



# CIVII: An AI-Assisted Civilian Initiative Platform for Post-Disaster and Civic Issue Reporting

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**Abstract:** Civii is a citizen-powered mobile-based disaster reporting and rescue support system that addresses the communication and coordination gap during emergencies. The application enables users to capture and report critical incidents using images or videos directly from their smartphones, with full support for offline functionality. Reports are stored locally when internet access is unavailable and automatically synchronized with the backend server once connectivity is restored. Civii integrates an AI/ML module built with Python (using TensorFlow and OpenCV) to analyze uploaded media and detect emergency conditions such as fire, flood, smoke, or the presence of people in distress. Based on the AI analysis, the system generates and delivers automated rescue guidance messages to the user, providing immediate actionable support. Civii also includes a real-time push notification system that alerts users within a 1 km radius of any new incident, activating local citizen responders and volunteers. In addition to disaster scenarios, Civii supports civic reporting for issues like damaged roads, power failures, water leaks, and garbage overflow, making it a multipurpose citizen assistance platform. A secure web dashboard is available for authorized responders and administrators to access geo-tagged reports, assess severity, and coordinate appropriate responses. Civii combines AI-driven intelligence, offline capability, and community collaboration to build a smarter, more resilient emergency and civic support infrastructure.

**Keywords:** Civic issue reporting, disaster management systems, edge artificial intelligence, geofencing notifications, mobile computing, multimedia verification, public safety informatics, smart urban services

# 1 INTRODUCTION

India continues to face recurring natural disasters and widespread civic infrastructure issues as a result of rapid urbanization, dense population growth, and extreme climatic variations. Flooding, road collapses, garbage overflow, fallen trees, drainage blockages, water leakage, and electrical hazards are among the most commonly reported problems in both rural and urban regions. These incidents significantly disrupt daily life, create threats to public safety, and require swift intervention from municipal authorities. Despite the urgency of such situations, existing reporting mechanisms—including municipal helplines, field visits, manual complaint counters, and mobile-based service portals—often suffer from slow processing, lack of verification, and limited accessibility during emergencies.

The increasing penetration of smartphones and mobile internet has created new opportunities for real-time reporting through user-generated multimedia content. Civilians today are capable of capturing high-quality images and videos that accurately depict local situations. However, current digital platforms rely heavily on manual review, do not support offline operation during network outages, and lack automated verification techniques. As a result, false reports, irrelevant content, privacy-violating media, and misuse of public platforms continue to create challenges for authorities. These limitations reduce the credibility of crowd-sourced data and delay timely decision-making in high-risk situations.

To address these challenges, this research proposes CIVII (Civilian Initiative), an AI-assisted mobile and web-based platform designed to support structured reporting of post-disaster incidents and everyday civic issues. The system enables civilians to upload geotagged images or videos, which undergo two levels of verification. First, an artificial intelligence module performs category validation and unsafe-content filtering through lightweight multimedia analysis. Second, a human administrator reviews the verified submissions through a central dashboard to ensure contextual accuracy before public dissemination. After approval, the system generates geofenced push notifications within a one-kilometer radius to inform nearby app users and automatically dispatches email alerts to the corresponding municipal departments.

The proposed solution emphasizes an offline-first architecture, ensuring that users can capture and queue reports even during network interruptions caused by disasters. Once connectivity is restored, the data are automatically synchronized with the backend system. This approach enhances inclusiveness and ensures that critical reports are not lost due to temporary disruptions. The platform further aims to act as a bridge between civilians and authorities, offering a scalable ecosystem for rapid, validated, and community-driven reporting.

## 2 RELATED WORK

Research in disaster management, public safety informatics, and civic reporting has expanded rapidly over the last decade as cities adopt smart technologies to improve emergency responsiveness. Existing studies have explored diverse approaches, ranging from predictive modeling and lightweight classification to communication frameworks intended to enhance situational awareness during crisis events. Although these efforts highlight significant technological progress, they reveal notable gaps in integrating artificial intelligence with community-driven reporting for real-time decision support.

Several works in the field of disaster prediction rely on machine learning and hybrid ensemble techniques to analyze environmental patterns. Saleem et al. [4] proposed the Neural-XGBoost model, a hybrid approach combining neural networks with gradient-boosted trees to predict disaster occurrences with improved accuracy. While their work demonstrates the potential of hybrid learning strategies, the system focuses primarily on forecasting and does not address the challenges of field-level media reporting or validation.

