McMicken
College of Arts & Sciences

Center for Geospatial Information
& Environmental Sensor Network (GIESN)

UNIVERSITY OF
Cincinnati

Mission & Objectives

The GIESN center undertakes R&D activities and funded projects involving the development, use and integration of various geospatial information technologies, including GIS, remote sensing, GPS, environmental sensor networks, internet-based mapping, geospatial data analysis, visualization and modeling. Research efforts at GIESN also cover a broad range of application domains, which are connected through the common interest in the acquisition and analysis of geospatial information through the sensing technologies. The overall goal of the Center is to facilitate and promote the cutting-edge research and applications of the state-of-the-art geospatial information technologies on campus. Specific objectives include:

- Leverage interdisciplinary interactions and collaborations on the research and applications of geospatial technologies across departments;

- Develop joint multi-disciplinary proposals and projects & procure external funding;

- Create high-quality research publications and increase academic visibility and reputation;

- Make technological innovations through developing innovative algorithms, software tools, and new sensors.

- Provide training, workshops, and support resources for applications of geospatial information technologies on campus and to local community.

Center for Geospatial
Information & Environmental
Sensor Networks

(GIESN)
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Center for Geospatial Information & Environmental Sensor Network (GIESN)

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Introduction

The Center for Geospatial Information & Environmental Sensor Networks (GIESN) is an interdisciplinary research unit of the McMicken College of Arts and Sciences. It was established based on the Geographical Information Networks (GINs) research initiative with a cluster of new faculty hires across departments. The overall goal is to facilitate and promote the cutting-edge research and applications of the geospatial information technologies on campus. The center personnel consist of faculty, researchers, and graduate students from Geography, Geology, Biological Science, Chemistry, and other departments. The center has unique and excellent combination of research expertise and technical capabilities in geographical information sciences (GIS), remote sensing, environmental sensor networks, geospatial computation, scientific visualization, internet mapping and web GIS, location-based services (LBS), global positioning system (GPS), space-time data assimilation, environmental and urban modeling. The geospatial technologies and spatial analysis methods are crucial for measuring, monitoring, modeling and predicting the complex geographical phenomena and addressing the pressing environmental issues that are the subject of multidisciplinary investigation, particularly in the disciplines of biological sciences, environmental science, geography, geology, and urban and regional planning.

Personnel

The GIESN center is a dedicated multidisciplinary team comprised of faculty, researchers, and graduate students from geography, geology, biological science, chemistry and other departments with diverse backgrounds and technical capabilities. What brings them together is their common interests in the cutting-edge research and innovative applications of geospatial information technologies. They are working on various projects in close collaboration to address geoscientific problems. The center personnel have received a large amount of research funding over the past years. Accumulated research infrastructure and expanded interdisciplinary collaborations will further increase the opportunities to obtain more external funding in the future.

Research Focal Areas

1. **Applications of geospatial information technologies in**
   - Monitoring and predicting environmental and climate conditions and changes;
   - Managing natural hazards (flooding, hurricanes, storm surges, coastal erosion, glacial hazards, etc.);
   - Acquiring geospatial information and intelligence for homeland security, sustainable development, and public health;
   - Addressing geoscientific research questions and issues of regional and national importance;
2. **Developments of geospatial information theories and technologies**
   - GIS, remote sensing, GPS, internet-based mapping;
   - Environmental sensor network/sensor web;
3. **Developments of geospatial information analysis & modeling techniques**
   - Multi-scale spatio-temporal analysis algorithms & techniques;
   - Multi-sensor data synthesis, fusion and assimilation;
   - Integrated dynamic environmental models;
   - Innovative geospatial decision-support tools;

Technical Capabilities

The GIESN personnel have technical skills in the following areas:

- LiDAR remote sensing, hyperspectral remote sensing, radar remote sensing;
- Development and deployment of environmental geo-sensor network;
- Development of chemical sensors and bio-sensors;
- Web GIS & mapping applications;
- Automated feature/target recognition, extraction, and tracking from sensed data;
- Automatic scene description & content-based information retrieval;
- Geospatial intelligence acquisition and knowledge discovery from large geospatial database;
- Kalman filter based spatio-temporal data fusion from multiple sensors;
- Object-oriented image analysis;
- Agent-based simulation models;
- Spatial interaction models;
- ….

Scientific expertise and interests

The GIESN personnel have scientific expertise and interests in the following areas:

- Watershed, water quality, and hydrological modeling;
- Polar lakes, glacial dynamics, permafrost;
- Natural hazards (flooding, wild fire, storm surge, coastal erosion, landslides, etc.)
- Environmental and urban modeling with GIS;
- Quaternary & geomorphological studies;
- Urban ecological systems
- Aquatic ecosystems, coastal and benthic habitats
- Land cover & land use changes, global environmental changes;
- Transportation modeling, crime modeling;
- ….