



Pimpri Chinchwad Education Trust (PCET)
Pimpri Chinchwad College of Engineering

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Department of Computer Engineering

Smart Evacuation Route Planning using GIS, AI, and IoT for Wildfire Evacuation

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Problem Statement:

Wildfires in Los Angeles have become increasingly severe due to climate change, urban expansion, and inadequate evacuation planning.

Traditional evacuation methods struggle to adapt to dynamic fire behavior, leading to delays, confusion, and loss of life.

There is a need for an intelligent **Smart Evacuation Route Planning System** that leverages **GIS, AI, and IoT** provide real-time, adaptive evacuation strategies, ensuring faster, safer, and more efficient evacuations in high-risk wildfire zones.

Wildfires damage roads and communication networks, making evacuations and emergency response even more challenging.

Los Angeles Wildfire Impact (Jan 2025)

Lives Lost: 29 fatalities reported.

Mass Evacuations: 200,000+ residents displaced at the peak of the fires.

Structural Damage: 18,000+ structures destroyed, with major losses in Pacific Palisades & Altadena.

Acreage Burned: Over 57,000 acres consumed across Greater Los Angeles.

Economic Impact: Insured losses projected to exceed \$20 billion, setting a U.S. wildfire record.

Key Challenges:

1. **Unpredictable Fire Behavior** : Traditional evacuation routes may become unsafe within minutes.
2. **Traffic Congestion & Panic** : High population density in urban-wildland areas causes road congestion.
3. **Limited Real-Time Data & Communication** : Inefficient communication between emergency responders and civilians.
4. **Geographical & Environmental Barriers** : Mountainous terrain and dense forests make evacuation challenging.
5. **Resource Allocation & Response Time** : Firefighting resources are often stretched thin during peak wildfire seasons.
6. **Public Awareness & Preparedness** : Lack of community drills and real-time guidance increases vulnerability.

Evacuation Challenges & Key Statistics:

Delayed Orders: Evacuation was issued 40 minutes late during the Pacific Palisades wildfire, worsening traffic congestion.

High Fatalities: Over 10 deaths reported due to confusion and lack of timely instructions.

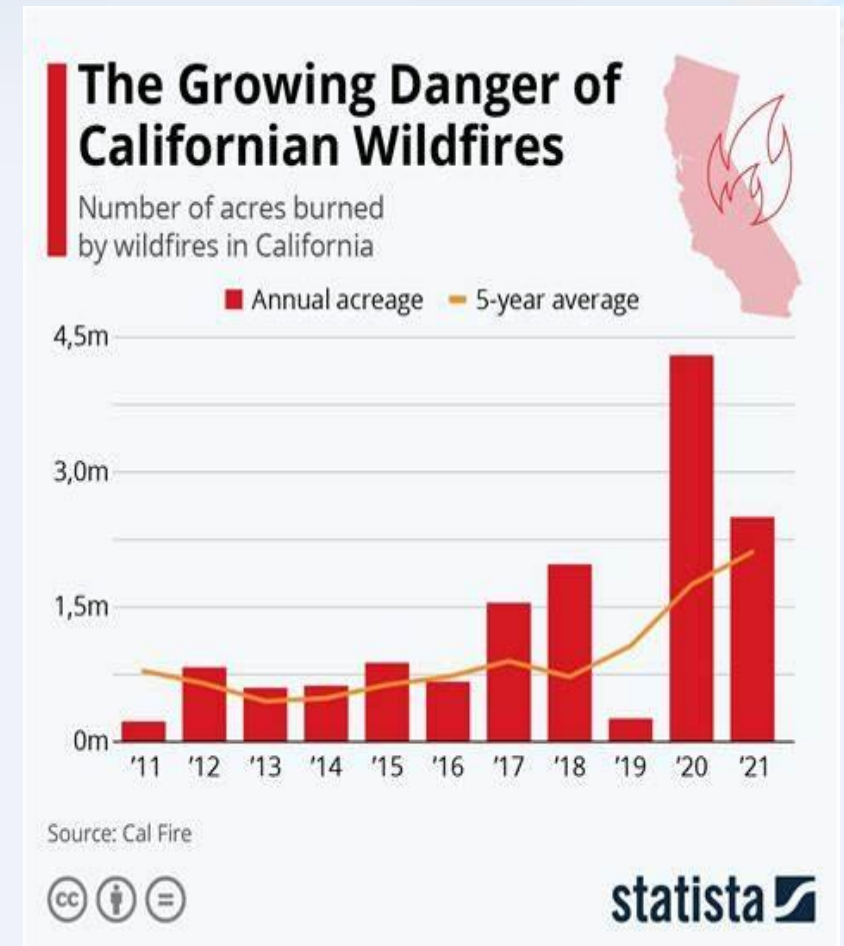
Mass Evacuations: 200,000 residents evacuated within hours, causing panic and logistical issues.

Communication Failures: Many Altadena residents received no alerts or delayed notifications, leading to late evacuations.

