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ALERT35: Development of Application for Emergency Rescue Response of Lal-Lo, Cagayan, Philippines

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ABSTRACT

The study focused on the design, development, and implementation of ALERT35: Development of Application for Emergency Rescue Response of Lal-lo, Cagayan. The study's objective is to lessen the time it took to respond to an emergency thus minimizing the figures of mortality and potentially saving more lives. Interviews with the Municipal Disaster Risk Reduction Office (MDRRMO) and documentary analyses of the documents and reports we conducted to determine the inputs in the conceptual paradigm of the study. Scrum methodology was used as a guide during the development of the applications. Three IT professionals as system evaluators, three IT professionals as panelist and six end-users evaluated the developed system. Findings shows that the developed system is compliant to a great extent vis-a-vis the ISO 25010:2011 criteria. The system would enable the residents and rescue to responders of Lal-lo, Cagayan to communicate effectively during emergency situation providing timely, efficient, accurate situational awareness, and effective resource management during those situations. The system would also allow real-time display of emergency reports and generation of update data and information on the MDRRMO thereby aiding in reporting and effective decision making.

Keywords: *Scrum Methodology, ISO 25010:2011, Emergency Rescue Response*

INTRODUCTION

There has been an advancement in the ways that emergencies are responded to and managed over the years due to the integration of software technologies. The advancement in data analytics, communication, and software technologies has increased the performances of responders to lessen the casualties during emergency cases and their ability to save lives. Every second matters when it comes to saving lives. Prompt and efficient is crucial to providing timely medication in accidents and medical emergencies. Lal-lo is a municipality in the province of Cagayan and it is facing unique challenges in its emergency rescue and response, due to the increasing number of emergency cases and its geographical location.

The Municipal Disaster Risk Reduction and Management Office of Lal-lo also known as Rescue 35, provides immediate emergency response in the municipality and its neighboring municipalities. However, the capability of the agency in rescue response is not yet at its full potential because it still relies on traditional methods such as phone calls, radios, and manual processes which have limitations in terms of resource management, record-keeping, public engagement, and situational awareness.

Efficiency, timeliness, accurate situational awareness, and effective resource management are crucial before, during, and after emergency response operations. Manual record keeping can delay the response time and it is prone to human errors.

The municipality of Lal-lo needs an enhanced and effective emergency response system because the number of emergency reports has been rising over the last three years. Automobile crashes, heart attacks, and other medical emergencies need to be attended to in the least amount of time and treated quickly. Delays in responding to this results in higher rates of morbidity and mortality. The difficulties experienced by emergency responders in Lal-Lo caused poor communication, a lack of situational awareness, and ineffective resource management.

To address these challenges and improve the emergency response capabilities of Rescue35, this capstone project aims to develop a rescue

system as an application specifically designed for Lal-Lo. The application will leverage mobile technology to enhance communication, situational awareness, resource management, public engagement, and overall response efficiency in the context of vehicular accidents and medical emergencies. By providing efficient communication, and data collection as well as features for resource tracking, public reporting, and record-keeping, the application has the potential to significantly enhance the emergency response capabilities of Rescue35 in Lal-Lo. The ultimate of this capstone is to save crucial time in emergency response operations and ultimately save lives. This aligns with SDG 3: Good Health and Well-Being, which aims to ensure healthy lives and promote well-being for all at all ages.

This initiative aligns with the mandate of the Municipal Disaster Risk Reduction and Management Office as stipulated in Executive Order No. 08 Series of 2013, which emphasizes the need to enhance emergency response capabilities and ensure the efficient and effective delivery of services to the community during emergencies. By leveraging mobile technology, the app aims to improve the emergency response system of Rescue35 in Lal-Lo in line with the municipality's disaster risk reduction and management policies and regulations.

MATERIALS AND METHODS

Research Instruments

The following were the research instruments used in gathering the needed data for the study:

Key Informant Interview. Using an interview guide, a formal interview with the MDRRMO officer was done to elicit information regarding needs and the processes, protocols of responding to emergencies. Moreover, the

information as regards the needed reports and deliverables of the proposed system were asked in the interview.

