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Crowd-Sourced Disaster Response and Rescue Assistant

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Abstract: *Disasters and emergency situations such as earthquakes, floods, fires, road accidents, and medical emergencies have always been serious threats to human life and infrastructure. Often times, delays caused by inefficient communication, the lack of real, time location information, and poor coordination between victims, authorities, and rescue teams are the problems that plague the first rescue operations.[1]. Most traditional emergency response systems rely on manual reporting and centralized control, which may not function effectively during large, scale disasters. As a result, a Crowd, Sourced Disaster Response and Rescue Assistant is a mobile, based emergency management solution that encourages rapid and efficient responses to crises. Users of the system can send an SOS alert via a mobile application with little interaction, thanks to the proposed system. The alert contains vital information such as the user's current geographic location and the nature of the emergency.[3] This information is sent to a centralized server and is securely stored in a real, time database. The admin application gets the alert, checks the emergency details, and then if everything is in order, the nearest available rescue team is assigned based on location, availability, and the priority of the situation. [11]. The rescue team can access the assigned task on their dedicated app, reach the victims' location through the integrated map services, and keep updating the rescue status during the operation. The system keeps the communication through time notifications and status updates without any break among users, administrators, and rescue teams. Crowd, sourced data from users is extremely helpful in improving situational awareness and thus, making the decision process in emergencies easier. The adoption of mobile technology makes the system viable even in hard, to, reach areas, and there are ways to take care of limited or unstable internet connectivity. The proposed system is a powerful tool for rescue operations that, by lowering the response time and making the coordination better, not only increases the chance of saving lives but also brings those operations to a higher level of effectiveness. The solution is designed to be easy, to, use, scalable, and capable of adapting to different disaster scenarios. Yesterday, like never before, the Crowd, Sourced Disaster Response and Rescue Assistant, is a reliable and efficient platform for modern disaster management and therefore, is a great promoter of public safety improvement and quick emergency response in times of dire need. [2].*

Key Words: *Disaster Management, Crowd Sourcing, SOS Alert, Emergency Response, Mobile Application..*

I. INTRODUCTION

Disasters and emergencies are unpredicted events that may happen anywhere and at any time, and they are capable of causing considerable damage to human lives, properties, and the environment. Immediate responses are necessary in the cases of natural calamities such as floods, earthquakes, cyclones, and landslides or human, made situations like road accidents, fires, and health crises to take the harm to a minimum and to save lives. The speed of sharing information and the efficiency in coordinating the rescue teams are the primary factors that determine how well the disaster response will be. The use of smartphones and mobile internet that has become common in almost every part of the world in recent years has led to the creation of new possibilities for the enhancement of emergency response systems. Mobile applications can be the means for communication in real, time, location tracking, and instant alerting, which are the most important things in the time of an emergency. Unfortunately, many of the existing emergency services are still dependent on the traditional methods of operation such as phone calls, manual reporting, or centralized control they which usually result in failure during a big disaster due to network congestion, delayed response, or lack of accurate information.[11].

The Crowd, Sourced Disaster Response and Rescue Assistant intends to address these issues by using mobile technology and crowd, sourced data for rescue operations that are not only faster but also more reliable. Initially, the system allows a person to send an SOS alert with the user's location and a short description of the emergency via a mobile application.

After that, a management system gets these signals and moves the closest rescue team. On the one hand, the rescue team application assists the responders to the victims' location on the other hand, it enables them to update the rescue status in real time. Therefore, by uniting users, administrators, and rescue teams on a single platform, the system makes it possible to have better coordination and reduces the response time in an emergency.

II.LITERATURE SURVEY

Paper No.	Reference Research Papers	Existing System	Proposed System
1	Harnessing the Crowdsourcing Power of Social Media for Disaster Relief[1]	Uses social media crowdsourcing to collect disaster information	Uses dedicated SOS mobile app for emergency alerts
2	Crowdsourcing for Disaster Relief: A Multi-Platform Model	Multi-platform crowdsourcing (web, mobile, social media)	Single mobile platform for faster response
3	Internet of UAVs to Automate Search and Rescue Missions in Post-Disaster for Smart Cities[3]	Crowd-based real-time assistance and information validation	Admin-verified SOS alerts
4	Emergency Response System Through Crowd Sensing	Crowd sensing using smartphone sensors	GPS-based location sharing from smartphones
5	Real-Time Monitoring Using IoT & Crowd Data	Crowdsourcing across disaster management lifecycle	Focus on real-time rescue & response
6	Smart City Crowd Sensing for Disaster Situational Awareness	Geolocation extraction from crowdsourced data	Direct live GPS tracking of victim
7	Crowdsourced Volunteer Coordination Systems (IEEE)	Smart-city infrastructure with crowd sensing	No smart-city dependency, works anywhere
8	Crowdsourced Geolocation and Social Media for Disaster Response	UAV / drone-assisted rescue using crowd data	Ground rescue teams with map navigation
9	Real-time Emergency Incident Detection from Crowdsourced Data (Waze)	Volunteer coordination via crowdsourcing platforms	Admin-assigned rescue teams
10	Rescue Robotics & Assistance Systems[10]	Decision-support dashboards for authorities	Admin dashboard with SOS status tracking

