CS480 Introduction

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Figure 1: Project's whole effects displayed in one scene.

ABSTRACT

In this project, we made an animation of the introduction of course CS480. This animation is fun and attractive, and it was designed to be played at the beginning of each class to grab students' attention, and also give them a brief overview of what gonna to be talked in the following class time. The introduction animation contains both visual effect like 3D model appears from a distance, rotates, collapse and recovery and so on. Sound effect including playing background music and introduction audio in appropriate time slots. All these effects are made based on the techniques of WebGL, Three.js, HTML and Java Script.

KEYWORDS

Animation, WebGL, Three.js, HTML, Java Script, Visual Effect, Sound Effect

CS460, Fall 2020, Boston, MA

ACM ISBN 1337.
https://CS460.org

ACM Reference Format:
Yue Sun and Fangda Chi. 2020. CS480 Introduction. In *CS460: Computer Graphics at UMass Boston, Fall 2020*. Boston, MA, USA, 4 pages. https://CS460.org

1 INTRODUCTION

It's quite challenging to present a course online in such a tough period. Students easily lose their interest to a course and hence won't pay attention to it. Hence, on the one hand, making an attractive introduction at the beginning of each class is a very good idea to grab students' eyes and hence inspires in them a love for learning. On the other hand, it can also give students a brief summary of what will be taught in the following class time.

According to the homepage of CS480, we know that this course is mainly focus on Biomedical Signal and Image Processing[4]. Hence, we decided to add some biomedical factors to stick as close to the theme. We used a high-tech human brain image[3] as our background, which can indicate the theme of the course. Besides, we also displayed a human body 3D model[2] at the center of the screen, with vivid animations, which will attract audience's attention. We also designed other animations of course logo "CS480" and appropriate text introduction together with its audio version.

The design architecture of our introduction animation is shown in Figure.2. Firstly, course logo "CS480" together with a spinning colorful cube appear from a distance and then go to the top-left

corner of the screen; Then a human body 3D model appears at the center and then repeatably collapses and recoveries. And then follows an audio to briefly introduce the content of this course, and the corresponding keywords or key sentences will be displayed at the meantime.

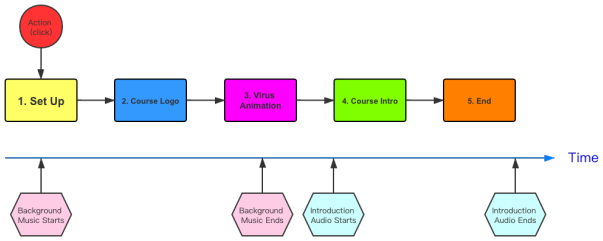

Figure 2: Design architecture of our animation.

2 RELATED WORK

Our project is built on the top of Prof. Daniel's code [5] and integrated knowledge we learnt in the course CS460. Besides, we also learnt more from Youtube and other websites. The technique of this project includes Three.js [1], HTML[7], and CSS[6].

3 METHOD

In this section, we will introduce details with the corresponding codes to achieve main animations. Note that we used to use a microscope virus 3D model, but later we changed it to a Human Body model, that's why we use "virus" in our code.

3.1 Implementation

The whole project can be concluded as three parts:

3.1.1 *Part 1:* Course Logo and Spinning Cube

We generate 3D course logo "CS480" by "THREE.TextGeometry" with "helvetikerregular" type, and use "THREE.MeshNormalMaterial" as Material.

```
const loader = new THREE.FontLoader();
loader.load( 'helvetiker_regular.typeface.json',
function ( font ){
const text_geometry = new THREE.TextGeometry
( 'CS480', {...}
const text_material = new THREE.MeshNormalMaterial();
const textMesh = new THREE.Mesh(text_geometry,
text_material);
group.add(textMesh);
});
```

And for the spinning cube, we first use 100000 small triangles to approximately generate a cube and then set color to each vertex. Finally we make it rotates.

```
var particles = 100000;
var positions = new Float32Array(particles*3);
var colors = new Float32Array(particles*3);
var color = new THREE.Color();

var n1 = 74, n2 = n1/2;

for(var i = 0; i<positions.length; i+=3){
  var x = Math.random() * n1 - n2;
  var y = Math.random() * n1 - n2;
  var z = Math.random() * n1 - n2;

  positions[i] = x;
  positions[i+1] = y;
  positions[i+2] = z;

  var r = (x / n1) + 0.5; // the max value = 1
  var g = (y / n1) + 0.5;
  var b = (z / n1) + 0.5;

  color.setRGB(r, g, b);
  colors[i] = color.r;
  colors[i+1] = color.g;
  colors[i+2] = color.b;
}
```

3.1.2 *Part 2:* Animation of Human Body Model

We first imported our OBJ file by THREE.OBJLoader, and then traverse all of the children to set the position of each vertex. Then, we create Mesh by Three.Points to render particles based on the vertices of the geometry. Finally, we implement the effect of model collapse and recovery.

```
function createObject();
function renderVirus();
```

3.1.3 *Part 3:* Introduction audio and Context

First we use website "Notevibes" to generate introduction audio with appropriate pauses, emphasis and volume as shown in Figure.??. Then we write keywords and key sentences in and assign appropriate time slots, so that they can be displayed when audio mentions them.

```
function start_context(){
  var frames = ['caption', 'content1', ...,null];
  var s = 3000
  var times = [...];
  var voice = document.getElementById('voice');
  voice.volume = 1;
  voice.autoplay = true;
  voice.load();
```

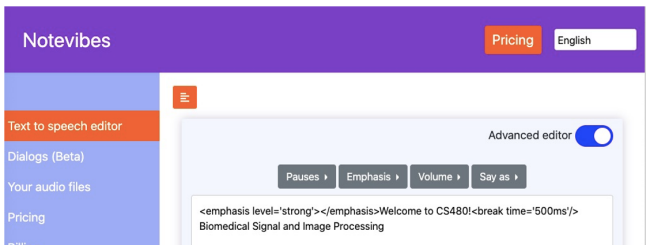

Figure 3: Website to generate introduction audio.