Related AI-based emergency planning research by Zhang et al. [5] integrated retrieval-augmented generation with reasoning large language models to predict post-earthquake emergency material demand. Although promising for logistics support and post-disaster planning, the study focuses on resource-demand prediction rather than citizen-generated reporting and multimedia verification.

Similarly, Raju et al. [1] introduced GeoDisasterAINet, an ensemble deep learning framework capable of classifying various disaster types such as floods, wildfires, and earthquakes using multisource data. Their method utilizes convolutional and explainable AI models to support rapid classification. However, the approach operates on structured datasets rather than real-time civilian uploads, and therefore does not incorporate user-generated multimedia or mobile-based reporting workflows.

Emergency communication systems have also been widely studied. He et al. [6] discussed the use of IoT-assisted communication infrastructures to support post-disaster recovery. Their findings emphasize the importance of robust connectivity and buffer-based support in unstable network environments. In a related direction, Wang et al. [7] explored blockchain-envisioned UAV-aided disaster relief networks and highlighted how aerial platforms can improve information relay and coordination in disrupted environments. Although such systems ensure communication continuity, they do not include verification mechanisms for public submissions or multimedia filtering, which are essential to preventing misinformation during crises.

Smart city research further extends into improving urban resilience and public safety. Costa [2] analyzed challenges associated with integrating technology across diverse population groups and identified issues of accessibility, digital literacy, and uneven information flow. Zhou et al. [8] additionally investigated the construction of an earthquake emergency information knowledge graph based on large language models, demonstrating the value of structured emergency knowledge for information organization and decision support. However, these studies focus more on accessibility and knowledge representation than on real-time mobile reporting by civilians.

Meanwhile, Bittencourt et al. [3] presented a comprehensive survey of adaptive smart urban systems that utilize GIS, multi-sensor networks, and cloud-edge collaboration. Pognon et al. [9] examined adaptive priority scheduling of Internet of Things data for disaster management in smart cities, showing the importance of prioritizing time-critical data streams during emergencies. Wang et al. [10] further demonstrated the use of large language models with smart meter big data to predict imminent electrical safety incidents, indicating the broader potential of AI for urban risk monitoring. While these studies highlight the importance of inclusive and adaptive systems, they lack detailed frameworks for incorporating civilian participation with AI-driven media validation.

Despite advancements in disaster prediction, emergency communication, and smart-city monitoring, existing research shows that very few systems combine AI-based multimedia verification, offline-capable mobile reporting, human-in-the-loop admin approval, and geofenced public notification within a single integrated framework. Current systems either focus on prediction, communication networks, or municipal reporting portals without applying AI to ensure the accuracy and safety of user-submitted content. The analysis of prior research reveals a clear need for a platform that supports real-time, validated, and community-driven reporting. The proposed system, CIVII, addresses these gaps by integrating lightweight AI models, geolocation-based filtering, offline-first synchronization, and admin-level moderation to enhance civic issue reporting and post-disaster information sharing.

### 3 PROPOSED SYSTEMS

India continues to experience frequent natural disasters and persistent civic issues that require timely detection and coordinated response. Despite the availability of municipal helplines, online complaint portals, and dedicated emergency services, the current reporting ecosystem suffers from several critical limitations. First, existing platforms rely heavily on manual verification, making them vulnerable to false complaints, irrelevant submissions, and inappropriate content, which reduces operational efficiency. Second, many systems do not support multimedia-based reporting with automated validation, limiting the accuracy and reliability of citizen-generated data. Third, during and immediately after disasters, network failures

prevent civilians from accessing online services, resulting in delayed information flow to authorities. Finally, there is no standardized mechanism for broadcasting verified incidents to nearby individuals who may be affected or capable of providing immediate assistance. Therefore, there is a need for a reliable, AI-assisted, and community- centered reporting system that validates user-submitted multimedia content, supports offline-first operation, facilitates transparent admin moderation, and delivers geofenced notifications to civilians and municipal departments. The problem addressed in this research is the absence of an integrated platform that ensures accurate, safe, and rapid reporting of post-disaster events and everyday civic issues through intelligent media verification and structured communication workflows.

