המעבדה לעיבוד גיאומטרי של תמונות

Geometric Image Processing Laboratory

Snake3D

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Methodology

Snake3D is the old Snake game, in 3D version.

Workspaces: Unity, Visual Studio.

Tools: Blender, Leap Motion Assets, Oculus Assets.

Languages: C#.

Rules:

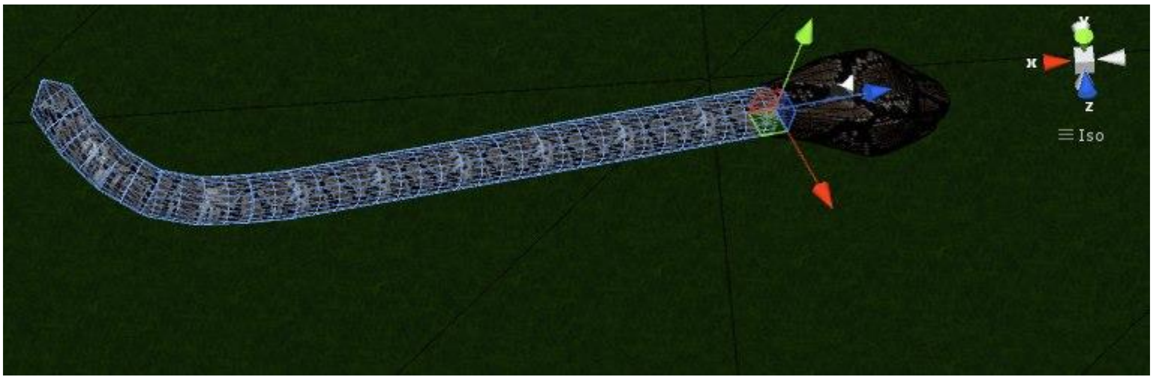
- the game is in 3D. The player wear Oculus glasses, and play with his hands according to Leap motion sensor.
- The player can play with his left or right hand.
- It is like the old game. Purpose: eat as much food, and don't touch the snake body or the objects in the environment.

Features:

- Fast rendering.
- User friendly.
- Textures and Animations.

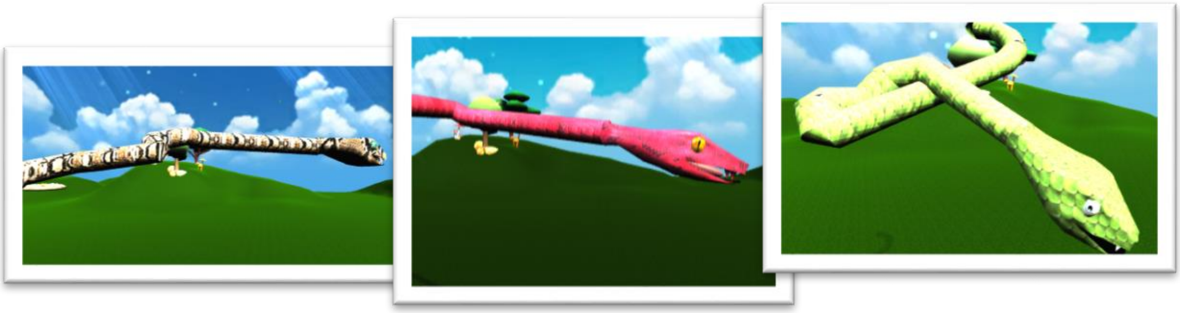
Snake Body:

- Dynamic mesh made up of: body - cylinders with shared bases, and tail - cone.
- The Dynamic mesh updated every move of the snake, according to the moves of the player's hand.
- New cylinder is created in this way: the base of the new cylinder is a circle that vertical to the direction vector of the snake.



