Capacity Building opportunities: Space and Geospatial Education in Nepal

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Outline of the Presentation

• Background
• Goals
• Research Activities
• Establishment of GNSS Lab
• Future plan
Background

• Pashchimanchal Campus, Tribhuvan University established Bachelor Degree in Geomatics Engineering in 2013 and Master of Science in Geospatial Engineering in 2020 to meet the demands of Geospatial engineering human resources in Nepal.

• Center for Space Science and Geomatics Studies established in 2018.
• Initiated the research activities to support for the Master in Geospatial Engineering
• The center is devoted to space science research and Geomatics education.
• Establishment of GNSS Lab for capacity building in the field of Global Navigation Satellite Systems (GNSS).
Background

- This center response in terms of specific needs of country and society’s economics, and the environment in the field of:
  - Land monitoring,
  - Disaster research
  - Tourism Planning
  - Agriculture planning,
  - Pollution studies and
  - GNSS Applications
VISION

• To become a center of excellence in the field of GNSS in Nepal.
• To become leading institute for research and training in Space Science and Geomatics studies.
• RESEARCH ACTIVITIES FOR CAPACITY BUILDING
## Statistics of UTOKYO/ICG GNSS Training Program hosted by CSSGS
### Pashchimanchal Campus, Tribhuvan University, Pokhara, Nepal - 2022

<table>
<thead>
<tr>
<th>Training Mode / Location</th>
<th>Hybrid-Training Venue: Nepal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date and Duration</strong></td>
<td>11 – 14 Jan 2022 3 days</td>
</tr>
<tr>
<td><strong>Course Type</strong></td>
<td>Course A</td>
</tr>
<tr>
<td>(A) ICG Funded International (travel only)</td>
<td>(5 awarded but Cancelled due to Corona Situation, attended online)</td>
</tr>
<tr>
<td>(B) Other Funding (travel only)</td>
<td>NA</td>
</tr>
<tr>
<td>(C) Self Funded International</td>
<td>(3 but cancelled due to Corona Situation, attended online)</td>
</tr>
<tr>
<td>(D) Self-Funded Domestic (Thailand or Nepal)</td>
<td>30 (On-site Nepal)</td>
</tr>
<tr>
<td>(E) Online Participants</td>
<td>45</td>
</tr>
</tbody>
</table>

**Total (A + B + C + D + E)**: 75 25

<p>| Number of Applicants                        | 90                           | 40                         |
| Number of Resource Persons                  | 13                           | 3                          |
| Number of Countries                         | 16                           | 10                         |
| Resource Persons’ Countries                 | 7                            | 2                          |</p>
<table>
<thead>
<tr>
<th>Training Mode and Location</th>
<th>Training –Hybrid Venue –Pashchimanchal Campus, Pokhara, Nepal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date and duration</td>
<td>3-6, January ,2023</td>
</tr>
<tr>
<td>Course type</td>
<td>Course A</td>
</tr>
<tr>
<td>(A) Self funded international</td>
<td>Total 3 participants one from Sri Lanka and 2 from India</td>
</tr>
<tr>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>(B) Self funded domestic</td>
<td>(50 participants) onsite from Nepal</td>
</tr>
<tr>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>(C)Online Participants</td>
<td>200 participants</td>
</tr>
<tr>
<td>Total (A+B+C)</td>
<td>255</td>
</tr>
<tr>
<td>No of Applicants</td>
<td>300</td>
</tr>
<tr>
<td>Number of Resource Persons</td>
<td>6</td>
</tr>
<tr>
<td>Number of Countries</td>
<td>16</td>
</tr>
</tbody>
</table>

2023
• Training on DGPS and Terrestrial LiDAR Scanner supported by UGC, Nepal

• Training was held from 12-16 Asar, 2079.

