

**PANDUAN**  
**“3D Model WebGL”**



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**SEKOLAH TEKNIK ELEKTRO DAN INFORMATIKA**

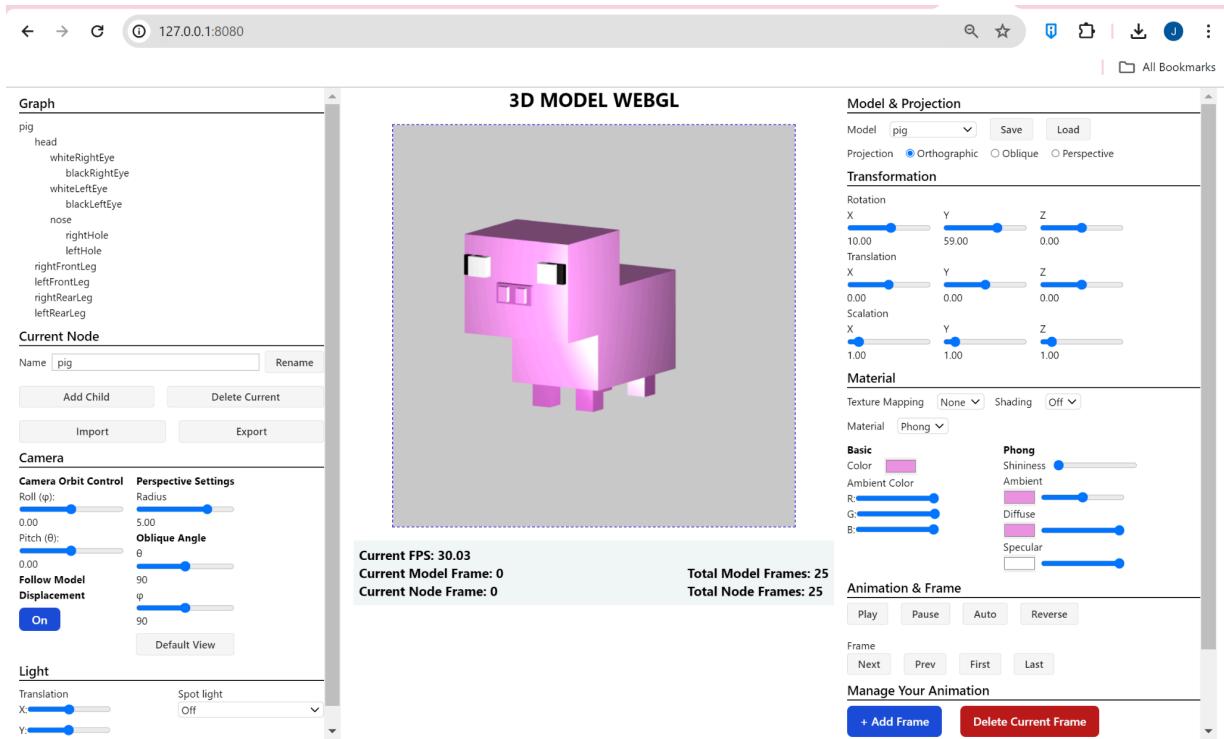
**INSTITUT TEKNOLOGI BANDUNG**

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# 1. Instalasi Perangkat Lunak

<pre>PS D:\programming\webdev\tugas-besar-grafkom-2-yaampun&gt; npm run dev  &gt; tugas-besar-grafkom-2-yaampun@1.0.0 dev &gt; concurrently "npx webpack --watch" "live-server" "tailwindcss -i ./src/input.css -o ./output.css --watch"  [1] Serving "D:\programming\webdev\tugas-besar-grafkom-2-yaampun" at http://127.0.0.1:8080 [2] Browserslist: caniuse-lite is outdated. Please run: [2]   npx update-browserslist-db@latest [2]   Why you should do it regularly: https://github.com/browserslist/update-db#readme [2] [2] Rebuilding... [2] [2] Done in 787ms.</pre> 	
<b>Fitur</b>	Instalasi perangkat lunak
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"><li>1. Clone Repository Github Berikut: <a href="https://github.com/GAIB20/tugas-besar-grafkom-2-yaampun">https://github.com/GAIB20/tugas-besar-grafkom-2-yaampun</a></li><li>2. Masuk ke folder clone, jalankan perintah <code>npm install</code> untuk menginstall seluruh dependensi</li><li>3. Jalankan perintah <code>npm run dev</code></li></ol>
<b>Hasil Pengujian</b>	Berhasil menjalankan aplikasi

