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SET 10110

Advanced Games Engineering

Module Handbook

This module is a capstone module combining your previous knowledge and experience from the modules studied thus far (i.e., physics-based animation and computer graphics). The module is project based, alongside lectures from staff and industry professionals which will focus on techniques and processes within the games industry. This module will asses your ability to plan, manage and deliver a large games project.

This is your chance to complete something flashy for your portfolio. You have the a large degree of freedom in what you decide to develop.

Learning Outcomes

Upon completion of this module you will be able to

LO1: Critically evaluate current and state of the art methods and technologies around games development.

LO2: Critically assess games development project lifecycles and planning techniques, and critically reflect on their usage within a group based project.

LO3: Design, construct and customise frameworks and technologies for the development of a gaming application.

LO4: Analyse the quality of a delivered games application against requirements and similar games on the market.

LO5: Develop a games application with related artefacts to a high professional standard for use in a portfolio of work.

Week 1 Project

You have one week to create a simple 2D arcade game from scratch.
The brief to create a simple arcade style game, the exact genre is up to you although it is recommended to stick to a 'shoot'em up' scrolling game.

Allowed technology is C++, the SFML graphics library, and any other required libraries.
A barebones starter project has been provided for you.
As there is only one week allocated to this, the scope should be kept to a bare bones minimum

Mandatory Features:
Gameplay

- Simple gamestate system (start screen, pause screen, menu screen)
- Multiple Enemy types
- Powerups
- Multiple levels / Scaling difficulty
- High Score system

Technical

- Simple Sound
- Controller & keyboard support
- Simple Graphics options (Resolution & window mode)
- Windows 10 x64 support
- Single file .exe game installer/uninstaller.
- Web presence with game promo material and downloads

The purpose of this exercise is to re-familiarise you with games development in the low level c++ environment. This will also serve as a great starting point with the future lectures as an example of the minimum working example of a full video game product.

You will demo your game in the week 2 practical to the class, before the group forming phase for the main group project. You may take this as an incentive to make your game a flashy as possible to give the best possible image of yourself to others when forming a team, and likewise you may want to use what others produce as a measure of their technical ability and commitment.

DUE DATE: Friday 15th September, 10:00 AM

Essay Assignment

To cover the suite of learning outcomes of this module, you will also be required to complete an essay assignment. The contents of which is information that you likely already know, or will research yourself when planning and building your main project. The assessment of the essay will be analysing if you have a good grasp of the concepts which you are writing about.

Essay Subject: Engine and Tooling investigation report

Word limit: 1000
This essay will be a high level overview of the state of the art games development tools and processes.

Questions you should attempt to answer could be:

- What are the engines and tools that are currently the most in use in the games industry today?
- Who is using them and what for?
- What are the pro's and cons, which types of studios choose which tools, why?
- Are there any common trends to engines, are they all introducing certain new features?
- If you were to choose an engine, what would you choose, or would you build one yourself, why?
- What software engineering methods are used, are they successful?

You don't have to list every engine and middleware library in existence, try to narrow down to a few common tools and compare and contrast them. This is a discursive assignments so you can and should include your own opinions. The targeted reader for this would be someone who is technically skilled in software development, but new to the games industry.

DUE DATE: Friday, 3rd November 2017, 11:55 PM

Main Project

This is your chance to produce something that is an amalgamation of everything you have learned so far, and a chance to build a fully functional game engine with features that you have not yet encountered. Keep in mind that this module is not assessing your game-design skills, however you will want to make something that is fun for people to play, but you must keep a close eye on your project scope. A great approach would be to make a ‘vertical slice’ of a bigger game, take one or two levels out of grand idea, something that shows of all the mechanics but doesn’t require a large quantity of upfront art assets.

You should know your own strengths and carefully analyse how much effort a game idea is going to need, specifically on the art side. A third person retro platformer is a great idea, but will require extensive art assets and character animations, both of which will take up too much of your time. You can find free content online, but be aware that as this is a portfolio piece; you don’t want everything a user sees in your game to be someone else's work.

There are some strict technical requirements that your must project must meet, these are all must-haves for the final submission. You are expect to go over and above the minimum features, a list of suggested features of varying difficulty have been provided. You should decide as a team what would benefit your game the most and what you can feasibly implement in the time provided, then in the PID specify what you are planning to implement

Required Documentation

Project initiation document (PID)

This a document that will outline your game idea and scope. This should include a detailed plan and timeline of the features you intend to implement. It may be a good idea in this first week to prototype with existing tools like Unity3d to see if your gameplay idea has merit before committing to developing fully in the PID.

Weekly reports

Each individual team member must at minimum write a small description of the work they have completed each week, and the work they intend to complete for the coming week. This should be shared with the team, and then combined together as an appendix in each Milestone report. Combining this with Git commit logs is a good idea.

