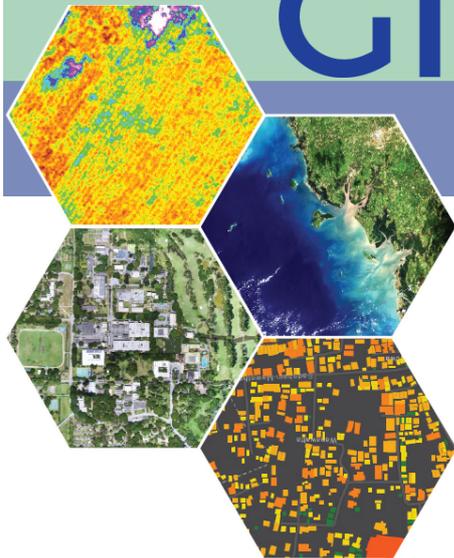




Performing onboard GNSS receiver testing for hexacopter at GIC

GEOINFORMATICS CENTER

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RTK Drone Development at GIC

Unmanned aerial vehicles are a disruptive technology that is changing the way we approach agriculture, surveying, and disaster monitoring. GIC is continually pursuing new avenues of drone development for use in upcoming research endeavors. The latest project is a rotary wing platform equipped with six brushless motors that is capable of missions up to 15 minutes in length. Weighing in at only 3.5 kg, the hexacopter features lightweight components including a Pixhawk 2.1 flight controller which provides autopilot functionality, and a Swiftnav Piksi GNSS receiver. The latter component makes the hexacopter capable of performing

both real time kinematic (RTK) and post process kinematic (PPK) surveys that, when used in conjunction with a GNSS base station, will allow for positioning accuracy of up to 2cm. GIC is looking to apply this platform to an upcoming road survey project which requires high precision measurement capability.

In 2018 GIC developed a fixed wing platform drone for use in large area surveying that cost approximately \$2000 USD. While the hexacopter is more expensive at nearly \$3000 USD, it is capable of achieving measurements with finer precision through RTK and PPK functionality.

Geospatial Knowledge Capacity Building in Lao PDR



Dr. Kavinda Gunasekara leading participants through a raster analysis exercise

The GeoInformatics Center is spending the first eight months of 2019 facilitating a series of training courses to support a project by the Food and Agriculture Organization of the United Nations (FAO) titled **Strengthening agro-climatic monitoring and information systems** (SAMIS) to improve adaptation to climate change and food security in Lao PDR.

Government officials from Lao PDR's Department of Meteorology & Hydrology and the Department of Agricultural Land Management are participating in the training courses to improve their departmental geospatial data processing capacities. The SAMIS project aims to shift away from relying on outside consultants to perform agricultural data processing and analysis, instead putting these tasks in the hands of departmental officers. Completing GIC's scheduled training courses will prepare staff from both departments with the skills necessary to independently carry out their own geospatial analyses.

This capacity building venture began on January 28, 2019 and will continue through August 2019. Training course topics include:

- Fundamental GIS Analysis
- Python and R Programming for Geoprocessing
- Spatial Analyst and Geospatial Databases in ArcGIS
- Land Suitability Assessment, Forest Mapping and Biomass Estimation
- Crop Area Mapping and Production Modelling using Satellite Data
- Advanced use of ArcGIS – Network Analysis and 3D Analysis



Mr. Lakmal Deshapriya delivering a lesson on Python for geoprocessing

The SAMIS project is currently in its first phase which places a focus on agroclimatic monitoring and analysis. This phase will establish a network of 15 agrometeorological stations, develop data sharing protocol between centers, identify data standards, and provide training to key staff. Upcoming phases of the project will deal with utilizing natural resource data and national agro-ecological zones to identify at-risk areas, as well as knowledge dissemination.

SAMIS has been made possible with funding from the Global Environment Facility (GEF), as well as support from contributors including Lao Ministry of Agriculture and Forestry and Lao Ministry of Natural Resources and Environment.

