Civilian and Scientific applications - using GAGAN/NavIC

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NRSC/ISRO

Civilian and Scientific applications - using GAGAN/NavIC

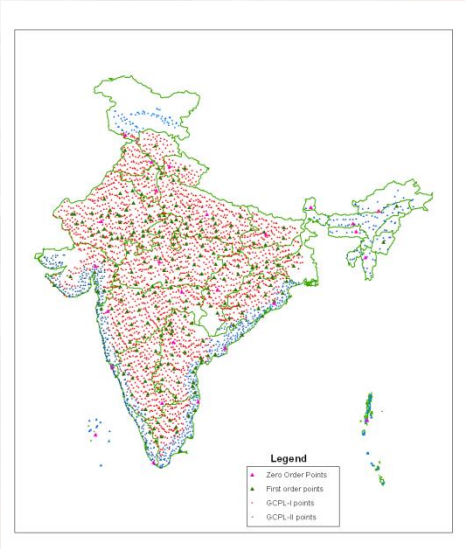
- Ground Control Points (GCPS) – Data Collection
- ISRO-GAGAN Hyperlapse Imaging System
- Cadastre resurvey
- Inventory & Site Monitoring plans for Heritage Sites and Monuments of National Importance
- Mining Boundary mapping
- Mobile app with GAGAN Bluetooth Device
- Map updation - Bridges / Flyover Models using GAGAN SBAS

Ground Control Point Library (GCPL)

Role of Ground Control Points

- Geometric calibration of satellite / platform
- Triangulation[1] of Satellite/Aerial Data for the generation of DEM[2] and Ortho[3] data.

GCP Schema



GCPL Design

- Location analysis with varying occupation
- Observation of 30 min in static position on a point provided 50cm(1σ)
- 3 tier client server database
- More than 1500 GCPs collected

1 – Triangulation is the process of determining the location of a point by measuring *angles* to it from known points at either end of a fixed baseline, which will help to densify the control points.
2 – Digital Elevation Model : Grid with Geographic location and height information
3 – Ortho Data corrected for terrain and tilt angle.

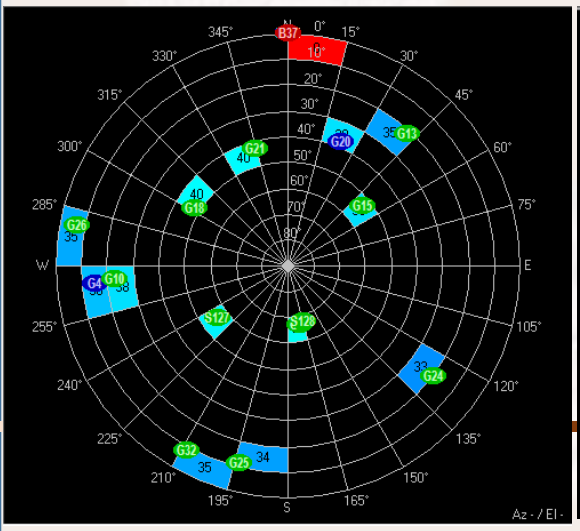
GAGAN Receiver - Geotagging

- GAGAN – GPS Aided Geo Augmented Navigation
  - Integrity, Accuracy, Reliability, Availability
- Jointly developed by ISRO and Airports Authority of India for Aircraft Navigation
- Dongle Based Receiver
- Sampling Rate: 1 second
- Geotagging of Still images
- Geo-path of video track
- Accuracy better than 2m

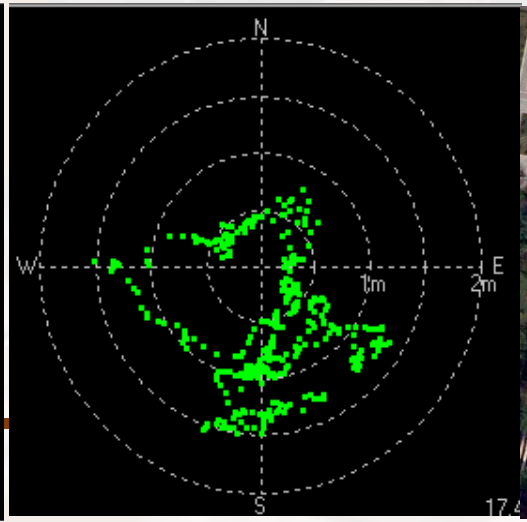
u-blox 6 Slim USB Dongle GPS Receiver/ GR-600