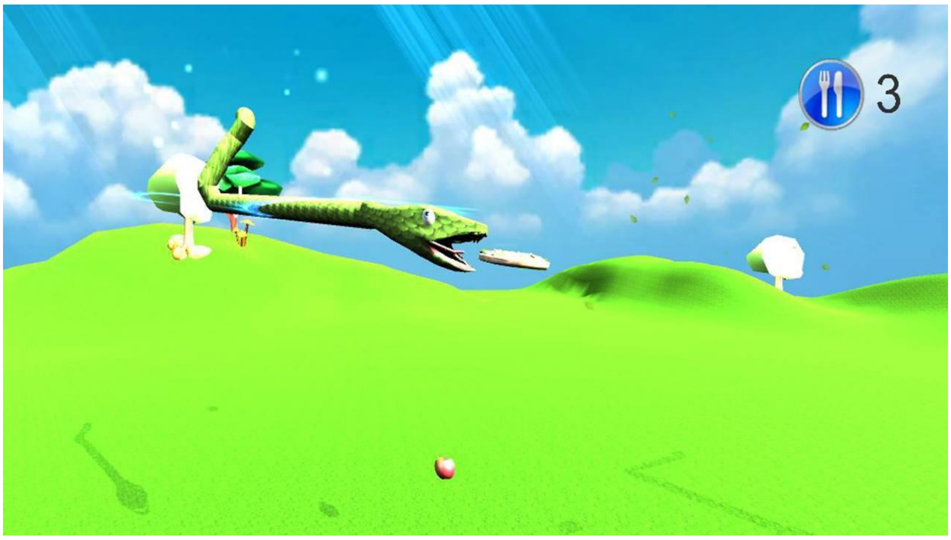
Texture:

- The Snake has 3 different textures, and the player can pick one at the beginning of the game.



Collision Detection:

- The snake can detect when it touches another object:
  - food: the snake grows and number of points increases.
  - Itself: the game is over.
  - The environment: the game is over.

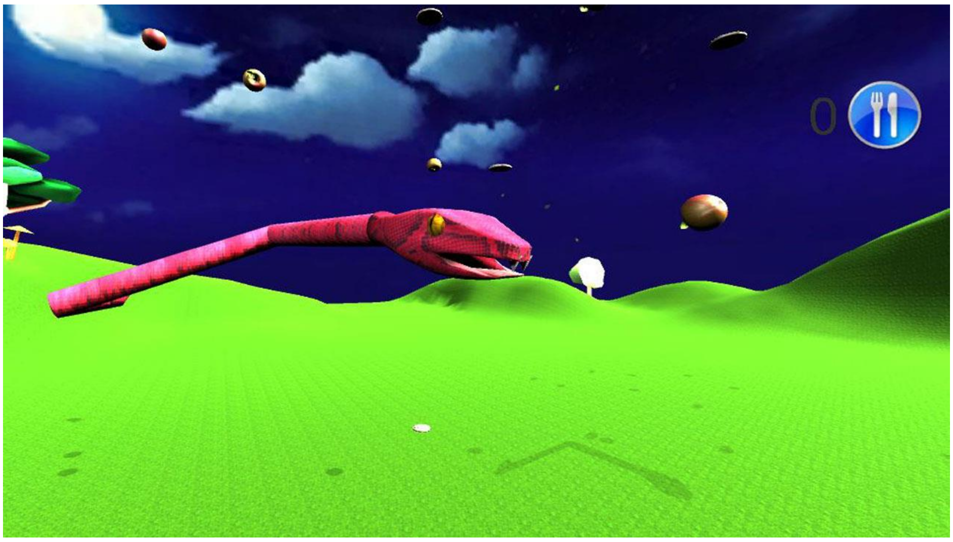


Animation:

- Opening Scene.
- When the snake eats food.
- Special effects in the environment and the flying food.

