

Project Title: Crowdsourced Disaster Relief Platform

Team Profile: Group 2

a.

- Casey Nguyen: Programming (Full Stack), management, formatting, organizing
- Kevin Pulikkottil: Programming (Back-end), data processing/management, AI-powered matching
- Sawyer: Programming (Front-end), documentation
- Andy Jih: Programming (Front-end)

b.

- Team Leader: None (Shared Responsibilities)

Proposed Project Description:

Problem Diagnosis:

Disasters such as earthquakes, floods, and hurricanes require a rapid and organized response to minimize damage and provide aid to those needed. However, coordinating relief efforts across various organizations such as government officials, Non-Government Organizations (NGOs), local volunteers, and affected individuals is a challenge for society. This includes overlapping efforts by various organizations, misallocated resources and funds, instant and real time communication, and slow response times to those affected by the disaster. Most of the time communication or more so the lack of it is a reason why relief efforts are slow and ineffective. Our proposed Crowdsourced Disaster Relief Platform will streamline disaster response by connecting victims, volunteers, and Non-Government Organizations (NGOs) in real time. This platform will connect disaster victims, volunteers, first aid as well as first responders, and relief organizations to share real time updates on the status of the situation. This includes updates on the needs of the victims involved, where resources are needed, and what areas or people need assistance.

Problem Domain:

During disasters, communities and the people within often struggle with accessing essentials and needs. The disaster victims may not know where to go to find help or how to get everyday essentials when disaster strikes. On the other hand, relief organizations and efforts may be directed at the wrong areas or not the areas where immediate need is required. They may not have the entire grasp of the situation. This means not everyone gets the help and assistance they need in order to survive the disaster. The underlying problem is a lack of real-time, clear, accurate and delayed communication between relief efforts and affected individuals. The lack of communication then leads to underutilization of resources.

Our centralized, crowdsourced disaster relief platform will be a central communication hub that gathers critical information about the situation and sends out information about where to go, what areas need assistance, where and what resources are available, and the status of ongoing relief efforts.

Our Platform will enable:

- Real time reporting: Disaster victims can report their needs like if they need water or medical assistance. They can also update the ongoing situation. This is all done through their mobile device or their web. This creates an up-to-date mapping of the current situation.
- Resource Matching: Relief organizations and in area volunteers can offer resources such as water, food, clothes, gas, and medical aid. They can also offer services that are matched with the area's immediate need based on priority and proximity.
- Data Coordination and Accessibility: Everyone will have a clear, real-time update on the unfolding situation. This allows for better resource allocation and faster decision making in regards to where help is needed for the disaster victims.

With our proposed platform, disaster response and efforts can be handled a lot more effectively by using the power of crowdsourcing and improving on the efforts made by all stakeholders in the situation. This in return will help reduce response times, maximize the usage of resources, and improve the overall impact of the disaster relief effort.

People Involved with Our Diagnosis:

- Disaster Victims – Individuals in affected areas who need help (e.g., shelter, food, medical aid).
- Volunteers – People willing to contribute time and skills for rescue, logistics, and relief efforts.
- NGOs & Government Agencies – Organizations providing structured disaster relief and resource management.
- Donors – Individuals or companies willing to provide financial or material support.
- First Responders - Local authorities like police and emt who will respond when a help request is made.

Specific Issues:

- Maximize reliable app functionality with poor connectivity.
- Securely handle user data and registration
- Be able to handle thousands of simultaneous users.
- Ensure system uptime during peak disaster situations.
- Protect general data and financial information of donors
- Make sure victims get the help they need
- Help organizations and volunteers know where help is needed
- Be able to provide real time updates about the unfolding situation

- Maintain communication lines between users and organizations

Sub Issues:

