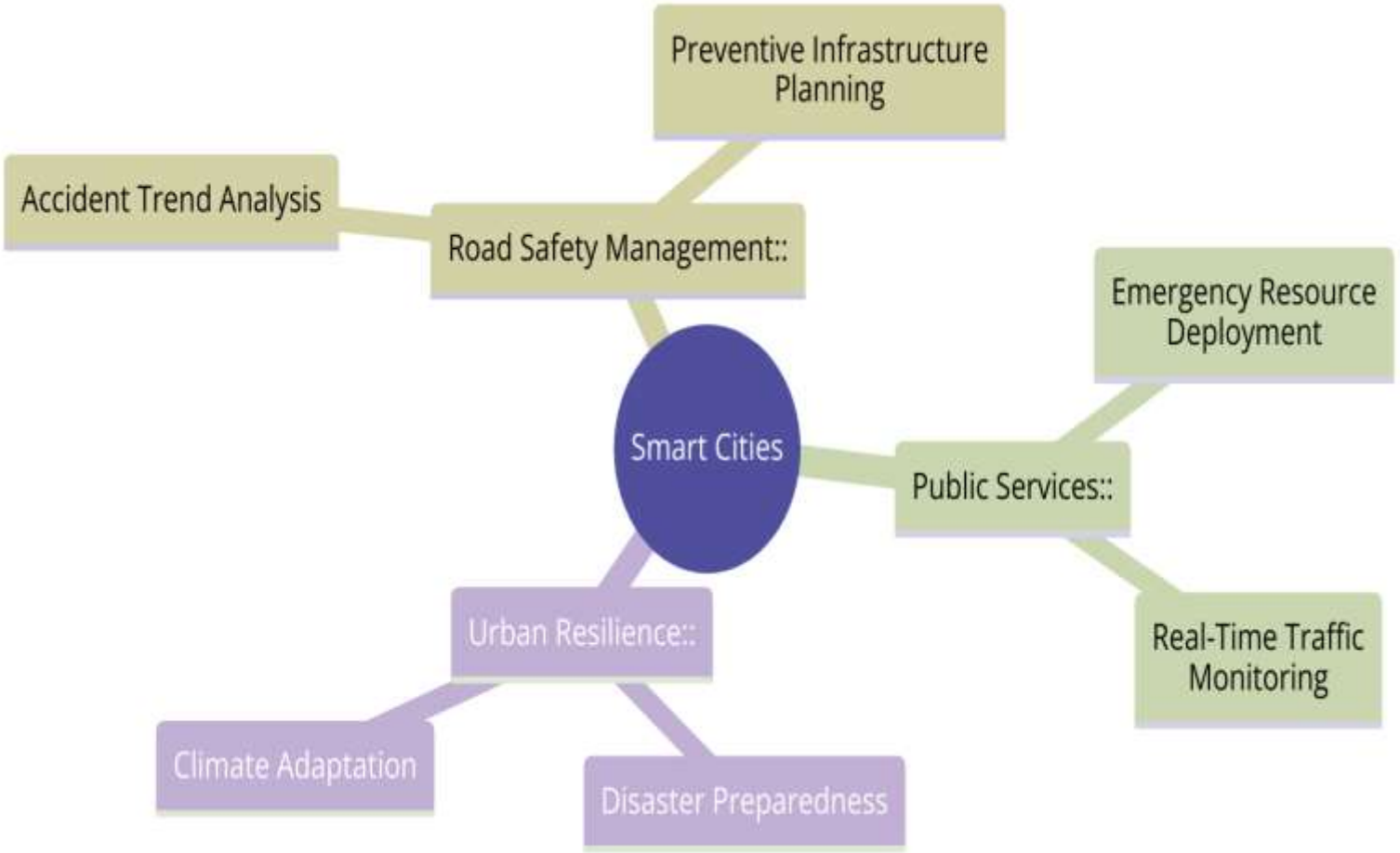
GeoAI for Smarter Cities: Revolutionizing Emergency Resource Management

IIM SAMBALPUR

GeoAI in Smart Cities



World Bank (2020). *Smart Cities and Urban Infrastructure Planning*.

