北京邮电大学 本科毕业设计（论文）任务书

Project Specification Form

Part 2 - Student

学院 **School**	International School	专业 **Programme**	**e-Commerce Engineering with Law**		
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BUPT 学号 **BUPT number**	2018212993	**QM 学号** **QM number**	190017767	班级 **Class**	2018215114
论文题目 **Project Title**	Large-scale scene simulation of games in cold-temperate deciduous coniferous forest area based on UE				

论文概述
Project outline
 	
Write about 500-800 words
 	
Please refer to Project Student Handbook section 3.2
	1. Project Background
	
	The distribution of vegetation in natural geographical environment changes regularly with latitude and topographic height. The plant species in different natural areas are obviously different, and different plants have different requirements for heat and water. The cold temperate zone in northern China covers an area of nearly 1 million square kilometres. Through the latest UE5 engine technology and program content generation (PCG) technology, the vegetation types and distribution patterns in this area are reconstructed to establish realistic cold temperate game scenes in the 3D game world. This graduation project has important research significance for computational geography, digital content production, game production and so on.
	
	When designing large terrain production, game designers need to plan terrain ecology and collect a large amount of natural ecological reference information (longitude and latitude, altitude, landform, etc.). Abstract the information and input it into the PCG tool production pipeline. In order to make the produced game world more natural, and maintain a certain rationality while having a certain randomness, so as to ensure that there is no sense of conflict.
	
	I believe that creating a simulated environmental terrain is a meaningful thing, creating a geographical environment in the virtual world to achieve an effect similar to or even beyond the real world. UE5-based terrain editing is of great significance to game development, film and television effects, and virtual reality
	
	2. Stages
	
	1. Collect data, including but not limited to
	    I. Unreal engine related information, blueprint learning, UE related C + + learning, plant material package, 3D assets, etc.
	    II. Information collection in China's cold zone, including terrain, climate and related terrain software learning (world machine,)
	    The purpose is to use such software to process DEM images, including but not limited to weather erosion, generation of surface plants, etc.
	    III. Collect plant information, classify it into vertical distribution and horizontal distribution, study plant species and growth, and collect qualified plant models.

2. Terrain design: according to the terrain data collected in 1. And combined with the terrain information given by supervisor, generate the terrain, import the terrain into world machine for adjustment, and generate special terrain (River).
Three important points:
- Classification: classify the materials of large terrain objects
- Division: Area Division for different material classification
- Mix: mix and merge different subtypes

Then, the import completes the material mixing in ue5, and automatically generates the material map to the qualified position. The mixed layer design includes many material mixing. It is expected that layers with more than 5 layers will behave differently at different heights, terrain slopes and terrain parameters.
3. Plant design, according to the data collected in
- Classify plants into plant combinations;
- Write a plant generation algorithm to make the plant combination generate in the desired terrain position;
- Adjust the size of plants and add noise.
4. Terrain is divided into blocks, and the terrain is divided reasonably to generate reusable plain, mountain and forest terrain. Form plot reuse for subsequent operation.
5. Repeat terrain generation, and use PCG technology Procedural Content Generation (PCG) to generate several blocks in regenerated plots to generate programmed block maps.

3. User interaction
In terms of user interaction, the terrain and landforms generated by this system can be used for subsequent game development and design, providing technical art and terrain art support. Users can use UE assets, materials and other terrain assets.

4. Programming
Languages: UE Blueprints；C++(IDE Visual Studio Code)
Software Packages: UE Quixel Bridge; UE market
Software: World Machine

5. Reference:
1. Unreal document: Blueprint document, engine document
https://docs.unrealengine.com

2. SpeedTree Document http://docs.speedtree.com/doku.php?id=ue4_introduction

3. WorldMachine Document http://dx3377.com/

4. https://www.youtube.com/watch?v=gQmiqmxJMtA

5. 2008. A Proposal for a Procedural Terrain Modelling Framework.

6. A. Barriga, N., 2021. A Short Introduction to Procedural Content Generation Algorithms for Videogames | International Journal on Artificial Intelligence Tools. Available at: <https://www.worldscientific.com/doi/abs/10.1142/S0218213019300011>

道德规范 **Ethics**	Please confirm that you have discussed ethical issues with your Supervisor using the ethics checklist (Project Handbook Appendix 1). [YES/NO] YES
	Summary of ethical issues: (put N/A if not applicable) N/A
中期目标 **Mid-term target.** **It must be tangible outcomes, E.g. software, hardware or simulation.** **It will be assessed at the mid-term oral.**	1. Explore the topography of the frigid zone in northern China, select research objects, establish plant distribution analysis on them, and generate quantitative calculation models. 2. Combined with the basic terrain data provided by the coach, the UE5 frigid zone vegetation simulation scene is generated through vertical distribution calculation

Work Plan (Gantt Chart)

Fill in the sub-tasks and insert a letter X in the cells to show the extent of each task

	Nov 1-15	Nov 16-30	Dec 1-15	Dec 16-31	Jan 1-15	Jan 16-31	Feb 1-15	Feb 16-28	Mar 1-15	Mar 16-31	Apr 1-15	Apr 16-30
Task 1 [Replace this line with the task 1 from the Spec part 1]												
Selected research object (topographic block of northern China)	X											
Explore the types and growth patterns of vegetation in the cold temperate zone		X	X									
Establish a quantitative calculation model			X	X	X	X						
Task 2 [Replace this line with the task 2 from the Spec part 1]												
Study the vertical and horizontal distribution under the surface of the cold zone				X	X	X						
Import terrain data into terrain software to generate a model, and perform a second iteration on the model to generate a basic model					X	X	X	X				
Generate vegetation in UE5, automatically generate vegetation in the terrain according to the parameters							X	X	X			
Refine the surface texture									X	X	X	
Task 3 [Replace this line with the task 3 from the Spec part 1]												
Establish realistic game scenes in cold temperate zone through simulation of sun height									X	X	X	X
Establish realistic game scenes in cold temperate zone through snow effect									X	X	X	X
Task 4 [Replace this line with the task 4 from the Spec part 1]												
only three tasks												