Genesys Urban Spatial Digital Twin

Dr. Aniruddha Roy
Chief Technology Officer
Genesys International Corporation Ltd.
India

16 November 2022

Presentation Outline

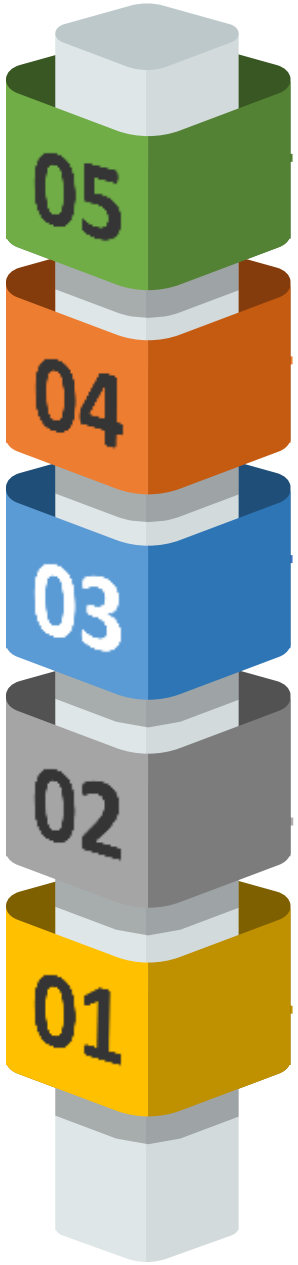
1. Urban Spatial Digital Twins
2. Generating 3D Models
3. Business Attributes
4. IoT Feeds
5. Artificial Intelligence
6. Predictive Analytics

1
Digital Twins
Our understanding

A digital twin is a virtual representation of the real world,
including physical objects, processes, relationships, and behaviors.

GENESYS

Real-Time and Predictive Digital Twins



Virtual Asset Digital Twins

PREDICTIVE

- Physics-Based Modelling
- Real-Time 'What-If' Scenario
- Predictive Analysis
- Recommended Actions

INTELLIGENT

Artificial Intelligence for:

- Automated Data Acquisition and Structuring
- Change Detection (Temporal Analysis)
- Data Analytics
- Patterns and Warnings

INTERACTIVE

- Sensors and IoT (CCTV, AWS, Smart Pole etc.)
- Data Modification at Asset Level, Updates Back to Source
- AR/VR/MR
- Connect Data Using API Microservices

INFORMATIVE

- Attribute Linking
- Ontology
- Document and Media Integration
- Performance and State Visualization
- Unified Data Search and Discovery Tools
- Temporal Data Management and Display

3D SPATIAL MODELS

- Real World Visual Replica
- Accurate 3D Geometrical Model
- Platform Agnostic Datasets
- (Unreal Engine and NVIDIA Omniverse ESRI, Bentley, AutoDesk, Cesium, Open Source, etc.)

GENESYS

2

Generating 3D Spatial Models

Genesys International Corporation Ltd

GENESYS

Proof of Concept carried out by Genesys at Worli, Mumbai

Genesys Launched "Urban Spatial Digital Twin" Program for top 100 cities of India on 1st Dec 2021

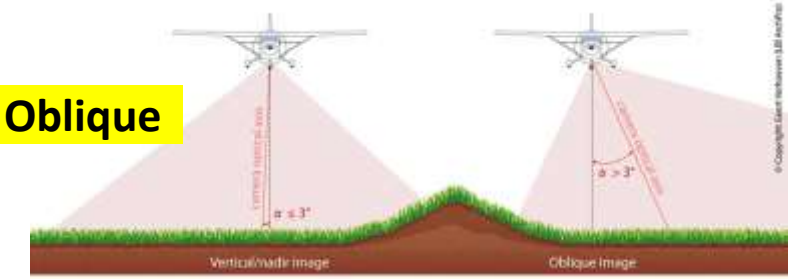
Partnerships and alliances with Start-ups, Technology Partners, Urban Bodies and Businesses.

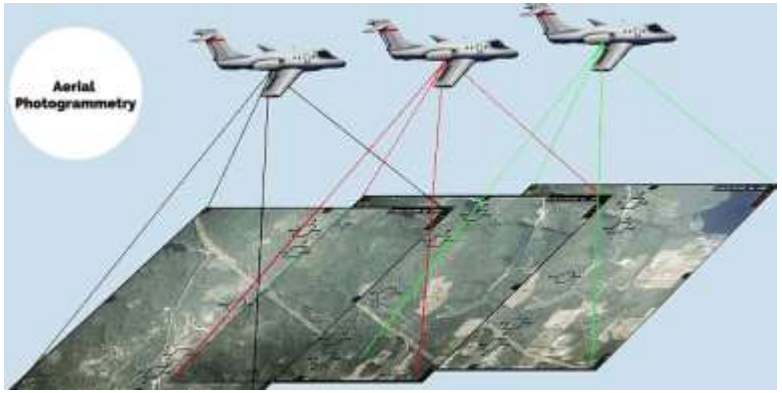

MH.02.FE.1831

Data Acquisition | LiDAR & Optical Sensors|

Top View

Vertical and Oblique





Ground View

Narrow lanes

Motorable roads

Solutions

GENESYS

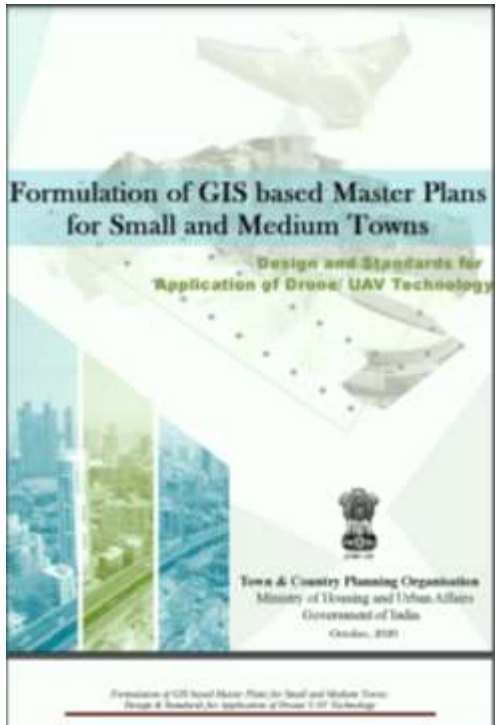
Urban Planning

Coastal Road 3D Model, Mumbai

3
INFORMATIVE
Business Attributes

Data Models in Cities

- Every Smart City uses its own data model and codification based on their usage.
- Design document developed for Master Plan Formulation for medium and smaller towns
- Brings homogeneity across Cities



I. BASE LAYERS:

The road feature will be captured as both Polygon and Line. Road area is represented as polygon and Road centerline as Line.

