

RIZALERT: A WEB APPLICATION AND IOT-INTEGRATED EMERGENCY RESPONSE SYSTEM

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ABSTRACT

Emergency communication needs to be quick and effective in order to have the least casualties and damage. Nevertheless, in most communities, there is a lag in reporting the incidents and getting in touch with the emergency responders because of lack of integrated communication networks. This research has come up with RizAlert, a web-based application and IoT-based emergency response system that aims to enhance emergency reporting, communication, and response management within the Municipality of Rizal, Occidental Mindoro. The system was created through the Rapid Application Development (RAD) methodology that involved requirements planning, prototyping, iterative testing, construction and deployment. RizAlert has the capability to share real-time GPS location, medical emergency, fires, disasters and crimes, safety status tagging (Safe, In Danger, or Evacuating), emergency warning, and resources on safety preparedness. The ISO 25010 and FURPS software quality standards were used to evaluate the system by selected students, residents, and emergency responders as well as IT experts. The results of the evaluation showed that RizAlert was an effective application in functionality, usability, reliability, performance efficiency and security. Real-time GPS monitoring, the cloud-based data management system, and IoT-based alerts were also integrated to enhance the coordination of users, administrators, and responders. The research finds that RizAlert can be used to improve the effectiveness of emergency response, disaster preparedness and community safety in Rizal, Occidental Mindoro and could be scaled to other municipalities.

Keywords: *emergency response system, Internet of things (IoT), mobile application, web application*

SDG: *SDG 3 – Good health and wellbeing, SDG 9 – industry, innovation and infrastructure, SDG 11 – sustainable cities and communities*

INTRODUCTION

The World Health Organization (2020) highlighted that emergency responses are an essential element of health and safety of the population, therefore, enabling a prompt medical intervention in case of emergencies, which leads to fewer victims and less complicated outcomes. As an example, cardiac arrests, severe injuries, and natural disasters need assistance at some point in time. In such cases every second can be life and death.

The technological innovations have led to the creation of the Internet of Emergency Services (IoES), which involves the integration of internet-connected devices and systems into the emergency response and management. By enhancing coordination of various agencies in emergency response and real-time data collection and analysis, such integration has the potential to revolutionize delivery of emergency services [Damaševičius et al., 2023].

As technology has achieved a lot of advancement in the sphere of communication [Sienkiewicz-Małyjurek & Zyzak, 2026], more effective ways of keeping in touch and being aware have emerged. Digital technology has revolutionized most industries, emergency being one of them where real time communication and sharing of information can be done. Emergency applications have shown their positive effectiveness in reducing response times, and improving coordination between responding resources. Nuevas et al. (2024) claim that the abundance of cellphones and the combination of cellphones with GPS opens up new possibilities to improve emergency response systems. The research also reveals that the thinking-out coming system plays a significant role in enhancing the overall emergency management process and emergency response time in the selected area. The majority of solutions available in the market have single features as opposed to a combined feature with real-time notifications, location tracking and first aid instructions.

Fabito et al. (2016) said that nothing is spared when a disaster occurs no matter how much mitigations or office of the prevention effort the government have done. Events such as floods, earthquakes and epidemics generally result in a high number of deaths and have an impact on the operation of adjacent medical institutions. In this respect, Chen et al. (2020) highlight the need for timely medical assistance and treatment. The study was conducted in the Municipality of Rizal, Occidental Mindoro specifically because this area exhibits unique significant definition with respect to geographic, infrastructure and socio-economic conditions for which the resultant queries demonstrated a high-level challenge that needs an improved emergency response system. With the municipality consists of widely dispersed barangays some are situated in remote and hinterland areas, it is also prone to various natural calamities such as flooding, typhoon and landslides which commonly occurs in the province. The lack of a quick and effective emergency communication system

