

GNSS Education Activities The University of Tokyo

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Center for Spatial Information Science, The University of Tokyo

6th NOV 2018

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Overview

- Conduct GNSS Trainings, Workshops and Seminars
 - Basically in Asian countries
 - Indonesia, Laos, Malaysia, Myanmar, Nepal, Thailand, The Philippines Vietnam
 - Bangladesh, India, Singapore (planned in 2019)
 - Also, Some African Countries
 - Mozambique, Rwanda
- Conduct Webinars
 - Conduct webinars under MGA (Multi-GNSS Asia)
 - Global Access, Anybody can attend and free
 - Upto 100 participants online webinar at a time
 - Please register at <http://gnss.peatix.com>
- RPD (Rapid Prototype Development) Challenge
 - Encourage students and researchers to bring solutions and business values by solving real-life problems
 - The 1st RPD Challenge was done during MGA 2018 in Melbourne, Australia on 24th OCT 2018
- Develop Low-Cost High-Accuracy Positioning Systems (L-CHAPS)
 - Integrate low-cost receivers for RTK, PPK or PPP processing
 - Android or Raspberry Pi versions

GNSS Training at GIC/AIT, Thailand, 23 – 26 JAN 2018

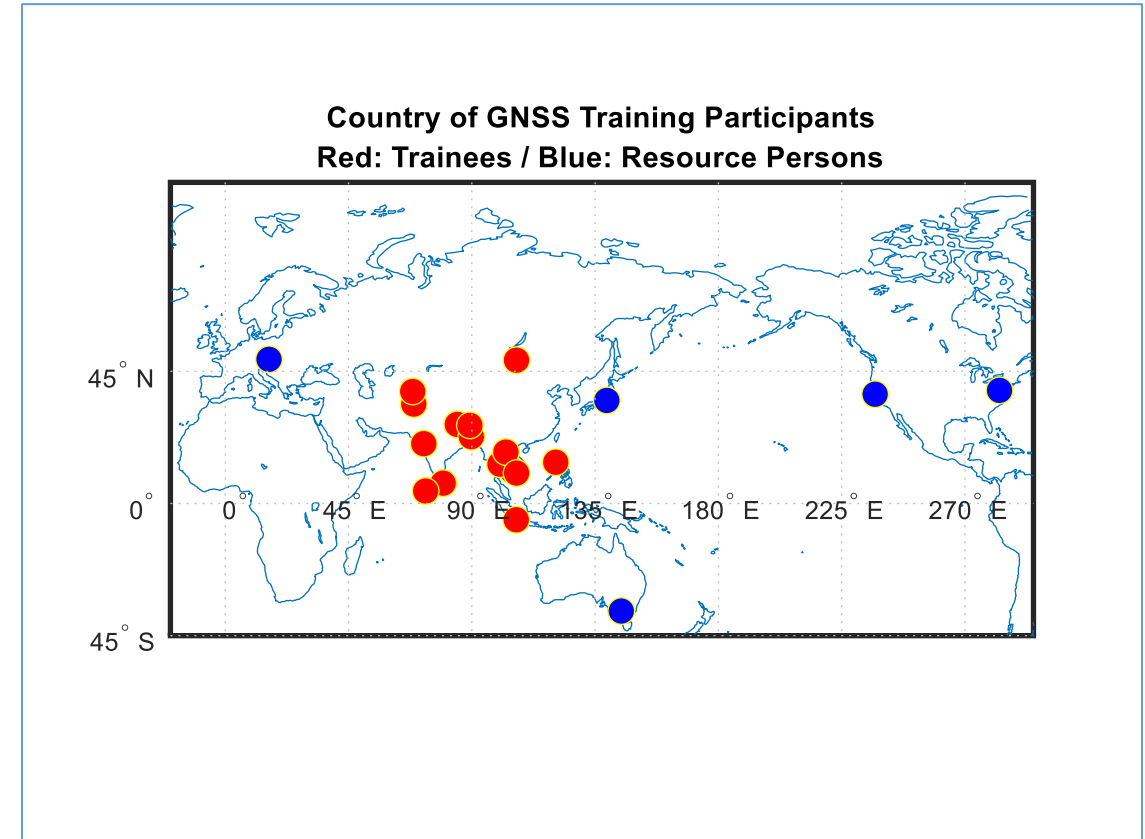
Jointly organized by CSIS/UT, GIC/AIT and ICG



Afghanistan, Australia, Austria, Bangladesh, Bhutan, Cambodia, India, Indonesia, Japan,
Maldives, Mongolia, Nepal, The Philippines, Sri Lanka, Tajikistan, Thailand,
The United States of America, Vietnam
64 Participants from 15 Countries

GNSS Training at GIC/AIT, Thailand, 23 – 26 JAN 2018

Total Participants	67
International Participants	25
Funded International Participants	(14)
Self-funded International Participants	(11)
Thai Participants	24
AIT Students and Researchers	18
Number of Countries	15 Afghanistan, Bangladesh, Bhutan, Cambodia, India, Indonesia, Japan, Maldives, Mongolia, Nepal, The Philippines, Sri Lanka, Tajikistan, Thailand, Vietnam
Number of Resource Persons (International)	7 (Australia: 1, Japan: 3, UNOOSA: 1, USA :2)
GIC Resource Persons	7



