

CRISIS COLLABORATION NEXUS: STRENGTHENING BONDS FOR EFFECTIVE RESPONSE

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ABSTRACT

Disaster is an Acute issue occurring over a period that causes widespread human, material, natural, economic, or environmental loss. The situation surpasses the capacity of the affected community or society to manage and address adequately with its existing resources. To cope up with these types of situations disaster management plays an integral role by ensuring the safety and security of communities which involves coordinating and collaborating the resources & responsibilities. Effective communication and coordination between the disaster management agency are essential for successful disaster response operations. However, the Shattered nature of disaster management often leads to communication breakdowns and it leads to inefficiency. This paper proposes a model for enhancing disaster communication and coordination between national rescue agencies. The model outlines the key challenges and opportunities for improvement, and it identifies strategies for developing and implementing effective communication and coordination systems. Specifically, the paper discusses the importance of establishing a unified command structure, fostering inter-agency collaboration, and leveraging technology to improve information sharing. The paper concludes by highlighting the need for continued research and innovation in this area.

Keywords: Coordination, Collaboration, Evacuation, GPS.

I. INTRODUCTION

A disaster is a serious disruption of the functioning of a community or society causing human, material, economic or environmental losses and impacts, which increases the ability of the affected community or society to cope using its own resources. Disaster can be caused by naturally occurring events, such as earthquakes, hurricanes, flooding, tornado, tsunami, or they can be due to man-made events, either accidental (such as accidental toxic spill or nuclear power plant event), or deliberately caused (such as various terrorist attacks, bombings, cases of poisonings etc.)

The recent surge of disasters, both natural and man-made, has resulted in unusual chaos and disruption across the globe. The world has witnessed the disruptive force of disaster from the sweeping ramifications of COVID-19 pandemic which not only posed significant health challenges but also had huge disrupted economies, social structures, strained healthcare systems and daily life. Additionally, natural disasters like the wildfires in Australia and California, the devastating hurricanes in the Caribbean and the United State and the frequent occurrence of floods and cyclones in various parts of the world. These events called disasters have vividly underscore the urgent necessity for robust and effective disaster management systems to handle these catastrophic impacts and safeguard communities worldwide.

Some natural disasters usually occur abruptly thereby affecting large areas, thus making it difficult to develop preventive measures [6]. India faced several cyclones causing widespread damage. Cyclone Fani (2019) affected Odisha and parts of West Bengal, leading to evacuations and infrastructure damage. Cyclone Amphan(2020) caused extensive devastation in West Bengal and Bangladesh. The disaster of floods in Uttarakhand (2013) resulted in loss of life and infrastructure damage. Assam, Bihar and Kerala faced recurring floods, impacting lives and agriculture. Not only these natural disasters have caused loss to society but some man-made disasters have also affected lives on earth in many ways. For example - Industrial accidents, notably the Visakhapatnam gas leak (2022), where a chemical part released toxic gas, resulting in casualties and illnesses, several railway accidents, including derailments and collisions, resulting in injuries and deaths. Road

accidents continued to be a significant cause of fatalities across the country. Number of disaster victims is going through a steep rise and estimated claims that 50000 to 60000 and more people lost their lives per decade, since the 1970s. The situation is the same for both developed and developing countries [4].

In a situation like this, it is highly important to take quality decisions quickly to make the evacuation process more effective than the traditional one [4]. The importance of GPS application in monitoring and managing disaster events cannot be exaggerated. This is because GPS is used in providing real-time information of location with high precision that can help in managing each of the processes of disaster event starting from pre-disaster, during disaster and post-disaster event [6]. map based representations of disaster situations can also be created for better understanding the support of spatial thinking and maintaining situational awareness and common operating picture [1]. The absence of effective collaboration between agencies have made the evacuation process little difficult. This platform will leverage the power of the internet and modern technology to streamline the proper coordination between different agencies to save victims of disaster. Furthermore, we will prioritize data security and privacy ensuring that users can share their data with us. The platform will be scalable, accommodating a growing user base and the platform will have multilingual support to help all types of people.