made it difficult for the residents to get the necessary help during emergencies in Occidental Mindoro. Rizal's spread of barangays and rugged topography can also provide a challenge for local government officials to maintain constant communication with the residents during emergency situations. These scenarios pave the way for a diversified local, accessible and technology mediated means to reduce these gaps. In 2024, there were a total of 155 emergency incidents, with 142 people involved resulting in two fatalities. These included mild injuries like skin abrasions to complex injuries such as open fractures and wounds. As there are no sufficient emergency facilities, urgent cases were brought to the San Jose District Hospital and not at the local Rizal Healthcare Unit (RHU). Moreover, 51 people were evacuated in 2024 after water level had been rising during heavy rainfall and when the southwest monsoon brought torrential rain as Tropical Storm Bebinca moved northward (ABS-CBN News, 2024). Lack of public awareness about safety measures and first-aid treatment contribute to the type of risk that becomes attached to people who are bitten by such animals. It is these challenges that reinforce the imminent requirement for a technology-based solution which can facilitate easy emergency response and community readiness through accessibility of safety content.

It is with these that RizAlert plans to fill the void in emergency management response, questing for responsive, easy-to-use and technology-based solution. Current systems are mainly application-oriented and do not have the integration of IoT and hardware devices such as Arduino, which strongly contribute to real-time monitoring and even automatically help with alarming in order to prevent accidents. Through harnessing Arduino's ability to connect with sensors and communication modules, RizAlert ultimately looks to improve disaster preparedness, response time and by extension the lives saved as a result of an integrated emergency response tailored for vulnerable communities. The deployment of RizAlert being deployed in Rizal is envisioned not only to solve these local problems where they are, but also provide a scalable model that can be replicated in other towns and municipalities facing this type of situation.

Android is the only platform that has the feature. It has a built in UI with some custom art and is based off the Android SDK. Students, professors and end-users' responses to the questionnaire along with an evaluation of the efficiency and usability of the application as well as its general efficiency service-learning.

The paper was designed to create RizAlert: A Web Application and IoT-Integrated Emergency Response System an application that is centered around emergency response management and includes functions like real-time alerts, location tracking, and safety preparedness with the Android programming platform.

Specifically, this study aims to: (1) design a web-based emergency assistance application; (2) Create RizAlert: A Web Application and IoT-Integrated Emergency Response System using an appropriate programming framework and the technologies; (3) test and improve the system of the application based on functionality, user feedback, and system reliability; and (4) evaluate the performance of the application in enhancing emergency response and personal safety.

METHOD

Research Design

The researcher applied a developmental method when it comes to the development of the Web Application and IoT-integrated Emergency Response System by using the Rapid Application Development (RAD) methodology, which encompasses planning, designing, developing, testing, deployment and reviewing phases. The system is system-on-a-board, consisting of software and hardware, such as an ESP32-based Arduino microcontroller with a siren module to generate IoT-enabled emergency notifications. To facilitate real-time data processing and the functionalities of the entire system, the application was created in Java, Python, Firebase, Adobe XD, Visual Studio Code and Arduino IDE.

Study Site

The study was conducted in the municipality of Rizal, Occidental Mindoro, a third-class. The area of the study was the municipality of Rizal, Occidental Mindoro, which is a third-class municipality with geographically scattered barangays and access to emergency services, which is limited. The selection of this area is because it is prone to natural disasters and complications in emergency communication.

Research Design

This study uses a developmental and practical approach, which involves systematic design, development, and testing of the RizAlert Application. Rapid Application Development (RAD) development model was used to guide the process, which consists of the following stages: Planning, Design, Creating, Testing, Deployment and Review.

Respondents of the Study

The respondents of the study include ten (20) prospective users from Rizal, Occidental Mindoro, five (5) MDRMO staff, and five (5) IT experts/professionals.

Sampling Technique

The researchers asked permission from the respondents including randomized prospective users from Rizal, Occidental Mindoro, MDRMO-Rizal staffs, and IT experts/programmers to obtain insights and evaluate the developed application.

Instrument

The research study employed a quantitative data collection tool in form of a structured survey using questionnaires that had Likert scale questions to measure the performance and acceptability of the system. Interviews and consultations were carried out with the help of the ISO 25010 software evaluation tool to back up the findings and get additional information about the functionality and usability of the system.

