A Sensor Network for Social Dynamics

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The UbER-Badge
- Wireless Wearable Sensor Node
- Display Badge
- Nametag Replacement
- Social Pattern Analyzer
- Social interaction motivator
- Why would we want something like this?

Motivation
- Remembering places (demos/stands)
- Remembering people
- Ice breaking
- Audience interaction (voting)
- Message broadcasting (time, advertising?)
- Learn about the audience

Previous work
- Ice breaking (Thinking Tag, Lovegetty)
- Social Interaction (Meme Tag)
- Conferences (nTAG)
- Inference of social behavior
- All of these based only on proximity!
- Can we do better?

A wearable sensor network
- Multimodal sensor data
- Line-of-sight IR
- Omnidirectional RF
- Accelerometer
- Microphone
- Output?
  - LED Screen
  - Vibrating Motor
  - Headphones
- And room for more…

Badge’s RF
- Based around the Chipcon CC1010
- Integrated Microcontroller
  - Communication offloaded from the main processor
- P2P random access network
  - CSMA/CA
- RF Range 100 meters
Positioning
- Uses IR beacons “squirts” to tag fixed locations
- Research Demos
- Broadcast a byte of ID to nearby badges at 1 Hz
  - A range of 2-6 meters
- Squirt position used as reference for badge’s
- Users can “bookmark” squirts

Communication
- Packets broadcasted are not multihop routed
- Network of fixed base stations
  - All badges within range of one
  - Allow clients to query and command badges
- Badges broadcast ID through IR
  - Alert badges and squirts of presence
  - “Encounters” monitored

Applications
- Applied in the context of a conference
- Bookmarking Demos and V-Card Exchange
  - Bookmark information later reported to users
  - Facilitate further exploration of demos

Applications
- Displaying public messages
  - Commanded from the network
  - Return to the room, food during open house, etc.
- Displaying personal messages
  - Sent from Kiosk PCs
  - Read from other person's badge
  - Foster social interaction?

Applications
- Timekeeping
  - Let speakers now they are running out of time
  - Use many badges as a large screen
  - Triggered manually or by radio broadcast
  - Better than watching the clock!

Applications
- Voting
  - Buttons on the badge used to poll the wearer
- Affinity Group Display
  - Cluster users in groups according to behavior.
  - How?
Inference
- The project’s most significant contribution
- Learn from user interactions
- Uses bookmarks… for now
- Encounter duration
- Motion patterns
- Microphone input
- Company name as ground truth
- Classifier runs entirely on badge…
  - Almost. Still needs server for routing

Interest Detection
- Feature correlation to bookmarks
  - Strong correlation with accelerometer features
  - Negative correlation with audio features
    - Perhaps reading or observing the demo?
- Used a subset of the most correlated features
- Linear regression predictor function
  - 86.2% accuracy for badge encounters
  - 78.4% accuracy for squirt encounters

Affiliation Detection
- Time spent face-to-face
  - Medium correlation to affiliation
- Influence Model
  - HMM used to learn “influence” across chains
- Expectation maximization
  - Learning Parameters
- Accuracy of 93.0%

Shortcomings
- Need for accelerometers, headphones, microphones
- Mobility really necessary....
  - Fixed cameras could also do same task
- Power is a design constraint yet....
  - many components, display, flash memory

Shortcomings
- Design goals met…
  - Display could be better accomplished by other means cheaply.
  - Are the features used enough
  - Human relationships/behavior is complex
  - Reuse not discussed

Summary
- Applies model learning and sensor networks for social inference
- Offers an innovative solution with rough edges
- Many applications don’t really use the sensor net
- Still relies on fixed network infrastructure
- Still depends on explicit bookmarking
- Model may not be adequate for all environments
  - It may be tuned!
Summary

- Room for improvement and further study
- Options for extra hardware available
- Not cheap ($80), power efficient or light (170g)
- Participants found them useful
- They were happy to wear it through all the event

Discussion, Questions?