GNSS Training at GIC/AIT, Thailand, 23 – 26 JAN 2018



Day 1: Online Presentation

GPS Introduction : David Turner, State Dept. of the USA

GPS Signal Structure : Tom Stansell, Stansell Consulting, USA

1. Sharafat Gadimova, UNOOSA/ICG, Austria
2. Dinesh Manandhar, Associate Professor, The University of Tokyo, Japan
3. Yuichi Hayakawa, Associate Professor, The University of Tokyo, Japan
4. Nobuaki Kubo, Associate Professor, TUMST, Japan
5. Suelynn Choy, Associate Professor, RMIT University, Australia
6. David Turner, State Department, USA (online lecture)
7. Thomas Stansell, Stansell Consulting, USA (online lecture)
8. GIC/AIT resource persons and staffs

GNSS Training Courses : 14 – 18 JAN 2019

Jointly organized by CSIS/UT, GIC/AIT and ICG

GNSS Applications

- Surveying, Mapping and Geodesy
- Personal Navigation
- Legal and Law Enforcement
- Mapping during Disasters
- Precision / Geo-Security
- Agriculture
- Location Based Applications
- Warning / Early Detection
- Precision / Time-Synchrony
- Power Grid
- Scientific Timing Applications

GNSS for Policy and Decision Makers – Course: T131-18
A Seminar and Workshop Program
Jointly Organized by GIC/AIT, CSIS/UT and ICG

Introduction

The Global Positioning System (GPS) is widely used in almost all systems that require absolute position and time. It is due to its accuracy, availability and reliability. In addition to GPS of the United States, several other systems such as Global Navigation Satellite System (GLONASS) of the Russian Federation, the European global navigation system (Galileo) of the European Union, the BeiDou Navigation Satellite System (BDS) of China, the Indian Regional Navigation Satellite System (NavIC), India and the Quasi-Zenith Satellite System (QZSS), Japan are now available. Collectively, they are called GNSS (Global Navigation Satellite System). Today, a GNSS receiver can provide centimeter level accuracy even with a low-cost receiver, if an error correction technique is used. Thus, availability of low-cost and high-accuracy receivers will eventually increase GNSS related applications and its market. In order to keep the pace with these new applications and technological developments, it is necessary to develop human resources and skills.

Geoinformatics Center of Asian Institute of Technology (GIC/AIT) together with the Center for Spatial Information Science of the University of Tokyo (CSIS/UT) and International Committee on GNSS (ICG) are taking initiatives to create awareness on GNSS and its applications in Asia and the Pacific region. This program is a part of this initiative.

Course Schedule : 14 – 16 JAN 2019

The participants may also join the last 2 days of GNSS Training (Course T151-30) on 17 – 18 JAN 2019. These two days are dedicated for GNSS Field Survey, Data Analysis, and Accuracy Estimation etc. This will provide the participants more field experience on GNSS data logging and processing.

Seminar Place:
Geoinformatics Center, Asian Institute of Technology,
Pathumthani, Thailand

Why you should attend this program?

GNSS is not only for Surveying, Mapping and Geo- Navigation. It's used in many systems where position data are required. For example, tracking traffic congestion data, monitoring public transport for security and safety, automation in applications, dynamic population census, timing services in banking sectors and telecommunication systems, security and safety related applications, law-enforcement, law-enforcement, location as well as space weather.

If you are involved in the policy and decision making level of any infrastructure project or any of the above mentioned working field or even if you would like to learn how GNSS can be utilized in various applications, then you are invited to attend this course in order to enhance your knowledge of GNSS and its applications.

Objectives

This course is designed to give the participants:

- An introduction to GNSS, comprised of GPS, GLONASS, GALILEO, BDS, QZSS and NavIC
- Introduction to GNSS Applications and Application Samples
- An Introduction to GNSS Receivers, Antennas, Base-stations, RTK & PPP Services
- GNSS Survey procedures and achievable accuracies
- Introduction to GNSS related Software
- GNSS Data logging using Android devices for GIS Applications
- Field Survey experience using Low-Cost receiver for High-Accuracy positioning
- General Budget estimation to implement an in-house GNSS system for high accuracy
- Interpreting GNSS Technical Specifications

Deadline for Applications : 17th December 2018

Accommodation and Logistics

Participants can stay at the AIT Conference Center with a tariff of US\$ 40-50/night/person. Travel time from the Suvarnabhumi International Airport to AIT is usually one hour. Living cost inside the AIT campus is very reasonable and lunch/dinner cost may vary from 3 USD to 5 USD per meal.

Insurance

Participants are requested to obtain travel and medical insurance before entering in to Thailand.

Benefits

Upon completion of this course, the participants will be able to understand about how a GNSS system works, its applications, survey methods, interpretation of technical specifications, approximate budget and manpower estimation to implement GNSS. The participants will also have half-day GNSS field survey experience using low-cost receiver for high-accuracy

Costs:
The course registration fee is low for all participants. The participants have to bear all the following costs as listed below:

1. Travel costs from the participant's home-town to AIT, Thailand and back to home-town.
2. Hotel accommodation at AIT Center Hotel for the whole seminar/workshop period
3. All expenses for food, insurance, medical emergencies etc.
4. Any other expenses if any not listed here to cover the participant's expenses

APPLY NOW

www.gicait.or.th/ait, www.facebook.com/gicait, www.twitter.com/gicait
For further information please contact
Training Coordinator, Geoinformatics Center, Asian Institute of Technology,
P.O.Box 4, 14180 Luang, Pathumthani 12120, Thailand
T : +66 2524 5580 E : gicait@ait.ac.th
Applications can be downloaded from:
www.gicait.or.th/ait/download/GNSS_Application_T151.pdf
Past Training and Additional Information:
http://www.csis.u-tokyo.ac.jp/~dinesh/

