NavIC Applications

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NavIC/GNSS Applications

- ✓ Location and Time Tagging
- ✓ NavIC/GNSS in routing and fleet management related operations
- ✓ Mandatory use of NavIC/GNSS based tracking devices in public transport vehicles
- ✓ Rail and Air Transport
- ✓ Satellite Launch Vehicle
- ✓ Alerts, Forecast and Directives using text message features
- ✓ Disaster Management and Search & Rescue
- ✓ Time and Frequency Synchronizations
- ✓ Surveying and Mapping
- ✓ Precision Agriculture
- ✓ Atmospheric and Ocean Studies

Location and Time Tagging at Aadhaar Enrolment Centres

- Aadhaar numbers are used for unique identification of Indian citizens
- To prevent malpractices and forgery while generating these unique identification numbers are observed
- Location and Time tagging of Aadhaar Enrolment Centres ensures legitimate generation within the national boundaries
- Low-power, small-sized receiver modules with outdoor to indoor connectivity

✓ **Installation of about 100000 devices is planned**

Location Tracking

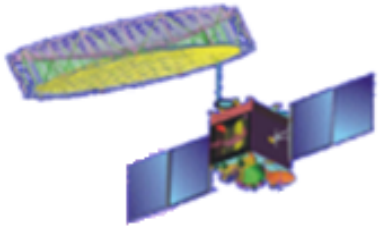
Land Vehicle Tracking through Cellular Network

- Mandatory use of NavIC based tracking devices in public transport for safety
- Road Transport and fleet management
- Real Time Train Information System

