Problem Statement and Goals
Digital Twin Forest

Team 8

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Table 1: Revision History

Date	Developer(s)	Change
September 16, 2022	All team members	First version of the problem statement and goals
September 17,2022	All team members	Complete stretch goals
September 26, 2022	All team members	Modify environment and goals
March 29 ,2023	All team members	Final Version

1 Problem Statement

1.1 Problem

A digital twin forest is a virtual representation of the natural forest located at Turkey Point Ontario. By taking various data from the forest such as environmental data and tree parameters, we are able to model the forest with these data. As a result, we can supervise the forest from a distance. More specifically, we are trying to solve the following three problems:

- A virtual representation of the real forest, allowing monitoring and analyzing from distance.

- Visualizing important data related to scientific research and decision-making.

- A forest model that can change dynamically according to the modification of the data.

This project can be beneficial for both commercial and scientific use. For commercial use, the product can help forest owners make decisions, and for scientific use, the product can help researchers to study climate change.

1.2   Inputs and Outputs

Inputs:

- Real forest data collected by the lab.

Outputs:

- Virtual representations of the real forest. (Tree Models)

- Forest data visualization.

- Synchronisation between forest data and tree models.

1.3   Stakeholders

- Dr. Alemu Gonsamo from School of Earth, Environment and Society McMaster University (Dr. Gonsamo is the supervisor of this project.)

- Forest Owners(The final project can be helpful for forest owners to better manage the forest and make decisions)

- Meteorologists(The final product can be helpful for researchers to study climate change)

1.4   Environment

- 3D Scanner app: The app generates the 3D-reconstruction of the environment. It provides the team with the basic data of the forest, such as the tree heights, diameters, etc.

- Unity: A game engine that supports augmented reality development and model editing. The team will build the virtual forest, and design the user interface here.

- Virtual Studio 2019: The IDE for augmented reality implementation. It supports C Sharp auto-correction and in game tests, so it has been widely used in the field of AR development.

- ArcGIS: An online tool to visualize forest distribution and tree data. The team can calculate the density of different tree species and the formulas according to the tree distribution based on the satellite pictures.

2 Goals

- To create a virtual representation of the real forest, allowing for monitoring and analyzing.

- To visualize important data related to scientific research and decision-making, including environmental data such as temperature and humidity, as well as tree-related data including density, height, and diameter.

- To develop a dynamic forest model that can be modified based on the collected data.

3 Stretch Goals

- Utilize AI models to predict various values relevant to the forest, such as soil conditions and carbon dioxide levels, to enhance the study of climate change in this forest.

- Implement seasonal changes into the virtual representation of the forest.