

GNSS for Policy and Decision Makers

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
 - 3-D Mapping without GCP
- Vehicle Accidents / Emergency Services
 - eCall/ ERA-GLONASS / E-911
- Taxation / Insurance
 - Taxation 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

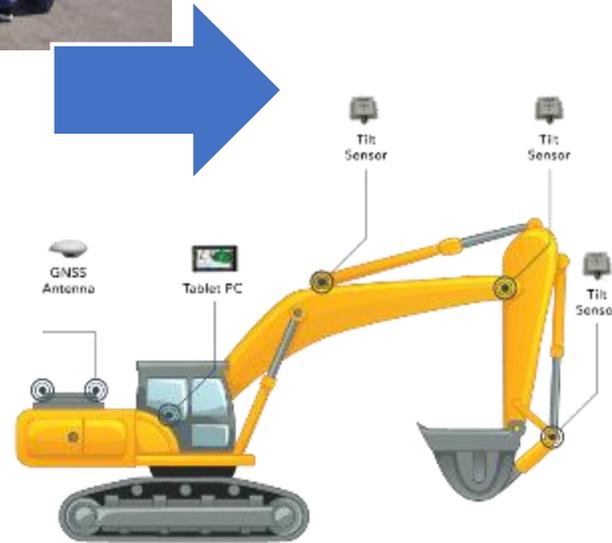
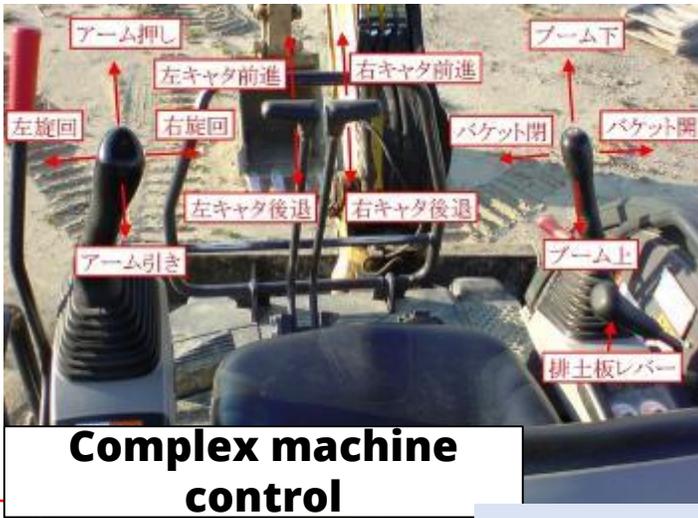
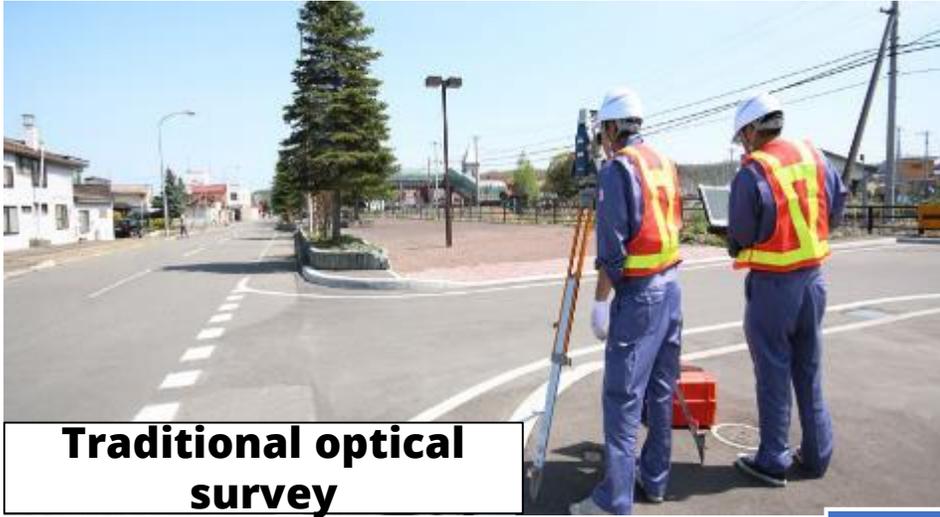
GNSS Applications - 3

