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e-KrisenSeva: A Web-App based Portal for Real Time Disaster Management System.

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Abstract - *Disaster management has been a challenging task since the evolution of mankind. The lack of proper communication, the status of various shelters and safe spots as well as overall administrative control over the situation is a tough operation to handle. Integration of modern technology and innovative solutions to such problems provides a better approach to managing disasters in real-time. e-KrisenSeva is our web application consisting of features like real-time shelter navigation and allocation, resource availability statistics, global communication at the time of disaster and various other online as well as offline features. This paper presents our implementation strategy along with a comparative analysis of the various tools and technologies used in building this comprehensive Disaster Management System.*

Key Words: *disaster management, hybrid app, navigation, resource allocation, Apache Cordova, web portal, shortest path algorithm.*

1. INTRODUCTION

A disaster[6] is a serious disruption, occurring over a relatively short time, of the functioning of a community or a society involving widespread human, material, economic or environmental loss and impacts, which is beyond the ability of the affected society and people to cope using its own resources.

Disaster Management [1] refers to how we can protect or preserve many lives and property. India has been vulnerable for a long time to the natural disasters on the account of its unique geo-climatic conditions.

Modernized and technical approaches can be used for disaster management on a small or a large scale by methods, which allow communication and passing of information for the officials and victims in need. Technologies like Apache Cordova [3] and web portal based applications can help the people affected by various disasters through useful offline information, an easy to use navigation interface and additional communication solutions.

Various algorithms and API's could be leveraged to make real-time disaster management more feasible and helpful. By comparing the available algorithms and solutions and picking the best ones for a complete disaster management system, e-KrisenSeva aims to solve the problem of delay in rescue and lack of proper communication.

2. RELATED WORK

2.1 Disaster Management Cycle

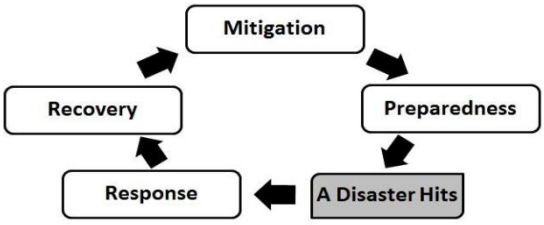

Fig -1: Disaster Management Life Cycle

A. Mitigation[1][2]

Mitigation activities actually eliminate or reduce the probability of disaster occurrence, or reduce the effects of unavoidable disasters. Mitigation measures consist of vulnerability analyses updates; building codes; zoning and land use management; building use regulations and safety codes; preventive health care; and public education.

Mitigation tends to depend mainly on the incorporation of appropriate measures in national and regional development planning. Its effectiveness is expected to depend on information available on hazards, emerging risks, and the countermeasures to be taken. The phase of mitigation, and the whole disaster management cycle indeed, includes the shaping of public policies and plans that either modify the causes of disasters or mitigate their effects on people, property, and infrastructure.

B. Preparedness[1][2]

The goal of emergency preparedness programs is to achieve a satisfactory level of readiness to respond to any emergency through programs that strengthen the technical and managerial capacity of governments, organizations, and communities.

These measures can be easily described as logistical readiness for dealing with disasters and can be enhanced by having response mechanisms and procedures, rehearsals, developing long-term and short-term strategies, public education and building early warning systems. Preparation measures can also take the form to ensure that strategic reserves of food, equipment, water, medicines, and other essentials are maintained in cases of national or local catastrophes.

C. Response[1][2]

The aim of emergency response is to provide immediate assistance to maintain life, improve health and support the morale of the affected population. Such assistance ranges from providing limited but specific aid, such as assisting refugees with transport, temporary shelter, and food, to establishing a semi-permanent settlement in camps and other locations.

The focus in the response phase is on 12 meeting the basic needs of the people until more permanent and sustainable solutions can be found. Various organizations, especially humanitarian, are often strongly present in the response phase.

D. Recovery[1][2]

As the emergency is brought under control, the affected population is capable of undertaking a growing number of activities aimed at restoring their lives and the infrastructure that supports them. No distinct point exists where immediate relief changes into recovery and then into long-term sustainable development. Many opportunities will exist during the recovery period to enhance prevention and increase preparedness, thus reducing vulnerability.

