Interactive Graphics - Homework 2

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I have tested my code in Chrome, Firefox and Microsoft Edge: in all of these three the code works.
Use a **python server**.

Request 1

I have used the hierarchical model shown below where basically everything is a son of the torso but the legs lower parts. Making this choice allowed me to move all the sheep components by moving only the torso in the animation. A left-child, right-sibling structure is used to store the hierarchical model.

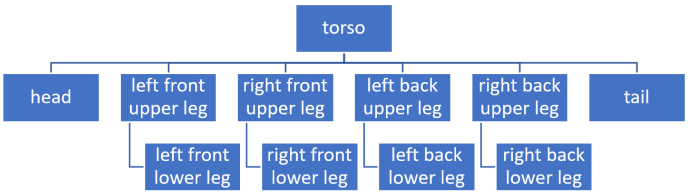

Figure 1: Hierarchical model of the sheep

Figure 2: Sheep

Actually to compute the cubes I have used the already written values: to model the sheep I have just selected different heights, widths and depths for the different parts.

Request 2

To generate the surface where the sheep has to stand I used another cube with different height and width and I have associated to it a color texture created from an image of a grass field (for this reason I need a **python server** to upload this kind of texture in my creation).

```
var grassHeight = 2.0;
var grassWidth = 200.0;
```

Request 3

About the wool effect, I have decided to use a color texture using an image of the sheep wool and in addition, as requested by the professor, I have combined it with a bump texture to give

a more realistic wool effect.
The lower parts of legs are colored with a vec4 brown color:

```
else if(uFlagTextureDownLeg == true){
    fColor = vec4(0.4, 0.27, 0.13, 1.0);
}
```

The texture attached to the face of the sheep is an image of a sheep face and it's combined with the wool image and the bump: I have done some tests to find which face of the cube is corresponding to the animal face.
To apply the bump mapping, I have used the same code implemented for the homework 1 and in particular I set the diffuse and ambient properties of the light to white because in this way the sheep gets a whitish color. I have needed also to compute the normals and the tangents of each face of the focused parts of the sheep to alter the surfaces.

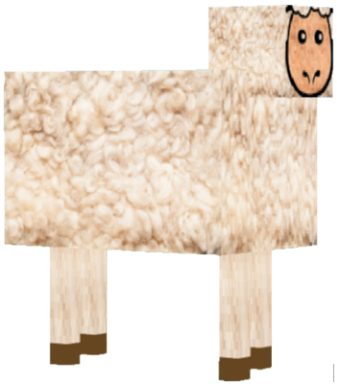

Figure 3: Color texture only

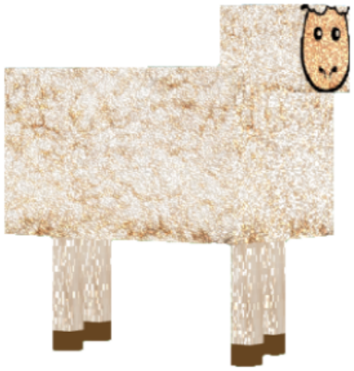

Figure 4: Color texture + bump texture

Request 4

To create the fence I used another hierarchical model (independent from the one of the sheep) and I used 3 vertical sticks and a horizontal one so in this way I got my simplified version of a fence.
At the fence I have associated a color texture using an image of wood.

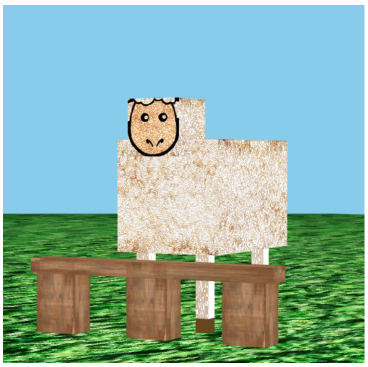

Figure 5: Fence model

Request 5

To get a continuous animation, I have use the Javascript function *setInterval* using an interal of 120 ms.
Pressing the reset button, the page will be reloaded; pressing the start button the sheep will start to walk towards the fence and then jump.
To walk towards the fence I have used the increment along the x-axis of the torso and to simulate the motion forward-and-back of the legs I increment and decrease of 10 degrees each leg.
To simulate the jump of the animal, I have used the sine function setting parameters as period and amplitude. The application of the sine function hasn't been trivial because I had to find right values to be applied in such way the sheep doesn't bump into the fence while ascending and descending during the jump beyond starting the jump in the same point of the end of the walking mode.

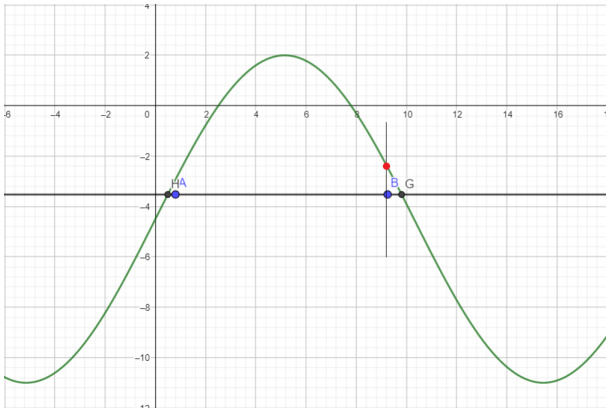

Figure 6: The sine function used in this application

Looking at the graph it can be noticed that the red point (where the sheep finishes to jump following the sine function) is above the plane of the grass field (point B) and for this reason I have decide to apply a translation along y-axis in such way the sheep, at the end, falls over the field.

Request 6

To allow the user to move the camera, I have introduced bottoms for **radius**, **theta** and **phi** in such way he can modify the eye position before, during and after the animation.
I have also decided to introduced bottoms for **fovy**, **near** and **far** to calculate the perspectiveMatrix (keeping constant the fourth parameter **aspect**). These four parameters are my solution to the fact that without them often I got situations where the grass field or parts of the sheep went outside the viewer volume. Another motivation to this choice is that thanks to **fovy** the user can zoom and looking in a better way at the sheep before, during and after the animation.