Final report:

Group 4

Group members: Taowen Qian, Daiyao Lin, Liyu Zhang, Jinrong GUO

Project background:

Hachiware (ハチワレ) is a creature who is friend with Chiikawa, and this character are very famous between young people currently. Hachiware cookies with playful design and sweet taste have made them popular among cat lovers and dessert enthusiasts. This project recreates these cookies in a 3D model using OpenSCAD and Three.js, merging culinary artistry with digital innovation.
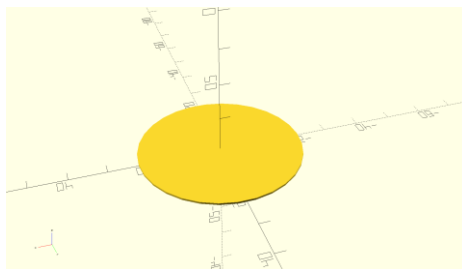
Modelling part:

Part 1:

The First part of the whole modelling we need to consider is the plate, because it is the easiest part.
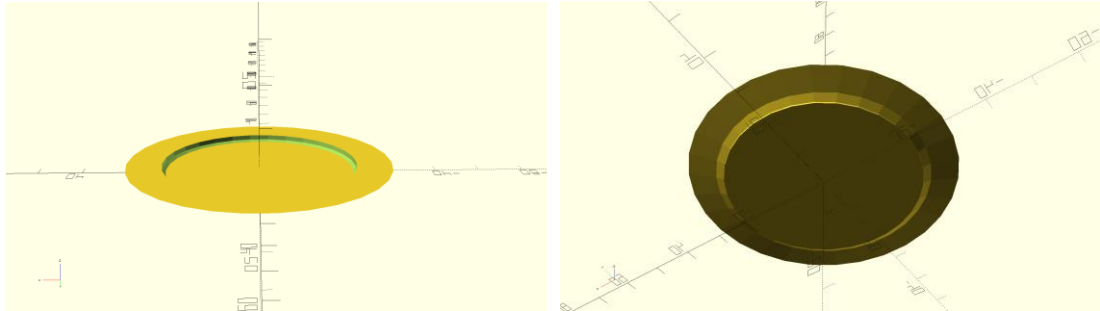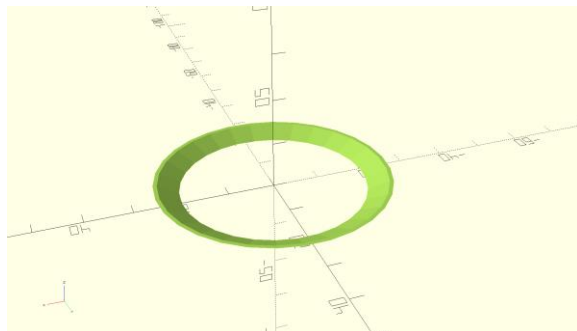

The way to complish it is by 3 different main part of model, bottom, connect and the brim. The bottom part we just use the cylinder function with small z parameter.

```
cylinder(0.5, 22, 22);
```