Leveraging Historical Data

Traffic Pattern Insights

GeoAI utilizes historical traffic patterns to predict accident-prone areas, enabling better resource allocation.

Data Integration

Combining traffic data with spatial information to identify high-risk zones effectively.

Proactive Resource Placement

Optimizes the strategic placement of emergency services, such as ambulances and fire trucks.

Machine Learning Models

Accident Hotspot Identification

Machine learning identifies accident hotspots using historical data, enabling focused interventions.

Adaptive Predictions

Models adjust dynamically based on real-time inputs, improving accuracy.

Improved Decision Making

Empowers emergency services with predictive analytics to enhance readiness.

Real-World Case Studies

Urban Metropolis

GeoAI reduced response times by 25% in accident-prone areas.

Suburban Safety

Smaller cities benefited from optimized resource allocation, enhancing coverage.

Pilot Projects

Simulations confirmed improved emergency handling efficiency.

Impact of GeoAI on Response Times

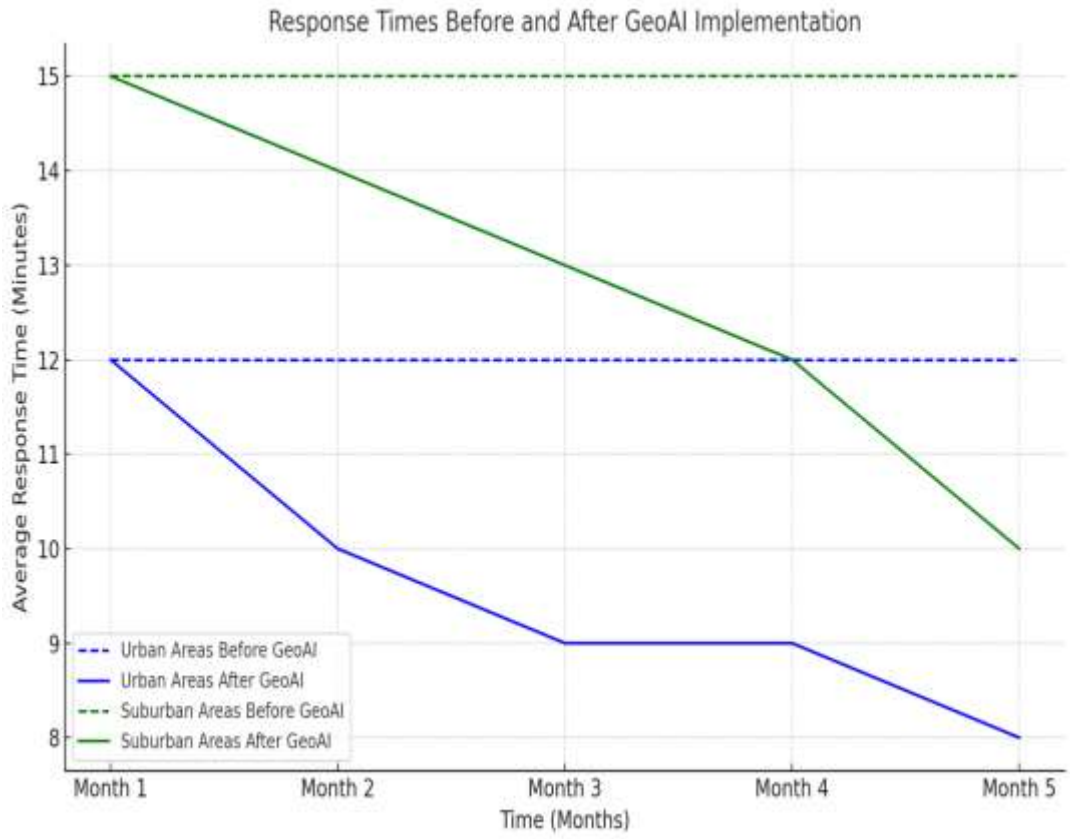
01 Urban areas reduced response times from 12 to 8 minutes.

