



RESQNET- Uniting Relief, Empowering Resilience

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Abstract. In times of natural or man-made disasters, effective coordination among rescue agencies is paramount to minimize casualties and alleviate suffering. To address this critical need, we introduce RESQNET, an innovative application designed to centralize information and facilitate communication among rescue agencies during emergencies. RESQNET provides a centralized database where rescue agencies can register their locations, contact details, and areas of expertise. Leveraging advanced mapping technology, the application offers an intuitive interface that displays the locations of registered agencies and allows users to filter search results based on specific criteria. Additionally, RESQNET incorporates robust communication and collaboration features, enabling agencies to send alerts, request assistance, and share resources seamlessly. Security and privacy measures are prioritized to ensure sensitive information remains protected and accessible only to authorized users. Through RESQNET, we aim to empower rescue agencies to coordinate their efforts more efficiently, ultimately enhancing the effectiveness of disaster response efforts and saving lives.

Keywords: Rescue management, Android Application, Firebase, Relief agencies, Rescue operations, Google maps API

1 Introduction

Accidents and crises have long been an intrinsic part of human existence, disrupting societies and inflicting widespread human, material, and economic losses. The United Nations Strategy for Disaster Reduction (UNISDR) defines disasters as events, whether natural or man-made, that severely disrupt social or communal functioning. These events underscore the critical importance of community resilience and resourcefulness in the face of adversity.

Disasters can be broadly categorized into natural and man-made occurrences. Natural disasters encompass a range of hazards, including thunderstorms, floods, hurricanes, earthquakes, and wildfires, among others. Conversely, man-made disasters stem from technical risks such as hazardous substance leaks, terrorist acts, and nuclear accidents. While some natural disasters are predictable to varying extents, others present unique challenges in forecasting and mitigation.

Emerging threats, such as exotic animal disease outbreaks, volcanic eruptions, and drought-related disasters, add further complexity to disaster management efforts. Infectious disease outbreaks, such as H1N1, Ebola, and the COVID-19 pandemic, have posed significant health and societal challenges in recent years.

Recent catastrophic events, such as the Lebanon collapse in 2020 and Cyclone Fani's impact on India in 2019, highlight the urgent need for effective disaster response mechanisms. These tragedies have resulted in widespread casualties and destruction, underscoring the imperative for innovative solutions to enhance disaster preparedness, response, and recovery efforts. By

minimizing human suffering and safeguarding communities' well-being, such solutions can play a vital role in building a more resilient future.

2 Literature Survey

Norazlina Khamis, et al [1] Accidents and crises have perpetually punctuated human history, necessitating robust systems for rescue operation and disaster management (RODMS). Existing systems aim to assist rescue operators and aid workers by establishing relationships between disasters, types of rescue operations, operators, and aid organizations, while persisting such critical information. However, the sustainability of current RODMS is compromised by issues such as high ownership costs, short product lifetimes, and inadequate adaptability to evolving technological trends and environmental changes. Despite these challenges, sustainability remains an overlooked quality attribute in most RODMS projects, potentially due to limited awareness among software engineers. This paper explores sustainability measures and proposes a conceptual framework for sustainable software design in RODMS, addressing the readiness of current system designs to accommodate frequent client requirement changes.

Wilhelm Carstens Soto, et al [2]

Digital mapping has become indispensable for decision-making processes, yet traditional mapping practices often reflect the interests and biases of specific entities. Open Street Map (OSM) offers an alternative repository of geospatial data contributed by a global community, promoting transparency and inclusivity in decision-making processes. However, socio-technical barriers hinder volunteer participation in data capture and editing processes. To address these challenges, this paper presents a functional prototype developed as free software to enhance participation in geospatial data management.

Wilhelm Carstens Soto, et al [3] Disasters, whether natural or human-made, entail severe disruptions to communities, exceeding their coping capacities and resulting in significant losses. Despite the staggering economic losses associated with disasters, many minor events often go unnoticed but continually impact communities. To mitigate these challenges, the study introduces E-Saklolo, a mobile and web-based system designed to respond to various emergencies within communities using modern ICT solutions. E-Saklolo aims to reduce casualties and enhance emergency response efficiency, as evidenced by increased resolved emergency cases following its deployment in 2019.