## 2. Mengubah *pre-defined* Model

**3D MODEL WEBGL**

**Model & Projection**

Model: pig

Projection: Perspective

Transfo: fox

Rotation: X: 0, Y: 0, Z: 0

Translation: X: 0, Y: -0.5, Z: 0.4

Scalation: X: 1, Y: 1, Z: 1

Material: Basic

Color: #FF0000

Ambient Color: #000000

R: 1.0, G: 0.0, B: 0.0

Shading: Off

Current FPS: 47.85

**3D MODEL WEBGL**

**Model & Projection**

Model: Hollow Thingy

Projection: Perspective

Transfo: fox

Rotation: X: 95, Y: 112, Z: 61

Translation: X: 0.00, Y: 0.00, Z: 0.00

Scalation: X: 1.00, Y: 1.00, Z: 1.00

Material: Phong

Color: #FF0000

Ambient Color: #000000

R: 1.0, G: 0.0, B: 0.0

Shading: Off

Current FPS: 48.31

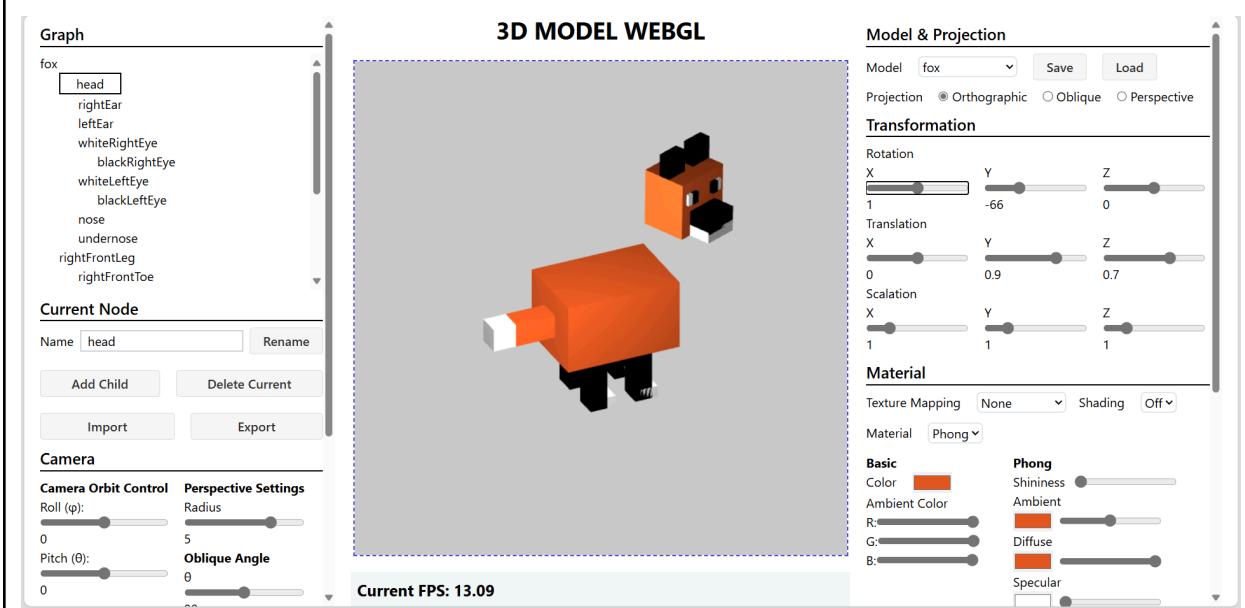
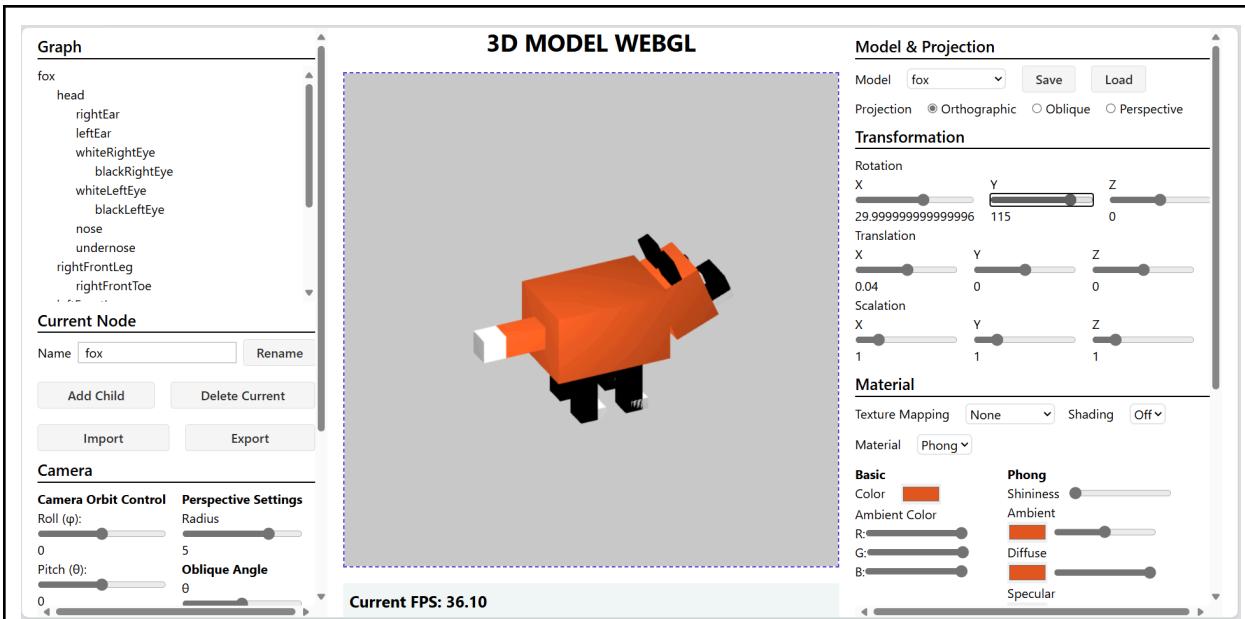
<b>Fitur</b>	Mengubah <i>pre-defined</i> model (hollow dan articulated)
<b>Langkah-Langkah</b>	1. Pilih model menggunakan selection pada model & projection section
<b>Hasil Pengujian</b>	Menampilkan model

