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FLOOD RESCUE MANAGEMENT AND ZONE MAPPING USING GIS AND ADVANCED TECHNOLOGIES

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Abstract - *This project is based on a disaster management application which deals with all humanitarian aspects in case of emergencies in order to lessen the impact of disasters. People can get information regarding rescue camps operating nearby in case of disasters like floods. Here the victims can request for a list of relief camps operating nearby their current location. Victims can raise their basic needs to the authority and meet their necessities on time with the help of this application during flood. There is a separate platform for the assessment of the post-disaster needs. The victims are provided with the benefit of restoring their losses during the flood Request for basic needs like food, cloth etc. request for medical services. The application has a flood mapping system which provides area navigation for rescue teams before conducting efficient rescue operations. Flood-affected roads are marked which provides guidance to the public for safe driving. Also, additional features in that particular zone like wells, ponds etc. and other obstructions can also be tagged which prioritize risk reduction during the disaster.*

1. INTRODUCTION

Flood, being a natural disaster, has a huge impact on both individuals and communities and has social, economic, and environmental consequences. The impacts of a flash flood includes loss of human life, damage to property, people being trapped, loss of documents, etc. to which the flood victims find no quick solution.

As communication links and infrastructure such as power plants, roads and bridges are damaged and disrupted, people are forced to leave their homes and normal life is disrupted. Thousands of houses were destroyed which left the residents with no choice but to shift to the nearest relief camp. Evacuating families and shifting them to relief camps are done to survive from any kind of live losses. A person can be trapped in their own homes due to a flash flood. In order to rescue them and shift them to a safer location, a rescue request must be sent to the rescue team. But the relief and rescue operation team would not know how to find their way to exact locations. They would not be aware of what exact obstacles are there on the chosen route such as lake, road or any other features, that is, teams in position don't have proper ground information.

Before dispatching rescue teams, it is necessary to know where to send them. Large expanses of floodwaters can mask landmarks leaving unprepared rescuers disoriented and unable to locate survivors. Many flood victims had to leave their homes and shift to rescue camps in order to keep themselves safe. They face a lot of difficulties due to the lack of basic things used in our daily lives. Thousands of flood victims have lost their homes, their assets, valuable goods including vital documents.

This paper describes a web page which is a quick solution to all the problems faced by the flood victims and the rescue teams. It helps the rescue teams to travel through the safer path option. This path can be shown in the map which is open to the public and is editable by the local guides or public. Users may feel unsafe in their own homes as the water level rises. This may force them to move to a nearby relief camp once they are aware that they are no longer safe in their homes. With the help of this application, users can request information like the exact location of relief camps near them. This information can be provided to them with the help of their current location by GPS.

There may be some missing cases and these can be reported by their relatives by uploading the missing person's photo, his\her address, and visible birthmarks. During floods, people may fear to get out of their homes and get themselves some daily essentials, mainly food and drinkable water for survival. These people can request their daily essential needs through this portal.

Flood Relief Portal also focuses on after effects caused by the floods, that is, post disaster need assessment. Flood victims may be left with nothing, not even for their survival. Documents of great value may be lost, their vehicles may be destroyed, they may be left with no food, clothes nor drinkable water, and some even may be hurt. Flood victims can find a solution to all these problems in this portal like vehicle repair services, request for lost documents, request for daily essentials like food, water, etc., medical services and much more.

2. EXISTING SYSTEMS

Some similar applications or web pages that are useful for flood victims or trapped ones are listed below:

2.1 OpenStreetMap

OpenStreetMap is built by a community of mappers that contribute and maintain data about roads, trails, railway stations, and much more, all over the world. Open Street

Map (OSM) is a collaborative project to create a free editable map of the world. Map data is collected from scratch by volunteers performing systematic ground surveys. The core of OpenStreetMap can be used for many different purposes. Many different routing services are built on OpenStreetMap data, not only for cars.

2.2 Map Action

Map Action is a non-governmental organization that specializes in providing mapping for humanitarian emergencies. They quickly gather crucial data at the disaster scene, conveying it visually in the form of maps. By creating this 'shared operational picture' for aid agencies, governments and local partners, they help them make informed decisions and deliver aid and emergency supplies to the right place quickly. The application is nourished by citizen actions and enhanced by participation of communities. Map Action has a small but full-time staff but most of its capacity is provided by volunteers. Its volunteers are skilled with geographical information systems (GIS) and are trained to work in humanitarian emergencies.

