Dirty Bomb Detection and Localization

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http://www.isis.vanderbilt.edu/projects/rips
What you are going to see...

Outside the window

Jumbotron: automatic camera feed

Jumbotron/Screen: Tracking info inside Google Earth

Security is guard walking around the stadium with a cell-phone connected radiation detector and an Crossbow XSM mote.

His position is continuously tracked using a radio interferometric technique running on the motes.

A camera automatically tracks his position using the geolocation info from the mote network.

When the radiation level crosses a threshold the detector sends an alarm and the camera zooms in on the position.
Demonstration Architecture

- Rad detector, mobile phone mote
- Tracking service and user interface
- Mote network
- Nextel/Internet
- Rad level servlet and camera glue code
- Internet
- Camera control node (Linux)
- VGA to NTSC adapter
- Jumbotron controller
Radio Interferometric Ranging and Tracking (Vanderbilt)

→ **Ranging:**

- group-based peer authentication
- prevents false tracking command and information injection from spoofed nodes
- SkipJack implementation in TinySec
- predefined keys stored in FLASH (8 bytes)
- multiple message authentication codes are calculated for every message (2 bytes)

→ **Tracking:**

- 12 motes deployed at known positions
- One extra node is tracked
- The tracked node and one other are the transmitters, the rest are receivers
- 11 channels are measured, but only 4 consecutive ones are used at a time in the sensor fusion
- Consistency function based multiresolution search algorithm running on the base station finds location estimate
- Accuracy: <1m
- Update rate: ~1 per 3 seconds
- Max speed: ~4m/s

→ **Authentication:**

- group-based peer authentication
- prevents false tracking command and information injection from spoofed nodes
- SkipJack implementation in TinySec
- predefined keys stored in FLASH (8 bytes)
- multiple message authentication codes are calculated for every message (2 bytes)
Radiation Detector and Camera Control (ORNL)

- Rad detector connected to phone via RS-485/RS-232 cable
- Java app on phone reads detector data
- Java app uploads data to ORNL server approximately once per second using Nextel data network
- Server displays rad readings, obtains location from Vanderbilt server, and sends commands to camera

- Camera controller is a Java servlet running in Tomcat on a Linux box
- Java servlet issues IEEE-1451 commands to the Pan-Tilt-Zoom (PTZ) algorithm that controls camera positioning and field-of-view
- Camera image is served as a streaming JPEG over HTTP