- Telecommunication
 - Synchronize cell towers, microsecond order for CDMA
 - 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



2. RTK applications

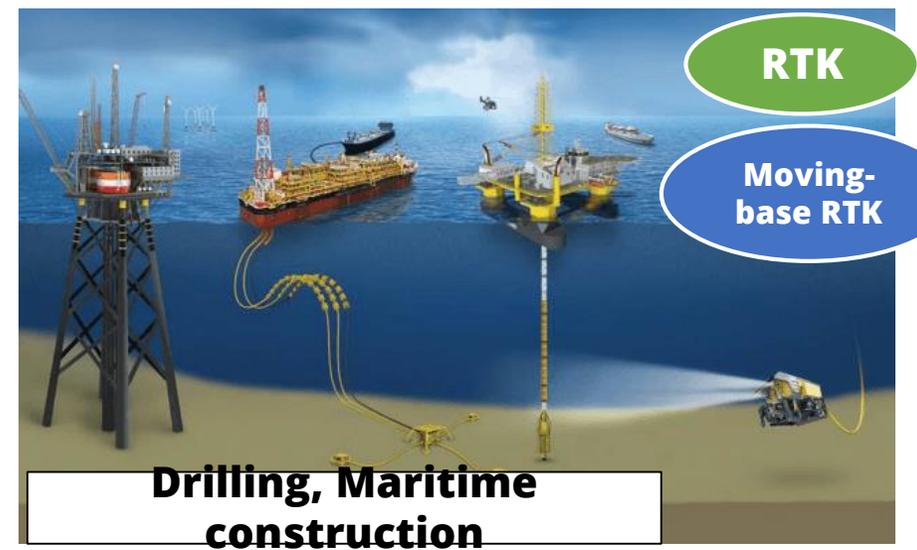
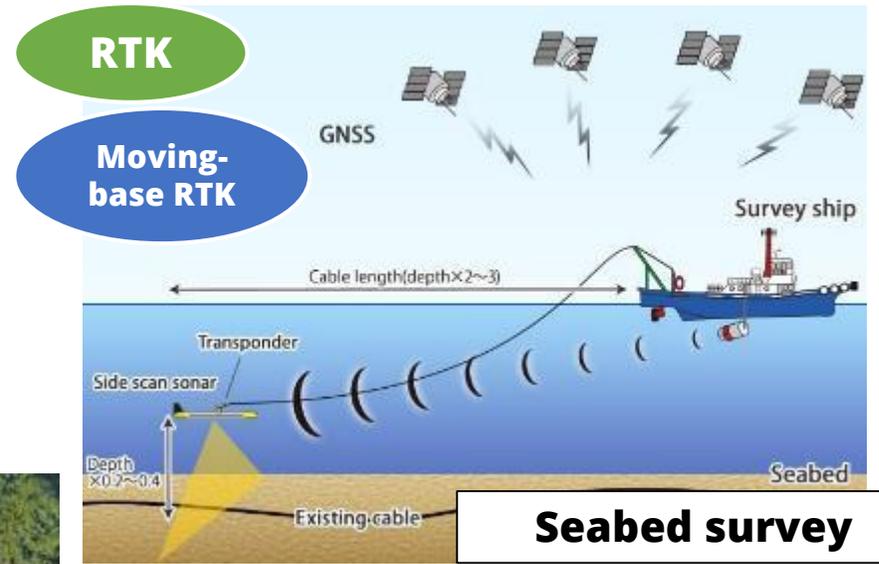
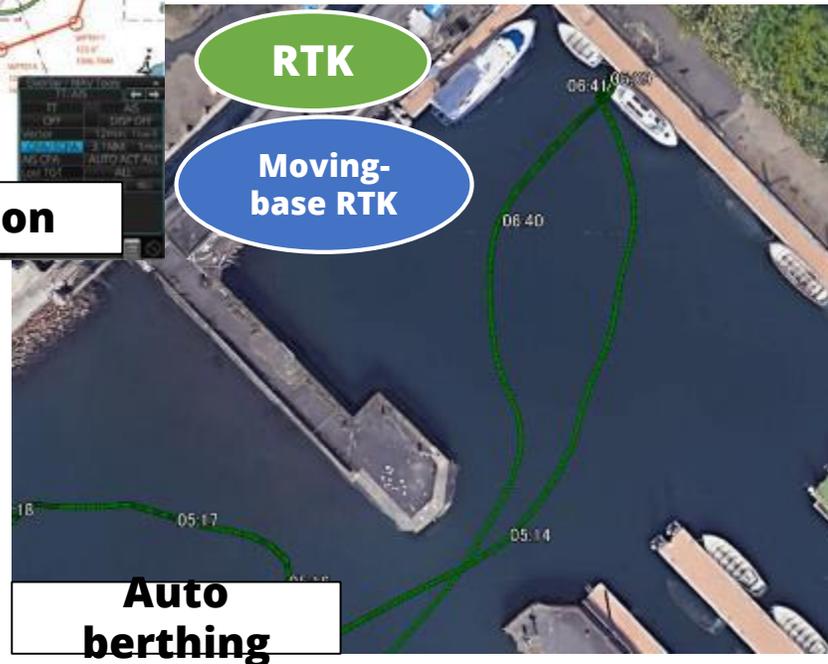
- Construction



