CMPE 491-O SENIOR PROJECT

Eren Kaan Çakır - 14179079828

Berke Beyazbenli - 10022751132

Selin Siviş - 10562058838

Project Analysis Report

QuakePath - Advanced Emergency Response System

1. Introduction

The QuakePath system is an innovative emergency response solution designed to enhance disaster management, particularly for earthquake-prone regions like Turkey. The system integrates real-time route optimization, damage assessment, and resilient communication networks to improve emergency response efficiency. This analysis report provides a detailed examination of the system, covering its functional and nonfunctional requirements, system models, and user interactions.

2. Current System

Currently, emergency response systems face several challenges:

- Delayed response times due to a lack of real-time data.
- Communication failures caused by damaged infrastructure.
- Inefficient resource allocation due to the absence of real-time damage mapping.
- Limited preparedness among communities and responders. QuakePath aims to address these shortcomings by offering a comprehensive and technology-driven emergency response framework.

3. Proposed System

3.1 Overview

QuakePath leverages advanced technologies such as GPS tracking, IoT devices, and mesh networks to enhance disaster response. The system ensures:

- Real-time location tracking of victims and rescue teams.
- Dynamic route optimization for emergency vehicles.
- Seamless communication through a resilient mesh network.
- Interactive planning and simulation tools for disaster preparedness.

3.2 Functional Requirements

- **Real-Time Route Optimization:** Identifies the safest and fastest paths for emergency response vehicles.
- **Damage Assessment and Mapping:** Uses satellite imagery and sensor data to visualize affected areas.
- **Resilient Mesh Network Architecture:** Ensures communication continuity even when traditional infrastructure fails.
- **Rescue Coordination:** Facilitates real-time data sharing and coordination among emergency teams.
- **Preparation Mode:** Allows pre-disaster planning and evacuation route management.
- **Live Emergency Simulations:** Provides realistic training scenarios for responders and communities.
- **User-Specific Screens:**
    - **Map Screen:** Displays the nearest safe locations for users based on real-time data.
    - **Rescue Team Screen:** Designed for rescue teams to coordinate response efforts efficiently.
    - **Victim Assistance Screen:** Helps earthquake victims communicate their needs and location.
    - **Mesh Network Communication Screen:** Enables offline messaging and coordination during disasters.

3.3 Nonfunctional Requirements

- **Scalability:** The system should handle large-scale disasters across multiple regions.
- **Reliability:** The network should function with minimal downtime.
- **Security:** Data integrity and secure communication protocols must be maintained.

- **User Accessibility:** The system should be user-friendly for both emergency teams and civilians.

3.4 Pseudo Requirements

- **Compliance:** Adheres to national disaster management regulations.
- **Integration:** Compatible with existing emergency response infrastructure.
- **Cost-effectiveness:** Ensures affordability and sustainability.

3.5 System Models

3.5.1 Scenarios

- **Scenario 1:** An earthquake strikes a major city, triggering QuakePath's automatic damage assessment and route optimization for emergency teams.
- **Scenario 2:** A communication blackout occurs, but the mesh network ensures continued coordination.
- **Scenario 3:** Authorities use the Preparation Mode to develop evacuation plans and conduct training sessions.

3.5.2 Use Case Model Actors:

- Emergency Responders
- Disaster Management Authorities
- Affected Civilians Use Cases
- Request emergency assistance
- Receive optimized evacuation routes
- Share real-time location and damage reports
- Communicate via mesh network during outages