	L1 frequency, C/A code
Horizontal Position Accuracy	< 2.5m (Autonomous) < 2.0m (WAAS) (CEP, 50% 24hr static, -130dBm)
Velocity Accuracy	<0.1 m/s (speed) <0.5 (heading), (50%@30m/s)
Time To First Fix Hot start Warm start Cold start	Autonomous <1sec <32sec <32sec (50% -130dBm)
Sensitivity (Autonomous)	-147dBm (acquisition) -161dBm (tracking & navigation)
Max. Update Rate	5Hz
Max. Altitude	<50,000 m
Max. Velocity	500 m/s
Protocol Support	NMEA 0183 v2.3 (compatible to 3.0), 4800~115200bps N,8,1; GGA, GLL, GSA, GSV, RMC, VTG
Datum	WGS-84
SBAS Support	WAAS, EGNOS, MSAS, GAGAN

GNSS & SBAS Sky Plot

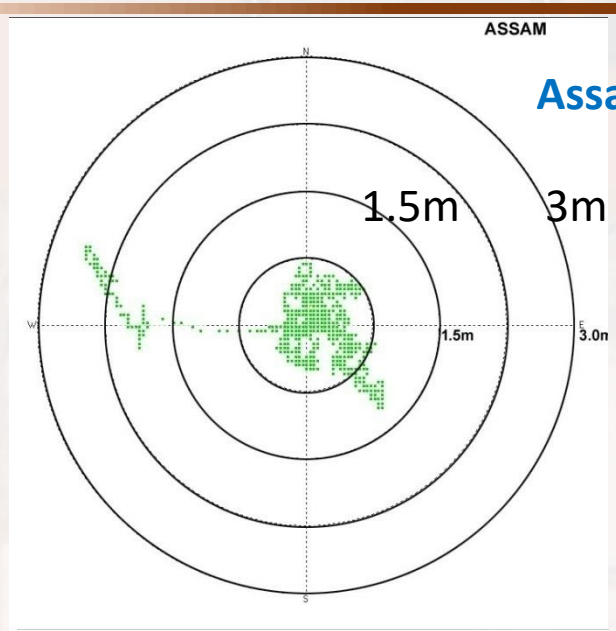


Positional Accuracy

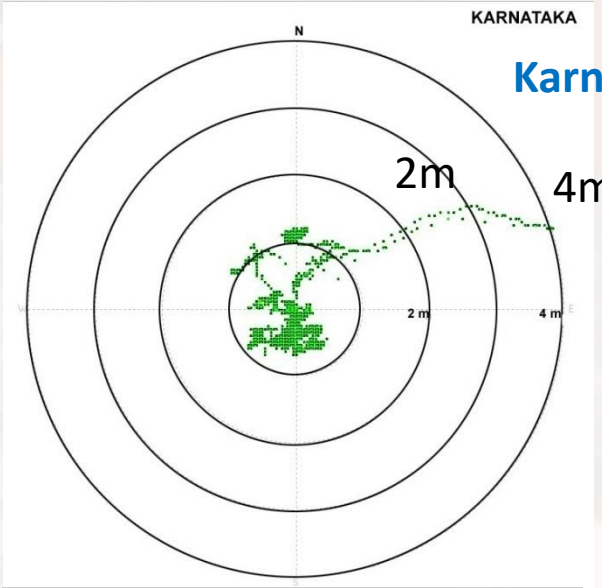


GAGAN SBAS – Ground Trace

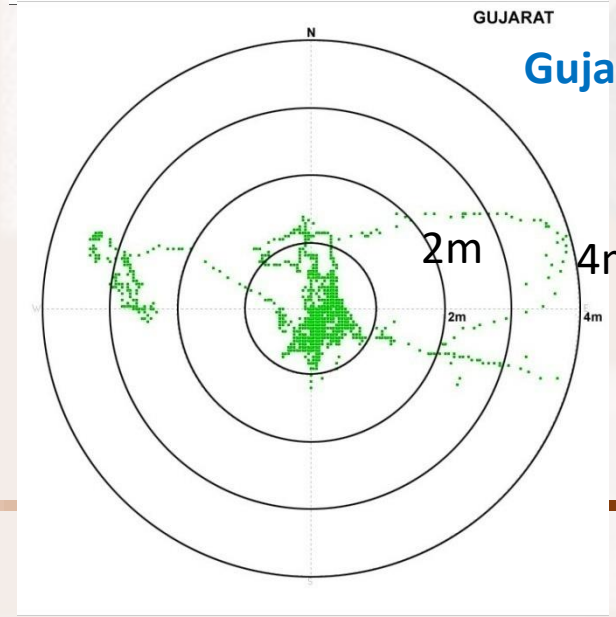
Scatter Plots: GAGAN SBAS Data (30 minutes observation)