### 3. Melakukan Save dan Load Model

The screenshot shows the 3D MODEL WEBGL application interface. On the left, there's a tree view labeled 'Graph' showing a hierarchy of nodes for a 'fox' model, with 'head' as the current node. Below it is a 'Current Node' section with fields for Name (head), Add Child, Delete Current, Import, and Export. A 'Camera' section includes 'Camera Orbit Control' and 'Perspective Settings' with sliders for Roll, Pitch, Radius, and Oblique Angle. In the center, a 3D view shows a stylized orange fox model with black features. At the bottom of the central area, it says 'Current FPS: 36.10'. On the right, there are sections for 'Model & Projection' (Model set to 'fox', Save and Load buttons, Orthographic, Oblique, Perspective projection options), 'Transformation' (Rotation, Translation, Scalation sliders for X, Y, Z axes), and 'Material' (Texture Mapping dropdown set to 'None', Shading dropdown set to 'Off', Material dropdown set to 'Phong', Basic and Phong color sliders). A legend at the bottom right identifies the colors: R=255, G=0, B=0.

Fitur	Melakukan save dan load model
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"><li>1. Tekan tombol save untuk menyimpan model</li><li>2. File model dalam format json akan terdownload</li><li>3. Tekan tombol load untuk melakukan load model</li><li>4. Pilih file json yang akan diload</li></ol>
<b>Hasil Pengujian</b>	Model dapat disimpan pada format json dan diload kembali

### 4. Transformasi Model



Fitur	Transformasi Model
<p><b>Langkah-Langkah</b></p>	<ol style="list-style-type: none"> <li>1. Default <i>selected node</i> (atau komponen) adalah root node pada graph (dapat dilihat pada current node)</li> <li>2. Ubah transformasi dengan menggunakan slider-slider yang ada pada section transformation</li> </ol> <p><b>Alternatif</b></p> <ol style="list-style-type: none"> <li>1. Pilih node yang ada pada section</li> </ol>

	graph 2. Ubah transformasi
Hasil Pengujian	Transformasi sesuai dengan target/selected node

## 5. Basic Material & Ambient Color

**3D MODEL WEBGL**

Current Node: Name: pig

Camera: Camera Orbit Control, Perspective Settings, Light: Translation X: 0, Y: 0, Z: 0; Spot light: Off

Model & Projection: Model: pig, Projection: Orthographic, Transformation: Rotation X: 8, Y: 59, Z: 0; Translation X: 0, Y: 0, Z: 0; Scalation X: 1, Y: 1, Z: 1. Material: Texture Mapping: None, Shading: Off, Material: Basic, Phong: Shininess: 100, Ambient: Color: #FF0000, Diffuse: Color: #0000FF, Specular: Color: #FFFFFF.