- Offer offline functionality.
- Optimize data usage via compression, utilize efficient APIs, implement pagination and caching in API design, network monitoring, etc.
 - For data compression: choosing appropriate algorithms (Huffman, Lempel-Ziv, Run-length, etc. and lossless vs lossy compression?)
 - For network monitoring: packet loss, network availability, API monitoring, alert systems (for when networking availability drops)
- For handling user data and registration, implement a role-based access system/control (RBAC) (i.e. victims, volunteers, and NGOs).
 - For certain roles, offer differing functionality (like resource management via NGOs, etc.).
 - Biggest issue would be the danger of people registering for a role they aren't authorized (the roles of volunteers and NGOs) - since they have sensitive information that can put victims in danger, the ability to manipulate resources, etc.
- Utilize cloud-computing and/or load balancing to ensure system uptime.
- For protection of user data and donor's financial information, utilize two-factor authentication? (not really sure how to handle financial info)
 - Sub issues of two-factor authentication: dependence on secondary devices due to SMS, Authentication apps, etc., potential security vulnerabilities, lockout scenarios (which could be "life threatening" due to the nature of this app)., etc.

Expert Opinions:

- **From the ScienceDirect:** Their case study from the early 2010's suggest that with the growing number of users on the internet, particularly on various social medias, that people alike are connected enough to have benefits of crowdsourcing. This is even more true now with the rise of Instagram, Facebook and Tiktok. There are millions and millions of people throughout these platforms where this idea will have a high chance of succeeding. Communication is the key here and with the ever growing amount of people in the online world, crowdsourcing will only get easier. The only thing left is to make a trustworthy app and a trustworthy line where people can feel comfortable helping others and feeling safe from doing so. This includes the protection of users' data especially.
- **From Global Disaster Preparedness Center:** The Haiti earthquake and the Japan Tsunami were infamous natural disasters that were aided from a source of crowd disaster response. Youtube, Twitter and Facebook were the main social media at the time and a lot of people got information from that. The platforms allowed millions to get

information they needed to stay alive and stay connected to each other to hear important updates and shelter places. In their analysis, they came to the conclusion that crowdsourced data offers three key advantages: real-time collection of disaster reports, automated categorization and analysis for prioritizing aid, and geotagging for accurate location tracking. Challenges do exist at the end of their article though. Some challenges include the lack of coordination among relief organizations, inaccurate or fraudulent data, and security concerns regarding public access to sensitive information. They do suggest some fixes like geo-tagging, verified reports and reporting outlets, and various social computing techniques.

- **How NGO's usually operate in Disaster Relief Efforts:** NGOs play an important role in disaster response by closing the gap between government resources and urgent local needs. Their key functions include:
 - Rapid Response & Coordination: Deploying emergency teams, assessing damage, and working with government and humanitarian groups. They use satellite imagery and AI for aid prioritization.
 - Resource Distribution: Managing logistics for food, water, shelter, and medical aid. Large NGOs like Red Cross and UNICEF pre-position supplies for quick deployment.
 - Volunteer Deployment: Matching skilled volunteers (e.g., doctors, engineers) to disaster zones. Our AI platform can streamline this process.
 - Data Collection & Needs Assessment: Gathering real-time data via surveys, social media, and crowdsourcing to identify unreported disaster areas.
 - Long-Term Recovery: Supporting rebuilding efforts, mental health services, and economic development post-disaster.
 - Transparency & Accountability: Ensuring aid reaches those in need while exploring technologies like blockchain for secure tracking.
 - By integrating crowdsourced data with NGO operations, our platform improves coordination, minimizes redundancy, and enhances response efficiency.

Proposed Treatments:

Problem Addressing:

Our solution will provide a real time platform where:

- Victim Assistance: Victims can request immediate aid via a mobile app or a web portal. They can specify what type of assistance they need. Examples include food and water, medical assistance, or shelter. They will then be able to submit their request at their exact pinpoint location, ensuring help arrives exactly where they need to be. The

platform will be prioritized and categorize requests so that responders can focus on the most urgent needs first.