Land Vehicle Tracking through Satellite Communication

MSS Terminal + NavIC Rx

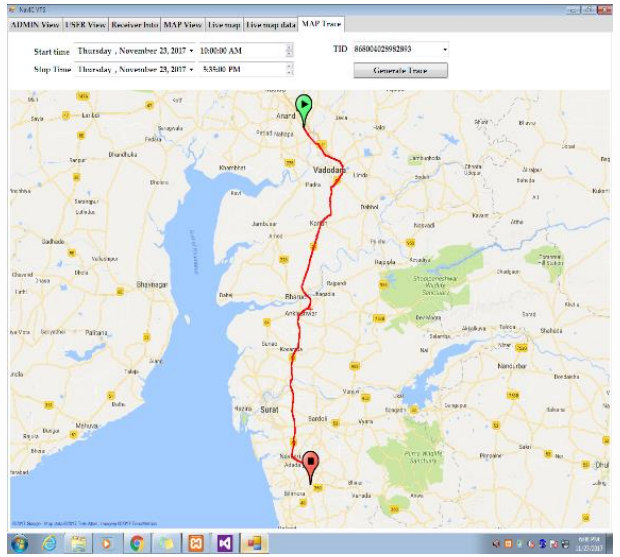
S Band



GSAT-6 Satellite

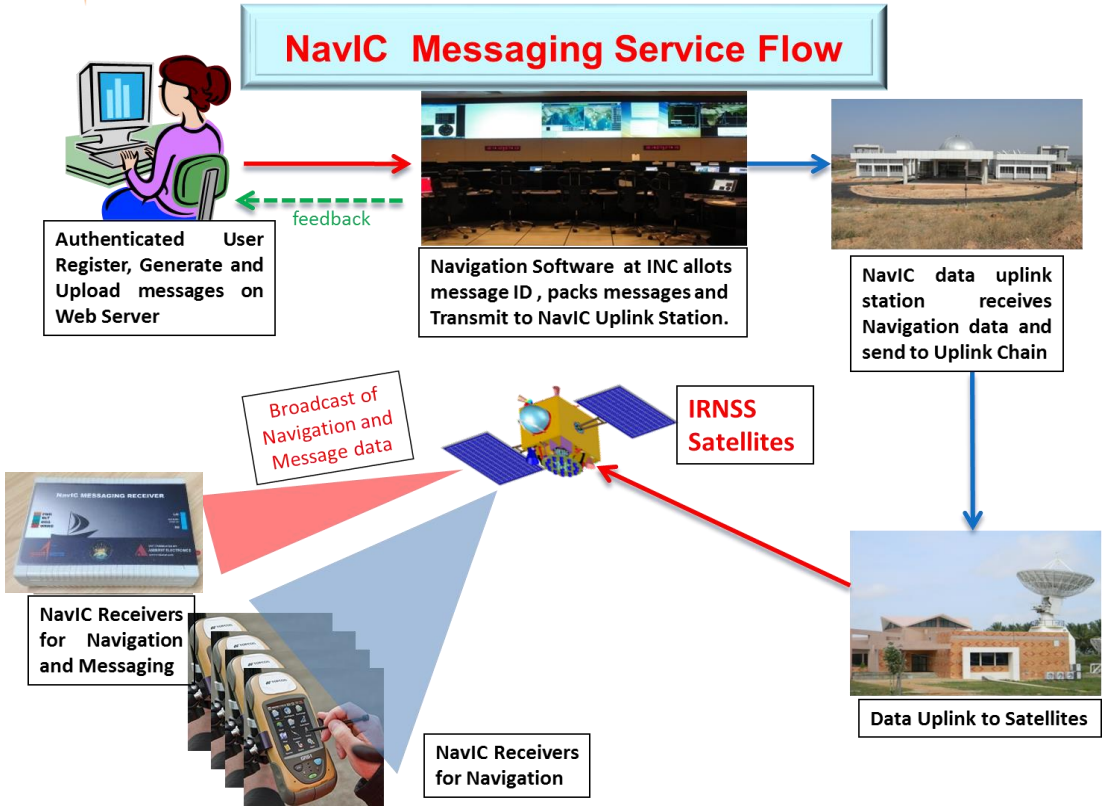
C Band

Earth Station



Client PC (Authorised User)

NavIC-based Messaging Service

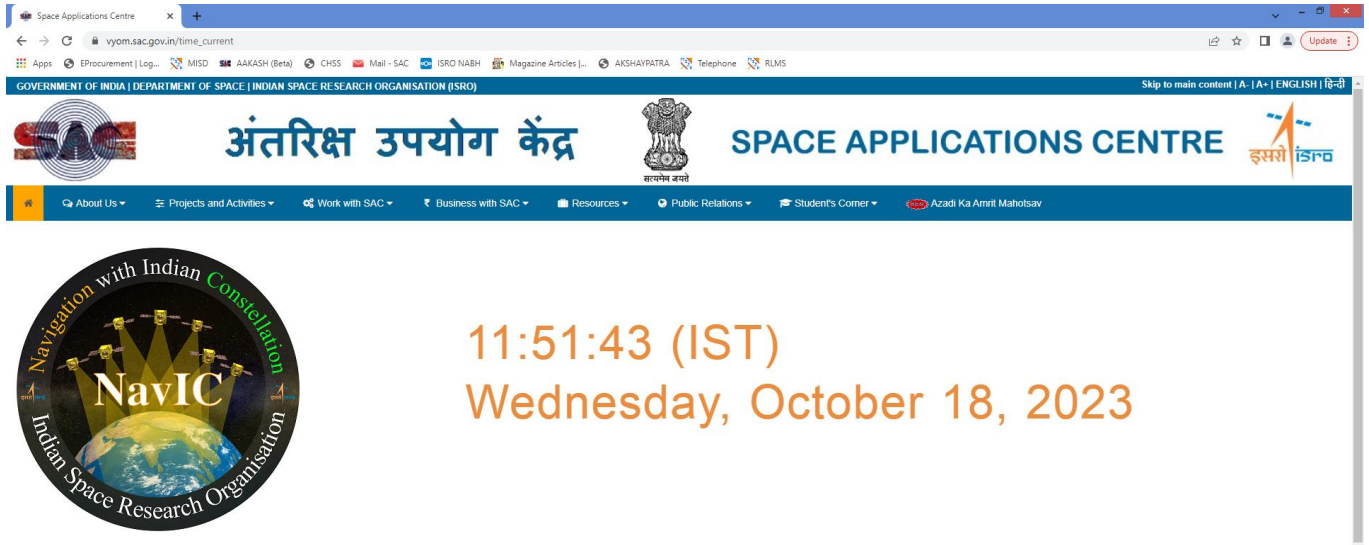


- Provision to send short text messages from NavIC Satellites
- Messages and Alerts in the case of disasters and exigencies
- Advisory and alert messages in deep sea to Fishermen
- Geo-fencing for International Boundaries
- Messages from Battery operated receiver to Mobile Application via Bluetooth link
- Two-way communication in conjunction with MSS terminals