GNSS Applications

- Surveying, Mapping and Geodesy
- Personal Navigation
- Legal and Law Enforcement
- Mapping during Disasters
- Precision / Geo-Security
- Agriculture
- Location Based Applications
- Warning / Early Detection
- Precision / Time-Synchrony
- Power Grid
- Scientific Timing Applications

Training on GNSS - Course: T151 - 30
Jointly Organized by GIC/AIT, CSIS/UT and ICG

Introduction

The Global Positioning System (GPS) is widely used in almost all systems that require absolute position and time. It is due to its accuracy, availability and reliability. In addition to GPS of the United States, several other systems such as Global Navigation Satellite System (GLONASS) of the Russian Federation, the European global navigation system (Galileo) of the European Union, the BeiDou Navigation Satellite System (BDS) of China, the Indian Regional Navigation Satellite System (NavIC), India and the Quasi-Zenith Satellite System (QZSS), Japan are now available. Collectively, they are called GNSS (Global Navigation Satellite System). Today, a GNSS receiver can provide centimeter level accuracy even with a low-cost receiver, if an error correction technique is used. Thus, availability of low-cost and high-accuracy receivers will eventually increase GNSS related applications and its market. In order to keep the pace with these new applications and technological developments, it is necessary to develop human resources and skills.

Geoinformatics Center of Asian Institute of Technology (GIC/AIT) together with the Center for Spatial Information Science of the University of Tokyo (CSIS/UT) and International Committee on GNSS (ICG) are taking initiatives to create awareness on GNSS and its applications in Asia and the Pacific region. This training course is a part of this initiative.

Course Schedule : 14 – 18 JAN 2019

Training Place :
Geoinformatics Center, Asian Institute of Technology,
Pathumthani, Thailand

Objectives

This course is designed to give the participants:

- An introduction to GNSS, comprised of GPS, GLONASS, GALILEO, BDS, QZSS and NavIC
- General overview of signal processing in receiver, receiver performance (low cost receiver vs. higher survey grade receiver)
- Introduction to RTK/B and related software for High-Accuracy GNSS Data Processing (RTKLIB, RTKDRDID, SW MAPS etc.)
- Field Survey using Low-Cost receiver for High-Accuracy positioning
- GNSS Data Processing for real time and Post-processing RTK and PPP
- GNSS Raw Data Processing logged by Android Device

Course Contents:

- Introduction to GNSS
- GNSS Signal Structure
- Signal Processing in Receiver
- Data Formats, Coordinate Systems etc
- Importance of Base Station
- GNSS Errors
- Applications of GNSS
- Survey Procedures – DGPS, RTK, PPP
- Use of Android Device for GNSS Survey
- Hands-on Training for RTK using RTKLIB, RTKDRDID etc
- Field Survey and Data Processing

Funding

Co-organizers have kindly agreed to provide limited financial assistance for travel for eligible participants and preference given to participants from the developing countries. Financial assistance will cover the travel costs only, and will NOT include expenses such as accommodation, food, insurance, medical emergencies etc. Please see below for an estimation of cost at AIT for Accommodation and Food.

The organizers reserve the right to selecting the participants for granting the financial assistance for travel.

Deadline for Applications
Requesting for travel funding : 31st October 2018
Self-funding : 17th December 2018

Accommodation and Logistics

Participants can stay at the AIT Conference Center with a tariff of US\$ 40-50/night/person. Travel time from the Suvarnabhumi International Airport to AIT is usually one hour. Living cost inside the AIT campus is very reasonable and lunch/dinner cost may vary from 3 USD to 5 USD per meal.

Insurance

Participants are requested to obtain travel and medical insurance before entering in to Thailand.

Benefits

Upon completion of this course, participants will be able to understand about how a GNSS receiver works, its applications, survey methods and data processing for high-accuracy in real-time or post-processing modes.

Course Schedule
14 – 18 January 2019 (5 days, 40 hours)

Training Costs:
The training fee is free for all participants. The participants have to bear the following costs:

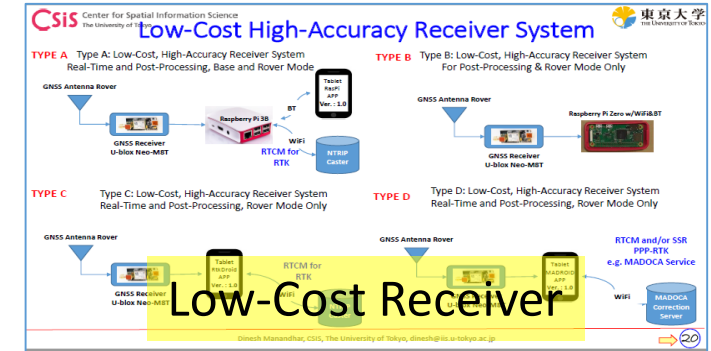
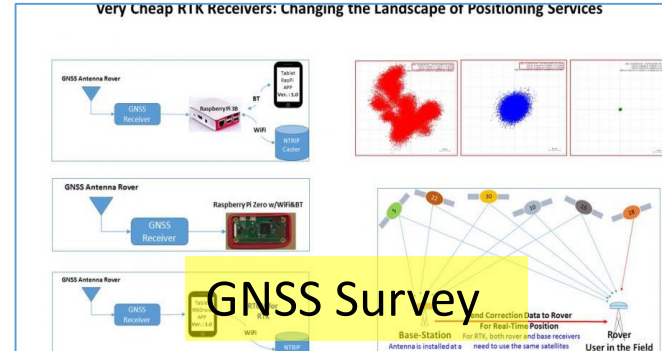
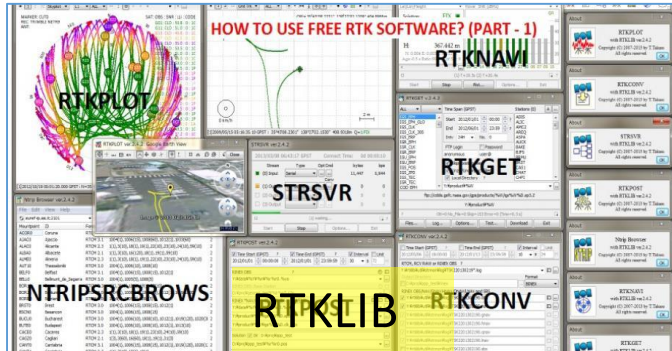
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2. Hotel accommodation at AIT Center Hotel for the whole seminar/workshop period
3. All expenses for food, insurance, medical emergencies etc.
4. Any other expenses if any not listed here to cover the participant's expenses