2.3 Volunteer Rescue

Volunteer Rescue is an application including a set of tools for anybody involved with search and rescue, the tools are suitable for the new recruit through to the experienced rescue leader. Volunteer Rescue provides an electronic means to capture, store and analyze information centrally and enables an organization to access this information using just an internet browser and an internet connection. The mobile app is also a client to the main Volunteer Rescue service for members of organizations that also use the Volunteer Rescue service although this is not a requirement.

2.4 PathAway

PathAway platform can be used for search and rescue efforts. The route of each search personnel can be tracked in real-time with remote tracking, or on-device for later analysis. Map routes can be created for the most efficient coverage of the search area. Text details, pictures and video of any possible evidence found can be added along the way.

3. PROPOSED METHOD

I. People can get information regarding rescue camps operating nearby in case of disasters like flood with the help of this platform.
II. People who had to leave their homes and shift to rescue camps can raise their needs and the volunteers can help them with this application.
III. Affected ones can also seek help for restoring their loss of properties caused as an impact of disaster. People stuck in flood prone areas can also make use of this app for getting their immediate rescue.
IV. This application allows the refugee camp volunteers or survivors to bring awareness about the things they need.
V. There is also a provision for area navigation for rescue teams before conducting efficient rescue operations.
VI. The flood affected zones are marked in this portal.
VII. Both missing and trapped victims are rescued with respect to their details uploaded.

4. SYSTEM MODULES:

The entire project is divided into four modules namely, flood victims, administrator, rescue leader and camp in charge.

The users are the ones who are affected by the flash flood, some of whom may have shifted to a refugee camp before or after the water level had risen in such a way that it had caused a difficult situation to stay back in their homes. The public user can interact with the user friendly homepage. The user can get the simple guidelines regarding the webpage from the portal. The local user can report missing cases. Missing ones details and images will be scrolling in the homepage continuously along with alerts. Users can view relief camp details added by the camp in charge where they can select appropriate camps of their wish. Users can request for shelter and post it. Also they can request for their basic needs like food, sanitary, etc. Users can report about the trapped ones and can be rescued by sharing their current location. Here they have to submit the number of people to be rescued.

Fig 1:- Upload areas and alerts for the public

Admin is the one responsible for controlling all the webpage information. Admin has the power to activate and deactivate each working head which includes the camp in charge and rescue leader. They have to check and filter all relevant information. The right details of missing persons reported by the public are activated to display in the homepage by the admin. If they are seen found the admin is removing them correspondingly from the webpage. Admin displays all current relief camps that are active along with their directions.

Admin can mark the flood affected routes by drawing red lines in the map. Also admin can tag obstacles like wells and ponds in the flooded zone which is very helpful for the rescue teams to get aerial information for conducting their safe rescue operations. Admin is the one who has to add and remove alert comments in the homepage. They have to grant the request for shelter and needs to the authority. Another important role of them is the concern for rescue reports. They have to handle the operations behind rescue requests including time and date of request post, the number of people from various request sides, and the details of date and time for each completion of rescue.

The camp in charge holds the responsibility to add or register new camp details by filling in the location, address, district, pin code and capacity of the particular relief camp. If the capacity of the camp is exceeded, no further entry of people allowed is alerted. The registered relief camp will be added to the list of existing relief camps. The camp in charge can also view the shelter requests and rescued details, missing cases once found are updated.