Resource Delays: Late deployment of firefighting resources blocked evacuation routes and left evacuees without proper guidance.

Rising Wildfire Intensity

1. **Growing Impact:** Wildfire activity in California has surged, peaking in 2020 and 2021.
2. **Worst Year:** 2020 saw a record 4+ million acres burned.
3. **Worsening Trend:** The five-year average shows a continuous rise in wildfire severity.
4. **Extreme Seasons:** Significant wildfire spikes occurred in 2017, 2018, 2020, and 2021.
5. **Climate Link:** Data highlights the role of climate change, droughts, and rising fire frequency.
6. **Need for Action:** Advanced GIS, AI, and IoT-based evacuation strategies are critical for safety.



Color Coding:

Yellow: Low risk of wildfire or minimal fire danger.

Orange: Moderate wildfire risk.

Red: High wildfire risk.

Dark Red: Very high wildfire risk.

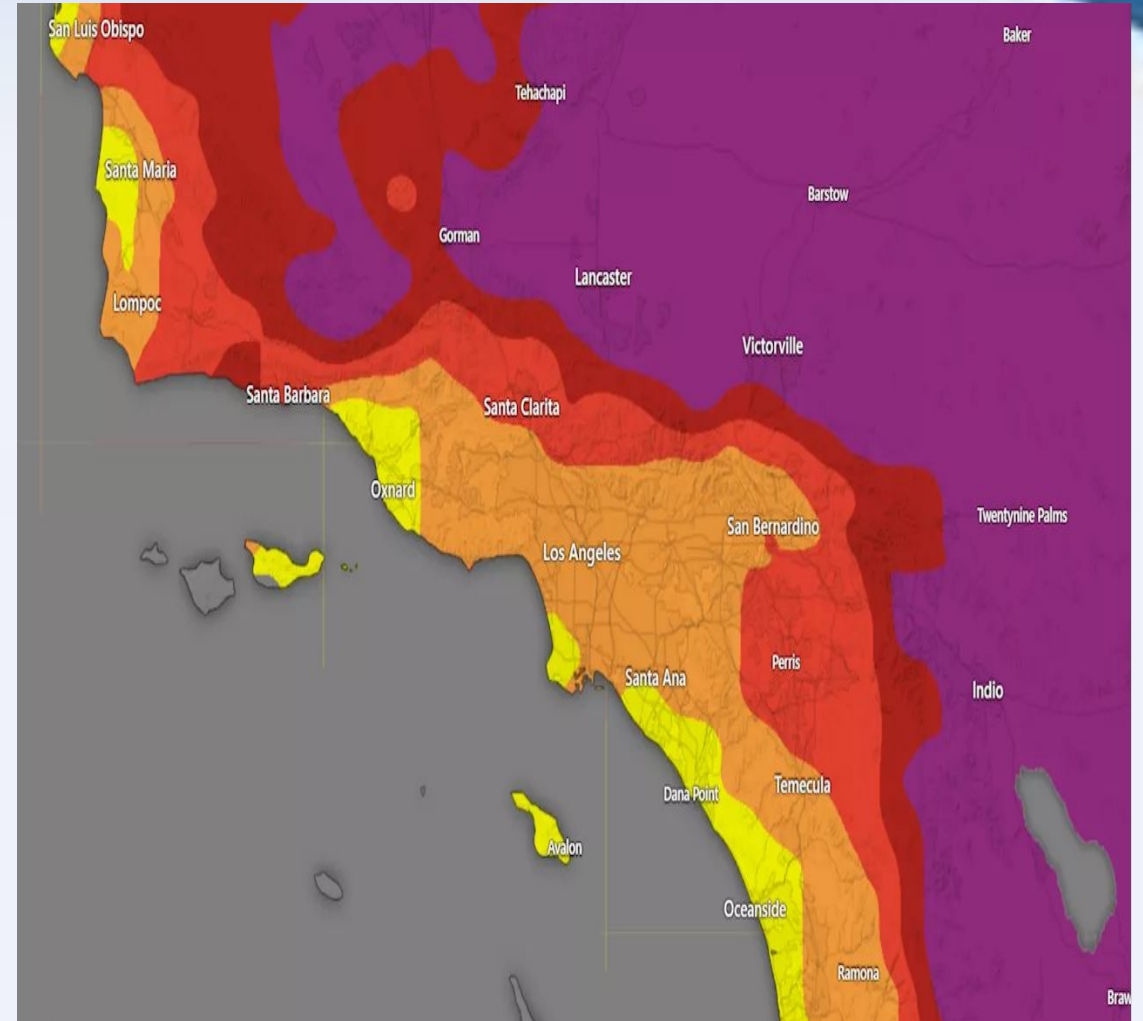
Purple: Extreme wildfire risk, likely indicating areas with the highest danger.

Geographic Coverage:

Los Angeles, Santa Ana, San Bernardino: These areas are under moderate to high risk (orange to red).