**3D MODEL WEBGL**

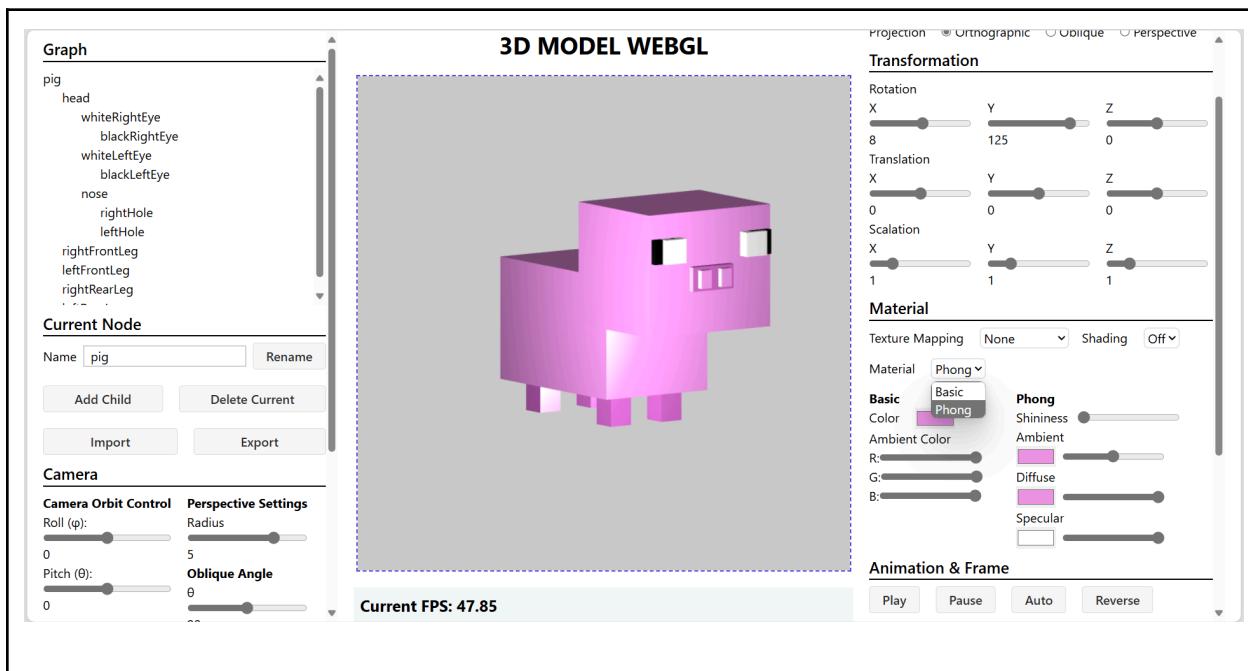
Current Node: Name: pig

Camera: Camera Orbit Control, Perspective Settings, Light: Translation X: 0, Y: 0, Z: 0; Spot light: Off

Model & Projection: Model: pig, Projection: Orthographic, Transformation: Rotation X: 8, Y: 59, Z: 0; Translation X: 0, Y: 0, Z: 0; Scalation X: 1, Y: 1, Z: 1. Material: Texture Mapping: None, Shading: Off, Material: Basic, Phong: Shininess: 100, Ambient: Color: #0000FF, Diffuse: Color: #00FF00, Specular: Color: #FFFFFF.

<b>Fitur</b>	Mengubah warna dasar dan ambient light
<b>Langkah-Langkah</b>	<p>1. Pilih basic material pada selection      2. Pada section basic pilih color      3. Gunakan slider ambient color untuk mengatur RGB ambient</p> <p><b>Catatan: color dan diffuse color merupakan variabel yang sama</b></p>
<b>Hasil Pengujian</b>	Warna berubah sesuai dengan basic color dan ambient light

## 6. Phong Material



**3D MODEL WEBGL**

**Graph**

```

pig
  head
    whiteRightEye
    blackRightEye
    whiteLeftEye
    blackLeftEye
  nose
    rightHole
    leftHole
  rightFrontLeg
  leftFrontLeg
  rightRearLeg

```

**Current Node**

Name: head    Rename

Add Child    Delete Current

Import    Export

**Camera**

Camera Orbit Control    Perspective Settings

Roll ( $\varphi$ ): 0    Radius: 5  
Pitch ( $\theta$ ): 0    Oblique Angle: 0

Current FPS: 8.01

**Model & Projection**

Model: pig    Save    Load

Projection: Orthographic

**Transformation**

Rotation: X 0, Y 0, Z 0

Translation: X 0, Y 0, Z 0

Scalation: X 1, Y 1

**Material**

Texture Mapping: None

Material: Phong

**Basic**

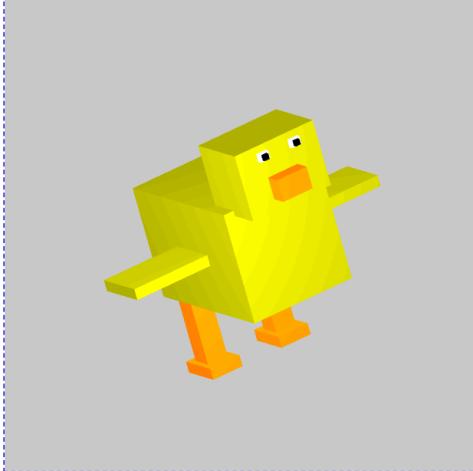
Color: #3161209  
Ambient Color: #3161209  
R: 31, G: 61, B: 209

Diffuse: #3161209  
Specular: #3161209

Fitur	Phong Material
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"> <li>1. Phong material dapat dipilih pada selection material</li> <li>2. Pengubahan warna ambient, diffuse, dan specular dapat dilakukan dengan menggunakan color picker pada kolom Phong</li> <li>3. Masing-masing konstanta dapat diubah dengan slidernya</li> </ol> <p><b>Catatan:</b></p> <ul style="list-style-type: none"> <li>- <b>color</b> dan <b>diffuse color</b> merupakan variabel yang sama</li> <li>- Semakin kecil nilai shininess semakin shiny</li> </ul>
<b>Hasil Pengujian</b>	Warna berubah sesuai dengan basic color dan ambient light

## 7. Custom Texture with Diffuse Texture

### 3D MODEL WEBGL



Current FPS: 4.29  
 Current Model Frame: 0  
 Current Node Frame: 0  
 \* Current Frame start from index 0

Total Model Frames: 111  
 Total Node Frames: 100

### Model & Projection

Model: chicken

Projection:  Orthographic  Oblique  Perspective

### Transformation

Rotation X: 42.00 Y: -55.00 Z: 27.00  
 Translation X: 0.00 Y: 0.00 Z: 0.00  
 Scalation X: 1.00 Y: 1.00 Z: 1.00

