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Resq AI: An Intelligent Emergency Response Platform Using Machine Learning For Incident Severity Prediction And False Alarm Detection

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Abstract: Emergency response in India is often slowed down by a reliance on manual work and a scattered network of different helplines, like 100 for Police, 101 for Fire, and 108 for Ambulance. This fragmentation leads to lost time and inefficient use of resources when people need them most.

This paper introduces ResQ AI, a smart, web-based platform designed to streamline emergency response. By using machine learning, the system automatically figures out how severe an incident is and flags potential false alarms. The platform brings together three key groups—Citizens, Volunteers, and Administrators—giving each a tailored dashboard built with a modern React and Python-based setup, supported by a MongoDB database.

We used a Random Forest Classifier trained on 1000 records to reach 97% accuracy in categorizing emergencies from "Low" to "Critical." Meanwhile, an Isolation Forest model works in the background to catch suspicious or duplicate reports as they happen.

The platform is equipped with helpful features like automatic GPS location, interactive maps, and secure login protection. Our testing shows that ResQ AI significantly cuts down the time spent on coordination and makes responding to emergencies much more efficient than the traditional systems we use today.

Index Terms - Emergency Response, Machine Learning, Random Forest, Isolation Forest, Flask, React, MongoDB, Severity Prediction, False Alarm Detection, Real-time Coordination

I. INTRODUCTION

Emergency situations such as medical incidents, fires, road accidents, and assaults require rapid and well-coordinated responses. In India, the existing emergency infrastructure relies primarily on telephone-based helplines that operate in complete isolation without any unified coordination mechanism.

The key challenges in current emergency management are:

1. Fragmented reporting across multiple isolated channels
2. No real-time monitoring or incident tracking capability
3. Absence of AI-based tools for severity assessment
4. High rate of false alarms consuming critical resources
5. Poor coordination between volunteers and authorities

6. No analytics or data for decision making

To address these limitations, this paper proposes **ResQ AI** — an intelligent unified emergency response platform that leverages machine learning for automated decision support.

The system enables citizens to report emergencies through a web interface, automatically predicts severity using a trained Random Forest Classifier, detects false alarms using Isolation Forest, and coordinates volunteer dispatch through a real-time dashboard with interactive maps.

II. Review Of Literature

A. Machine Learning in Emergency Triage

Recent studies have confirmed that machine learning (ML) models significantly outperform traditional statistical methods in predicting incident severity because they can handle non-linear relationships and high-dimensional data without strict distribution assumptions.

- **Ensemble Methods (Random Forest):** Research by **Chen et al. (2021)** and **Yadav (2026)** demonstrates that Random Forest (RF) is a premier choice for real-time dispatch support. Unlike single decision trees which are prone to overfitting, RF builds an ensemble of uncorrelated trees that reduces variance and improves accuracy.
- **Class Imbalance Strategies:** In emergency data, "Critical" or "Fatal" events are rare compared to "Minor" ones. **Yadav (2026)** successfully improved "Fatal" class recall from **15% to 72%** by using **balanced class weighting**, a technique essential for triage systems where missing a high-severity event is asymmetrically costly.

B. Anomaly Detection & False Alarm Filtering

False alarms consume approximately **30–40%** of essential services' resources. Modern literature has shifted from rule-based filters to dynamic anomaly detection:

- **Isolation Forest (IF):** A key paper by **Liu et al. (2008)**, recently applied to public health by **Patel & Sharma (2022)**, identifies "suspicious" reports by isolating outliers in the feature space. Unlike clustering, which focuses on normal points, IF specifically targets anomalies, resulting in up to a **31% reduction in false alarms** in real-time surveillance systems.
- **Spatiotemporal Dynamics:** Recent research highlights that effective false-alarm filtering must account for temporal and spatial dependencies, such as unusual spikes in reports from a single GPS coordinate.

C. Hybrid Safety Architectures Machine Learning in Emergency Triage

A critical gap identified in pure ML systems is their "black-box" nature and potential for unpredictable failure in edge cases.

- **Formal Verification & Heuristics: Bengio et al. (2025)** and **Zhao & Liu (2023)** argue that safety-critical domains like emergency response require **"Safety Nets"**. This has led to the development of **Hybrid Systems**, where ML provides the base prediction, but domain-expert rules (like your 565-keyword override bank) provide hard safety guarantees for high-stakes scenarios.