Documentary Analysis. Documentary analysis was conducted to review relevant documents such as emergency response protocols, standard operating procedures, incident reports, and communication records. These documents provided insights into the existing emergency response system, its strengths and weaknesses, and any areas requiring improvement.

Surveys. A survey questionnaire was administered to residents of Lal-Lo to gather their feedback and opinions on the effectiveness of the proposed emergency response mobile app. The survey included questions about their awareness of the app, their perceived benefits, and suggestions for enhancements.

Data Gathering Procedure

Before data gathering and collection, the researchers performed the following steps:

1. Requested permission from the Campus Executive Officer to conduct the study at the Municipal Disaster Risk and Reduction Office of the Local Government Unit of Lal-lo.
2. Submitted a formal letter to the Municipal Disaster Risk and Reduction Officer, requesting an interview to gather data as outlined in the study objectives.
3. Sent an official communication to IT professionals, informing them of their selection to test the system's viability prior to its deployment. Their feedback and suggestions during the evaluation were taken into consideration for system improvement and enhancement.
4. Provided a comprehensive system orientation to the user. Following the orientation and initial system check, the assessment tool was administered to evaluate the system's performance, acceptability, and the user's satisfaction with its usage.
5. Retrieved, reviewed, and validated the completed assessment tool forms, and then compiled and tabulated the scores in a master datasheet or MS Excel. The coded data sets were inputted into the spreadsheet application and subjected to statistical analysis.

Analysis of the Data/Statistical Treatment

The responses gathered from the interview participants were documented and examined. Notable points pertaining to the interview questions were highlighted based on the interviewees' responses, aiding in the analysis of the data. To analyze the rating given by the IT experts, MDRRMO Administrator and Residents, regarding the compliance of the developed application with ISO standards, the mean value was utilized. The level of system compliance was assessed using the matrix provided below:

Table 1. Likert Scale for the Measurement of the Extent of Compliance to ISO 25010:2011 Software Quality Standard.

Mean Range	Descriptive Equivalent	Interpretation
4.20 - 5.00	Moderate Extent	The measure described in the item is compliant to the very high extent or **OUTSTANDING.**
3.40 - 4.19	Moderate Extent	The measure described in the item is compliant to a high extent or **VERY SATISFACTORY.**
1.80 – 2.59	Low Extent	The measure described in the item is compliant at low extent or **FAIR.**
1.00 – 1.79	Very Low Extent	The measure described in the item is compliant at the lowest extent or **POOR.**

Hardware Used

Laptop. Developers used laptops in system development due to portability allowing developers to work from various locations, collaborate with team members, and perform on-site demonstrations. This versatility enabled the installation of different development tools, programming languages, and environments, facilitating efficient coding, debugging, and testing.

Smartphone. To check the responsiveness of the mobile application, developers used different gadgets such as desktop.

Desktop. To check the responsiveness of the web application for administrator.

Table 2. Minimum Hardware Requirements for the Proposed System.

Hardware Components	Size
CPU	2.0 – 3.5 Ghz
RAM	8 GB
SSD (for faster performance)	256 GB
Server IP (optional)	1 Static IP Adress

Software Used

Visual Studio Code. Developers of the above-mentioned system used VS Code for its lightweight nature, rich editing environment, language support, integrated version control, extension ecosystem, cross-platform compatibility, and community support make it a suitable choice for developing systems.

MySQL Database. The database used by the developers because of its database management, data manipulation, SQL querying, import/export capabilities, security features, relationship visualization, user-friendly interface, and community support make it a valuable tool for developing systems.

XAMPP. XAMPP is an acronym that stands for "Cross-Platform, Apache, MySQL, PHP, and Perl." It is a widely used open-source software package that provides a local development environment for building and testing web applications. XAMPP is designed to be easy to install and use, making it popular among developers, especially those working with PHP and MySQL.

Bootstrap. is a popular open-source framework for building responsive and mobile-first websites and web applications. It provides a collection of CSS and JavaScript components, as well as pre-designed templates and themes, that make it easier to create visually appealing and functional web interfaces.

