, mechanics, and administrators. For the people who use their cars, they need to register accounts, get car information, determine the location of their cars, find mechanics, call for roadside assistance, check the status of their car, receive notifications, make payments, and get a status report on the payment. Mechanics need to register, manage profiles and availability, process service requests, display customer location, accept requests, update services, and monitor payments. Users and mechanics are managed by administrators, and service requests and payments are monitored, as well as accident alerts and system activities, via a web-based dashboard.

The proposed system comprises a mobile application, a web-based platform, a payment module, and an IoT module. The mobile application is used by vehicle users and mechanics, with the web-based platform being used by the administrators for managing and monitoring system activities. The roadside help procedure starts with the activation of a request by the road user from within the current geographical area. Mechanics in the vicinity get the message and are able to accept it before heading to the user's address. Once the service has been completed, payment will be processed through the app and the status of the transaction will be updated for monitoring.

The payment module logs the service that has been completed and the service's flat fee being applied. The service payment is after the agreed commission is deducted, and the admin can check the transaction and payment status using the web-based dashboard.

The planned IoT module comprises an ESP32 microcontroller, a vibration sensor, and a communication module. If the ESP32 receives a large vibration or impact, it will analyze the input and activate the SOS system. The relevant information is then transmitted to the predetermined WhatsApp contact via an emergency message, which may include the vehicle identification, the user's identification, and location.

The development tools are Visual Studio Code, Arduino IDE, XAMPP, MySQL, phpMyAdmin, Google Maps API, and Firebase Realtime Database. They can be used for development, databases, place-based services, IoT modules, and syncing of real-time data.

Testing is planned to evaluate the functionality and integration of the system components as development progresses. The planned functional tests will cover registration, GPS location detection, mechanic searching, assistance requests, acceptance of assistance requests, service status updates, notifications, payment processing, payment status, and dashboard monitoring. The IoT testing will cover impact detection, SOS generation, WhatsApp message delivery, location information, and communication with the emergency contact. The defined impact condition is intended to be assessed using controlled vibration and impact tests. Measurable indicators such as response time, GPS accuracy, SOS transmission success rate, and payment status accuracy will be considered when the relevant components are ready for testing.

The mobile application, web-based platform, payment module, and IoT-based crash detection module are intended to be connected through the system server and database as development progresses. The mobile application is designed to send roadside assistance requests and service updates to the system, while the web-based dashboard is designed to retrieve the information for administrative monitoring. Once a roadside service is completed, the payment module is intended to record the transaction and update the payment status for the relevant users. For the IoT component, the ESP32 is designed to process data from the vibration sensor and trigger an SOS alert when a significant impact is detected. The alert is intended to be transmitted through the communication network and delivered as a WhatsApp message to a predefined emergency contact.

Results and Discussion

The MyPomen system is currently under development. Functional and integration testing have not yet been completed, as the mobile application, web-based platform, payment module, and IoT-based crash detection module are still being developed and integrated. The planned evaluation will focus on mobile application functions, online payment and platform commission handling, system-wide integration, and the emergency response of the IoT crash detection module.

The mobile application is being developed to support vehicle-user functions such as account registration, real-time location detection via GPS, locating nearby mechanics, and submitting roadside assistance requests. The mechanic application is intended to support receiving request alerts, viewing vehicle breakdown locations on Google Maps, accepting jobs, and updating service progress. These functions remain subject to functional testing once the relevant development and integration work is completed.

The web-based administration dashboard is being developed to support the management of mechanic registrations, monitoring of SOS jobs, and tracking of financial records. The consistency of transaction details and service-fee information between the web dashboard and mobile application will be evaluated during the planned integration testing. These functions have not yet been reported as fully tested.

The payment module is being developed to support digital transactions through online banking (FPX) integration and the calculation of the platform fee according to the predetermined business model. The payment process, allocation of service payments to the mechanic's wallet balance, and recording of the platform commission for administrative accounting will be evaluated once the payment integration is completed. No completed payment-test outcome is reported at this stage.

The IoT crash detection module is being developed using an ESP32 microcontroller and a vibration sensor. Its planned evaluation will examine whether an impact exceeding the defined threshold can trigger the emergency protocol and whether an automated WhatsApp distress alert containing the vehicle ID and location can be delivered to the predefined emergency contact. Controlled physical-impact testing and verification of message delivery have not yet been completed. The planned testing components and measurable indicators are outlined in Table 1.

Table 1. Planned System Testing and Evaluation

Test Component	Test Parameter	Measurable Indicator	Testing Status
Mobile Application	Location Detection	GPS accuracy	Pending – to be evaluated after implementation and integration.
Mobile Application	Mechanic Search	Search response time	Pending – to be evaluated after implementation and integration.
Assistance Request	Request Submission	Request response time	Pending – to be evaluated after implementation and integration.
Mechanic Application	Request Acceptance	Acceptance response time	Pending – to be evaluated after implementation and integration.
Service	Status Update	Status update accuracy	Pending – to be evaluated after implementation and integration.
Payment	Payment Processing	Payment processing accuracy	Pending – to be evaluated after implementation and integration.
Payment	Commission Calculation	Commission calculation accuracy	Pending – to be evaluated after implementation and integration.
Web-Based Dashboard	Payment Monitoring	Payment status accuracy	Pending – to be evaluated after implementation and integration.
IoT Module	Impact Detection	Impact detection accuracy	Pending – to be evaluated after implementation and integration.
IoT Module	SOS Alert	SOS transmission success rate	Pending – to be evaluated after implementation and integration.
WhatsApp	Emergency Message	Message delivery success rate	Pending – to be evaluated after implementation and integration.
System Integration	End-to-End Process	End-to-end response time	Pending – to be evaluated after implementation and integration.

As development and integration are still ongoing, end-to-end testing between the IoT hardware, Android mobile application, and web administration portal has not yet been completed. GPS accuracy, network connectivity, mechanic availability, payment processing, and vibration-sensor sensitivity will be considered during subsequent evaluation. Further testing will be required to assess the overall operation of MyPomen as an integrated roadside assistance platform.

Conclusion

MyPomen is being developed as a holistic roadside assistance system to connect vehicle users with mechanics through a mobile application and centralized control via a browser-based platform. The proposed system is intended to support the roadside assistance process, from a location-based service request and mechanic acceptance to service completion and digital payment. The payment module is designed to record transactions and split service payments between the mechanic and the MyPomen platform according to a predetermined commission structure.

An emergency function is also being developed through an IoT module. The proposed ESP32 and vibration sensor are intended to detect vehicle impacts and send a WhatsApp message to a predefined emergency contact. This feature is designed to provide an additional means of communication if the vehicle driver is unable to request assistance.

The system structure, user functions, payment flow, IoT procedures, and testing strategy have been defined during the development stage. Functional and integration testing will be carried out after the relevant components have been implemented and integrated. Areas requiring evaluation include GPS accuracy, network connection, the availability of mechanics, payment methods, and the sensitivity of the vibration sensor. Further enhancements may include more accurate sensors for crash detection, improved payment and transaction handling, broader testing scenarios, better emergency notification capabilities, and additional emergency response integration.

MyPomen is designed to create a single, technology-enabled roadside assistance solution, combining mobile application services, a web-based platform, digital payment, GPS, and an IoT module based on emergency communication in a single solution.

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