III.PROPOSED SYSTEM

The innovation in the form of the Crowd, Sourced Disaster Response and Rescue Assistant is a mobile, based emergency response platform that intends to give fast, reliable, and coordinated help during calamity and crisis situations. The system merges users, administrators, and rescue teams into a single integrated framework to enhance communication and lower the response time. In the scheme of things, a user in an emergency situation can send an SOS signal through a mobile application with a minimal number of interactions. The signal is an absolute necessity for the innermost location of the user and the type of emergency. The data is sent to a centralized backend server and stored securely in a real, time database. The admin application is there to get the alert immediately and also it displays all the emergency details on the dashboard. After verifying the alert, the admin decides and assigns the nearest rescue team who is available and is close to the location in terms of both their location and availability. The rescue team thus assigned receives their task through their dedicated mobile application. The rescue team application facilitates navigation to the victim's location and also enables the team to update the rescue status at different stages, e.g., accepted, on the way, and resolved. The system keeps on updating the rescue status and also sends the notifications to the user which is a kind of transparency and also reassurance during the most unfortunate situations. The crowd, sourced data from which information about the disaster is collected from a large number of users, thereby enhancing situational awareness and supporting decision, making at higher levels. The proposed system is not only scalable and user, friendly but is also effective in even difficult network conditions, thus making it suitable for real, world disaster management and emergency response scenarios.

IV.PROBLEM DEFINITION

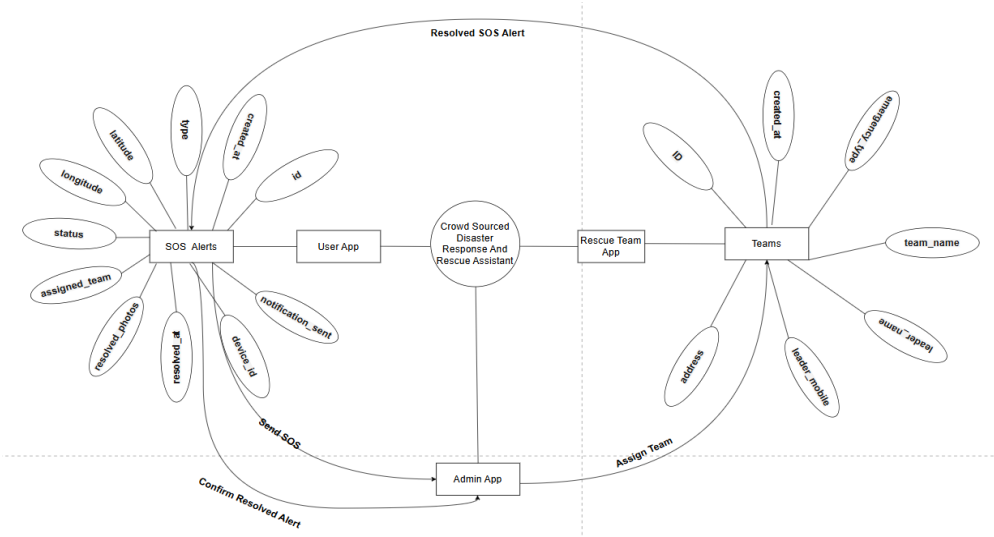
Despite technological progress, addressing disasters effectively is still a significant problem. This is mainly due to delayed communication, lack of real, time location data, and the inefficient coordination of victims with rescue authorities. In emergency situations, victims are in most cases the last ones to get help and sometimes especially when they happen to be in unfamiliar locations or are under extreme stress. On the other hand, emergency helplines could be overburdened, or even unavailable and in any case unable to track the exact location of the victim which eventually results in the resucue fail resucing delays. The lack of a unified platform that connects users, administrators, and rescue teams in real time is another big problem. Usually, information is available in different systems, which makes it very difficult for authorities to see through the chaos and respond in a timely manner. There is a high chance that rescue teams will be given only partial or even incorrect information which eventually results in slower, less effective, and less efficient response. To add to the existing issues, few of the current systems are designed in such a way that they can take full advantage of crowd, sourced data which is extremely useful in enhancing situational awareness during disasters.