A smooth transition is ideal from recovery to ongoing development. Recovery activities are continued until all systems are back to normal or better. Recovery measures, including both short and long term, consist of temporary housing; public information; returning vital life-support systems to minimum operating standards; health and safety education; reconstruction; counseling programs; and economic impact studies.

Services and information resources are composed of data collection related to rebuilding, and documentation of lessons learned. e-KrisenSeva mainly operates under the response and recovery phase of the disaster management cycle.

2.2. Comparative Analysis

A comparative analysis was carried out on the various app development technologies.

Table -1: Comparison of Native and Hybrid Apps

Parameters	Native Apps	Hybrid Apps
Device access	Full	Full
Performance	High/Fast	Medium/Good
Development Language	Objective C for iOS or Java for Android operating systems	HTML5, CSS and JavaScript
Development Cost	Expensive	Reasonable
Development Time	High	Medium
Maintenance	High	Medium
Speed	Good	Very Fast
Cross Platform Support	No	Yes
User Interface	Good	Good
Advance Graphics	Moderate	HIGH
Security	High	High
Code Portability	Low	High
Complexity	More complex to code	Less complex to code

Graphics	Better graphics	Lesser graphics than native apps
Portability	Harder to port to other systems	Easier to port to other systems
Integration	The camera, address book, geolocation, and other features native to the device can be seamlessly integrated into native apps.	Some device features may be harder to integrate into hybrid apps.
Internet Connection	Not Required Always	Not Required Always
Gesture Support	Yes	Yes

Also, a comparison of various shortest path [4] algorithms was carried out for the navigation system.

Table -2: Comparison of Shortest Path Algorithm

Parameters	Dijkstra	Bellman Ford	Breadth-First Search	A*
Time Complexity	O(V^2 + E)	O(V * E)	O(E + V)	Depends on the Heuristic
Weights	Non-Negative weights	Negative weights	Unweighted	Negative weights
Graphs	Cyclic	No Cycle	Regardless of the kind of graph	No Cycle

2.3. Technology Stack

A. Web Portal

A web portal is a website specially designed to bring information from diverse sources, like emails, online forums, and search engines, together in a uniform way. Usually, each information source has a dedicated area on the page for displaying information (a portlet); often, the user can configure which ones to display. Some variants of portals include the ones that represent mashups and intranet dashboards for executives and managers.

The extent of displaying content in a uniform way; may depend on the intended user and the intended purpose, as well as the diversity of the content. Very often design emphasis is on a certain metaphor for configuring and customizing the presentation of the content (e.g., a dashboard or map) and the chosen implementation framework or code libraries.

In addition, the user's role in an organization may determine which content can be added to the portal or deleted from the portal configuration. For quick accessibility using cross-platform mobile devices, Apache Cordova [3] is one of the best solutions, which can be used to integrate the web portal into a mobile application.

B. Apache Cordova App

Apache Cordova [3] enables software programmers to build applications for mobile devices using CSS3, HTML5, and JavaScript instead of relying on platform-specific APIs like those in Android or iOS.

It allows us to wrap up CSS, HTML, and JavaScript code depending upon the platform of the device. It helps to extend the features of HTML and JavaScript to work with the device. The resulting applications are hybrid, meaning that they are neither truly native mobile application nor purely web based.

Web-based means that they are not just Web apps, but are packaged as apps for distribution and have access to native device APIs. Mixing hybrid and native code snippets have been possible.

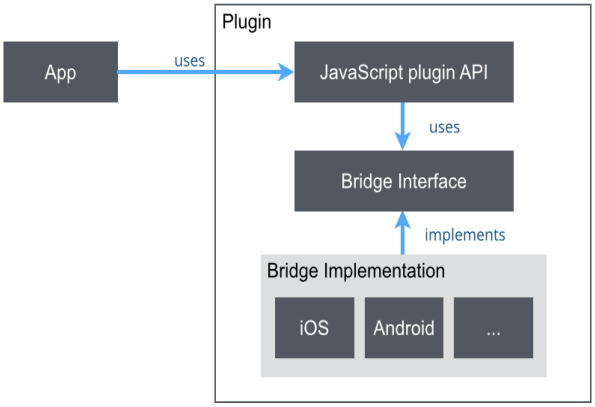

Fig -2: Apache Cordova Architecture

C. Wireless Technology

Wireless communication [5], or sometimes simply wireless, is the transfer of information or power between two or more points that are not connected by an electrical conductor. The most common wireless technologies use radio waves.

