SafeGuard: Design and Develop A Cross-Platform Emergency Response and Assistance System using GPS and Artificial Intelligence

Team Information

Md. Abdur Rahim Sarkar	221902011
Sarwar Hosen	221902292
Sumaiya Akther Chowdhury	221902379
Fahmida Akter Nupur	221902385

Abstract

SafeGuard is a smart emergency response system that helps people during critical situations like natural disasters.Using GPS and artificial intelligence, it provides live location tracking, sends timely alerts, and offers step-by-step solutions during emergencies.The system also includes an SOS distress feature and helps connect rescue teamsand volunteers for better coordination. SafeGuard aims to make emergency response faster and more effective, ensuring safety for everyone.

Introduction

SafeGuard is a real-time emergency response system designed to assist during natural disasters like floods, storms, and earthquakes. The Android app uses GPS tracking and Google Maps to provide accurate live location sharing, enabling faster rescue efforts. Users can send distress signals, communicate with emergency responders via a live chat feature, and receive timely updates or instructions. SafeGuard aims to reduce delays, enhance resource coordination, and save lives by bridging the gap between users and rescue teams during critical emergencies.

Problem Domain

- The problem domain in Bangladesh extends to limitations in the 999 emergency service, which faces challenges like delayed response times, lack of advanced location tracking for precise user identification, and insufficient integration with modern technologies such as IoT and AI. [1,2]
- This year, the southern part of our country met with a sudden flood and this disrupted lives, damaged property, and delayed aid due to inefficient systems. [1].
- The current System has a Lack of coordination, which leads to redundant or inefficient resource allocation, so AI can suggest some efficient direction.[2]
- Lack of live GPS tracking hinders identifying affected areas, delaying timely assistance.[3]

Motivation

- A real-time response system can help minimize casualties through early warnings and live location updates.
- Most current solutions focus on one aspect of emergencies (e.g., SOS signals or alerts) rather than combining live tracking, AI-driven solutions, and volunteer coordination.
- Effective communication between rescue teams, volunteers, and victims ensures a coordinated and timely response.
- Users need fast SOS signals and SafeGuard offers a user-friendly solution to alert authorities and emergency contacts.

Objectives

- To learn develop a robust and user-friendly Android app for emergency response
- To learn integrate GPS functionality and Google Maps API to accurately locations.
- To learn about integrating AI in disaster management
- To learn communication technologies like SOS requests.
- To learn implement a database to store and manage user data, emergency alerts, and response information.

Literature Review

Table 1: Table of Literature Review for Our Proposed System

Author	Contribution	Limitations
Kafi et al. [3]	Established GPS technology applications across various stages of disaster management	Dependence on stable communication networks, which can fail during disasters.
Ahmad et al. [4]	It provides real-world examples, showcasing AI's applications across various domains.	Challenges include data privacy concerns, system integration complexities, and ethical issues.
S. Abdalzaher et al. [5]	Surveys the integration of IoT and cloud infrastructure in early earthquake detection, focusing on improving disaster response	Challenges include the need for efficient and reliable communication networks, sustainability issues.

Tools & Technologies

- **Backend**
  - .NET Core 9 (C#) – Backend API framework
  - PostgreSQL – Relational database
- **Frontend**
  - React – Web frontend (SPA)
  - CapacitorJS – Cross-platform mobile app (Android & iOS)
- **DevOps & Deployment**
  - GitHub Actions – CI/CD automation
  - Docker Compose – Container orchestration for frontend + backend
  - Self-hosted Ubuntu Server – Application server OS
- **AI & Machine Learning**
  - LLaMA Model via Ollama – Local AI model integration
- **Geolocation & Mapping**
  - Mapbox – Interactive maps and geospatial tools
- **SMS & Notification**
  - ADN SMS Gateway – For sending OTPs and alerts

Back-End Design (ER-Diagram)

