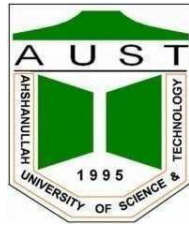# Ahsanullah University of Science & Technology
Department of Computer Science & Engineering

Forestscape

(A Dynamic Forest Environment with Seasonal Transitions)

Computer Graphics Lab (CSE 4204)
Project Final Report

Submitted By:	
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Project Requirements:

Basic Requirements:

- ❖ **Custom Shaders**: Develop and apply custom shaders to enhance visual effects and realism in the scene.Implementation of lighting
- ❖ **Lighting Implementation**: Proper lighting techniques to simulate realistic light sources and dynamic changes.
- ❖ **Perspective Projection**: Utilize perspective projection for a realistic 3D view of the scene.
- ❖ Incorporate animation, such as changing leaves and dynamic lighting, to mimic seasonal transitions.
- ❖ **Mouse and Keyboard Interaction**: Enable user interaction through mouse and keyboard to control camera movement and scene navigation.

Project-wise:

3D Objects:
- • **Trees**: Textured 3D models of trees.
- • **Cliffs**: Textured 3D models of cliffs, adding depth and realism to the environment.

Camera Movement:
- • **Exploring the Scene**: The camera will move around the forest, allowing the user to view the trees and cliffs from different perspectives.

Dynamic Lighting:
- • Light Color Change: The color of the light will change dynamically, simulating different times of day or atmospheric effects

Animation:
- • **Seasonal Leaf Change**: The leaves on the trees will gradually change over time, simulating a seasonal transition (e.g., green to autumn colors).

Software Platform:

1. VS Code (Visual Studio Code)

Visual Studio Code (VS Code) is used for writing and debugging the project's code. Its support for JavaScript, along with features like IntelliSense, Git integration, and a wide range of extensions, provides an efficient development environment.

2. Node.js

Node.js is utilized for server-side development, allowing us to run JavaScript code outside the browser. Its rich library of modules facilitates file system I/O, network communication, and data streaming, ensuring robust performance for our 3D application.

3. Adobe Photoshop

We used Adobe Photoshop for creating and manipulating textures for the 3D models. Its powerful tools for photo editing and graphic design enable the creation of high-quality visuals, essential for the project's realistic rendering.

Project Features:

The project titled Forestscape incorporates several advanced features to create an interactive and visually captivating 3D scene.

1. **Custom Shaders**:
   The project uses custom vertex and fragment shaders written in GLSL (OpenGL Shading Language). These shaders manage tasks like applying textures to trees and cliffs, and controlling the appearance of surfaces to simulate realistic lighting and depth.

2. **Perspective Projection**: The project utilizes a perspective camera for a realistic 3D view of the forest. The field of view and aspect ratio are adjusted to match the screen dimensions, providing an immersive experience.

3. **Texture for Each Object**: Each object in the scene, including trees, cliffs, and the ground, has detailed textures applied. These textures are further enhanced with normal maps and roughness maps to simulate realistic surface details and material properties.

4. **Animation and Interactivity**:

   o **Seasonal Leaf Transition**: The trees' leaves change colors over time to simulate the progression of seasons, transitioning from lush green to autumn hues.

   o **Dynamic Lighting**: The light's color and intensity change throughout the scene to simulate different times of the day, enhancing the overall realism of the environment.

   o **Cliff and Tree Animation**: Slight movements of tree branches and environmental elements make the scene feel alive and constantly evolving.

5. **Mouse and Keyboard Interaction**:

   o **Keyboard Controls**: The camera can be moved around the forest using the arrow keys, allowing the user to explore the scene from various angles.

   o **Mouse Interaction**: Clicking on objects such as trees or cliffs changes their textures, providing an interactive experience for the user.

6. **Camera Movement**: The camera moves freely around the forest, giving users the ability to explore different views of the trees and cliffs, and take in the changing light effects from multiple perspectives.

7. **Texture Change with Mouse Interaction**: The texture of trees or cliffs can be changed with a mouse click, allowing users to alter the visual appearance of objects in real time, enhancing interactivity.

8. **Enhanced Environmental Realism**:

   o **Shadows**: Shadows are enabled for trees and cliffs, providing depth and increasing the realism of the forest environment.

   o **Cloud Movement**: Animated clouds are present in the sky, adding a dynamic and natural element to the scene, making it feel more vibrant and lifelike.

   o **Bushes and Plants**: The inclusion of various bushes and plants enriches the visual landscape, making the forest scene feel more natural and immersive.