For the connect part used the partial of sphere by difference function which only need use two cube to subtract the useless part in the sphere.

```
7  difference()
8  {
9  translate([0, 0, 45])
.0  sphere(50);
.1
.2  translate([0, 0, 45.5])
.3  sphere(50);
.4
.5
.6  translate([-50, -50, 2])
.7  cube([100, 100, 50]);
.8
.9  translate([-50, -50, -5])
.0  cube([100, 100, 5]);
.1  }
.2
```
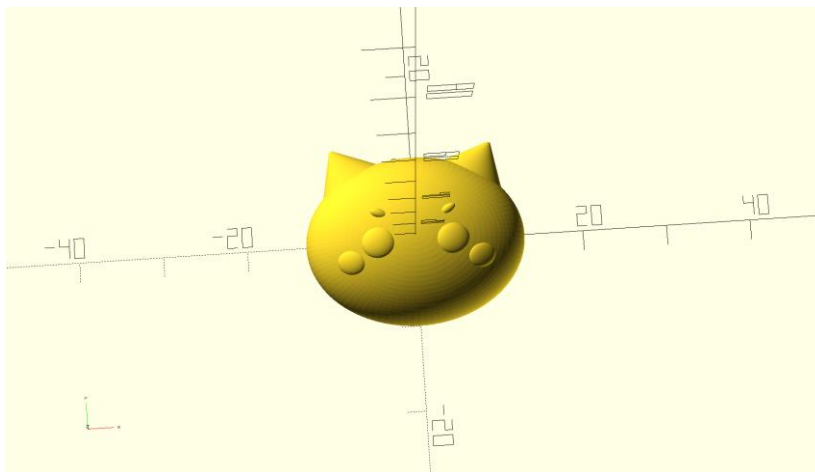
For the brim part we use the cone (cylinder function) as the brim with subtract (difference function) the center part.

```
difference()
{
rotate([180, 0, 0])
translate([0, 0, -2])
cylinder(4, 30, 0);

translate([0, 0, -5])
cylinder(10, 22, 22);
}
```
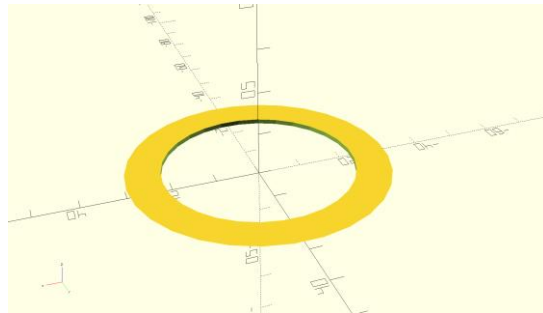

Part 2:
4 different cookies.

First cookie just need some orignial shape can obtain, we just finishing by dividing it to multiplies part to help use rendering in the following step.
Head is made by rescale sphere and ear is cylinder, eyes, eyelash and blush are same way as head (no need for code mention just use shape).

```
74
75 module main(){
76   head();
77   ears();
78   eyes();
79   eyelash();
80   blush();
81 }
82
```
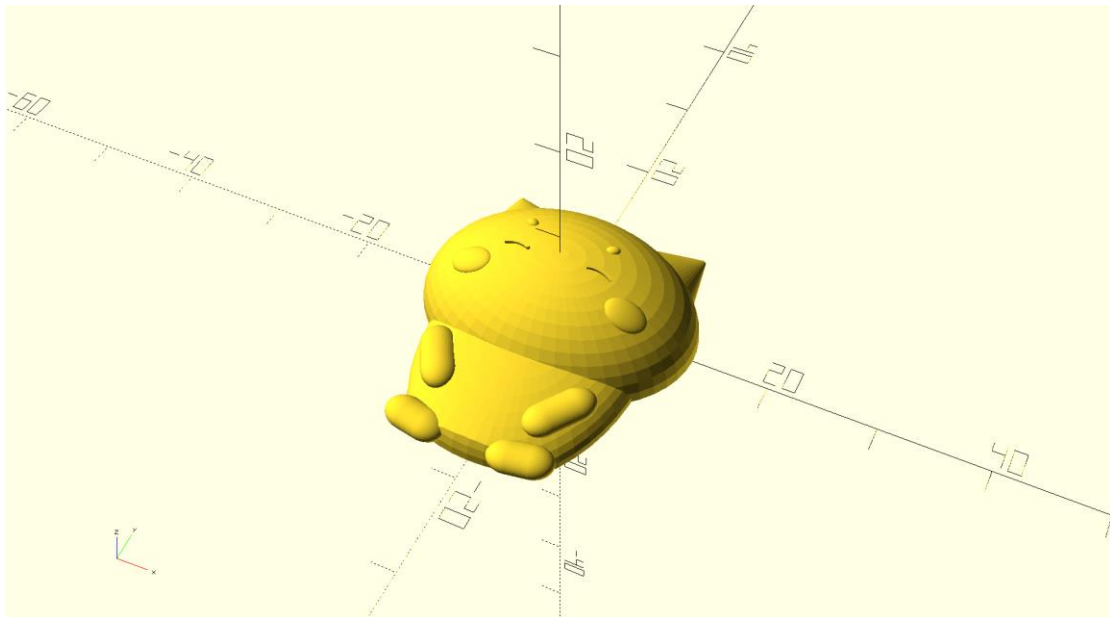
Second cookies is much harder because it have two part need create new shape eyes and hand leg.