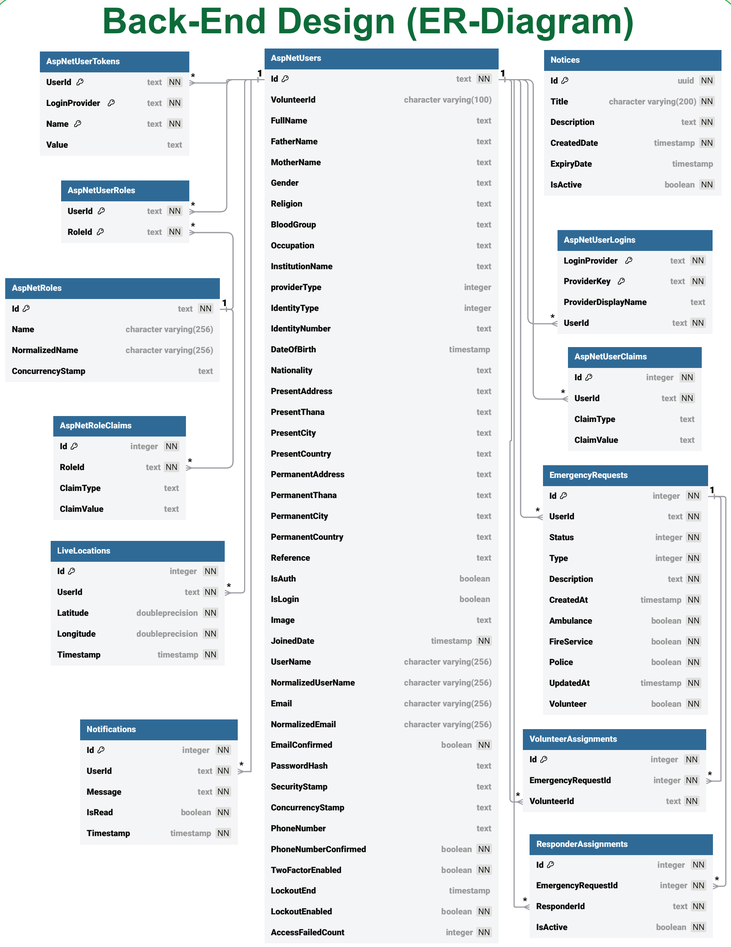

Fig-1: ER-Diagram

Implementation

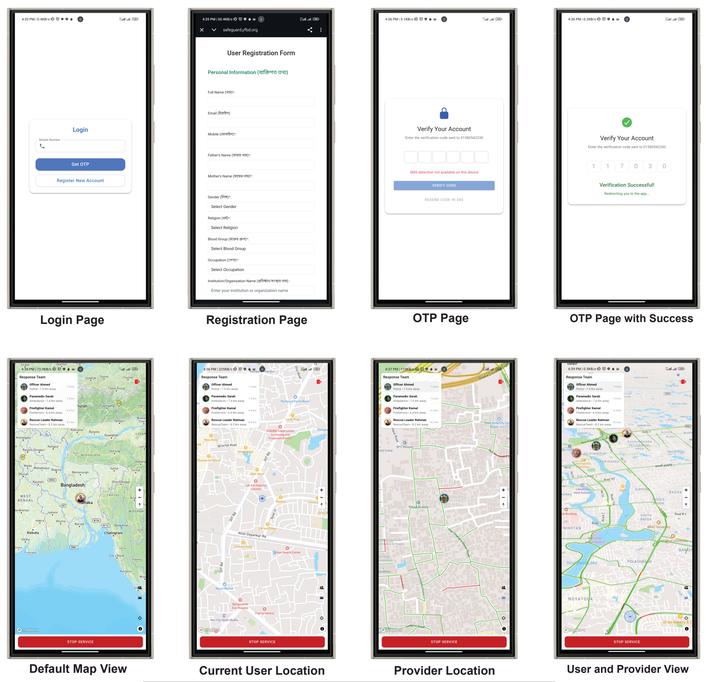

Fig-2: User or Provider Application

Admin Panel

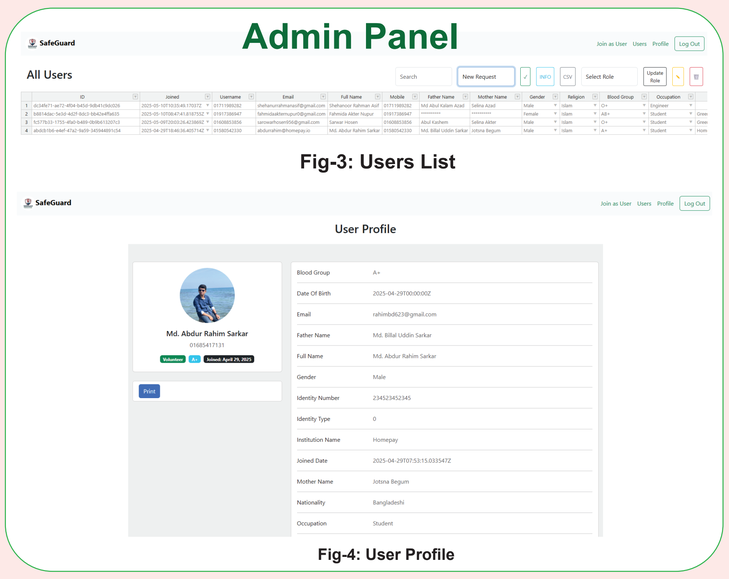

Fig-3: Users List

Fig-4: User Profile

Testting

Table 2: Test Case for the safeguard Android Application.

