Multi-modal exploration of rugged digital terrain on mobile devices

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Overview

• Mobile devices are becoming dominant in digital map display (tablets too)
  – Challenges of small map display, storage / processing limitations
  – Dominance of Google Maps / Earth

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What about terrain?

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What do they not communicate?

• The look of a surface?

• The *feel* of a surface?

• Really?
Rolling ball examples

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What about balls?

- Actively engaged with the data
- “Energy” spent to roll the ball
  - Gravity, momentum, force
- Sense of presence
  - A spherical avatar
- Haptic (and sound) feedback

Griffin, 2002
Minimal Requirements

Graphics
• OpenGL ES 2.0 (graphics language)
  provides direct access to vertex and fragment shaders

Sensors
• Accelerometer / Gyroscope
• Magnetic sensor
  supported on modern Android/iOS smartphone & tablets
Development environment: software and hardware

- Android HTC Desire (2.3.7)
- Galaxy Nexus (4.1.1)
- Eclipse
- Android SDK and NDK
- GitHub version control
  (public version coming soon)
Architecture Diagram

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What goes on behind the scene

- **Sensors** feed data to the scene manager (C++)
- **Scene Manager**
  - prepares the scene objects
  - sets data for renderer in OpenGL rendering engine
- **Renderer** (mixed C and C++ code and Graphical Library Shader Language, GLSL)
  - Dynamically binds vertex and fragment shaders
  - renders the scene with a given perspective and lighting arrangements
- **Processors** internally perform
  - matrix manipulation, matrix algebra and geometry manipulation to create the scene out of triangles.
  - Lighting setup is already provided.
- **Application** is managed from Java through Android Activity, which sets the initial graphical context
- Textures and additional effects currently under development.

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Screen shots

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Summary

• Richness of elevation not communicated?
• TerrainBall is tilting / twisting the terrain (the device) to roll the ball
• Haptic feedback to add to the visual
• Future testing on usability
• Where would you use this?
• Learning of terrain data – retention enhanced? (outdoor types, kids)
• Adding game like elements?

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