For the eyes, we want to make squint eyes, which actually need a curve square, we deal with it by rotate_extrude and for function to simulate with higher angle.
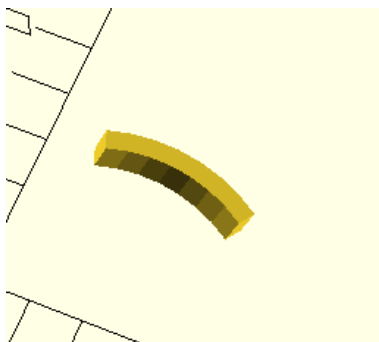
```
module eyes(){
 translate([4, -0.5, 9.8])
 rotate([13,0,85])
 curve(1, 0.3, 2.5, 0.3);

 translate([-4, -0.5, 9.8])
 rotate([-13,0,85])
 curve(1, 0.3, 2.5, 0.3);
 }
```

```
module curve(width, height, length, dh){
    r = (length*length + 4*dh*dh)/(8*dh);
    a =  2*asin(length/(2*r));
    translate([-(r -dh), 0, -width/2])
    rotate([0, 0, -a/2])
    rotate_extrude(angle = a)
    translate([r, 0, 0])
    square(size = [height, width], center = true);
 }
```

For the leg part, we use for statement to simulate same sphere to reach.

```
module leg(){
  rotate([0,0,-10])
  translate([3.5, -7.5, -6])
  union(){
    for(i = [0:0.1:2])
        translate([-7 + i, -10, 7.5])
        scale([1.1,0.9,0.8])
        sphere(1.8);
  }

  rotate([0,0,10])
  translate([7.5, -7.5, -5.5])
  union(){
    for(i = [0:0.1:2])
        translate([-7 + i, -10, 7.5])
        scale([1.1,0.9,0.8])
        sphere(1.8);
  }
}
```
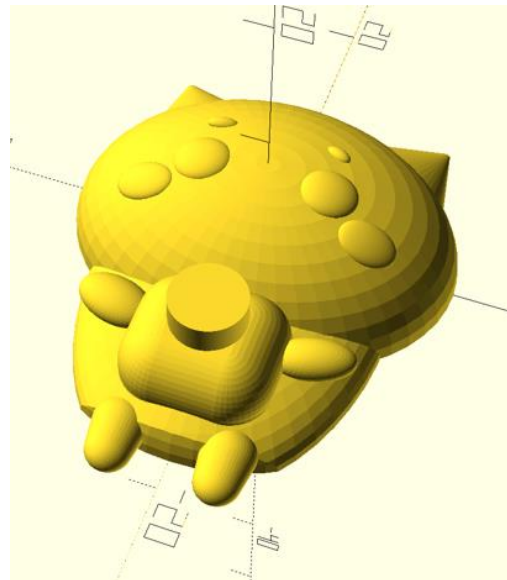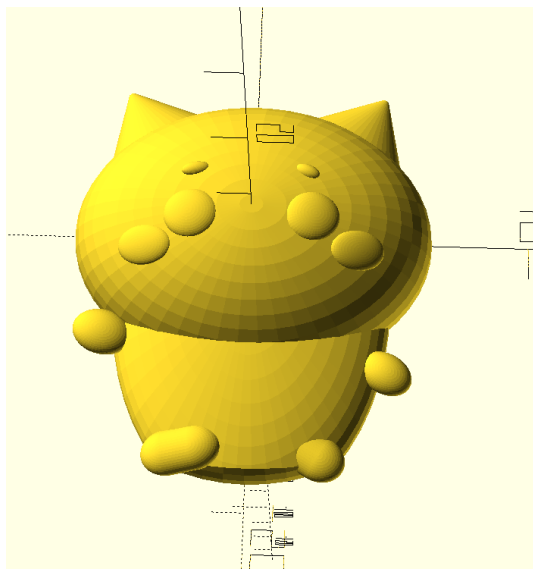
```
module hand(){
  rotate([0,5,120])
  translate([-1, 21, -5])
  union(){
    for(i = [0:0.1:3])
        translate([-7 + i, -10, 7.5])
        scale([1.1,0.9,0.8])
        sphere(1.8);
  }

  rotate([0,0,55])
  translate([-1, -1.5, -4.2])
  union(){
    for(i = [0:0.1:3])
        translate([-7 + i, -10, 7.5])
        scale([1.1,0.9,0.8])
        sphere(1.8);
  }
}
```
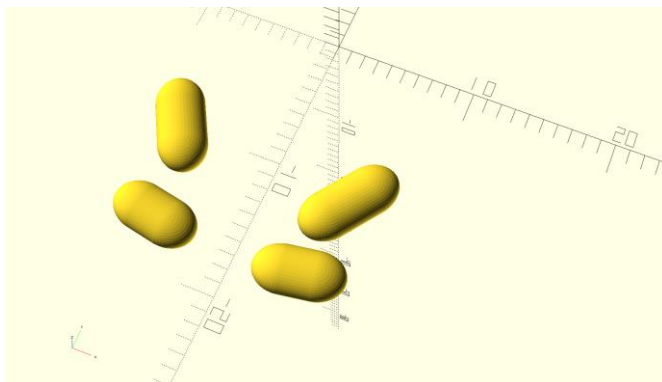