Precise and Stable Time from NavIC System

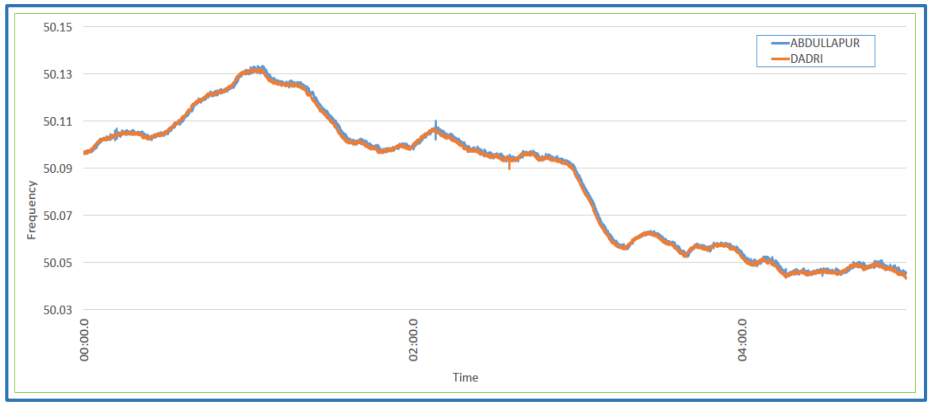
- Disseminate NavIC time on Internet
- Data Network synchronization
- Time server to Center for Railway Information System (CRIS)
- Remote Sensing satellite data time-stamping
- 1PPS disciplined 10MHz output for frequency reference

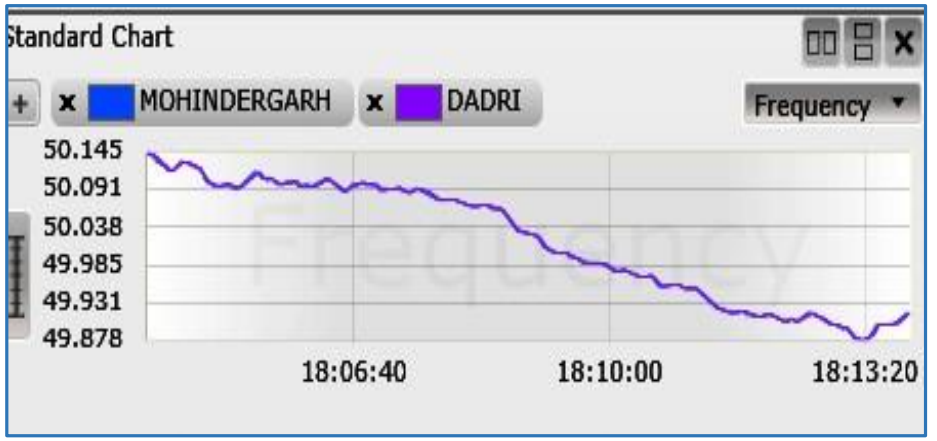
NavIC based time on Webpage:
https://sac.gov.in/Vyom/time_current.jsp



NavIC Timing in Power Grid

- NavIC Dual frequency receiver with IRIG Standard output for Phasor Measurements at National Power Grid sites
- Time stamping of power grid phasor measurements for Indian Power-grid control, measurements and monitoring applications