Angelique D, et al [4] Gas leakage poses a significant safety hazard in domestic, residential, and industrial settings, necessitating robust detection and prevention mechanisms. This paper discusses an automatic gas leak detection system equipped with GSM module alerts, buzzer alarms, and exhaust functionalities to control gas leakage. The system aims to promote the adoption of gas leak protection systems, offering a straightforward solution to mitigate gas-related hazards in high-risk areas.

Vibhu Singh , et al [5] In their study, Vibhu Singh underscores the persistent challenge of effective disaster management systems amidst a rising frequency of disasters, signaling a critical need for enhanced coordination and information management strategies. Recognizing the ubiquity and connectivity of smartphones, the authors advocate for leveraging these devices as a promising solution for addressing disaster management challenges. Their paper meticulously reviews existing proposed solutions in the field, carefully assessing their strengths, weaknesses, and success factors. Drawing upon this analysis, the study proposes a prototype aimed at synthesizing the advantages of existing solutions while addressing their limitations. Looking ahead, the authors advocate for future research to focus on integrating these smartphone applications with government authorities, hospitals, and other key stakeholders involved in disaster response efforts. By fostering greater collaboration and coordination among diverse entities, such initiatives hold the potential to significantly enhance disaster response capabilities and mitigate the impact of future calamities.

3 Methodology

The methodology for implementing ResQNet is carefully crafted to address the diverse needs of users and ensure effective emergency response coordination. It begins with user categorization, where distinct roles are assigned to different stakeholders, including Normal People, Public Amenities, Call Center operators, Rescue Organizations, Volunteers, and the Administrator. This categorization ensures that each user group has specific responsibilities and functionalities within the application.

Once users are categorized, the system architecture is designed to facilitate seamless communication and collaboration. Modules such as Public Amenities, Relief Organizations, Volunteer Support, Call Center, and User are established to streamline operation and response coordination. These modules serve as the backbone of ResQNet, enabling efficient handling of emergency reports and effective distribution of resources.

Core functionalities of ResQNet focus on emergency reporting, validation, and response coordination. Normal People can report emergencies through the application, which are then validated by the Call Center before being disseminated to relevant stakeholders such as Public Amenities and Rescue Organizations. Real-time mapping features allow users to track the locations of rescue teams and monitor response progress, ensuring swift and efficient action during emergencies.

The implementation of Aadhaar authentication further enhances the security of ResQNet, mitigating the risk of false reports and unauthorized access. This authentication mechanism adds an extra layer of validation, ensuring that only authorized users can access and utilize the application's functionalities.

Overall, ResQNet's methodology aims to centralize information, streamline communication, and enhance coordination during emergencies. By leveraging technology and user categorization, ResQNet contributes to community resilience and safety, providing a robust platform for effective emergency response management.

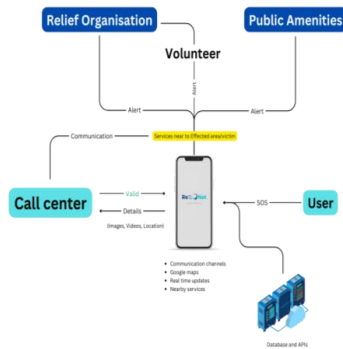


Fig 1 : Basic Architecture

5 Implementation

User-Centric Design:

ResQNet's implementation prioritizes user experience, catering to the diverse needs of different stakeholders. Residents, representing the primary users, engage with the mobile application seamlessly to report emergencies. Call Center operators validate these reports, ensuring prompt and accurate responses. Rescue or Relief Organizations, Public Amenities, Trained Volunteers, and the Administrator each have designated roles and

functionalities within the system, facilitating efficient coordination and response efforts during emergencies. This user-centric approach ensures that each user group can effectively utilize the application to fulfill their respective roles in emergency response scenarios.

