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Disaster Management System

Prof. Mangave T.G.[1], Alisha M. Patel[2], Aditya G. Kulkarni[3], Om P. Shinde[4]
Professor, Department of Computer Science and Engineering[1]
Students, Department of Computer Science & Engineering[2,3,4]
All India Shri Shivaji Memorial Society, Institute of Information Technology, Pune

Abstract: *This paper presents SAFERA, a smart campus-based disaster intelligence system designed to enhance emergency preparedness, response, and recovery within institutional environments. The system addresses the critical challenge of lacking a centralized platform for real-time disaster management and post-disaster assessment. It integrates modern web technologies with intelligent prediction mechanisms to provide a comprehensive solution for disaster scenarios such as fire, flood, earthquake, and cyclone.*
SAFERA enables instant emergency alerts, SOS reporting with geolocation, and real-time communication between users and administrators. A key contribution of this system is its ability to estimate damage levels and predict post-disaster requirements, including the number of injured individuals, required medical support, shelter needs, and essential resources. The platform also includes evacuation route mapping and a directory of emergency contacts to improve coordination during crises.
The system is implemented as a Progressive Web Application using a full-stack architecture, ensuring accessibility, scalability, and offline support. By combining real-time data handling with intelligent assessment features, SAFERA provides an efficient and cost-effective approach to disaster management in campus environments, ultimately reducing response time and improving safety outcomes.

Keywords: Artificial Intelligence (AI), Emergency Response System (ERS), First Aid Management, SMS Gateway Integration, Multilingual Interface

I. INTRODUCTION

Disasters, both natural and man-made, pose significant threats to human safety, infrastructure, and resource availability, especially in densely populated environments such as educational campuses. Effective disaster management requires timely communication, accurate damage assessment, and efficient coordination of resources. However, many institutions lack an integrated digital system that can support these critical operations in real time.

In traditional setups, emergency responses are often delayed due to the absence of centralized alert mechanisms, limited access to evacuation information, and inefficient communication between affected individuals and authorities. Furthermore, post-disaster analysis is typically performed manually, which slows down decision-making and impacts the allocation of essential resources such as medical aid, food, and shelter.

II. LITERATURE REVIEW

PAPER NAMES 1: Deep Learning for Real-Time First Aid Assistance and Medical Symptom Detection
AUTHOR- Rahul Sharma ,Neha Verma ,Amit Kulkarni
ABSTRACT= This paper proposes an intelligent emergency management system designed specifically for smart campus environments using Internet of Things (IoT) and real-time data analytics. The system integrates multiple sensors such as smoke detectors, temperature sensors, and motion detectors to continuously monitor environmental conditions and detect potential hazards. Upon identifying abnormal patterns, the system automatically triggers alerts and notifies users through mobile and web-based platforms.

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PAPER NAME 2: AI-Based Disaster Damage Assessment and Resource Allocation Framework
AUTHOR- Priya Nair ,Sandeep Gupta, Kavita Joshi
ABSTRACT= This research presents an artificial intelligence-driven framework for post-disaster damage assessment and efficient resource allocation. The system utilizes machine learning models to analyze multiple parameters, including disaster type, severity, population density, and infrastructure characteristics, to estimate the extent of damage and human impact.
The framework generates predictive insights such as the number of injured individuals, required medical facilities, shelter capacity, and essential supplies. It also prioritizes resource distribution based on urgency levels, ensuring optimal utilization during critical situations. A web-based interface is developed to visualize damage reports and facilitate communication between emergency responders and authorities.

PAPER NAME 3: Web-Based Disaster Response and Evacuation Management System for Institutional Environments
AUTHOR- Ankit Deshpande ,Sneha Patil, Rohit Mehta
ABSTRACT= This paper introduces a web-based disaster response and evacuation management system designed to improve safety and coordination within institutional environments such as colleges and universities. The system focuses on providing real-time communication, structured evacuation planning, and efficient emergency handling through a centralized digital platform.
The proposed solution includes features such as instant alert broadcasting, user-initiated emergency notifications, and interactive evacuation maps that guide individuals toward safe zones. It also allows administrators to monitor ongoing situations, track user responses, and manage emergency workflows effectively. The integration of location-based services enhances the accuracy of evacuation guidance and incident tracking.

OBJECTIVE

1. To design and develop a centralized digital platform for effective disaster management within a campus environment.
2. To enable real-time emergency communication between users and administrators through alerts and broadcast mechanisms.
3. To implement an SOS alert system with location tracking for quick identification and response to emergencies.
4. To provide safe evacuation guidance using map-based navigation for users during disaster situations.
5. To develop an intelligent module for estimating damage severity and predicting post-disaster needs such as medical aid, shelter, and essential resources.
6. To improve decision-making efficiency by offering data-driven insights during and after disaster events.
7. To ensure accessibility and usability through a web-based application that works across multiple devices.
8. To support offline functionality for critical features so that the system remains usable even with limited internet connectivity.

III. TECHNOLOGY

The SAFERA system utilizes the following technologies to ensure efficiency, scalability, and real-time disaster response:
1. Frontend Framework: React.js with Vite is used to build a fast, responsive, and interactive user interface for seamless user experience across devices.
2. Backend Framework: Node.js with Express.js is implemented to handle server-side logic, API routing, and efficient request processing.
3. Database Management: MongoDB Atlas is used as a cloud-based NoSQL database to store user data, SOS alerts, broadcasts, and damage reports securely.
4. Authentication & Security: JSON Web Tokens (JWT) are used for secure user authentication, while bcrypt ensures safe password hashing and data protection.