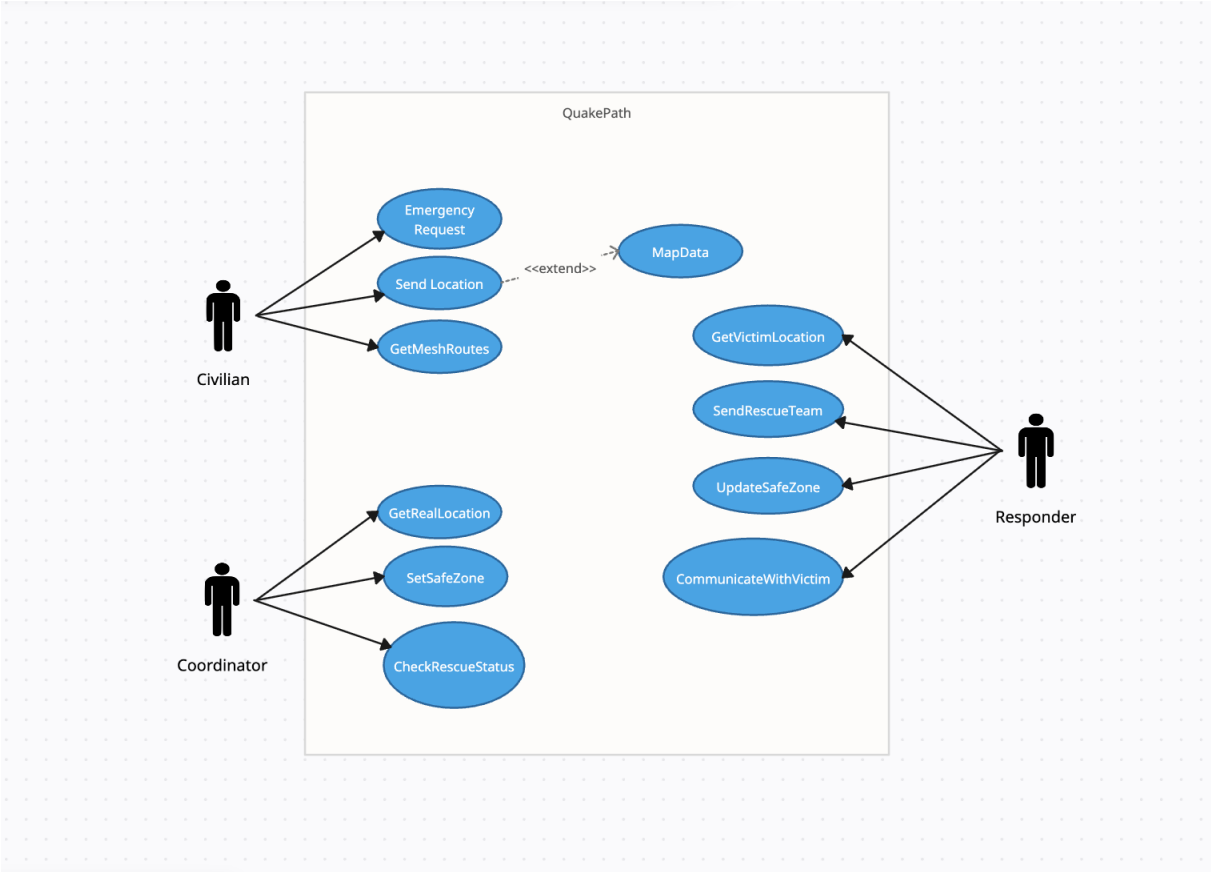

Figure 1

3.5.3 Object and Class Model

- **Classes:** User, Emergency Vehicle, Route, Communication Node, Disaster Zone
- **Objects:** GPS Tracker, Mesh Node, Rescue Team, Control Center, Map Location