APPLY NOW

www.gicait.or.th/ait, www.facebook.com/gicait, www.twitter.com/gicait
For further information please contact
Training Coordinator, Geoinformatics Center, Asian Institute of Technology,
P.O.Box 4, 14180 Luang, Pathumthani 12120, Thailand
T : +66 2524 5580 E : gicait@ait.ac.th
Applications can be downloaded from:
www.gicait.or.th/ait/download/GNSS_Application_T151.pdf
Past Training and Additional Information:
http://www.csis.u-tokyo.ac.jp/~dinesh/

- GNSS Training : 5 days Training Course
- GNSS for Policy and Decision Makers : 3 days Seminar + Workshop

MGA GNSS Webinar



GNSS Survey

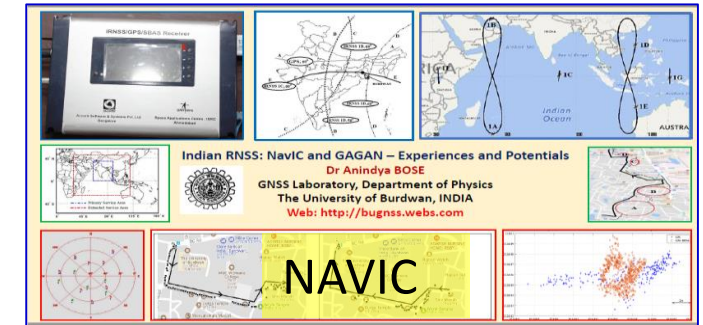
Low-Cost Receiver



GNSS Vulnerability



Dynamic Map



NAVIC

Upcoming Webinars: (1) RTK from Android GNSS Raw Data (2) Early Warning System (3) GNSS Signal Authentication (4) PNT from Micro/Cube Satellites and many more.....

Webinar Registration : <http://gnss.peatix.com>

Past Webinar Reference: <https://home.csis.u-tokyo.ac.jp/~dinesh/WEBINAR.htm>

We need YOU as a Resource Person. Please contact us.....
Dinesh Manandhar, CSIS, The University of Tokyo, dinesh@iis.u-tokyo.ac.jp

MGA GNSS Webinar

MGA Webinar Series : 1
Very Cheap RTK Receivers:
Changing the Landscape of Positioning Services

Dinesh Manandhar
Center for Spatial Information Science
The University of Tokyo
Contact Information: dinesh@iis.u-tokyo.ac.jp
25th May 2018

MGA Webinar Series : 5
Threats to GNSS : Can We Falsify GPS Data?

Dinesh Manandhar
Center for Spatial Information Science
The University of Tokyo
Contact Information: dinesh@iis.u-tokyo.ac.jp
22nd June 2018

GNSS Online Lecture # 1
Lecture ID: WT-103-401
Lecture Topic: GNSS Data Processing in RTKLIB

Dinesh Manandhar
Center for Spatial Information Science
The University of Tokyo
Contact Information: dinesh@iis.u-tokyo.ac.jp
11th May 2018

MGA Webinar 1st June

How to use free RTK Software?

Tokyo Univ. of Marine Science and Technology: Nobuaki Kubo

MGA Webinar by Prof. N. Kubo

MGA Webinar

Automated Driving Systems and Dynamic Map

15th June 2018
Satoru Nakajo
Spatial Information Business team leader,
Mitsubishi Research Institute Inc.

MGA Webinar by Dr. Nakajo

Multi-GNSS Asia Webinar #7 July 20, 2018

GNSS Applications from Daily Life to Plantations

Naohiko KOHTAKE, Ph.D., PMP.
Professor, Grad. School of System Design and Management, Keio University
Steering Committee Member, Multi-GNSS Asia
Adjunct Prof., School of Engineering, Asian Institute of Technology
<http://www.sdm.keio.ac.jp/> <mailto:kohtake@sdm.keio.ac.jp>

MGA Webinar by Prof. Kohtake

Single Point Positioning RTK

Fish!

MGA Webinar by Prof. N. Kubo

IRNSS/ NavIC- Indian Effort towards a regional independent satnav

An independent regional navigation satellite system being developed by Indian Space Research Organization (ISRO).

Designed to provide accurate position information service to users in India as well as the region extending up to 5500 km from its boundary (primary service area).