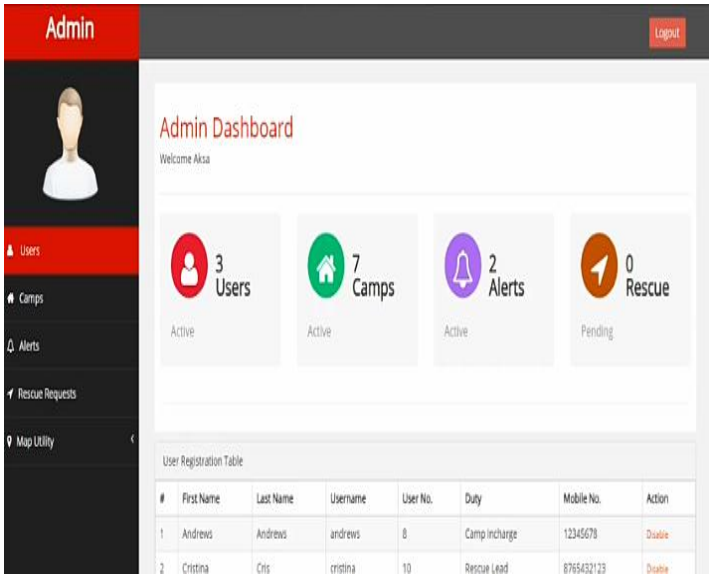

Fig 2:- Image of admin controlling portal fields

The rescue leader controls and monitors the rescue teams in various sites. A person trapped can request for rescue at any time. This rescue request will be updated and can be viewed by the administrator. The location from where the person requires rescue as well as the current location of the rescue leader will be marked on the map. Once the rescue leader along with the team reaches the location of the trapped person, the web page considers this action as the completion of the rescue operation.