II. LITERATURE SURVEY

This research endeavours to provide a comprehensive exploration of diverse strategies aimed at addressing the intricate challenges inherent in natural disasters. The overarching objective is to enhance communication and collaboration during critical situations precipitated by such calamities. The study, therefore, serves as a multifaceted guide to understanding and improving disaster response efforts. At the forefront of effective disaster management lies the critical role of Geographic Information System (GIS) technology. This research accentuates the profound impact of GIS in disaster management, showcasing its ability to contribute significantly to data visualization, informed decision-making, and optimal resource allocation. However, it is imperative to note a discernible gap in the research concerning the scalability of GIS solutions for large-scale disasters. The paper acknowledges the need for a more profound exploration into how GIS systems can manage extensive data influx and accommodate a considerable user base [1]. Emergency Response Information Systems (ERIS) emerge as a pivotal component in the research, with an emphasis on their communication and collaboration features among diverse agencies and stakeholders involved in emergency response. The paper advocates for the optimization of communication channels within ERIS and prompts an examination of the efficiency of real-time data processing and analytics.

The central argument posits that enhancing these aspects could significantly contribute to providing timely and pertinent information to responders [2]. Introducing a novel dimension to disaster relief efforts, the research proposes an Emergency Supply and Demand Framework that incorporates the use of social media. This framework is positioned as a valuable tool for organizations, including the National Disaster Management Agency Malaysia (NADMA), to make more effective decisions in disaster relief efforts. However, a critical observation reveals potential gaps, specifically pointing to the need for more explicit guidance on the development and implementation of social media-based frameworks for disaster management [3]. The technical intricacies of the SmartEvac system take centre stage, offering a solution that identifies and prioritizes clusters of people in disaster-affected areas based on big data's 3Vs: volume, velocity, and variety. This prioritization streamlines evacuation services, effectively mitigating network congestion. The paper advocates for an in-depth exploration of SmartEvac's technical implementation details, including data collection methods, real-time data processing mechanisms, and the requisite network infrastructure [4].

Mobile applications emerge as a transformative force in disaster reduction and management. The research underscores their potential to significantly improve preparedness, response, and recovery efforts. However, a critical observation raises concerns about the lack of comprehensive evaluations or assessments for existing mobile applications in the disaster reduction domain. This deficiency signals a pertinent need for more extensive evaluation studies to gauge their efficacy and reliability [5]. Delving into the broader context of disaster reduction and the escalating role of mobile applications, the research underscores the importance of considering usability and accessibility aspects. This is particularly pertinent concerning vulnerable populations and individuals with disabilities, emphasizing the need for inclusive design principles in the development of

these applications [6]. The study probes into the effectiveness of mobile applications in disaster response, raising pertinent questions about the integration of Information Technology (IT) solutions in streamlined and optimized ways. It also sheds light on the challenges associated with data security and privacy within the context of disaster management and information technology, acknowledging the critical nature of these concerns in the contemporary digital age [7]. The paper explores questions related to the effectiveness of mobile apps in disaster response and the integration of IT solutions in easy and optimized ways. Challenges of data security and privacy in the context of disaster management and information technology, a critical concern in the digital age [8].

III. OBJECTIVES

Centralization of Rescue agency information

Aggregation and Centralization of Rescue agencies data. The primary goal is to create a central database where rescue agencies can register their information, fostering a unified platform for disaster response

Enhanced Coordination

Improved coordination among rescue agencies, leading to more efficient and effective disaster response efforts. This will facilitate the coordination among agencies.

User Friendly Interface

Provides a user-friendly interface so that it will be easy to filter disaster types, providing location and accessing information of agencies quickly and easily.

Communication and Collaboration

This is the main goal of an application. Develop features that will allow agencies to communicate and collaborate directly through app so that they will work together during crises and will improve the performance.

Resources Tracking

We need to centralize the information of resources of agencies that are required during disaster.

IV. RESEARCH METHODOLOGY

1. Methodological Approach:

This study adopts a quantitative research approach to comprehensively investigate and propose solutions for enhancing disaster communication and coordination among national rescue agencies. This approach involves a thorough review of literature, case studies, and expert opinions, offering a comprehensive understanding of the challenges and opportunities within the existing disaster management framework.