Data Gathering Procedures

The data gathering procedures involved distributing evaluation forms to the respondents, which include randomized prospective users from Rizal, Occidental Mindoro, MDRMO-Rizal staff, and IT experts/programmers. Subsequently, interviews and consultations were conducted to gather qualitative data.

Data Analysis

The research involved a data analysis using statistical tools, particularly the average weighted mean, to interpret the responses gathered from the survey questionnaires. The analysis was used to evaluate the system's performance based on established software quality standards including functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. The computed results were interpreted using a Likert scale to determine the level of acceptability and overall effectiveness of the developed system.

RESULTS

Demographic Profile

A total of 30 respondents took part in the study, of whom 33.33% or 10 were IT students, 33.33% or 10 residents of Rizal, 16.67% or 5 were MDRMO-Rizal staff, and 16.67% or 5 were IT experts/programmers.

Project Description and Structure

Figure 1 shows the Landing Page of the RizAlert mobile app. This interface will be the point of entry of the system where the users are exposed to the application and its use. It offers the choice of roles and navigation, which means that the user can move on to the relevant module. Its design is clear and accessible to facilitate fast navigation in times of emergencies.

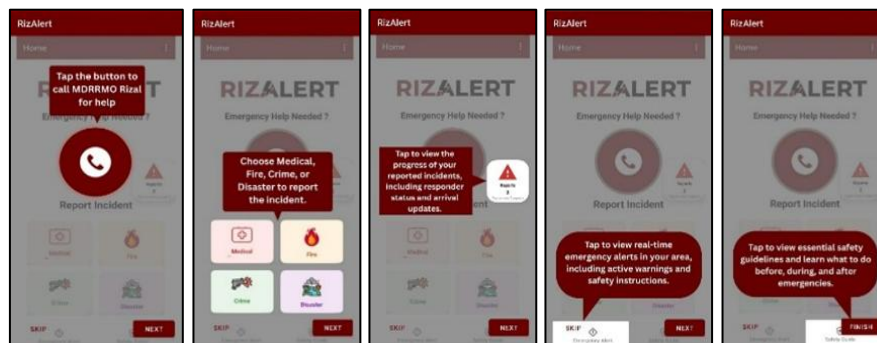


Fig. 1. Preview page of RizAlert: A Web Application and IoT-Integrated Emergency Response System

Figure 2 shows a RizAlert page where people can report about incidents like medical emergencies, fire, disaster and crime. Pressing the center MDRMO button will cause an alert. The bottom has navigation to the safety guide and emergency alert. The floating reports button displays all the reported incidents, as well as its coordinates, message, date and a progress update. This validates the correct credential validation and effective access to system features.

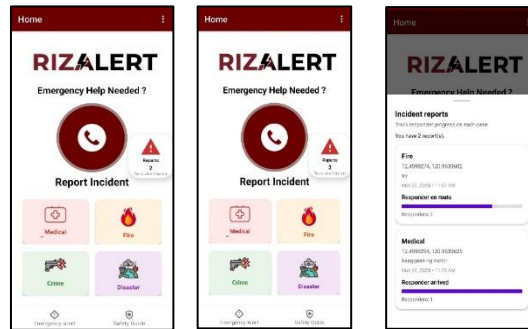


Fig. 2. Homepage and Floating button of RizAlert.

The User Homepage or Dashboard is shown in Figure 3. The interface shows the key functionalities of the application, which include MDRMO Call, Report Incident, Emergency Alerts, Safety Guide, and Settings. The design is designed in such a way that it is easy to use and retrieve in times of emergency.

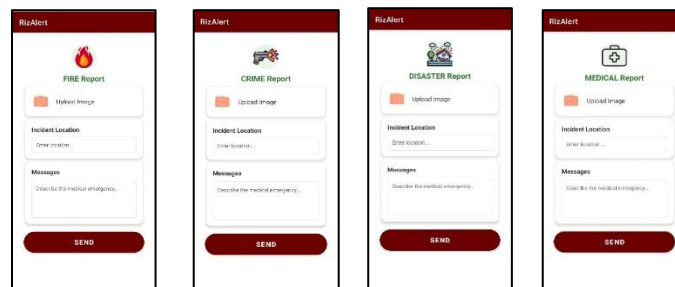


Fig. 3. Report categories of RizAlert: A Web Application and IoT-Integrated Emergency Response System.