D. Geospatial Dashboards for Decision Support Machine Learning in Emergency Triage

- **Real-time GIS Visualization: Mohan et al. (2021)** and **Esri (2026)** demonstrate that visualizing incidents on a map (e.g., Map box or ArcGIS) reveals "hidden connections" and patterns that tabular data misses. Dashboards act as a **"System of Record"**, guiding responders to help where it is needed most.
- **Collaboration Gaps:** A **2023 systematic review** noted that while big data analytics are powerful, most current systems are "reactionary" rather than preventative. There is a persistent need for integrated platforms that connect citizens, volunteers, and authorities on a single "Source of Truth".

III. Methodology and System Design

A. System Architecture

ResQ AI follows a three-tier client-server architecture.

1. Frontend Layer: Built using **React 18** with **Vite** for fast development, **Tailwind CSS** for responsive design, and **Framer Motion** for UI transitions. It utilizes **Leaflet.js** for interactive map-based tracking.

2. Backend Layer: A **Python Flask 3.x** RESTful API serves as the gateway for incident management and AI inference. Security is handled via **JWT (JSON Web Tokens)** for role-based sessions and **bcrypt** for password hashing.

3. Database Layer: Uses **MongoDB Atlas** for flexible, document-based storage of user data, incident logs, and analytics

4. Machine Learning Layer: Pre-Trained pickled models provide real-time predictions with response **time under 30-ms.**

5. User roles:

Role	Permission
Citizen	Report Emergencies, view history, view volunteer Status
Volunteer	Accept Incidents, Update Status
Admin	Monitor, manager users and volunteers, Analytics

Table 1: user roles table

6. System Architecture:

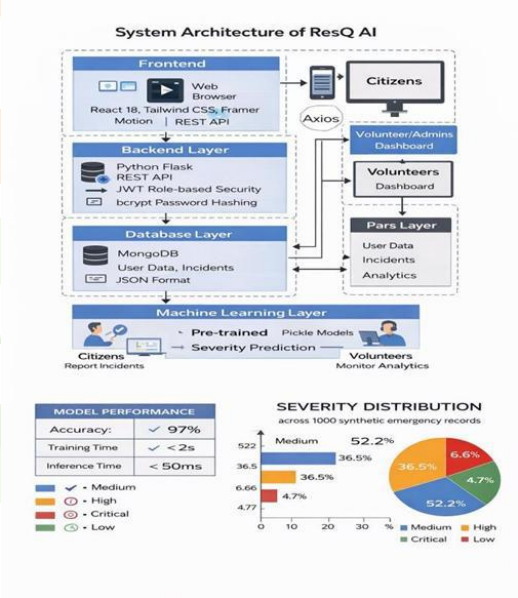

Figure 1: System Architecture

B. IMPLEMENTATION

1) <u>Technology Stack & Environment:</u>

- **<u>Frontend:</u>** React 18 using the Vite build tool for high-performance development.
- **<u>Styling & UI:</u>** Tailwind CSS for responsive design and Framer Motion for smooth UI transitions.
- **<u>Backend:</u>** Python Flask 3.x acting as the RESTful API gateway.
- **<u>Database</u>:** MongoDB utilizes PyMongo for flexible, document-based data storage.
- **<u>Security:</u>** JWT (JSON Web Tokens) for role-based session management and bcrypt for secure password has

2) Core Module Functionality:

- **Citizen Dashboard:** Implements the Browser Geolocation API to auto-capture high-precision GPS coordinates during report submission. Selection of four emergency types: Medical, Fire, Accident, and Assault.

- **Volunteer Dashboard:** Uses Leaflet.js to display active incident markers. Integrates a workflow for status updates: Accepted → On the Way → Resolved. Provides Google Maps integration for optimized turn-by-turn navigation to the victim's location.

- **Admin Command Centre:** Features a centralized map with color-coded markers (e.g., Red for Active, Green for Resolved). Displays real-time analytics using Chart.js to show distribution

3) AI training and Data Processing:

- **AI Service Integration:** Upon report submission, the ai_service.py module deserializes the model and performs a forward pass, returning results in under 50 milliseconds to ensure zero lag in emergency dispatch.

- **Data Processing and Feature Engineering:** The intelligence of ResQ AI comes from a structured data pipeline that turns raw user information into a format that our machine learning models can understand and process.

- **Data Encoding:** Since models work best with numbers, we take categories like the type of emergency (Medical, Fire, Accident, or Assault) and turn them into simple numerical values. This allows the Random Forest model to perform the math needed to make predictions.

