Geographic Information Networks, Sensing Technologies and Real-time Monitoring and Analysis of Physical and Biological Hazards

Departments of Geography, Geology, Biological Science and Chemistry

The McMicken College of Arts and Sciences at University of Cincinnati initiated a cluster of hires focused on integrating Geographic Information Networks (GINs) and related sensing technologies to support real-time environmental monitoring, analysis and response. GINs expand the scope of Geographic Information Systems (GIS) in the traditional sense by linking them to sensors including imagers, navigation systems, information standards and distributed parallel computers for geospatial information storage, retrieval and analysis, and, ultimately, to users via wide-area wired and wireless networks.

One can imagine electrical networks that are instantly aware of the locations of landslides or floods and that are self-healing via intelligent geographic routing. Real-time traffic management and the sensors and networks that support it must also be inherently geographically aware. Application of GINs to our drinking water supply systems can detect and prevent potential terrorist attacks. New mobile, geographically-aware Internet protocols will enable a new generation of inexpensive connectivity that is ideally suited to the developing as well as more developed parts of the world. These are just a few examples of GINs' power and utility in our daily life.

GINs can also play a transformational role in scientific research. With the availability of real-time data, scientists can better capture and model the dynamic nature of real-world systems, and make more accurate predictions. Overall, GINs have the potential to become transformative tools on the scale of the Internet by creating spatially aware communications, transportation, sensor, analytical, research, education and social networks.

The end-to-end integration of GINs inevitably requires cross-disciplinary collaboration. However, the discipline silos that typically exist in academic institutions are not conducive to this type of research. The cluster hire presents an ideal opportunity to combine our existing strengths with those provided by cluster members. We propose four positions in this cluster, with the senior hire in charge of the overall GINs technologies, a junior hire responsible for developing and designing sensors and sensing technologies needed by the two other junior hires, who will focus on applying GINs to the real-time monitoring, analysis and response to physical and biological hazards during the initial four years. The experience learned from applications to natural hazards by the cluster will be extensible to many other areas, including homeland security, emergency response and even military situations.

A brief survey of major federal funding agencies reveals over 25 programs with a total of over $600 million that support GINs related research. At this time, GINs research in our college and university is mainly confined to the Department of Geography, with approximately $2 million of current funding from NSF and DoD. With the complementary expertise of the four new cluster hires, the GINs group will be able to expand the scope of its research and be highly competitive in many other funding programs. The cluster is expected to generate an average of $0.5 - 1 million per year during the initial four years. Expanded collaboration will substantially increase annual funding in future years.

Our overall goal is to become one of the first four fully integrated GINs research centers in the world and the first end-to-end GINs research center in the United States. This center will enhance many research and education programs in A&S and other colleges at UC. There also exists a strong likelihood that GINs technologies will be commercialized in the near future, which could bring additional revenue streams to UC.