2. Method of Data Collection:

Literature Review: A systematic literature review is undertaken to gain insights into the current state of disaster communication and coordination. Ten meticulously selected literature surveys serve as the basis for understanding existing challenges and potential strategies.

Case Studies: Real-world case studies are analysed to extract practical insights, particularly focusing on instances where communication breakdowns occurred and assessing their impact on disaster response operations.

3. Method of Analysis:

Thematic Analysis: Employing thematic analysis, this study aims to derive patterns and themes from the literature review and case studies. This qualitative approach aids in identifying common challenges and opportunities within the realm of disaster communication and coordination.

Comparative Analysis: Case studies undergo a comparative analysis, enabling the identification of patterns and variations across different instances. This analysis is designed to draw insights into the factors contributing to both successful and failed communication and coordination efforts.

4. Evaluation and Justification of Methodological Choices:

Holistic Understanding: The choice of a quantitative research approach is made to provide a holistic understanding of the complex issue of disaster communication and coordination. Thematic analysis facilitates an in-depth exploration of emerging patterns and key issues.

Triangulation: The inclusion of multiple data sources, encompassing literature and case studies, ensures triangulation, thereby enhancing the reliability and validity of findings.

Applicability: The selected methods align closely with the research objectives of proposing a model for improving communication and coordination. By emphasizing quantitative analysis, the research aims to provide nuanced insights and practical recommendations for national rescue agencies.