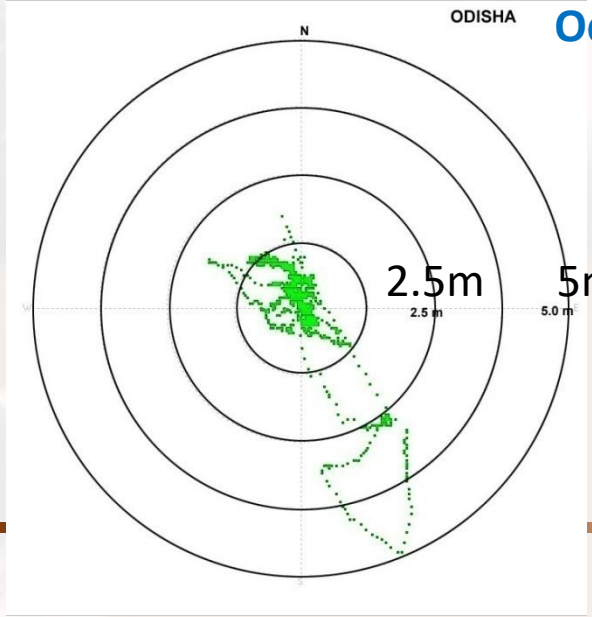
Assam



Karnataka



Gujarat

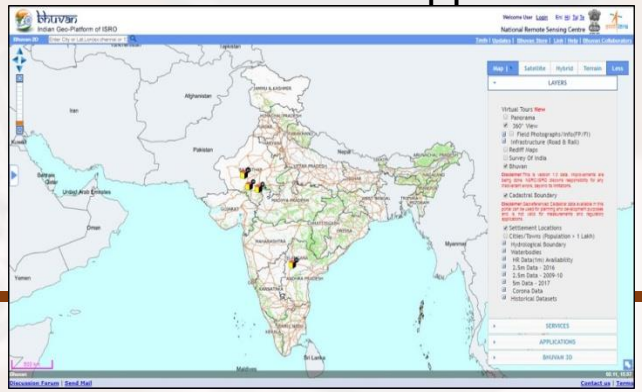


Odhisa

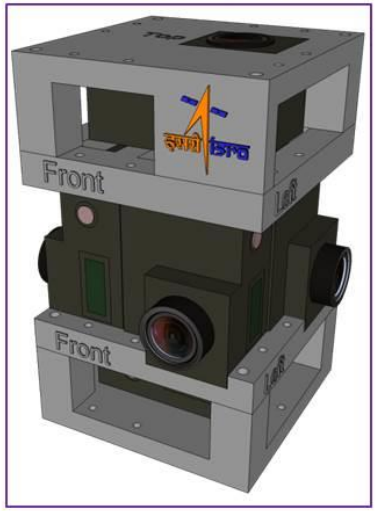
ISRO-GAGAN HYPERLAPSE IMAGING SYSTEM

- **ISRO GAGAN HYPERLAPSE IMAGING SYSTEM (I-GHIS)**
  - Indigenous low cost 360˚ image acquisition system
  - Conceptualized, designed and developed at NRSC, ISRO
  - GAGAN SBAS corrected coordinates for position informa
  - Camera Rig realized through 3D printing
  - Light Weight System: 1.2 kg
  - Mountable on UAVs, SUVs/MUVs, Tripod, Backpack etc.
- **GAGAN SBAS coordinates integrated with 360˚ views**
  - Still images and Video
  - Generation of interactive geotagged panoramas, walk through and 360˚ virtual tours
  - Virtual reality solution on ISRO's Geoportal Bhuvan
  - Catering to Civilian and Non-Aviation applications