Google Cloud Console-Firebase Realtime Database. A cloud-hosted NoSQL database that allows data to be stored and synced between users in real-time. It provides real-time data synchronization, offline capabilities, and secure access control, making it an excellent choice for developing applications that require real-time communication and data updates.

Table 3. Minimum Software Requirements for the Proposed System.

Software	Versions
Windows OS	10
XAMPP	8.0.11
Adobe Photoshop	2019
Bootstrap	5
Visual Studio Code	1.60
Google Cloud Console-Firebase	n/a

RESULTS AND DISCUSSION

Personal Information

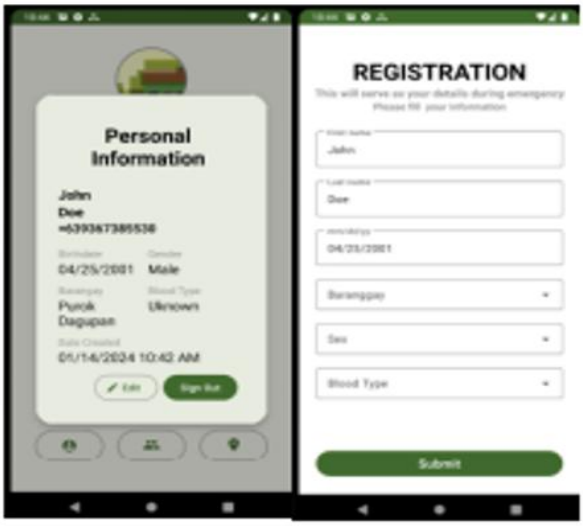

Figure 1. Personal Information/Registration Page.

This activity allows users/residents to view and review their personal information.

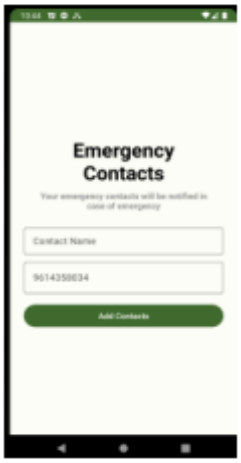

Figure 2. Emergency Contact Page.

This activity enables users/residents to register their emergency contacts, who will receive notifications in the event of an emergency.

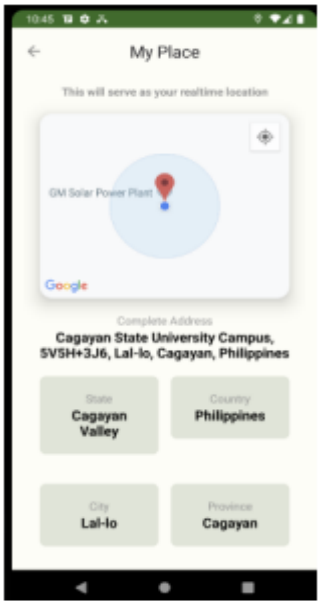

Figure 3. Realtime Location.

This activity displays the real-time location of the user.

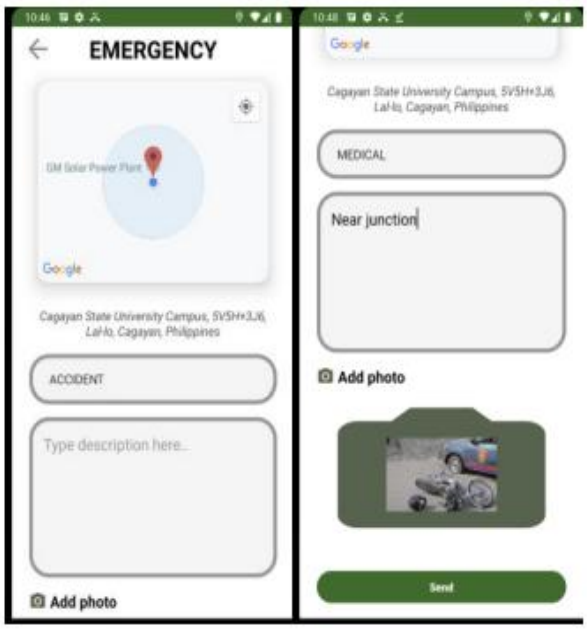

Figure 4. Emergency Reporting.