### 4 SYSTEM ARCHITECTURE

The architecture of CIVII is designed as a multi-layer, modular, and scalable system that supports real-time media reporting, AI-based verification, administrative approval, and geofenced notifications as shown in Fig 1. The complete workflow integrates a mobile front-end, a cloud-based backend, an AI verification engine, a centralized administration dashboard, and communication modules for notification and email dispatch. The architecture ensures reliability, extensibility, and support for offline operation, which is critical in post-disaster scenarios.

The overall system architecture is organized into five major components: Mobile Application Layer, Backend Service Layer, AI Verification Layer, Data Storage Layer, and Admin Dashboard Layer. Each component interacts through well-defined APIs to enable seamless data flow and system coordination.

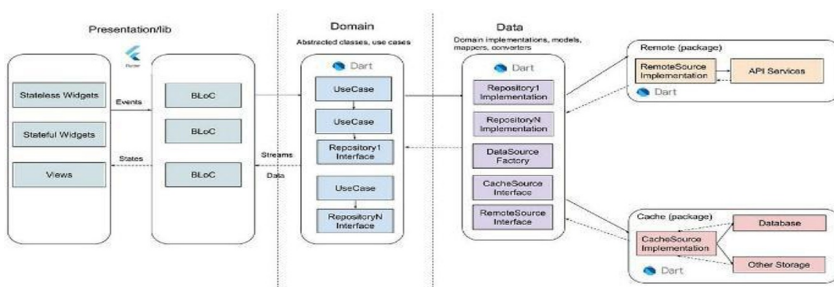


Fig.1. Architecture Diagram

#### A. Mobile Application Layer

The mobile application, developed using Flutter, serves as the primary interface for civilian reporting. Users capture images or videos of an incident, select a predefined

category, and submit a report along with automatically captured geolocation metadata. Offline-first capability enables users to cache reports locally when connectivity is unavailable, with automatic upload once the network is restored. The app communicates with backend services through RESTful APIs and uses Firebase Authentication for secure login.

#### B. Backend Service Layer

The backend, implemented using Node.js and Express, manages communication between the frontend, AI engine, database, and notification systems. The backend receives user reports, validates request integrity, stores metadata, forwards media to the AI module, and updates report status based on AI and admin decisions. This layer also handles geofencing logic to identify users within a one-kilometer radius of approved reports, and integrates Nodemailer for email dissemination to municipal offices.

#### C. AI Verification Layer

The AI module operates as an independent Python-based microservice. It performs two core tasks: category validation and unsafe-content detection. Lightweight deep learning models such as MobileNet-based classifiers and TensorFlow Lite models are used to ensure fast inference on server-grade and edge-based environments. The AI module evaluates whether the submitted media matches the user-selected category and screens content for nudity, violence, or abusive visuals. The module returns a structured response containing confidence scores and classification decisions to the backend.

#### D. Data Storage Layer

Firebase Firestore is used to store structured metadata, including user information, report details, timestamps, categories, and verification status. Firebase Storage maintains the actual media files associated with each report. This separation of metadata and media enhances scalability and reduces query overhead. Additionally, Firestore's real-time update capability enables instant synchronization across the app and admin dashboard.

#### E. Admin Dashboard Layer

The admin dashboard, implemented using React or Flutter Web, provides municipal staff or authorized operators with full visibility into incoming reports. Administrators review media, verify context, and approve or reject submissions. Approved reports trigger push notifications and email alerts, while rejected reports are archived with a corresponding reason. The dashboard also displays analytics such as report density, status counts, and frequently reported categories.

#### F. Communication and Notification Layer

After an admin approves a report, the system uses Firebase Cloud Messaging (FCM) to send geofenced push notifications to users located within a one- kilometer radius

of the incident. The notification engine uses the Haversine distance formula to compute user proximity based on stored location data. In parallel, Nodemailer dispatches structured email alerts to the appropriate municipal authorities, including details such as location, category, and media links.

The modular nature of the architecture ensures that each subsystem can evolve independently, supporting future enhancements such as severity estimation, multilingual reporting, and automatic municipal routing. The architecture is optimized for reliability in disaster-affected environments and for scalable deployment across urban regions.