MGA Webinar by Dr. Bose, India

Early Warning System

MGA Webinar by Prof. Kohtake

Past Webinar Reference: <https://home.csis.u-tokyo.ac.jp/~dinesh/WEBINAR.htm>

MGA 2018 & (YP/S) Young Professional & Student Forum

- ICG provided Travel Funding to SIX Participants from Asia to attend MGA 2018 in Melbourne
 - India (2), The Philippines (2), Thailand (1), Vietnam (1)
- YP/S : Forum for interaction between the students, researchers and professionals
 - A networking event between the YP/S Forum participants and industry representatives were held



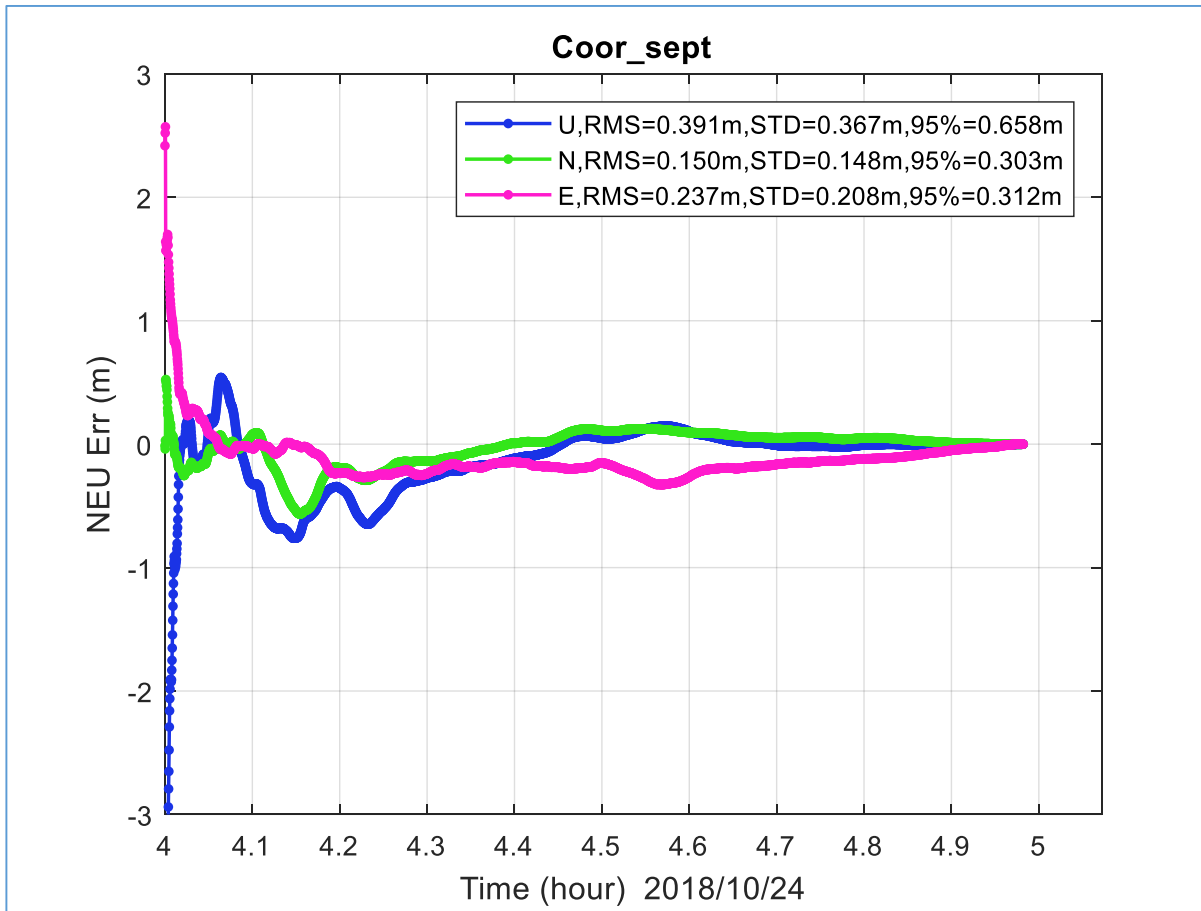
RPD (Rapid Prototype Development) Challenge

- RPD Challenge Topics during MGA 2018
 - PPP from GNSS Dual Frequency Smart-Phone Raw Data
 - GNSS for Rowing Speed Measurement
 - Low-Cost GNSS for Smart-Agriculture
 - Driver's Behavior Index (DBI) Development from GNSS Data
 - Interference Monitoring
- All ICG funded participants participated the RPD Challenge
- Follow-Up Discussions will take place even after MGA through online meetings

