ATON: Autonomous Transportation Agents For On-Scene Networked Incident Management

A DiMI & Caltrans Partnership Project
Research Overview

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And
Ramez Gerges, TCFI, Caltrans

January 30, 2001
Team Meeting Agenda

9:30 AM: Welcome and Introductions

9:40 AM: ATON Project Activity Overview (Mohan Trivedi, UCSD)
10:00 AM ATON Project Activity Overview (JoAnn Kuchera Morin+Stephen Pope, UCSB)
10::20 AM ATON Activity Overview (TCFI, Team)

10:40 AM: Activity Report Infrastructure and Architecture (Thrust 1): Brett Hall and Greg Kogut
11:00 AM Activity Report Vision Systems (Thrust 2): Ivana Mikic and Greg Kogut
11:15 AM Activity Report Televiewing (Thrust 3): Brett Hall and Kohsia Huang
11:30 AM Activity Report Databases (Thrust 4): Shailendra Bhonsle
11:50 AM Activity Report Thrust 5: (UCSB Team)

12:30 PM: Lunch

1:30 - 2:30 PM: Demonstrations and Discussions of Accomplishments and Ongoing Activities
2:30 PM- 3:30 PM: Discussions of Future Directions
3:30 PM: Adjourn
UCSD Contributors

- Shailendra Bhonsle
- Greg Kogut
- Brett Hall
- Kohsia Huang
- Ivana Mikic
- Nivedan Tiwari
- Steve Roche
- H. Ishiguro
- Rachel Goshorn
- Andrea Prati
- Ofer Achler
- Mohan Trivedi
- Gayle Morelan
- Pat Campbell
UCSD Research Thrust Areas

**Thrust 1:** System Architecture and Coordinated Robotic Agents

**Thrust 2:** Distributed Multisensor Networks

**Thrust 3:** Televiewing

**Thrust 4:** Databases and Activity Analysis

**Cross-cutting Thrust Area:** Design of Novel Testbeds and Integrated Experiments
Remote Environments (distributed)

Environment Awareness
Telecommunication
Semantic Information Processing
Database Archiving and Active Query
Televiewing and Interactive Control

Observers and Interactors (multiple)

For more information, please contact Mohan Trivedi, UCSD (619-822-0075) trivedi@ece.ucsd.edu http://swiftlet.ucsd.edu/
Autonomous Transportation Agents for On-Scene Networked Incident Management

Research Objective
Realization of an integrated traffic-incident detection, monitoring, and recovery system to enhance safety, and reduce congestion on the highways.

Step 1: Incident Detection reporting by an ODVS network.

Step 2: KMET dispatches Remote Agent (RA).

Step 3: RA arrive at the site, verify incident and divert traffic.

Step 4: Team of Little agents (LALIA) dismounted from RA and forms a safe zone in a coordinated way.

Step 5: Assistance offered by a RA using a tele-existence.

For more information, please contact Mohan Trivedi  E-mail: trivedi@ece.ucsd.edu  Phone: 858-822-0075  FAX: 858-822-1918
**Research Objective** Realization of an integrated traffic-incident detection, monitoring, and recovery system to reduce congestion on the highways.

**System Architecture**

- **DiMI:** A Digital Media Innovation Initiative Project
- **Website:** [DiMI Website](http://www.dimi.ucsd.edu)
- **Contact:** Mohan Trivedi, E-mail: trivedi@ece.ucsd.edu, Phone: 858-822-0075, FAX: 858-822-1918
Systematic and Verifiable Progress in this Challenging Research Project is accomplished using Distributed and Networked Experimental Facilities.

**Network should support:**

- Multi-modal sensory clusters
- Real-time Event detection and Analysis
- Multimedia full Duplex Communication
- Reconfigurable Mobile Sensor Platforms
- On demand perspective and resolution televiewing
- Tele-existance
- Multimedia Queries, Past and Future What-if scenarios

**Important Terms:**

- Command Node
- Base Node_i
- Mobile Node_i
- Virtual Node_i
Autonomous Transportation Agents for On-Scene Networked Incident Management

DiMi: A Digital Media Innovation Initiative Project

UMBRELA:
Ubiquitous Multi-Sensor Bases and Robotars Distributed in Experimental Laboratory Networked Areas
Sensor Infrastructure

* **Development of the infrastructure necessary for real-time bidirectional communication in the distributed environment.**
  - Multiple sensor modalities.
  - Sensor fusion (omni and rectilinear cameras, PTUs, microphones)
  - Real-time telepresence
  - Test bed for development of next-generation vision algorithms
  - Robust all-weather design

Research Objectives

- Provide rich data for development of robust segmentation, tracking, and behavior analysis algorithms
- Provide rich real-time information to users of system, regardless of network bandwidth available
- Framework for Coordination of a Team of Mobile Probes

* A novel network, server, and interface architecture is necessary to handle the high volume of data produced by multiple sensors and sensor modalities in multiple locations
  - Broadband network architecture for local development.
  - Robust performance across high and low bandwidth networks
  - Environmental intelligence

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Mobile Infrastructure for Intelligent Environments
Autonomous Transportation Agents for On-Scene Networked Incident Management

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Three separate perspective transformed images selected from a single ODV image frame.

Algorithms for real-time transformations and pan-tilt and zoom have been developed.
Mobile Infrastructure for Intelligent Environments
Semantic Databases in Traffic Incident Detection, Mitigation, and Management

Research Objectives

- Detection, representation, storage, and query of semantic events.
- Representation, storage, and query of spatio-temporal composition of traffic behavior.
- Traffic behavior analysis using semantic databases.

Results of Tailgate and Exit Queries.

Simple Patterns used in Semiorder Semantic Query Language

Spatial Structure of A Highway Segment

Multiplicity of Database Types, including Semantic Databases, in ATON

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ATON Inspired New Initiatives

1. “VICTOR”: Video Clusters for Travelling-vehicle Occupancy Analysis in Real-Time, CalTrans and Lawrence Livermore Laboratory, November 2000.

2. Cal (IT)2: ITS Layer


4. Speech and Audio Databases (Qualcomm, April 2000-Sept. 2000)
Thank you!!
For more information: http://swiftlet.ucsd.edu
Video Demonstrations

Clip 1: KSWB News Report

Clip 2: KGTV News Report
Smooth Walkthrough: AVIARY
Synthetic Panoramic Views and Walkthru: Outdoor
Audio-Video Interfaces for Intelligent Environments

Digital Media Innovation Initiative

Sony Electronics Corporation
Digital Equipment Corporation

Industry Partners

AVIARY
Audio-Video Interactive Appliances Rooms, & sYstems

Research Goals
Develop novel intelligent systems which can:
• Develop and maintain awareness of their environment
• Acquire and respond to the voice and visual inputs from the users in a robust manner
• Adapt to the dynamic changes in their surroundings
• Interact in a natural and flexible manner with the users
Virtual view synthesis: Conference Room
Virtual view synthesis and Walkthru: Hallway

Walkthrough: Hallway

Armed1 HALLWAY

35 Cameras

Dimensions:
- Wall: 121"
- Window: 154"
- Door: 72"
- Walkthrough: 15"
Intelligent Environments and Tele-Presence
- Key Technologies -

- 3D Modeling
- Real Time Event Recognition
- Mobile Probe Control
- Interaction Analysis
- Human Interface

University of California, San Diego

Computer Vision and Robotics Research

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