## 5 METHODOLOGY

The methodology of the proposed CIVII platform is designed as a structured, multi-stage workflow that ensures secure, validated, and contextually accurate reporting of civic and post-disaster issues. The system incorporates artificial intelligence, human moderation, geospatial computation, and cloud-based communication services to deliver a complete end-to-end reporting pipeline. This section outlines the planned methodology, including the data acquisition process, media verification module, administrative approval flow, notification system, and offline-first synchronization logic.

### A. Data Acquisition and User Submission Workflow

After the user login as shown in Fig 2, the reporting process begins at the user level. Civilians capture images or videos representing a civic issue or post-disaster situation using the mobile application. The application collects the following metadata:

- Media Content (image/video)

- GPS Location Coordinates

- Selected Category (e.g., flood, road damage, garbage overflow, lighting failure)

- User Description (optional text input)

- Timestamp

To ensure usability during network failures, reports are temporarily stored in a local queue using on-device caching. Once network connectivity is restored, the queued reports automatically synchronize with the backend server.

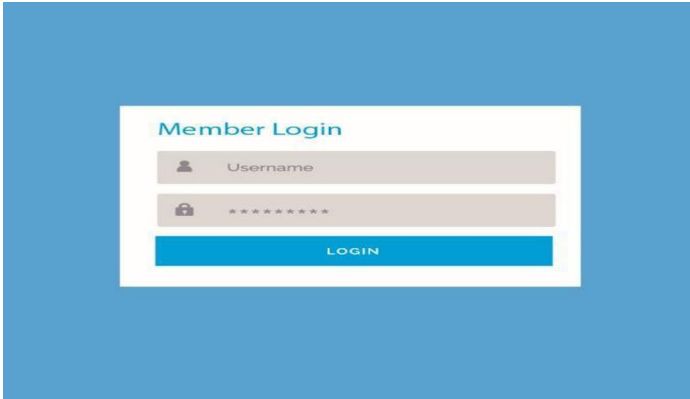


Fig.2. Login

### B. Media Upload and Backend Preprocessing

After synchronization, the report is transmitted to the backend server through a secure REST API. The backend performs two initial tasks:

- Media Storage in Firebase Storage

- Metadata Logging in Firestore (report information, status, user ID)

Once the media is stored, the backend generates a secure URL and forwards it to the AI verification module for further processing as shown in Fig 3.

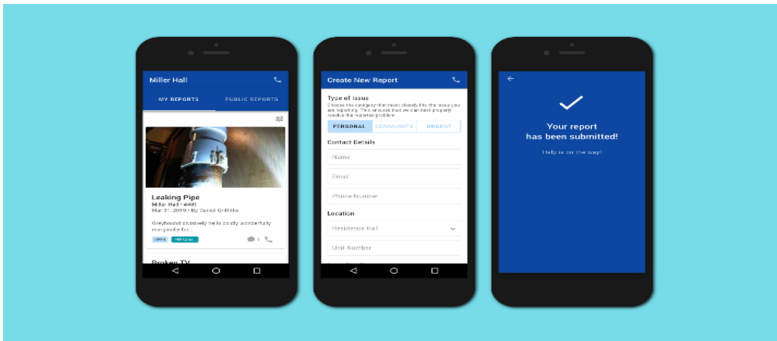


Fig.3. Media Upload

### C. AI-Based Category Validation

The AI verification stage ensures that the uploaded media corresponds to the category selected by the user. A lightweight computer vision model—such as

MobileNet or EfficientNet-Lite—will be employed to classify the image/video frame according to predefined civic and disaster categories. The AI computes a confidence score for the predicted label. If the predicted label matches the user-selected category with sufficient confidence, the content is marked as Category Verified. Reports with low confidence scores are flagged for manual scrutiny by the administrator.

#### D. Unsafe Content Detection (NSFW Filtering)

To prevent misuse of the platform, a secondary AI model performs NSFW detection. This module identifies:

- sexually explicit content
- violent or abusive visuals
- privacy-violating recordings
- inappropriate or irrelevant media.

Only reports that pass both category validation and NSFW screening proceed to the administrative review stage. This two-layer filtering ensures data integrity, improves public safety, and minimizes the risk of false or harmful submissions.

#### E. Administrative Review and Verification

A web-based dashboard is provided for municipal staff or appointed moderators. Each incoming report is displayed with:

- media preview,
- AI validation results,
- location on map,
- user details,
- timestamps.

The administrator performs the final verification by marking the report as Approved or Rejected. This hybrid AI + human approach balances automation with accountability.

