A Navigation Engine for Ubiquitous Computing Environments

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Overview

- What is navigation
- Navigation in ubiquitous computing
- What is the navigation engine
- How it works
- Case Studies
- Future Work
Introduction

• What is navigation
• Navigation in physical space
  – Maps, signs, compasses, GPS
• Navigation in virtual/information space
  – Database, virtual environments, WWW
    • Search Engines
• Navigation in Ubiquitous computing environments
  – Physical and Virtual Combined
Types of Navigation - British Museum Example

- Physical Navigation
  - Find an exhibit

- Information Navigation (Museum’s web site)
  - E.g. Find video related to Parthenon marbles
  - Historical information

- Ubiquitous computing scenario
  - Provide navigation guidance and adapt the ubicomp environment on the user
Scenario - British Museum

• Visitor
  – After visiting a couple of landmarks the system recognizes the user interests.
  – Displays attached at the exhibits gives personalized information for this user
    • Information about the exhibit that is of particular interest for the visitor e.g. for Egyptian artifact: comic for children, art info for the artist
    • Recommend where to continue his museum experience
  – Return the user experience in a CD or museum’s web site

• Museum Manager
  – Improve the physical navigation and update accordingly information about the exhibits
Aims

• Understand space usage and improve physical navigation system
  – What do people do when they visit an exhibition area?
  – What exhibits are they interested in?
• Recommend significant trails
  – A tool for navigation assistance
  – Recommendations
Model of Navigation

- Identify users
- Landmarks
  - Physical or information object that you interact during a visit
- Record interactions between users and landmarks
  - Sequence of interactions = trail
- Use the interaction record to create navigation tools
- Previously collected trails
- Definition of metrics for calculating best routes
- Mechanisms for calculating best routes
- Output
  - Significant Trails
  - Landmark usage information
Trail Representation

Suffix tree for ABCABCD and ABCEABCD
Simple Queries

- **Landmarks**
  - All questions answered from first level nodes
- **Queries**
  - When a landmark was visited
  - Average time spent on the landmark
  - Number of visitors interacted with the landmark
  - The above information in specific period of time
Complex Queries

• Queries about significant user trails
• Significant Trails by:
  – Frequency
    • E.g. Most popular trails between two landmarks, lasting 20 minutes
  – Other metrics of significance
    • Time, Orientation. Exhibit Relevance
    • The above metrics combined
10 most popular trails of length 10 7 distinct landmarks
Example - Dartmouth

10 first by time spent

10 first by time and frequency combined
Future Work

• Data Collection
  – London Zoo
  – Flexible network in the London Knowledge Lab

• Performance
  – Large data set

• Prediction
  – Recommended trails based on significant trails
  – Clustering / Classification

• Interface
Questions

• Questions?