Table 7: Road Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
1	01-01	Road	*National Highway*	Polygon / Line	
	01-02		*State Highway*	Polygon / Line	
	01-03		*Major District Road*	Polygon / Line	
	01-04		*Other District Road*	Polygon / Line	
	01-05		*Expressway*	Polygon / Line	
	01-06		*Bypass*	Polygon / Line	
	01-07		*Ring Road*	Polygon / Line	
	01-08		*Service Road*	Polygon / Line	
	01-09		*Major City Road**	Polygon / Line	
	01-10		*Minor City Road**	Polygon / Line	
	01-11		*Other Public Road*	Polygon / Line	
	01-12		*Other Private Road*	Polygon / Line	
	01-13		*BRTS*	Polygon / Line	
	01-14		*Cycle Track*	Polygon / Line	
	01-15		*Village road*	Polygon / Line	
	01-16		*Foot path*	Line	
	01-17		*Cart track*	Line	
	01-18		*Ropeway*	Line	
	01-19		*Carriageway**	Line	
	01-20		*Right of way**	Line	
	01-21		*Cantonment Roads*	Polygon / Line	
	01-22		*Notified Industrial Area Roads*	Polygon / Line	
	01-23		*Public Staircase*	Polygon / Line	

Table 8: Road Line GIS Data Structure

Geospatial Layer Name: Road_Line

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Road Id	**Rd_ID**	Alphanumeric	15	Unique Id
Survey Date	**SVY_Date**	Date		Date of Surveying
Code	**Code**	Alphanumeric	10	Code as given in Table 8
Sub-Class	**Sub_Class**	Text	20	Sub Class as given in Table 8
Length in kms.	**Length_kms**	Double	10 Up to 4 decimals	Length (in kms.)
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road Name	**Rd_Name**	Text	30	Specific/ Name if any
Road Construction Material	**Cons_Mat**	Text	10	Concrete/ Asphalt/ WBM/ As Other
Carriage Width (in mt.)	**CW_Width**	Double	10 Up to 4 decimals	Carriage Width in metres
Right of Way Width (in mt.)	**ROW_Width**	Double	10 Up to 4 decimals	Right of Way Width in metres
Maintained By	**Maintain**	Text	15	Municipal body/NHAI/R and Dept./Other
Foot Path	**FP**	Text	3	Yes/No
Foot path width(in mt.in case Yes)	**FP_Width**	Double	10 Up to 2 decimals	Footpath Width in metres
Foot Path Construction material	**FP_Cons_Ma**	Text	15	Slabad/Tiles/Concrete/Other Stone
Motorable Season	**Mot_Sea**	Text	50	Mention whether all-weathe Motorable season
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph Feature