To learn more about the FAO-SAMIS project please visit: <http://www.fao.org/in-action/samis/en/>

and to find out about our latest training courses in Laos please visit: <http://geoinfo.ait.ac.th/>



Participants working together to complete a class exercise

Recent GNSS Training Courses at AIT



The GeoInformatics Center, the Center for Spatial Information Science - University of Tokyo, and the International Committee on Global Navigation Satellite Systems (ICG) jointly organized two parallel training courses on GNSS in January 2019. **GNSS for Policy and Decision Makers** was a 3-day course which ran from January 14 – 16, 2019 that introduced participants in administrative and managerial positions to how GNSS could improve the policy-making process. **Training on GNSS** was a comprehensive 5-day course that lasted from January 14 – 18, 2019 and featured an overview of GNSS and implementation of GNSS receivers for field use.

The objective of the trainings courses was to introduce participants to the field of GNSS and instill an understanding for what the technology is capable of achieving. The organizers' vision is for training course alumni to incorporate GNSS technology to improve their workflow or solve an outstanding quandary upon resuming work in their home country.

Ninety-five training course participants hailed from 14 countries around Asia and abroad including Afghanistan, Bangladesh, Bhutan, Brazil, Cambodia, India, Japan, Maldives,

Mongolia, Nepal, Pakistan, Philippines, Sri Lanka, and Thailand. They work in a range of professional settings including universities, the government sector, the private sector, and NGO's.

During the training courses participants became acquainted with a number of GNSS concepts during lecture sessions including signal structure, signal processing, data formats, errors, and survey procedures. Engaging practical sessions in the **Training on GNSS** course allowed participants to perform real time kinematic surveys with low cost GNSS receivers. GNSS, or Global Navigation Satellite Systems, is the term used to describe the constellations of positioning satellites that occupy Earth's orbit. Around the world numerous fields currently utilize the positioning technology including transportation, agriculture, surveying, weather services, the sciences, security, emergency services, and humanitarian services.

Resource persons from United Nations Office for Outer Space Affairs, GNSS Space Agency, Bundeswehr University Munich, The University of Tokyo, Tokyo University of Marine Science and Technology, and GIC-AIT were on hand to ensure the success of the parallel training courses.



GNSS discussion led by Dr. Dinesh Manandhar



Participants engaging in a field demonstration of GNSS data collection

Applications of IoT for Waste Management

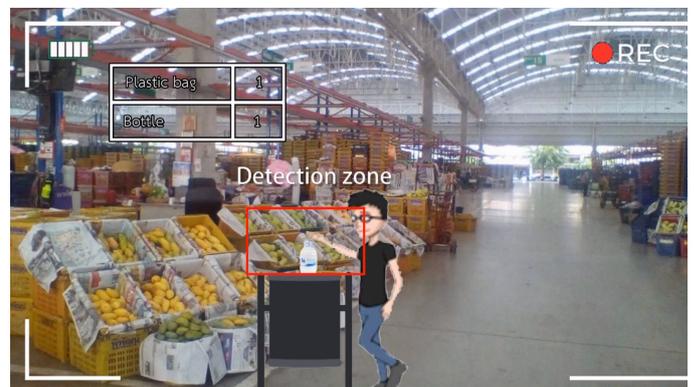
On February 13, 2019, GIC staff participated in a meeting organized by AIT Solutions at the AIT Conference Center which addressed a smart approach to waste management titled **Applications of IoT and AI for Sophistication of Waste Management in Thailand**. Special guests delivering remarks included Mr. Nakorn Kitipultanakorn, Mayor of Soongnern Municipality in Nakorn Ratchasima province, Thailand; Dr. Chamniern Vorratnchaiphan, Special Adviser with the International Union for Conservation of Nature – Thailand; and Dr. Naveed Anwar, Vice President for Knowledge Transfer - AIT. GIC staff presented the Center's current research with IoT-based sensors and how the technology could be applied to the waste management sector.

Moving forward, GIC and AIT Solutions staff met with representatives from Talaad Thai on February 27, 2019 to discuss IoT options to refine the market's waste management practices. Known to locals as one of Thailand's largest fresh markets, Talaad Thai encompasses an area of 450 rai (72 ha) in Pathum Thani province and operates 24 hours a day. A market as large as this one generates a sizable amount of waste daily. Talaad Thai management is looking to improve routine waste collection efficiency

as dumpsters fill around the massive complex. GIC and AIT Solutions are exploring applications of deep learning algorithms and logistics systems to improve waste management at Talaad Thai. By integrating these approaches with the market's pre-existing CCTV system, the AIT team will provide a solution to aid waste disposal monitoring and waste identification for effective waste segregation and data generation.



