Prototyping and Debugging Realtime Interactive Systems with Augmented Reality

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Overview

- Two uses of AR in development
  - AR as a prototyping tool
  - AR as a debugging aid
- One problem
  - (Sup)Porting systems across desktop and mobile environments
AR Prototyping: A Wrist-Worn Projection Display

G. Blaskó, F. Coriand, & S. Feiner, ISWC 2005
AR Prototyping: A Wrist-Worn Projection Display  Gábor Blaskó, Franz Corian

- High-res, full color, bright, tracked... with integrated UI
AR Prototyping: A Wrist-Worn Projection Display  
Gábor Blaskó, Franz Coriand

Wrist-mounted Touch Sensor

Orientation Tracker

Synaptics Touchpad
InterSense InertiaCube2 3D Orientation Tracker
AR Prototyping: A Wrist-Worn Projection Display

Wrist-mounted Touch Sensor

Orientation Tracker

Position Tracker

Origin Instruments Dynasight 3D tracker

Retroreflective marker
AR Prototyping: A Wrist-Worn Projection Display  
Gábor Blaskó, Franz Corian

- Wrist-mounted Touch Sensor
- Orientation Tracker
- Position Tracker
- Generation of texture mapping coordinates (projected textures)
- Real-time rendering of simulated projection on wall

NEC WT600 short throw projector
Basic Simulation
Orientation-based Interaction
AR Prototyping: String-Based Interaction

G. Blaskó, C. Narayanaswami, & S. Feiner, CHI 2006
AR Prototyping: String-Based Interaction Gábor Blaskó

- 2D primary touchscreen display
- 1D secondary display with angle/length input
AR Prototyping: String-Based Interaction

Gábor Blaskó

Watch mockup contains badge reel

Retroreflective marker

Reel cable

Screen

Projector

Origin Instruments Dynasight 3D tracker

Cable
Stock Sector Overview

- Apple (AAPL)
- Dell (DELL)
- Hewlett-Packard (HPQ)
- IBM (IBM)
- SGI Inc (SGI)
- Sun Microsystems (SUNW)
Stock Sector Details on Demand
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AR Debugging: Redirected Motion

O. Oda & S. Feiner, ISMAR 2009
AR Debugging: Redirected Motion

O. Oda & S. Feiner, ISMAR 2009
Now for the not so fun, ...
Supporting Desktops and Mobile Devices  http://goblinknxna.codeplex.com

- Goblin XNA: Infrastructure for 3D UIs and AR, built on XNA
  - Scene graph interfaces to external physics, tracking, networking, cameras, HWDs, GUI…
  - Windows Desktops: 2008–
  - Windows Phones: 2012–
- Problem: Need to support external functionality across desktop and mobile devices without reinventing the wheel reimplementing
Supporting Desktops and Mobile Devices  
http://goblinxna.codeplex.com

- **Implementation Differences**
  - **Development environment**
    - OS: Windows 7 vs. 8
    - Native machine vs. VM (GPU issues)
  - **Deployment environment**
    - OS: Windows vs. Windows Phone
    - Rendering: Texture aspect ratio, Shader capabilities, Silverlight,…
    - Mobile OS: Windows Phone 7.8 vs. 8
    - Hardware: Desktop vs. Phone, Real phone vs. emulator
  - **Mismatched “equivalent” APIs → Versionmania™**
    - Physics: Newton/Havok vs. Matali
    - Tracking: ALVAR vs. NyARToolKit
  - **License: BSD, MIT, GPL, LGPL,…**
    - Need for *internal-only* version of open-source system that uses GPL’d utilities, if all source not available (e.g., XNA)

NyARToolKit not on Codeplex
Supporting Desktops and Mobile Devices http://goblinxna.codeplex.com

- Example from 3DUI & AR course last week: “3D transformations aren’t working on the phone!”
  - Some students used physics for raycast picking
  - But, pickable objects then participate in physics
  - Phone physics implementation is missing support for non–physics-based transformation of objects in physics simulation… Uh oh!
  - Pickable objects don’t move when transformed
- Nothing that can’t be solved with full multi-platform regression testing (with inferencing of consequences)… 😊
How can we fix this?
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