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Smart Application for Emergency Response (S.A.F.E.R.): An Android Mobile Application for Real-Time Safety and Location Tracking in Manila

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ABSTRACT

The increasing incidence of urban fire emergencies in Manila City emphasizes the need for efficient, technology-driven response systems capable of improving situational awareness and communication. Conventional fire reporting methods, which rely primarily on manual calls and delayed verification, often result in slower response times and limited coordination among emergency responders. This study aimed to develop and evaluate the Smart Application for Emergency Response (S.A.F.E.R.), an Android-based mobile application designed to enhance fire emergency preparedness and response through real-time location tracking, rapid incident reporting, safety guidance alerts, direct communication channels, and community resilience tools. A descriptive research design was employed, supported by an agile iterative development methodology. The system was evaluated using the Mobile App Rating Scale (MARS) for user-based assessment and the ISO/IEC 25010 software quality model for technical evaluation. A total of 56 respondents participated in the study, comprising 50 Manila City residents and 6 IT/subject matter experts. Descriptive statistical techniques, including mean and standard deviation, were used to analyze the collected data. Evaluation results showed that

S.A.F.E.R. achieved a Very Good overall rating from residents, with an overall mean score of 4.44, demonstrating high functionality, clear information quality, and strong user engagement. Similarly, IT and subject matter experts rated the system Very Good, with an overall mean of 4.43, and Excellent ratings in functional suitability and usability. These findings confirm that the system effectively meets its objectives and complies with established software quality standards. The study concludes that S.A.F.E.R. is a reliable, user-centered mobile solution that significantly enhances fire emergency preparedness and response in urban communities, contributing to improved public safety and disaster resilience.

Keywords — Emergency Response, Mobile Application, Fire Safety, Community Resilience, Real-Time Tracking, Usability Evaluation.

INTRODUCTION

The increasing frequency of urban fire incidents in Manila City highlights the urgent need for efficient and real-time emergency response systems. Traditional methods of fire reporting, which rely heavily on manual phone calls and physical inspection, often lead to delays in response times and limited situational awareness, ultimately affecting the effectiveness of rescue operations and endangering lives and property (De Leon & Miranda, 2022; Gema & Lubis, 2020). Advances in mobile technology have created opportunities to address these limitations, as mobile applications have proven effective in disaster management by enabling rapid notifications, GPS-enabled location tracking, and real-time communication between affected individuals and emergency responders (Astarita et al., 2020). Despite these advancements, existing solutions in the Philippines often focus on isolated functionalities, such as alert dissemination or incident reporting, without integrating a holistic approach that combines real-time tracking, safety guidance, communication, and community resilience.

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In response to these gaps, this study aims to develop and evaluate the Smart Application for Emergency Response (S.A.F.E.R.), an Android-based mobile application designed to enhance fire emergency preparedness and response in Manila City. The application integrates multiple features, including real-time location tracking to expedite emergency response, an emergency reporting module with precise GPS coordinates for accurateincident reporting, safety guidance alerts tailored to user location and incident severity, direct communication channels to facilitate interaction between residents and responders, and community resilience tools such as offline emergency contacts and dynamic news feeds to support preparedness before, during, and after fire events.

Using a descriptive-developmental design and the agile iterative methodology, S.A.F.E.R. was developed and evaluated with feedback from 50 residents and 6 IT/subject experts to assess its usability, functionality, and effectiveness. This study contributes to the field of emergency management by providing an inclusive, community-centered digital solution that demonstrates the practical benefits of mobile applications in urban fire response scenarios. The findings are expected to inform future developments in emergency preparedness technology, ultimately promoting faster response times, improved situational awareness, and enhanced community resilience in densely populated urban areas.

REVIEW OF RELATED LITERATURE

Mobile applications have become vital tools in emergency management, providing significant improvements in situational awareness, communication, and resource allocation during disasters. GPS-enabled reporting features, for instance, allow for precise incident location identification, reducing response times and enhancing the accuracy of rescue operations (Akpalu, 2022; Kirci et al., 2023). Beyond location tracking, integrated communication platforms embedded within mobile systems enable two-way interaction between affected residents and emergency responders, ensuring more coordinated and efficient emergency operations (Montefalcon et al., 2021; Rey et al., 2024). These capabilities allow authorities to monitor evolving situations in real time while providing guidance and support to individuals on the ground.

