Interactive Graphics Final Project

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Cars Game: Introduction

The game i have realized is a version of a very popular genre of games: the endless running where users have a limited control over a character that keep moving forward. The user must also avoid incoming obstacles while trying to collect points. The game only stops when the character run out of lifes colliding with more than 2 obstacles.
In my particular case the game is inspired by the famous movie "Disney Pixar Cars". Characters,obstacles and side models have all a link with the "Cars" world.

libraries, tools

In order to realize my fina project i have used the following technologies: HTML, JavaScript, CSS, ThreeJS, GLTFLoader, jQuery, Bootstrap.
ThreeJS used to create 3D graphics, in particular i have used it to create the environment of the game.
GLTFLoader is a specific library built on ThreeJS that i have used to load .gltf and .glb files.
jQuery library helps in the DOM manipulation.
Bootstrap framework and CSS are used for stylesheet, different objects in the project use Bootstrap's style.
All the models used can be found online on sketchfab.com. I have downloaded them as .gltf files and then imported into the project using GLTFLoader.

Environment

In the initAll function i initialize the scene with render setup, camera and light.

The main character is placed on a road in a flat ground. I have used Three.js in order to create 3 flat objects that represent Road,Ground and Sky. Then i have also added a texture to each one of this elements using Three.js again:

```
26   //street texture material and mesh
27   var roadTexture = textLoader.load('../textures/street.jpg');
28   var roadMaterial = new THREE.MeshLambertMaterial({map:roadTexture,});
29   var meshRoad = new THREE.Mesh(new THREE.PlaneBufferGeometry(600, 100000), roadMaterial);
30
31   //ground texture material and mesh
32   var groundTexture = textLoader.load('../textures/ground.jpg');  //texture loaded
33   var groundMaterial = new THREE.MeshLambertMaterial({map:groundTexture,});
34   var meshground = new THREE.Mesh(new THREE.PlaneBufferGeometry(20000, 20000), groundMaterial);
```

Inside the functions Ground() and Sky() i set the features of the three objects like position.

To this initial environment i have added the element on the two side of the road,the main character, obstacles and cups loading .gltf models:

Models

Main Character:

Users can choose among three different characters: Finn, Hicks and Saetta. I have used Jquery and javascript in order to pass the information about the user's choice of the character and difficulty.



Obstacles and Score:

In order to bring up Obstacles and Cups on the road i use the Math library and generate a random number that will be used to decide the next element to load on the road (obstacle or cup). Moreover depending on the difficulty chosen by the user the number of obstacles simultaneously on the road increase.
Also the lane of the road in which the elements are loaded is decided randomly.


Side element:

To complete the environment i have added 4 types elements on the two side of the road. These side elements move toward the user until they go out of the camera view and at this point i render their position moving them back on the horizon line.


Models References:

Saetta Model: https://sketchfab.com/3d-models/disney-infinity-lightning-mc-queen-89495fca06f04e08a62ef0129766b5d2

Finn Model: https://sketchfab.com/3d-models/disney-infinity-finn-mc-missile-80624879dd0b4cfe95f76accaa388ba7

Hicks Model: https://sketchfab.com/3d-models/disney-infinity-chick-hicks-ddac58561ccf49dfbb5ade36803562a6

Obstacle Model: https://sketchfab.com/3d-models/epic-traffic-cone-f7fb6e4589c441a0b25169459e2e2b43

Piston Cup Model: https://sketchfab.com/3d-models/trophy-2e32184ea51d4b50968beaf48aef0d2a

Old Rusty Car Model: https://sketchfab.com/3d-models/old-rusty-car-3-cc8f07d18d4048a28f942c0d9049fd54

Recycle Bin Model: https://sketchfab.com/3d-models/radiator-springs-racers-recycle-bin-43527008a9cb459ea00fab730e59b31b

Old Gasoline Pump Model: https://sketchfab.com/3d-models/old-gasoline-pump-40279644d57b45449466dfc256309022

Tree Model: https://sketchfab.com/3d-models/fur-tree-41fa3210e50944eaa489c148e5e2ccc7

Animations

All the animations are handled in the different render functions. The project has one render function to handle the animation of the different elements in the environment:

```
651  // RENDER THE SCENE
652  function render(){
653      renderer.render(scene, camera);
654
655
656      if(allReady()){
657
658
659          rendersaetta();
660          renderstreetandground();
661          renderlaterals();
662          renderTrees();
663          rendercups();
664          rendercones();
665          checkCollision();
666          if(clock.getElapsedTime() > maxTime){
667              clock.start();
668              loadElements();
669          }
670      }
671      requestAnimationFrame(render);
672
673  }
```

In particular:

-The main character moves in a way that simulates the tremor of a moving car while the wheels remain stationary. When the user lose the character is placed on the center of the screen rotating and different nodes of the model are separated. The last one is just a visual effect.

-Trees and the other side elements are move toward the user and replaced when they go out of the camera view. In this way the same models are reused instead of loading it again.

-Cones and Obstacles models are loaded continuously during the game. The speed in which they are brought up on the road and the maximum number of obstacles depend on the difficulty. The lane in which they are loaded is random instead. They also move toward the main character until they go out of the camera view..

-Ground and Road keep moving toward the camera togheter with all the elements of the scene except for the main character and the sky that are the only two element of the environment that stay still on the z-axis

User Interactions

Regarding the interactions,users can choose their main character among three possibility in the index page. They can also choose the level among three different difficulties. The number of obstacles on the road depends on the chosen level.

Once the game start users can move the main character sideways in order to avoid obstacles and collect pinston cups to increase his score.

User Manual

1)User have to choose difficulty and main character.

2)User have to move the character toward right or left using keyboard arrows in order to avoid obstacles and collect pinston cups.

3)If user want to exit the game while playing he can press the "exit" button and will be rendered to the index page.

4)If the user have a collision with more than two obstacles, he lose the game. At thi point if the user want to play again with the same difficulty and main character, he can click the button "Play again". If the user does not want to play anymore or wants to play with a different character and/or difficulty then he can press the "exit" button that will bring him back to the index page.