9. **Enhanced User Experience**:

- **Sound Effects**: Background sounds like wind blowing or birds chirping add an immersive auditory experience, enhancing the user's connection with the forest environment.

Attach a table with all your required/additional features and classify them into three categories: Implemented, Partially Implemented and Not Implemented.

| #	Features	Status
1	Custom Shaders	Implemented
2	Implementation of Lighting	Implemented
3	Perspective Projection	Implemented
4	Texture for each object	Implemented
5	Mouse and Keyboard Interaction	Implemented
6	Environment Enhancement by Animation	Partially Implemented

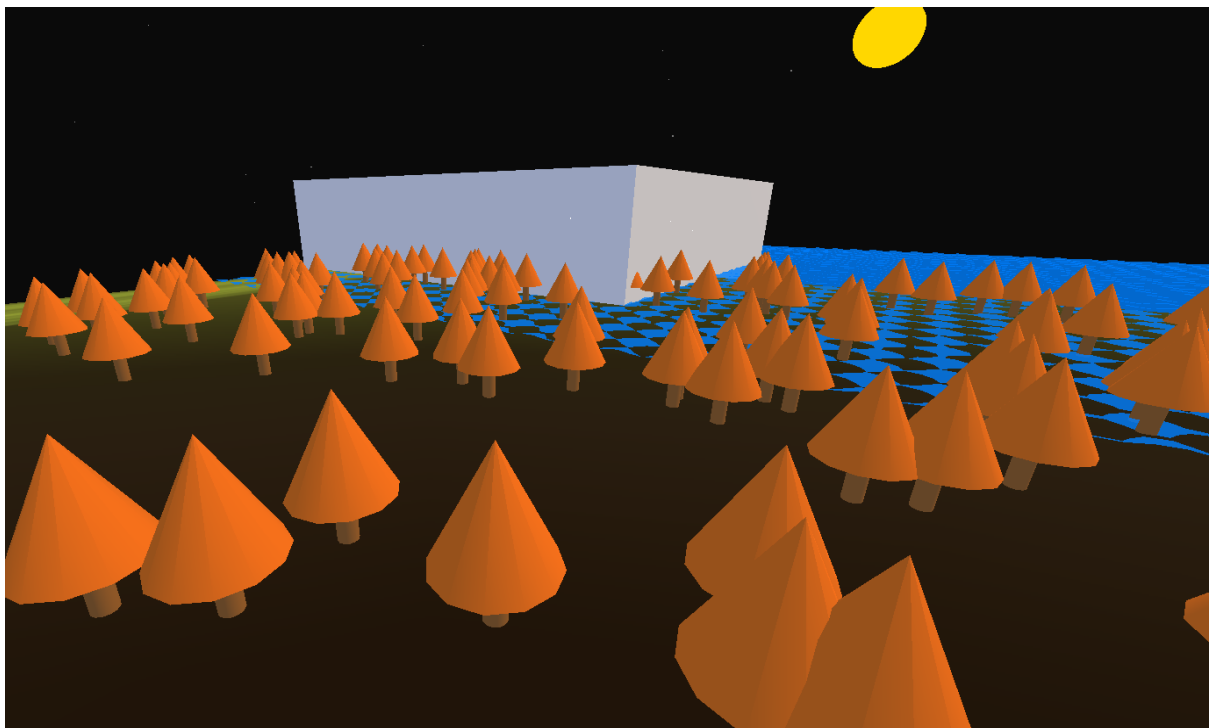Table 01: Project Feature Table