In addition to communication and reporting, mobile applications enhance safety and preparedness by delivering actionable, location-specific guidance during emergencies. Safety alerts provide users with step-by-step instructions tailored to the type and severity of an incident, enabling effective decision-making under stressful conditions (Fernando et al., 2020; Kodali & Mahesh, 2017). Offline tools, such as emergency hotlines, contact directories, and dynamic community news feeds, further strengthen resilience by ensuring continued access to critical information, even in areas with limited or no internet connectivity. These features empower communities to maintain preparedness before, during, and after emergency events.

The effectiveness and reliability of such applications are assessed using structured evaluation frameworks. The Mobile App Rating Scale (MARS) and ISO/IEC 25010 standards, for instance, provide systematic measures of usability, performance, functionality, and technical reliability (Brandy Klug, 2023; ISO, 2023). By combining these frameworks, developers can identify strengths and areas for improvement, ensuring that emergency applications meet user needs while adhering to quality standards. This study applied both evaluation frameworks to validate S.A.F.E.R., collecting feedback from 50 residents and 6 IT/subject matter experts to assess usability, functionality, and effectiveness in real-world scenarios.

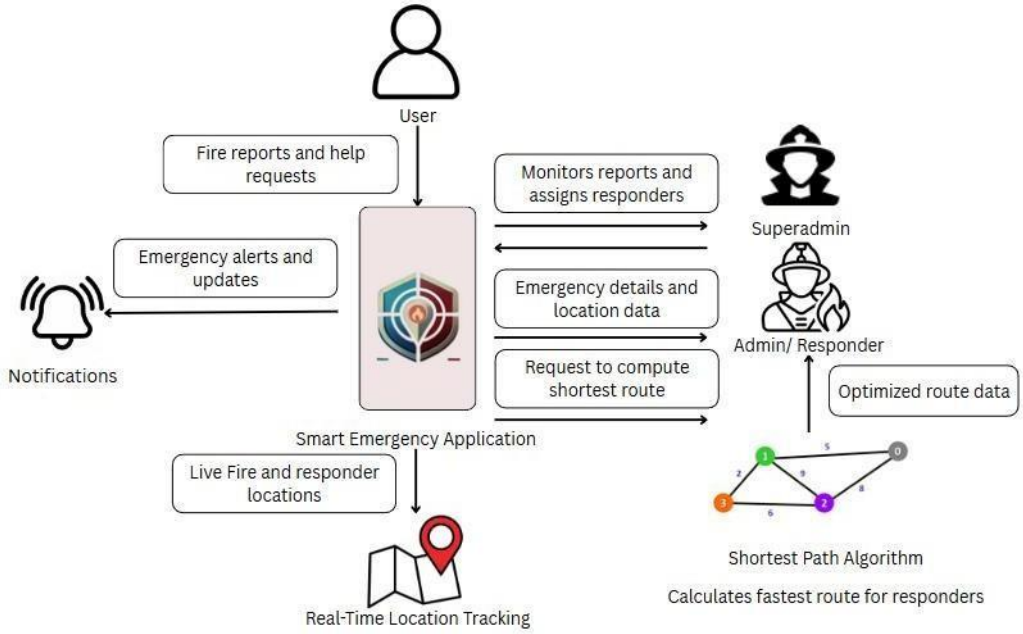
Conceptual Framework

The conceptual framework, as illustrated in Figure 1, centers on the development of the Smart Emergency Application, which i-s specifically designed to manage fire emergencies. The system accommodates two user types: the responder and the resident. The responder is responsible for receiving and acting on fire emergency alerts, while the resident triggers the emergency request when immediate assistance is required.

