

# GNSS Applications

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# GNSS Applications - 1

- Surveying, Mapping and Geodesy
- Transportation
  - Car Navigation, ITS, ADAS, V2X
  - Road Pricing, Toll Collection
  - Congestion Management
  - Railway Network
  - Marine : AIS, VMS
  - Aviation : SBAS / GBAS
  - UAV / DRONE
- Vehicle Accidents / Emergency Services
  - eCall/ ERA-GLONASS / E-911
- Tax / Insurance
  - Tax based on location or distance traveled

ITS: Intelligent Transport System  
ADAS: Advance Driving Assistance System  
V2X: Vehicle to Anything  
V2V: Vehicle to Vehicle  
AIS: Auto Identification System  
VMS: Vessel Monitoring System  
GCP: Ground Control Point

# GNSS Applications - 2

- Legal and Law Enforcement
  - Fishing Zone Management, Illegal Fishing Control
  - Crime Prevention
- Agriculture
  - Precise farming, Auto or Semi-Auto Driving of Tractors
  - Product Supply-Chain Management
- Location Based Applications
  - Services, Entertainment, Advertisement, Gaming, Marketing
- Warning during Disasters
  - EWS of QZSS, SAR of GALILEO
- Geo-Fencing / Geo-Securities
- Robotics
  - Navigation, Actions based on Location
- Scientific Applications
  - Space Weather : Scintillation, Radio Occultation, Plasma Bubble

EWS: Early Warning System

# GNSS Applications - 3

- Telecommunication
  - Synchronize cell towers
    - microsecond order for CDMA
    - Few hundred nanoseconds for 5G
  - Network Time Protocol
    - millisecond order
- Power Grid
  - Phase Synchronization between grids is required for higher efficiency and avoid power failures
- Time Stamping of
  - Financial and Banking Transactions
  - Legal, Clerical, Shipping Documents
- Scientific Timing Applications
  - Time stamping of events
    - e. g. Global VLBI Observation, earthquake occurrences, arrival of neutrino in particle physics



# GNSS based Fishery Management

- IUU (Illegal, Unreported and Undocumented) Fishing Control and Management
  - Protect marine ecology and biodiversity
  - Protect the livelihood of fishermen
  - Promote marine agriculture
  - Uplift life standard of people in the fishing sector
- Supply-Chain Control and Management
  - Let the end-customers know the sources of the marine products
  - Provides better price value
  - Branding of products
  - Controls Illegal products



May 2018



# Queensland (Australia) Monitoring Fishing Boats

Queensland to introduce mandatory GPS trackers for commercial fishermen to track sustainable catch

<https://www.youtube.com/watch?v=2qWTAZ8hmOY&t=77s>

## 4 Vessel Tracking Obligations

### 4.1 Vessel tracking requirements for all commercial fishing boats

Unless otherwise specified under this policy or the *Vessel Tracking Guidelines*, all commercial fishing boats (including primary and tender boats fishing under Commercial Fishing Boat Licences, Commercial Harvest Fishing Licences and Charter Fishing Licences) are required to have a vessel tracking unit installed and operational while undertaking commercial and non-commercial activities.

This obligation will commence from 1 January 2019 for all crab, net and line boats, and from 1 January 2020 for all other commercial fishing boats.

The vessel tracking unit must be an approved unit and installed and maintained in accordance with the Fisheries Queensland's *Vessel Tracking Installation and Maintenance Standards*.

Penalties apply for using a commercial fishing boat without an approved and operational vessel tracking unit.



<https://www.abc.net.au/news/rural/2017-10-20/queensland-introduce-mandatory-gps-trackers-commercial-fishing/9066936>

daf.qld.gov.au/business-priorities/fisheries/monitoring-compliance

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## Fisheries monitoring and compliance

The future of profitable commercial and enjoyable recreational fisheries relies on our natural resources being used in a sustainable way. This requires keeping a close eye on fish stocks and the performance of management arrangements for each fishery. By routinely collecting information from commercial and recreational fisheries using a range of monitoring programs, and assessing that information, we can make objective decisions to ensure the future of our resources.

