

Game Programming II (Wrath of Khan)

GAM 575

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Description:

Game Engine Programming II (Wrath of Khan) is being offered this spring. This class continues to explore C/C++ game engine programming, data structures, and practices. Topics include audio, network access, threads and multi-processor systems, profiling, scripting, content libraries, animation, and a survey of game engines. The previous quarter's game engine will be furthered strengthen with more systems integrated into our framework.

Prerequisites:

- GAM 475 Game Programming Engine I

Grading

- 80% - 2 milestones (grouping of assignments)
- 10% - Perforce Submissions (at least 10 per week with comments)
- 10% - Final Exam

NOTE: You must pass the final exam (70% or higher) to receive a passing grade in the class.

Textbooks and printed resources

Additional course material will be many supplied through class notes, handouts or online links.

- 2 Required Books
 - **OpenGL SuperBible: Comprehensive Tutorial and Reference (5th Edition)**, 2010, by Richard Wright and others, ISBN: 978-0321712615
 - **Game Engine Architecture**, 2009, Jason Gregory, ISBN: 978-1-56881-413-1
- Recommended:
 - **Windows System Programming (4th Edition)**, 2010, Johnson Hart, ISBN: 978-0321657749
- Assumed you already have:
 - **The C++ Programming Language: Special Edition** - Bjarne Stroustrup

Topics will include:

- **Main Lectures:**
 - 2nd pass on Graphics engine
 - Run time formats
 - Texture manager
 - Camera Culling
 - Bounding volumes
 - FBX
 - Model conversion
 - Animation extraction
 - Skeleton
 - Skinning
 - Transformations
 - Interpolation
 - Linear, slerp, blerp
 - Hierarchy relative vs flat transformations
 - Quaternions
 - Animation
 - Key frame vs motion capture
 - Animation Controllers
 - Skeletons
 - Blending / Mixing
 - Morphing
 - Move the animation by game control
 - Puppet-ting
 - Skinning
 - Rigid body
 - EA technique
 - Midway Technique
 - Object
 - Cloning
 - Replication
 - Scene Graph

- **Secondary Lectures (if time permits)**
 - 1) Level of Detail
 - 2) Multiple rendering targets
 - 3) Input / Events trigger
 - 4) Sound System
 - 5) UI
 - 6) Threading
 - 7) Serialization / Networking

Programming Assignments – 80%

2 major milestones, each milestone builds on the previous milestone. There are mini check points to make sure the student is on convergence path between milestones.

- **Milestone 1:** Model Converter and more... - 40% (due Week 6 – May 8, 2013)
 - Write a generic file Archiver
 - Takes loose binary files, adds headers and formatting info to create chunks
 - Packages the chunks together into a single binary package
 - Extracts chunks on demand from the package
 - Write a FBX converter to convert to run-time file format.
 - Place data into the file archiver
 - VBO with VAO format
 - Convert 3 FBX models to Game Engine runtime format from a batch/script file.
 - Models need to be
 - In FBX format
 - Exceeding 200 polygons each
 - Contain textures
 - Models need to be lit in game engine
 - Model viewer
 - Load models from the archiver
 - Rotate camera 360 around the viewer
 - Zoom
 - Add ground plane
 - Demo the game engine to display the 3 supplied models + 3 others
 - Quaternion library
 - Write and integrate the quaternions into the math library
 - Validate against unit tests

- **Milestone 2:** Animation Engine 40% (Week 11 – June 13, 2013)
 - FBX animation exporter
 - Write a converter to extract Animation data (Skeleton and animation) from an fbx file
 - Convert 3 FBX animations to a run-time file format
 - Animation engine
 - Demo the game engine to display the 3 different animations
 - Be able to dynamically interpolate the play back of the animation
 - Each animation needs at least 5 or more bones
 - At least 20 or more key frames
 - Each keyframe containing rotation and translation
 - Playback engine
 - Animation should be able to:
 - Play forward / backwards
 - Loop
 - Faster or slower playback rate
 - Transition to different animations

- **Extra Milestone:** Skinning 10% (extra credit)
 - Write a converter to extract the skin and bone information from a fbx file
 - Fbx data needs to have simple animation
 - Display the animation with
 - Rigid body (no skinning)
 - EA technique
 - Midway technique

Perforce Submissions - 10%

- At least 10 perforce incremental submissions a week.
 - Reality there will be many more during the course of the week
 - Want to see real incremental development, frequent submissions, problem broken down into individual mini-tasks
- A descriptive check-in comment
 - Should be able to read the changelist comments that describe the step by step development process

Final Exam – 10% (11th week)

Take home final exam covering the concepts and the material of the class.

- Take home exam
 - Not an essay, but actual engineering dialog