This screen facilitates users in reporting emergency cases. During the reporting process, users are required to provide details such as the type of emergency, a description, and a photo of the incident.

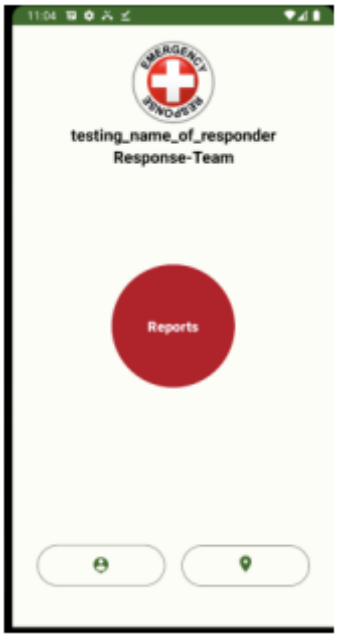

Figure 5. Responder Home Activity.

This screen serves for responder operations, allowing them to navigate through various functions. Responders can view emergency reports, access detailed information, and track the real-time location of incidents.

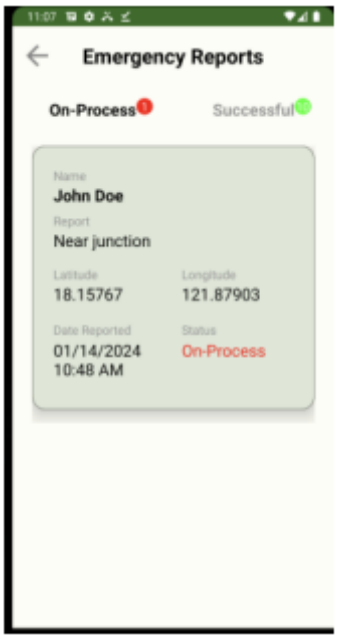

Figure 6. Emergency Reports.

This activity enables responders to switch between ongoing and successfully resolved reports. The screen provides responders with concise details about each report.

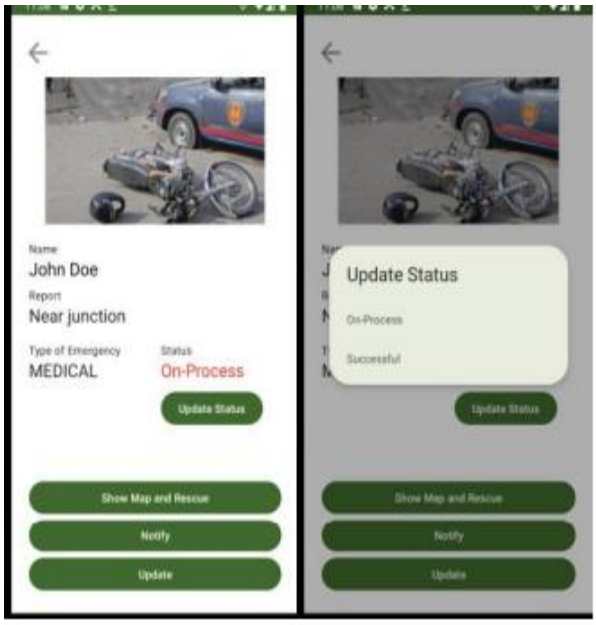

Figure 7. Emergency Details.

This activity enables the responder to both view and update the status and details of the emergency case.

Figure 8. Google Maps Integration.

When the responder selects "Show Maps and Rescue" from the previous activity, the location of the emergency case will be displayed, along with the route from the responder's location to the user's (resident's) location.