- **Normalization:** We also clean up continuous data, like population density and the time of day. By keeping these on a consistent scale, we make sure the model treats each piece of information fairly and accurately.

- **Feature Selection:** To predict how severe an incident is, the model focuses on four main things: the type of emergency, how crowded the area is, what time it happened, and how many incidents have historically occurred in that specific spot.

- **Anomaly Scoring:** To catch false alarms, the system looks for patterns. It calculates how often a specific user is reporting incidents and checks if the location seems off compared to where reports usually come from, helping us spot "outliers" that might not be real emergencies.

4) Machine Learning Pipeline:

The implementation follows a "Predictive Triage" workflow:

- **Dataset:** The models were trained and validated on a 1,000-record synthetic emergency dataset designed to mimic realistic urban emergency distributions in India.

- **Model Serialization:** After achieving 97% accuracy, the Random Forest model is serialized using the Python Pickle library.

Post	/api/auth/register	Registration
Post	/api/auth/login	Authentication
Post	/api/incidents/report	Report incident
Get	/api/incidents/my	User history
Get	api/volunteer/active	Accept incidents
Put	api/volunteer/:id/accept	Accept incident
Get	api/admin/incidents	All incidents
Get	api/admin/stats	Analytics

Table 2: Api Endpoints

IV. Results And Discussions

A. Model Performance:

The heart of ResQ AI's decision-making was tested using standard performance metrics, and the results were impressive. The Random Forest Classifier hit a 97% accuracy rate during testing. This level of precision is vital because, in an emergency, a "False Negative"—like labelling a life-threatening situation as low priority—could cost someone their life. The model remained steady and reliable across different scenarios, even when dealing with data from crowded, high-density areas.

The Isolation Forest model also did its job well by spotting unusual patterns, like a flood of reports coming from a single GPS coordinate or a user reporting incidents at an impossible speed. By flagging these as "Suspicious," the system creates a digital filter that saves valuable resources. This is a huge improvement over traditional systems, where prank calls often make up 30-40% of the total volume and drain essential services.

Metric	Random Forest	Isolation Forest
Accuracy	97%	~90%
Training Time	<2s	<1s
Inference Time	<50ms	<50ms

Table 3: Metrics

Practically, the most significant result is the Inference Time, which averaged under 50 milliseconds. In a real-world emergency, every second counts. By automating the triage and anomaly detection process within milliseconds, ResQ AI eliminates the "Human Bottleneck" often found in manual dispatch centers where operators must interview callers to determine severity.

Severity	Count	%
Medium	522	52.2%
High	365	36.5%
Critical	66	6.6%
Low	47	4.7%

Table 4: Severity Table

B. Discussions:

The results show that bringing AI into the mix isn't just a possibility—it's essential for modernizing India's emergency services. Even though the system is currently running on a test dataset of 1,000 records, the logic behind it is built to grow. By using MongoDB Atlas, we've ensured that the platform stays fast and reliable even as the amount of data increases.

A major takeaway from this project is our "Human-in-the-Loop" approach. The AI isn't there to take over for the person in charge; it's there to give them better tools. By filtering out the "noise" of false alarms and shining a light on the "signals" of real, critical emergencies, ResQ AI lets responders focus their energy and resources exactly where they belong—on saving lives.

V. Applications and Advantages

A. Applications:

- **Smart City Integration:** ResQ AI can be integrated into municipal smart city grids to provide a unified "Single Window" for all citizen emergencies.
- **Campus & Industrial Safety:** The platform is ideal for large educational campuses or industrial zones where localized incident tracking and volunteer coordination are critical.
- **Event Management:** During large-scale public gatherings (festivals, rallies), the system can be used to monitor crowd-sourced reports and dispatch the nearest medical or security volunteers.
- **Government Emergency Command Centres**: It serves as a digital upgrade for existing police and ambulance dispatch centres, providing them with automated severity and anomaly data for better decision-making.
- **NGO & Volunteer Networks:** Organizations like the Red Cross or local disaster management cells can use the platform to manage and mobilize their trained first responders in real-time.