Robust Authentication and Data Management:

Aadhaar authentication serves as a cornerstone of ResQNet's implementation, ensuring the integrity and security of user data. By leveraging Aadhaar authentication, the application verifies the identity of users, mitigating the risk of false reports and unauthorized access. Additionally, robust data management practices, including the utilization of Room database for user information and Firebase for incident-related data, enable efficient storage, retrieval, and analysis of critical information. This combination of authentication and data management mechanisms forms the backbone of ResQNet's reliability and effectiveness in emergency response operations.

Seamless Communication and Collaboration:

ResQNet facilitates seamless communication and collaboration among stakeholders through dedicated communication channels and real-time mapping features. Upon verification of an emergency report by the Call Center, nearby users and relevant organizations are notified based on the incident's intensity. This notification triggers collaborative efforts among Rescue Teams, Public Amenities, and Volunteers, who utilize the application's communication channels to coordinate response efforts effectively. Real-time mapping features allow stakeholders to track incident locations and monitor response progress, ensuring swift and coordinated action during emergencies.

Scalability and Adaptability:

ResQNet's implementation is designed to be scalable and adaptable to various emergency scenarios and changing requirements. The modular architecture of the application allows for seamless integration of new features and functionalities to meet evolving needs. The system's scalability ensures that it can accommodate a growing user base and handle increased demand during peak emergency periods. Moreover, the application's adaptability enables it to effectively respond to different types of emergencies, whether natural or man-made, ensuring its relevance and utility across diverse contexts.

Continuous Improvement and Optimization:

ResQNet's implementation emphasizes continuous improvement and optimization through iterative development cycles and user feedback mechanisms. Regular updates and enhancements are made to the application based on user input, emerging trends, and technological advancements. This iterative approach ensures that ResQNet remains responsive to the evolving needs of its users and continues to deliver value in emergency response scenarios. By prioritizing continuous improvement and optimization, ResQNet strives to enhance its effectiveness, efficiency, and usability, ultimately contributing to improved outcomes in emergency situations.

Data Privacy and Security Measures:

ResQNet prioritizes the protection of user data and privacy through stringent security measures. Encryption protocols are implemented to safeguard sensitive information transmitted within the application, ensuring confidentiality and integrity. User authentication mechanisms, including Aadhaar verification, bolster the security of the platform, mitigating the risk of unauthorized access and fraudulent activities. Additionally, regular security audits and vulnerability assessments are conducted to identify and address potential threats, ensuring that ResQNet adheres to the highest standards of data privacy and security.

Integration with Emergency Response Infrastructure:

ResQNet's implementation includes seamless integration with existing emergency response infrastructure to enhance coordination and effectiveness. APIs are utilized to connect the application with government agencies, hospitals, and other key stakeholders involved in disaster management. This integration enables real-time data sharing, streamlined communication, and coordinated response efforts during emergencies. By

leveraging existing infrastructure and fostering collaboration among stakeholders, ResQNet optimizes resource utilization and improves overall response capabilities, ultimately enhancing community resilience in the face of disasters.

6 Results & Comparison



Fig 2 : Logo

Aspect	Sahana	ResQNet
Abstract	Emphasises the need for effective ICT solutions for disaster management and introduces Sahana as a FOSS application.	Provides an overview of ResQNet, highlighting its aim to centralise information and enhance coordination during emergencies.
Introduction	Discusses the shortcomings of existing ICT solutions for disaster management and the need for effective coordination among multiple organisations.	Introduces the methodology for ResQNet implementation, focusing on user categorization, system architecture, and core functionalities.
FOSS and Humanitarian Applications	Discusses the alignment between FOSS development and humanitarian applications, highlighting Sahana as a successful example.	Emphasises the use of Aadhaar authentication and real-time mapping features in ResQNet for enhanced security and response coordination.
History	Describes the origins of the Sahana project in response to the 2004 tsunami and its subsequent deployments in disaster scenarios.	Provides insights into the development history and deployment strategy of ResQNet, citing its evolution from conceptualization to implementation.

