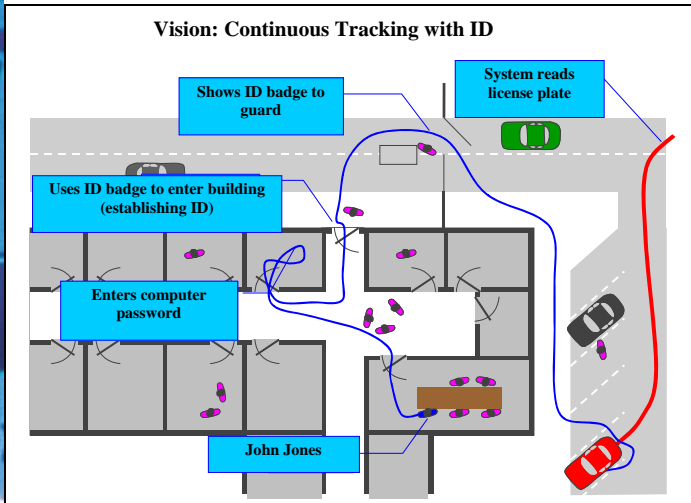


## Project Profile: The Sentient Environment



*In the post 9/11 world, physical security around sensitive facilities has become much more critical. However, existing methods and technologies are often not adequate or cost effective. New technologies and methods must be developed and applied to provide an intelligent, accurate, and automatic system – a sentient-like environment. The NTA is developing and deploying a system that will serve as a long-term development environment for exploring the benefits of incorporating these new technologies including biometric sensors, such as iris scanners, face and head/hair recognition and fingerprint readers, integrated into a system that is designed to maintain identities during handoffs between sensor coverage and tracking over an extended period of time.*

**Project Goals and Objectives:** Provide real-time situation awareness and monitoring of a site using a blanket of stereo video cameras and other sensors, with 100 percent immersive monitoring of all individuals/vehicles while associating positive ID throughout the site. DoD and Intelligence agencies have expressed interested in using the Sentient system for monitoring their sites once it has been proven within sponsor environments. Build an extensible immersive monitoring and visualization architecture that will merge real and virtual environments, and support:

- Monitoring an indoor/outdoor site with an architecture expandable for tens to hundreds of cameras
- Monocular and stereo tracking, object re-acquisition, and event recognition
- Incorporating a functionally annotated 3D Model of the monitored site such that overlaying video feeds on the 3D models allow users to view the monitored area from selected angles
- Management of metadata and video databases to enable event reasoning and intelligent alarm generation
- Incorporation of a network-based controller that provides intelligent, rule-based reasoning about components
- Integration of identification systems, such as iris scanners, RF tags, and fingerprint scanners

The Sentient project is building a foundation of monitoring capabilities into which security inference techniques can eventually be automated, for example:

- Detecting unusual events, such as an individual touring a set of offices or an individual entering and loitering in an office when the regular occupant is away
- Monitoring what an individual does in an office, such as type on a keyboard, pick up a book, or write on a whiteboard
- Detecting suspicious events such as a package, briefcase, or similar object that is left behind and not retrieved.

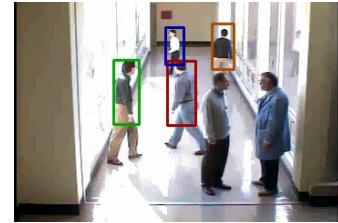
Challenges: Develop and install a high-visibility demonstration system that can visually monitor individuals and their activities for extended periods of time by recognizing and "handing off" tracked objects from one sensor node to another and recognizing key events, such as an individual entering a restricted area.



Immersive Monitoring, Continuous Activity Tracking, Event Recognition, and Alert Signaling



Real-time Video Overlay on 3D Model



Stereo Tracking

**Key Technologies/Activities:** The overall project is structured in two-phases. In the first phase, NTA efforts resulted in the development and delivery of the following:

- Video flashlight system for immersive monitoring of site
- Integrated stereo tracker and change detection modules
- Integrated video and metadata database
- Initial re-acquisition of moving objects
- Event reasoning
- Initial capability for characterization of hair properties and their use for re-acquisition

In the second phase the system will significantly enhance the Phase 1 system by adding:

- Enhanced re-acquisition capabilities
- Functional site model
- Enhanced event reasoning
- Network-based component controller
- Integration of interfaces to other sensors and biometric systems

**Accomplishments/Results:** First phase capabilities were successfully developed and integrated, then successfully installed in a sponsored facility with an initial demonstration of capability in July 2004. Further refinements and demonstration are to follow soon thereafter. Second phase capabilities development are underway.

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