- Volunteers and NGO Coordination: Volunteers and NGOs will have access to a dynamic map that will show real time requests categorized by need and urgency. This special feature will allow them to respond based on their resources on hand and on the level of priority and proximity.
- Disaster Updates and Alerts: Provide updates and news about the ongoing disaster and relief efforts. News updates will be about the weather, road closures, and shelter alerts and updates. This will allow users to make decisions in a timely manner and overall be informed about the situation around them.
- Resource Allocation Management: Will maximize resources by tracking current inventory, monitoring available volunteers in the area, and putting together deliveries for help requests among the organizations. This will allow waste reduction, prevent different organizations from making the same help request and efforts, and ensure valuable supplies are being directed in areas where people are in need.
- Streamlined Communication: A centralized communication system will connect all stakeholders, including victims, volunteers, NGOs, and first responders within one platform for easy networking and communication. This system will allow for 24/7 instant messaging, group and relief effort coordination, and progress tracking for each help request during times of disaster. This system will ensure no duplicate checking on help requests. This then in return allows people to receive the help they need with minimal delays or interruptions.

Business Value:

What customers and users will gain is a free to use platform where they can track real time feed and news about ongoing disasters. What they looked before is the crowdsourcing based platform. They also lacked an all in one centralized communication line between victims, first responders, organizations, and volunteers. Organizations also gain from the fact that their resources are being maximized so none goes to waste. They would be allowed to communicate with other organizations to send help to different areas and people, ensuring no duplicate responses to help requests. The communication line will then vastly reduce wait times for immediate aid and reduce communication interruptions.

Summary of Gains for Users and Customers :

- For Users (Victims, Volunteers, First Responders)
 1. Free to use platform
 2. Real Time Tracking and Updates
 3. Centralized Communication line
- For Customers (Organizations and Relief Agencies)
 1. Resource Allocation
 2. Resource Utilization
 3. Reduced wait times and faster responses

4. Minimized communication interruptions

Envisioned Benefits:

- Faster emergency response
 - Immediate visibility into disaster hit areas through crowdsourced reports
 - Victims can report their needs instantly, reducing wait times for assistance.
- Improved Coordinations Between Relief Organizations
 - Centralized platform eliminates redundant efforts and improves communication and efficiency.
 - NGOs and government agencies can collaborate on resource distribution.
 - Inventory tracking prevents oversupply
- Enhanced Volunteer Engagement
 - Volunteers receive personalized assignments, increasing efficiency.
- Greater Accessibility
 - Offline functionality allows victims in low connectivity regions to access critical help
 - User friendly UI makes it easy for every to navigate the system
 - Multilingual support ensures that users from different backgrounds can participate.
- Optimized Resource Allocation
 - Live tracking ensures that resources reach the areas most in need
 - Inventory tracking prevents over allocation of supplies and improves distribution
- Real-Time Tracking and Communication
 - Victims receive instant emergency alerts about shelter locations, rescue updates, and aid availability
 - NGOs can broadcast critical updates to coordinate efforts more efficiently.

Examples and Implementation:

- Scenario 1: Emergency Medical Aid Request
 - With current practice, victims call emergency hotlines, but these lines are often overwhelmed during critical times. This causes delays and produces inefficiency. Relief teams struggle to locate those in need, and response is slowed down. However, with our solution victims can directly submit aid requests via the app or website, which are geotagged and automatically matched and assigned to nearby volunteers and NGOs. Real time notifications ensure faster response.
- Scenario 2: Coordinating Food & Shelter Distribution
 - Currently NGOs and government agencies distribute resources based on estimates, often leading to oversupply in some locations and shortages in others. During emergencies, victims also often rely on word of mouth, social media, or government announcements to find help, this can be unreliable and slow,

especially if infrastructure is damaged. Relief organizations also struggle to track real time supply levels and needs. Our platform addresses this issue by providing a centralized, real time tracking system that allows NGOs and shelters to update inventory levels. Victims can easily access this information, allowing them to efficiently access available aid centers with adequate supplies. This system ensures that everyone has access to accurate and updated information, allowing faster and more reliable access to essential resources.