भारतीय मानक
Indian Standard

IS 18008 (Part 1) : 2021

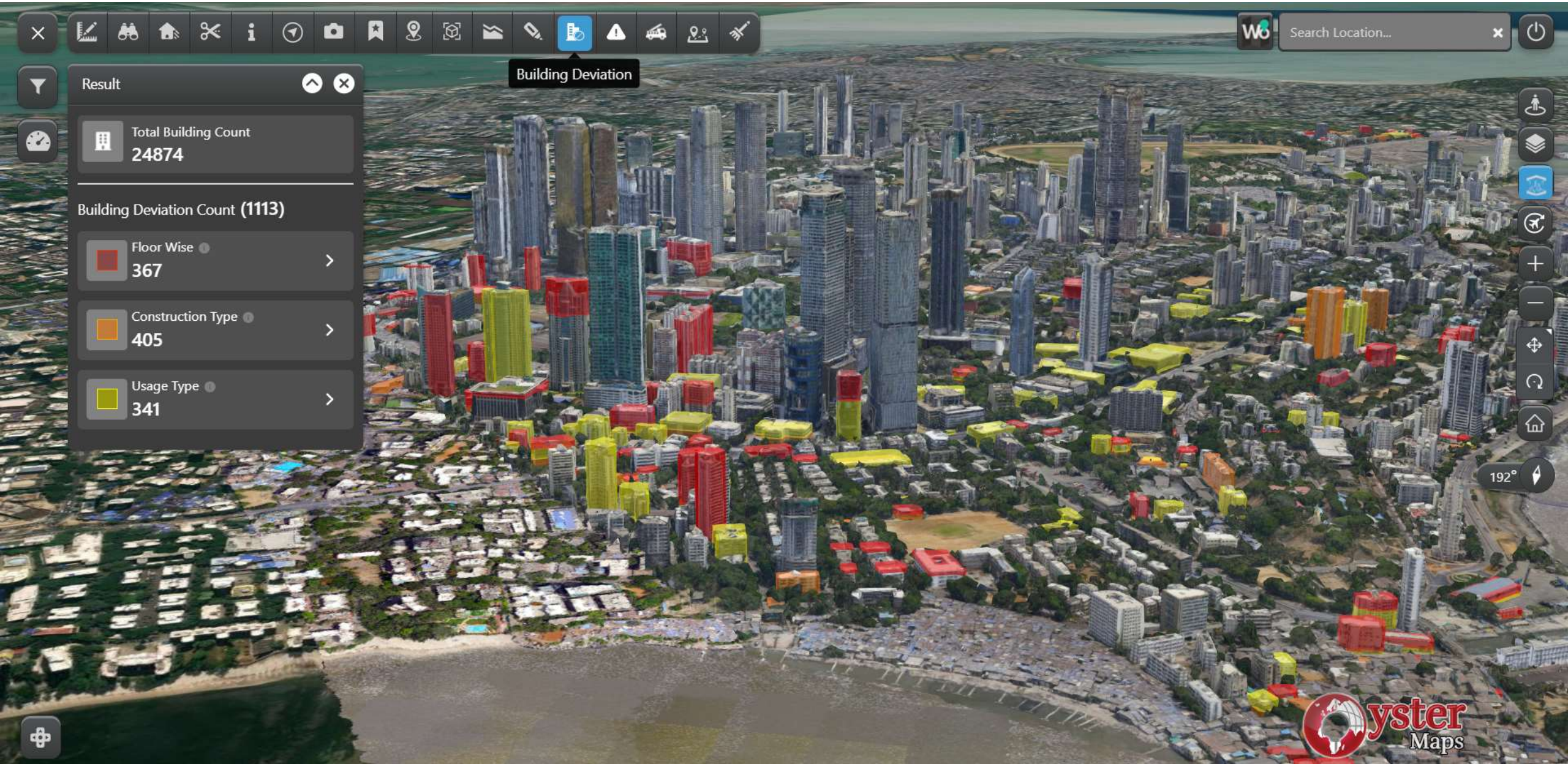
स्मार्ट सिटीज — जीआईएस

भाग 1 रेफ़रेंस आर्किटेक्चर

Smart Cities — GIS

Part 1 Reference Architecture

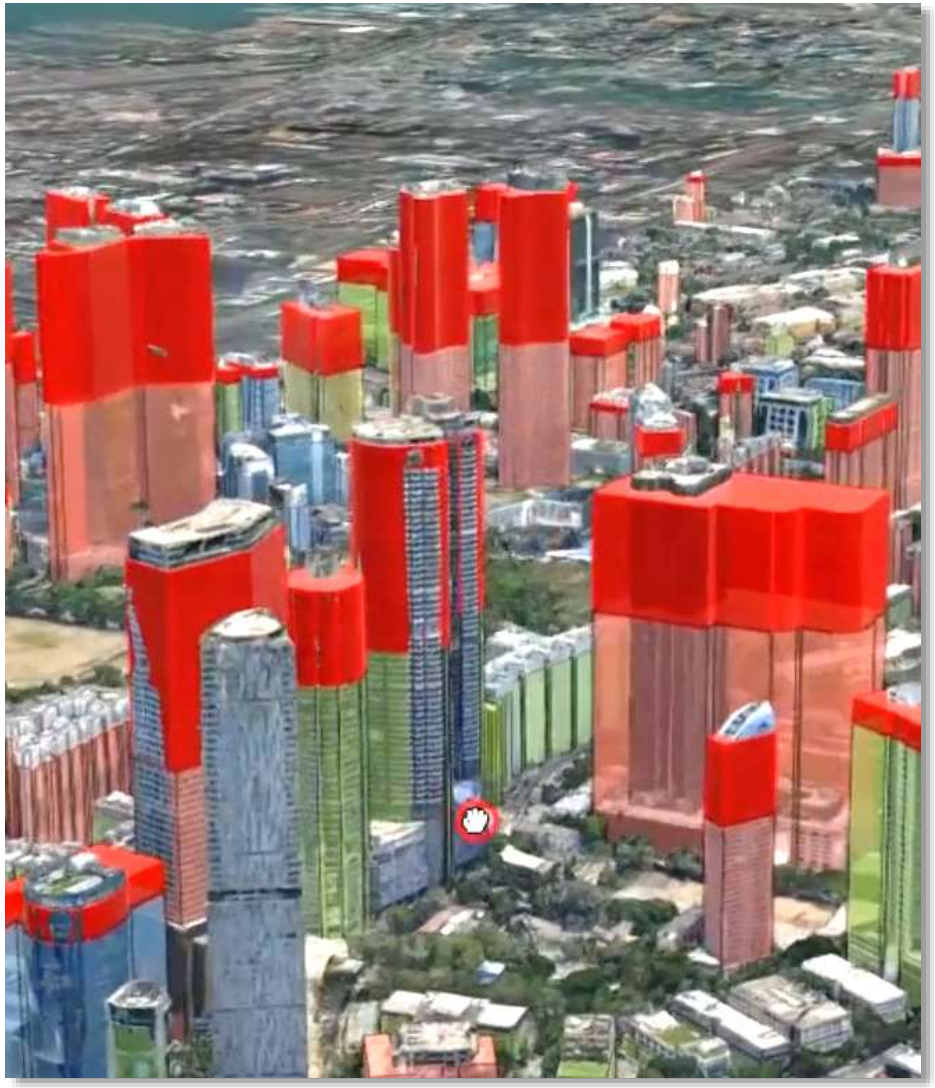
Worli, Mumbai



Solutions

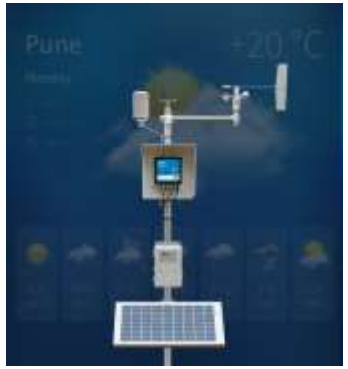
GENESYS

2. Property Tax



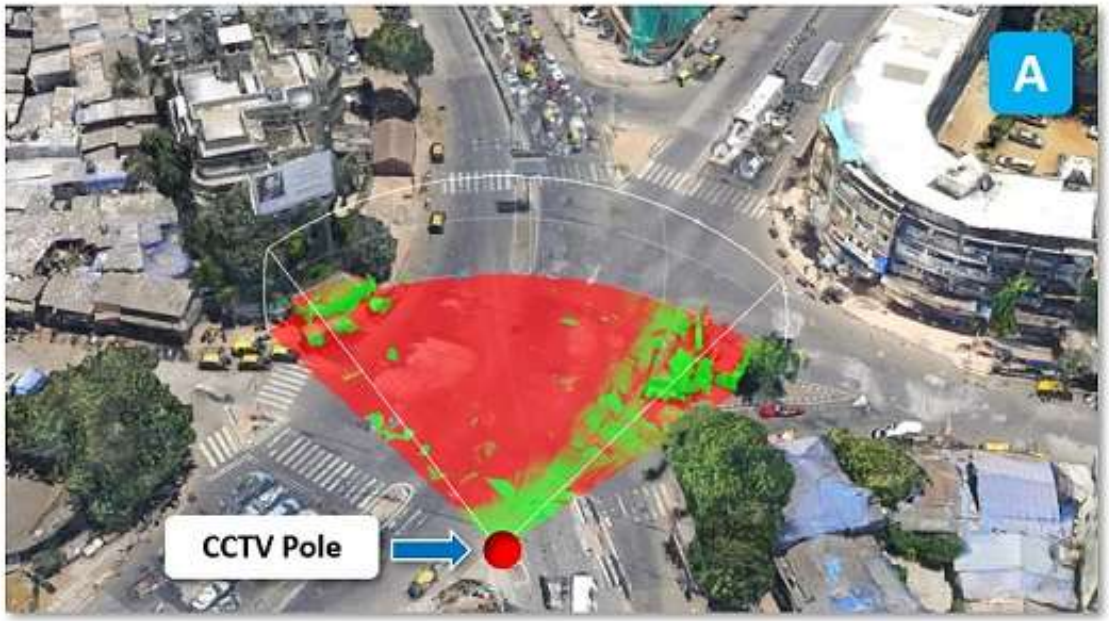
4

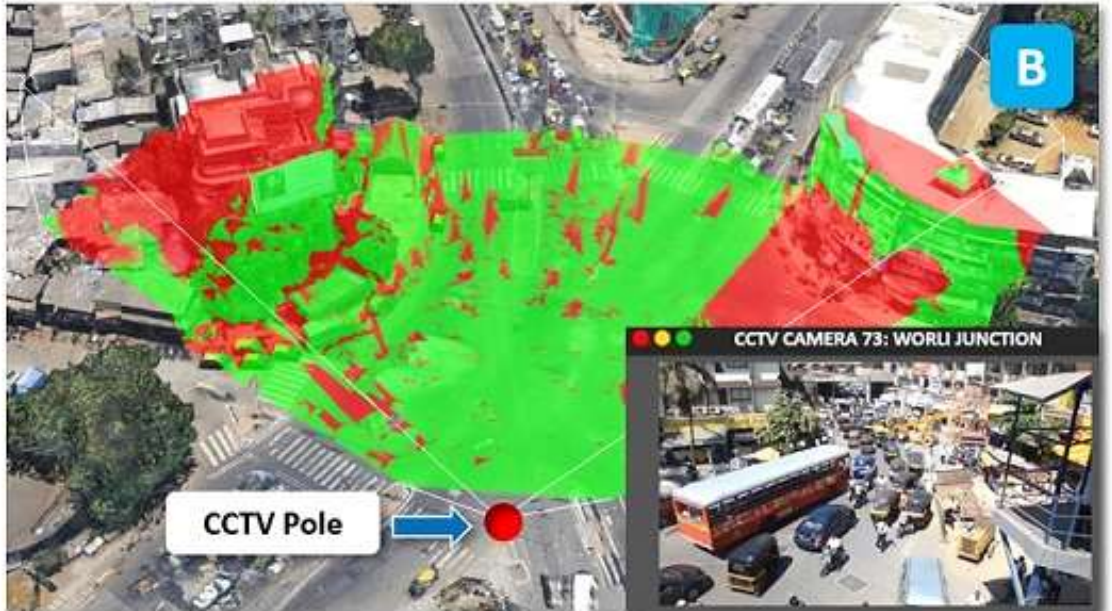
IoT Data Feeds



Solutions

GENESYS





Citizen Safety

CCTV Field of View (FoV) Analysis

FoV Analysis enables the Traffic Department and Law Enforcement officials to understand the exact distance and extent of an Area/ Location/ Junction that a CCTV camera captures ensuring that there are no blind spots, obstructions, etc. thereby maximizing the efficiency of monitoring and coordination. In PTZ cameras the bearing and azimuth can be changed. But for elevation and obstacle analysis 3D Models are required.