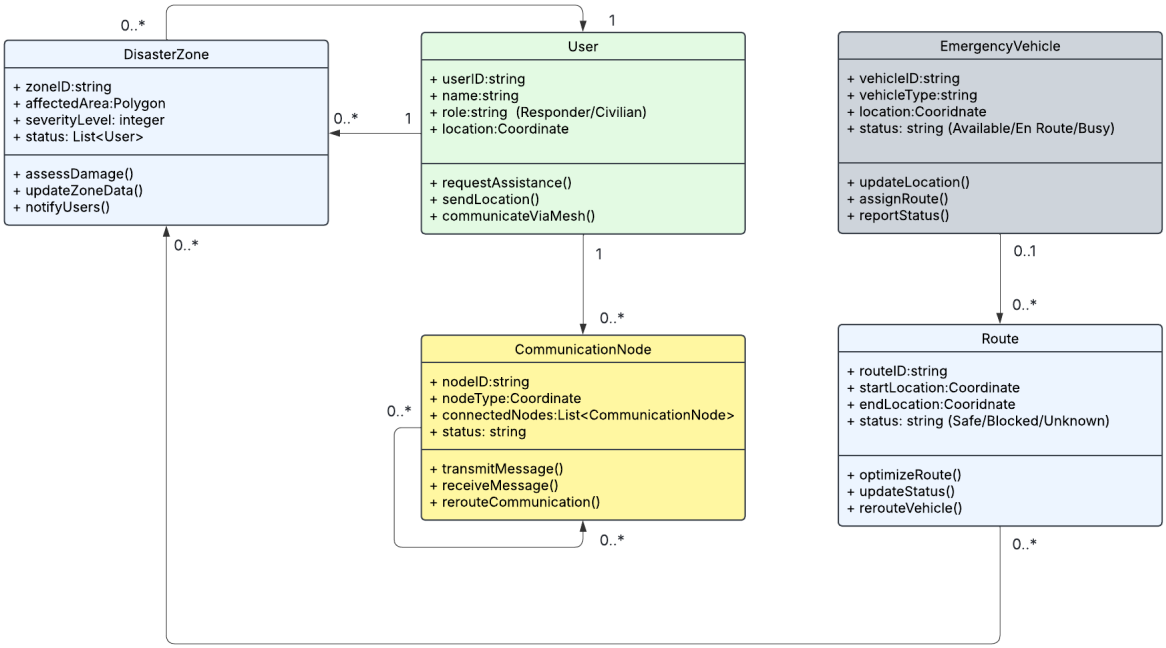

Figure 2

3.5.4 Dynamic Models

- **Sequence Diagram**

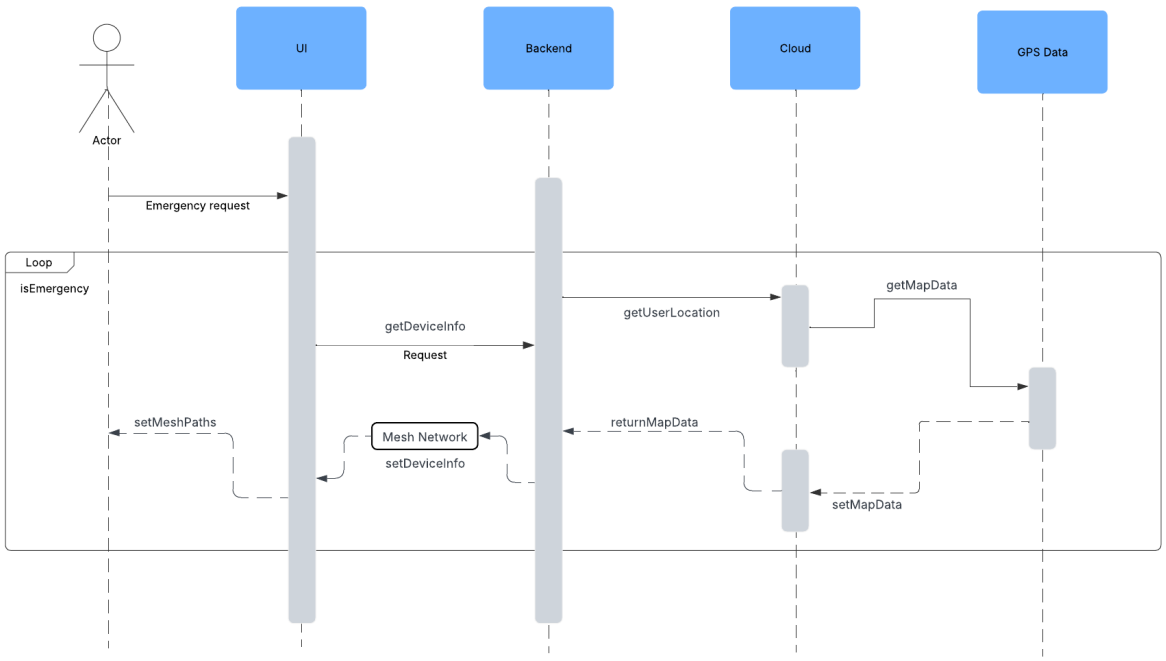

Figure 3

3.5.5 User Interface - Navigational Paths and Screen Mock-ups

- **Dashboard:** Displays real-time disaster updates and rescue operations.
- **Navigation Panel:** Provides optimized emergency routes.
- **Communication Hub:** Facilitates coordination between response teams.
- **Map Screen:** Guides users to the nearest safe locations.
- **Rescue Team Interface:** Allows rescuers to strategize and deploy effectively.
- **Victim Assistance Interface:** Enables affected individuals to signal their status and needs.
- **Mesh Network Messaging Screen:** Ensures offline communication in case of network failure.

4. Glossary

- **Mesh Network:** A decentralized network that maintains communication even in infrastructure failure.
- **IoT (Internet of Things):** A network of connected devices transmitting real-time data.
- **GIS (Geographic Information System):** Technology used for mapping disaster zones and planning routes.

5. References

- Bruegge, B., & Dutoit, A. H. (2004). *Object-Oriented Software Engineering, Using UML, Patterns, and Java (2nd ed.)*. Prentice-Hall.
- Project Proposal: QuakePath - Advanced Emergency Response System