

Example projects ideas for CS 4621/5621

1. A modeling system that allows editing of triangle meshes and spline or subdivision surfaces (= modeling) with substantial care given to really nice and usable user interface that allows all manipulations to be done controllably (= interaction).

SIGGRAPH 2000 subdivision course notes.

Scene assignment as a jumping-off point.

Blender as an example of a user interface for editing.

2. A Minecraft-like world that allows the user to roam a procedurally-generated world they can somehow edit (modeling) and is able to efficiently render large scenes (rendering). Or the world could come from publicly available elevation maps of the real world.

Book: Texturing & Modeling: A Procedural Approach (Ebert et al.)

Data: USGS National Elevation Dataset <http://ned.usgs.gov>

3. A game that allows the user to roam a manually specified world and has a lot of fancy shading effects (rendering) and has a nice interactive level editor (interaction).
4. An interactive art piece that uses some creative interaction technique (e.g. analysis of camera or Kinect data) to drive a 3D model or animated simulation (modeling or animation) with an emphasis on aesthetics of the image and interactive experience.
5. A procedural plant modeling system based on L-systems (modeling) with interactive control over parameters and constraints (interaction) or some fancy realistic rendering techniques (rendering).

Book: Prusinkiewicz, The Algorithmic Beauty of Plants (available on line)

6. An artistic rendering system that simulates some traditional medium (pen-and-ink, watercolor, charcoal, ...) under interactive control (rendering, interaction).

Book: Gooch & Gooch, Non-Photorealistic Rendering

Book: Strothotte & Schlechtweg, Non-Photorealistic Computer Graphics

7. A real-time ray tracer built from scratch with an optimized, multithreaded implementation (rendering) that supports interactive viewing of models or exploration of environments (interaction).

SIGGRAPH 2005 real-time ray tracing course notes

8. Some kind of physics simulation, such as a system of rigid bodies or a deformable object (animation), with either associated interactive authoring tools (to allow setting up initial conditions, interacting with the running simulation -- interaction) or some fancy shading for realistic results (rendering).

Would want a couple of team members who are good at physics.

9. A volume renderer for medical data that supports direct volume rendering (rendering) and also either extraction of isosurfaces from the volumes (modeling) or an interactive system for adjusting the rendering parameters, extracting slices, etc (interaction).

Book: GPU Gems, Chapter 39. Volume Rendering Techniques (available online)

Data: Many samples available in DICOM format e.g. <http://www.osirix-viewer.com/datasets/>

10. Mesh morphing (modeling) with a nice UI for authoring correspondences (interaction).
11. Real-time renderer for large scenes (rendering) that uses progressive meshes (modeling) or similar tool to do level-of-detail to maintain speed.

Paper: Hoppe, Progressive Meshes

12. Project that computes images to be viewed in stereo on a smartphone display using one of the many inexpensive stereo viewers (rendering, needs a second component).
13. Blobby modeling system based on implicit surfaces (modeling) that are either triangulated for display or ray traced directly (rendering), with simple tools to position the basis functions.

Implicit models chapter in the 4620 textbook.