Specifying and Verifying Location Events with Panoramic

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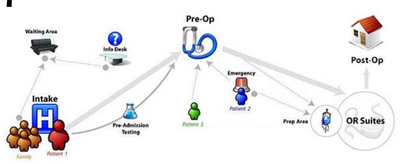
Motivation

- $2B+ market for real-time location by 2019
- Increasing dependence on *complex events*
  - ex: Hospital workflows



- Events must be *customized* to site needs

State-of-the-Art

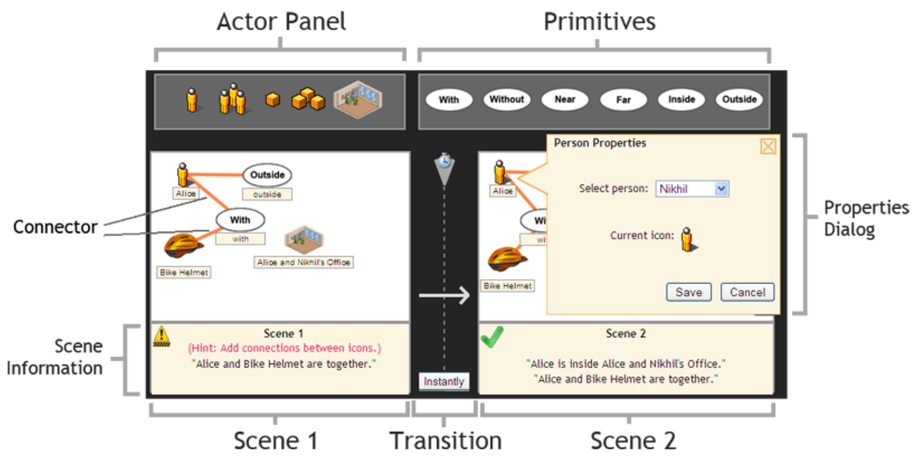
- Costly alternatives for customization:
  1) Adapt processes to vendor-supported events
  2) Hire consultants to code support for events
- End-user programming by demonstration:
  - Difficult to train & debug event specifications
  - Event representations are often unintelligible
- Expensive Active RFID technologies

Goals

1) Low-cost customization w/complex events
   - Web-based end-user tool
   - Quick, easy-to-understand specifications
   - Easy to verify behavior and/or debug
2) Low-cost location technology
   - Works with low-cost, unreliable sensors

Specification

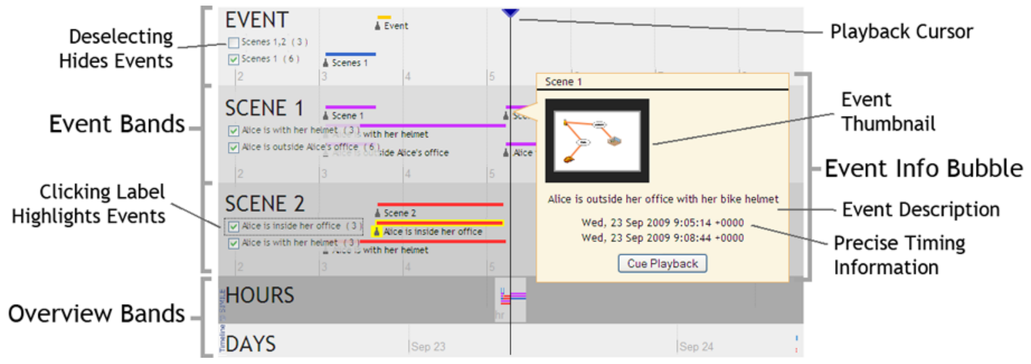
Iconic Visual Language



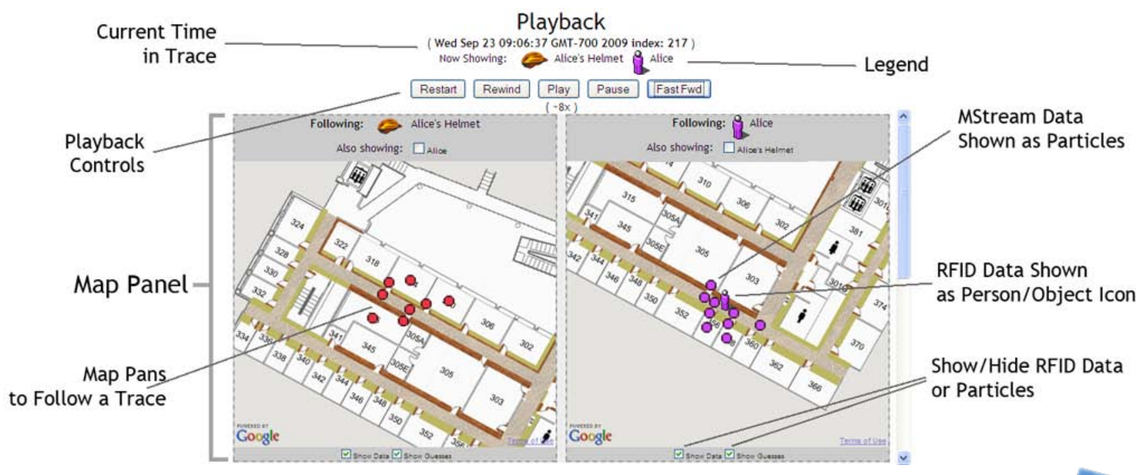
- Storyboard metaphor for specifying complex events
- Pictorial icons represent people, places and things
- Word icons represent basic spatio-temporal events
- Real-time grammar checker ensures correct syntax
- Sequential structure facilitates translation
- Covers > 80% of events in survey of 100+ apps

Verification

Timeline Overview



- Zoomable, scrollable overview with filtering
- Leverages users' natural understanding of temporal events
- Clusters events vertically; shows why detection worked or did not
- Reveals over-specification, under-specification and timing errors



- Drill-down into timeline to view trace for some window
- Map panels auto-track individual people or objects
- Helps user distinguish specification errors from sensor errors

Detection

- Specifications are translated into finite state machines
- Raw sensor data transformed into probabilistic data
- Lahar system detects events over historical traces
- Output signals are merged and filtered