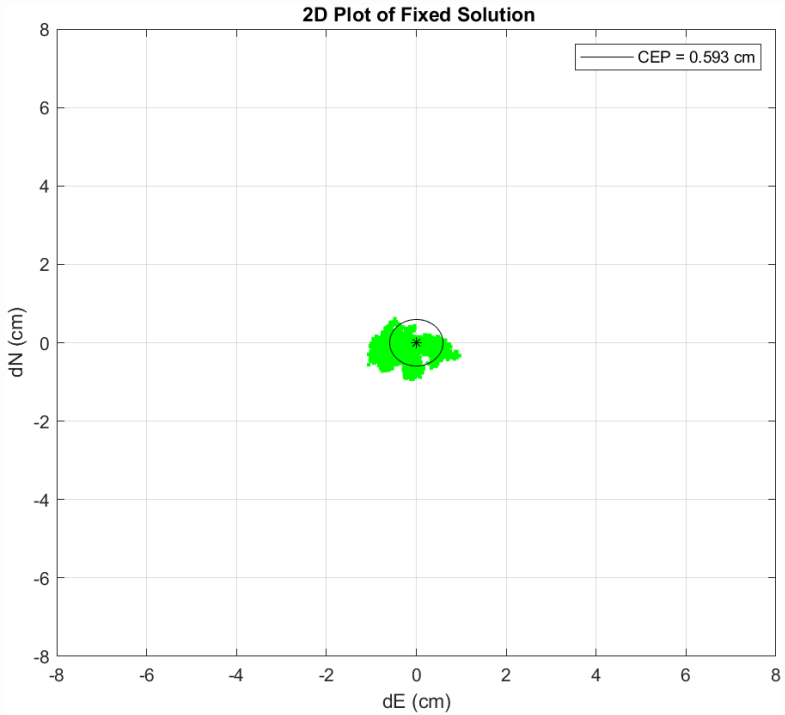
NavIC for High Accuracy Applications

Differential NavIC/NavIC based RTK

Base

Baseline

Rover



- **NavIC L5+S based CORS Receiver** for CORS Network and N-RTK
- Wider frequency separation (L5 & S) provides better mitigation of ionospheric errors
- Instantaneous Fixed Solution at longer baseline
- NavIC based RTK for surveying of reflectors for remote sensing satellite data calibration
- NavIC is incorporated in CORS Receivers of national and state surveying agencies

High Accuracy Positioning for Safety-of-life Applications using GAGAN/NavIC (1/2)

- Combination of Differential NavIC/GNSS and GAGAN based solution to achieve required accuracy with integrity for applications in Railway's Automatic Train Protection (ATP) system (KAVACH program)
- A combined approach with seamless switching between Differential NavIC/GNSS and GAGAN based on their availability during operation can ensure the required accuracy with integrity
- An integration with IMU and odometer sensors shall be done and a hybrid solution will be provided which shall be more robust and reliable in challenging environments
- Deriving integrity parameters for railways having diverse ground based scenarios