#### F. Geofenced Push Notification Dispatch

Upon approval, the system initiates a geofencing algorithm using the Haversine distance formula. The backend retrieves all active users within a 1 km radius of the incident's location. These users receive a push notification through Firebase Cloud Messaging (FCM), alerting them of the nearby issue. This mechanism enhances situational awareness and encourages community action.

### G. Automated Email Alert System

In addition to user notifications, the system sends an automated email to the concerned municipal department. The email includes:

- issue description
- media link
- geolocation
- time of detection.

This ensures that authorities are informed promptly and can initiate field-level response operations.

### H. Issue Resolution Update Workflow

Users or authorities may later update the report status to Resolved. This update is reflected across all interfaces and archived for future analysis. A resolution timestamp is stored for performance tracking.

### I. Offline-First Synchronization Logic

Because disasters frequently disrupt communication networks, the system integrates an offline-first behavior:

- Reports are saved locally when offline
- A background service monitors connectivity
- Automatic upload occurs once the network returns

This increases reliability and ensures no data are lost due to temporary disconnections.

## 6 IMPLEMENTATION DETAILS

The implementation of CIVII is organized into five major subsystems: the mobile application, backend service, artificial intelligence module, cloud infrastructure, and the administrative dashboard. Although full system development is ongoing, each component has been carefully designed to support modular integration, offline functionality, and scalable data processing.

### A. Mobile Application (Flutter)

The mobile application is developed using Flutter to ensure cross-platform support for Android and iOS. The app enables users to capture images or videos, select an

appropriate issue category, and attach an optional description. To accommodate disaster scenarios with unstable connectivity, the application uses a local queuing mechanism that temporarily stores unsent reports. When connectivity resumes, the queued reports are automatically uploaded to the backend. Additional modules include user authentication, GPS-based location tagging, media compression, and real-time notification handling using Firebase Cloud Messaging.

#### B. Backend Service (Node.js and Express)

The backend is implemented using Node.js with Express to provide lightweight, asynchronous REST APIs. These APIs handle tasks such as user management, report submission, metadata storage, status updates, and AI communication. The backend also acts as the gateway between the mobile app, the AI module, and the database. It generates email alerts to municipal officers through a dedicated mailing service built using Nodemailer. Error handling, token-based authentication, and secure media access links are incorporated to ensure robustness.

#### C. AI Verification Module (Python)

The AI component is implemented as an independent microservice using Python, TensorFlow Lite, and OpenCV. Once a report is uploaded, the backend sends the media link to the AI module, which performs two tasks: (1) category validation, where a lightweight convolutional neural network checks whether the image or video frame matches the user-selected category; and (2) unsafe-content detection, where a pre-trained NSFW classifier filters inappropriate or privacy-violating media. The module returns a verification score and a binary validation flag to the backend.

#### D. Cloud Infrastructure (Firebase Firestore and Storage)

Firebase Firestore is used to store structured metadata, including user information, report details, timestamps, coordinates, and admin decisions. Firebase Storage is used to securely store uploaded images and videos. The cloud environment also manages push notifications through Firebase Cloud Messaging. Firestore's real-time listeners enable automatic UI updates on both the mobile app and dashboard.

#### E. Administrative Dashboard (React Web Application)

The administrative interface as shown in Fig 4 is developed using React. Administrators can view pending reports, inspect uploaded media, verify AI results, approve or reject entries, and change the issue status to "Resolved" when completed. The dashboard provides a unified view of all active and past reports, enabling efficient monitoring and decision-making. Additional tools support manual notification broadcasting and email re-sending.



Fig.4. Dashboard

### F. Integration Workflow

The integration process follows a layered approach: the mobile app uploads the report → the backend stores media and metadata → the AI module validates the content → the admin dashboard handles review → approved reports trigger notifications and emails. This modular approach ensures that each subsystem is independently scalable and easily testable.