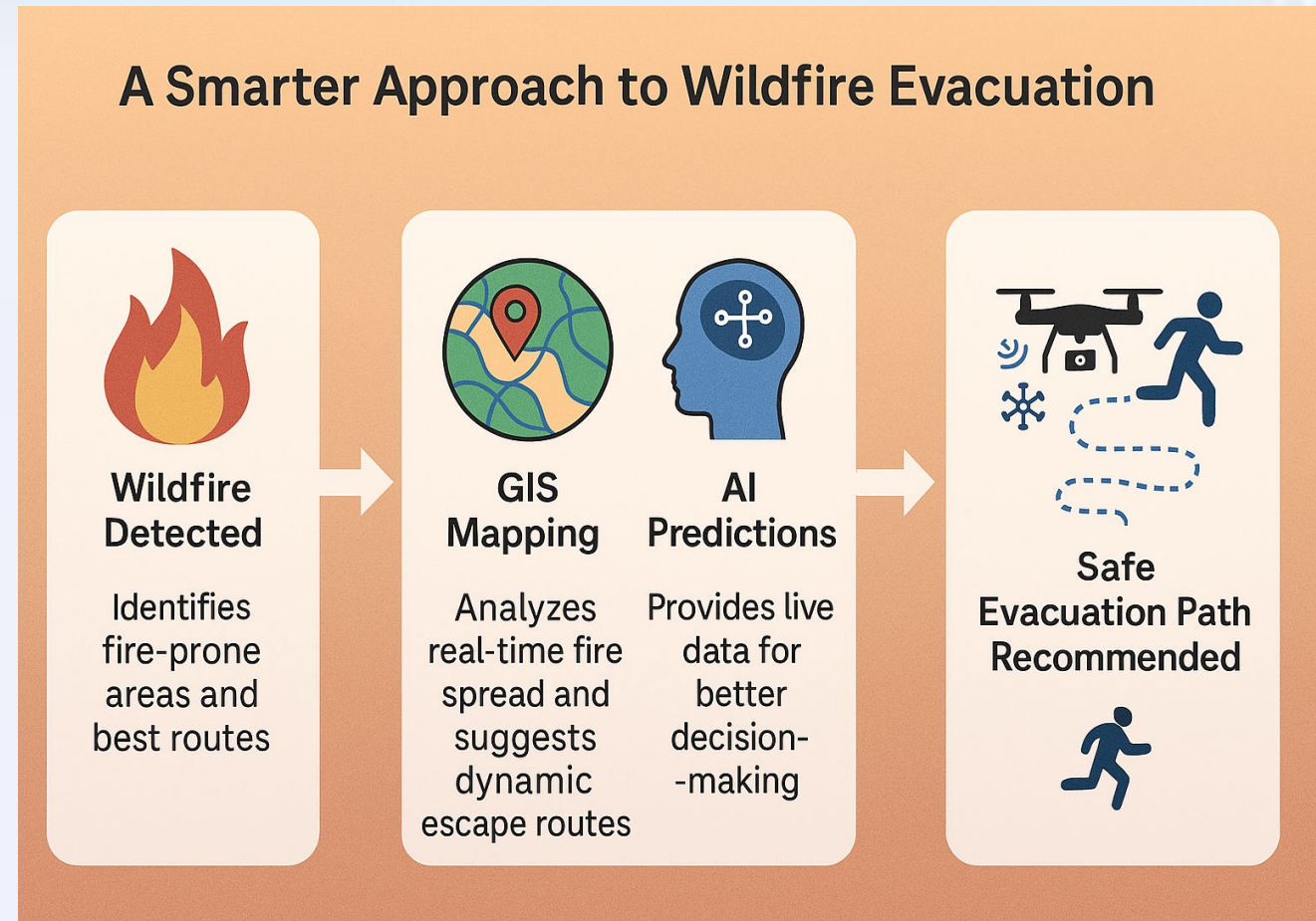
Santa Clarita, Lancaster, Victorville: These areas fall under very high risk (dark red).

Further inland areas (Barstow, Tehachapi, and regions toward Indio): Extreme wildfire risk (purple), indicating the highest danger level.



A Smarter Approach to Wildfire Evacuation

- **GIS Mapping:** Identifies high-risk zones and maps safe evacuation routes.
- **AI Predictions:** Analyzes fire spread and provides real-time escape paths.
- **IoT and Drones:** Monitors fire progression and detects environmental risks.
- **Smart Alerts:** Sends instant evacuation updates and dynamically adjusts routes.



Impact of GIS, AI, and IoT on Wildfire Evacuation

Faster Evacuations, More Lives Saved: AI predicts fire spread, enabling early warnings and quicker evacuations.

Smart Routing, Reduced Congestion: Dynamic route planning prevents bottlenecks and suggests alternative escape paths in real time.

Real-Time Monitoring, Safer Response: Live drone footage and IoT sensors help first responders allocate resources efficiently.

Impact

50% reduction in evacuation delays with AI

- ✓ Faster evacuations
→ More lives saved
- ✓ Smart routing
→ Reduced congestion
- ✓ Real-time monitoring
→ Safer disaster response

THANK YOU