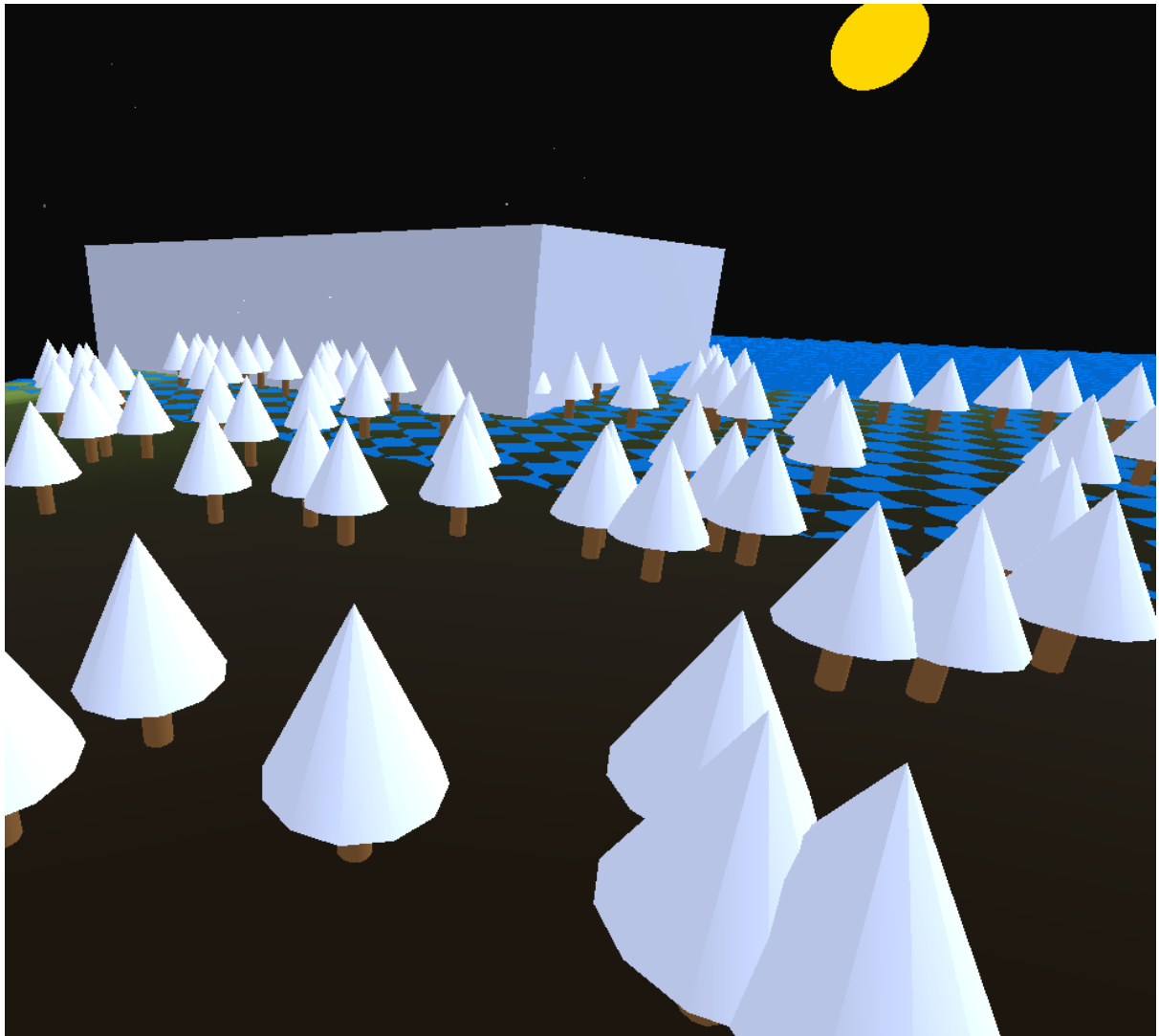**Snapshots:**

Perspective Projection:
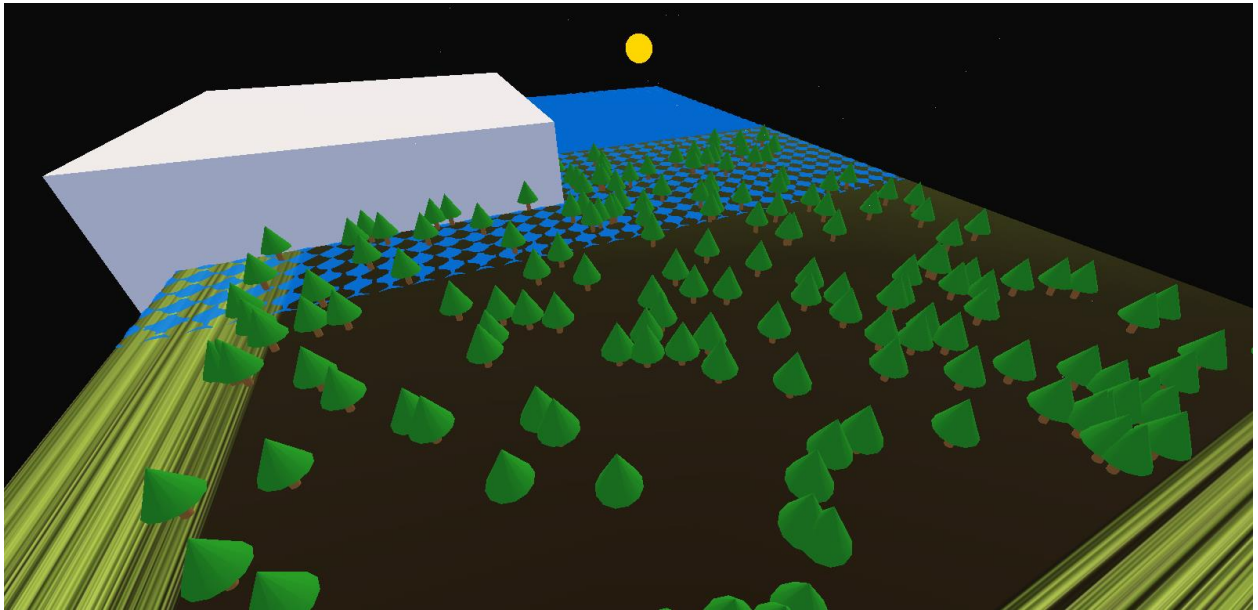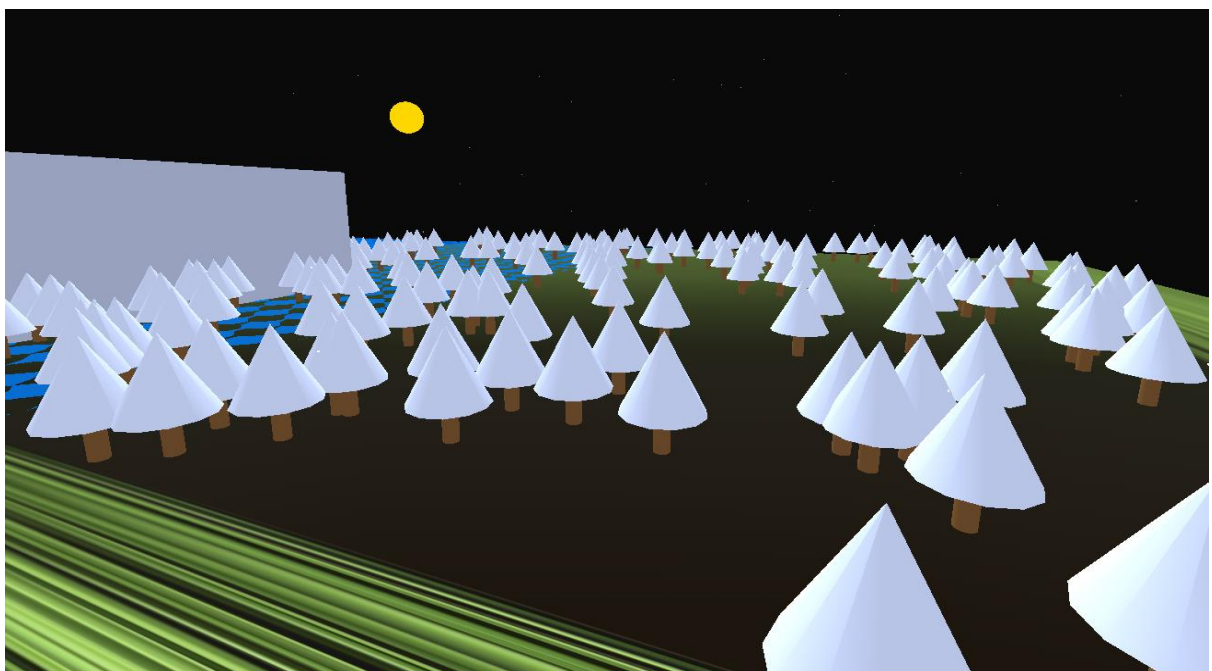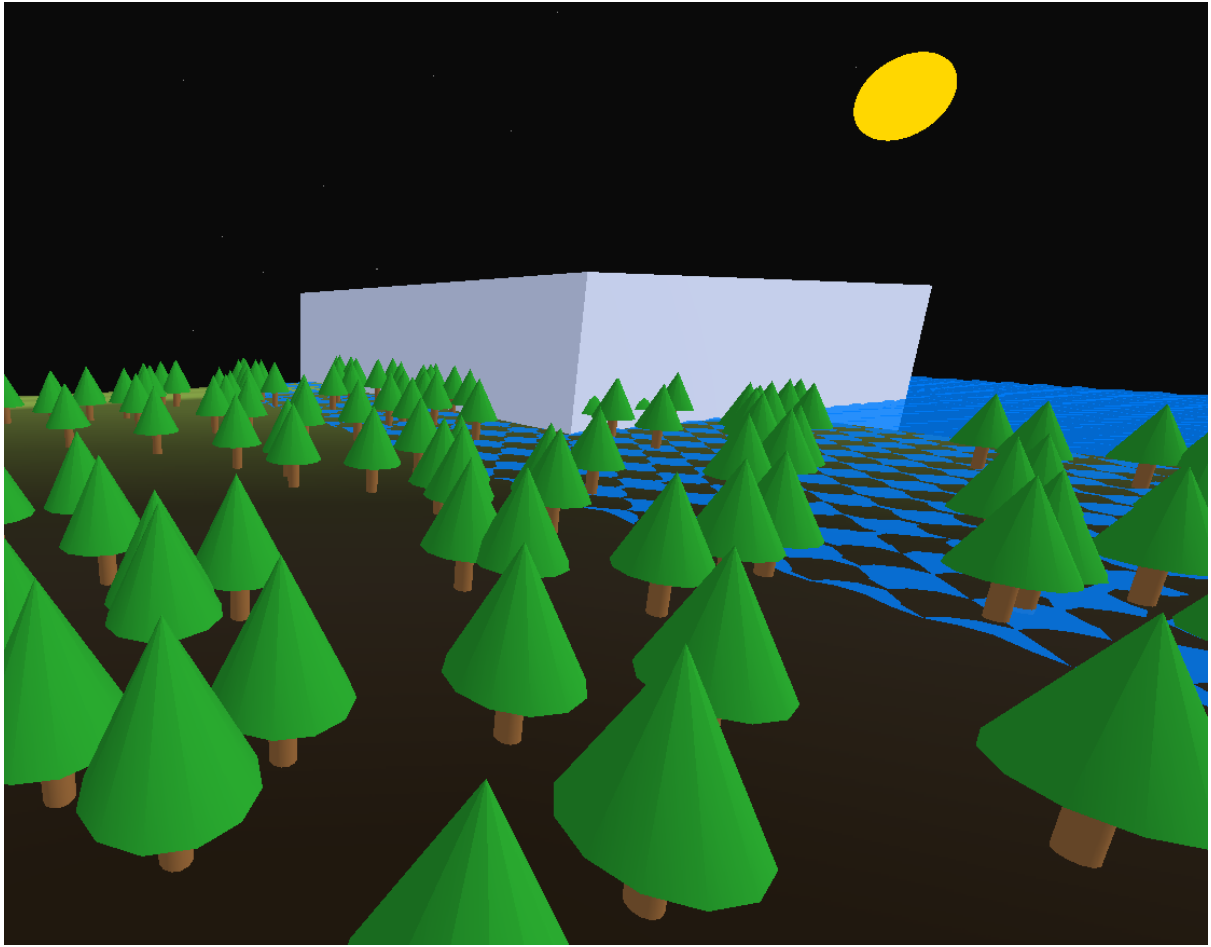
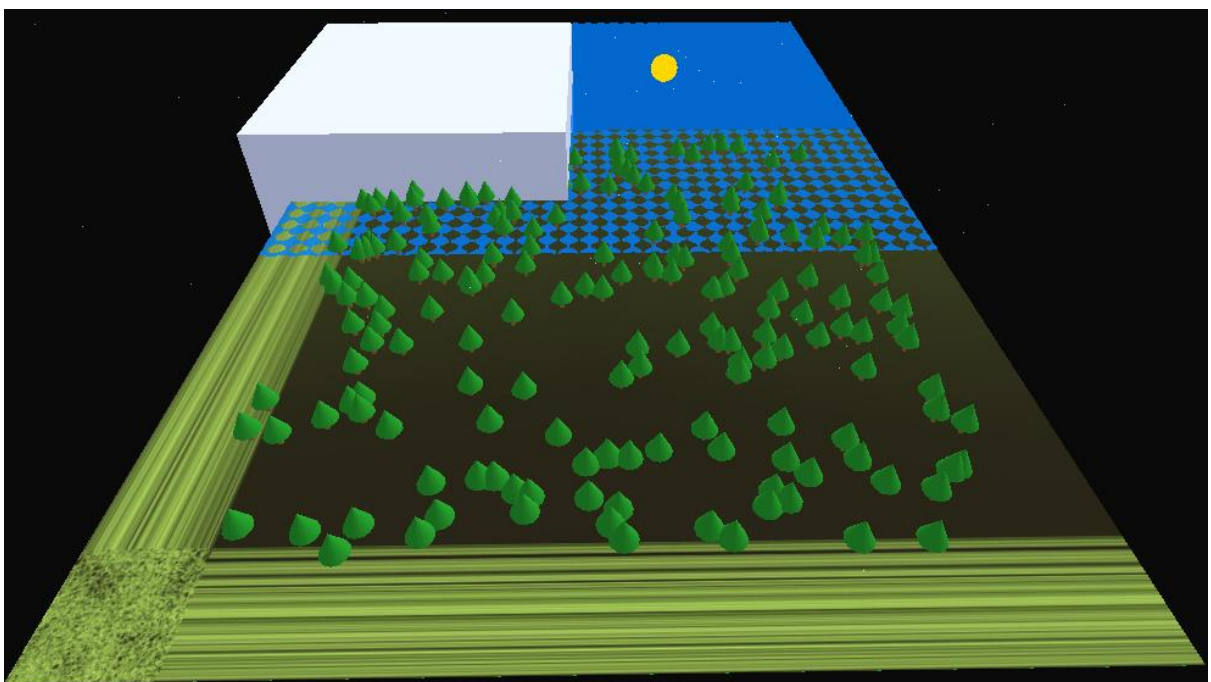