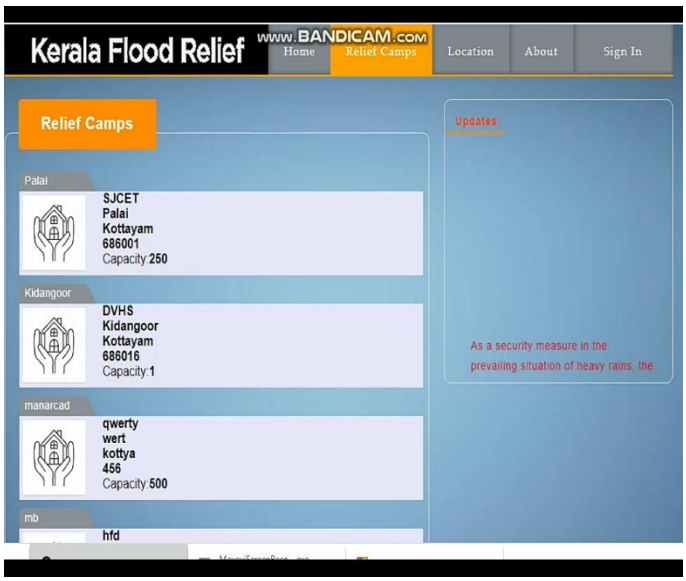

Fig 3:- List of relief camps

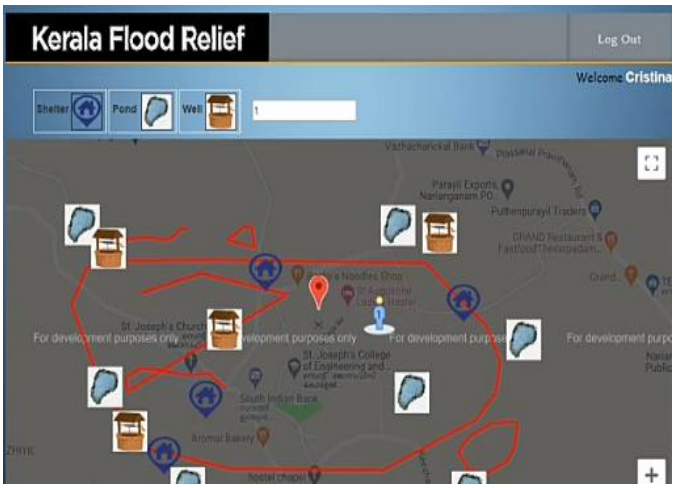

Fig:-4 Red lines are the manually drawn flooded roads

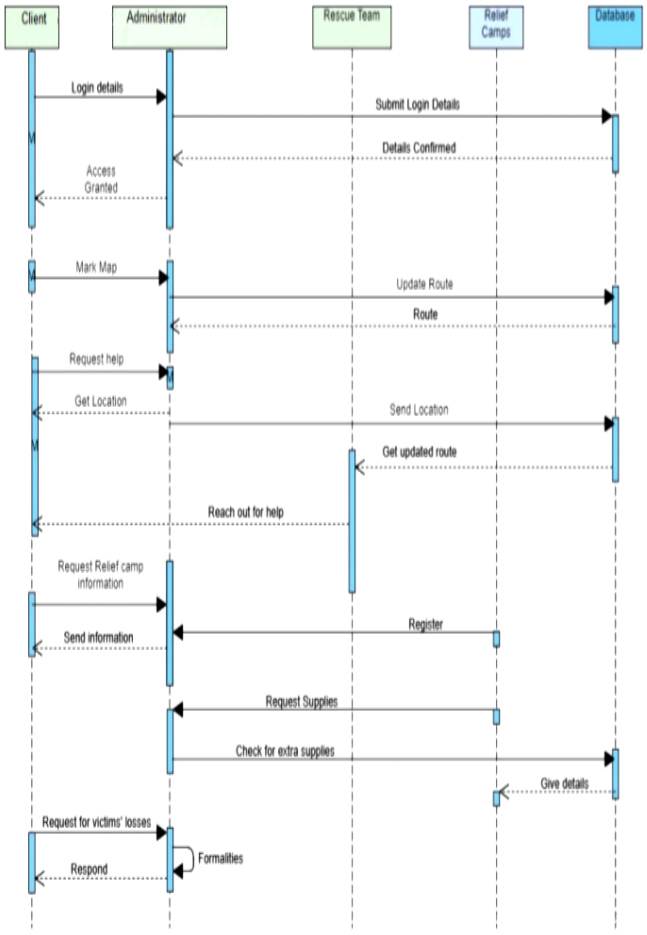

Fig 5:- System design

The administrator keeps a table containing information about the trapped ones. Once the rescue leader reaches the trapped person, the person is considered to be safely rescued and this update is reflected in the admin's table. The rescue leader ensures safe rescue of the person from the accurate location specified and considers the safety of the rescue team by choosing the right path in order to reach the destination

5. TECHNOLOGY REQUIREMENTS

5.1 GPS

The Global Positioning System (GPS) serves as a facilitating technology in addressing these needs. Search and rescue teams used GPS, geographic information system (GIS), and remote sensing technology to create maps of the disaster areas for rescue and aid operations, as well as to assess damage.

5.2 Android Emergency Location Service (ELS)

ELS is a supplemental service that sends enhanced location directly from Android handsets to emergency services when an emergency call is placed. The stuck and missing people's location is computed on the handset and sent to Emergency Services and it is sent via Data SMS.

RESULTS

Relief and rescue operations in flood-hit locations will be highly demanded in times of destruction. Relief and rescue agencies have mounted amongst the toughest and most comprehensive operations with more work force, material and equipment. Once a flood hits, the number of victims requesting for help, during or post-flood, massively increases. Flood rescue management mainly focuses on flood victims and rescue teams. The details and information given to the victims are made sure to be precise and correct. Trapped ones need not worry about finding a nearby relief camp as Flood Relief Portal serves them with correct details of the nearest relief camp including the capacity of the camp. Public can report missing cases easily and the rest of the task will be assigned to the rescue teams. Victims need not worry about the destruction happening to their properties as Flood Relief Portal takes care of post-flood needs. The aim of a responsible rescue team would be to reach the trapped ones as soon as possible by considering their safety as well. Rescue teams find it easier to find their path to the trapped ones by following the manually updated flood map. This flood map can be edited as if it shows the obstacles on their way to rescue.

CONCLUSIONS

During floods or even after floods, many individuals need help in various ways. During floods, some may be trapped in their own homes and will be in search of nearest relief camps. Some may be missing and these missing cases will be reported immediately. Some in relief camps may lack

daily essentials for their everyday life. Whereas some may be even trapped and may need to be rescued. In this case, the rescue team needs to be directed to their proper location through a safe path. With the help of flood rescue management, trapped victims can be rescued by tracking their location. Once this is done, the rescue team is guided by the manually created flood map and rescues the trapped ones, in this way better and safer routes are provided to these rescue teams. Stuck victims can get information about nearby refugee camps using their current location. Missing individuals' details will be displayed in the home page as it is given much importance in order to find them. Once they are found, the list of missing details is updated and hence creates no confusion. Basic needs of the victims in refugee camps are met. Many victims may be suffering after a flood hit and many require help in many ways. Using this rescue management the after needs of the survivors are considered.

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