Bhuvan - 360° Virtual Tours



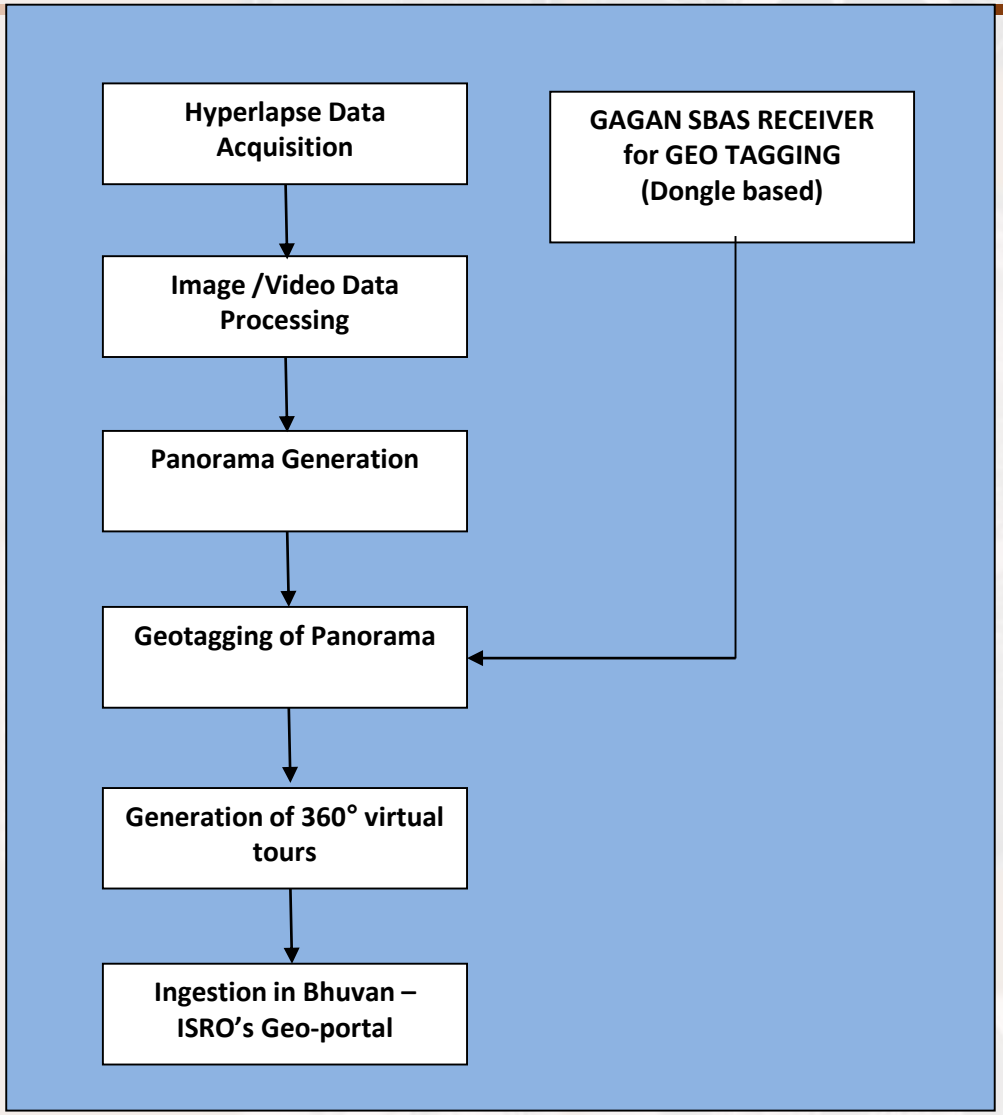
I-GHIS - Conceptualized

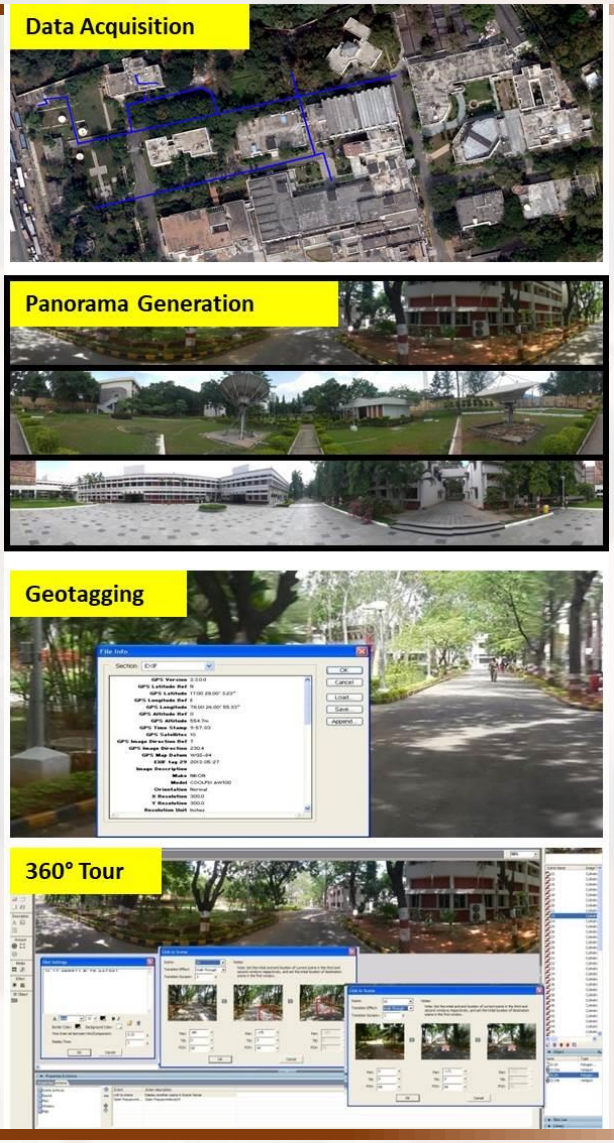


I-GHIS - Realized

GAGAN SBAS Receiver

I-GHIS Data Processing Methodology



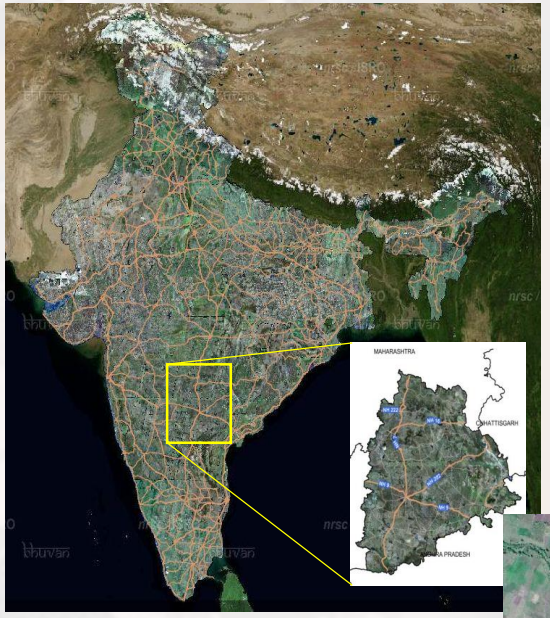


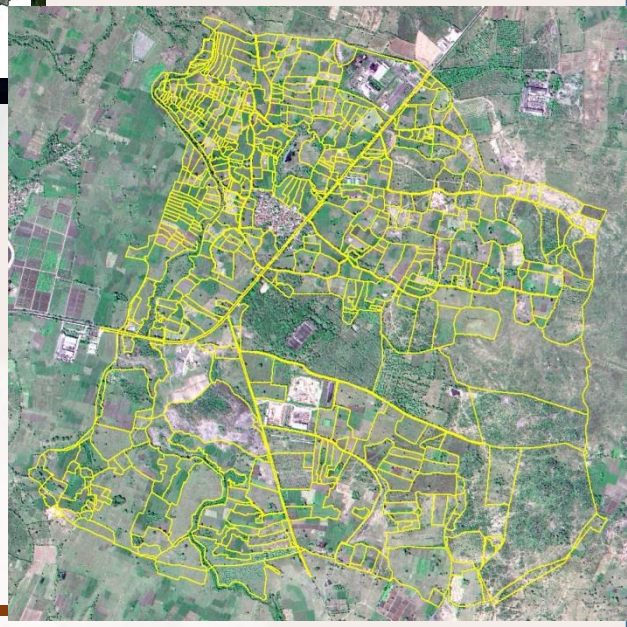
Cadastral Resurvey - GAGAN

- The objective of the study is to demonstrate the usefulness of GAGAN for Cadastral mapping