- Fisheries
- Aquaculture
- Fisheries habitats
- Recreational fishing
- Commercial fisheries
- Sustainable fisheries
- Fisheries monitoring and compliance**
- Fisheries compliance
- Monitoring interactive map
- Fisheries monitoring and reporting
- Queensland Boating and Fisheries Patrol
- QFish
- FishNet
- Fisheries data
- Illegal fishing activities
- Fisheries contacts

Watch later Share

[Fisheries compliance](#)

Information about how fisheries legislation is monitored and enforced

[Monitoring interactive map](#)

Visual representation of the agency's monitoring program

[Fisheries monitoring and reporting](#)

Fisheries Queensland monitors recreational fishing and

[Queensland Boating and Fisheries Patrol](#)

Information on the Queensland Boating and Fisheries

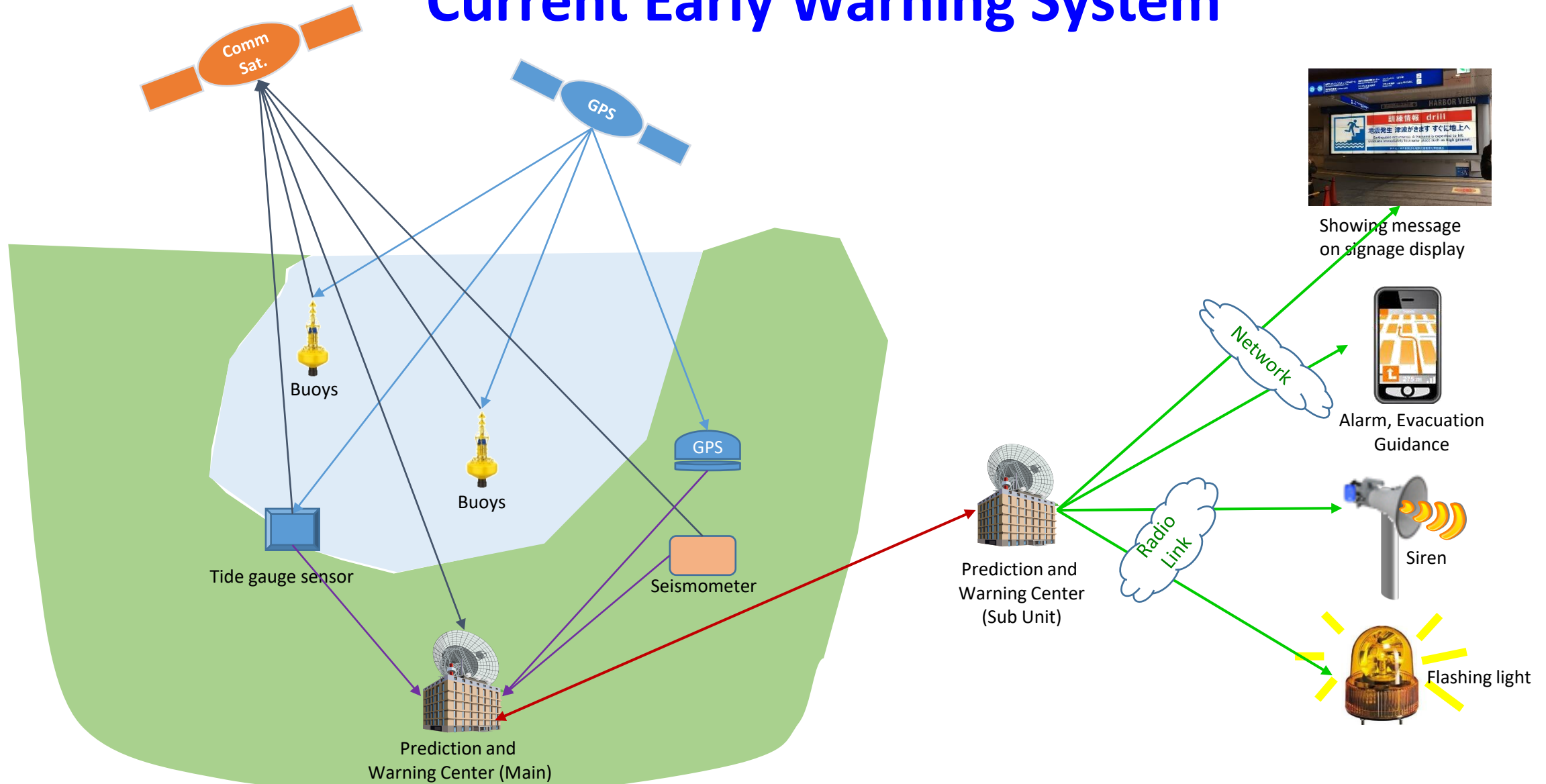
Link to Video:  
<https://www.daf.qld.gov.au/business-priorities/fisheries/monitoring-compliance>