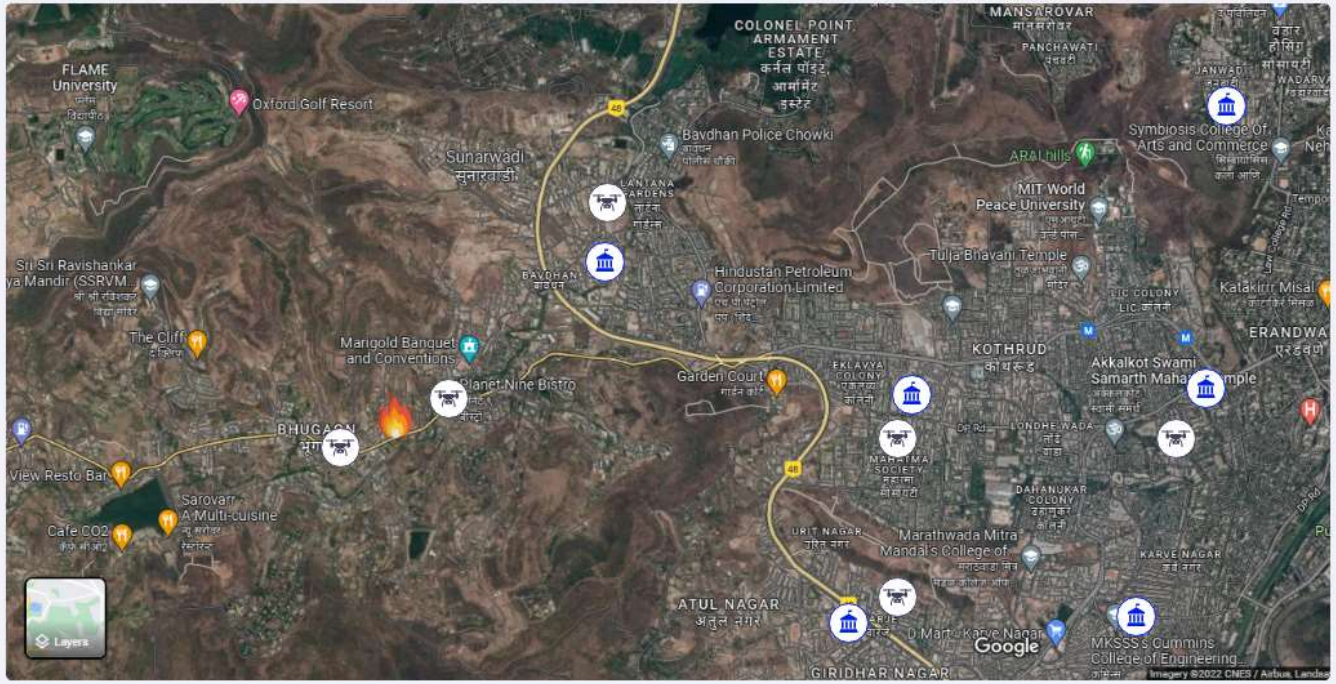
Image A in the left has a small FoV with the CCTV cameras placed at a lower height.

The Camera height in **Image B** has been increased in the Application and FOV too has been increased accordingly. Optimum height can be set by City Administrators using the application.

GENESYS

- Dashboard
- Electricity
- Weather
- Smart Surveillance — Coming Soon
- Waste Management — Coming Soon
- WIFI Hotspot — Coming Soon
- Air and Noise Pollution — Coming Soon
- Hospital Management — Coming Soon
- GIS Mapping of Govd — Coming Soon
- Flood management — Coming Soon

Disaster Management



Drone

100

Active Drone: 03	Inactive Drone: 10	Total Working: 95

Active Rescue Team

1250

Active Team: 800	Reserved Team: 400	Inactive Team: 400

Surveillance of live Incident

500

New Incidents: 350	Closed Incidents: 251	Resolved Incidents: 149

Call SMS Incidents

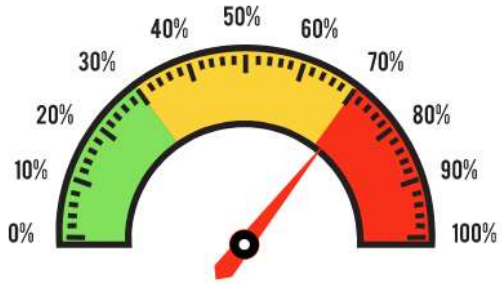
300

New Calls SMS: 350	Fake Calls SMS: : 251	Resolved Incidents: 149

Risk Distribution by Rescue Office

Office	Risk Range	Inherent Risk Score	Management Controls Score
Fire Station	Critical	215.5	3.5
Ambulance Control Room	Critical	350.3	6.3
Police Station Control Room	Critical	180.6	4.6
Government Hospitals	Critical	150.8	6.8
Rescue offices	Critical	80.1	8.1
Special Task Force	Critical	60.3	6.3

Management Control Score



Fire Brigade

Fire safety sensor :

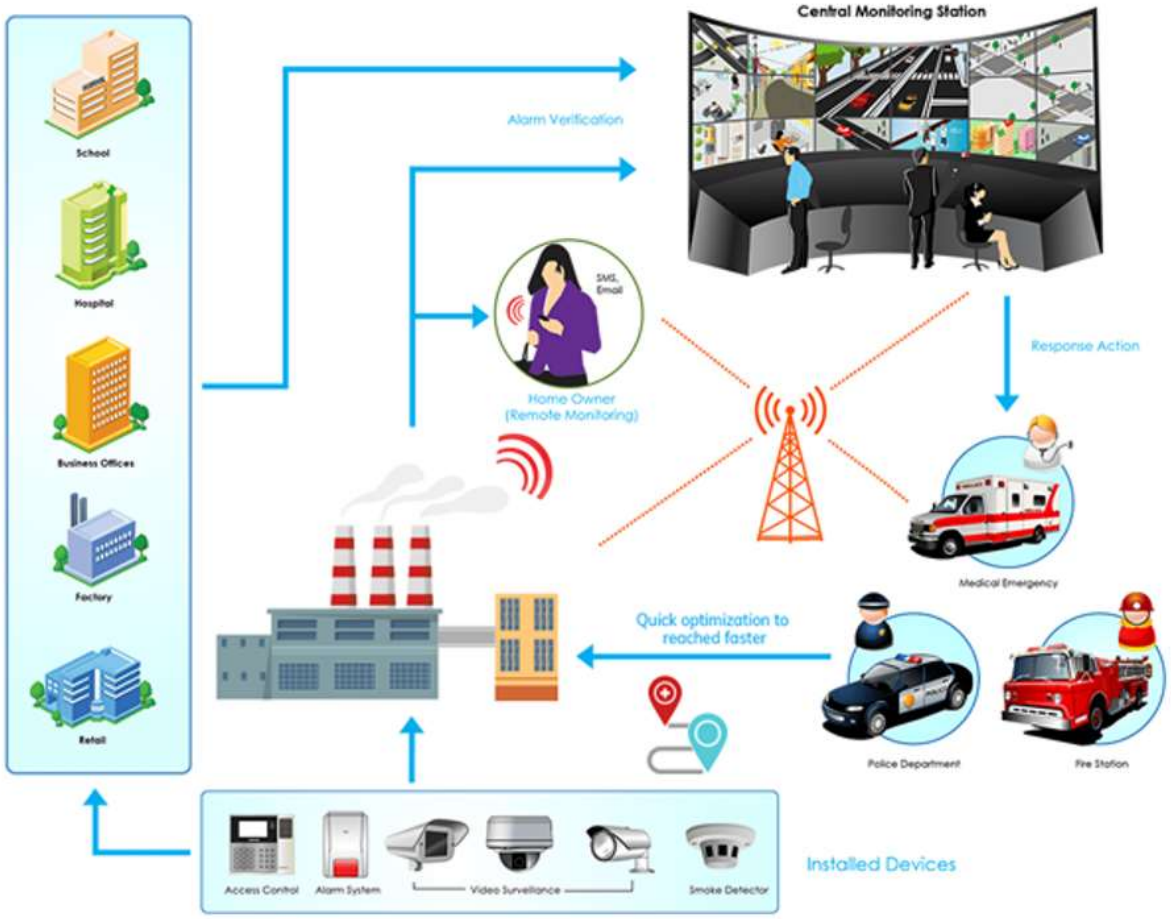
We will be mounting Temperature sensors configured to detect temperatures, heatproof sensors to detect the temperature of fires. This will alert rescue team before it emits smoke to take quick action for the cause.