02 Suburban areas improved from 15 to 10 minutes.

03 Line graph depicts month-by-month improvement.

04 Significant gains in efficiency within five months.

05 GeoAI optimizes resources dynamically for better results.



GeoAI Consortium, *Impact of GeoAI on*

GeoAI Efficiency and Resource Distribution

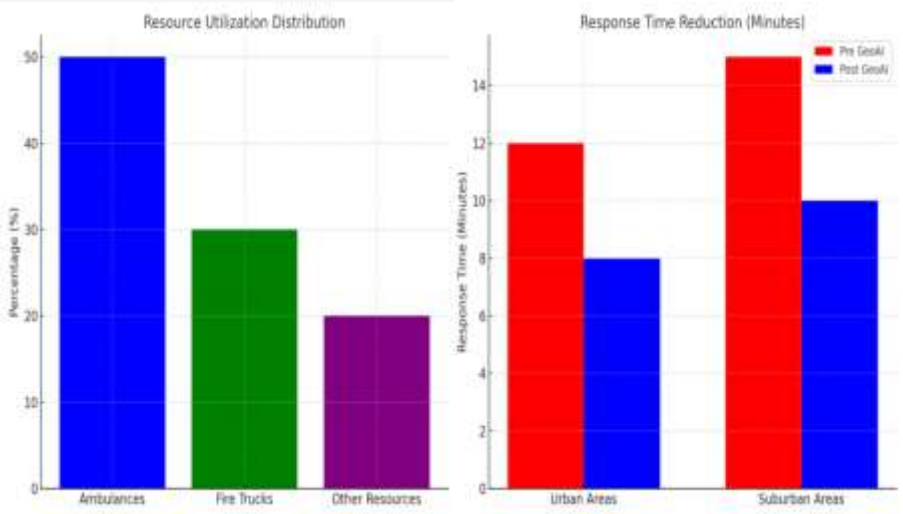
01 Ambulances make up 50% of resource utilization.

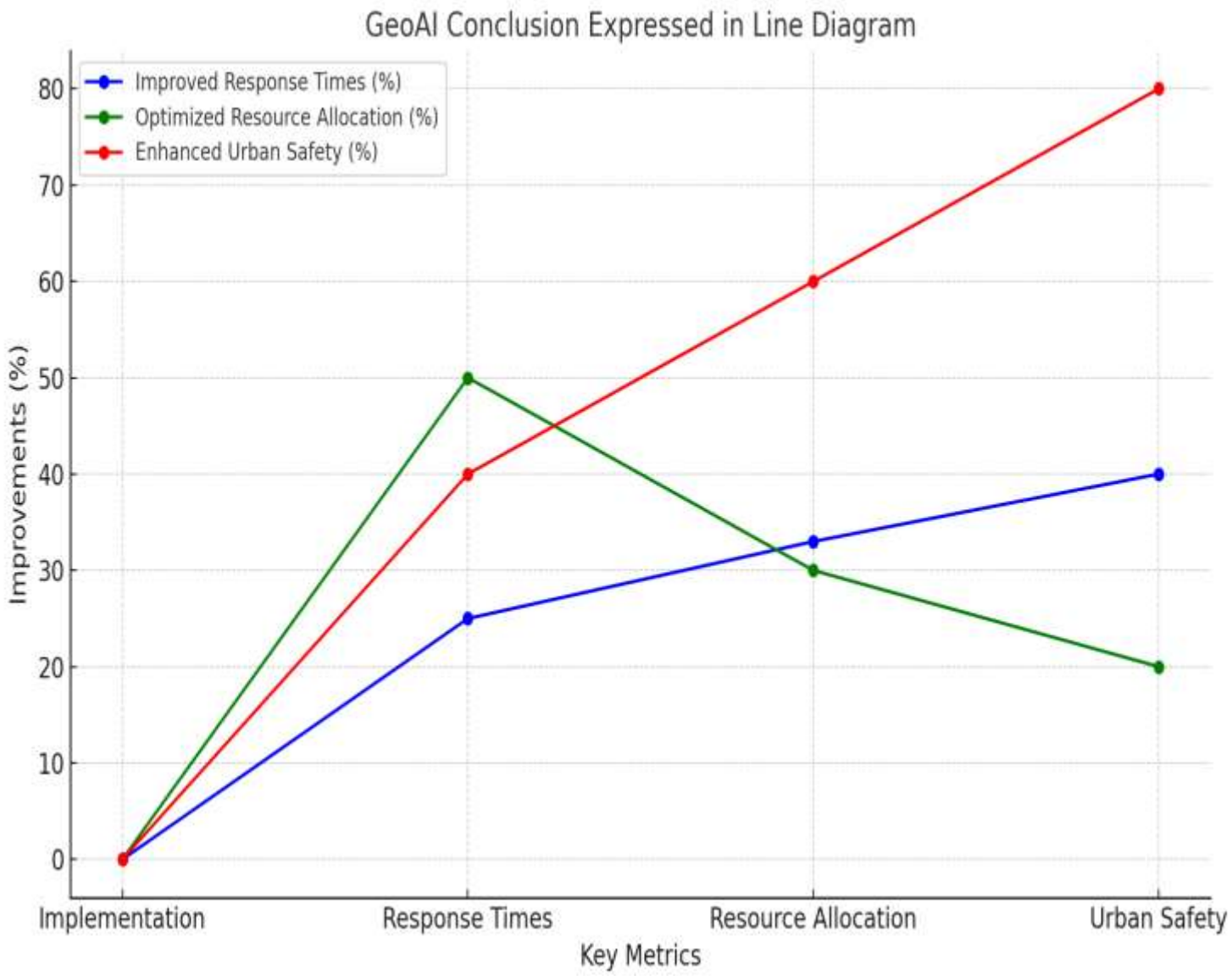
02 Fire trucks account for 30% and other resources for 20%.