## Early Warning System (EWS)

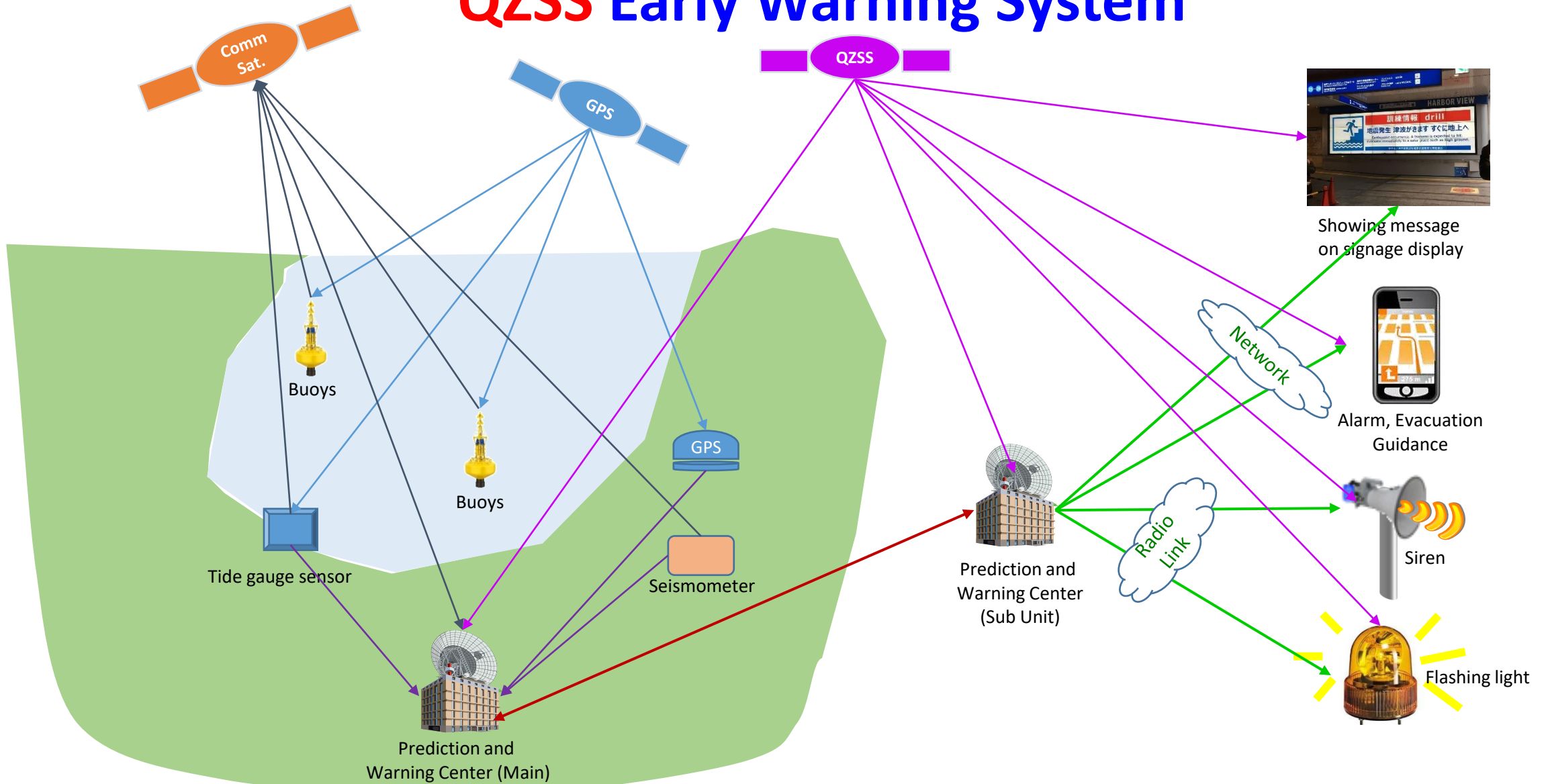
- Difficulty in reaching the people at risk or reaching to the “the Last Mile”
  - How to send alerts to people in the risk zones?
- Shutdown of power and communication systems due to Earthquake, Tsunami etc.
  - Alerts can't be send effectively
    - Mobile-phones, SMS, Internet, Social Media may not work
  - Even if mobile phone is working, due to bandwidth congestion, communications may not be established on time
    - Delayed arrival of alert message



