2024 / 25

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South East Technological University

Module Descriptor

Advanced Graphics for Games (Computing and Mathematics)

Advanced Graphics for Games (A12601)

Short Title: Advanced Graphics for Games
Department: Computing and Mathematics
Credits: 5 **Level:** Advanced

Description of Module / Aims

Design and construct realistic scenes/effects requiring advanced graphics rendering techniques using OpenGL and the OpenGL Shading Language (GLSL).

Programmes

		stage/semester/status
GAME-0007	BSc (Hons) in Applied Computing (WD_KACCM_B)	4 / 8 / E
GAME-0007	BSc (Hons) in Applied Computing (WD_KCOMP_B)	4 / 8 / E
GAME-0007	BSc (Hons) in Computer Science (WD_KCMSC_B)	4 / 8 / E

Indicative Content

- Constructive solid geometry (CSG): constructing objects using primitives and boolean operations, ray tracing CSG models
- Surface modelling: parametric curves and surfaces, Beziers and NURBS, subdivision surfaces, implicit surfaces and Voronoi diagrams
- Illumination: ray tracing, global illumination, reflection and refraction rays, optimisation methods for ray tracing, Monte Carlo ray tracing and soft shadows, photon mapping
- Textures: texture mapping, procedural textures, Perlin noise, normal mapping
- OpenGL and Shaders: Review of the OpenGL pipeline, programming GPUs, the basics of the OpenGL shader language GLSL, vertex and fragment shaders, memory management and optimisation concerns

Learning Outcomes

On successful completion of this module, a student will be able to:

1. Construct realistic scenes using core technologies of constructive solid geometry, implicit surfaces, illumination technologies and texture mapping.
2. Assess a given geometry to determine properties such as normals, curvature, convex hull, bounding box, etc..
3. Design and implement multi-pass rendering sequences on the GPU.
4. Evaluate the computational cost of a GPU implementation.

Learning and Teaching Methods

- Lectures will be used to present all the relevant theory and concepts that will be used in the supervised labs. Supplementary material will be accessible online.
- Practical exercises will provide students with an opportunity to develop a range of technical competencies relating to creating graphical effects using industry standard development tools, technologies and techniques.

Learning Modes

Learning Type	F/T Hours	P/T Hours
Lecture	24	
Practical	24	
Independent Learning	87	

Assessment Methods

	Weighting	Outcomes Assessed
Continuous Assessment	100%	
Assignment	20%	1,2
Assignment	30%	3,4
Assignment	50%	1,2,3

Assessment Criteria

<40%: Inability to demonstrate knowledge or understanding of the concepts outlined in the syllabus content, inability to apply concepts to selected problems.

40%–49%: Able to demonstrate a basic understanding of the fundamental concepts outlined in syllabus content.

50%–59%: In addition to above, able to evaluate own code for significant performance and resource bottlenecks.

60%–69%: All of the above, in addition implement all required features consistently well.

70%–100%: All previous to an excellent level. Implement additional features or uses techniques not directly presented in class.

Supplementary Material(s)

- Angel, E. and D. Shreiner. *Interactive Computer Graphics: A Top-Down Approach with Shader-Based OpenGL*. 6. USA: Pearson, 2011.
- Hearn, D. *Computer Graphics with OpenGL*. NY: Pearson, 2004.
- Shreiner, D., G. Sellers, J. Kessenich and B. Licea-Kane. *OpenGL Programming Guide: The Official Guide to Learning OpenGL*. 8. USA: Addison-Wesley Professional, 2013.

Requested Resources

- Room Type: Computer Lab