03 Urban response times improved from 12 to 8 minutes.

04 Suburban response times improved from 15 to 10 minutes.

05 Bar charts illustrate resource allocation and efficiency gains.




GeoAI Conclusion Expressed in Line Diagram
Improved Response Times (%)
Optimized Resource Allocation (%)
Enhanced Urban Safety (%)
Improvements (%)
0
10
20
30
40
50
60
70
80
Implementation
Response Times
Resource Allocation
Urban Safety
Key Metrics

Accuracy of GeoAI Models

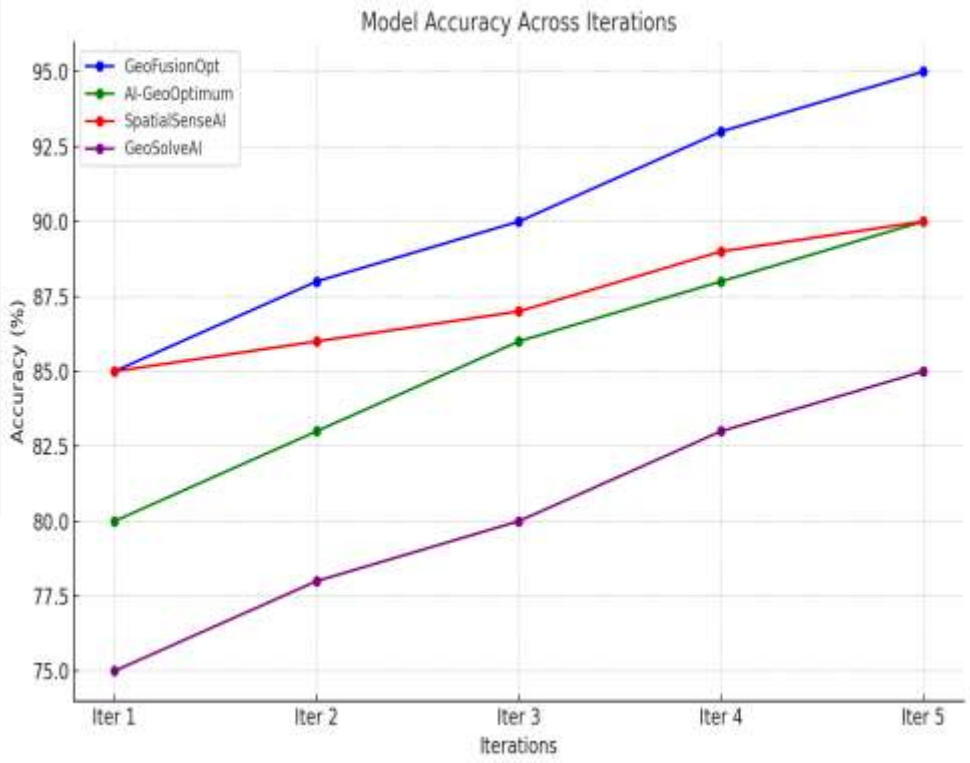
01 GeoFusionOpt achieves the highest accuracy, improving to 95%.

