KHARMA + Argon: KML/HTML Augmented Reality Mobile Architecture and Client Browser

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Augmented Reality Technology

- Superimposing Synthetic Content
  - Usually graphics, but not exclusively
  - Usually focused on 3D content

- Three Technical Approaches
  - a) Projector-Based
  - b) See-Through
  - Video-See-Through (VST)
Augmented Reality Technology

Three Technical Approaches
- Projector-Based
- See-Through
- a,b) Video-See-Through (VST)

Video-See-Through Advantages
- Easily control live-synthetic registration
- Easily deployed on mobile devices
Mobile Augmented Reality

- Two Main Approaches
  - Computer Vision-based
  - Compass/GPS-based
- Computer Vision-based
  - a) Fiducial or b) Natural Feature Tracking
  - Content relative to camera
    (ex. ARToolKit, FLAR)
Mobile Augmented Reality

- Two Main Approaches
  - Computer Vision-based
  - Compass/GPS-based

- Compass/GPS-based
  - GPS location/Compass orientation
    - Standard equipment on many phones
  - Content absolutely geo-referenced
  - Numerous Commercial Offerings
    - a) Layar, b) Wikitude, Junaio, AcrossAir

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a) Layar, b) Wikitude, Junaio, AcrossAir
Mobile AR: Research Themes

- Systems
  - What technologies to deploy mobile AR?

- Applications
  - What application areas benefit from mobile AR?

- Interaction Techniques
  - What techniques appropriate/efficient?

- Authoring Techniques
  - How facilitate authoring and content development?
  - Is there an AR “language” like in film and literature?
Mobile AR: Research Approach

- Systems
  - Leverage platforms already in use
  - Foster creation of standards

- Applications
  - Foster creation of numerous prototypes
  - Support user community creation

- Interaction Techniques
  - Let developers author presentation (i.e. clustering, labeling)

- Authoring Techniques
  - Reuse existing assets, skills and toolkits when possible
  - Add features to facilitate emerging techniques
Mobile AR: Prior Work

- Designers AR Toolkit
- Unity AR Toolkit

- research tools
- media hackers
- skilled computationalists
- savvy technical designers
- general public
- breadth of adoption
- our past focus
- current focus
KHARMA: Motivation

Mobile Client → Layar Servers → Content Aggregator → Content Provider

- no accepted standard
- proprietary client protocols
- limited client-side interactivity
- limited expression (coordinates, description, hyperlink)

“effectively Web 1.0”
KHARMA: Motivation

- **Systems**
  - No new architecture needed
  - 2D content powerful (i.e. billboards, buildings, surfaces)
  - Single application should handle multiple applications (i.e. a browser)

- **Applications**
  - Web 2.0 interactivity a minimum bar
  - Multiple applications “sandboxed” (i.e. tabs in a browser)

- **Interaction Techniques**
  - Applications respond to context (i.e. GPS accuracy)
  - Users switch context/focus (i.e. “tab” between Twitter, Coke, Google, etc.)
**Predictable Authoring**
- Lightweight Content
  - reference existing models
- Visual Control
  - match content w/ accuracy

**Common Shared Resources**
- Tracking Services
  - GeoSpot Server
- Infrastructure Services
  - Building Models

**Leverage Existing Standards**
- HTML/CSS for 2D Client
- COLLADA/WebGL for 3D
- HTTP Web Servers
KHARMA: KML/HTML Augmented Reality Mobile Architecture

HTML + KML

for What? How? and Where?