The Anatomy of system	Details the architecture and components of the Sahana FOSS project, including its application framework and core modules.	Describes the module division and system architecture of ResQNet, highlighting core functionalities and optional modules for effective response coordination.
Case Study	Presents a detailed case study of Sahana deployment in the Philippines, outlining the customization process and lessons learned.	Provides examples of ResQNet deployment scenarios and outlines the adaptation process based on specific disaster contexts.
Lessons Learned	Highlights key guidelines and lessons learned from Sahana deployment experiences, including system authorization, data granularity, and localization.	Offers insights into the challenges and best practices encountered during ResQNet deployment, focusing on system flexibility and data security.
Conclusions and Future Work	Concludes with reflections on the viability of FOSS solutions for humanitarian applications and outlines future research directions.	Summarises the impact of ResQNet in enhancing emergency response coordination and suggests areas for further enhancement and research.

This comparison highlights similarities and differences between the base paper's approach with Sahana and our project, ResQNet. Both projects aim to address the challenges of disaster management through ICT solutions, but they differ in specific features, deployment strategies, and lessons learned.

7 Conclusion

In conclusion, the ResQNet project represents a significant advancement in emergency response technology, offering a comprehensive solution to facilitate efficient coordination and communication during natural or man-made disasters. By prioritizing user-centric design, robust authentication, seamless communication, scalability, and continuous improvement, ResQNet aims to empower stakeholders at every level of emergency response. Through the integration of Aadhaar authentication, real-time mapping features, and dedicated communication channels, ResQNet streamlines the process of reporting emergencies, validating incidents, and coordinating rescue efforts. Moving forward, the project's success hinges on ongoing collaboration, feedback integration, and adaptation to emerging challenges, ensuring that ResQNet remains at the forefront of disaster management technology and continues to make a tangible difference in saving lives and mitigating the impact of emergencies on affected communities.

8 References

- [1] Rescue Operation and Disaster Management System Model – Norazlina Khamis, Azrinsyah Mirza Misfian, Raffidah Md Noor
- [2] Free software to support collaborative processes to improve OpenStreetMap – Wilhelm Carstens Soto, Jaime Gutiérrez Alfaro
- [3] Frontline SMS and Ushahidi - Ken Banks, Erik Hersman

