804246 - MVJ - Game Engines

Coordinating unit: 804 - CITM - Image Processing and Multimedia Technology Centre
Teaching unit: 804 - CITM - Image Processing and Multimedia Technology Centre
Academic year: 2018
Degree: BACHELOR'S DEGREE IN VIDEO GAME DESIGN AND DEVELOPMENT (Syllabus 2014). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish, English

Teaching staff
Coordinator: Pillosu González, Ricard

Prior skills
Coding in C++. Previous knowledge and experience coding 2D games.

Teaching methodology
During each class, the lecturer will first show the students the theory behind the problem that needs solving. Together with the students, the lecturer will explore the different solutions that exist in the present that solve and simplify the complexities of real time applications like videogames.

Learning objectives of the subject
- Understand how to organize the rendering pipeline and proper loading of a 3D scene.
- Knowledge in how to integrate 3D animation systems.
- Internal structure for entities and their components.
- Audio for 3D environments.
- Most common graphic techniques.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 18h</th>
<th>12.00%</th>
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<tbody>
<tr>
<td>Hours medium group: 30h</td>
<td>20.00%</td>
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<tr>
<td>Hours small group: 0h</td>
<td>0.00%</td>
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<td>Guided activities: 12h</td>
<td>8.00%</td>
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<tr>
<td>Self study: 90h</td>
<td>60.00%</td>
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## Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Learning time:</th>
<th>Description:</th>
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| **OpenGL basics**                            | 15h            | Theory classes: 6h
Self study: 9h                                |
| **Loading 3D models**                        | 10h            | Theory classes: 4h
Self study: 6h                                |
| **Camera and scene loading**                 | 15h            | Theory classes: 6h
Self study: 9h                                |
| **Basic rendering optimizations**            | 10h            | Theory classes: 4h
Self study: 6h                                |
| **Initialization**                           |                | Description: Initialization, Rendering in direct mode, Vertex Buffers       |
| **Rendering in direct mode**                 |                |                                                                              |
| **Vertex Buffers**                           |                |                                                                              |
| **Loading of model information: geometry and materials** |  | Description: Loading of model information: geometry and materials |
| **Rendering of single models**               |                |                                                                              |
| **Free roaming camera, FPS style and single model** |  | Description: Free roaming camera, FPS style and single model, Loading scene information, Execution in threads |
| **Loading scene information**                |                |                                                                              |
| **Execution in threads**                     |                |                                                                              |
| **Frustum culling**                          |                | Description: Frustum culling, Level of details, Octree                      |
| **Level of details**                         |                |                                                                              |
| **Octree**                                   |                |                                                                              |
### Animation systems

**Description:**
- Implementing a Transformation Tree
- Structure of an animation system
- Loading of animations
- Playing and blending of animations

**Learning time:** 25h  
- Theory classes: 10h  
- Self study: 15h

### Component structure and player control

**Description:**
- Component system for entities
- Messaging and event system
- Physics and player control

**Learning time:** 30h  
- Theory classes: 12h  
- Self study: 18h

### 3D Audio

**Description:**
- Loading and playing music
- Playing 3D effects

**Learning time:** 10h  
- Theory classes: 4h  
- Self study: 6h

### Graphics effects

**Description:**
- Particle systems
- Postprocess effects
- Illumination models

**Learning time:** 20h  
- Theory classes: 8h  
- Self study: 12h
Final exam with a weight of 40% with all subject knowledge will be put to test. 
First assignment about GameObjects hierarchy, components and Bounding boxes with frustum culling with a weight of 15%.
Second assignment about Quadtrees, Time Management, Mouse Picking, optimized formats and serialization with a weight of 15%.
Third assignment about a single high level system to choose from: animation, particles, audio, scripting, physics, shaders or UI with a weight of 20%.
The final exam can be revaluated for its weight of 40%
Attitude and class participation will weight 10%

**Bibliography**

**Basic:**