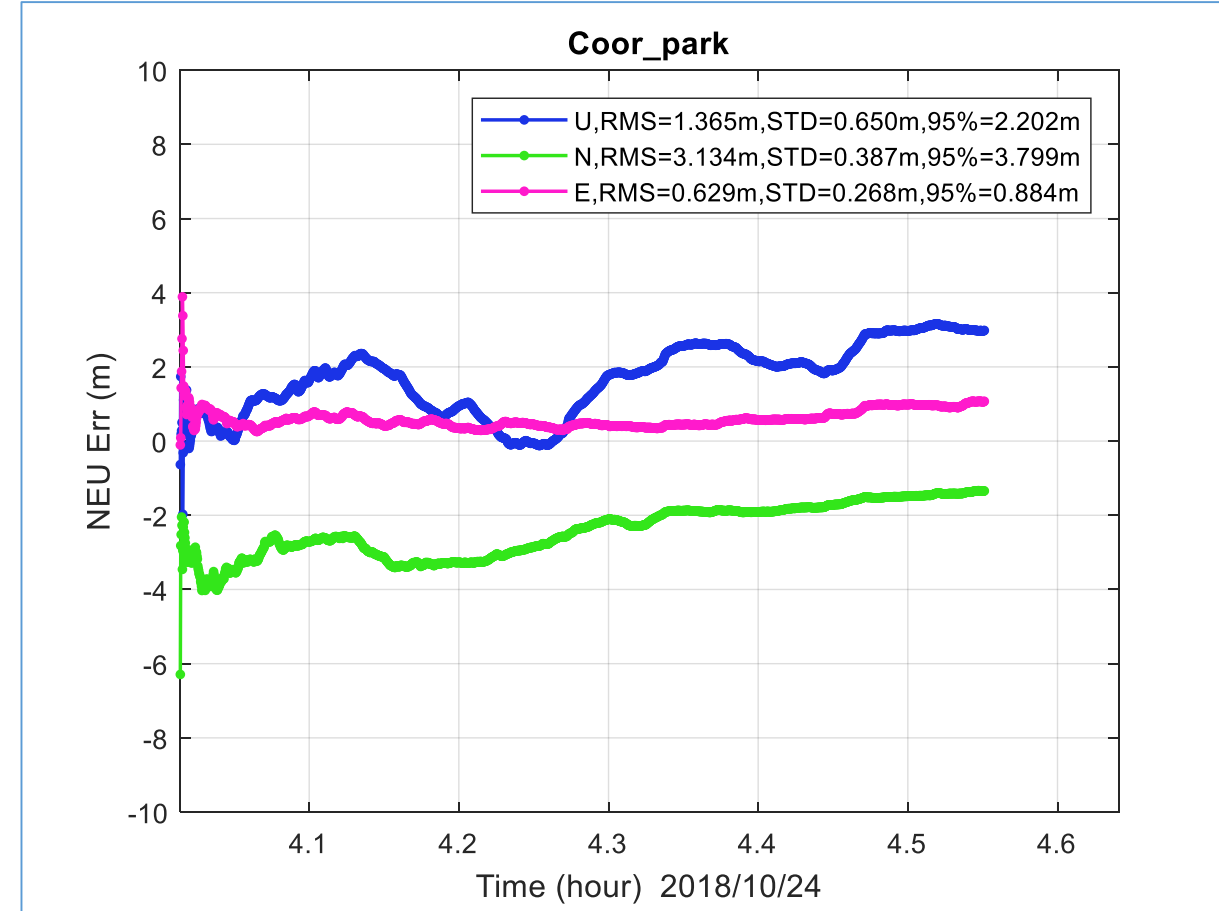


RPD Challenge: Xiaomi Mi8 vs. SEPTENTRIO PPP Results

SEPTENTRIO



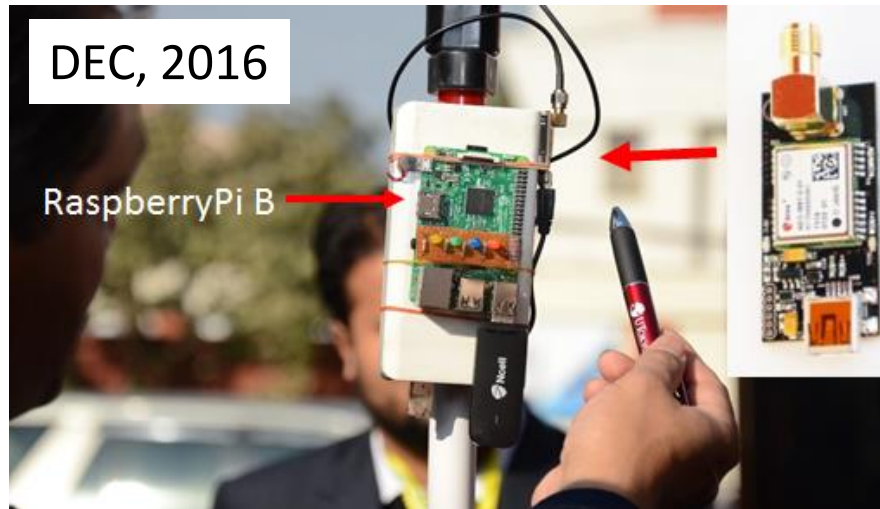
Xiaomi Mi8



These are just a very quick comparison between multi-frequency, multi-GNSS receiver (Septentrio) vs. Dual-frequency (L1/L5) GNSS receiver of Xiaomi Mi8 smart-phone device. These results do not reflect the actual performance capabilities of Septentrio receiver. Actual performance will be better than these results with proper antenna setting.

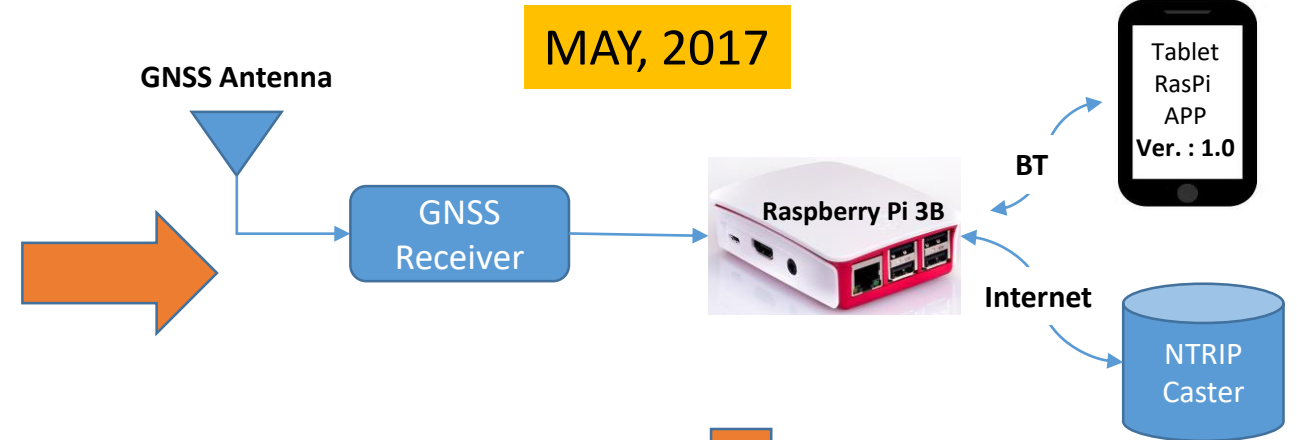
Low-Cost High-Accuracy Positioning System (L-CHAPS)