• Training was focused for faculty, Master level students and fourth year students of Bachelor of Geomatics Engineering

• 90 participants

• 5 days training and it was conducted in two groups
Center for Space Science and Geomatics Studies (CSSGS)

LIDAR Training Activities (UGC Fund)
MOU and Collaboration with National and International Organization

1. Canada Nepal Geomatics Advancement Foundation (CNGAF)
2. Center for Spatial Information Science, The University of Tokyo
3. Annapurna Rural Municipality, Kaski
4. South Queensland University, Australia
   (Informal cooperation process for MOU)
5. Phranakhon Si Ayutthaya Rajabhat University, Thailand (Process)
Membership in international organization

• CSSGS is associate member in Asian Association of Remote Sensing

Associate Members | AARS (a-a-r-s.org)

• Adviser in International Society for Photogrammetry and Remote sensing (ISPRS) working Group IV/V

• ICWG V/IV (isprs.org)

• Stakeholders partner in Space 4 water in UNOOSA
Research Activities with Provincial Government in Nepal

• Precision Agriculture for Small Scale Farming Project collaboration with Lamjung Agriculture Campus
Research Activities with Provincial Government in Nepal

• Policy Level talk programs for establishment of CORS in Gandaki Province, Nepal
• Formation of task committee for Natural Disaster Reduction and Management based on GNSS Technology in Gandaki Province, Nepal
• Workshop on GNSS for Policy and Decision Makers in 2022 and 2023
Center for Space Science and Geomatics Studies (CSSGS)

Collaboration with Center for Spatial Information Science (CSIS)
The University of Tokyo

• Conduction of Pilot Projects in the fields of GNSS applications
  • Low-Cost High-Accuracy Position Assessment using MADOCA-PPP
  • Traffic congestion analysis
  • Dynamic Air Quality Monitoring using Low-Cost GNSS receiver systems
  • Rapid Prototype Development (RPD) Challenge
Master Thesis on GNSS Applications

- Master students have selected GNSS as a part of their Master Thesis.
  - Analysis of Perceptible water vapor using Global Navigation Satellite System Observation
  - Total Electron Content Estimation and Comparison Using Multi-GNSS Constellations
Rapid Prototype Development (RPD) Challenge

• It was conducted by CSIS, UTOKYO of Japan and Thailand
• Participated in 2022, two groups of students (8 persons) and instrument were supported by sonny and CSIS
• Participated in 2023, two groups of students (8 persons) and instrument were supported by sonny and CSIS
• They model the prototype of flood and forest fire early warning system
• The judge of 2023 year groups has recommend for writing the project for research for funding
Forest Fire Early Warning System

Prototype On
Forest Fire
Early Warning System

Presentation by
Team Extinguisher
RPD Challenge

Project Process

Realtime Working

- **Fire Alarm**: Audio & Video signalization to warn people about a possible fire occurrence in the certain area of coverage.
- **Webapp**: Area & direction of fire, danger level, windspeed, rescue team status, safezone & forest fire related data can be determined.

Team Introduction

**Saugat Paudel**
Bachelor in Geomatics Engineering (3rd Year)
IOE Pashchimanchal Campus

**Ramesh Pariyar**
Bachelor in Geomatics Engineering (3rd Year)
IOE Pashchimanchal Campus

**Aayush Chand**
Bachelor in Geomatics Engineering (2nd Year)
IOE Pashchimanchal Campus

- **Mobile app**: Every service of the webapp is available. Other services like user’s location, fire brigade & rescue team tracking, safer place navigation etc can be done.
- **Toll-free line, SMS service**: Used for getting updates as well as customer support for people enquiries, local updates, and rescue support. This service will be useful during internet issues due to disaster.
Flood Early Warning System

Team: GEOCODERS-FLASH

Bhoj Raj Bist  Hem Raj Pandey  Hemant Mahatara  Hem Raj Pandey

Undergraduate Geomatics Engineering Student at IOE, Pashchimanchal Campus
Pilot Projects: Dynamic Air-Quality Monitoring

Before Lockdown Period

During Lockdown Period

Prototype System

Photo Sources: https://www.nepaltimes.com/here-now/nepals-smoky-mountains/?fbclid=IwAR31xbeCK5S5j9_gN0AU7BMqyQAZtg0Z6J-LUTmt52u907090sz5du8Z5Vo

PM1, PM2.5, and PM10

PHT & VO Sensor

Accelerometer & Gyro

CO and NO2 Sensor

GNSS Receiver

ESP-32 Microcontroller

NO2 Concentration in Pokhara Valley

Humidity Distribution Map of Pokhara Valley

PM2.5 Concentration in Pokhara Valley
A semi-automatic method for crop loss estimation due to monsoon flood using remote sensing data (Funded by UGC)