By sensing exactly where the fire is, the nature of the fire and whether there are any occupants in the room, a smart IOT enabled fire system could deploy different measures to specific rooms, minimizing damage to the broader facility.

In future, it's even possible that drones could be released autonomously, and sent to help fight the fire in lieu of real people.

Quick optimization to reach faster:

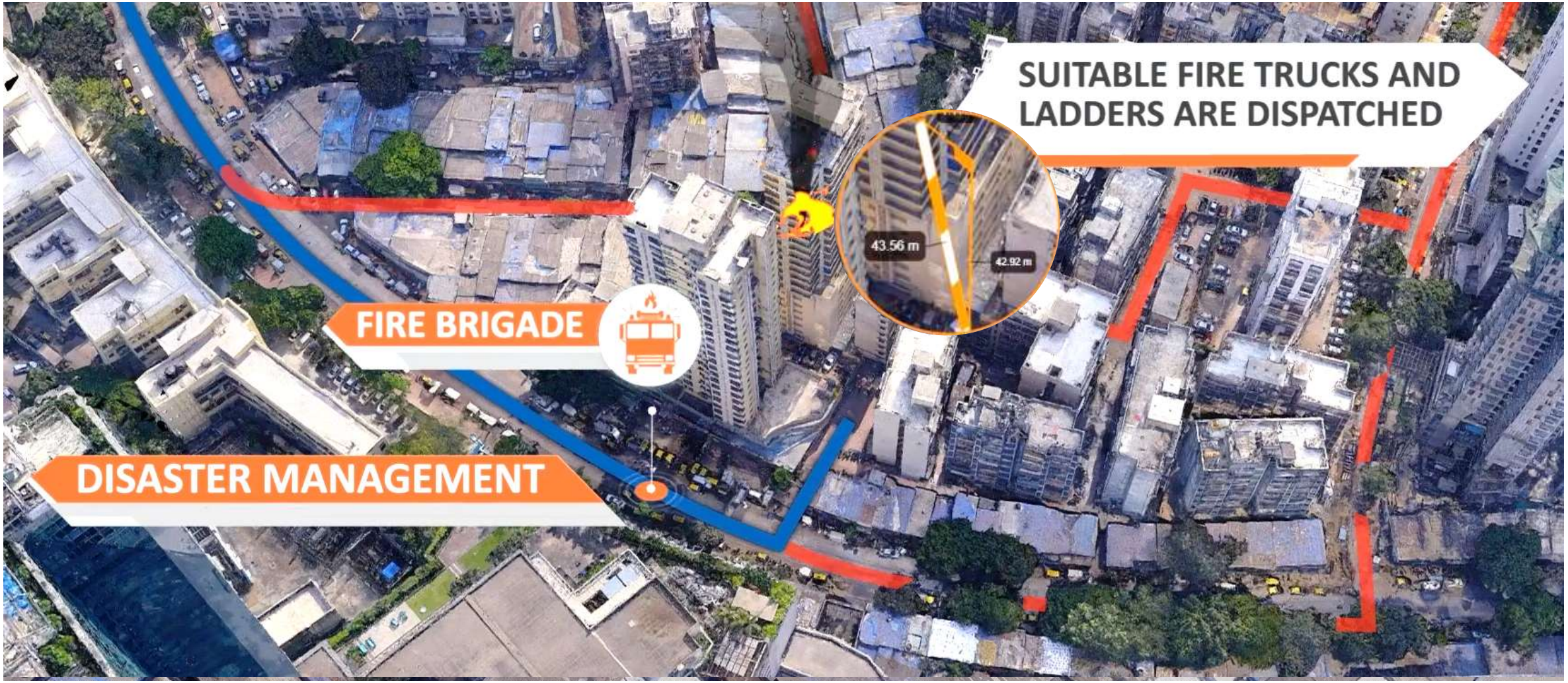
Pin point location of affected area. Map functionality to navigate the rescue crew time frame to reach the location. Traffic congestion alert. Route optimization. All will track and guide to the user from CCC.



