

III: Large: Collaborative Research: Moving Objects Databases for exploration of virtual and real environments

Project Summary

Florida International University (FIU), the University of Illinois at Chicago (UIC), Brown University (Brown), and Northwestern University (Northwestern), with data and expertise support from NASA and the Department of Interior (Dol-USGS), propose to perform research on efficient querying, processing and analysis of moving objects in conjunction with stationary multi-temporal geospatial data. This research will utilize the TerraFly platform as its test bed with its collections of 30 billion vectors and 40TB of mosaicked raster data. The project's aim is to make spatio-temporal and moving-object data ergonomically and efficiently indexed, and searched.

Intellectual Merit of the Proposed Activity: FIU, UIC, Brown and Northwestern will perform research advancing knowledge in the areas of spatial-temporal moving-object data querying and processing. The research outcomes will be incorporated into the test bed at TerraFly.fiu.edu. Algorithms will be devised for: (1) combined optimization of querying moving objects by distance, keywords, structured predicates, context, and semantics; (3) prediction of the most likely location and a probabilistic cloud of object location derived from its past trajectory, mechanical properties, and analysis of raster and vector terrain data; (6) distributed mobile visualization; (7) ergonomic uniform and querying models applicable to a wide range of domains; (8) optimization of geospatial indexing of objects and trajectories; (9) optimization of client-server communication; This work will take a transformative step towards combining the real and virtual worlds, an emerging research frontier. The virtual world has been studied for many years, and is relatively well understood. But the combination of the real and virtual poses the greatest challenges and the highest potential payoff. Car navigation systems and location-based services are a small demonstration of this potential.

Broader Impacts of the Proposed Activity: While advancing the state of Computer Science knowledge, the project will also leverage prior investment of, and provide direct benefit to, NASA, Dol, DoT and other stakeholders. By improving the efficiency of spatial, temporal, and moving object management and making these results available to constituencies, the project will benefit society. TerraFly's web service will enable dissemination of the results to a broad community. The TerraFly test bed has been covered by both scientific and popular media, including *Fox TV News, NPR, New York Times, USA Today, Science, and Nature*. FIU awards more degrees to Hispanic students than any other institution in the US, and the FIU team will continue its track record as the Nation's leading producer of Hispanic Ph.D.'s in CS and involving underrepresented groups in research efforts. The research proposed will benefit multiple applications in disaster management, environmental monitoring, transportation, education, and logistics. The proposed Web prototype will have an educational component and modules to facilitate studies of computer science, geography, and zoology in institutions nationwide.

Key Words: Geospatial data; Moving Objects; Trajectory; Virtual Worlds