Two Test Beds for Mobile Visual Analytics

Mobile devices can become a vital tool for in-field analytics in numerous applications including emergency response and security. However, while their functionality is increasing, their limitations continue to pose a major challenge in developing effective applications. Getting past these challenges will allow field visual analytics to solve critical mission needs of situational and context awareness.

The Purdue Regional Visualization and Analytics Center is exploring the potential of mobile analytic techniques using two applications as test beds:

- wireless network/sensor mobile analytics in Purdue’s Ross-Ade Stadium for the eStadium project
- first responder mobile analytics using the Muscatatuck Urban Training Center.

Both applications effectively display information from streaming data sources to enable in-field decision making. To do so, the PURVAC team first had to overcome the following mobile analytics limitations:

- **Data flow.** Both network bandwidth and device memory are limitations, especially for applications for which real-time streaming data is often one of the inputs.
- **Interface.** Application developers must design for small screens and non-traditional interaction modalities.
- **Display.** Both graphics processing and screen resolution are limited.

PURVAC has developed client-server architectures that work within these restraints for both the eStadium and MUTC applications. A powerful, well-connected server receives all of the streaming data and integrates the data into a unified representation. Basic information analysis, extraction and abstraction are performed on the server to determine which data and at what rate it should be sent to the mobile client. The client processes all user interactions and creates the appropriate visual display for the users and their tasks, allowing in-field information analysis and exploration.

**eStadium Test Bed**

The eStadium project allows football fans to get play-by-play (text and graphical), player and stadium information; game statistics; and streaming video replays via their PDAs or smartphones.

The eStadium team uses PURVAC’s mobile visual analytics tools to monitor both the wireless network infrastructure performance and the load on wireless access points. By visualizing the video server log, access log and access point information in real time, network engineers can determine if access point and network settings need to be adjusted. Because streaming video creates the most demand on the system, PURVAC has created tools to 1) analyze streaming video requests per access point during the game and 2) perform a comparative analysis of the download frequency by location and play type.

PURVAC plans to expand the use of this analytical tool to aid in crowd guidance and security operations.
Muscatauck Urban Training Center Mobile Analytics Test Bed

MUTC was created in July 2005 to train emergency response and homeland defense professionals. MUTC’s unique 1000-acre environment allows virtually unlimited exercise scenarios for single units, multiple agencies and joint forces to train in both contemporary urban and rural settings. MUTC is becoming a full-immersion contemporary urban operating environment where organizations can hone their skills and test the systems and concepts under various weather conditions and terrains (field, forest, reservoir, urban). The emergency response and training capability forms our second mobile analytic test bed: creating mobile analytics tools for first responders to use during training exercises at MUTC.

In this project, PURVAC needs to tailor the display capability to the type of responder and his or her role and provide a succinct, quickly understood display of relevant information extracted from all of the information recorded during the exercise. In the case of a SWAT team responding to a gunman in a school, the first and most critical need of the team leader is the most accurate situational awareness possible:

- Where are team members located?
- Where are the locations of responding personnel?
- Where are the secure, neutral and hot zones of the incident?
- What locations provide opportunity or threat information?

The ability to provide information back to the emergency operation center, such as indicating rooms cleared or information contradictory to current situational assessment, is also vital. As previously indicated, relevant information is specialty-dependent. A firefighter responding to a fire at the same building would need some of the same information as the SWAT team but also task-specific information, such as fire spread, and potential reactive measures appropriate for a rapidly changing environment. First-generation mobile analytics could include PDAs and smartphones. Next-generation displays may be incorporated into heads-up displays.

More information about eStadium can be found at: http://estadium.purdue.edu/php_site/web/index.php.

More information about the Muscatatuck Urban Training Center can be found at: http://www.mutc.org.

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Features:

**Disaster Response Life Cycle** A true visual analytic environment will aid first responders (page 5)

**Threat Stream Generator** Synthetic test data helps analytic tool builders perfect their creations (page 10)

**Flow Maps** Using clues from 19th century cartography to automate flow maps (page 16)