2. RTK applications



- Maritime



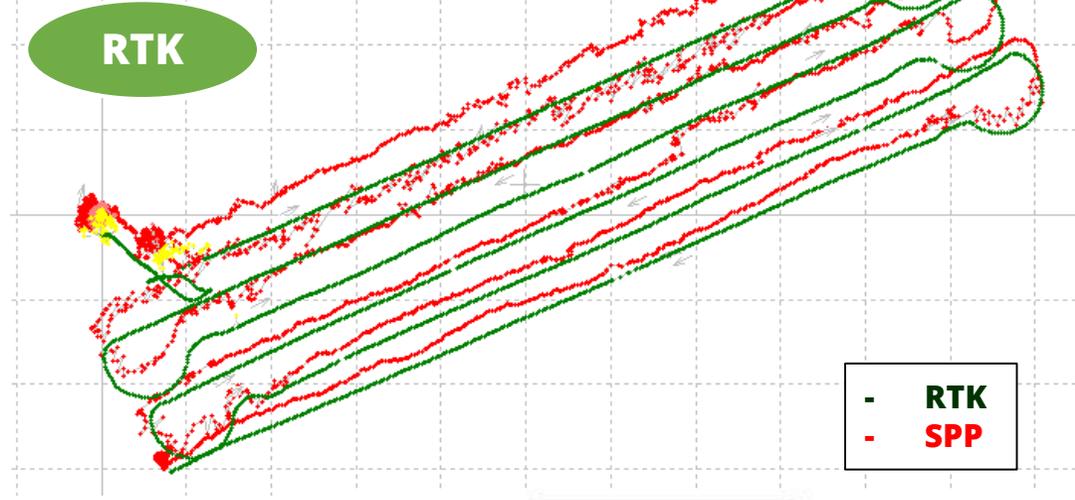
2. RTK applications

- Agriculture



Shift to young generation
Effective working

Agriculture Machinery Guidance



Queensland (Australia) Monitoring Fishing Boats

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

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>

The screenshot shows a web browser displaying the URL daf.qld.gov.au/business-priorities/fisheries/monitoring-compliance. The page features a navigation menu with options like 'Our organisation', 'Strategic direction', 'Business priorities', 'Contact us', and 'News and media'. A sidebar on the left lists various fisheries-related topics, with 'Fisheries monitoring and compliance' selected. The main content area is titled 'Fisheries monitoring and compliance' and includes a video player for 'Fisheries monitoring film' and several text-based links for 'Fisheries compliance', 'Monitoring interactive map', 'Fisheries monitoring and reporting', and 'Queensland Boating and Fisheries Patrol'.

