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Course Module Description

General module information
Title: Computer Graphics Programming
Type: Course module
Language of instruction: English

ECTS point: 5 ECTS

Period: 1. september 2022 – 31. januar 2023

Placement
5. semester, B.Sc. i Medialogi

Module Coordinator
George Palamas (coordinator) Elsebeth Andersen (secretary)

Academic content and relationships to other modules/semesters
The formal study plan description of the module can be found here:

https://moduler.aau.dk/course/2022-2023/MSNMEDB5202C?lang=da-DK

The course provides a practical introduction to real-time 3D computer graphics concepts and techniques that are used in most interactive software systems that generate 3D computer graphics in real-time. The course begins with an overview of graphics hardware, an introduction to 3D graphics programming, and coverage of basic geometric primitives and transformations. It then proceeds to introduce other essential topics, including lighting, shading, texture mapping, and bump mapping. A major focus of the course is the implementation of these features in GPU-based shader programs for modern graphics processors (GPUs) using Unity and UE5. In addition, the course covers the use of 3D models and materials as well as the important concepts of camera control. Also included in the course is a section on advanced topics in real-time graphics, such as particle systems and post-processing effects. A final lecture will introduce procedural content generation; this is an area of computer graphics research that is growing rapidly, and it has many practical applications.

Objectives
The goal of this course is to teach students how to program shaders in order to create real-time 3D graphics applications. Shaders are programs used to calculate various aspects of the image, such as the color of each point and the light reflection for each pixel. A graphics pipeline is a process by which GPUs generate 2D images from 3D models using a virtual camera, which consists of several phases. An example of these phases would be the matrix transformation of a 3D mesh into a 2D image based on the location and orientation of a virtual camera, the interpolation of point attributes, such as the color of each point, the calculation of light reflection for each pixel, and the handling of texture information. In order to program shaders effectively, students need to be able to read and understand shader applications. Students are expected to be able to read, analyze, and customize shader applications to meet their specific needs.

Topics Covered:
Graphics Hardware
Basic Geometry & Transformations
Lighting and Shading
Texture & Bump Mapping
Particle Systems
Post Processing
Procedural Content Generation

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Extent and expected work load
Lectures: about 1 ECTS
Assignments: about 1 ECTS
Group mini-projects: about 2.5 ECTS
Exam preparation: about 0.5 ECTS

Prerequisites for participation
Any further information on pre-requisites can be found in the module description (see the link above).

Examination
Modality and duration: Individual oral exam based on submitted mini project. The duration will be 15 minutes followed by 5 minutes deliberation

Assessment: In accordance with the 7-point grading scale

Pre-approved aids: Mini project report and slides for presentation of same

Prerequisites for participation: None

Further detail on the exam: In the beginning of the exam the student will do an approximately 5 minutes presentation of the mini project, after which the examiner will ask follow-up questions within the topic of the mini-project and the entire curriculum. The mini project is used solely as a foundation for the discussion and the quality of the mini project does not count towards the grade.

Information concerning the mini-project: Students should create a media application based on the topics covered in this module (e.g. water shader or post-processing filter). They can pick up a topic from a list of available topics or work on another topic upon agreement with the subject teachers. They are allowed to work either individually or as a team of two. The deliverables are: A) a shader application B) technical report and C) presentation slides.