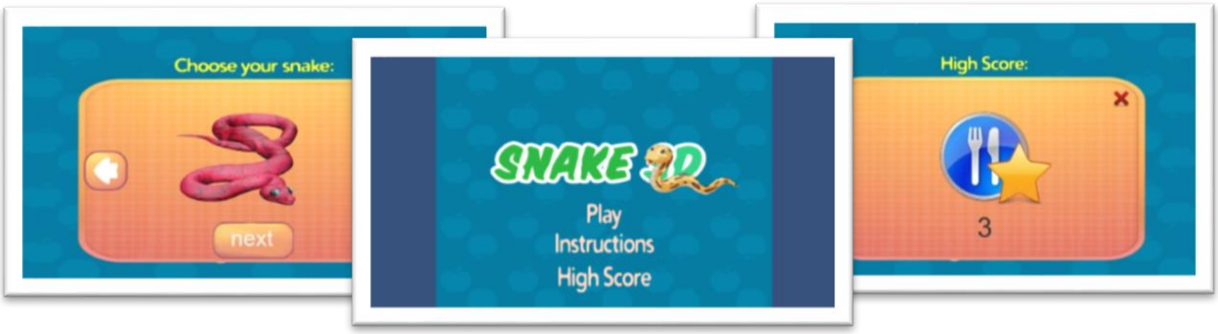
Sky Box:

- User friendly sky box which preserves the playfulness.
- Changing skybox according to the time spent playing for better user experience.



Opening Scene + Interactive Guide:

- User friendly
- Includes:
  - 3 choices of textures.
  - Choice of which hand the player wants to play with.
- The guide includes interactive instructions for the game.
- An option to view the player's highest score so far.



Leap Motion and Real Sense:

- The game supports:
  - Real Sense – the location of the hand processed and mapped to location of the snake.
  - Leap motion – the palm of the hand and the direction mapped to the location and direction of the snake.

OVR:

- The game supports Oculus rift – The game is viewable in the oculus rift device, provided with full VR world environment and contains oculus player controllers and cameras.

Problems

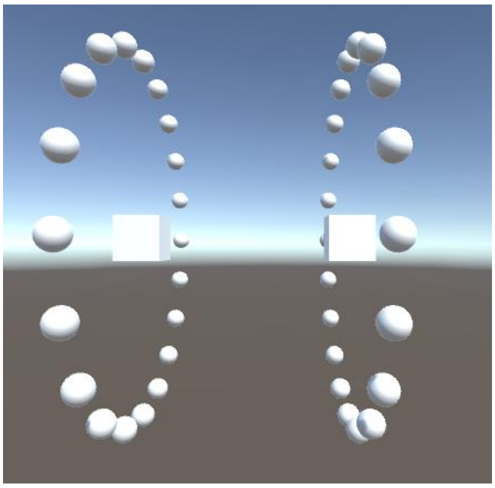
Runtime Spline path

- The snake path is a runtime spline path, which means we did an initial delay, processed number of points, and created the spline path.
- We found out that the ultimate delay was 3 points for a smooth path.
- The Spline is created using "De Boor's algorithm", which is a fast and numerically stable algorithm for evaluating spline curves in B-spline form (from Wikipedia).

Dynamic Mesh

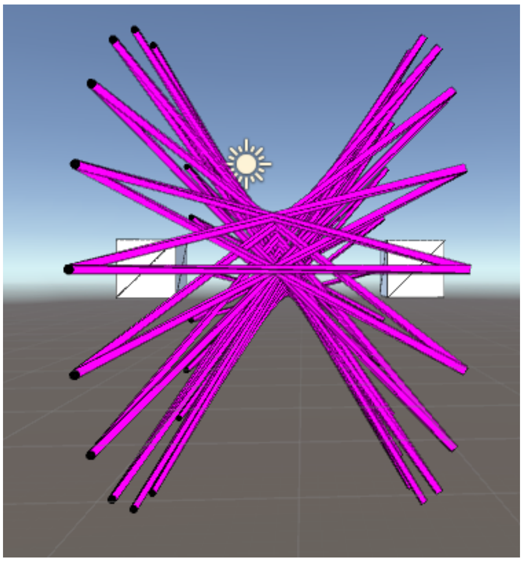
- The problem was to match two near cylinders, and build them at the same direction. We solved the problem in that way:

  - Build the new cylinder base according to the direction vector between two center points of the two cylinders. The new base verticals to the direction vector.