Test case ID	Test Case Scenario	Title	Steps/Action	Test Data	Expectation Result	Actual Result	Status	Executed By	Executed Date
TC_01	User registers with valid information	User Registration	Open app -> Go to Register -> Enter all information -> Submit	Enter the all Required information in Register Section	User register successfully, redirected to login page	Success	Pass	Sarwar	10/05/2025
TC_02	User Login with valid Mobile Number	Request OTP	Open app -> Enter Mobile Number -> Tap "Get OTP"	Mobile Number : "01608853856"	OTP is sent via SMS	Success	Pass	Sarwar	10/05/2025
TC_03	Users enters Correct OTP	OTP verification Success	Enter recieved OTP -> Submit	OTP : "123456"	User logged in and redirected to dashboard	Success	Pass	Sarwar	10/05/2025
TC_04	GPS enabled during SOS	GPS Location Active	Tap SOS -> GPS ON -> Submit	Location : "Enabled"	Location is tracked and sent	Success	Pass	Sarwar	10/05/2025
TC_05	Select Police Service SOS	Police SOS Alert	Tap SOS -> Choose "Police" -> Submit	Location auto-Detected	Alert sent to Police responder	Success	Pass	Sarwar	10/05/2025
TC_06	Select Fire Service SOS	Fire SOS Alert	Tap SOS -> Choose "Fire" -> Submit	Location Auto-Detected	Alert sent to Fire Departments	Success	Pass	Sarwar	10/05/2025
TC_07	Select Ambulence Servie SOS	Ambulence SOS Alert	Tap SOS -> Choose "Ambulence" -> Submit	Location Auto-Detected	Alert sent to Ambulence Team	Success	Pass	Sarwar	10/05/2025

Social Impact

- **Saving Lives:** Sends real-time alerts for quick action during disasters like floods and earthquakes.
- **Improved Rescue Operations:** Connects users with rescue teams and volunteers for faster assistance.
- **Disaster Awareness:** Educates the public on safety and disaster preparedness.
- **Reaching Remote Areas:** Offers timely aid to rural and inaccessible regions.
- **Building Community Strength:** Promotes global teamwork among volunteers and responders.
- **Environmental Focus:** Encourages sustainable disaster recovery efforts.

Conclusion

SafeGuard is a game-changing solution designed to revolutionize disaster management.By using real-time GPS, AI, and efficient communication, it helps save lives, support vulnerable groups, and coordinate rescue efforts.SafeGuard empowers communities to act swiftly and effectively. Its global scalability and focus on disaster preparedness make it a vital tool for a safer, more resilient world.

References

[1] The Daily Star. Flash floods wreak havoc in 12 dists, December 2024. Available at: https://www.thedailystar.net/environment/climate-crisis/natural-disaster/news/flash-floods-wreak-havoc-12-dists-3684126 (Accessed: 2024-12-14).

[2] Wenjuan Sun, Paolo Bocchini, and Brian D Davison. Applications of artificial intelligence for disaster management. Natural Hazards, 103(3):2631–2689, 2020.

[3] Kamil Muhammad Kafi and Mohamed Barakat A. Gibril. "gps application in disaster management: A review". Asian Journal of Applied Sciences, 4(1), 2016.

[4] Zeeshan Ahmad. How ai is transforming emergency response systems. TGI, July 2024.

[5] Derya Yiltas-Kaplan Imed Ben Dhaou Wilfried Yves Hamilton Adoni Mohamed S. Abdalzaher, Moez Krichen. Integration of iot and cloud infrastructure for early earthquake detection. Journal Name, 2024. Accessed: 2024-12-17.

SafeGuard EMERGENCY RESPONSE & ASSISTANCE SYSTEM

NATIONAL HELP DESK 999

Android App

Poster PDF