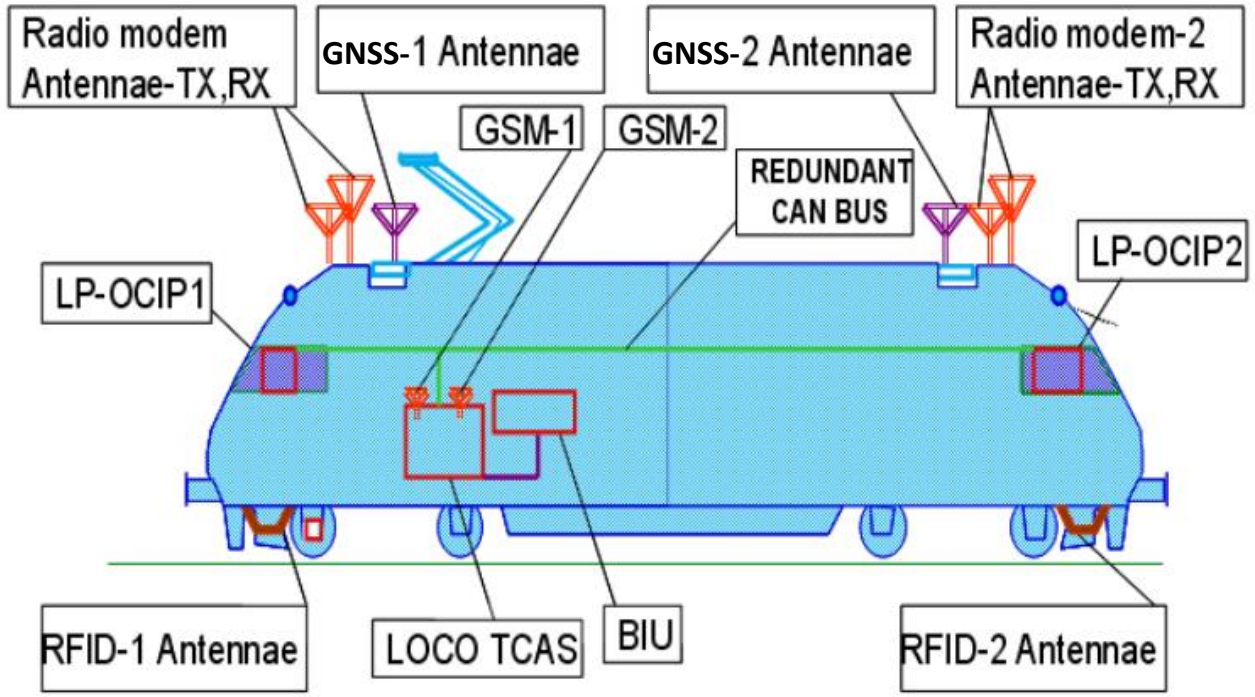
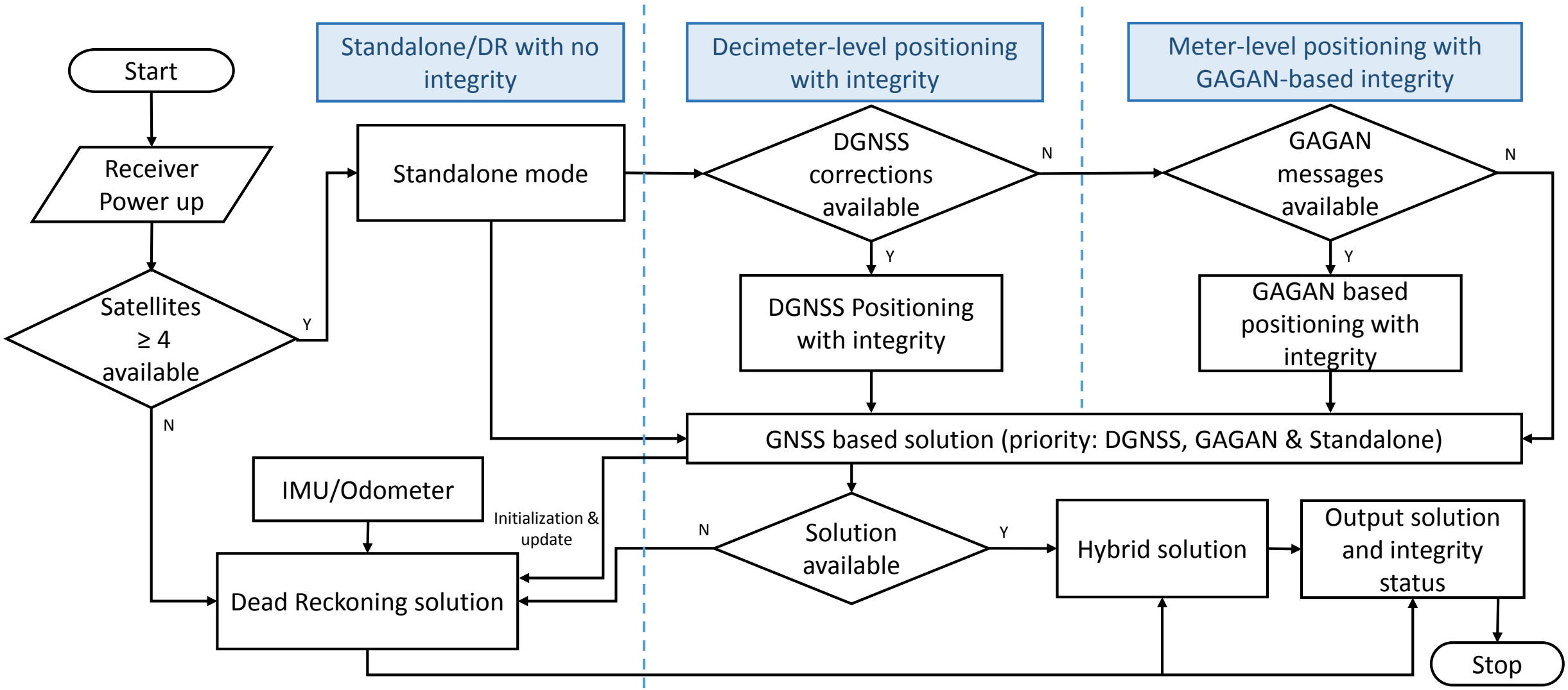


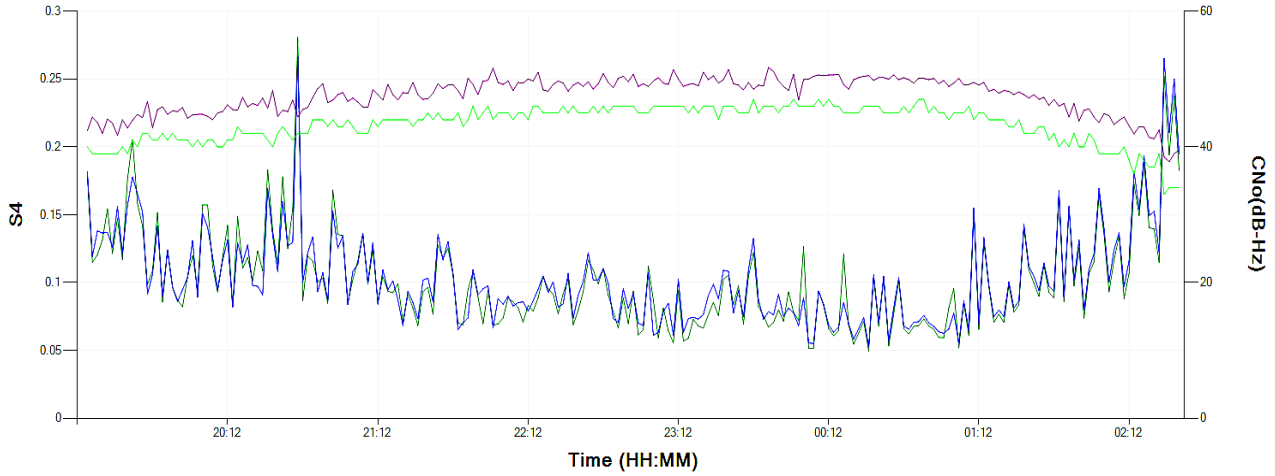
Image source: Handbook on Train Collision Avoidance System (TCAS) - An Indigenous ATP System, Ministry of Railways