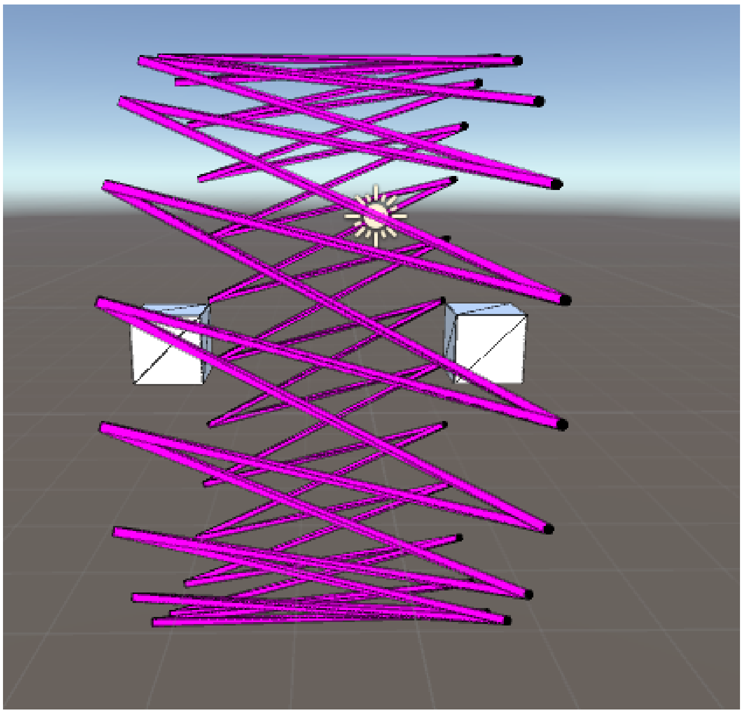
    

  - Rotate the new base of the new cylinder using "Projection method". The algorithm projects the first point of the new circle on the previous circle, calculates a local rotation, and moves all the points on the new circle according to this rotation.

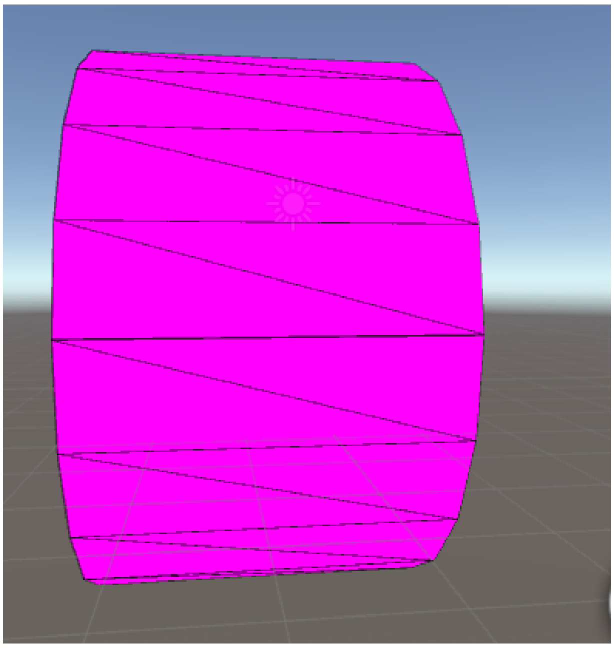
    Before rotating:

After rotating:



After updating the vertices and triangles arrays:



Leap Motion

- We processed the input from the leap motion sensor, and updated the direction and position of the snake and all of its parts in runtime.
- We extended player's hand movement area so that it will fit Unity coordinated system.