The application leverages geolocation technology to track the real-time position of users and incorporates a shortest path algorithm to determine the most efficient route for responders. This ensures that responders can reach the fire scene as quickly as possible, thus improving the overall speed and effectiveness of the fire

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emergency response. The system also offers live updates regarding the fire status and the locations of nearby responders, providing critical situational awareness.



System Interaction Flow Figure 1. Conceptual Framework of S.A.F.E.R

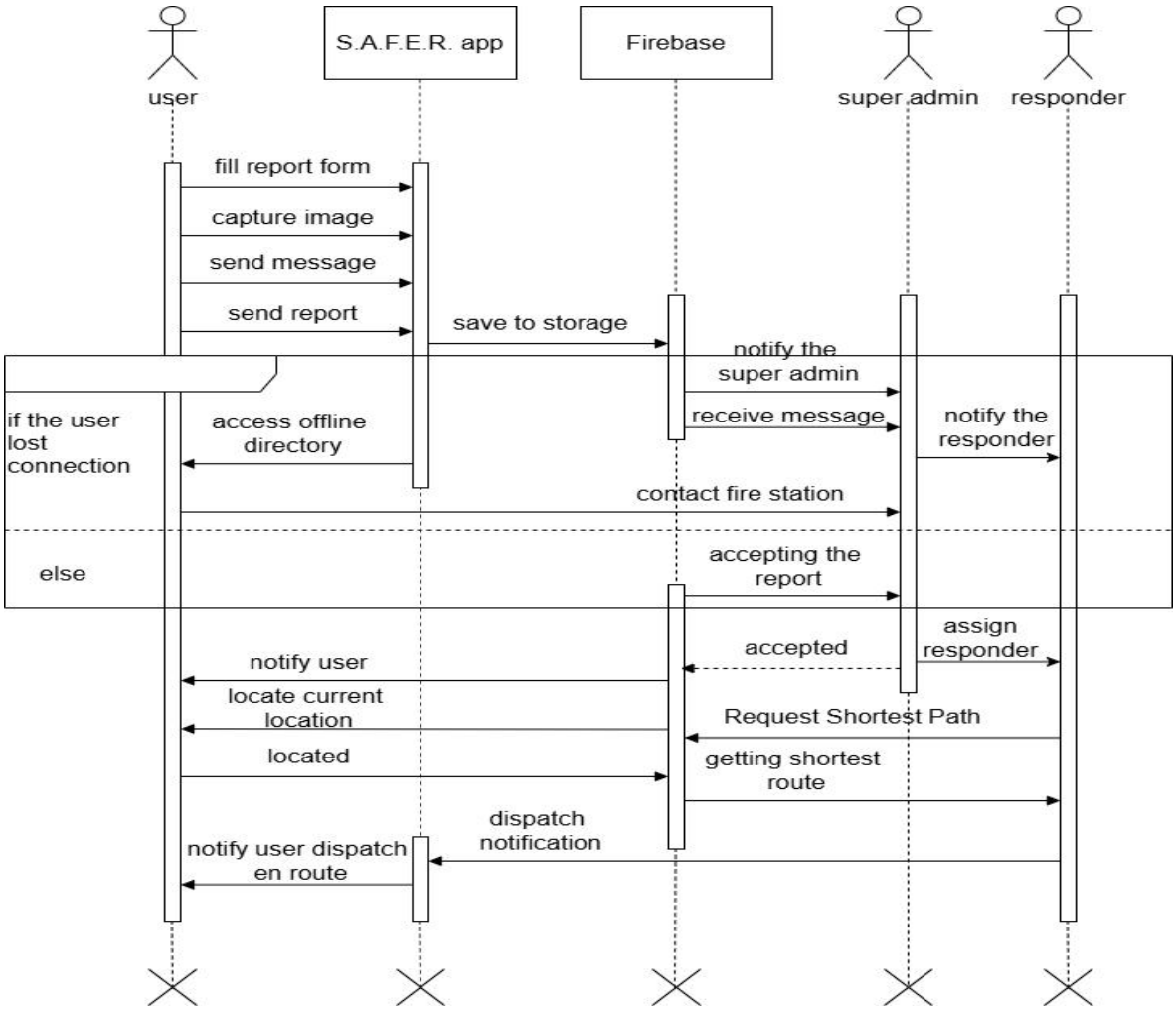


Figure 2. Sequence Diagram of S.A.F.E.R

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Figure 2 illustrates the sequence diagram depicting the emergency reporting and response workflow in S.A.F.E.R. The process begins when a resident triggers an emergency alert via the mobile application. The app captures the user's real-time GPS location and submits incident details to the backend server. The server processes the request and disseminates alerts to nearby responders, who acknowledge and respond through the application. Concurrently, the system provides live updates and facilitates direct communication between residents and responders to coordinate timely assistance.

METHODOLOGY OF THE STUDY

This study employed a descriptive-developmental research design to develop and evaluate the Smart Application for Emergency Response (S.A.F.E.R.), an Android-based mobile application designed to enhance fire emergency preparedness and response in Manila City. The methodology integrates software development principles with empirical evaluation to assess usability, functionality, and effectiveness in real-world scenarios.

Research Design

The research followed a developmental approach where the application was designed, implemented, and iteratively tested to meet the project objectives. The study adopted user-centered design principles to ensure the app's interface and features are accessible, intuitive, and responsive to the needs of residents and emergency responders. The evaluation of S.A.F.E.R. incorporated both qualitative and quantitative methods, combining expert reviews and user surveys to measure functionality, usability, and overall effectiveness.