Using radio waves, the distances can be short, such as a few meters for Bluetooth or as far as millions of kilometers for deep-space radio communications. It encompasses various fixed, mobile, and portable application types, including two-way radios, cellular telephones, personal digital assistants (PDAs), and wireless networking.

Other examples of radio wireless technology applications include GPS units, garage door openers, wireless computer mice, keyboards and headsets, headphones, radio receivers, satellite television, broadcast television, and cordless telephones.

3. PROPOSED METHOD

A. Architecture of e-KrisenSeva

The 3-tier architecture of the system contains the client-side, server side, and the database. The database contains information needed in the various phases of a disaster. The server handles tasks like real-time analysis and statistics. The client side contains the web portal and app for the victims, officials, and administrators. Integration of all these modules happens via the internet on a secure and robust connection.

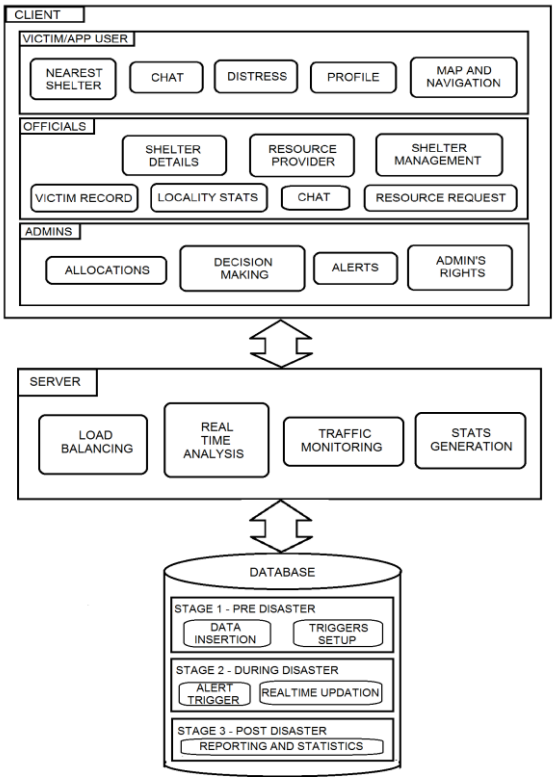

Fig -2: Architecture of e-KrisenSeva

B. Phases of the system

I. Pre – Disaster Planning :

The pre-disaster planning consists of the selection of permanent shelters, the allocation of resources and the assignment of regional administrators to the system. Planning of getting the application installed to the residents of vulnerable regions is also carried out during the pre-disaster phase.

II. Active Disaster Phase :

The active disaster phase is initiated in the occurrence of a disaster such as a natural calamity. The system administrator continuously monitors the system and generates necessary alerts for the region. It also communicates to the regional administrator, and resource providers to make sure that every shelter is well equipped. Real-time shelter allocation and navigation is also enabled which helps the victims to move towards a safe location via the installed app. The database and the client side are at 100% load during this response operation.

III. Post Disaster Assessment :

After the response operation, it is ensured that the various shelters have the required resources and amenities for some period of time. The system enters the recovery phase and statistical reports are generated to evaluate the disaster's effects on the region and the benefits achieved by the system's implementation.

C. Modes of System

I. ON-NETWORK :

Real-time data synchronization between the victim's application, the administrator's portal and the system database for features such as shelter navigation, resource allocation and live overview of the region's operation will be available on the network. Global chat platform for communication between the victims, the system administrator and various officials will also help in fast information transfer. This chat module requires network connectivity however zero network communication is planned to be implemented after thorough research as a future scope of the project.

II. OFF-NETWORK :

The mobile application contains offline information such as a list of emergency contacts of that region, a table of all the nearby shelters containing details about their location, officials' contact information, etc. and an offline map of the entire region.

4. CONCLUSION

Due to the implementation of the e-KrisenSeva disaster management system, we found out that using a highly integrated system for management of disaster helps to reduce the problems faced by rescue bodies using offline methods of management and actions in these situations.

The integration of real-time system makes it easier to view shelter details in nearby locations, their resource availabilities and other vital pieces of information. By using various algorithms and technologies in this project, we learned that many tools and resources can be used for operations such as rescuing people during disasters. We also discovered various techniques of offline (i.e. Zero Network) communication and we plan to implement these methodologies in the later stages as the future scope, providing a whole new dimension to the project.

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