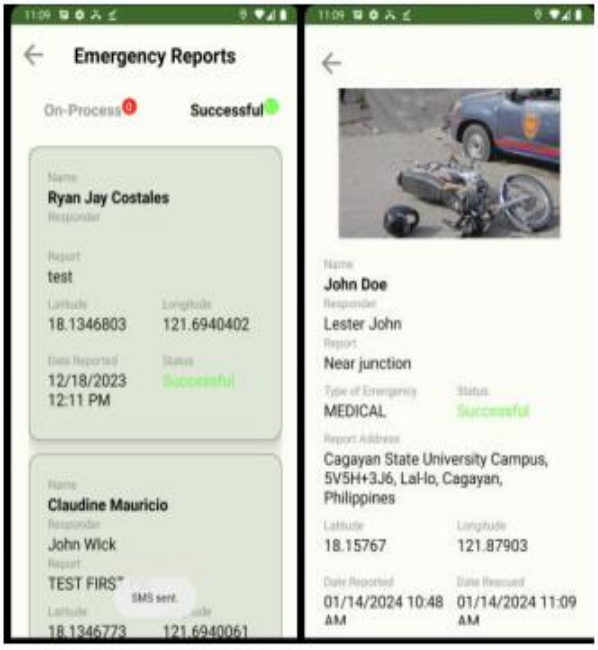

Figure 9. Successful Reports.

This feature allows the responder to review the details of successfully resolved emergency reports.

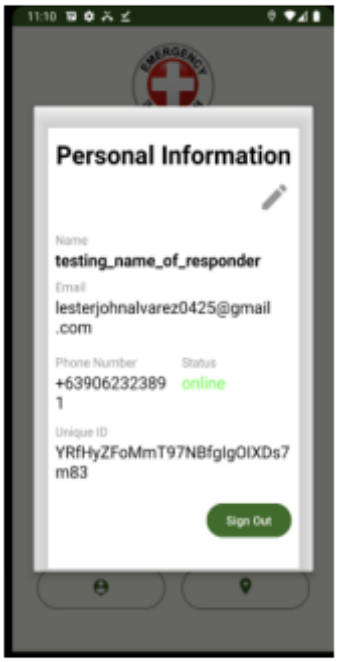

Figure 10. Responder Information.

This activity enables the responder to view their personal information.

Personal Information

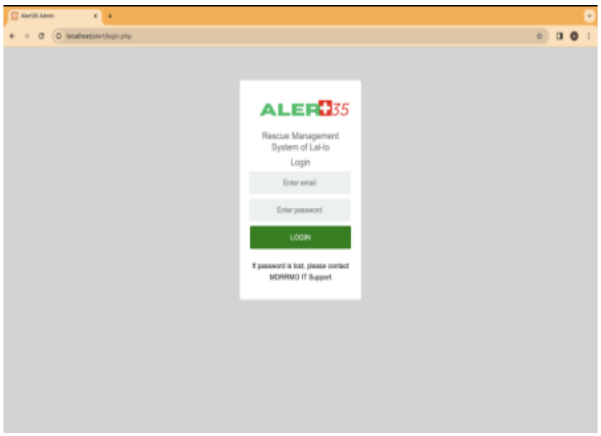

Figure 11. Login Screen.

The admin personnel will enter their email and password credentials for authentication. If the entered credentials do not match those in the database, the user will be prompted to reenter their credentials. Upon successful validation, the system will proceed to the next screen.

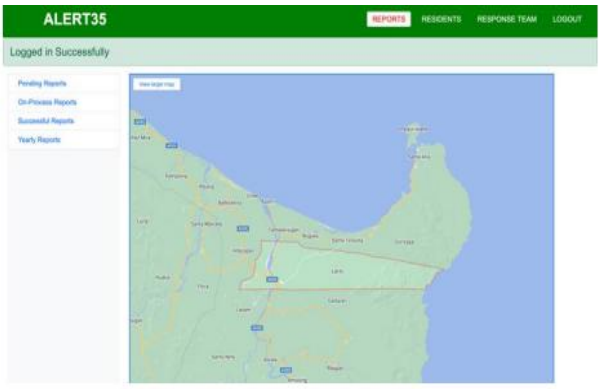

Figure 12. Home Screen.

A Google Map will display the location of the incident report.