Link to Video:

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

GNSS Field Demo for Fishing Management



May 2018

Presenting how GPS can help fishermen



About 50 local fishermen attended the program

May 2018

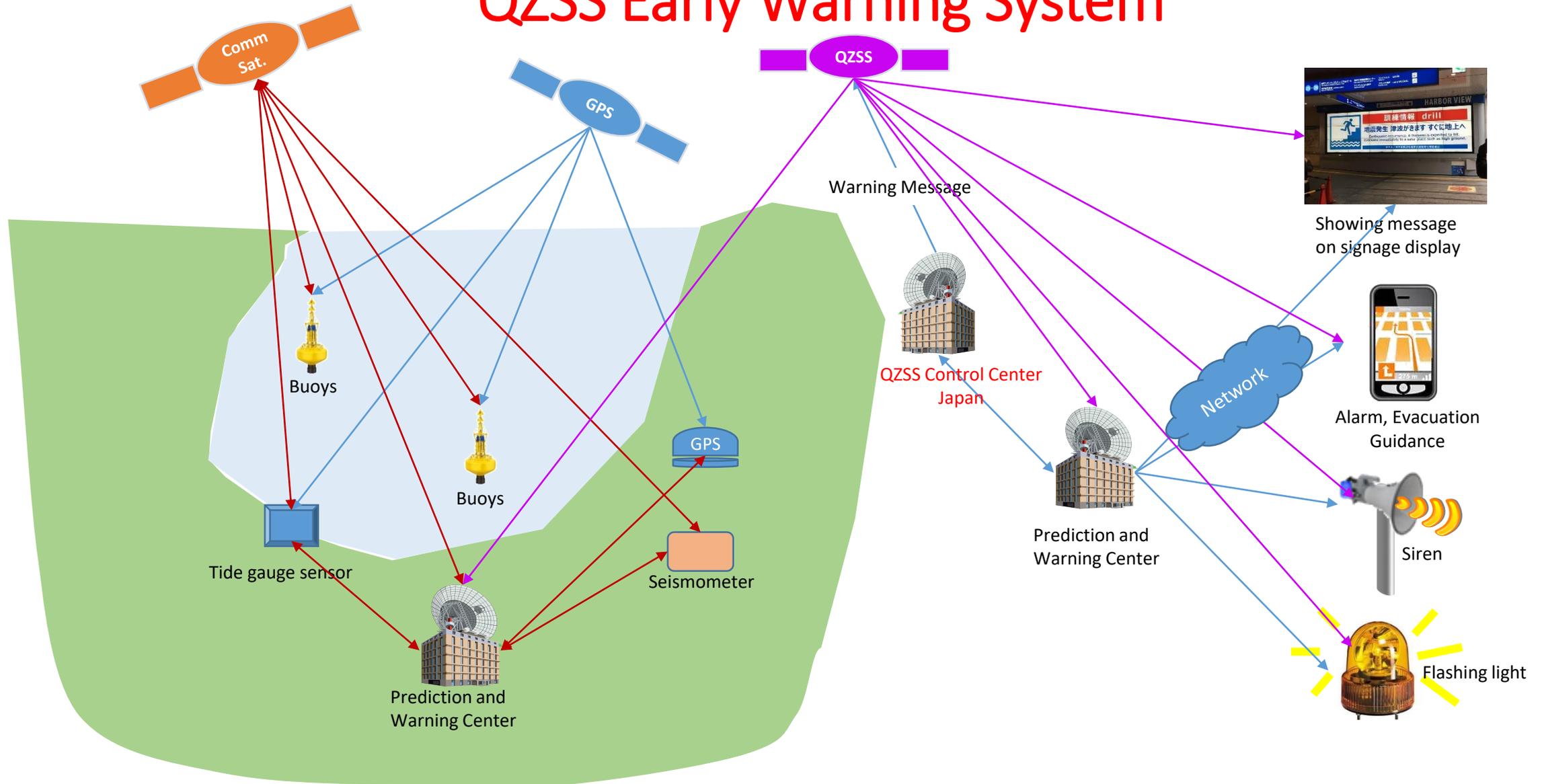
New Possibilities beyond Position and Time Data