Emergency situations require a response system that is reliable, user, friendly, and operate in real, time. This system should have features that allows for quick reporting of emergencies, sharing of accurate location, assignment of rescue teams efficiently, and status updates continuously. The Crowd, Sourced Disaster Response and Rescue Assistant is a project that intends to address these issues by delivering a mobile, based centralized solution that facilitates communication, coordination, and response efficiency during disasters and emergency situations.

Objectives

1. Provide a fast and reliable SOS alert system in emergency situations.
2. Enable real, time location sharing for accurate and quick rescue operations.
3. Improve coordination between users, administrators, and rescue teams.
4. Reduce response time in disaster and emergency situations.
5. Allow efficient assignment of rescue teams based on location and availability.
6. Provide real, time rescue status updates to users.
7. Utilize crowd, sourced data to enhance disaster response effectiveness.
8. Develop a user, friendly mobile application for emergency assistance.
9. Ensure secure storage and management of emergency data.
10. Improve overall public safety through technology, driven disaster management.

System Architecture



V.METHODOLOGY

Frontend Technologies

• Flutter – a UI toolkit for creating visually attractive, natively compiled applications for mobile, web, and desktop from a single codebase.
• Dart - a client, optimized language for fast apps on any platform, used to develop the app logic and UI design.
• Google Maps API - a service that enables adding location tracking and turn, by, turn navigation features to the victim's address.

Backend Technologies

• Supabase / Firebase - a platform for implementing user authentication, real, time data management, and cloud services.
• REST APIs - are the interface through which mobile applications communicate seamlessly with backend services.
• Cloud Functions - is a server less execution environment mainly used to send notifications and handle backend operations.

Database Technologies

• PostgreSQL (Supabase) - is a relational database management system used to store personal data of users, SOS alerts, rescue assignments, and status updates.
• Real - Time Database - a local database that allows the data to be instantly synchronized among all system modules.

Other Supporting Technologies

• GPS Services - providing an accurate and up, to, date location of the user in an emergency.
• Push Notification Services - a source that sends notifications to users, admins, and the rescue teams about alerts and status updates.
• Android Studio - As the development environment, it was utilized in the application building and testing phases.

Implementation Details

The Crowd, Sourced Disaster Response and Rescue Assistant constitutes a multi, module mobile application setup comprising a User App, Admin App, and Rescue Team App. All these components interact through a centralized backend and a real, time database. The entire architecture is tailored to maintain a speedy exchange of information, pinpoint accurate location sharing, and smooth coordination of resources during the time of an emergency.

User App Implementation

The User App is powered by Flutter. If a situation arises, the user is able to dispatch an SOS signal in the most

straightforward way possible. The app grabs the user's GPS coordinates at that moment and the type of emergency selected, then sends the data to the backend server. The application also keeps a continuous connection with the server for rescue status updates and presents notifications so that the user can be updated until the incident is resolved.

Admin App Implementation

The Admin App is designed to fetch SOS alerts in real time from the backend database. The app presents the details of the emergency in totality, inclusive of the user's location and the type of alert, visually, on a dashboard. After confirming the alert, the admin is assigning the nearest available rescue team to the task. Consequently, the rescue information is updated via the database and, thus, instantly reflected in the rescue team application.

Rescue Team App Implementation

The goal of the Rescue Team App is to enable the rescue personnel to know their newly assigned tasks and find their way to the victim's location by means of the map services integrated into the app. The rescue team keeps the rescue status updated with different stages, e.g., accepted, on the way, and resolved. The updates are also shown in real time on the admin and user applications.

Backend and Database Implementation

To execute authentication, data synchronization in real, time, and notifications, the backend makes use of cloud, based services. Emergency alerts, user details, and rescue status are the data stored securely in the real, time database.

VI.RESULTS AND DISCUSSION

The Crowd, Sourced Disaster Response and Rescue Assistant is an excellent and vivid example of a real, time and efficient emergency response system. The device was tested with separate mobile applications for users, administrators, and rescue teams, which were all linked through a centralized backend and a real, time database.

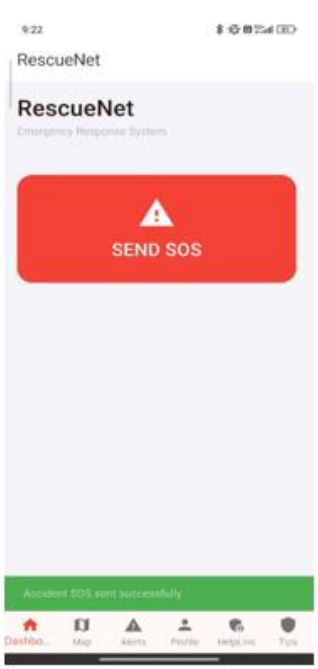
Results:

The experiment was such that the User App could not have been any more effective in prompting SOS alerts in a quick manner, complete with the exact GPS location and the nature of the emergency. These alerts were recorded in the database and were hardly ever delayed in being mirrored in the Admin App. The Admin App not only displayed the details of the emergency but, further, it was instrumental in facilitating the fast assignment of the rescue teams. Therefore, the Rescue Team App had no difficulty in receiving the message right away. In addition, it showed the direction details to the location of the victim.