By those ways, we can create following two cookies easiler.
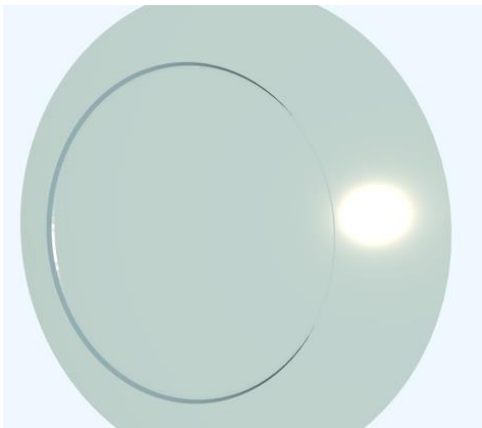
Shader part:

First is the rendering of 3 different cookies (only three cookie because accident of computer of member)



Then is the rendering of the plate:

The shader of the plate is like ceramics, the code is following.

```
const porcelainMaterial = new THREE.MeshPhysicalMaterial({
    color: 0xE0FFFF,
    roughness: 0.1,
    metalness: 0.0,
    clearcoat: 1.0,
    clearcoatRoughness: 0.1,
    transmission: 0.5,
    ior: 1.5
});
```

Environment and animation:

For the environment we choose the light background (0xF0F8FF) which correspond to our cute cookies.
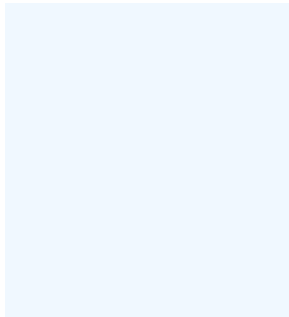
Then for the light we choose warm light 0xFFDAB9 which can show our cookies is delicious.

And for the animation we choose the camera move around the cycle which center at (0,0,35) and radius is 25 which can rotate show out cookies.

In addition part:

I use the 3D printer to print our module.

Problems: Even the plate is look nice in the 3D view, but it cannot complish in the human life because the brim of plate is actually approach 0 which cannot see in the real world.

Contribute description:

Taowen qian:
Modeling 3 different cookies (no camera one), modeling plate.
Rendering plate.
Write the three js file (include animation and environment)
Set basic html file
3D print
Write report.
PPT report

Daiyao Lin:
Rendering 3 different cookies with very cute emotion.
PPT report

Liyu Zhang:
Modeling most complex cookies.
PPT report

Jinrong GUO:
Rendering 1 cookies
PPT report

Experimental results:

We successfully create a 3D CG content of the delicious cookies by openSCAD and Three.js.

Summary and reflection:

Summary
The project recreated Hachiware cookies in 3D using OpenSCAD and Three.js. The team modeled a plate and four cookies—one with complex features like squinting eyes-applied ceramic-like shaders, and animated the scene with a rotating camera.

Reflection
The work enhanced technical skills in 3D modeling and shader programming while underscoring the importance of teamwork and adaptability in overcoming challenges such as hardware issues. Future projects could explore more advanced effects and interactivity.