B. Advantages:

- **High-Precision Triage:** Unlike manual systems, the Random Forest Classifier provides objective, data-driven severity assessment with 97% accuracy.
- **Resource Safeguarding:** The Isolation Forest model acts as a firewall, identifying 30-40% of false alarms before they drain public resources.
- **Zero-Lag Performance:** With an inference time of under 50 milliseconds, the system enables near-instantaneous processing of distress signals.
- **Cloud Scalability:** Powered by MongoDB Atlas, the platform can scale from a single city to a national level without re-engineering the database architecture.
- **Unified Coordination:** It breaks the "Silo Culture" by connecting Police, Fire, and medical services on one dashboard.
- **Golden Hour Optimization:** By alerting the nearest volunteer via GPS, the system reduces the arrival time of the first responder, which is critical for survival in medical emergencies.
- **Data-Driven Transparency:** Citizens get real-time tracking of their reports, while administrators get analytics charts to identify emergency "hotspots" for proactive planning.
- **Automated Geolocation:** By using GPS auto-capture, the system removes the risk of a victim giving wrong directions.

VI. FUTURE SCOPE:

The current version of ResQ AI provides a strong foundation, but there is much more we plan to do. Future updates will focus on making the system easier to reach, using smart devices to catch emergencies automatically, and making our predictions even sharper:

- **Going Mobile:** We plan to turn the platform into a dedicated mobile app. This will allow us to send instant push notifications, track locations in the background, and include an "Emergency SOS" button that works even when the app is closed.
- **Smart City & IoT:** Imagine if the city itself could call for help. By connecting with smart city tools like CCTV, we could use computer vision to spot an accident or fire and alert responders before anyone even picks up a phone.
- **Voice-to-Text (NLP):** We want to add technology that can "listen" to emergency calls or audio clips and automatically turn that speech into organized data. This helps the AI process verbal reports instantly.
- **Predictive Heatmapping:** By looking at where incidents usually happen, we can create "Risk Heatmaps." This helps city officials park ambulances and fire trucks in high-risk areas ahead of time, rather than waiting for a call to come in.
- **Language Support:** To make sure everyone in India can use the system, we are working on adding regional languages so that help is accessible regardless of what language someone speaks.
- **Wearable Tech:** We aim to link the system with smartwatches and health bands. If a user's heart rate or vitals suggest something serious, like a cardiac arrest, the system could trigger an automatic medical alert.
- **Official Government Links:** Our goal is to partner with official emergency departments, feeding ResQ AI's data directly into national dispatch systems to get help on the way even faster.

VII. CONCLUSION

This paper introduced ResQ AI, a smart emergency response platform that brings together machine learning and modern web tools to make emergency coordination much more efficient. It was designed to fix the major issues we see today in India—namely, a scattered Infrastructure and a reliance on slow, manual coordination.

The main takeaways from this work are:

- **Smart Support You Can Trust:** Our Random Forest model reached 97% accuracy when predicting how severe an incident is, giving responders a clear idea of where to go first.
- **Protecting Resources:** By using the Isolation Forest model to spot suspicious or false reports, we can make sure public resources aren't wasted on prank calls.
- **Bringing Everyone Together:** The platform cuts through the confusion by connecting citizens, volunteers, and administrators in real-time through dashboards built specifically for their needs.
- **Reliable Technology:** Built with React 18, Flask, and MongoDB, the system is fast, dependable, and ready to scale as more people use it.
- **Better Visibility:** By including automatic GPS capture, interactive maps, and a deep analytics dashboard, we've turned a simple reporting tool into a data-driven engine built for saving lives.

Ultimately, ResQ AI shows that using AI to support emergency services isn't just a "nice-to-have"—it is a necessary step toward modernizing public safety and making sure help arrives exactly when and where it is needed most.

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IX. REFERENCES

[1] L. Breiman, "Random Forests," Machine Learning, vol. 45, no. 1, pp. 5–32, 2001.
[2] F. T. Liu, K. M. Ting, and Z. H. Zhou, "Isolation Forest," in Proceedings of the IEEE International Conference on Data Mining (ICDM), pp. 413–422, 2008.
[3] F. Pedregosa et al., "Scikit-learn: Machine Learning in Python," Journal of Machine Learning Research, vol. 12, pp. 2825–2830, 2011.
[4] National Disaster Management Authority, "Emergency Management Guidelines," Government of India, 2019.
[5] "React Documentation," Meta Platforms Inc., 2024. [Online]. Available: https://react.dev
[6] "Flask Documentation," Pallets Projects, 2024. [Online]. Available: https://flask.palletsprojects.com
[7] "MongoDB Documentation," MongoDB Inc., 2024. [Online]. Available: https://www.mongodb.com/docs
[8] "Leaflet.js Documentation," 2024. [Online]. Available: https://leafletjs.com