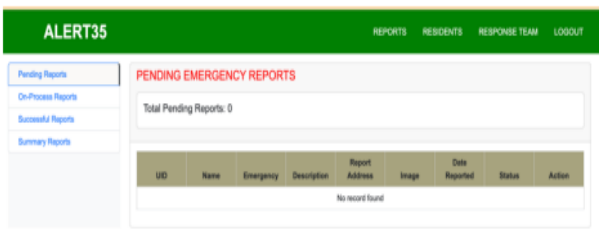

Figure 13. Pending Emergency Report.

This section will display all the pending emergency reports in the system.

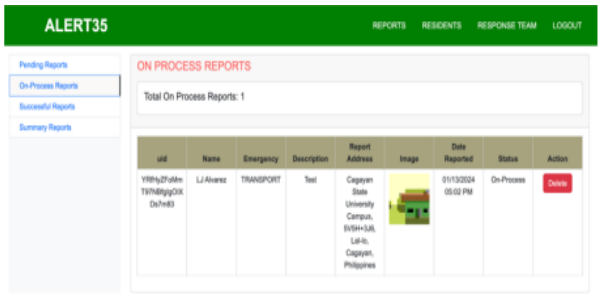

Figure 14. On-process reports.

This section will display all the ongoing processes in the system.

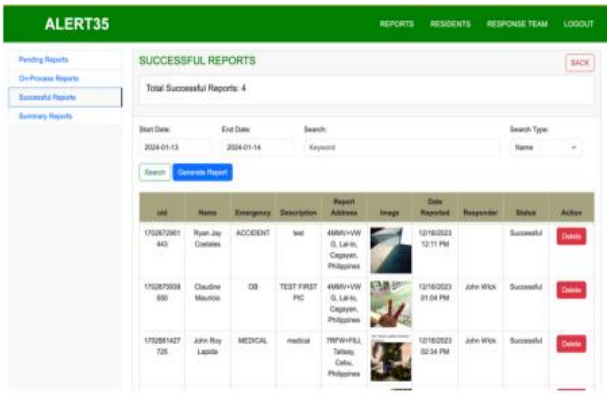

Figure 15. Successful Reports.

This section will display all the successfully resolved reports in the system. Additionally, it will provide the admin with the capability to generate and search records.

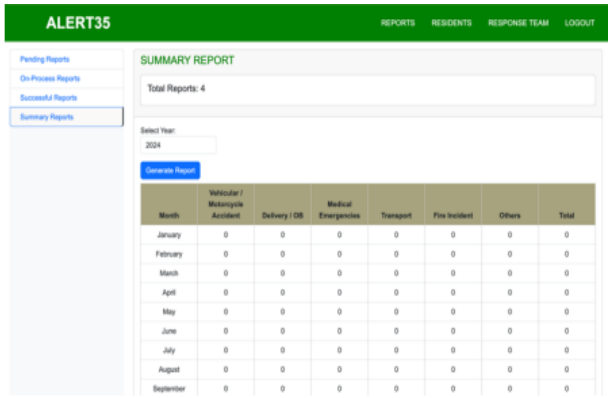

Figure 16. Successful Reports.

This section will provide a summary of all the accident cases for the entire year and can be generated for reporting purposes.

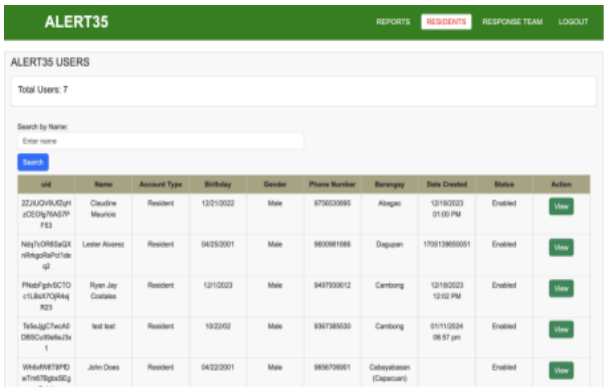

Figure 17. Resident Management.

The administrator will have the capability to view, edit, and delete residents/users within the system.

