Research Paper

RescueMitra : A Mobile Application for Incident and Disaster Notification

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Abstract **—** The importance of utilizing information technology to enhance disaster response and recovery efforts. It highlights the need for flexible information and workflow concepts, distributed databases for information access in unreliable environments, and GIS for aiding operations staff. The abstract also emphasizes the significance of preparation before disasters, automatic actions during critical phases, and post-disaster data analysis for lessons learned and training purposes. The document outlines user requirements, system architecture, applications, information flow, network technologies, service configuration, data management, and resource scheduling.

I. INTRODUCTION

The increasing role of smartphones and social media applications in disaster management and response. It highlights the shift in the use of social media from personal communication to crisis communication during emergencies. The document emphasizes the importance of citizen-side information generation and dissemination in disaster preparation, warning response, and recovery.

Furthermore, the introduction discusses the utilization of Information and Communications Technology (ICT) by governments to promote active citizen participation, particularly through mobile and wireless technology (m-government). This technology enables citizens to report incidents and access services electronically, thereby enhancing disaster response capabilities.

Overall, the introduction sets the stage for the discussion on the development of the Android-based mobile application, RescueMitra, which aims to facilitate help-seeking and notification during disasters using smartphone capabilities such as GPS, camera, social network interaction, and internet connectivity. The document underscores the potential of ICT in disaster prevention, mitigation, and management, highlighting the importance of proactive measures and careful planning to minimize the impact of disasters.

II. SYSTEM ARCHITECTURE

1. **User Interaction**: The system architecture involves interactions between users, the mobile application, and various smartphone capabilities essential for seeking help during emergencies. Users are required to register using their Facebook accounts to access the application's features and functionalities.
2. **Mobile Application Features**: The mobile application consists of three main modules: Send Report Module, Send Rescue Module, and Send Location to Family Module. These modules enable users to report incidents, request rescue assistance, and share their location with family members or trusted contacts in times of crisis.
3. **Command Center**: A back-end system referred to as the command center is established to receive, validate, and respond to reports sent by users through the mobile application. The command center plays a crucial role in coordinating with responding units and ensuring timely assistance to individuals in need. It is responsible for validating user reports and disseminating warning alerts to mobile application users.
4. **Integration with Social Media**: The system architecture includes integration with social media platforms, particularly Facebook, to enhance information sharing and community engagement. By leveraging social media integration, the application can reach a wider audience and facilitate real-time communication during emergencies.
5. **GPS and Multimedia Capabilities**: The architecture utilizes the GPS functionality and multimedia capabilities of smartphones to provide accurate location data and visual information to res-ponders and authorities. Users can capture and send pictures or videos of the incident scene, aiding in quick assessment and response efforts.
6. **Communication Networks**: Police, fire department, and other services' headquarters buildings are interconnected with each other and with government authorities through terrestrial and/or satellite networks. Disaster site command posts are also linked to the respective headquarters using terrestrial wireless or satellite connections. Additionally, wireless LAN (infrastructure, ad hoc, or both) is established for on-site communications in "hot spot" areas.

Ⅲ. SYSTEM FEATURES

1.Send Report Module: This feature allows users to send a report to the command center regarding any disaster or incident in their area. The report includes details such as the type of disaster, description of the incident, optional pictures or videos of the scene, and the address of the incident based on GPS data. Once validated, these reports are visible to other users of the application, serving as a warning system to inform them of ongoing incidents. This crowd sourcing approach ensures that all users are updated on incidents near their location .

2.Send Rescue Module: The Send Rescue Module enables users to request help from responders by sending relevant information about their situation. By providing multimedia data (such as pictures) and GPS tracking data, the application assists emergency responds in locating and aiding the victim promptly. This feature aims to reduce response time and enhance the efficiency of rescue operations during disasters or incidents

3.Send Location to Family Module: This module allows users to share their location with family members or trusted contacts during emergencies. By sending their precise location using GPS data, users can ensure that their loved ones are aware of their whereabouts and well-being in times of crisis. This feature enhances communication and safety measures for individuals affected by disasters or incidents.

4.Real-Time Mapping: The application incorporates real-time mapping capabilities that allow administrators or the command center to visualize all user-generated reports on a map in real time. This feature enables responds to identify the precise locations from which help requests are originating, thereby reducing response time and improving coordination during emergency situations.

5.Multimedia Data Sharing: The application supports the inclusion of multimedia data, such as pictures and videos, in user-generated reports. By allowing users to provide visual evidence of incidents or disasters, responds and emergency managers can gain a more comprehensive understanding of the situation, leading to more informed decision-making and efficient response action.

6.Crowd-sourcing and Community Engagement: RescueMitra leverages crowd-sourcing principles to engage users in reporting incidents, sharing information, and warning others about potential dangers. By empowering the community to actively participate in disaster management efforts.

Efficient Communication Channels: The application provides efficient communication channels between users, the command center, and responding units. By facilitating quick and direct communication through the mobile platform, RescueMitra ensures that critical information is relayed promptly, enabling swift response and assistance to individuals in distress.

IV. APPLICATION OF SYSTEM

1.Smart Sensors and Detectors: Firefighters and rescue workers utilize sensors and detectors for detecting radiation, explosive gases, and other hazards. These readings are transmitted via networks to a central computer for instant analysis and contextualization, enabling quicker decision-making.

2.Data Transmission and Analysis: The system enables immediate and reliable data transmission by linking smart sensors to computers in vehicles or headquarters. This setup allows for real-time analysis of data collected from the field, providing valuable insights for decision-makers.