- GNSS is not only for Position and Time
- Also capable of
 - Broadcasting Warning Messages during disasters
 - QZSS (Japan) EWS (Early Warning System)
 - GALILEO (Europe), in future
 - Search And Rescue Services (SAR)
 - GALILEO (Europe)

Problems of Early Warning System

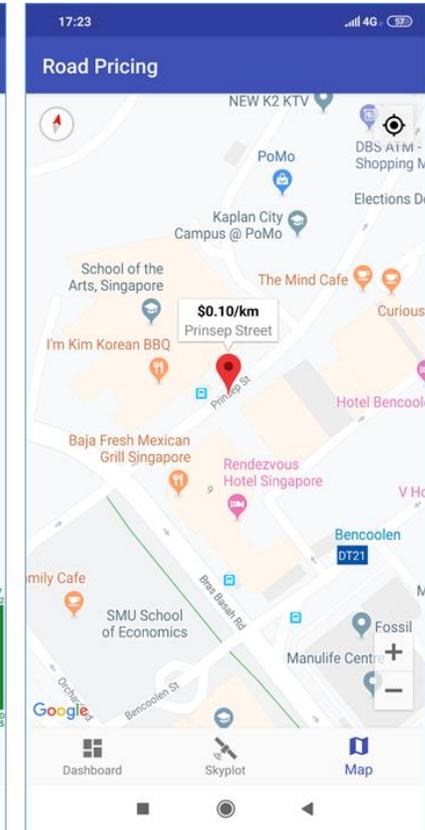
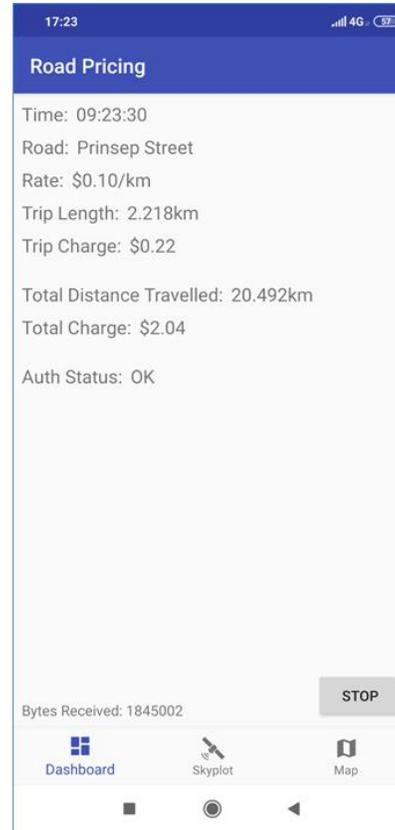
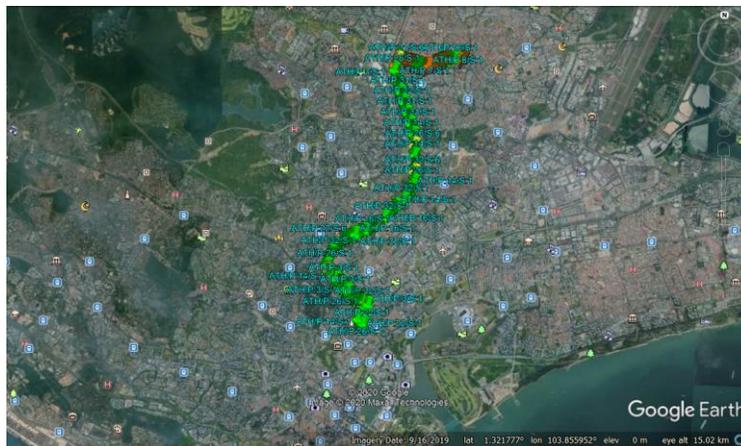
- Difficulty in reaching the people at risk or reaching to the “the Last Mile”
 - How to send alerts to people in the risk zones?
- Shutdown of power and communication systems due to Earthquake, Tsunami etc.
 - Alerts can't be send effectively
 - Mobile-phones, SMS, Internet, Social Media may not work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