- Pilot study Shabashpalle village, Medak district, Telangana State

- Area = 1600 acres





Existing :

Total polygons= 350

Gagan Cadastre:

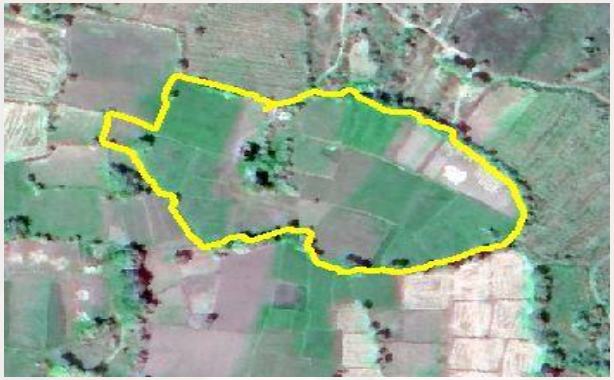
No. of polygons = 540

Cadastral Resurvey - GAGAN

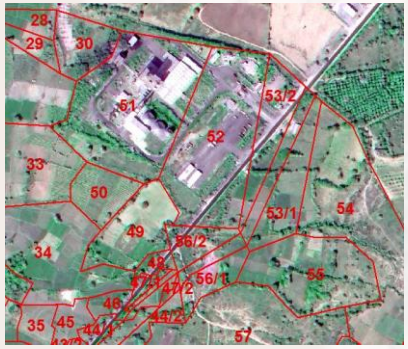
- Gagan dongle connected to laptop & attached to cap
- Land records verified in the presence of land owners and officials
- Data evaluation & Attribute data collection