3.Workflow System: A workflow system based on templates adapts to changing organizational structures and facilitates collaborative work within and across emergency services. It helps in aggregating, DE-aggregating, and exchanging data according to the situation's requirements.

4.Resource Scheduling and Coordination: Headquarters staff use applications for scheduling and coordinating resources, ensuring the smooth flow of operations. These applications serve as interfaces to other agencies and the public, providing up-to-date information for effective decision-making.

5.GIS and Cooperative Command Environments: Geographic Information Systems (GIS) and cooperative command environments aid operations staff in managing resources and coordinating activities. These tools enhance situational awareness and support decision-making processes.

6.Geo-spatial Analysis: Through the integration of Geographic Information Systems (GIS), the system facilitates spatial analysis of flood-prone areas. It helps in visualizing and analyzing spatial data related to disaster risks, vulnerability, and critical infrastructure, enabling better-informed decision-making in resource allocation and emergency response.

7.Optimization of Logistics Operations: The system optimizes logistics operations by identifying the most efficient combination of organizations and resources needed to perform humanitarian activities.

8.Fill Rate Improvement: The system focuses on improving fill rates, ensuring that a higher number of affected individuals receive necessary assistance during disasters. By optimizing resource allocation and logistics operations, the system aims to enhance the fill rate and reach more people in need.

9.Collaborative Environment: The system promotes collaboration among different organizations and stakeholders involved in disaster response. It emphasizes the importance of coordination and communication to ensure a cohesive and effective approach to humanitarian logistics.

10.Data-Driven Decision-Making: The system relies on accurate and timely data to generate optimal solutions. It emphasizes the importance of data quality, forecasting tools, and demand estimation methods to support informed decision-making and improve the overall outcome of disaster relief operations.

V. MODEL EVALUATION

1.Effectiveness: The effectiveness of the model is evaluated based on its ability to achieve the desired outcomes and objectives of disaster preparedness and response. This includes assessing whether the model can accurately allocate resources, optimize logistics operations, and improve decision-making in emergency situations. Effectiveness can be measured by comparing the system's performance against predefined criteria and evaluating its impact on enhancing disaster relief efforts.

2.Efficiency: The efficiency of the model is evaluated in terms of resource utilization, cost-effectiveness, and operational performance. This involves assessing whether the system can optimize resource allocation, streamline logistics processes, and minimize wastage of resources during disaster response. Efficiency metrics such as cost savings, time reduction, and resource utilization rates are used to evaluate the efficiency of the model.

3.Practicality: The practicality of the model is evaluated based on its feasibility and usability in real-world disaster scenarios. This includes assessing the ease of implementation, data requirements, technical capabilities, and user-friendliness of the system. Practicality evaluation involves considering factors such as data availability, system complexity, training requirements.

4.Performance Metrics: Various performance metrics are used to evaluate the model, including fill rates, cost-effectiveness, resource allocation accuracy, response time, and overall satisfaction levels. These metrics help in quantifying the impact of the system on disaster relief operations and assessing its effectiveness in improving outcomes for affected populations.

5.Comparison with Existing Approaches: The model may be evaluated by comparing its performance with existing approaches or traditional methods of disaster preparedness and response. By conducting comparative analyses, the strengths and weaknesses of the proposed system can be identified, and its advantages over conventional approaches can be highlighted.

6.Validation with Real Data: The model evaluation may involve validating the system using real data from past disaster events or simulations. By testing the system with historical data or realistic scenarios, its performance can be assessed in a controlled environment, allowing for adjustments and improvements based on the outcomes.

VI. CHALLENGES

Reliability: Ensuring that users receive complete information in a timely manner is crucial. Detecting incomplete information and requesting re-transmission, or notifying users of transmission failures, are essential to maintain data integrity.

Performance: System performance is impacted by communication channel bandwidth. Efficient utilization of communication channels is necessary to deliver complex data, such as maps, quickly. The system's response time should be consistent regardless of the number of communication partners.

Data Exchange Flexibility: Data structures must be flexible to accommodate proprietary sensor data formats. Handling data transformation and compatibility between different versions of data schema is vital for seamless communication.

VII. SUGGESTED APPORACHES

1.Standard Data Interchange Format: Using XML as a standard data interchange format allows for the inclusion of all necessary information, from simple messages to complex maps. XML 's flexibility in handling evolving data structures makes it suitable for dynamic environments like disaster response.

2.Data Transformation and Standardization: Proprietary sensor data formats can be transformed into standard data structures using XML. This transformation can occur at the receiving device or through encapsulation into standard messages, ensuring compatibility and seamless communication.

3.Handling Data Schema Changes: Managing compatibility between different versions of data schema s is crucial. Devices with varying application versions should still be able to communicate effectively, even as data schema s evolve over time.

VIII. RESULT AND CONCLUSION

The document emphasizes the crucial role of smartphones and social media in enhancing connectivity and communication during emergencies, underlining their significance in bolstering community resilience and improving disaster response capabilities. The development and testing of the RescueMITRA application, constructed using Android SDK with React JS, showcased its potential effectiveness in accurately determining user locations through GPS capabilities. The integration of a web application component utilizing React JS, and the Google Maps API enables real-time visualization of user-generated reports for swift identification of help requests and streamlined disaster response coordination. The findings suggest that the RescueMitra application, with its diverse features, can enhance the efficiency and effectiveness of incident and disaster notification processes by empowering users to report incidents, share multimedia data, and communicate with responds. The conclusion offers recommendations for future work, including real-time mapping integration, community testing to evaluate effectiveness, and incorporation into broader disaster preparedness planning to further amplify the application's impact in disaster management.

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