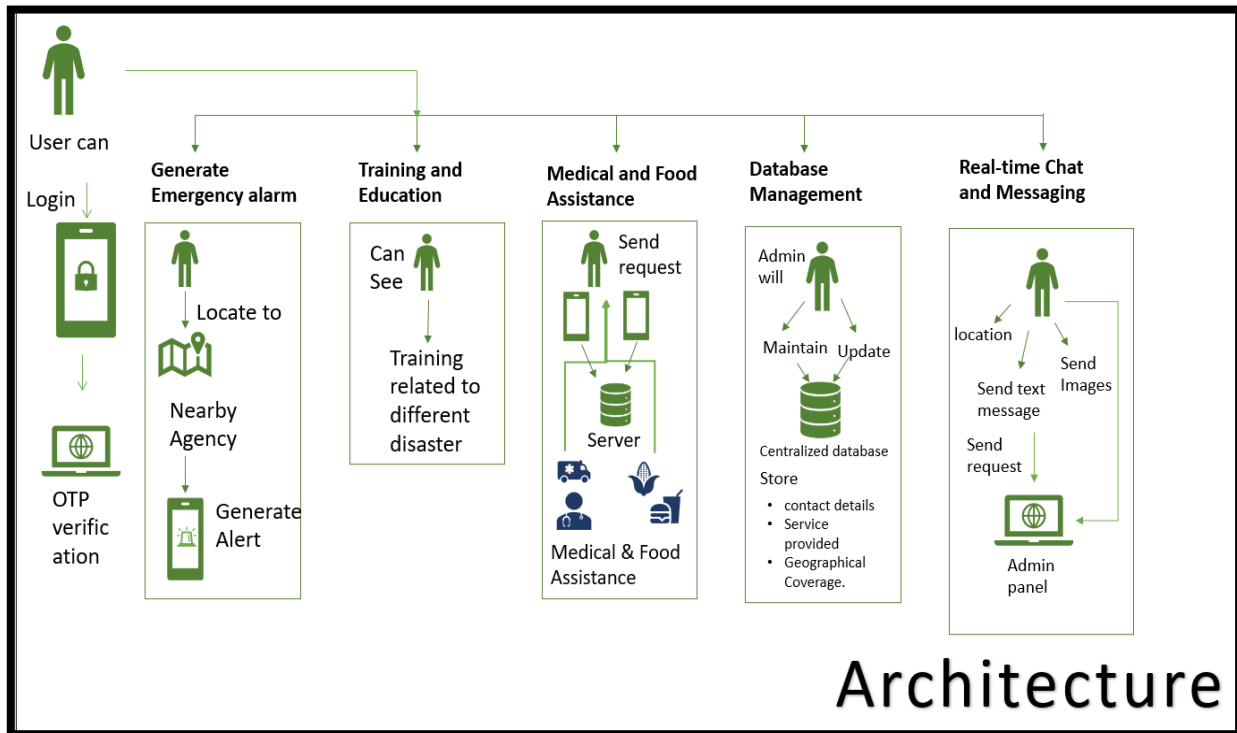
V. ALGORITHM USED

Dijkstra's Algorithm plays a pivotal role by determining the shortest path from a rescue agency's location to the disaster-prone area. As the algorithm considers the weighted edges of a graph, it provides an optimal route for rescue teams to reach the affected region swiftly. By leveraging Dijkstra's Algorithm, the project aims to streamline emergency response operations, ensuring that resources are deployed efficiently and timely to minimize the impact of disasters. The algorithm's ability to calculate the most time-effective path is instrumental in optimizing rescue routes and guiding rescue teams to disaster-stricken areas with minimal delay.

K-Means Clustering is employed to segment the affected area based on similarity in damage characteristics. This clustering technique enables categorizing regions with comparable types and extents of damage, providing a nuanced understanding of the disaster's impact. By grouping similar areas together, K-Means facilitates a more targeted approach to resource allocation, allowing emergency responders to prioritize regions based on specific damage patterns. This ensures that aid and resources are directed efficiently, addressing the diverse needs arising from various types of damage. The utilization of K-Means Clustering enhances the project's ability to tailor disaster response strategies to the unique characteristics of different affected areas.

VI. ARCHITECTURE

Rakshak, an innovative mobile application, is meticulously designed to streamline disaster management efforts through its robust architecture and user-friendly interface. At its core, the application prioritizes prompt response and efficient coordination among users, rescue agencies, and volunteers during crisis situations. Upon installation, users undergo a seamless registration process, ensuring authentication through Aadhaar and email verification. This step establishes a secure user base, vital for maintaining the integrity of the platform. Once registered, users gain access to the dashboard, where real-time location tracking is provided, enabling immediate assistance in times of need. The hallmark feature of Rakshak is its emergency alert system. In the face of danger, users can swiftly trigger an alert by pressing the SOS button and selecting the type of disaster they are experiencing. This action triggers a cascade of notifications, promptly informing the relevant rescue agencies and the user's designated contacts. This ensures a rapid and coordinated response, crucial for mitigating the impact of disasters. Complementing the emergency alert system is the volunteering feature, empowering individuals to contribute actively to rescue operations. Through this feature, users can offer their assistance and expertise, bolstering the capacity of rescue agencies during critical moments. Moreover, Rakshak facilitates community support by enabling users to share or donate essential supplies like clothing, food, or shelter to those affected by disasters. The 'Find a Victim' feature serves as a lifeline for users concerned about the safety of their acquaintances. By leveraging the app's network and user database, individuals can quickly ascertain the well-being of their loved ones, providing invaluable peace of mind during tumultuous times. In addition to its crisis management capabilities, Rakshak offers users access to vital resources such as helplines and emergency tips, empowering them to navigate emergencies effectively. Dedicated sections for app information and support ensure that users can easily access assistance and guidance when needed.



Technologies used:

