

PROJECT PROPOSAL, EXECUTIVE SUMMARY & PROBLEM DEFINITION

SmartSOS: AWS-Based Location-Aware Emergency Assistance and Management System

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1. **Executive Summary** - This paper presents the design and implementation of SmartSOS, a secure, scalable, cloud-based emergency assistance and management system built on Amazon Web Services (AWS). SmartSOS addresses key limitations of traditional emergency response mechanisms by enabling citizens and first responders to generate one-tap alerts with precise GPS coordinates and photographic evidence, instead of relying only on voice descriptions. The system adopts a three-tier web architecture that uses a React single-page application (SPA) in the presentation tier, a Node.js/Express backend hosted on Amazon EC2 in the application tier, and Amazon RDS as the relational database in the data tier. Amazon S3 provides secure storage for multimedia incident evidence, while Amazon Simple Notification Service (SNS) delivers real-time email or SMS alerts to designated responders. SmartSOS also integrates an AI-style guidance module that offers structured, rule-based first-aid and safety recommendations for injuries, fires, and crimes. By leveraging AWS VPC, IAM roles, security groups, and CloudWatch monitoring, the system demonstrates a production-like implementation that can improve emergency response times, enhance bystander support, and provide a robust evidence management pipeline for post-incident analysis.

2. Introduction

In urban and semi-urban environments, including Lahore, Pakistan, emergency response systems often suffer from inefficient communication and coordination between citizens, rescuers, and control rooms. During high-stress situations such as road accidents, fires, or criminal incidents, victims and bystanders struggle to describe their exact location and the severity of the event over a traditional voice call. Voice-only communication typically lacks structured metadata, precise geolocation, and visual evidence, leading to delays, misallocated resources, and in some cases preventable fatalities.

The widespread availability of smartphones with GPS, cameras, and mobile internet connectivity creates an opportunity to modernize emergency communication. Cloud platforms such as AWS provide scalable, fault-tolerant infrastructure and managed services for location-aware, data-rich applications. SmartSOS leverages these technologies to bridge the gap between people in distress and emergency agencies by offering a web-based channel that supports location-aware reporting, photo evidence upload, and immediate first-aid guidance.

3. Problem Statement

Individuals involved in or witnessing emergencies face two primary challenges:

1. **Inaccurate location communication:** Under stress, people often cannot communicate their location accurately, especially in unfamiliar areas or dense urban environments without clear landmarks. This causes delays as responders try to infer or confirm the incident location.
2. **Lack of immediate procedural knowledge:** Bystanders frequently do not know how to provide basic first-aid or follow correct safety procedures while waiting for professional help, which can worsen outcomes.

Existing solutions centered on voice hotlines and simple mobile apps typically do not capture structured data, photographs, or incident history, and they do not provide integrated decision support to bystanders. There is a need for an integrated, cloud-based platform that facilitates precise GPS-based location sharing, multimedia evidence management, incident status tracking, and access to structured first-aid and safety guidance, within a secure and scalable architecture.

4. Aim

To design and implement a secure, scalable, AWS-based three-tier web application that provides location-aware emergency reporting, photographic evidence management, and structured first-aid guidance for citizens and rescuers.

5. Objectives

1. **Architectural Design:** Design a three-tier AWS architecture utilizing Amazon EC2 for backend compute, Amazon RDS for relational data persistence, and Amazon S3 for secure evidence storage, within an Amazon VPC that employs security groups and IAM roles to enforce least-privilege access between tiers.
2. **Frontend Development:** Develop a responsive React SPA that supports user authentication, GPS location capture through browser APIs, emergency type selection (Police, Ambulance, Fire), photographic evidence upload, and a dashboard for viewing incident history and status.
3. **Backend Implementation:** Implement a RESTful backend API using Node.js and Express.js hosted on Amazon EC2. The backend manages user sessions, incident creation and updates with status workflow (NEW, ACKNOWLEDGED, RESOLVED), file upload handling to S3, and storage of structured incident and evidence metadata in Amazon RDS.
4. **Notification Integration:** Integrate Amazon SNS to automatically send email and/or SMS alerts to configured responder contacts when new incidents are created, including essential details such as location, incident type, and links to evidence.
5. **Guidance Module Provision:** Provide an AI-style guidance module implemented as a rule-based service accessible via a dedicated API endpoint, delivering scenario-based first-aid and safety recommendations through a chat-like interface in the frontend for injuries, fires, and crimes.
6. **System Documentation and Monitoring:** Configure Amazon CloudWatch to collect EC2 metrics and application logs, and document the system with an AWS-standard architecture diagram, detailed implementation steps, test cases, and screenshots, in accordance with academic and professional standards.