

# CI5525 3D GRAPHICS PROGRAMMING COURSEWORK

## PORTFOLIO OF ASSESSED WORKSHOP EXERCISES

### LEVEL 3 PROJECT: **HERO DEMO**

The **Hero Demo** aims to showcase the best of your skills and expertise in 3D rendering, with an option to use some of your prowess in Artificial Intelligence. It is an **open-ended**, mid-sized software project combining several different algorithms, special effects and 3D rendering techniques to create a compelling 3D scene, a centrepiece for your professional portfolio. Not only technical, but also aesthetic and artistic merits will be taken into account in the marking process. The Hero Demo gives an opportunity for students aiming at the highest marks to shine.



A Hero Demo project should incorporate several different rendering techniques – you will find the list of the techniques currently covered in the module at the end of this document. It reflects the project topics available for Level 2 submission. You can reuse the same techniques you practised in your Level 2 submission, but it is expected that at least one of them will be new. On top of that, you can aim at one of the following special merits – for potentially higher mark:

- Technical merit: anything beyond the standard list of rendering techniques published in Appendix 1. It may be a novel, extended or untypical use of any of them, original combination (for example: using an environment map to create realistic reflections on the surface of rendered water, or using a particle system to create a waterfall). Even more interesting would be using of an original algorithm you investigated for or modified on your own, beyond the module curriculum. Example might include physically-based rendering or elements of global illumination.
- Programming merit: creative extensions of the scene incorporating such features as non-trivial interactivity, animation, physical simulations, gameplay or AI features.
- Optimisation merit: good examples of effective optimisation techniques, well documented in the report.
- Art design merit: visually attractive scenes, particularly those using special effects to creatively enhance the scene or game mood and atmosphere; own artistic creations (3D models, textures) will be appreciated.
- Web-based project: instead of C++/GLSL, you would deliver a web-based project written in javascript and WebGL, utilising the three.js library. There is still a requirement to use GLSL-based shaders.

**Teamwork:** Teams of up to 3 developers are allowed to submit projects but we will expect them to deliver considerably higher standard. To avoid disappointment, always agree the scope of a team project with the Module Team and we will propose a marking scheme on an individual basis. Unless specified, it will be assumed that all topics are equally split among the team members. Team members can supplement the Hero Demo with additional individual submissions.

**Report:** Your report should include the following:

- Screen shot (one or more).
- Scene design: justify the scene composition and selection of objects and special effects. Explain anything special about your work, such as use of lighting or any unorthodox application of sfx.
- Instructions – if needed (for example, if the scene/game uses any special key combinations other than the default navigation)
- 3D techniques and algorithms applied in the solution – please provide details, particularly if you have done something differently to what we did in the workshops.
- Brief specification of the source code (major classes, important functions and variables).
- References (if applicable).

The report should not exceed 800 words (excluding references). Figures, diagrams and screenshots are welcome.

If you submit a **report** as a **team**, then just one report should be submitted for the entire team. It should cover all the techniques and effects (“topics”) used in the project, with a clear indication of who did what. If you also submit any individual project or projects (other than the team project), you will need a separate report for them.

**Video Footage** does not have to be long – it is recommended not to exceed 1 minute unless really justified. It is also recommended to add some form of commentary to your footage. It may be displayed as subtitles or recorded and added to the sound track. In case of team projects, only one video submission per team is expected.

**In-Class Pitch** is a formative assessment event and it is highly recommended to attend. You will receive last-minute feedback and a predicted mark which will help you to polish your final submission – for which you will have some time after the pitch. During the pitch, you will only show your project to the marker(s), it is not a formal public pitch.

## APPENDIX 1: RENDERING TECHNIQUES COVERED IN THE MODULE

Simple Techniques	Advanced Techniques
3.1. Spotlight	3.8. Reflections with Environment Maps
3.2. Animated light	3.9. Shadow maps
3.3. Attenuated light	3.10. Mirrors (planar reflections)
3.4. The Fog	3.11. Lakeside Scene (water rendering)
3.5. Animated textures	3.12. Particle systems
3.6. Rim light effect	3.13. Post-processing
3.7. Normal maps	3.14. Rigged characters

## APPENDIX 2: MARKING SCHEME

Your mark will be broken down into following criteria:

Technical criteria	50%	Quality of the deliverable – its completeness, correctness, reliability and complexity of both C++ code and shaders.
Visual criteria	30%	The appearance of the 3D scene which may result from your artistic creativity or be an effect of purely technical achievements. In both cases, the application aesthetic standard should be high.
Coding quality	10%	Program structure, consistent use of coding standards, use of indentation and comments.
Report and video footage	10%	Quality of the report presentation and structure (completeness, use of the technical language). Video footage quality (visuals and commentary) is more important than its percentage weighting suggests: a clear and informative footage can emphasise positive aspects of your entire submission.