QZSS Early Warning System



Dynamic Road Pricing

Toll Charging, Traffic Congestion Management, Traffic Monitoring



Dynamic Road Pricing



Green pins show points where GPS authenticated location data are available

Distance between two GPS observation points. In this case its about 160m.

Database of each GPS location point. It shows, 3D coordinates, satellite azimuth and elevation, signal quality, vehicle speed, authentication status

ATH/P:19/S:1

Variable	Value
SVID	GP
TIME	91122
NMEA TIME	141019011825
PRN_ID	19
Longitude	103.965
Latitude	1.31764
Height	11.5
Azimuth	60
Elevation	43
C/N0	31
Speed	93.896
STATUS	1
BitError	1

Directions: [To here](#) - [From here](#)

Dynamic Road Pricing

DRP For:

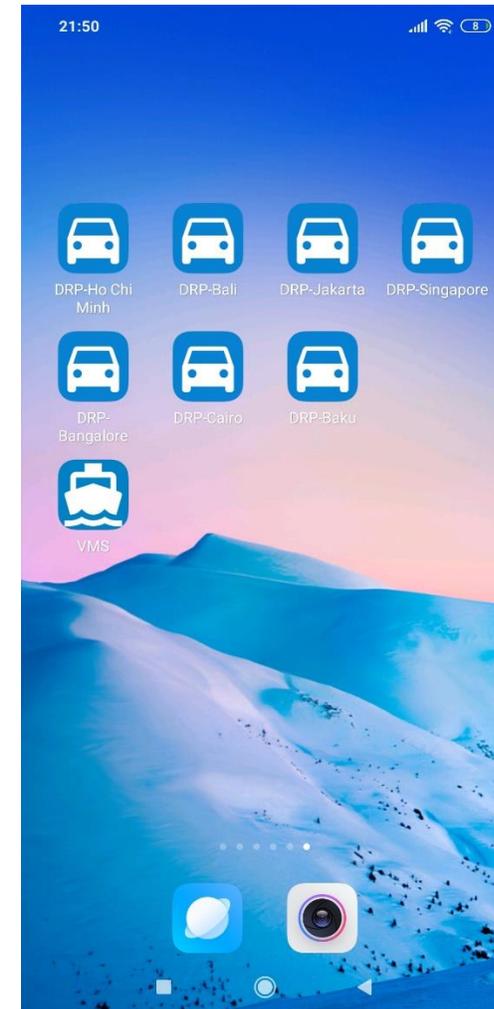
- Gate-less Toll Charging
- Traffic Congestion Monitoring and Reduction
- Parking Service and Management
- Emergency Route Planning
- Vehicle Monitoring for Safer and Secure Services
- MaaS (Mobility As A Service)
- Micro-Mobility Services and Management
- Driver's Behavior Monitoring
- Traffic Data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

- **DRP Prototype Systems:**
The prototype logs vehicle data with GNSS signal authentication.
- **DRP Prototype is ready for the following cities:**
 - ✓ Jakarta
 - ✓ Bali
 - ✓ Singapore
 - ✓ Ho Chi Minh
 - ✓ Cairo
 - ✓ Bangalore
 - ✓ Kathmandu
 - ✓ Baku
- **Some tests data are available for Singapore**



Contact and Additional Information

- Homepage

- Main Page : <https://home.csis.u-tokyo.ac.jp/~dinesh/>
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