Staff from GIC and AIT Solutions visit Talaad Thai to realize how IoT might benefit the market



Depiction of how GIC's video detection approach could be used to monitor waste disposal at Talaad Thai

Drought Monitoring Training at GISTDA Sri Racha

In February GIC staff helped to deliver a training course called **Advanced Training on Geospatial Information Applications for Drought Monitoring**. The course, which was organized by GISTDA and UN-ESCAP, took place at GISTDA's Siracha campus from February 19 – 22, 2019. Officers from Myanmar's Department of Meteorology and Hydrology

were in attendance and had the opportunity to develop skills using a drought monitoring system with a focus on Myanmar. Other resource persons on hand included officers from the Geo-Informatics and Space Technology Development Agency (GISTDA), the Institute of Remote Sensing and Digital Earth (RADI), and the Indian Space Research Organization (ISRO).



Dr. Rishiraj Dutta delivering presentation on geospatial applications for drought monitoring



Drought training participants performing practical exercise

Expert Group Meeting on the Effective Use of Space Technology for Drought Monitoring and Early Warning in Central Asia from UAV

Among natural disasters, drought gets relatively less attention from policymakers, even though it has serious long-term socioeconomic implications. Drought adversely affects sustainable development and exacerbates poverty among millions of people who depend directly on the land as a source of livelihood. Many Central Asian countries suffer from frequent droughts along with challenges in water resource availability and management. These lead to failures of crop production and increase of food price and security. Applications of geographic information can play a key role as important tools to monitor drought and water resource management. Despite the significant progress achieved in this region, these applications continue to be underutilized to fully benefit the most vulnerable in managing drought of this region, primarily because of the

lack of human, scientific, technological capacity and organizational and institutional systems. In order to support member States in Central Asia region, ESCAP, with the support from the Government of Russia Federation, has started a new project titled “Enhancing the capacity of the developing countries in Central Asia on effective use of space applications for drought monitoring and early warning through the I Drought Mechanism”. The project is also in line with the implementation of the Asia Pacific Plan of Action on Space Applications for Sustainable Development (2018-2030) and the ESCAP Regional Roadmap for the Implementation of the Agenda 2030 for Sustainable Development in Asia and the Pacific. As an initial action of the project, ESCAP plans to build a project working team which is consisted of a few regional renowned experts in Asia and the Pacific region.



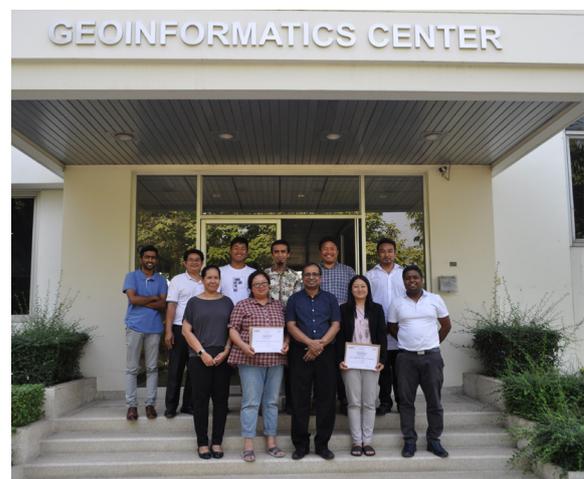
Brainstorming session at the expert group meeting



Session in progress for drought monitoring discussion

Cryosphere Experts Visit GIC for SAR Training

Five officers from the Bhutan National Center for Hydrology and Meteorology participated in a two-week training course for SAR snow detection at GIC from March 11 – 22, 2019. Titled **SAR Processing and Snow Mapping Training Program**, participants learned the theory and techniques required to use SAR imagery for DEM creation, mapping glacial lakes, detecting glacial movement, and mapping snow. This course is a follow-up to a training the officers participated in last year that focused on introductory remote sensing and glacier detection with multispectral satellite imagery.