<b>Minimum Pass</b> 40 – 49 (D)	<p><b>Technical criteria:</b> A 3D indoor or outdoor scene, technically correct and properly lit and textured. The program must build and run without major runtime errors. The scene combines at least two advanced rendering techniques (see the list in Appendix 1).</p> <p><b>Visual criteria:</b> The scene may be closely based on one of the sample scenes provided in the learning and teaching materials but it needs to include some distinct features, such as different models or terrain.</p> <p><b>Coding:</b> No major defects allowed.</p> <p><b>Report:</b> The report roughly follows the required format but information is basic, not all sections covered or content is inaccurate.</p> <p><b>Video footage:</b> Roughly on topic, but minimum effort, not enough imagery or not convincing, visually unappealing, inadequate or missing commentary.</p>
<b>Fair</b> 50 – 59 (C)	<p><b>Technical criteria:</b> As the minimum pass, but the project combines two or more advanced rendering techniques and one of them has not been presented for marking in Level 2 (see the list in Appendix 1).</p> <p><b>Visual criteria:</b> The scene may be based on one of the sample scenes provided in the learning and teaching materials but it has to hold a distinct, individual look-and-feel.</p> <p><b>Coding:</b> Correct code structure.</p> <p><b>Report:</b> All required sections covered with basic information; or good content but required sections missing.</p> <p><b>Video footage:</b> Demonstrates your work, but commentary is missing or inadequate, or the material is difficult to follow or contains serious flaws.</p>

<b>Good</b> <b>60 – 69 (B)</b>	<p><b>Technical criteria:</b> Technically sound project combines three or more advanced rendering techniques, with one of them not presented for marking in Level 2 (see the list in Appendix 1).</p> <p><b>Visual criteria:</b> The solution should demonstrate good level of artistic or technical creative work.</p> <p><b>Coding:</b> Good code structure, consistent use of coding standards, indentation and comments.</p> <p><b>Report:</b> All sections completed to good standard.</p> <p><b>Video footage:</b> Fairly well done, informative, with solid commentary, with no major flaws.</p>
<b>Very Good</b> <b>70 – 79 (A)</b>	<p><b>Technical criteria:</b> The project must be of very good overall quality and combine at least three advanced rendering techniques, with one of them not presented for marking in Level 2 (see the list in Appendix 1). For this grade it is expected that the project will demonstrate very good technical skills, such as creative combination or enhancement of the rendering techniques.</p> <p><b>Visual criteria:</b> The scene must demonstrate very good level of original artistic or technical creative work.</p> <p><b>Coding:</b> Very good code structure.</p> <p><b>Report:</b> Very good quality with full technical specification.</p> <p><b>Video footage:</b> Completed to very good standard, accurate and convincing imagery and adequate commentary.</p>
<b>Excellent</b> <b>80 and above</b> <b>(A / A+)</b>	<p>The highest marks will be attracted to projects combining technical proficiency with impeccable visual appearance, especially if they clearly demonstrate that an independent research has been conducted. This will require aiming at the merits listed in the main part of this brief. Some ideas of special, A+ worthy achievements include advanced 3D techniques not normally covered in the module, great visual designs, particularly those utilising specific shader-based techniques to achieve desired artistic design concepts, and elaborated interactivity or meaningful gameplay, particularly if it is somehow enabled or otherwise related to the special effects used in the project, or utilises AI methods.</p> <p><b>Technical criteria:</b> Overall excellent technical quality. Specific merits are expected either in technical, optimisation or programming areas. Alternatively, a very good web-based solution (WebGL and JavaScript).</p> <p><b>Visual criteria:</b> The solution should demonstrate aesthetic and creative excellence through very good use of a range of visual tools, achieving high artistic merit.</p> <p><b>Coding:</b> Excellent code structure.</p> <p><b>Report:</b> Report of exemplary quality.</p> <p><b>Video footage:</b> Outstanding, professional work.</p>