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# A Review of Emerging Technologies for Fire Detection and Reporting System

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**Abstract**- Due to an array of factors like climate change, urbanization, and infrastructure vulnerabilities, wildfire and structural fire incidents are increasing in occurrence and magnitude. Traditional reporting systems, calling on manual calls and delayed communication, usually end up incurring huge losses. This review collects three recent works of research: (1) an Android-based reporting application that is a wildfire reporter by community participation Android_mobile_application_for_…(2) a web-based Online Fire Reporting System, and (3) an AI-and IoT-based automated fire detection and reporting solution. Altogether, they present a technological evolution from human-oriented, community-based reporting toward intelligent, automated systems. A comparative analysis brings into focus issues of strength, limitation, and potential adoptions toward rendering emergency response systems more resilient.

## 1. Introduction

Fire incidents have always threatened humanity with paramount threats to life, property destruction, and the environment. Hence, an efficient fire detection and reporting system is the most important thing that can minimize the potential damage. Traditionally, emergency dispatches rely heavily on human reports, generally based on human time for calling the emergency. This is therefore an impediment to efficiency due to delays, incomplete information, and prank calls. With the contemporary blow of mobile computing, IoT, and AI, researchers wish to think of fire reporting today's digital, real-time, and automated ecosystem.

**Scope and objectives of this review**

An Android App for Geographical Reporting of Wildfires

Rony Teguh et al. (2021) have proposed and developed an Android application for wildfire detection in the Central Kalimantan peatlands of Indonesia, with major features including:

GNSS/GPS Integration: A smartphone is used to take a geotagged photo that contains Exchangeable Image File Metadata.

Citizen Participation: Users voluntarily report the appearance of a fire, thus acting as “human sensors” or observers.

Web Scenario: Authorities see fire hotspots and then confirm reports, allocating firefighting resources accordingly.

Offline Mode: Reporting can proceed in the absence of an Internet connection, with the stored report being transferred once connectivity has been restored.

  

**Online Fire Reporting System**
Indhumathi and Angelin Rosy (2024) designed a comprehensive web-based fire reporting platform.

**System Components:**
User Module: Citizens log fire incidents with details and optional media uploads.
Admin Module: Fire departments track, manage, and allocate resources.
Database Module: Stores incidents for analysis and prevention strategies.

**Technological Stack:**
PHP, HTML, JavaScript (frontend/backend).
MySQL database.
Real-time dashboards with analytics.

**Performance Metrics:**
Reporting time reduced from ~15 minutes (traditional) to ~2 minutes.
Data completeness improved from 70% to 98%.
Response time improved by ~10 minutes compared to traditional systems.

**Advantages:**
Centralized, scalable, and structured reporting.
Facilitates resource optimization with analytics.
Enhances transparency and accountability.

**Limitations:**
Web dependency limits accessibility in areas with poor internet connectivity.
Still requires human initiation (report submission).

Automated Fire Detection and Reporting System Using AI and IoT

Abubakari et al. (2023) introduced an IoT- and AI-powered fire detection system.

**System Description:**
Sensors: Sensors of flame, smoke (MQ5), gas (MQ4), and temperature.
Processing Unit: A data fusion embedded microcontroller Arduino Nano.
Communication: The GSM SIM900 module sends an SMS alert with GPS coordinates of the fire.
Additional Feature: Automatic switch-off of the electricity supply to avert electrocution in the event of firefighting.

**Key Findings:**
Can detect naked flames, smoke, and gas leaks.
Average time for sending SMS alerts by the system: 3 ms in a stable cellular network.
SMS contains the Google Maps link to the exact coordinate of the fire.

**Advantage:**
Prevents delay caused in human reporting.
Gives detailed information about the situation (kind of fire, GPS location).
Reduces prank calls and false alarms.
Drawbacks:
Dependent on sensor calibration and maintenance.
Limited scalability in low-resource countries without IoT infrastructure.
Has to be with power backup for continuous monitoring.

  

An automated fire detection and reporting system using AI and IoT.

Abubakari et al. (2023) proposed an IoT- and AI-enabled fire detection system.

**System Description:**
Sensors: Flame, smoke (MQ5), gas (MQ4), and temperature.
Processing Unit: Sensor data fusion embedded microcontroller Arduino Nano.

**Communication:** SMS alert generation from a GSM SIM900 module with GPS coordinates of the fire.
Additional Feature: Electricity supply switch-off to prevent electrocution during firefighting.

**Key Findings:**
It can detect naked flames, smoke, and gas leaks.
Average time for sending SMS alerts by the system: 3 ms on a stable cellular network.
The SMS contains a Google Maps link to the exact coordinate of the fire.

**Advantages:**
Avoids human delay in reporting.
Provides detailed knowledge of the situation (kind of fire, GPS location).
Reduces frivolous calls and false alarms.

**Disadvantages:**
Highly dependent on sensor calibration and maintenance.
Limited scalability in low-resource countries without IoT infrastructure.

At this point, the GNN is at its ability to generalize over multiple domains, the way LLMs can generalize across text.

**Fine-tuning and Task-Specific Adaptation**
A GNN is trained unders upper vision fornode, link, or graph classification through labeled data and domain adaptation from large graphs to specific domains. Recent work uses graph alignment under application-specific constraints, chemical validity being an example.

**Hybrid Architectures and Memory-Augmented GNNs**
Just like RAG enhances an LLM's performance and reasoning, hybrid architectures do the same in graph networks. Knowledge-enhanced GNNs ingest from external knowledge bases, dynamic graph learning updates itself side by side with evolving data, and memory-augmented graph nets keep track of historical graph states for temporal reasoning. These approaches, therefore, manage to address scalability, adaptation, and integration into knowledge.

**Evaluation and Benchmarks**
Key bench mark used for GNN evaluation are OGB (node, link, and graph prediction), TU datasets(graph classification), and real-world data (traffic, social networks). Evaluation aspects include scalability, inductive generalization robustness, and interpretability. Just like biases and hallucinations in LLMs ,issues related to over- smoothing, over-squashing, and fairness across graph substructures need to be dealt with in GNNs.

  

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# Conclusion

The reviewed studies represent progressive stages in digital fire management technologies. The Android application emphasizes citizen participation, the web-based system enhances structured communication and analytics, and the IoT-AI system achieves real-time automation with minimal human input. While each approach has unique advantages and limitations, integrating them could create robust, multi-layered systems capable of reducing losses from wildfires and structural fires.

## Works Cited

1. https://ijirmet.com/
2. https://www.researchgate.ne
3. https://phpgurukul.com/
4. https://www.studocu.com/

  