Physical Deformation of Plants

Chen Kan

Displaying and animation large scene with vegetation provide users immersive feelings. Because of the geometry and dynamics complexities, creating natural and interactive ecosystem is still considered a difficult task. The R&D team in TQ Global, Singapore proposed techniques for real-time rendering and animating ecosystem. All the techniques have been integrated in a game engine, and used in TQ Rally Racing game (Figure 1, 2, 3, 4).

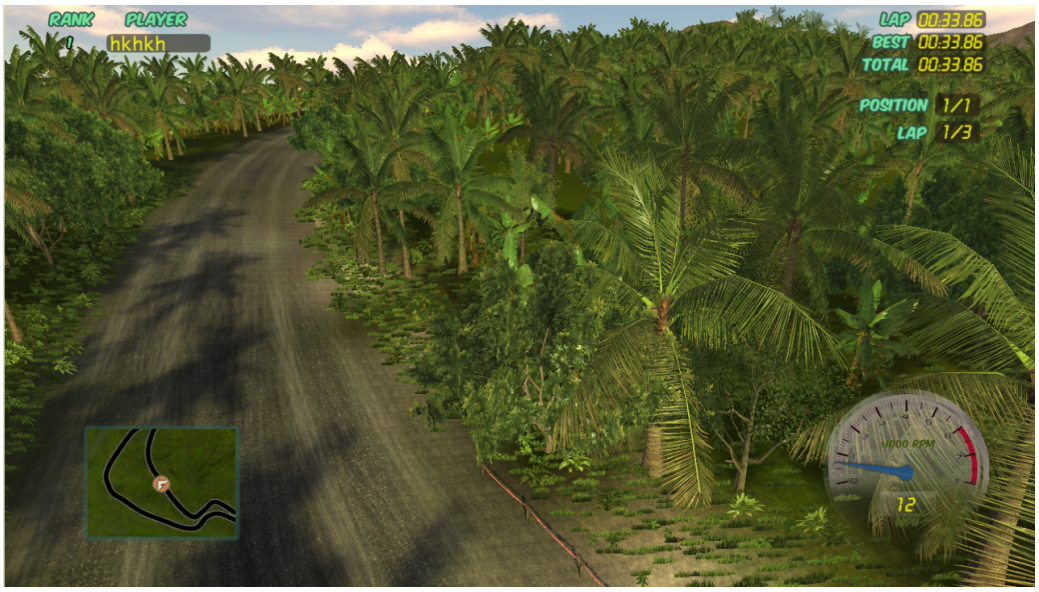

Figure 1: This Ecosystem is tropical with lots of vegetation. The vegetation is densely populated.

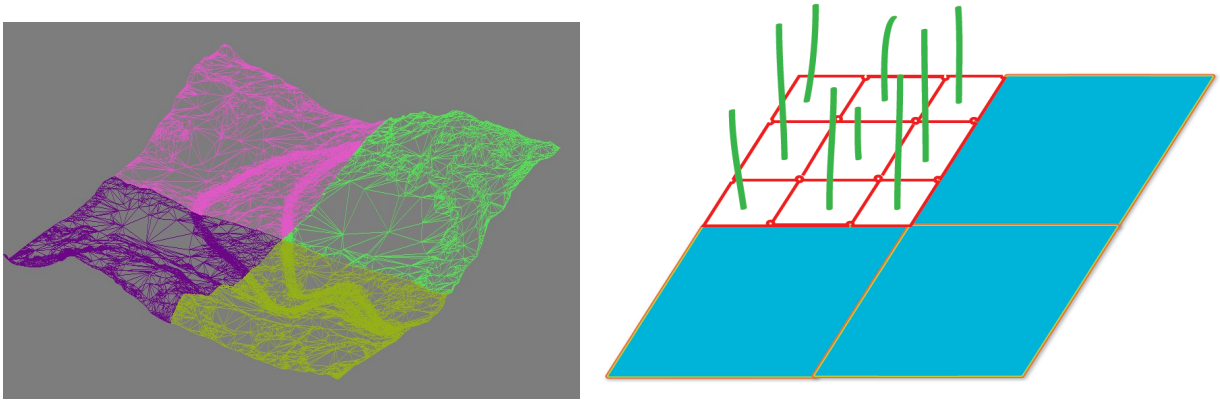

Figure2: Left is this terrain with four patches. Right is an example with 4 patches and each patch has nine grids. This hierarchical structure enables us to render and animate plants efficiently. For example, the patches of plants have been pre-sorted in eight directions to avoid expensive z culling test

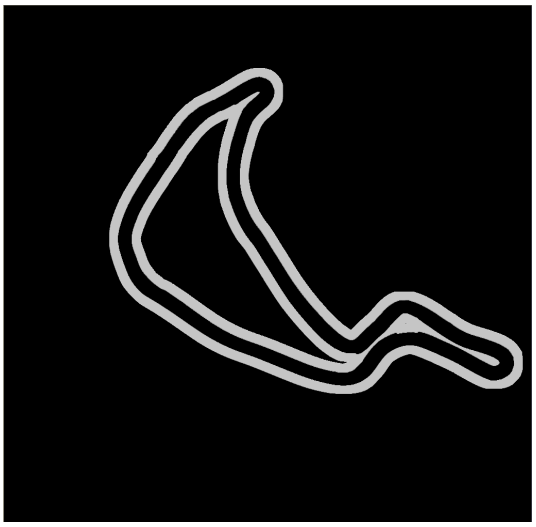

Figure3: We generate the ecosystem based on a 2D texture.
Darker means lower probability.

To efficiently render and animate the ecosystem, a level-of-detail (LOD) method for trees has been developed. Our LOD system consists of 3 layers according to the distance to the viewer from near to far (Figure 4):

3D model with physics: For the trees are close to the viewer and able to interact with the viewer.

3D model without physics: For the trees are close to the viewer and not able to interact with the viewer.

2D billboard: For trees at a far distance to the viewer.

Figure4: LOD

The transition between each levels of detail is achieved based on alpha blending, interpolation and other computer graphics techniques.

In rendering process, we also designed a LOD system by controlling the visual effects on the fly. If the viewer is at a far distance, a cheaper shader will be loaded.

A billboard-based grass (Figure 5) system has been implemented in GPU and can be integrated in TQ Rally. It simulated wind and multiple moving objects interact with huge number of grass. The grass can bend and recover realistically while a track may be left on the field (Figure 6).

Figure 5: Interactive grass in game

Figure 6: Billboard based grass