Figure 29 Crop loss in Province 2 in 2020 due to the inundation water.
Integration of Participatory GIS and Local Knowledge for Sustainable Tourism Resource Mapping in Machhapuchchhre Model Trek, Kaski

Faculty Research grants from UGC
Accuracy Assessment of Low-Cost GNSS Receiver Systems

Precision farming, tourism model trek, Drone mapping, Tourism trek
Publication

- Mapping high-resolution seasonal crop pattern using sentinel imagery in mountainous region of Nepal: A Semi-Automatic Approach (MDPI-Geomatics)

Process in Publication

• Participatory Geographic Information System and Open-Source Data for Sustainable Tourism Management [FOSS4G 2023] Academic Track - Abstract review

• Under review:
  • Deep Learning for Detection of Irrigation Status in Tomato Plants Using Plant Leaves Journal: International Journal of Intelligent Systems

• Planned paper: A semi-automatic method using remote sensing for rice crop loss estimation due to flood.
Future Plans (Research Project)

• Establish and improve infrastructures necessary for GNSS education, research and capacity development.

• Extension of the CORS station (Gandaki Province) collaboration with Ministry of internal affairs and law, Gandaki Province, Survey department and GPAST.

• Multi-year project for the early warning system in Gandaki province collaboration with GPAST, Ministry of internal affairs and law, Gandaki Province and CSIS, The university of Tokyo, Japan
Establishment of CORS station at Pashchimanchal Campus

CORS Antenna

CORS Receiver: PolaRx5
Capable to receive all GNSS signals in all frequencies
Data from this receiver is available for R&D
Establishment of GNSS Lab with support from University Grants Commission and CSIS, UTokyo

SETTING UP GPS ANTENNA OVER A BENCHMARK

- GPS antenna
- GPS mount
  - Mount dia (Φ)
  - Mount length
- Tribrach
- Concrete survey marker

Antenna Connector: Type N Outer Diameter: 22 mm
PVC pipe Diameter: 45 mm or above
Shall be large enough to pass cable with N connector, diameter 22 mm

3 m

3 m
Collaborative Research and Training Activities

• CSSGS has collaboration with national and international institutes for the establishment and development of the GNSS lab.
• CSSGS has been providing GNSS training in collaboration with
  • International Committee on GNSS (ICG)
  • Center for Spatial Information Science (CSIS), The University of Tokyo
  • University Grants Commission (UGC), Nepal
• This training has beneficial masters and Bachelor and faculty members
Center for Space Science and Geomatics Studies (CSSGS)

- Extension of GEO portal pilot project of Annapurna-2 rural municipality into whole Annapurna Rural Municipality.
- Collaborative research on "River Flow Velocity, Discharge, and Channel Morphologic Data Acquisition and SWOT-enabled Sedimentation Investigation in the Mobile River Basin in USA and the Gandaki River Basin in Nepal".

Great news RE: [EXTERNAL] NASA NSPIRES - Proposal has been Submitted to NASA.

Hi Sagy, Lei, Song, Krishna, and Vishnu,

I just got the notification that our NASA Terrestrial Hydrology proposal "River Flow Velocity, Discharge, and Channel Morphologic Data Acquisition and SWOT-enabled Sedimentation Investigation in the Mobile River Basin in USA and the Gandaki River Basin in Nepal" has been selected for funding.

I am most excited about this project. I will share more info when it becomes available.

Many thanks to everyone's contribution to this award! Congratulations to everyone!

Hongxing

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Phone: (205)348-2319
Email: Hongxing.Liu@ua.edu
http://geography.ua.edu/
Training, Summer School for 2079-2080

- Climbing for Climate GEOspatial School at Pokhara-Nepal Period: December 2023 (Collaboration with International Society for Photogrammetry and Remote Sensing)
- International GNSS training in January, 2024
- End to end UAV/Drone Mapping and Image Processing for GIS data generation Training Program (UGC Budget approve 125,000.00)
Thank You