Participants

The study involved 50 residents of Manila City and 6 IT/subject matter experts. Residents represented the primary end-users and provided feedback on the usability, accessibility, and practical utility of the application. The IT/subject matter experts evaluated the technical reliability, system performance, and adherence to emergency management standards. Participants were selected using purposive sampling, ensuring inclusion of individuals familiar with mobile technology and local emergency protocols.

System Development

S.A.F.E.R. was developed using the Agile iterative methodology, allowing incremental implementation and continuous refinement based on user feedback (Moniruzzaman, 2025). Key features of the application include:

1. Real-time location tracking via GPS to support rapid emergency response.
2. Emergency reporting module with precise GPS coordinates and incident details.
3. Safety guidance alerts delivering actionable instructions based on location and incident severity.
4. Direct communication channels for residents and responders through a secure chat system.
5. Community resilience tools, including offline emergency contacts and a dynamic news feed.

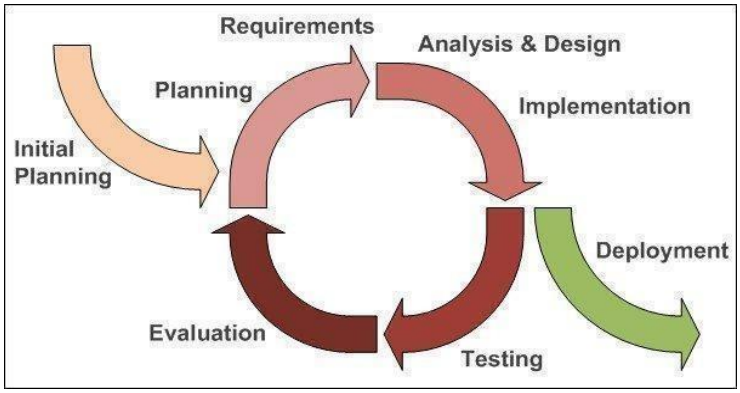


Figure 3. Agile Iterative Methodology

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Data Collection and Evaluation

Evaluation of S.A.F.E.R. employed the Mobile App Rating Scale (MARS) and ISO/IEC 25010 standards to systematically assess usability, functionality, reliability, and overall performance (Brandy Klug, 2023; ISO, 2023). Resident feedback was collected through structured surveys using a 5-point Likert scale, while expert reviews focused on technical validation. Data were analyzed using descriptive statistics including mean, frequency, and standard deviation to determine the app's effectiveness and areas for improvement. This methodology ensured that S.A.F.E.R. was rigorously tested and validated, producing empirical evidence of its usability, technical reliability, and potential to enhance fire emergency preparedness and response in Manila City.