High Accuracy Positioning for Safety-of-life Applications using GAGAN/NavIC (2/2)



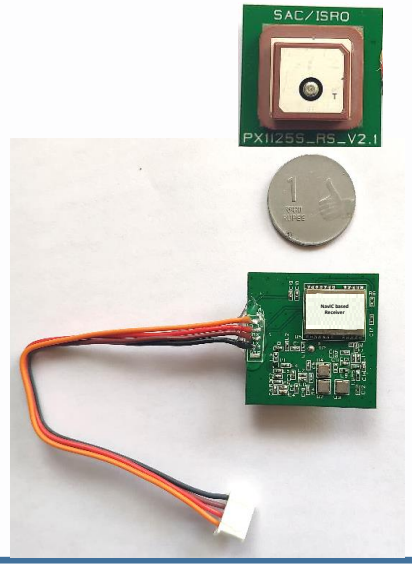
Atmospheric Study and Remote Sensing

Ionospheric Study



- Triple Frequency (L5+S+L1)
- Faster Measurement rate (50Hz)
- Scintillation parameters (S4 & sig-phi)
- TEC calculation (L5+S)

Atmospheric Profiling using Radio Sonde

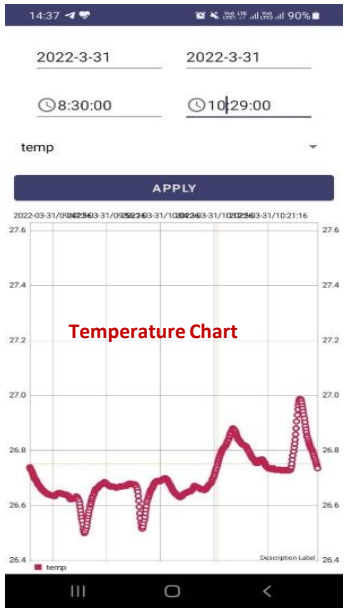


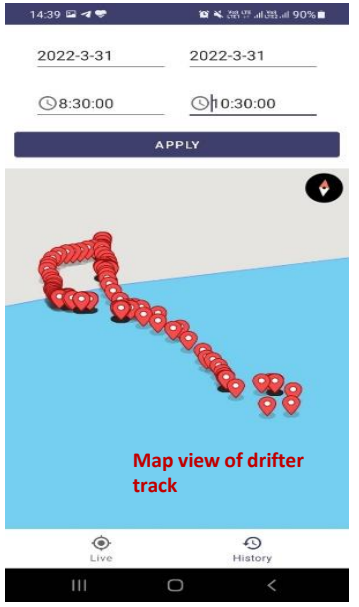
- Radio Sonde devices are used in atmospheric profiling
- Uses NavIC/GNSS receivers for getting Position, Velocity and Time information
- Battery operated, light weight, one-time usable
- Small size, light weight, low power and low cost
- Requirement of ~100000 devices per annum

Remote Sensing Drones

NavIC-based Drifter for Coastal and Marine Study

- Multi-parameter output in real-time i.e., Position, Temperature, Salinity, Turbidity, pH, DO, Speed and Direction
- Mobile App and Webserver for real-time download of charts and logged data
- Applications:
  - ✓ Rip current identification and monitoring
  - ✓ Bathing water quality monitoring
  - ✓ Search and Rescue
  - ✓ Oil spill monitoring
  - ✓ Bloom tracking
  - ✓ Pollution dispersion monitoring in the surf zone
  - ✓ Beach Nourishment effects
  - ✓ River and estuarine pollution monitoring
  - ✓ Coastal research & modelling





Thank You