- [4] E-Saklolo: A Mobile-based Crowdsourcing Platform for Disaster Risk Management and Emergency Response in the City - Wilhelm Carstens Soto, Jaime Gutiérrez Alfaro
- [5] An Application for Emergency Response and Disaster Management - Vibhu Singh, Karan, Vansh Panwar, Mandeep Kaur, Nitin Rakesh, Parma Nand
- [6] Reddy Madhavi, K., A. Vinaya Babu, and S. Viswanadha Raju. "Clustering of Concept-Drift Categorical Data Implementation in JAVA." In International Conference on Computing and Communication Systems, pp. 639-654. Berlin, Heidelberg: Springer Berlin Heidelberg, 2011.
- [7] W.H.M., "The use of earth observing satellites for hazard support," in Geoscience and Remote Sensing Symposium, 2001. IGARSS 01. IEEE 2001 International, Aug. 2002, pp. 135 – 137.
- [8] Hussain, M., Arsalan, M. H., Siddiqi, K., Naseem, B., and Rabab, U., "Emerging geo-information technologies (git) for natural disaster management in Pakistan: an overview," in Recent Advances in Space Technologies, 2005. RAST 2005. Proceedings of 2nd International Conference on, Oct. 2005, pp. 487 – 493.
- [9] R.G. and Kumar, A., "A natural disasters management system based on location-aware distributed sensor networks," in Mobile Adhoc and Sensor Systems Conference, 2005. IEEE International Conference on, Dec. 2005.
- [10] O.S., Maly, K., F.E.C., and Y.S.M., "Wireless support for telemedicine in disaster management," in Parallel and Distributed Systems, 2004. ICPADS 2004. Proceedings. Tenth International Conference on, July 2004, pp. 649 – 656.
- [11] (2005) Tsunami-inspired FSF award focuses on humanity. [Online]. Available: <http://www.tectonic.co.za/view.php?id=686>
- [12] Firebase Database by Google : <https://console.firebase.google.com/>
- [13] K.Venkateswara Rao, "A Comprehensive Analysis of Machine Learning and Deep Learning Approaches Towards IOT Security" IEEE explorer, May, 2023 DOI: 979-8-3503-9737-6/23/\$31.00 ISBN:979-8-3503-0009-3
- [14] K.Venkateswara Rao, "Smart Farming for Agriculture Management using IOT" IEEE explorer, Mar, 2023 DOI: 979-8-3503-9737-6/23/\$31.00 ISBN:979-8-3503-9738-3
- [15] K.Venkateswara Rao, "A Swarm Intelligence-Based Model for Disease Detection in Mango Crops" IEEE explorer, Feb, 2023 DOI: 10.1109/ICCST55948.2022.10040428 ISBN:978-1-6654-7656-0
- [16] K.Venkateswara Rao, "Support vector machine based disease classification model employing hasten eagle cuculidae search optimization", concurrency and computation: practice and experience, ISSN : 1532-0626, Vol-34, Issue-25 (Nov-2022), Wiley Publisher.
- [17] K.Venkateswara Rao, "Regression based price prediction of staple food materials using multivariate Models", Scientific Programming, ISSN : 1058-9244, Vol-2022(June), Hindawi Publisher.
- [18] K.Venkateswara Rao, "A Study on Defensive Issues and Challenges in Internet of Things", Lecture Notes in Electrical Engineering 853, Springer Nature Singapore Pte Ltd. 2022, Page No: 591- 600.
- [19] K.Venkateswara Rao, "Disease Prediction and Diagnosis Implementing Fuzzy Neural Classifier based on IoT and Cloud", International Journal of Advanced Science and Technology (IJAST), ISSN : 2005-4238, Vol-29 Issue-5, May 2020, Page No: 737-745.
- [20] K.Venkateswara Rao, "Rotating Solar Trees ", Lecture Notes in Electrical Engineering 601, Springer Nature Singapore Pte Ltd. 2020, Page No: 482-487.
- [21] K.Venkateswara Rao, "Wireless-Sensor-Network with Mobile Sink Using Energy Efficient Clustering ", Lecture Notes on Data Engineering and Communications Technologies , Springer Nature Switzerland AG. 2020, Page No: 582-589.
- [22] K.Venkateswara Rao, "Research of Feature Selection Methods to Predict Breast Cancer", International Journal of Recent Technology and Engineering(IJRTE), ISSN : 2277-3878, Vol-8 Issue-2s11, Sep 2019, Page No: 2353-2355.
- [23] K.Venkateswara Rao, "Suicide Prediction on Social Media by Implementing Sentimental Analysis along with Machine Learning", International Journal of Recent Technology and Engineering(IJRTE), ISSN : 2277-3878, Vol-8 Issue-2, July 2019, Page No: 4833-4837.
- [24] Dr.K.Venkateswara Rao, "Issues for building an Artificial Intelligent System" JARDCS, Vol-7 Issue-13, Dec 2018, ISSN : 1943-023X, Page No: 1447-1451.
- [25] Mr. K.Venkateswara Rao and Dr.T.Saravanan, "LATE PATTERNS IN CHART MODEL FOR CONTENT EXAMINATION AND CONTENT MINING" IJPT, ISSN: 0975-766X, Volume-8, Issue-2, June-2016, page no: 14729-14736.

- [26] Mr. K.Venkateswara Rao and Dr.T.Saravanan “TEXT MINING TO KNOWLEDGE MINING USING FRAMENET BASED GRAPH MODEL” IJPT, ISSN: 0975-766X, Volume-8, Issue-2, June-2016, page no: 14715-14721.

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