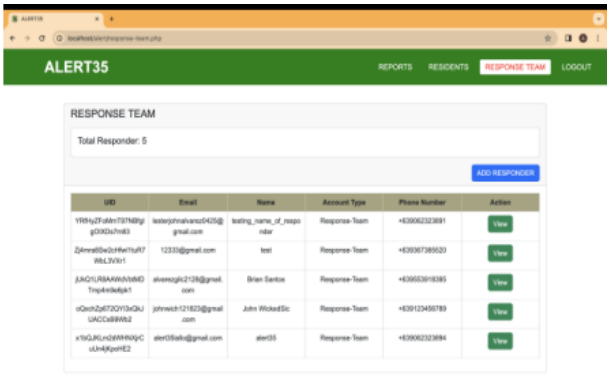

Figure 18. Response Team Management.

The administrator will have the ability to view, edit, and delete response teams within the system.

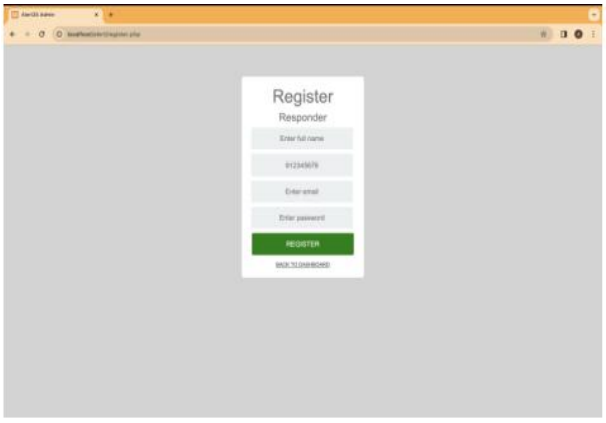

Figure 19. Responder Registration.

The administrator will have the ability to register responders within this section.

I. Practices and procedures of the MDRRM office in emergency response and rescue operations in Lal-lo

The MDRRM office receives a call. Operator answers, identifies caller and emergency. Location, type of emergency, and number of people affected are recorded. Situation is assessed and triaged, classifying emergency and determining resources and response teams. Teams are activated based on emergency type and receive instructions. Communication is maintained until situation resolves. All calls, actions, and resources are documented.

II. Problems, needs, and gaps in the in existing system in the emergency response and rescue operations of MDRRMO in Lal-lo

The problem in the existing system of the MDRRMO is the slow response time, often attributed to delayed information gathering and decision-making. There is a need for the implementation of systems that enhance the speed of communication and decision-making processes. Additionally, limited accessibility to critical information during emergencies is a concern, emphasizing the necessity for a better system that facilitates quick and easy data access. Communication breakdowns are also common due to inefficient communication channels, indicating a need for diverse and redundant communication methods, including digital platforms. Community engagement is another area that requires improvement, with a need for the development of community-based programs and awareness campaigns to enhance disaster preparedness. Inefficient resource allocation during emergencies is a persistent challenge, underscoring the importance of a robust resource management system. The limited use of technology is apparent, emphasizing the need for incorporating modern technology for data collection, analysis, and response coordination. Addressing these challenges calls for a holistic approach, including the adoption of technology, community involvement, continuous improvement in standard operating procedures.

Based on the preceding issues learned, the following table summarizes the problems, gaps, and needs in system in responding emergency practices and procedures of MDRRMO of Lal-lo.

Table 4. Problems, needs, and gaps in the existing system in responding to emergency cases, practices and procedures of the MDRRMO Lal-lo.