Figure 4 shown below will enable the users to report an incident by taking an image, uploading it, specifying the location and adding a message. After filling out the details, users can submit the report using the "Send" button. This interface enables one to key in relevant information about the emergency. The system automatically records real-time GPS location data and information is sent correctly and immediately. Real-time emergency alerts will be shown in Figure 6, such as the date, time, affected areas, and safety instructions. Users are able to see safety tips, share the alert and indicate their status as being safe, in danger or evacuating. This interface will show official announcements and warnings made by administrators. It guarantees the flow of important information to the residents in time.

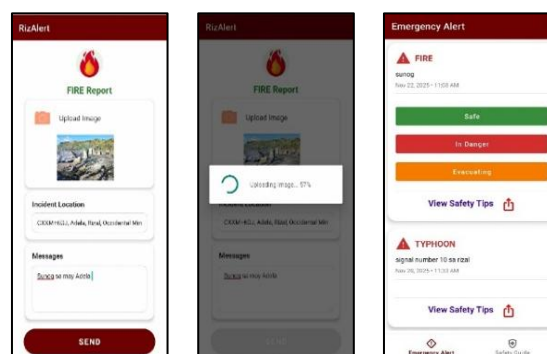


Fig. 4. Incident report page and Emergency alert page of RizAlert.

Figure 5 has categorized tips on safety of natural disasters, life safety, earthquakes and fire safety. The initial picture depicts the principal safety guide interface. The second picture describes how the users can prepare prior to the emergencies. The second image shows how users can prepare in advance of emergencies. It emphasizes the significance of preparedness by urging users to develop an emergency plan, disaster kits, and keep abreast of potential hazards. The third picture dwells upon safety tips. The fourth pictorial image is on the safety of the earthquakes. In the fifth image, a fire safety guide is depicted. It includes key measures like locating the fire exit, escape route, keep low to avoid smoke and dial the emergency services. The last image shows basic life support. It also involves protocols like checking responsiveness, requesting help, and basic life-saving measures in case of necessity.

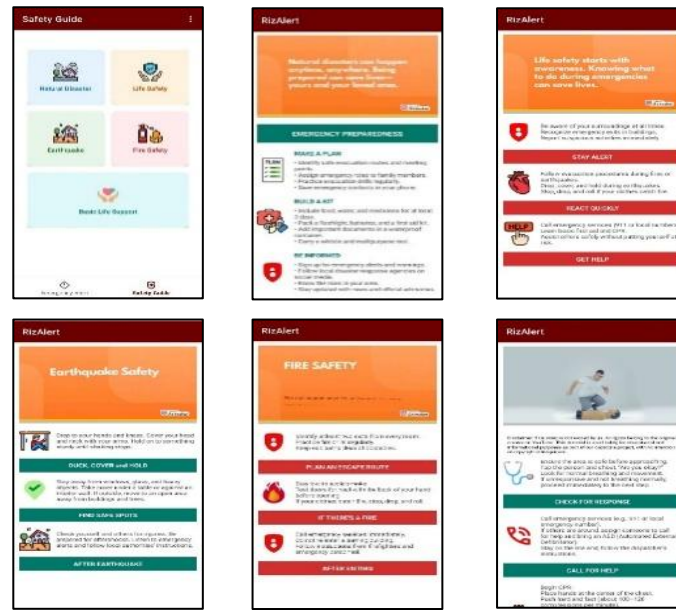


Fig. 5. Safety guide page of RizAlert: A Web Application and IoT-Integrated Emergency Response System.

The map used in figure 6 indicates the location of the incident on the route. The page is essential in navigation in case of an active emergency. It presents a map of the precise direction the route of an incident reported. It also gives the Estimated Time of Arrival (ETA) which assists the responders in coordinating their travel between the MDRRMO office and the scene.