- extensive client side (albeit 2D) interactivity and expressivity
- two most broadly adopted presentation and geo location standards
- HTTP server distribution, CSS and Javascript = Web 2.0 content
KHARMA: KML/HTML Augmented Reality Mobile Architecture

KARML extension to KML

- description tag accepts CDATA enclosed markup
  - no global styling or scripting
- no control over balloon styling
- no control over balloon position and orientation
- no relative positioning
KHARMA: KML/HTML Augmented Reality Mobile Architecture

KARML extension to KML

- added undecorated displayMode
- added Balloon element
  - similar in nature to Model element
- relative locationMode
  - accepts “units” attribute
- global scope for Javascript and CSS
KHARMA: KML/HTML Augmented Reality Mobile Architecture

KARML extension to KML

• surveyed locations
  - GeoSpots
  - find local spots on a map
  - manually override GPS

• panoramic backgrounds
  - shot at GeoSpot location
  - manually override compass
  - eliminate compass error
KHARMA: KML/HTML Augmented Reality Mobile Architecture

Argon client for iPhone 4

- reference implementation of KARML
- multiple simultaneous channels
- bookmarked examples
KHARMA: KML/HTML Augmented Reality Mobile Architecture

- **Applications**
  - Foster creation of user community
  - Foster creation of many prototypes

- **Authoring Techniques**
  - Add features to facilitate emerging techniques

- **JavaScript API**
- **GoogleEarth tutorial**
- **KARML reference**
- **Basic and API examples**
Project Videos

- Systems
  - 2D content powerful (i.e. billboards, buildings, surfaces)

- Interaction Techniques
  - Let developers author presentation management (i.e. clustering, labeling)

- Applications
  - Web 2.0 interactivity must be minimum bar

http://www.youtube.com/watch?v=F_M8C2jW8PI

http://www.youtube.com/watch?v=01S1BbeJ-ik
Student Videos

http://www.youtube.com/watch?v=3dMvS6u_kHY

http://www.youtube.com/watch?v=AD5QbVcegkQ

http://www.youtube.com/watch?v=gKeX7umvWWY

ARBoretum

- Systems
  - Leverage platforms already in use (i.e. webservices)
- Applications
  - Foster creation of numerous prototypes
- Applications
  - Web 2.0 interactivity a minimum bar

Poring AR

Dotman’s Revenge
KHARMA: KML/HTML Augmented Reality Mobile Architecture

- Systems
  - Foster creation of standards

• W3C: Point of Interest Working Group
  - Launched September, 2010
  - Nokia, Open Geospatial Consortium, Navteq, Georgia Tech, others
  - December 2010, Atlanta
  - March 2011, Amsterdam

• International Workshops on AR Standards
  - October 2010, Seoul
  - February 2011, Barcelona
  - W3C, Khronos Group, OGC, VodaPhone, Nokia, IGD Fraunhoufer, others
**KHARMA:** KML/HTML Augmented Reality Mobile Architecture

- Implications for Accessibility
  - Leverage existing HTML standards
    - screen readers/tab through
    - some limited experimentation
    - DIVs become “visible” when in view
  - Universal Design
    - Virtual Reality bias towards full body interaction
    - VST AR is effectively flattened
    - results in “image-plane” techniques
    - selecting content similar to mousing (i.e. heading and pitch)
    - Applies to alternate input methods (i.e. Brain-Body, etc.)
KHARMA: KML/HTML Augmented Reality Mobile Architecture

- Implications for Accessibility
  - Leverage mobile sensors
    - forward facing cameras
    - hand tracking
    - obstacle detection
    - rear facing cameras
    - eye/head/gaze tracking
    - emotion detection (i.e. frustration)

- Telepresence
  - Place videos into surroundings
  - Place 3D avatar into surroundings
  - User controlled representation
**KHARMA**: KML/HTML Augmented Reality Mobile Architecture

- **Future Work**
  - Authoring Tools
    - desktop version
    - integration with MS Kinect
    - peripherals (i.e. external GPS, location services)
  - Infrastructure
    - elevation services
    - references to 3D models
  - Tracking
    - fiducial tracking
    - Natural Feature Tracking
  - Android version
KHARMA: KML/HTML Augmented Reality Mobile Architecture

http://research.cc.gatech.edu/kharma

Thank you

http://www.argon.gatech.edu