## 7 EXPECTED RESULT

The CIVII platform is currently under development; therefore, this section presents the expected outcomes and planned evaluation procedures based on design objectives, related literature, and system architecture. The evaluation focuses on four major dimensions: AI performance, system efficiency, user experience, and operational reliability during post-disaster or low-connectivity scenarios. The artificial intelligence module is expected to provide reliable multimedia verification by validating whether an uploaded image or video corresponds to the selected category and by identifying inappropriate or unsafe visual content. Prior studies on lightweight convolutional neural networks suggest that edge-optimized models can achieve strong performance for classification tasks. Based on these findings, the multimedia classifier in CIVII is expected to obtain a level of precision and recall between 80% and 90%, depending on the category. The NSFW detection model is expected to reduce unsafe uploads and maintain platform safety by minimizing false positives and false negatives during screening. System performance will be evaluated through response time, network handling, and notification delivery. The platform is expected to process a complete report—upload, AI validation, and admin review request—within a few seconds under stable network conditions. The geofenced notification system, which uses Firebase Cloud Messaging, is expected

to deliver alerts to users in the defined one-kilometer radius with minimal latency. The offline-first workflow will be assessed by measuring its ability to store reports locally and synchronize them reliably once network connectivity is restored. Operational usability will be evaluated using user studies and standard usability scoring methods. The system is expected to provide an intuitive interface as shown in Fig 5 that simplifies report submission and ensures transparent status tracking. Admin usability will be examined through dashboard responsiveness, media review clarity, and efficiency of the approval process.

The evaluation plan includes:

- Functional testing to ensure correctness of each module;
- AI performance testing using labeled datasets;
- Load testing on the backend to examine scalability;
- Notification accuracy testing using geofenced user groups;
- Usability assessments using structured questionnaires;
- Failure-case testing for offline conditions, weak networks, and invalid uploads.

Overall, the system is expected to improve the accuracy, safety, and reliability of civilian reporting while enabling authorities to respond more effectively to post-disaster and civic issues.

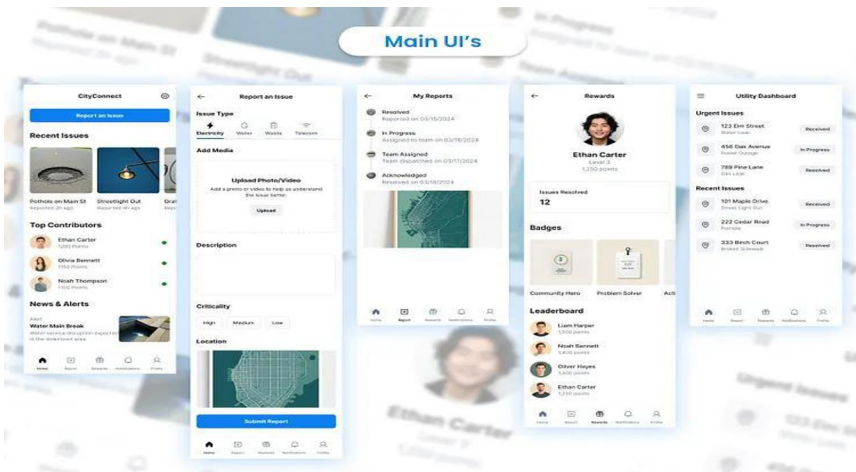


Fig.5. Main UI

## 8 CONCLUSION

The increasing frequency of natural disasters and persistent civic infrastructure issues across India highlight the need for faster, more reliable, and community-centered reporting mechanisms. Existing systems remain heavily dependent on manual communication channels, which often fail during emergencies or become ineffective due to slow processing, limited verification, and poor accessibility. The proposed CIVII (Civilian Initiative) platform addresses these challenges by integrating mobile computing, offline-first data handling, and lightweight artificial intelligence to support authentic and timely reporting of post-disaster and civic incidents. By allowing civilians to upload geotagged images and videos, the system enables real-time visibility into ground-level conditions. The incorporation of AI-based category validation and unsafe-content detection further ensures that incoming reports are relevant, appropriate, and free from misuse. The two-level verification process—AI filtering followed by admin approval—adds an essential layer of trustworthiness before information is shared with nearby users or municipal departments. The geofenced notification system and automated email dispatch mechanism promote rapid dissemination and encourage faster response actions from authorities.

Although the system is still under development, the proposed design is expected to improve reporting accuracy, enhance transparency, and strengthen the collaboration between civilians and local administration. Future extensions will include multilingual support, automated department routing, severity-level estimation, and expanded AI capabilities for video analysis. Overall, CIVII has the potential to evolve into a scalable, community-driven public safety platform that improves civic governance and empowers citizens to actively contribute to disaster resilience and urban development.

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