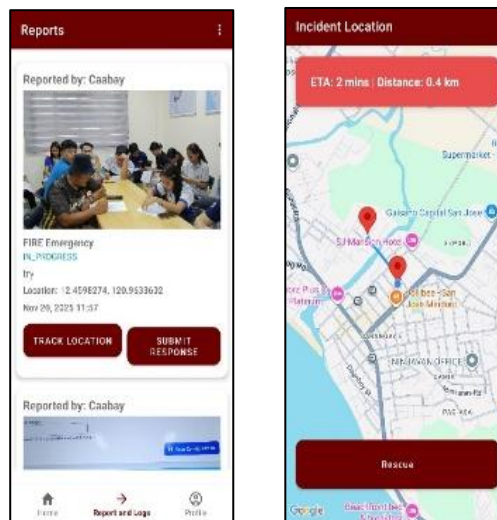


Fig. 6. Track location page of RizAlert: A Web Application and IoT-Integrated Emergency Response System.

Figure 6a demonstrates the Admin dashboard on which an overview of the incident reporting in 2025 is presented in a bar graph. Delivers real-time emergency notifications, incident resolutions (medical, fire, disaster, and crime cases) categorized by default, and possibilities to see reports, control users, and settings. At the bottom of the page, there are navigation buttons of Home, Users, Reports and IOT Siren.