Problem	Gap	Need
Slow response time because of no integration of emerging technologies	The current system lacks integration technologies like GIS and faster data analysis.	Implementation of system with real-time reporting, easy to use, faster and quicker to report emergency
Manual generation of reports	The current system relies on manual effort for report generation, making it inefficient and prone to errors	Automate report generation processes to improve efficiency and eliminate errors
Limitations of situational awareness during emergencies	The existing system lacks capabilities for comprehensive and real-time situational awareness.	Implementation of GPS API for the system to easily locate the reporter, and ability to send photo as evidence and for the rescuer to assess the situation
Absence of better system that is efficient, quick, and reliable in responding to emergencies	Absence of better system that is efficient, quick, and reliable in responding to emergencies	Implement a comprehensive and integrated emergency response system to ensure faster response time, improved efficiency, enhanced reliability and seamless coordination

III. The developed system, ALERT35 (Development of Application for Lal-lo Emergency Response Teams)

The development of ALERT35, an Application for Lal-lo Emergency Response Teams, stems from a comprehensive analysis aimed at addressing challenges, improving response efficiency, and filling gaps in the current emergency response systems. Through extensive documentary reviews and interviews with key stakeholders, particularly the MDRRMO Lal-lo, a robust and versatile application system has been designed to revolutionize emergency response efforts.

The developed application aims to address coordination, communication, and data management issues by offering key features such as GPS integration, real-time notifications, administrator tools, rescuer functionality, and resident engagement. ALERT35 is highlighted for its user-friendly.

The technology stack includes Java, PHP, XAMPP, and Google Cloud Console to ensure stability and scalability.

Description of the Developed System

This section illustrates the usage flow of the developed ALERT35 Application for Lal-lo Emergency Response Team of MDRRMO Lal-lo.

To address the challenges faced by MDRRMO Lal-lo, a comprehensive solution has been devised in the form of a mobile application and web application. These applications seamlessly integrate GPS functionality, real-time notifications, and efficient coordination between rescuers and headquarters to ensure a swift and effective emergency response.

ALERT35 allows administrators to receive real-time reports, review user credentials, send reports to responders, monitor pending and ongoing reports, and generate successful reports for archival purposes. The application also grants administrators the ability to manage users, including adding, editing, and deleting users, as well as adding new responders to the system.

For rescuers, the application enables them to log in, receive emergency reports, respond promptly, and update the status of ongoing reports.

Residents of the municipality can utilize the application to register, submit proof of identification, log in, edit their profiles, report emergencies, and receive timely notifications.

Screenshots showcasing the features of ALERT35 are included in the User's Manual. The system is designed to be installed and run on Android devices for the rescuer and responder app, while the web admin app is

optimized for desktop computers and laptops. The application was developed using Java, PHP, XAMPP, and the Google Cloud Console.

Extent of Compliance of the Developed Application to ISO 25010 Software Quality Standards

The table below presents the assessment of IT experts and users of the extent of compliance of the developed system to ISO 25010 standards.

Table 5. Summary Table of the Assessment of IT Experts and Users of the Extent of Compliance of the Developed System to ISO 25010.

Criteria	IT Experts (N=8)		User (N=6)	
	Weighted Mean	Descriptive Average	Weighted Mean	Descriptive Average
Functional Suitability	3.78	Great Extent	4.19	Very Great Extent
Reliability	3.76	Great Extent	4.35	Very Great Extent
Usability	3.82	Great Extent	4.37	Very Great Extent
Performance Efficiency	3.87	Great Extent	4.38	Very Great Extent
Maintainability	3.96	Great Extent	4.27	Very Great Extent
Portability	3.90	Great Extent	4.23	Very Great Extent
Security	3.48	Great Extent	4.35	Very Great Extent
Compatibility	3.57	Great Extent	4.33	Very Great Extent
Overall Weighted Mean	**3.77**	**Great Extent**	**4.32**	Very Great Extent

It can be seen from the table that a varying result of the assessment made is comparable. In particular, the users generally assessed the compliance of the developed system to a very great extent with a mean of 4.31 as compared to the assessment of IT experts with a mean of 3.77. Normally, due to technical difference of experience and skills, the developed system has sustained a significant level of conformity to software quality standards. Similarly, the perceived compliance with the standard reflects the overall positive impression of the system. Further, the results show that system does not only conform to but extends beyond standards of the ISO 25010.

IV. Enhancements that can be made to the developed system

Additional features can be implemented to enhance the system including real time chat, video streaming, pushing notifications, incident map plotting and weather alerts.

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