# Current Early Warning System



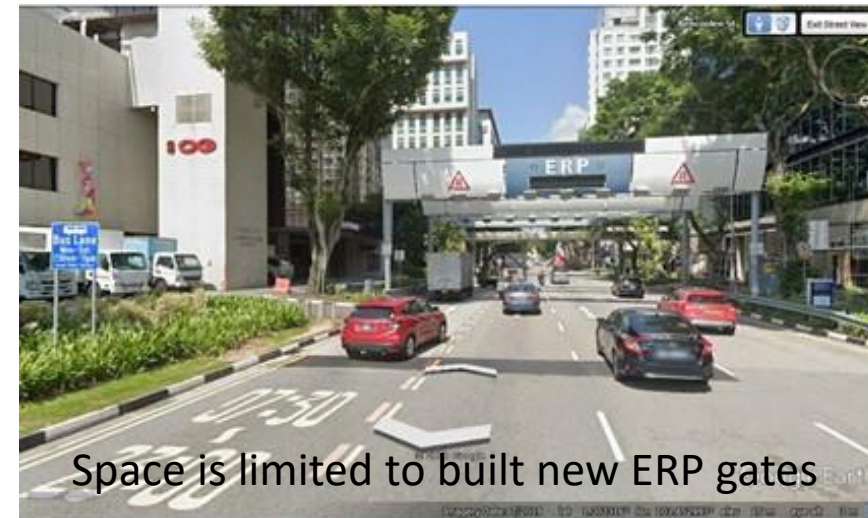
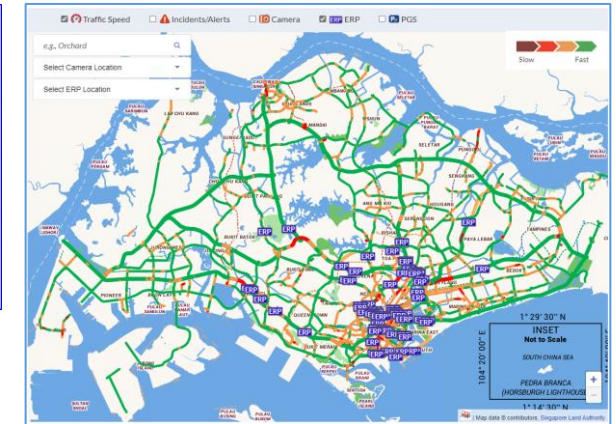
# QZSS Early Warning System