3.2 Milestones

The basic Milestones to implement our final project are shown as following:

3.2.1 Milestone 1. (12/04/2020)
Build up the team.

3.2.2 Milestone 2. (12/06/2020)
The team brainstormed different designs through zoom meeting and finally determined to choose the project "CS480 Introduction" as our final project.

3.2.3 Milestone 3. (12/08/2020)
The team went through some details of project architecture and main ideas.

3.2.4 Milestone 4. (12/11/2020)
Presented Fast forward presentation in the class.

3.2.5 Milestone 5. (12/12/2020)
Build a dynamic course logo and spinning cube using Three.js;
Design the path of them.

3.2.6 Milestone 6. (12/13/2020)
Render a human body 3D model using Three.js;
Add background image.

3.2.7 Milestone 7. (12/15/2020)
Choose the background music;
Generate introduction audio on the website;
Add the keywords and key sentences and set appropriate time slots.

3.2.8 Milestone 8. (12/16/2020)
Finish debugging and Presentation.

3.2.9 Milestone 9. (12/20/2020)
Finish optimization and Report.

3.3 Challenges

Both of us are beginner to graphics, so we met lots of challenges during our final project.

- Challenge 1: Even though we could do every homework during the whole semester, we found it hard to apply what we have learnt to a new project. We need to deal with so many bugs during coding process.
- Challenge 2: Each time when we have a new idea and want to add something cool in our project, we found that we still need spend some time on learning extra materials from YouTube video or other tutorials before we could do so.
- Challenge 3: Since CS480 mainly talks about biomedical, we want apply some related graphics like a neuron in our introduction animation. However, to find free obj/ply/stl files that can be used by Three.js is quite challenging.
- Challenge 4: In a way, teamwork allows us to separate the whole project into smaller sections and makes it easier to complete. And we could also gather more ideas benefit for our project. However, on the other hand, we need to spend more time on communication and commonly met some troubles on merging our work together.

4 RESULTS

The final project demonstration can be find in our group members' GitHub Pages: https://yuesun0609.github.io/cs460student/FinalProject/code and https://cfd123123.github.io/cs460student/final/code.
In the following subsection, I will introduce some main results in more details.

4.0.1 Part 1: Course Logo and Spinning Cube
3D course logo "CS480" and a 3D spinning cube as shown in Figure.4 under it appear from the far to near. After they show at the nearest center position, then they move to the topleft of the screen together and rotate around their center.

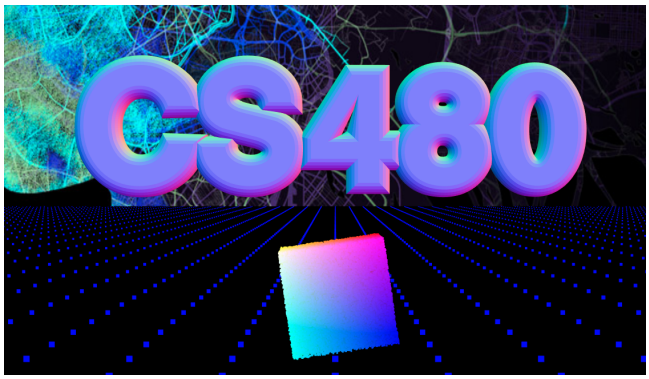

Figure 4: Course Logo and Spinning Cube.

4.0.2 Part 2: Animation of Human Body Model
After course logo and cube arrive at topleft corner, there will be a 3D human body model shown in the middle of the screen, spinning and constantly repeating collapsing and recovering. The effect shown as Figure.5 and Figure.6.

Figure 5: Human Body Model Collapsing.

4.0.3 Part 3: Introduction audio and Context
Keywords and key sentences can be displayed at different positions on the screen in different colors when the introduction audio mentions them. One example shown in Figure.7.

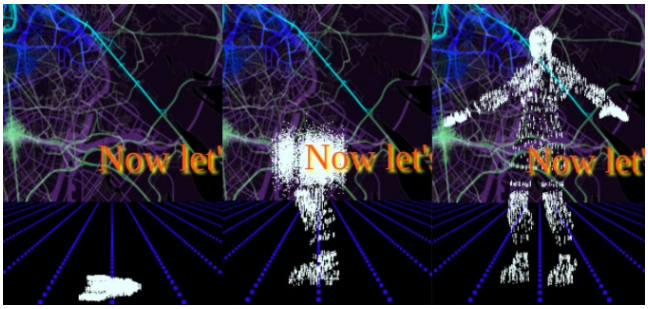

Figure 6: Human Body Model Recovering.

Figure 7: Context is shown on the screen.

5 CONCLUSIONS

We made an attractive animation of the introduction of course CS480. It can dynamically display course logo, some animations and introduction context. We use the knowledge of WebGL, Three.js, HTML and Java Script to finish this project. Although we met many challenges in debugging and finding resources, we tried our best to finish this project.

In the future work, we can add more animation effects in this introdction animation, for example, display more biomedical demonstrations at the same time, applying more attractive voice to record introduction audio, and so on.

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