Solutions

GENESYS

Emergency Response



5

Artificial Intelligence

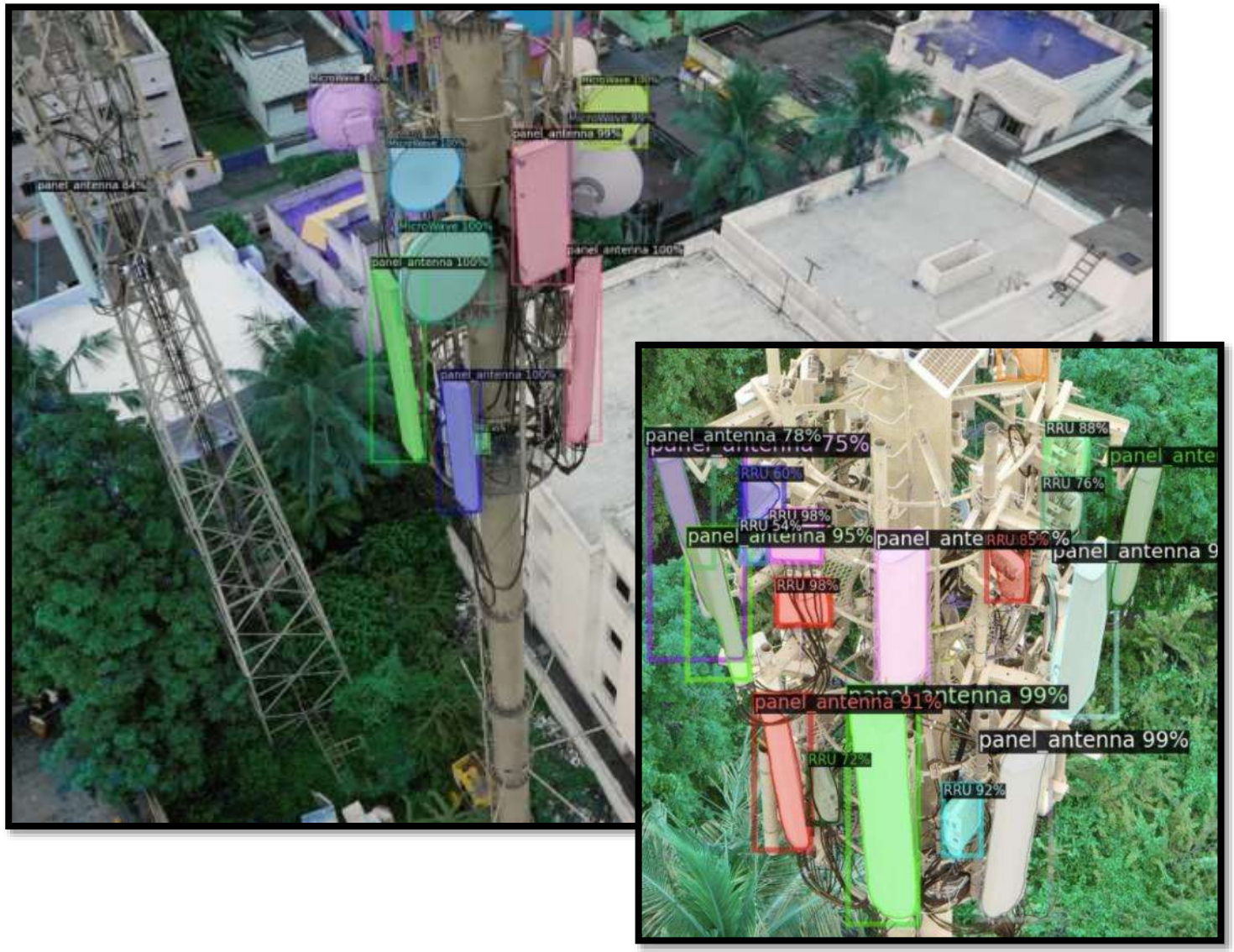
Telecom Tower Antenna Detection, Location & Measurements

Objective

Identify Antennas of Telecom Towers from drone images and get their measurement, tilt, azimuth and convert into 3D data

Process

1. Train all types Antennas
2. Detect and identify each Antenna by type
3. Get real world coordinates of bounding boxes of Panels using Triangulation from drone captured points
4. Create 3D coordinates of the bounding box and push data in model for final adjustment
5. Generate reports (Height, width, depth, tilt, azimuth, etc)



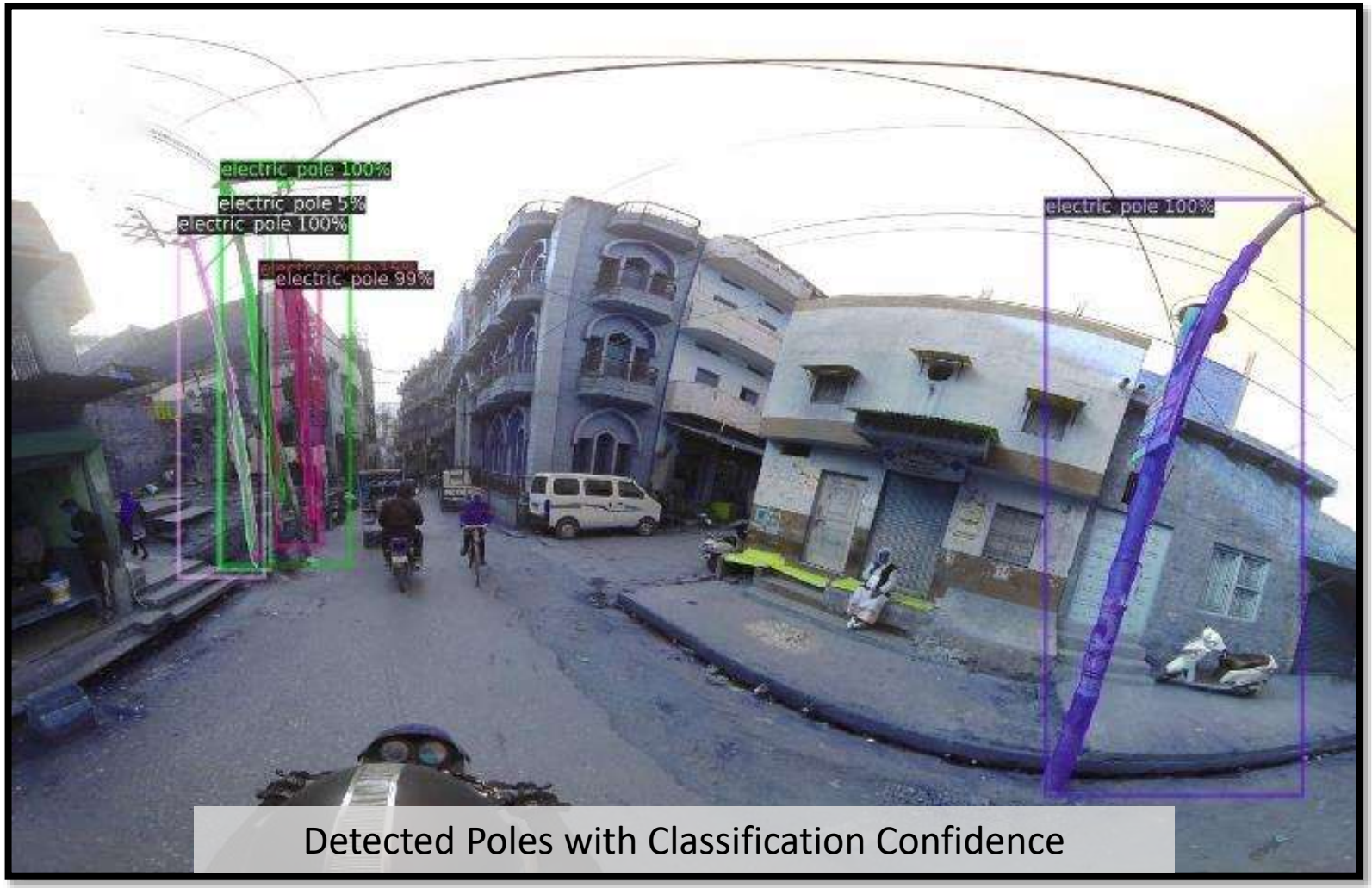
Panoramic Street View Asset Location Detection