Milestones

There will be two milestones, one in week 5, and one in week 10.
For each milestone a short report is required along with a playable build of the game. This will be submitted on Moodle.

Milestone Report

This should cover the progress of the project, what features have been completed, and what the status is of the incomplete features. Each report should include a revised plan if any of the time allocations for features have changed.

Final submission Documentation

There will be an electronic submission on moodle similar to the milestones. You are required to also make your game available publicly via a website (Github pages is good idea for this).

Final submission report

This is split into two main parts; firstly documenting your final game, and documenting the development process.This is a technical report, keep it brief and to the point.

The first stage should document the final state and features of the game, this should showcase every feature you have put into your game engine along with a description of your gameplay. Treat this as an advanced user guide/readme along with technical commentary regarding features.

For documenting the process: include a rundown of the project timeline, justification for any changes from the original spec or milestone reports. Also include a chart of who worked on which feature and when. Include as an appendix: all weekly reports.
This section will be used for marking against criteria 3.C.1/2/4, so make sure this section of the report covers everything you have done regarding planning, engineering and testing.

Final Evaluation Report

After completion of your final project you are required to individually submit an evaluation report. This will cover your thoughts on the management and technical choices of your project.
With evaluation on your own performance and contribution and those of your team included.
Word limit 2000. This is worth 10% of your overall grade.
Sections to Include, and questions to answer in your discussion:

1. **Introduction:**
    a. What was your initial view on the project, and the game idea, and the scope.
    b. What skills and game features did you want to especially work on and develop, including both technical and soft skills.
2. **Project Lifecycle & Personal Reflection:**
    a. How did the development of the project play out with regards to your expectations.
    b. What is your view on you contribution to project.
3. **Group Reflection:**
    a. How were group social dynamics thought the project, how/did they change?
    b. What factors were involved in changing and driving development focus and work? Were these unavoidable? Could they have been managed differently?
    c. What is your opinion on your individual team members.
    Give marks out of 5 for each team member, for the following categories
        i. Project management & Communication
        ii. Share of group workload and contribution
        iii. Maintaining & improving group relations
        iv. Overall project contribution
4. **Conclusion:**
    a. What are your thoughts on the experience in general?
    b. What went well? What didn't go well? Why?
    c. What would you do differently next time / in future?

For High marks in this report, and in all documentation:

Your writing should be of a high professional standard, be clearly focused and articulated, and where necessary; well argued and supported by a good evidence. You should be demonstrating critical thinking in review of your experiences. As you will be describing your views on your team members, you should be honest but also maintain an awareness of nuance and social complexities and issues that may be outwith the area of relevance for this project and report.

Main Project Mandatory Features:

1. 3D graphics (Gameplay does not have to be 3d, but should be rendered a 3d world)
2. Multithreaded game engine
3. Sound
4. 1080p/60fps on a reasonable systems specification
5. Usability options:
    a. Remappable controls
    b. Controller support
    c. Graphics options (Resolution & window mode)
6. Operating system support:
    a. Windows: 10 x64 and x86 support
7. Single file .exe game installer/uninstaller
8. User preference(+savegame where applicable) saving/loading from disk
9. Web presence with game promo material and downloads
10. Automated build testing

Optional & Suggested Features

- **Networking**
    - Online score system & update/news ticker
    - Full Networked multiplayer support
- **Advanced/Multiple Rendering backends**
    - Console support, Psvita / PS4
    - Some form of VR integration
- **Advanced rendering techniques**
    - Screen space AO & reflections
    - PBR
    - Global illumination / Offline lightmaps
    - Clustered / Deferred shading
    - Performance based dynamic quality scaling
    - Volumetric Fog and Lighting
- **Performance**
    - View culling
    - Smart data Management / loading / streaming
    - Memory management: Custom allocators & memory pools
    - Use of gpu compute for auxiliary tasks
- **Engine Features**
    - In-game runtime debug console
    - Error handling and reporting
    - Ingame debugging overlays and diagnostic info
    - In-Engine level editing
    - Runtime reloading of modules / code
- **Gameplay**
    - Basic game AI : pathfinding, behavioral state machines
    - Lua gameplay scripting system
    - Local Multiplayer

Module Mark Allocation

1. Week 1 Project		**10%**
2. Essay Assignment		**10%**
3. Main Project		**70%**
a. Documentation	(10%)	
b. Final Game: Required Features	(20%)	
c. Final Game: Quality	(40%)	
4. Final Evaluation Report		**10%**

1. **Week 1 Project**
   Individual Pass/Fail - Game MUST meet all mandatory technical requirements.

2. **Essay Assignment**
   Individual, marked on a scale of report quality. Word limit: 1000

3. **Main Project**
   A. Documentation - group - marked on scale
      Required documentation MUST be submitted at all stages, and be of suitable quality.