# Road Pricing System

## Singapore Case

- Singapore has already dedicated
  - 12% land for roads and 14% land for housing
- 45% households own a car
- Traffic Congestion Control is necessary for smooth traffic
  - Use ERP to charge the road users on some of the road sections.
  - ERP encourages the drivers to consider alternative routes
  - It also encourages to use public transports
- Singapore was the first country in the world to manage road congestion by implementing an **Electronic Road Pricing system (ERP)**.
  - ERP has since been used as a reference by other cities like London.
- ERP-2 is now being developed based on
  - Global Navigation Satellite System (GNSS) Technology



Space is limited to built new ERP gates

# Dynamic Road Pricing (DRP)

## DRP For:

- Gate-less Toll Charging
- Traffic Congestion Monitoring and Reduction
- Parking Service and Management
- Emergency Route Planning
- Vehicle Monitoring for Safer and Secure Services
- MaaS (Mobility As A Service)
- Micro-Mobility Services and Management
- Driver's Behavior Monitoring
- Traffic Data Analysis

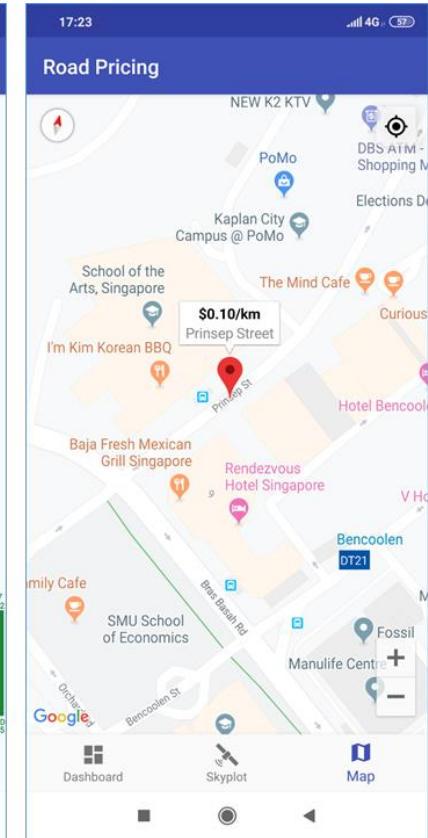
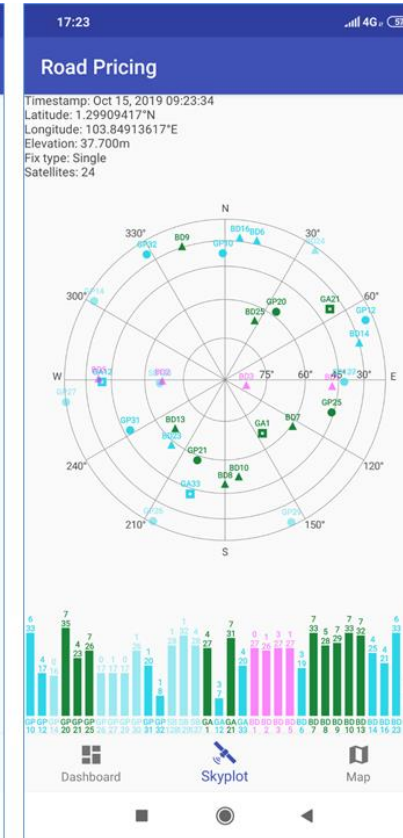
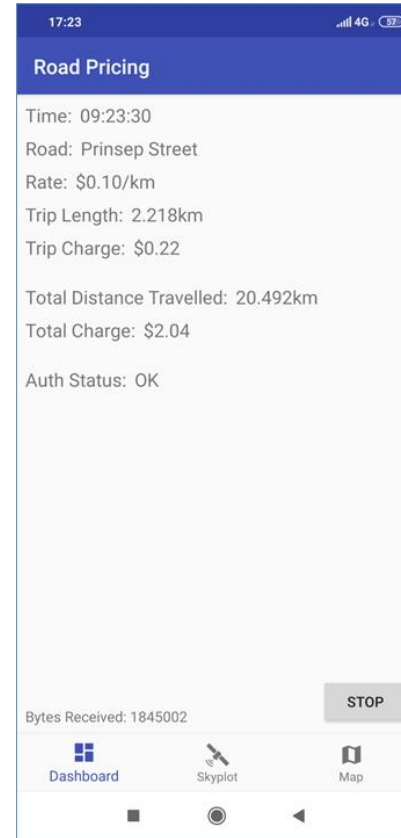
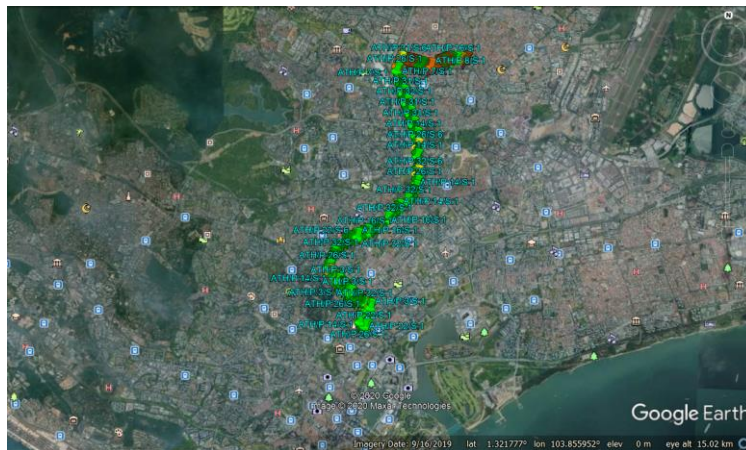
## Key Features of DRP:

- High-Accuracy Position Data
  - Lane-level positioning capabilities
- Secured and Certified Position Data
  - Using signal authentication and Position certification system to protect from spoofing, data tampering etc
- Proprietary AI based Technology
  - Prediction of traffic congestion in advance for better route management
- Cross-border Implementation System
  - The same system can work seamlessly regardless of national boundary
- Easy and Simple implementation in vehicles



# Dynamic Road Pricing

Toll Charging, Traffic Congestion Management, Traffic Monitoring





# City Environment Monitoring

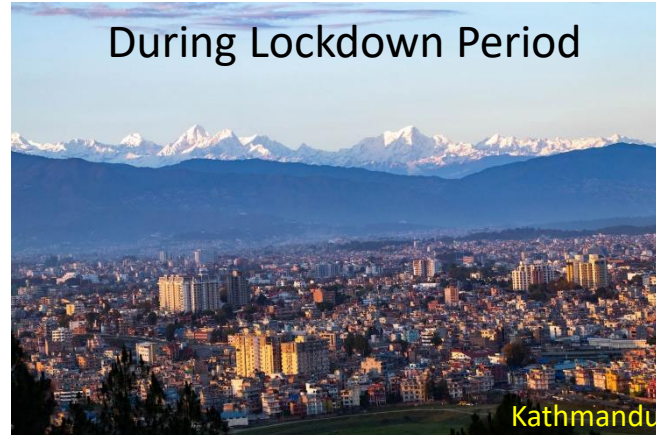
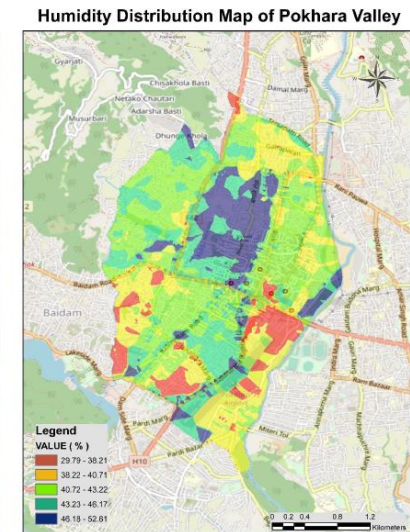
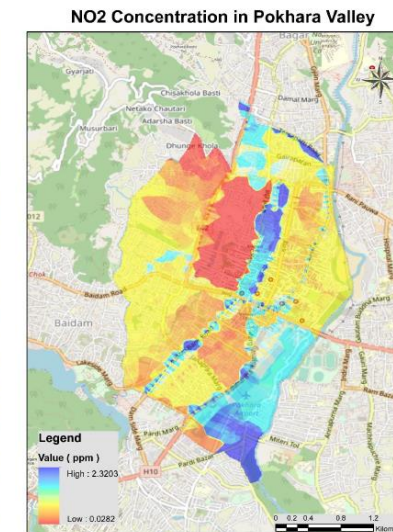
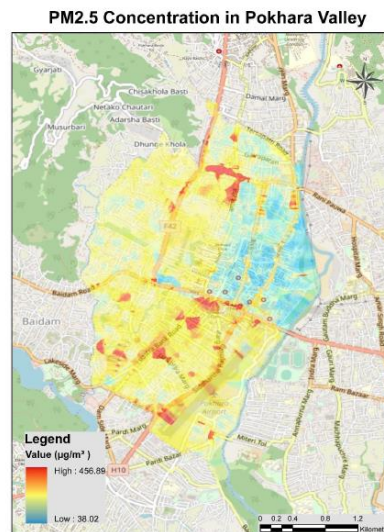
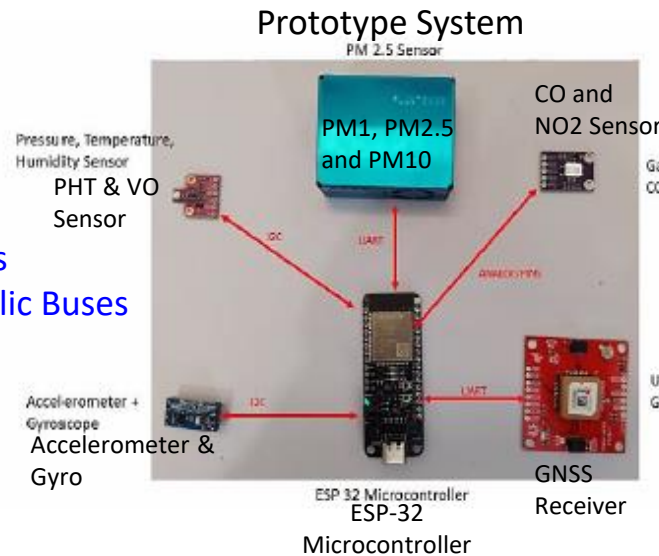


Photo Sources: [https://www.nepalitimes.com/here-now/nepals-smoky-mountains/?fbclid=IwAR31xbeCKSSj9\\_gNOAU7BKMquQAzTg0Z6J-LUTmtsZu9o7o9ozsddu8Z5Vo](https://www.nepalitimes.com/here-now/nepals-smoky-mountains/?fbclid=IwAR31xbeCKSSj9_gNOAU7BKMquQAzTg0Z6J-LUTmtsZu9o7o9ozsddu8Z5Vo)

- Monitor City Air Quality
- Dynamic and Real-Time
- Use Low-Cost Sensor Systems
- Implement the Sensor in Public Buses





# Sea Level Rise Measurement

## University of Philippines, Philippines

### MADOCA for Sea Level Rise Measurement

Explore MADOCA accuracy assessment for Sea Level Rise Measurement