Training participants from Bhutan upon completion of SAR training program

GIC Director Participates in Satellite Discussion Panel

Dr. Manzul Kumar Hazarika was invited to Singapore to participate in a launch event for Synspective, a Japan-based SAR satellite development company. Synspective aims to launch a constellation of small-size SAR satellites for data acquisition, provide products and solutions using machine learning techniques, and host a big data platform. Participating in the Panel Discussion on **Satellite Utilization for Public Organizations**, Dr. Hazarika commented on applications of SAR data for (1) monitoring floods, (2) the importance of image acquisition just before/after a disaster and obtaining the right pair of images for SAR interferometry earthquake monitoring, and (3) all-weather and day/night capabilities of SAR satellites which makes them the best earth observation satellite option for monitoring disasters, especially hydro-meteorological disasters. Prof. Seiko Shirasaka, Board Director of Synspective, showed interest in collaborating with GIC/AIT for SAR data processing and providing related solutions.



Discussion panel at Synspective launch event, Singapore

Sentinel Asia Committee Meeting in Sri Racha

GIC staff participated in the **9th Steering Committee Meeting of Sentinel Asia** at GISTDA's Sirindhorn Center for Geoinformatics on January 30, 2019. At the meeting GIC delivered a progress report detailing the Center's progress towards end-user enhancement. Sentinel Asia is a cooperative for sharing Earth observation data to aid disaster response for countries located in Asia and the Pacific. A number of organizations serve to carry out Sentinel Asia's mission including Japan Aerospace Exploration Agency

(JAXA), Asian Disaster Reduction Center (ADRC), Yamaguchi University, GISTDA, International Water Management Institute (IWMI), and GIC-AIT. GIC's role in the program involves end-user enhancement, which focuses on assessing users' needs, empowering local agencies with user friendly analysis tools, and capacity building.



Participants for the 9th Steering Committee Meeting of Sentinel Asia

GIC Attends Conference on Tea Sustainability

Dr. Manzul Kumar Hazarika participated in the 35th Tocklai Tea Conference titled **SustainabiliTea: Challenges & the Way Forward** from 22-23 February 2019 in Jorhat, Assam, India. The conference was well attended by the tea industry, academia, as well as several national and international organizations and institutes. Dr. Hazarika contributed with a presentation titled **Monitoring Tea Estates with Remote Sensing Data**, especially in regard to applications of UAVs for tea estate monitoring. Conference participants appreciated the potential of UAV applications in monitoring the tea estates. TRA, the conference organizer, expressed their desire to conduct a pilot project with GIC to monitor tea gardens for early detection of pest attacks and diseases.



Presenters at the 35th Tocklai Tea Conference, Assam, India

Inception workshop on integrating cutting-edge geospatial information for agricultural monitoring in the Lower Mekong Basin

ESCAP has started a new project titled “Building resilient agricultural practices by integrating geospatial information for agricultural monitoring in the Lower Mekong Basin: An emphasis on rice condition” from 2019 to 2022 under support from the Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences.

The project will contribute to the implementation of the Asia-Pacific Plan of Action on Space Application for Sustainable Development 2018-2030, within the framework of the Regional Roadmap for Implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific. It will address the SDGs such as SDG1 (Poverty eradication); SDG2 (Zero hunger); SDG6 (Clean water and sanitation) and SDG13 (Climate action) in line with the Plan of Action on Space Applications 2018-2030. The project will strengthen food security and livelihoods of vulnerable rice growing countries at the national and sub-national levels against climatic and other natural disasters through improving the access to digital early warning information for climatic shocks, addressing transboundary water issues and establishing geo-referenced production forecasts using the cloud-based geospatial technology.



Meeting underway in Larn Luang, Bangkok, Thailand

As an initial action of the project, ESCAP organized the inception workshop on 20-22 March with relevant ministries responsible for agriculture, water and agrometeorology policy from lower Mekong countries, such as Cambodia, Laos, Myanmar, Thailand, and Vietnam. The meeting briefed the member States on how the project tends to strengthen the capacity of lower Mekong countries to identify suitable climate resilient agricultural practices in rice crop production through (a) development of a crop monitoring system called CropWatch Cloud System for lower Mekong with integrated data, information and applications that combines ground-based information with satellite data; (b) building awareness and capacity of government of participating countries to utilize the system to access and use space applications for agricultural and other purposes.



Dr. Manzul Hazarika presenting on crop monitoring at the inception workshop



GIC led session on rice monitoring and yield forecasting with UAV

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