Development Plan
Digital Twin Forest

Team 8
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Table 1: Revision History

Date	**Developer(s)**	**Change**
Sept 17, 2022	All team members	Revision 0
Sept 26, 2022	All team members	Modify technology
March 29, 2023	All team members	Final Version

1 Team Meeting Plan

- Time
  Every Thursday from 1:30 PM to 3:30 PM.
- Location
  If the team needs to work with Dr. Gonsamo's lab members, the meeting room will be the lab of room 316 of the General Science Building. Otherwise, the meeting will be hosted in H.G. Thode Library.
- Frequency
  Weekly. (Multiple meetings will be held within one week if necessary.)
- Contents of meeting
  The contents of meetings include discussion, implementation, assigning work outside the meetings and reporting working progress. All the decisions and modifications should be recorded and updated by the end of the day of meetings.
- Roles
  Bowen Zhang: Host all the meetings and gather participants' ideas.
  Tingyu Shi: Record and document meeting contents.
  Jiacheng Wu: Participant.

Yichen Jiang: Participant.
Junhong Chen: Participant.

- Rules for agendas
  An agenda is supposed to be made before every meeting. The following are rules for meeting agendas:
  - All team members are supposed to attend the meetings. If any member cannot attend the meeting, he/she needs to tell the other teammates at least one day before the meeting.
  - Topics must be determined before every meeting.
  - The duration of the meeting should be established prior to its commencement.
  - There is only one chair/leader in the meeting.
  - Conflicts in the meeting shall be recorded and solved before the next meeting.
  - All members should communicate respectfully during the meeting.
  - All members shall be assigned a "take home" work after the meeting. The estimated time of the work of each member shall be close.
  - First topic will be reviewing the agenda.
  - Assess all team members' contributions in every meeting.

2 Team Communication Plan

Communication within our group will be completed through weekly in-person meetings, Microsoft Teams, emails, and informal daily communications.

3 Team Member Roles

- Jiacheng Wu: Unity Developer
- Yichen Jiang: UI designer
- Tingyu Shi: Unity Developer, Latex Expert
- Bowen Zhang: Forest modeling, Liaison
- Junhong Chen: UI designer, coder, PhotoShop expert

4 Workflow Plan

- We will use Unity for the majority of the development process. We will use GitHub to deliver, store, and synchronize all the Unity scripts. The latest version of the Unity project will be updated during the weekly meetings. Then the team will push the latest scripts to GitHub with corresponding tags, which include folders of assets, user interface, and user settings. We would also utilize issues posted by other teams on GitHub to record and track any suggestions on our project and document.
- For the documentation required in the development process, we will follow the template provided on the course's GitLab page. For any documentation, we will use overleaf for LaTeXwriting to accomplish real-time communication and synchronized collaboration. After the documents are finished, we push documents to our GitHub with corresponding comments such as Rev0 and Rev1.

5 Proof of Concept Demonstration Plan

5.1 Risks

- Creating huge amounts of trees efficiently.
- How to ensure the fidelity of the model
- How to simulate the first perspective of a real person to view the forest.
- Different assets used in Unity may require different Unity versions or rendering pipelines.
- As the plant density increases, it uses more and more draw calls which is not affordable.
- How to design the UI to visualize all the forest data efficiently.

5.2 POC Demonstration contents

- The POC demonstration should include a virtual representation of a limited amount of trees.
- POC should have a working UI to present all the forest.
- POC should demonstrate a way to view the forest from a first-person view.

6 Technology

- programming language: The whole project will be implemented in C Sharp language.
- Linter tool: The team will use Visual Studio 2019 as the main IDE.
- Unit Testing Tool: the team will not do automatic tests because all the tests will be done manually in unity, and require the whole system to run.
- CI plans: We will not use continuous integration in our project because the majority of our project will be finished in Unity. For each iteration or any change, we would choose to test the packages in Unity instead of using automatic testing. We need to make sure the latest version of the model can be loaded and give a satisfying view of the forest, so the automatic testing may not satisfy our requirements in this project.
- Performance measuring tools: Unity will be used to record the number of frames per second of the final project.
- The following are possible libraries:
  - UnityEngine.UI
  - UnityEngine
  - Terrain Tool
  - Tree Editor
  - Scene Manager
  - Newtonsoft
  - Aura

7 Coding Standard

7.1 Program File Names

The file names will be written in Pascal style, and the titles will be descriptive.

7.2 C Sharp

The coding style of the C sharp language that the team will adopt is the Microsoft C# Coding Conventions. The variable names will be short but descriptive. All variables will be written in camel case. For example, the height of a tree should be written as $treeHeight$.

7.3 Unity File Names

Unity files such as images, videos, prefabs, and scene files will be written in lowercase. The team will use − to replace the spaces in file names for readability.

8 Project Scheduling

- Technology: Shared MS Excel Gantt Chart
- Major Milestones:
  - SRS Rev0 (October 5)
  - Hazard Analysis 0 (October 19)
  - V&V Plan Rev0 (November 2)
  - POC Demo (November 14-25)
  - Design Document Rev0 (January 18)
  - Demonstration Rev0 (February 6- 17)
  - V&V Report Rev0 (March 8)
  - Final Demo (March 20 - 31)
  - Final Documentation (April 5)
- Task Decomposition Plan:
  We will discuss this plan with Dr. Gonsamo and his lab members first. Then the team leader will allocate tasks according to team members' roles. Our current plan is to decompose this project into three parts: measuring data, modeling, and coding.
- Please check our project schedule here.