   B. Final Game: Required Features - group/individual
      Final game project MUST include ALL mandatory technical features. Failure on any component will result in forfeit of the full component marks.

   C. Final Game: Quality - group/individual
   Your final game will be judged by a panel of experts. Your documentation and plans will be analysed and compared to your final deliverable. Teams that took on advanced features will be marked favourably. However, games that have all necessary features, are well built, and were developed effectively will also be marked favourably. The aim is not to cram as many features in, but to create something of portfolio quality. The final evaluation report from all team members will also be used to inform this grade. While this is a group mark, evidence of individual contribution will be taken into account and individual marks could be scaled accordingly.
   Areas that will be considered for quality:
   1. Code quality and software engineering
   2. Build and Work management (Version control practises, group management, individual contribution)
   3. Game playability and user experience
   4. Attempted project scope and features, and achieved scope and features (both gameplay and technical).

4. **Final evaluation report.**
   Individual, marked on a scale of report quality. Word limit: 2000

Group Work Management

This project is too large for any one student to take on for themselves and a well run team working with a good plan is greater than the sum of its parts. Keeping a team productive and happy is a job for every member of such team. As this is a final year project; this is to be shining example of your abilities, and one of your most important abilities is the skill of working well with others. Games are made in teams, in the real world you won't be fighting for marks, but against development time and resource budgets, producers, publishers, fanbases, and deadlines.
With that justification out the way, we do want to give acknowledgements to students who go over and above during this module, therefore the 80% of marks devoted to the project can and will be scaled based on the evidence of individual contribution. This is why it is important to keep your weekly progress logs up to date and to make your work allocation plans detailed and fair.

Team Formation

Team Size: Three students, Teams of four may be authorised given acceptable circumstances. (e.g even number of students).
You may form your own team, based on your own criteria. Having a team with a similar vision for a game idea is a good method, another would be based on the output of the week 1 project.

You must have formed your team and submitted the PID by the end of week 3.

We do not require any team member to take on specific roles (e.g Manager), if you want to do this, feel free to. Communication is key, stay in contact, always be aware of what everyone is working on. What the status of the projects is, and any upcoming deadlines.

Work and Mark Allocation

Not all features require the same amount of work, and not all developers have the same strengths. How you divide work is up to yourselves. More often than not,a simple feature is found to be more complicated when development starts, embrace this, inform your team, and re-adjust your plans.

As stated above, individual student contribution will be taken onboard during the mark allocation. This is based on evidence, so your weekly work logs should have links to GIT commit IDs/Pull requests. If you feel there is any major imbalance in the work being done, you should consult the module staff to try to remedy the situation before the final submission.

Dispute Management Procedure

In the unfortunate event of a dispute within a team, based on work contribution, social issues or anything else: a team member, or the entire team should consult a member of the module team to resolve it.
As this is a group based module, the nuclear option removing or moving a team member is near impossible, so other solutions will be advised. This could take the form of a revised & cut down plan, and individual consultation with team members to try and find a unilateral agreed solution.
This is a tough module, the work is going to be hard, keep this in mind and treat each other with respect, fairness and professionality. This module is about showcasing the best of your talents, it should be enjoyable, and we as the module team will try to make it so as much as we can.

Deliverables

For group submissions, only one team member needs to submit to moodle.
For accurate due dates and times, always check the moodle submission page.
All reports should be submitted as .pdf

Week 2

Week one Project, Due Friday, 15 September 2017, 10:00 AM

Single Zip file: <matric>_week1_.zip, Containing:

- .exe installer
- Readme.txt - any readme info & link to project website

Week 3

Group - Project Initiation Document - Friday, 22 September 2017, 10:00 AM

Week 6

Group - Milestone One - Friday, 13 October 2017, 10:00 AM

Single Zip file: <game_name>_ms1_.zip, Containing:

- .exe windows installer/build
- Milestone Report
  - Feature list, progress report, weekly individual reports as appendix

Week 9

Individual - Engine and Tooling investigation report - Friday, 3 November 2017, 11:55 PM

Max 2000 words, .pdf only.

Week 10

Group - Milestone Two - Friday, 10 November 2017, 10:00 AM

Single Zip file: <game_name>_ms2_.zip, Containing:

- .exe windows installer/build
- Milestone Report
  - Feature list, progress report, weekly individual reports as appendix

Week 15

Group Final Submission - Friday, 15 December 2017, 10:00 AM

Upload Separately:

1. Group - Single Zip file: <game_name>_final_.zip,
   Containing: .exe windows installer/build

2. PDF Final submission report

3. Code Repo + Build Server link in textbox
   (Repo must have readme, describing how to build your game)

Individual - Personal Report - Friday, 15 December 2017, 11:55 PM

Max 2000 words, .pdf only.