Objective

Detect various assets like street furniture, telecom related assets, using Panoramic Imagery

Process

1. Train and detect assets on Panoramic imagery
2. Get bounding boxes of detected assets
3. Convert pixel values to coordinates using approximate depth, location of imagery and bearing



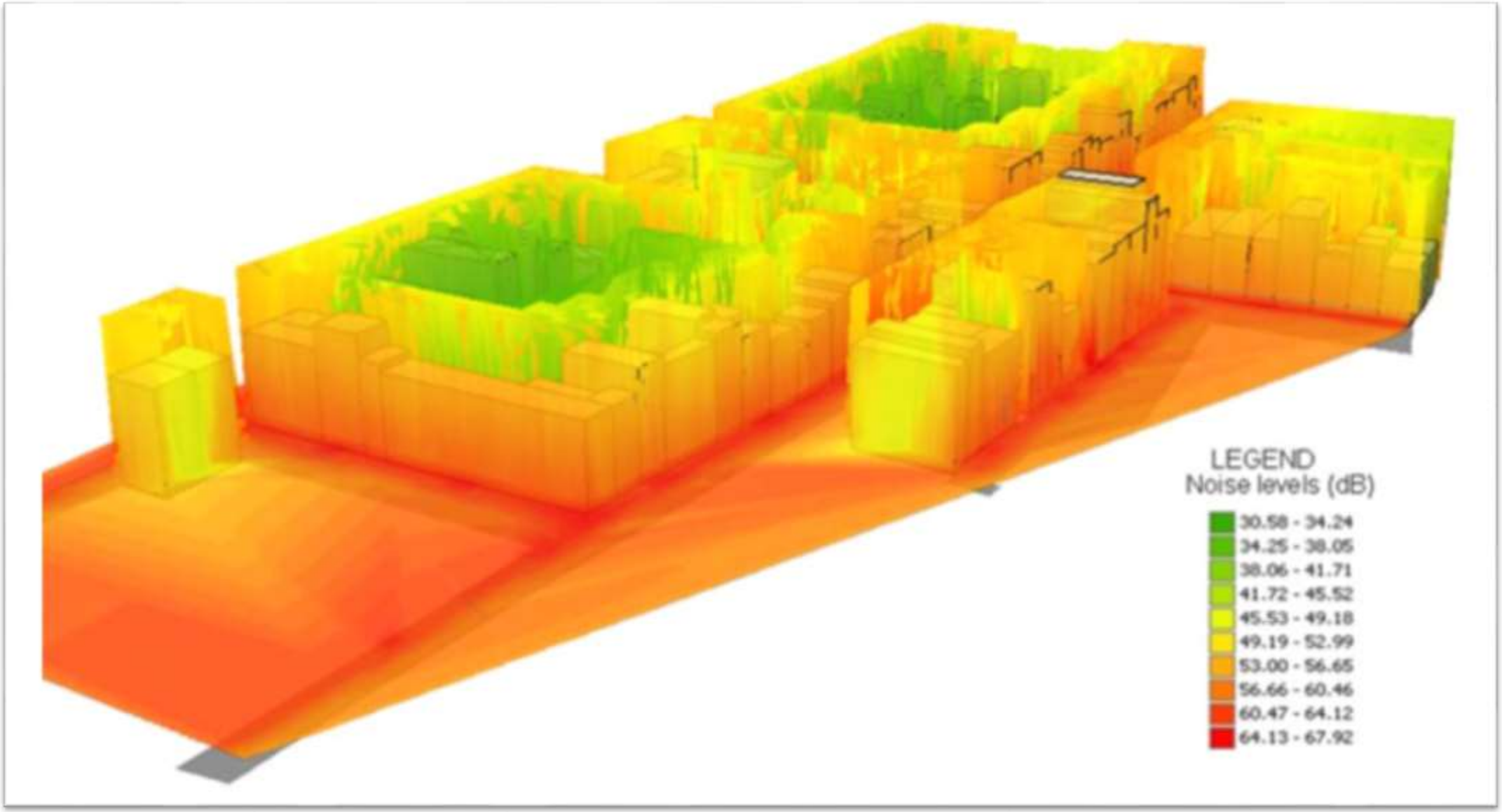
Detected Poles with Classification Confidence

6

Predictive Analysis

Noise Simulation derived with City 3D Model

GENESYS



GENESYS

Thank You

ani.roy@igenesys.com