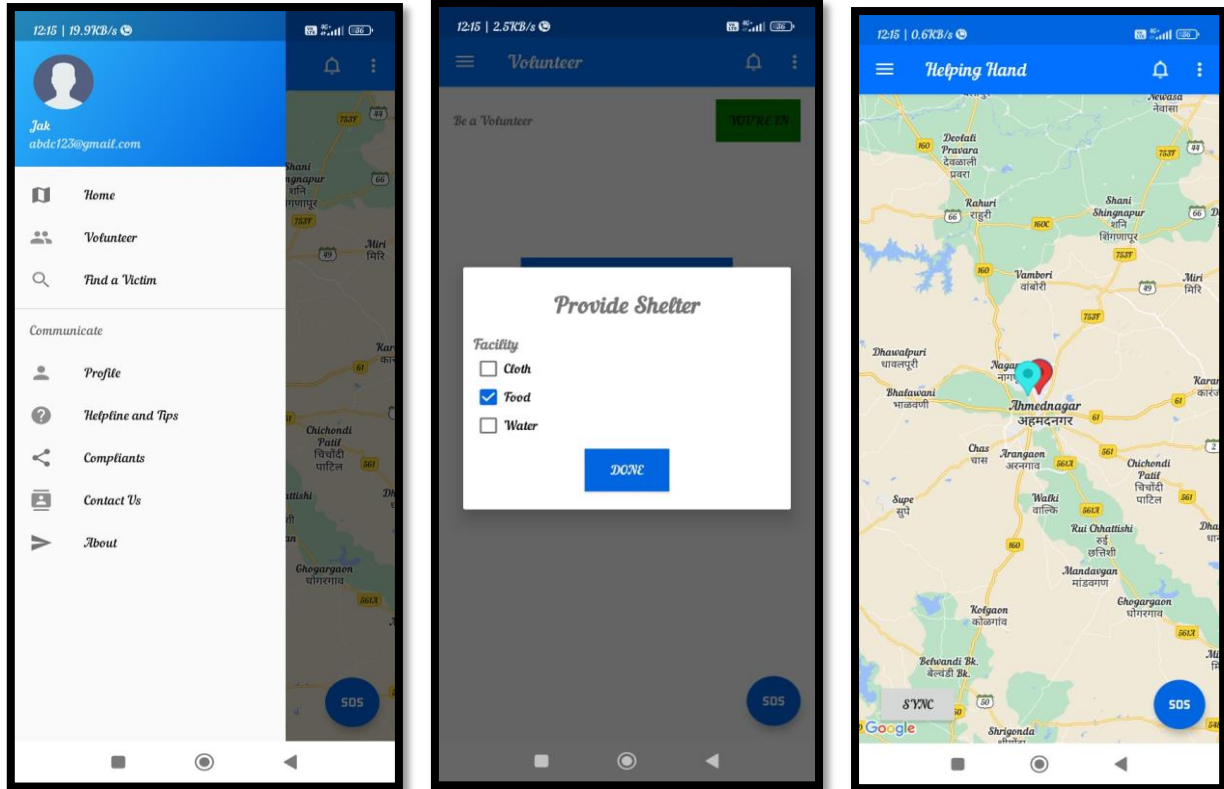
Java: Java Programming is a general purpose and platform independent language. Platform independence is an outstanding feature of java which will make java different from other languages. Java is used in desktop as well as mobile application development. Java is compiled as well as interpreted it points towards the thought write once, compile once and execute anywhere.

Android: Rakshak employs Android technology as its primary platform, leveraging its widespread accessibility and robust features. The application harnesses the power of Android's development framework to deliver a seamless user experience, ensuring compatibility across a wide range of devices and optimizing performance for efficient disaster management operations.

Node.js: It is an Open Source, cross-platform runtime environment for executing JavaScript code. In our case it will serve as a backbone of application. Node.js is helpful in handling heavy traffic or multiple requests during an emergency due to this it also smoothen the user experience. Node.js is also used in building back-end services like API's, Mobile apps etc. It enables event-driven, asynchronous, and non-blocking server-side operations.

Firestore: In our application we are going to use firestore as DBMS. No programming knowledge is required to work with Firestore which makes it easy to use. It also provides services to android, iOS. It uses NoSQL as a database for storage of data. Data is stored as JSON and synchronized in real-time to every connected client means every client can see the most recent updates.

VII. RESULT



VIII. CONCLUSION

In conclusion, the research paper navigates diverse strategies to enhance communication and collaboration during natural disasters. Leveraging Dijkstra's Algorithm optimizes rescue routes, expediting emergency responses, while K-Means Clustering categorizes affected areas based on damage characteristics, aiding in targeted resource allocation. The study underscores the critical role of technology, such as GIS and ERIS systems, in disaster management, emphasizing the need for efficient communication channels. Integrating social media-based frameworks and evaluating mobile applications further enrich the disaster response toolkit. However, challenges in scalability, security, and comprehensive evaluations remain, urging ongoing research and innovation in disaster communication and collaboration.

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