02 AI-GeoOptimum shows steady improvement, reaching 90%.

03 SpatialSenseAI maintains consistent high accuracy.

04 GeoSolveAI improves steadily from 75% to 85%.

05 Line graph highlights comparative accuracy across iterations.



GeoFusionOpt Overview

Optimization Framework

GeoFusionOpt leverages advanced optimization techniques, such as genetic algorithms and AI-GeoOptimum, to process spatial data efficiently.

Real-Time Data Processing

This model integrates real-time data fusion, ensuring decisions are based on the latest information available.

Urban Planning Applications

Widely used for urban planning tasks, such as traffic optimization, emergency response, and resource allocation.

Key Comparisons

Accuracy

GeoFusionOpt outperforms other models in precision due to its advanced fusion algorithms.

Scalability

While GeoFusionOpt excels in large-scale implementations, some models may lag in processing extensive datasets.

Cost Efficiency

GeoFusionOpt provides a balance between performance and resource utilization, surpassing others in cost-effectiveness.

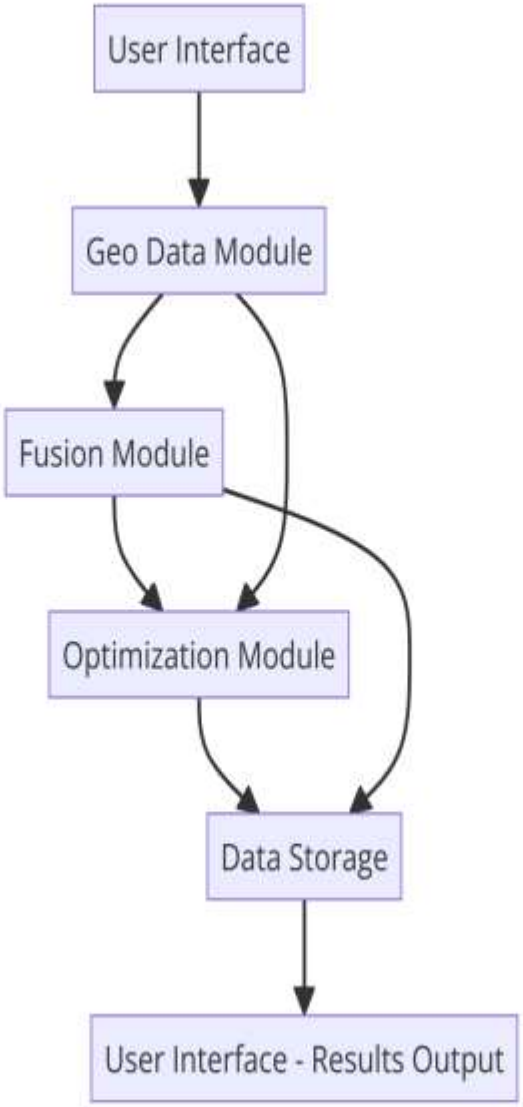
Dynamic Decision Making

Combines machine learning and clustering for adaptive emergency response.

GeoFusionOpt Model

Ensures efficient resource allocation by analyzing real-time data flows.

Modular Geo-Data Processing System



Key Challenges in Implementation

Data Quality Issues

Ensuring clean, compatible, and geospatially relevant data is crucial.

Algorithm Complexity

Balancing computational efficiency with predictive accuracy.

Scalability Concerns

Adapting the model for cities with varying infrastructures and demands.