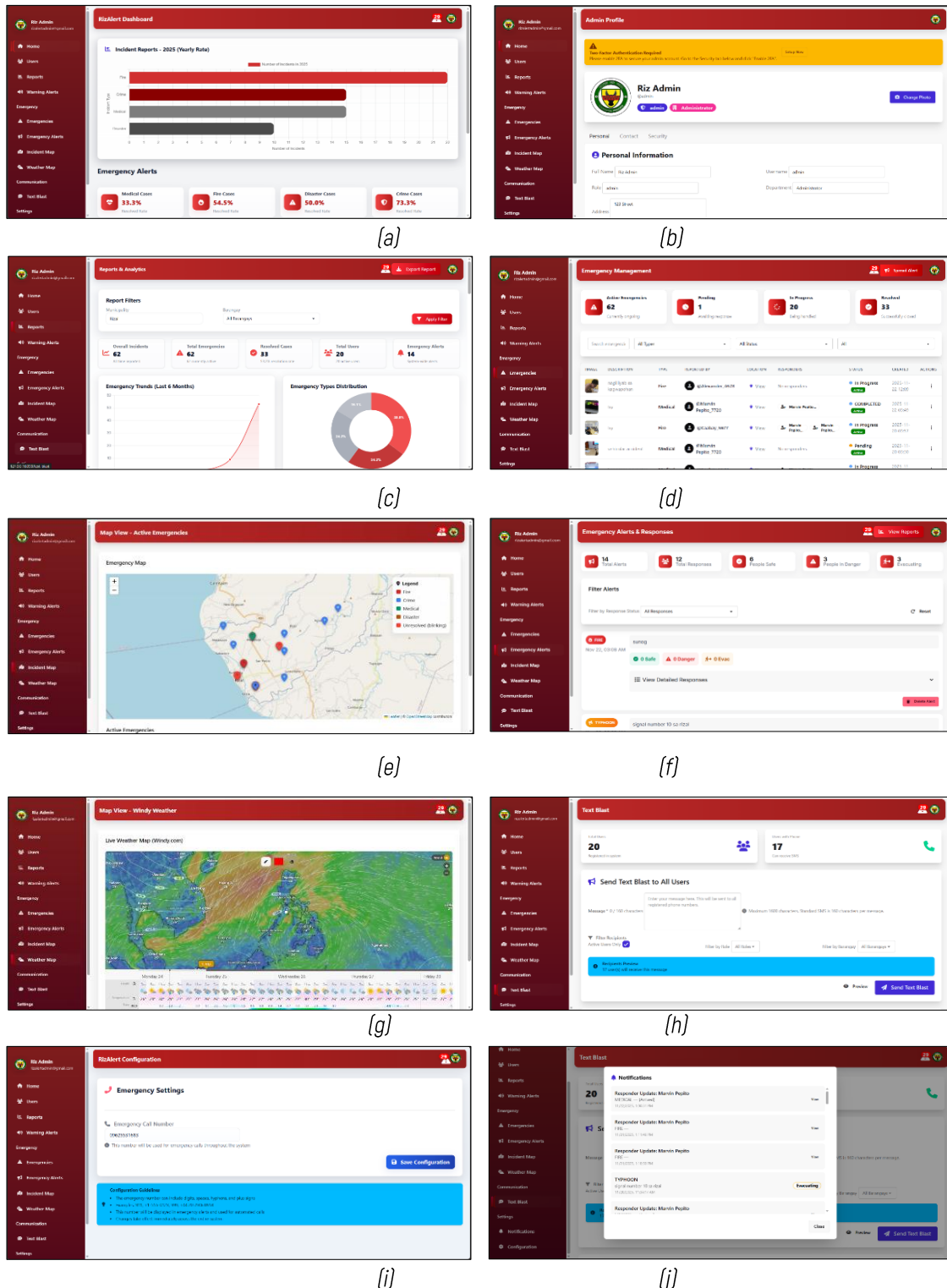


Fig. 6. Admin dashboard page of RizAlert: A Web Application and IoT Integrated Emergency Response System.

The admin profile page is where the administrators can update their personal account details in the system. It belongs to the larger administrative suite utilized in monitoring and managing the system [figure 6b].

The page, as reported in Figure 6c, is the Reports and Analytics page, which will enable the admin to view the statistics and rundown of all the reported incidents. It also has the option of the Export Report to get the summary of the reports in PDF.

The Emergency management page as shown in figure 6d allows one to view all the incident reported, its progress and all the information required about it. This dedicated page enables administrators to monitor different types of emergencies. It usually stores information on the ongoing medical, fire, disaster, and criminal cases.

The Emergency alerts page displays all the incidents reported. The page indicates whether the users have indicated that they are Safe, in Danger, or Evacuating. This page shows the emergency alerts in real time. It contains information like date, time, areas affected and special safety measures to be observed by people [figure 6e].

The Emergency Map that has been used is shown in figure 6f, and it displays all the active emergencies. Active emergencies range from Fire to Unresolved (blinking). The following page will graphically present all the incidents reported. It enables administrators to view precisely where different emergencies have taken place within the municipality in order to allocate more resources.

Figure 6g shows the Live Weather Map view that displays the real-time position of wind and rain by Windy.com. The weather map gives administrators real time monitoring of the weather environment, that is, wind and weather. This is crucial in planning against natural calamities such as typhoons or flooding.

In Figure 6h, the text blast page is indicated, on which the admin can send it to all users of the system. This interface can allow the administrator to deliver a text alert blast to all registered users at the same time. This is a critical aspect of quick and mass communication in times of emergency in the case of general public safety.

Figure 6i shows the alerts of the text blasting received by the admin. This page will be used as a system wide log or dashboard. It monitors the condition of dispatched alerts and distress messages received.

Figure 6j demonstrates the RizAlert Configuration page where the admin is able to modify the emergency call number of the entire system. The configuration page is employed in the settings of the back-end system namely in the management of emergency number settings. This is to make sure that the automated Emergency Call features of the user app are sent to the relevant authorities.

Evaluation Result

Table 1. Functionality suitability of RizAlert: A Web Application and IoT-Integrated Emergency Response System.

Content	Mean	Interpretation
Functional Suitability	4.52	Excellent
Performance Efficiency	4.40	Very Good
Compatibility	4.47	Very Good
Usability	4.54	Excellent
Reliability	4.49	Very Good
Security	4.36	Very Good
Maintainability	4.42	Very Good
Portability	4.77	Excellent
Overall Mean	4.49	Very Good

Legend: 4.51-5.00 – Excellent; 3.51-4.50 – Very Good; 2.31-3.50 – Good; 1.51-2.50 – Fair; 1.00-1.50 – Poor

DISCUSSIONS

Adaptability and installability of the system were considered as a measure of portability which was rated as excellent, indicates the flexibility and the ease of deployment in various settings of the system. In general, the findings confirm the portability of the system, which enables it to adapt to changing environments and is also easy to install, which is why it is a versatile and reliable solution under different operating conditions.