### Material

Diffuse Texture: None

**Basic**  
 Color: Ambient Color:   
 R:  G:  B:   
 R:  G:  B:

**Phong**  
 Shininess:  Ambient:   
 Diffuse:  Specular:

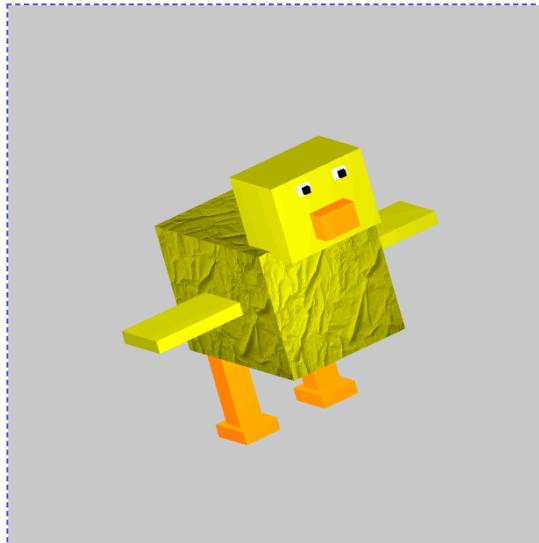
### Animation & Frame

Play

Frame:

### Manage Your Animation

### 3D MODEL WEBGL



Current FPS: 59.17  
 Current Model Frame: 0  
 Current Node Frame: 0  
 Current Frame start from index 0

Total Model Frames: 111  
 Total Node Frames: 100

### Model & Projection

Model: chicken

Projection:  Orthographic  Oblique  Perspective

### Transformation

Rotation X: 42.00 Y: -55.00 Z: 27.00  
 Translation X: 0.00 Y: 0.00 Z: 0.00  
 Scalation X: 1.00 Y: 1.00 Z: 1.00

### Material

Diffuse Texture: Paper

**Basic**  
 Color: Ambient Color:   
 R:  G:  B:   
 R:  G:  B:

### Animation & Frame

Play

### 3D MODEL WEBGL

Current FPS: 30.03  
Current Model Frame: 0  
Current Node Frame: 0  
\* Current Frame start from index 0

Total Model Frames: 111  
Total Node Frames: 100

#### Model & Projection

Model: chicken    
Projection:  Orthographic  Oblique  Perspective

#### Transformation

Rotation X: 42.00 Y: -55.00 Z: 27.00  
Translation X: 0.00 Y: 0.00 Z: 0.00  
Scalation X: 1.00 Y: 1.00 Z: 1.00

#### Material

Diffuse Texture: Bump  On   
Material: Phong

**Basic**  
Color:   
Ambient Color:   
R:  G:  B:

**Phong**  
Shininess:   
Ambient:   
Diffuse:   
Specular:

#### Animation & Frame

Play     
Frame: Next

#### Manage Your Animation

+ Add Frame

### 3D MODEL WEBGL

Current FPS: 29.94  
Current Model Frame: 0  
Current Node Frame: 0  
\* Current Frame start from index 0

Total Model Frames: 111  
Total Node Frames: 100

#### Model & Projection

Model: chicken    
Projection:  Orthographic  Oblique  Perspective

#### Transformation

Rotation X: 42.00 Y: -55.00 Z: 27.00  
Translation X: 0.00 Y: 0.00 Z: 0.00  
Scalation X: 1.00 Y: 1.00 Z: 1.00

#### Material

Diffuse Texture: Brick  On   
Material: Phong

**Basic**  
Color:   
Ambient Color:   
R:  G:  B:

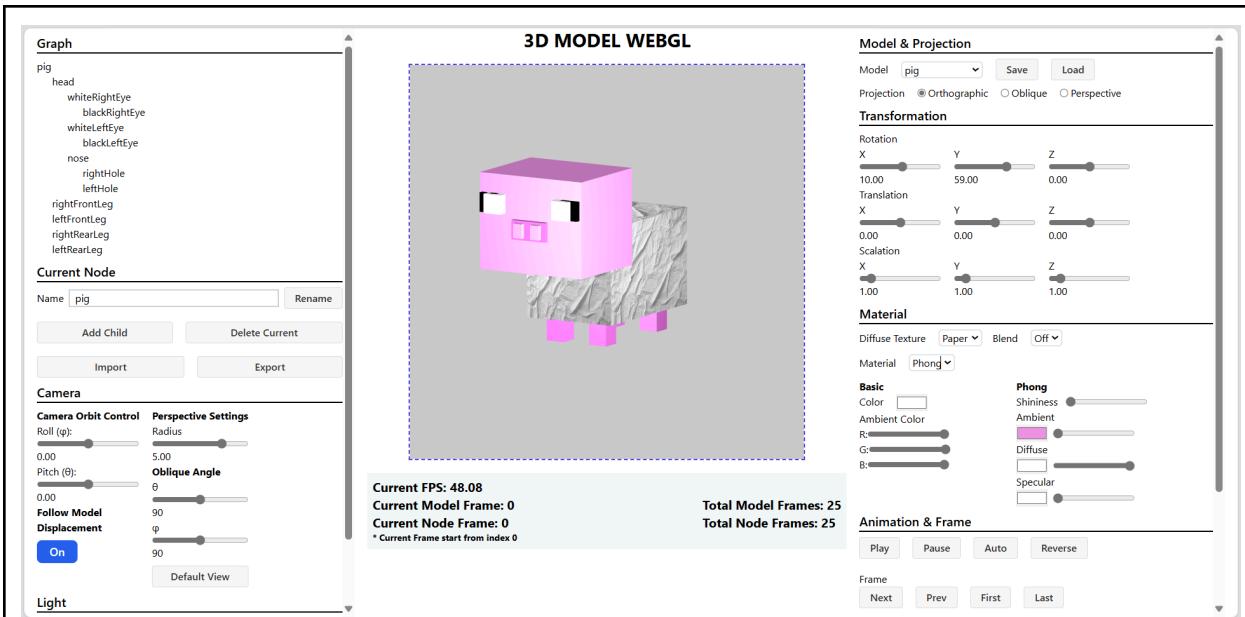
**Phong**  
Shininess:   
Ambient:   
Diffuse:   
Specular:

#### Animation & Frame

Play     
Frame: Next

#### Manage Your Animation

+ Add Frame



<b>Fitur</b>	Mengubah Tekstur Dasar pada Node/Komponen tertentu
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"> <li>1. Pilih komponen pada <i>scene graph</i></li> <li>2. Pilih jenis tekstur yang ingin diaplikasikan pada komponen terpilih pada komponen <i>diffuse texture</i></li> </ol> <p><b>Catatan:</b></p> <ul style="list-style-type: none"> <li>- Untuk menampilkan tekstur asli matikan <b>blend mode</b> dan atur slider <b>ambient</b> menjadi <b>0</b> dan <b>diffuse</b> slider menjadi <b>1</b></li> </ul>
<b>Hasil Pengujian</b>	Tekstur komponen terpilih berubah sesuai pilihan tekstur pada <i>Diffuse Texture</i>

## 8. Light Direction

**Graph**

Hollow Thingy

**Current Node**

Name Hollow Thingy

**Camera**

**Camera Orbit Control**

Roll ( $\varphi$ ): 0  
Pitch ( $\theta$ ): 0

**Perspective Settings**

Radius: 5  
Oblique Angle: 0

**Light**

Translation X: -0.02 Y: 0 Z: 1

Spot light: Off

**3D MODEL WEBGL**

Current FPS: 48.08

**Model & Projection**

Model: Hollow Thingy

Projection: Orthographic

**Transformation**

Rotation X: 29 Y: -38 Z: 0  
Translation X: -0.02 Y: 0 Z: 0  
Scalation X: 1 Y: 1 Z: 1

**Material**

Texture Mapping: None Shading: Off

Material: Phong

**Basic**

Color:  Ambient Color:   
R: 1 G: 1 B: 1

**Phong**

Shininess: 100 Ambient:  Diffuse:  Specular:

**Graph**

Hollow Thingy

**Current Node**

Name Hollow Thingy

**Camera**

**Camera Orbit Control**

Roll ( $\varphi$ ): 0  
Pitch ( $\theta$ ): 0

**Perspective Settings**

Radius: 5  
Oblique Angle: 0

**Light**

Translation X: 0 Y: 0 Z: 0

Spot light: Off

**3D MODEL WEBGL**

Current FPS: 47.85

**Model & Projection**

Model: Hollow Thingy

Projection: Orthographic

**Transformation**

Rotation X: 29 Y: -38 Z: 0  
Translation X: -0.02 Y: 0 Z: 0  
Scalation X: 1 Y: 1 Z: 1

**Material**

Texture Mapping: None Shading: Off

Material: Phong

**Basic**

Color:  Ambient Color:   
R: 0 G: 0 B: 0

**Phong**

Shininess: 100 Ambient:  Diffuse:  Specular:

Fitur	Light direction
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"> <li>1. Ubah posisi lighting dengan menggunakan slider yang ada pada light section</li> </ol>
<b>Hasil Pengujian</b>	Posisi lighting berubah

## 9. Component Editor: Delete Current

**Graph**

```
fox
  head
  rightEar
  leftEar
  whiteRightEye
  blackRightEye
  whiteLeftEye
  blackLeftEye
  nose
  undernose
  rightFrontLeg
  rightFrontToe
```

**Current Node**

Name  Rename

Add Child Delete Current Import Export

**Camera**

Camera Orbit Control Perspective Settings

Roll (φ): 0 Radius: 5  
Pitch (θ): 0 Oblique Angle: 0

Current FPS: 48.08

**Model & Projection**

Model: fox Save Load

Projection: Orthographic

**Transformation**

Rotation X: 0 Y: 0 Z: 0

Translation X: 0 Y: 0.1 Z: 0.7

Scalation X: 1 Y: 1 Z: 1

**Material**

Texture Mapping: None Shading: Off

Material: Phong

<b>Basic</b>	<b>Phong</b>
Color: #FF8C00	Shininess: 10
Ambient Color: R: 255 G: 140 B: 0	Ambient: 0.5
	Diffuse: 0.8
	Specular: 0.2