GeoAI for Smarter Cities & Highways

Why Land Acquisition Needs Reform

01 Delays cause 12–18 month project slowdowns

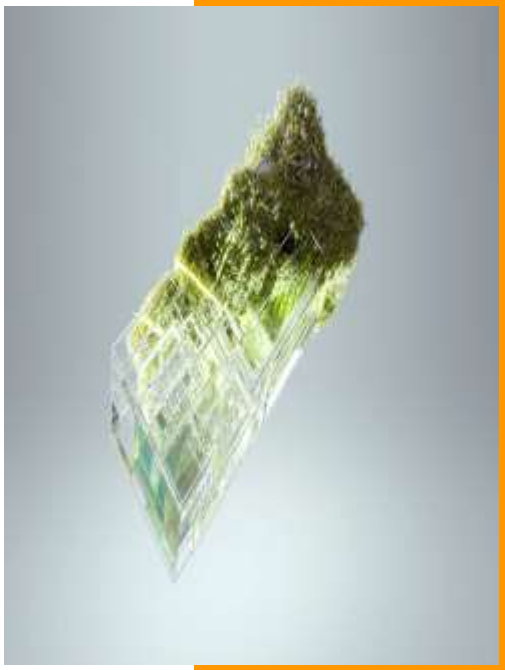
02 Disputes from unclear ownership & multiple claims

03 High costs & litigation

04 Low transparency & citizen trust

05 Resource inefficiency

The GeoAI Approach



Integration

Cadastral maps, satellite imagery, drone surveys, and land records are unified on a single platform.

Prediction

GeoAI identifies high-dispute zones with unclear ownership or overlapping claims before acquisition begins.

Optimization

Helps prioritize critical parcels and ensures fair, transparent compensation through data-driven decision-making.

GeoAI used in smart cities to integrate traffic and spatial data can also be applied to highways. It helps align revenue records, cadastral maps, and planning data to detect disputes, encroachments, and sensitive land proactively.

GeoAI in Action

Smart Cities → Highways

Machine Learning Models

Litigation Hotspots

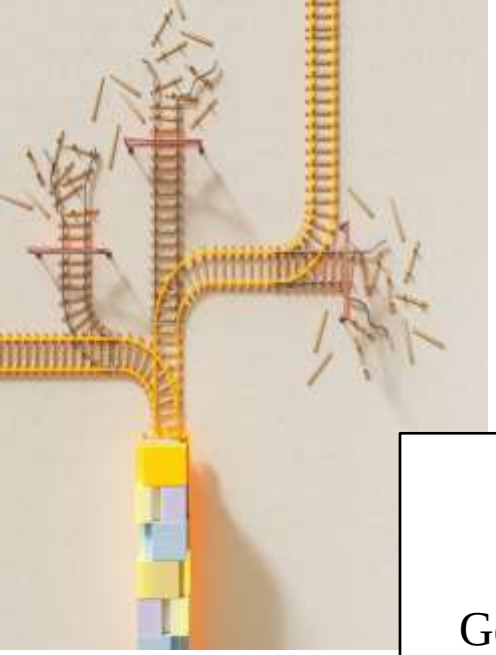
AI analyzes past acquisition cases to detect regions prone to disputes.

Dispute Prediction

Models flag parcels with multiple owners or mismatched records.

Compensation Insights

Suggests fair compensation based on transaction history and market trends.



GeoFusionOpt balances cost of land, displacement minimization, and environmental impact. It runs multiple alignment simulations to help planners choose the least risky and most cost-efficient routes.

Optimization Models

GeoFusionOpt Framework

Case Studies

Andhra Pradesh

Drone-based cadastral mapping quickly resolved disputes.

Karnataka

GIS integration sped up approvals by overlaying records with alignments.

Odisha

Digital land portals enabled faster compensation disbursal.

Impact on Timelines & Resources

Timeline Reduction

Digital cadastral integration and AI cut acquisition delays by 30–40%.

Resource Efficiency

Survey teams, legal experts, and officers are allocated based on priority on priority parcels.

Faster Execution

Projects move quickly from planning to ground execution, reducing reducing bottlenecks.

Benefits & Challenges

01 Faster project execution

02 Transparency in compensation

03 Lower disputes and litigation

04 Incomplete or incompatible land records

05 Need for interoperability & usability

IoT drones for real-time mapping, blockchain for tamper-proof land records, and scalable GeoAI platforms across states. Together, these innovations will make acquisition faster, transparent, and citizen-friendly.

Future Directions

Next-Gen Land Acquisition