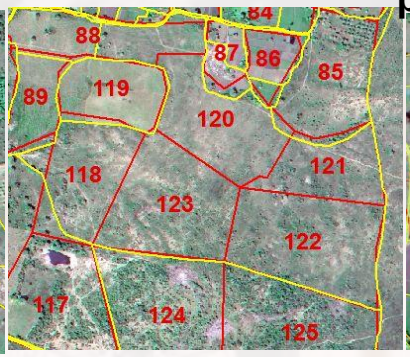
Due to industrialization

Bigger parcels



Survey numbers split into sub parcels due to inheritance

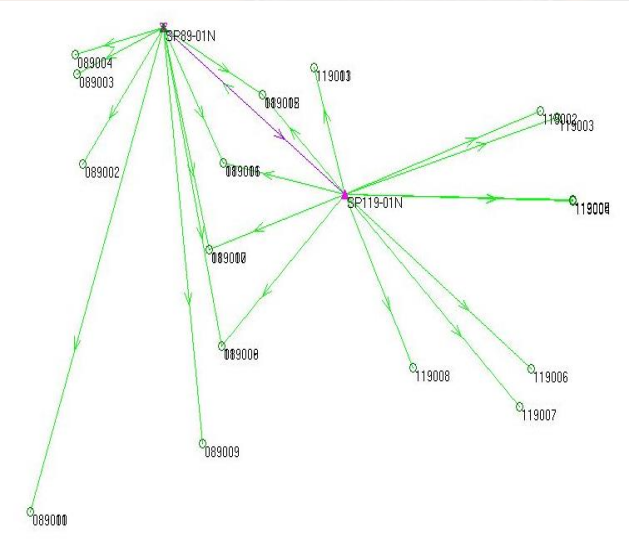




Old

New

GAGAN survey - Validation



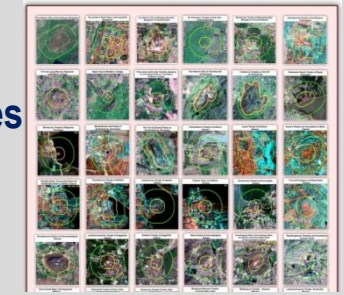
Sy. No.	Total Station (acres)	GAGAN (acres)	% Diff.
50	2.626	2.611	0.59
87	5.154	5.109	0.87
119	7.592	7.501	1.19
130	8.458	8.309	1.76
321	1.702	1.703	0.08
323	0.421	0.425	0.87
Average			0.8

Inventory & Site Monitoring plans for Heritage Sites and Monuments of National Importance

Activity I: Geodatabase Creation

- Geospatial Inventory of all notified 3658 heritage sites
- Preparation of site management plans

Database ready & available on Bhuvan

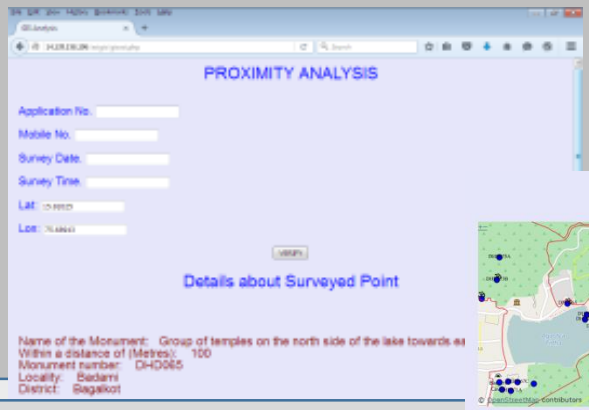


Prohibited Protected Regulated Zones

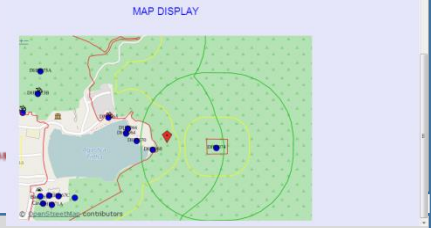
Ease of doing Business

Activity II: Location based services & Mobile apps

G2C Application : Smart Citizen App for online request processing



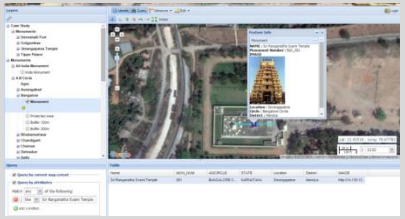
- Applicant's point

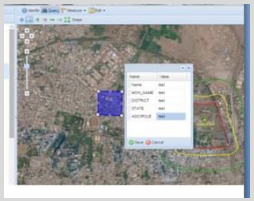


G2G Application : App

Empower ASI field Staff to Collect

- The Geocoordinates of Sites and Monuments
- Generate any Admin/Management Boundary around a site/Monument