**Graph**

```
fox
  rightFrontLeg
  rightFrontToe
  leftFrontLeg
  leftFrontToe
  rightRearLeg
  rightRearToe
  leftRearLeg
  leftRearToe
  tail
  tailedge
```

**Current Node**

Name  Rename

Add Child Delete Current Import Export

**Camera**

Camera Orbit Control Perspective Settings

Roll (φ): 0 Radius: 5  
Pitch (θ): 0 Oblique Angle: 90°

Current FPS: 47.85

**Model & Projection**

Model: fox Save Load

Projection: Orthographic

**Transformation**

Rotation X: 0 Y: 0 Z: 0

Translation X: 0 Y: 0.1 Z: 0.7

Scalation X: 1 Y: 1 Z: 1

**Material**

Texture Mapping: None Shading: Off

Material: Phong

<b>Basic</b>	<b>Phong</b>
Color: #FF8C00	Shininess: 10
Ambient Color: R: 255 G: 140 B: 0	Ambient: 0.5
	Diffuse: 0.8
	Specular: 0.2

Fitur	Delete current
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"> <li>Pilih node pada graph</li> <li>Tekan tombol delete current pada current node section</li> <li>Node yang dipilih akan terhapus beserta children-nya</li> </ol>

	<b>Catatan:</b> setelah melakukan penghapusan, current selected node akan kosong, perlu menekan node pada graph kembali untuk menggunakan fitur transformasi dll.
<b>Hasil Pengujian</b>	Node terhapus

## 10. Component Editor: Add Child

**Graph**

```
fox
rightFrontLeg
rightFrontToe
leftFrontLeg
leftFrontToe
rightRearLeg
rightRearToe
leftRearLeg
leftRearToe
tail
tailedge
```

**Current Node**

Name  Rename

Add Child Delete Current

Import Export

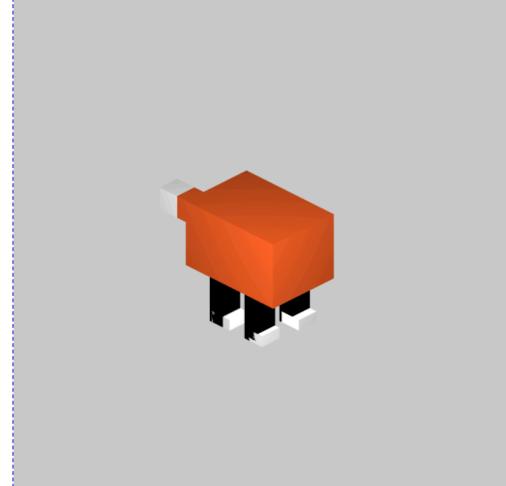
**Camera**

Camera Orbit Control Perspective Settings

Roll ( $\varphi$ ): 0 Radius: 5  
Pitch ( $\theta$ ): 0 Oblique Angle: 0

Current FPS: 47.85

**3D MODEL WEBGL**



Current FPS: 47.85

**Model & Projection**

Model: fox Save Load

Projection: Orthographic (radio button selected)

**Transformation**

Rotation X: 0	Y: 0	Z: 0
Translation X: 0	Y: 0.1	Z: 0.7
Scalation X: 1	Y: 1	Z: 1

**Material**

Texture Mapping: None Shading: Off

Material: Phong

**Basic**

Color: #FF0000	Shininess: 10
Ambient Color: #FF0000	Ambient: 1.0
R: 1.0	Diffuse: 1.0
G: 0.0	Specular: 1.0
B: 0.0	

**Phong**

Shininess: 10
Ambient: 1.0
Diffuse: 1.0
Specular: 1.0

**Graph**

```
fox
rightFrontLeg
rightFrontToe
leftFrontLeg
leftFrontToe
rightRearLeg
rightRearToe
leftRearLeg
leftRearToe
tail
tailedge
newCube1
```

**Current Node**

Name: fox Rename

Add Child Delete Current

Import Export

**Camera**

Camera Orbit Control Perspective Settings

Roll ( $\varphi$ ): 0 Radius: 5  
Pitch ( $\theta$ ): 0 Oblique Angle: 0

Current FPS: 35.97

**3D MODEL WEBGL**



Current FPS: 35.97

**Model & Projection**

Model: fox Save Load

Projection: Orthographic (radio button selected)

**Transformation**

Rotation X: 29.999999999999996	Y: 45	Z: 0
Translation X: 0	Y: 0	Z: 0
Scalation X: 1	Y: 1	Z: 1