Real, time rescue updates like assigned, on the way, and resolved were made to reflect all versions of the apps accurately. Notifications through which users were kept in the loop about the rescue progress are a big plus for transparency and user trust. The system was up to.

1) USER APP

1) User App UI

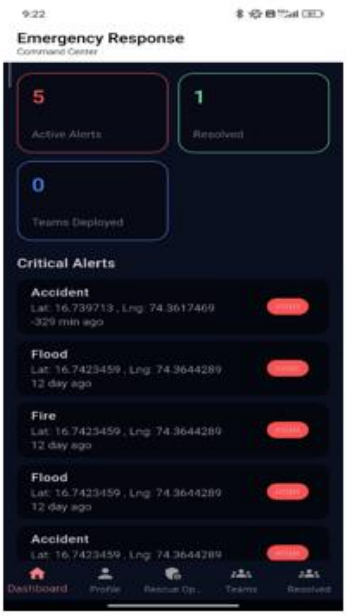


2) Emergency Type

3) Alert Resolved Confirmation

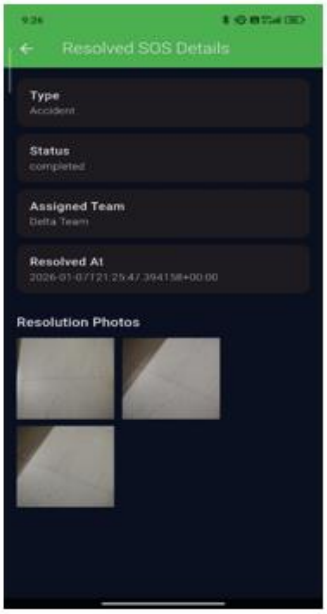
2) ADMIN APP

1) Admin App UI



2) Team Assignment

3) Resolved Alert Confirmation



3) Rescue Team App

1) Rescue Team App UI

2) Track User Location

VII.DISCUSSION

The comparison of response times and speeds clearly represent the proposed system as a winner as it shows the response times being halved or even better in some cases. Also, real, time data synchronization is a key factor that enables the coordination to go smoothly among users, admins, and rescue teams without any lag in response times or communication. So it can be said that the employment of mobile technology and cloud, based services is a source of scalability and reliability, even when there are high alert volumes, or there are multiple users in the same area at the same time.

Yet, it is considered that the performance of the system is mainly dependent on network availability, and limited internet connectivity may cause delays in real, time updates. Nonetheless, the execution of the project serves as a proof of concept that integrating crowd, sourced inputs with mobile applications can greatly influence disaster response efficiency. The main takeaway from the whole story is that the system is not only a feasible, user, friendly and effective tool, but also a real, world emergency and disaster management scenario.

VIII.CONCLUSION

The Crowd, Sourced Disaster Response and Rescue Assistant is a compelling example of a mobile, based emergency response system that is both efficient and dependable. The solution implemented equips users with the capability to dispatch SOS alerts inclusive of their real, time location. At the same time, it affords administrators a comprehensive view of the situation, enabling them to assign rescue teams with precision and effectiveness. Communication in real, time among the users, administrators, and rescue teams keeps everyone in the loop with the latest developments. It also facilitates coordination at different stages of the rescue operation. This tool shortens the time interval between occurrence and response, raises the level of situational awareness, and optimizes the effectiveness of disaster and emergency management from a holistic standpoint. The project, therefore, emerges as a scalable and user, friendly platform through which mobile technology and crowd, sourced data can be harnessed for actual rescue missions and can be of great help in ensuring public safety.

IX.FUTURE SCOPE

1. Build a system that can locally save SOS signals and send them at a later time in regions with weak network coverage.
2. Add a capability that decides the rescue team's location by the shortest distance and the flammability of the situation.
3. Employ AI, based on analytics, to foresee calamities and to keep the resources in a way that is most efficient.
4. Put in a crowd verification method so that the crowd can give feedback and that false emergency alert accounts can be detected.
5. Reinforce the system by incorporating multi, layer authentication and by encrypting the sensitive data.
6. Also, make the system work with iOS and create admin dashboards for the web, based as well.
7. Communicate transparently through channels between the government, public safety agencies, and the community.
8. Enable users to capture and instantly dispatch emergency visuals such as photos and videos.
9. Be more precise in your localization by using more sophisticated GPS technologies.
10. Implement language features so that a greater number of people will be able to utilize the system.

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