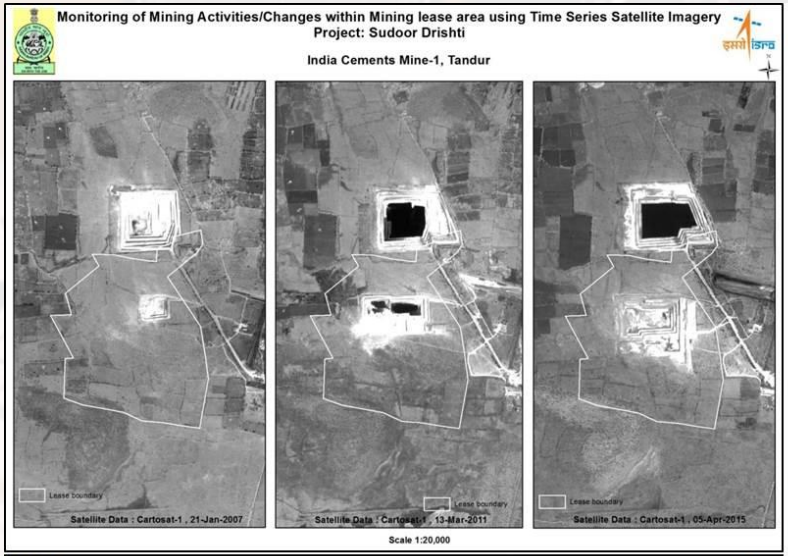


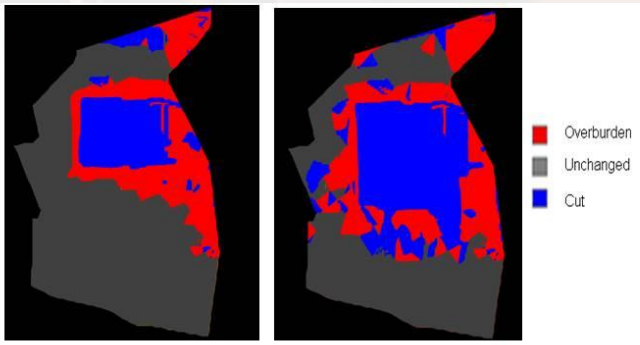


Smartphone based Android application

- Dual Option GPS
  - GAGAN
  - Inbuilt GPS

Monitoring of Mining Activities





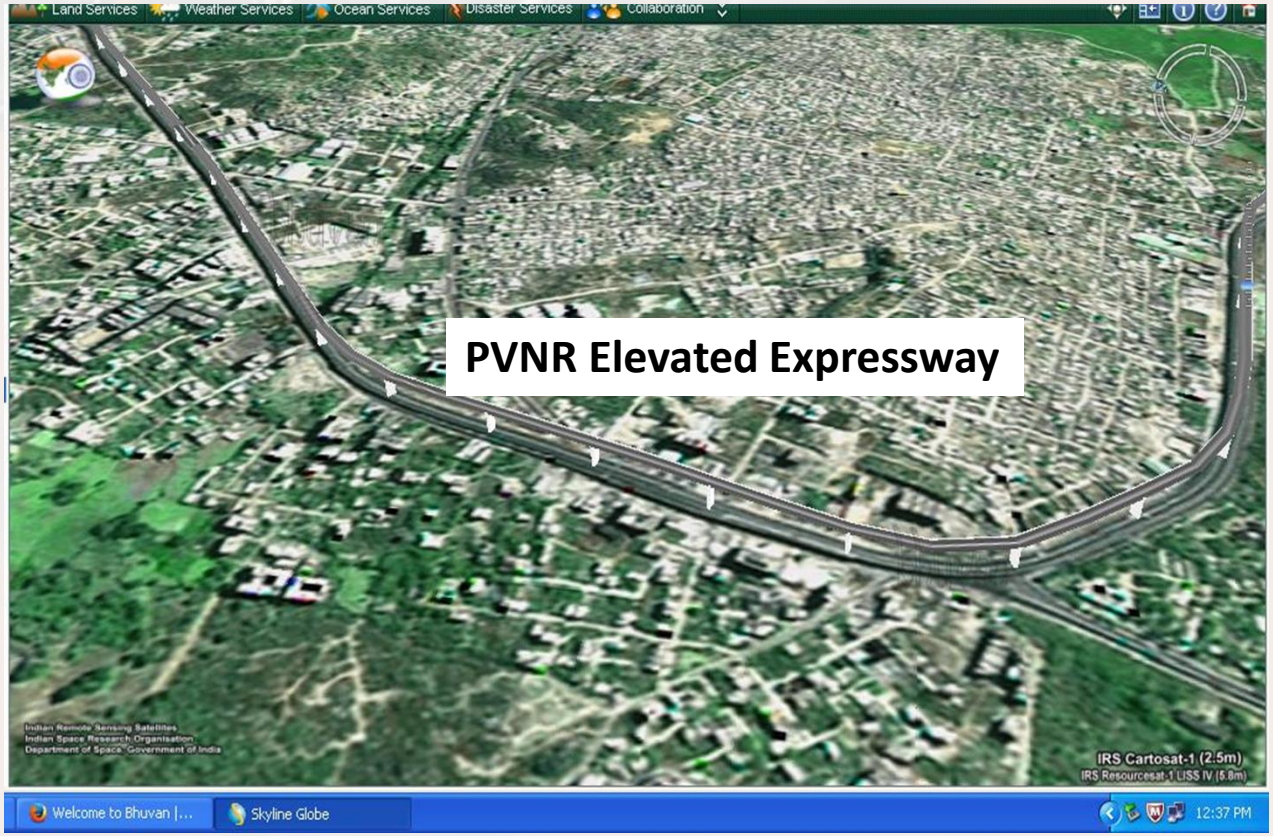
2007-2011 2007-2015

Year	Overburden volume (Cu.m)	Cut volume (Cu.m)
2007-11	172290.8	1717464.2
2007-15	253520.6	4238248.3

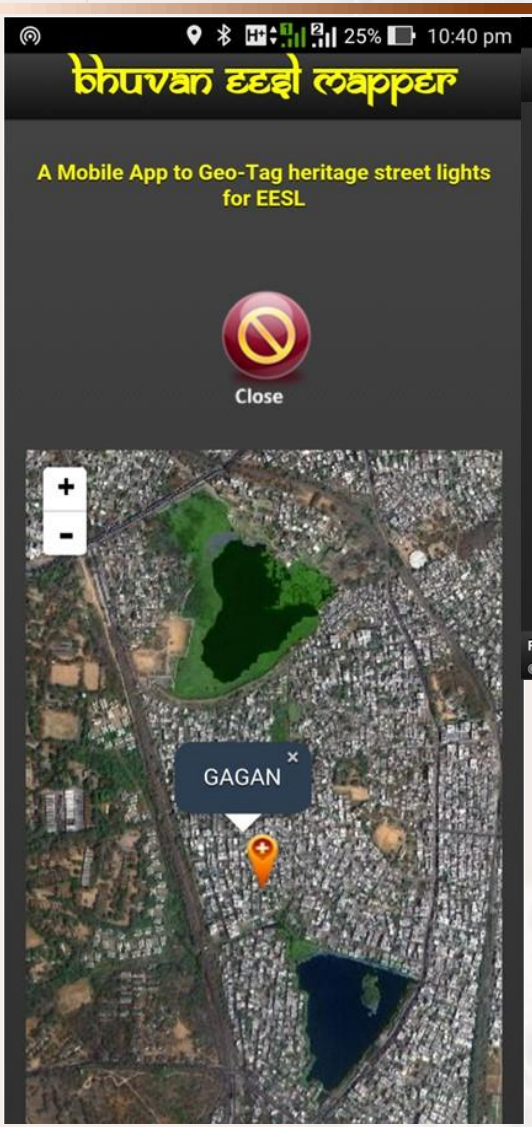
GAGAN MINE BOUNDARY MAPPING

Monitoring of Mining Activities

- GAGAN enabled SBAS receiver was used in the updation of transportation network features.
- Eg. bridges, flyovers etc., into existing large scale spatial databases.

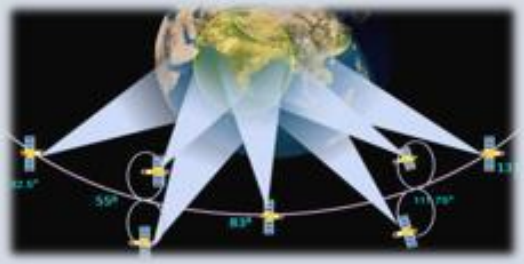


Mobile app with GAGAN Bluetooth Device



Heritage Light-5

- Bhuvan CCLA app to geo-tag Telangana Govt. leased land parcels using Bluetooth GAGAN receivers.
- Bhuvan Waqf app to map the properties of Waqf board using USB GAGAN receivers.
- g-Girdavari app to map the property boundary of Agriculture lands using USB GAGAN receivers.








Thank You