According to the results of the study, the system is extremely efficient in the important quality parameters. The overall review of RizAlert: A Web Application and IoT-Integrated Emergency Response System shows that it is a necessary application to improve the emergency response in the municipality of Rizal, Occidental Mindoro. The system has received a high rating in terms of functional suitability, usability, and portability. These findings support the idea that the main functionality of the system, including GPS location tracking and multi-category incident reporting is important in improving emergency response systems that need to run on various hardware and software platforms, which is in line with the results on wireless sensor-based emergency systems (Zhang et al., 2025).

Moreover, the system had a very good assessment in the core technical measures like performance efficiency, compatibility, reliability, security, and maintainability. These ratings prove the successful usage of such essentials as the opportunity to label the safety of users during the calamities, the capabilities of the responders to locate the specific place of the incidents and the assistance of the real-time transmission of the locations. These characteristics show how IoT-based emergency systems are becoming more important in improving situational awareness and responder's coordination (Damaševičius et al., 2023).

In addition, the findings are also in line with the findings of other similar mobile-based emergency response apps which demonstrate that real-time reporting and GPS monitoring can significantly reduce the response time and increase the efficiency of coordination (Nuevas et al., 2024). The high usability score also confirms the earlier research that states

that intuitive and easy-to-use interfaces are crucial during an emergency, as users need to respond quickly and efficiently (Fabito et al., 2016).

Overall, these results confirm the argument that RizAlert is not only technically correct but also aligned with the existing literature on the digital emergency response systems. The study is based on the earlier ones in that these technologies can be efficiently implemented in a low-income urban setting helping to increase the general population safety, faster emergency reaction and more cost-effective disaster management.

CONCLUSION AND RECOMMENDATION

The researcher was able to develop the RizAlert: A Web Application and IoT-Integrated Emergency Response System which is meant to improve emergency communication and response in the Municipality of Rizal, Occidental Mindoro. The research was able to develop an all-inclusive web-based emergency help application, which is effective in serving users, administrators, and responders. The key features that the system included were real-time location sharing, tagging of safety status, reporting on incidents, educational resources, and administrative dashboards. These elements saw to it that the application achieved the functional needs of all the targeted users thus the goal of developing a well-designed user-friendly emergency response platform was realized. The RizAlert was developed successfully with the help of the right programming frameworks and technologies, such as Java, Firebase, Python, and Arduino IDE. These technologies integration allowed effective operation of the systems, real-time processing of data, and smooth interaction of software and hardware devices. This attests to the fact that the system has been developed based on the goal of using appropriate tools and technologies in effective application development. The system was carefully tested and improved with each other on the basis of user feedback and evaluation of system performance. Findings indicated that RizAlert scored high in functionality, usability, reliability and performance efficiency. These results show that the system had been optimized and refined successfully, achieving the goal of improving the application by means of constant testing and refinement. The evaluation outcomes through ISO 25010 demonstrated that the system was operational, dependable, usable, safe and performance effective. Student, resident, responder, and IT expert feedback confirmed that RizAlert was of acceptable quality software and regarded user-friendly and functional.

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DECLARATION OF CONFLICT OF INTEREST

The authors declare no conflict of interest.

DECLARATION OF AI USE

The authors used SciSpace for gathering relevant research materials for the study. All outputs were reviewed and validated by the authors, who take full responsibility for the content.

AUTHOR CRediT STATEMENT

Pepito, M.C.: conceptualization, methodology, investigation, formal analysis; **Gaytano, N.L.L.:** data curation, methodology, and writing – original draft, review & editing; **Sualog, W.P.:** methodology, investigation, and data collection; **Dangeros, A.J.:** methodology, investigation, and data collection; **Jadia, V.:** methodology, investigation, and data collection; **pelayo, I.I.:** supervision.