Why Ours:

Existing disaster relief apps like FEMA and Relief Central focus on preparedness, emergency alerts, and health resources. Our platform goes beyond and enables real-time, AI-powered volunteer matching and resource coordination.

Key Differences:

- **AI-Powered Matching** - Connects victims directly with volunteers and NGOs based on skills, location, and urgency.
- **Live Resource & Aid Requests** - Victims can request food, shelter, or medical assistance and get matched instantly.
- **Real-Time Geolocation Mapping** - Identifies where help is needed most and optimizes response efforts.
- **NGO & Donor Coordination** - Reduces duplication by efficiently allocating resources.
- **Crowdsourced Disaster Updates** - Provides real-time information beyond official sources.

Unlike FEMA and Relief Central, which focus on information and alerts, our platform actively **implements aid through direct matchmaking and resource tracking.**

Functional Features:

- User Registration & Profiles (for victims, volunteers, and NGOs)
- Real-Time Request Posting (victims can request specific help)
- AI-Powered Matching (volunteers/NGOs automatically assigned based on proximity and skillset)
- Live Map & Geolocation Tracking (visualizing needs and available volunteers)
- Donation System (financial and material donations, with tracking)
- Emergency Broadcast Alerts (push notifications for urgent needs and updates)
- Resource Inventory Management (NGOs can track food, water, medicine supplies)
- Social Media integration (feeds, etc.)

Plan of Work and Product Ownership:

Steps to Take:

- Week 1-2: Requirement Analysis & Initial Design
- Week 3-4: UI/UX Wireframing & System Architecture Planning
- Week 5-6: Backend API Development & Database Setup
- Week 7-8: AI Matching Algorithm Implementation
- Week 9-10: Frontend Development & Feature Integration
- Week 11-12: Testing, Debugging, and Deployment

Team Description:

Casey - My strengths is that I want to stay ahead of schedule in regards to due dates. I am also easy to communicate with, so this means I am readily available for group meetings and discussion.. This in return allows the group to function smoothly. For programming I can contribute both front and back ends, wherever the group needs me.

Andy - Will contribute to the frontend web app.

Kevin - I will contribute mainly to the development of the AI aspect of the application and will also work on any back-end programming and database management/processing work.

Sawyer - Will contribute mainly to the front-end of the application, and the databases that handle user profiles and registration. Will also contribute to user documentation and guidelines, and possibly to the systems that maintain system uptime and security.

Why us four will work: We seem to all have something to contribute to the project and team, and our communication is clear and direct. We all have a part to do in the project. Some are better for the front end while others are suited for the back end. This allows us to work on the project simultaneously without any major setbacks.

Functionality:

- Casey: Social Media Integration, Resource Inventory Management.
- Andy: Real-Time Request Posting, Emergency Broadcast Alerts
- Kevin: AI-Powered Volunteer Matching (skill & location-based), Back-End Infrastructure & Database Management
- Sawyer: User Registration & Profiles (for victims, volunteers, and NGOs), Donation System (financial and material donations, with tracking)

Estimated Cost and Completion:

Since the project is in the nature of volunteering, and no members of the team are being paid and are working as volunteers, the cost should only be time and effort. The only area in which

we may see cost would be the payment of cloud services and other software tools. The estimated date of completion should be sometime in late April.

Why It Will Work:

Considering the size of our team, as long as we accomplish the functional requirements we will have succeeded. However, if we desire to excel we should implement and solve a couple or more of the “specific” issues that we have identified - those would include system uptime, user data and financial security, etc. To measure success based on these parameters, we would stress test, possibly seek out feedback and reviews, and test the accuracy of the AI matching, etc.