RESULTS AND DISCUSSION

Table 1 MARS Evaluation Results by Residents (n = 50)

MARS Dimension	Mean	SD	Verbal Interpretation
Engagement	4.32	0.54	Very Good
Functionality	4.55	0.49	Excellent
Aesthetics	4.41	0.51	Very Good
Information Quality	4.47	0.46	Excellent
Overall Mean	4.44	0.50	Very Good

The MARS evaluation indicates that residents perceived S.A.F.E.R. as a highly usable and effective emergency response application. Functionality obtained the highest mean score (M = 4.55), reflecting the reliability of features such as real-time GPS tracking, emergency reporting, and alert notifications. The high score in information quality (M = 4.47) suggests that users found the safety guidance and emergency instructions clear, relevant, and timely.

Table 2 ISO/IEC 25010 Evaluation Results by IT/Subject Matter Experts (n = 6)

Quality Characteristic	Mean	SD	Verbal Interpretation
Functional Suitability	4.67	0.41	Excellent
Usability	4.58	0.45	Excellent
Reliability	4.42	0.48	Very Good
Performance Efficiency	4.33	0.52	Very Good
Security	4.17	0.56	Very Good
Overall Mean	4.43	0.48	Very Good

The ISO/IEC 25010 evaluation confirmed that S.A.F.E.R. meets essential software quality standards. Functional suitability recorded the highest mean (M = 4.67), indicating that system features effectively address emergency response requirements. Security received the lowest mean (M = 4.17), suggesting opportunities for enhancement such as multi-factor authentication.

Table 3 Overall Evaluation Summary of S.A.F.E.R.

Evaluator Group	Framework Used	Overall Mean	Interpretation
Residents (50)	MARS	4.44	Very Good
IT Experts (6)	ISO/IEC 25010	4.43	Very Good

Both evaluator groups rated S.A.F.E.R. as Very Good, demonstrating consistency between user experience and technical quality. These results validate the system's effectiveness in enhancing fire emergency preparedness and response in urban communities.

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CONCLUSION

This study successfully developed and evaluated the Smart Application for Emergency Response (S.A.F.E.R.), an Android-based mobile application designed to enhance fire emergency preparedness and response in Manila City. The system integrates real-time GPS-enabled incident reporting, safety guidance alerts, and communication features to address delays and information gaps in traditional emergency reporting mechanisms. Evaluation results showed that resident users rated the application Very Good based on the Mobile App Rating Scale, while IT and subject matter experts assessed it as Excellent using the ISO/IEC 25010 quality model. High scores in functionality, usability, and information quality confirm that S.A.F.E.R. is both user-centered and technically reliable. Overall, the findings demonstrate the application's effectiveness as a supportive emergency management tool capable of improving situational awareness, response efficiency, and community safety during urban fire incidents.

RECOMMENDATIONS

Based on the findings, several recommendations are proposed to further enhance the S.A.F.E.R. application. Future versions should integrate stronger data security mechanisms, such as biometric authentication, multi-factor verification, and encrypted data transmission, to ensure user privacy and system integrity. Improvements in system architecture and performance optimization, particularly for map rendering and alert dissemination, are recommended to support reliability during emergency situations. Interface enhancements focusing on accessibility, multilingual support, and intuitive navigation should be implemented to accommodate diverse users. The inclusion of in-app voice communication and multimedia reporting features may further improve real-time coordination between residents and responders. For future research, large-scale and longitudinal evaluations involving a more heterogeneous group of users are encouraged, alongside the use of inferential statistical analyses. Integration with official government emergency systems and cross-platform implementation are also recommended to support scalability and wider adoption.

Ethical Approval

This study involved voluntary participants, ensured informed consent and confidentiality, and required no formal ethical clearance due to minimal risk.

Conflict of Interest

The authors declare no financial, personal, or institutional conflicts of interest that could have influenced the conduct or outcomes of this study.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request, ensuring transparency and reproducibility.

ACKNOWLEDGMENT

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