Meaning of Low-Cost : \$100 x 100cm x 100gm

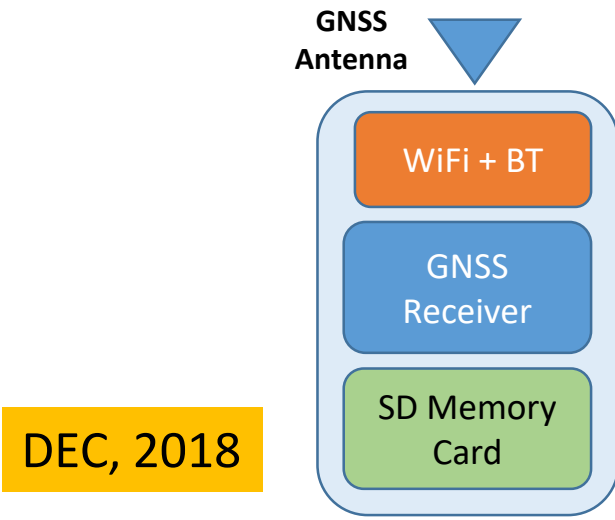


DEC, 2016

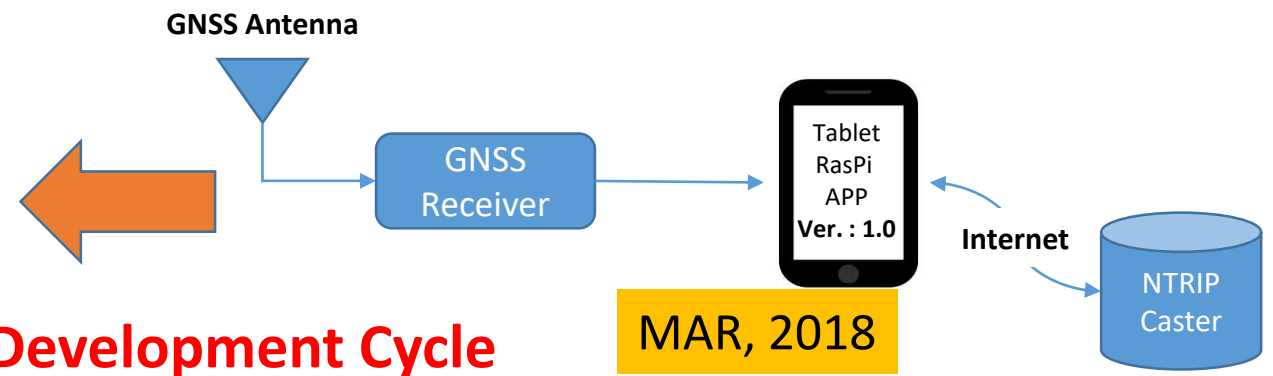
RaspberryPi B



MAY, 2017



DEC, 2018



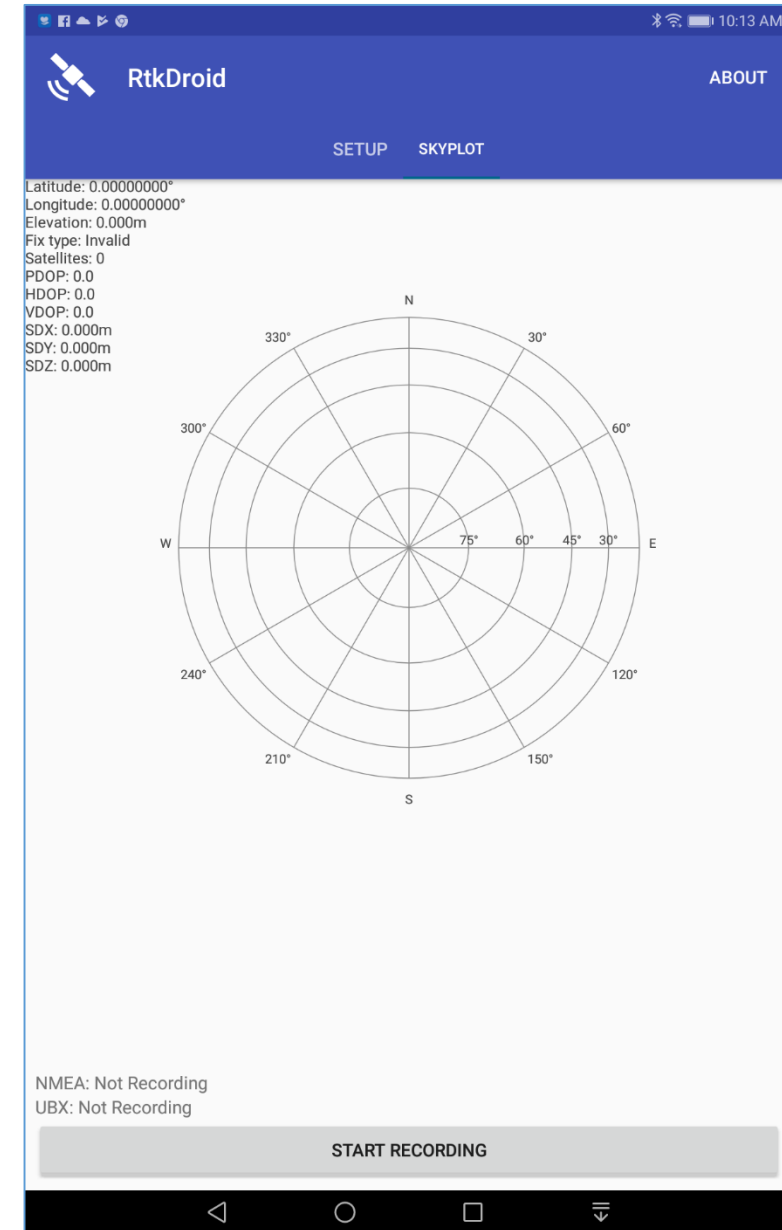
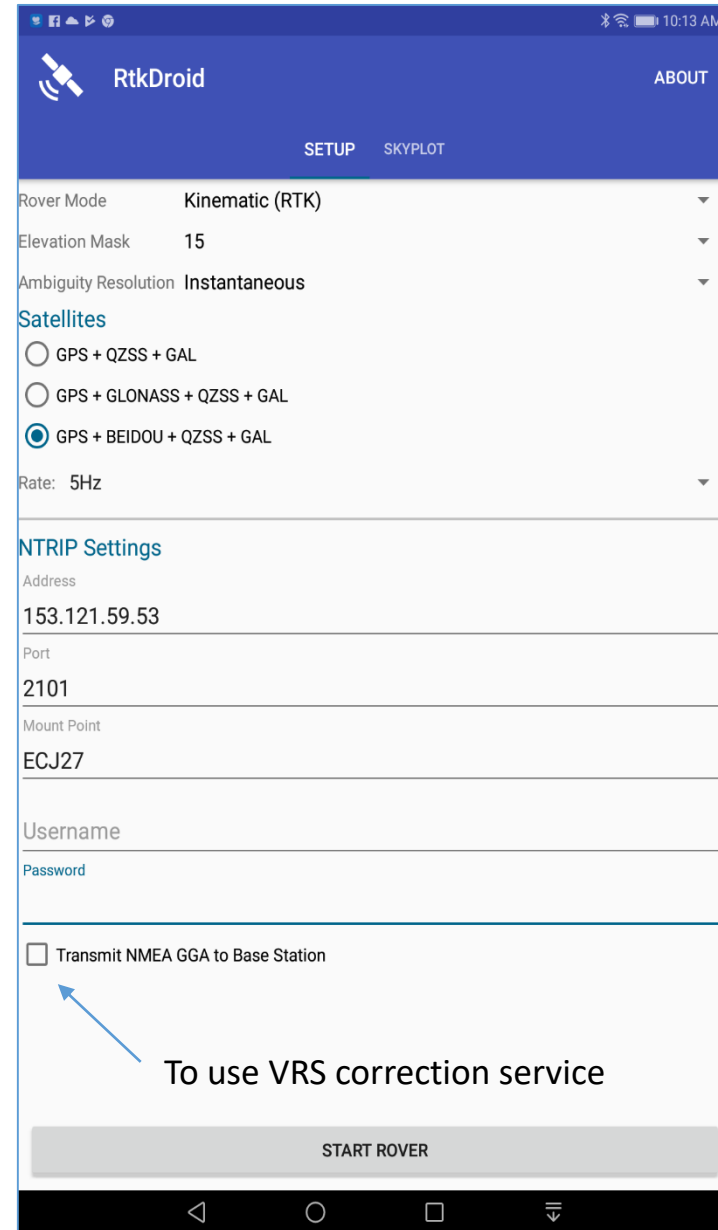
MAR, 2018

L-CHAPS, Development Cycle

Android APPs for GNSS Data Logging & Processing

- **RTKDROID**
 - Real-Time RTK for Android devices
 - Based on RTKLIB
 - Already Released – Distribution by Request
- **MADROID**
 - Real-Time PPP based on MADOCA correction data through MADOCA server
 - Based on u-blox F9 dual frequency receiver
 - Under Developed – will be released Q1 2019
- **SW Maps**
 - Excellent GNSS data input tool for GIS in Android devices
 - Built-in GNSS Receiver or External GNSS Receivers can be used
 - External GNSS Receivers can be connected by BT or Serial Cable using an OTG cable
 - Any receiver that output generic NMEA can be connected

RTKDROID APP



Link for Reference Materials

- Lab Home Page
 - <https://home.csis.u-tokyo.ac.jp/~dinesh/>
- GNSS Webinar
 - <https://home.csis.u-tokyo.ac.jp/~dinesh/WEBINAR.htm>
- Past GNSS Training Materials, Data etc
 - https://home.csis.u-tokyo.ac.jp/~dinesh/T141_30.htm
- Link to Documents, Software, Android APP etc.
 - <https://home.csis.u-tokyo.ac.jp/~dinesh/Download.htm>
- Contact : dinesh@iis.u-tokyo.ac.jp