Texture for each object:
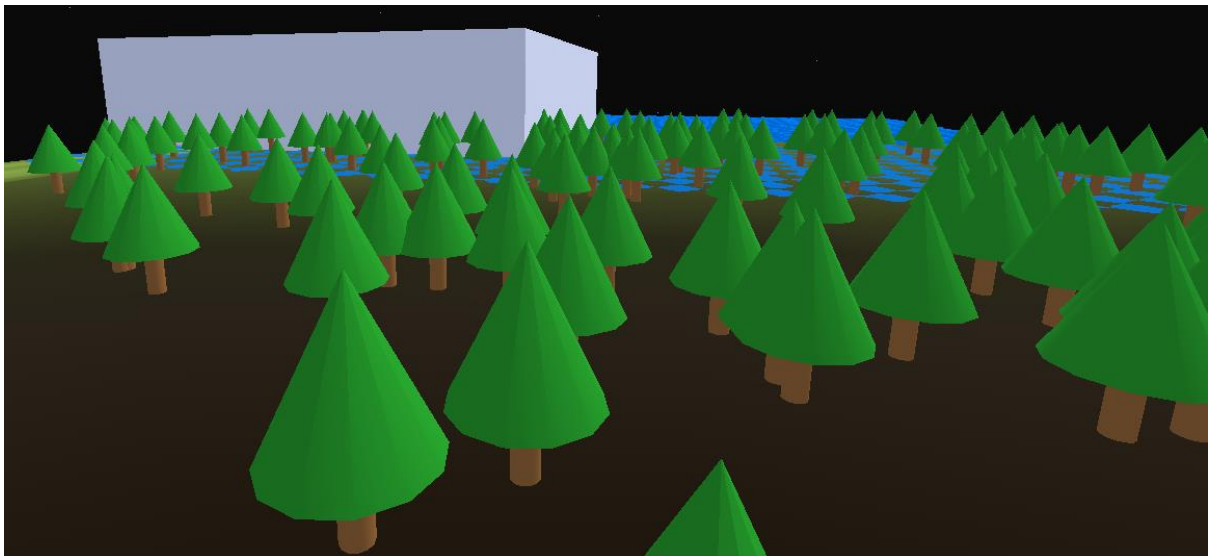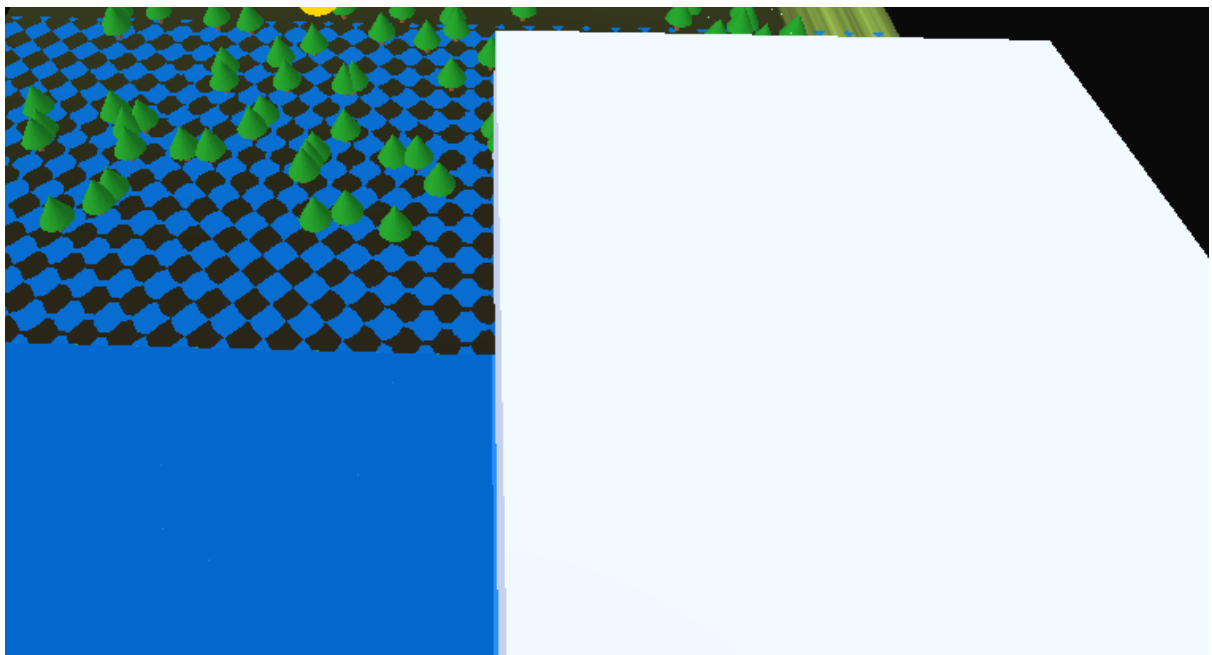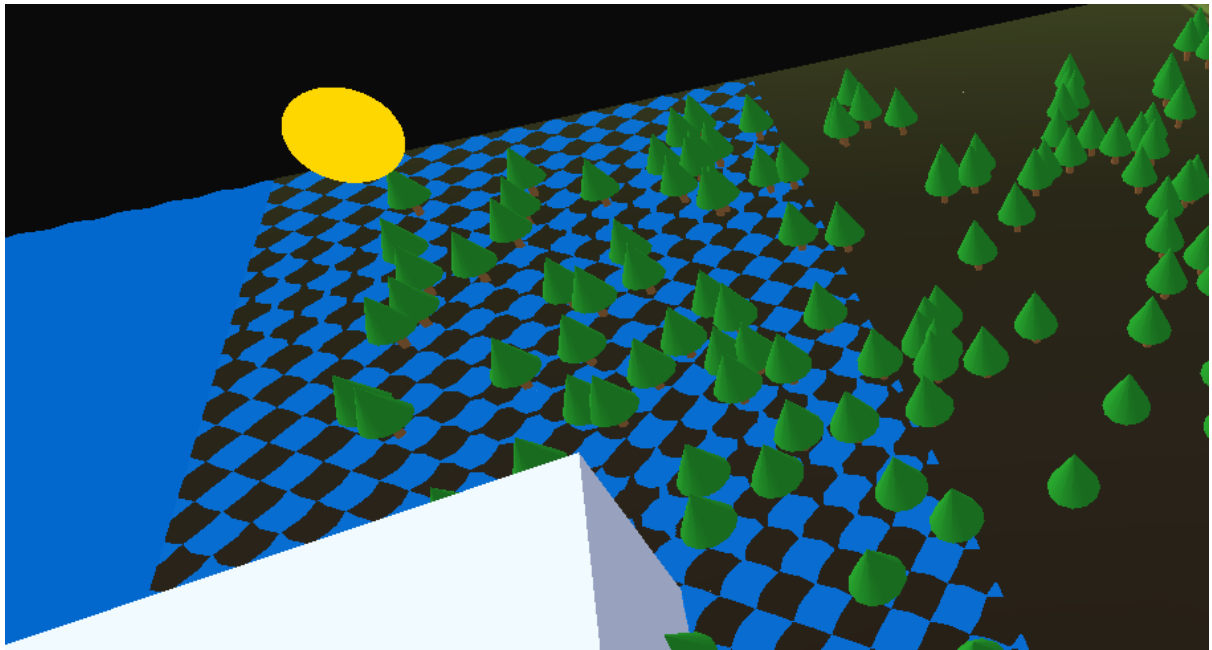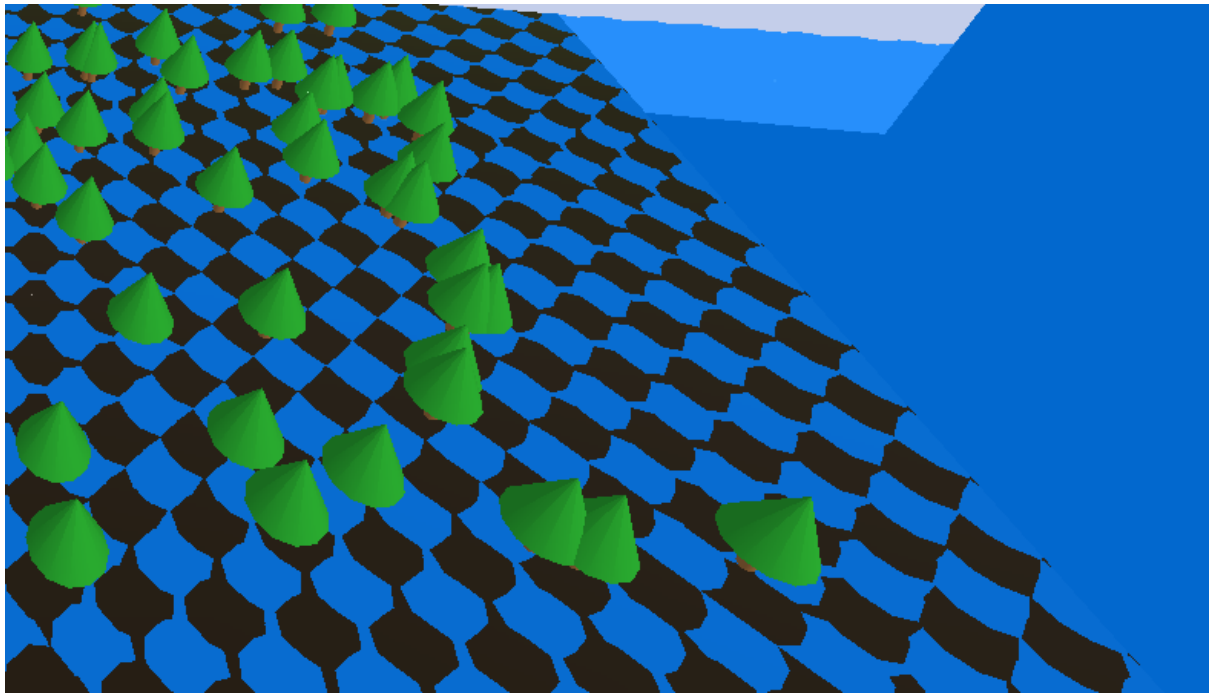
Mouse Interaction:

Keyboard Interaction:

Full Project-View:

Contribution:

Shuvashis Sarker (20200104116) and Shamim Rahim Refat (20200104125): Both equally contributed to the implementation of the project, structuring the 3D models, setting up ambient and directional lighting, modeling trees and cliffs, designing the scene, and report writing.

Future Work:

For future enhancements, we plan to add new features and improve existing ones. This includes creating a dynamic weather system with effects like rain or snow, along with a day-night cycle to make the scene more realistic. Introducing AI would allow for interactive elements like animals or changing seasons. We aim to expand interactions, enabling users to affect the environment, like changing weather or customizing objects. The project could also be optimized for mobile devices or extended with VR support for a more immersive experience. Adding more sound effects, such as footsteps or environmental sounds, would enhance realism. Finally, more detailed modeling, like creating hidden forest paths or expanding natural elements, can be added while optimizing performance to maintain smooth functionality.