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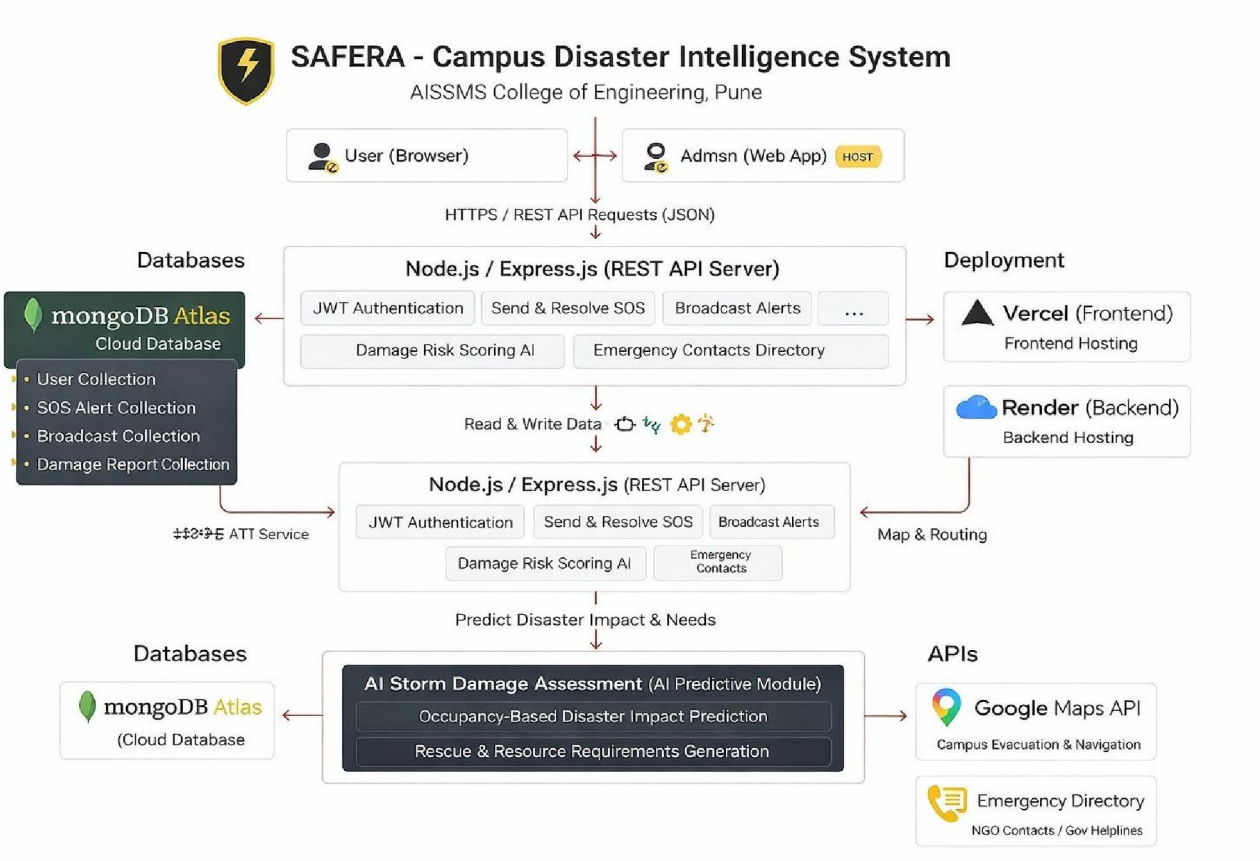
5. Geolocation Services: Browser-based GPS integration is used to capture real-time user location during emergencies for accurate SOS tracking.
6. Map Integration: Google Maps API is utilized to display campus layouts and provide safe evacuation routes with real-time navigation support.
7. Progressive Web Application (PWA): Service Workers and Web App Manifest enable offline access, app installation, and improved performance on mobile devices.

IV. SYSTEM ARCHITECTURE DIAGRAM



V. MAJOR FIELD APPLICATION

1. Educational Institution
2. Disaster Management Authorities
3. Smart Cities
4. Hospitals & Healthcare Centers
5. Public Safety Systems
6. Corporate Campuses

VI. ADVANTAGES AND APPLICATIONS

6.1 ADVANTAGES

1. Real-time emergency alerts
2. Faster response time

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3. Centralized disaster management
4. Accurate damage assessment
5. Efficient resource allocation

6.2 APPLICATION

1. Educational Institutions
2. Disaster Management Authorities
3. Smart Cities
4. Hospitals & Healthcare Centers
5. Public Safety Systems

VII. CONCLUSION AND FUTURE SCOPE

The SAFERA system provides an effective and integrated solution for managing disasters within campus environments by combining real-time communication, emergency response features, and intelligent damage assessment. It enhances safety by reducing response time, improving coordination, and enabling better decision-making during critical situations. The system successfully demonstrates how modern web technologies can be utilized to create a reliable and accessible disaster management platform. In the future, the system can be further enhanced by integrating advanced machine learning models for more accurate predictions, incorporating IoT-based sensors for automatic hazard detection, enabling mobile application development for wider accessibility, and expanding the system for use in smart cities and large-scale environments.

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