**Material**

Texture Mapping: None Shading: Off

Material: Phong

**Basic**

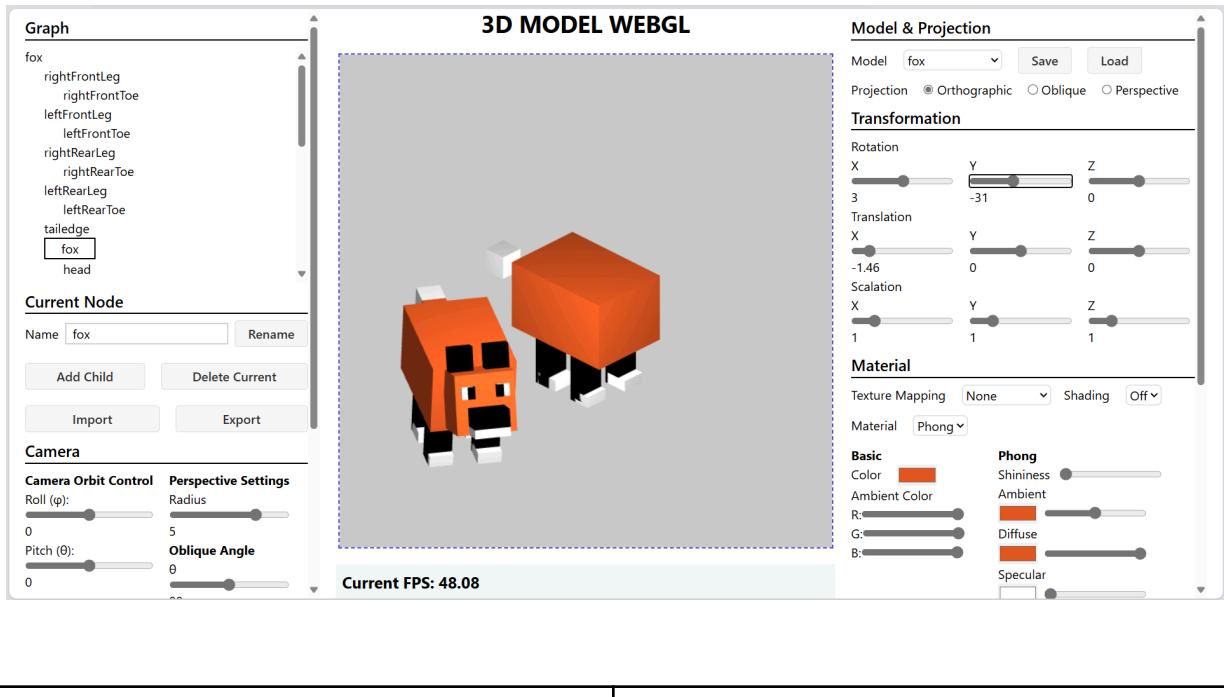
Color: #800080	Shininess: 10
Ambient Color: #800080	Ambient: 1.0
R: 1.0	Diffuse: 1.0
G: 0.0	Specular: 1.0
B: 0.0	

**Phong**

Shininess: 10
Ambient: 1.0
Diffuse: 1.0
Specular: 1.0

Fitur	Add child
<b>Langkah-Langkah</b>	<p>1. Pilih node pada graph      2. Tekan tombol add child pada current node section</p> <p><b>Catatan:</b></p> <ul style="list-style-type: none"> <li>- Pastikan nama tiap node berbeda</li> <li>- Penghapusan node menggunakan nama, maka seluruh node dengan nama yang sama akan ikut terhapus</li> <li>- Ubah nama node pada input field lalu tekan tombol rename</li> </ul>
<b>Hasil Pengujian</b>	Child pada node tersebut ditambahkan dengan default cube

## 11. Component Editor: Import & Export

	
<b>Fitur</b>	Import dan export node
<b>Langkah-Langkah</b>	<p>1. Pilih node pada graph      2. Tekan tombol import/export</p>

## 12. Spot Light

**Graph**

Hollow Thingy

**Current Node**

Name: Hollow Thingy

**Camera**

**Camera Orbit Control** **Perspective Settings**

Roll ( $\phi$ ): 0 Radius: 5  
Pitch ( $\theta$ ): 0 Oblique Angle: 0  
0 90  
0 90

**Light**

Translation X:  Y:  Z:   
Spot light: On

**3D MODEL WEBGL**

Current FPS: 47.85

**Model & Projection**

Model: Hollow Thingy

Projection:  Orthographic  Oblique  Perspective

**Transformation**

Rotation X: 44 Y: -8 Z: 0.00  
Translation X: 0.00 Y: 0.00 Z: 0.00  
Scalation X: 1.00 Y: 1.00 Z: 1.00

**Material**

Texture Mapping: None Shading: Off

Material: Phong

**Basic** Color:  Ambient Color:   
R:  G:  B:

**Phong** Shininess:  Ambient:  Diffuse:  Specular:

**Graph**

Hollow Thingy

**Current Node**

Name: Hollow Thingy

**Camera**

**Camera Orbit Control** **Perspective Settings**

Roll ( $\phi$ ): 0 Radius: 5  
Pitch ( $\theta$ ): 0 Oblique Angle: 0  
0 90  
0 90

**Light**

Translation X:  Y:  Z:   
Spot light: On

**3D MODEL WEBGL**

Current FPS: 36.10

**Model & Projection**

Model: Hollow Thingy

Projection:  Orthographic  Oblique  Perspective

**Transformation**

Rotation X: 44 Y: -8 Z: 0.00  
Translation X: 0.00 Y: 0.00 Z: 0.00  
Scalation X: 1.00 Y: 1.00 Z: 1.00

**Material**

Texture Mapping: None Shading: Off

Material: Phong

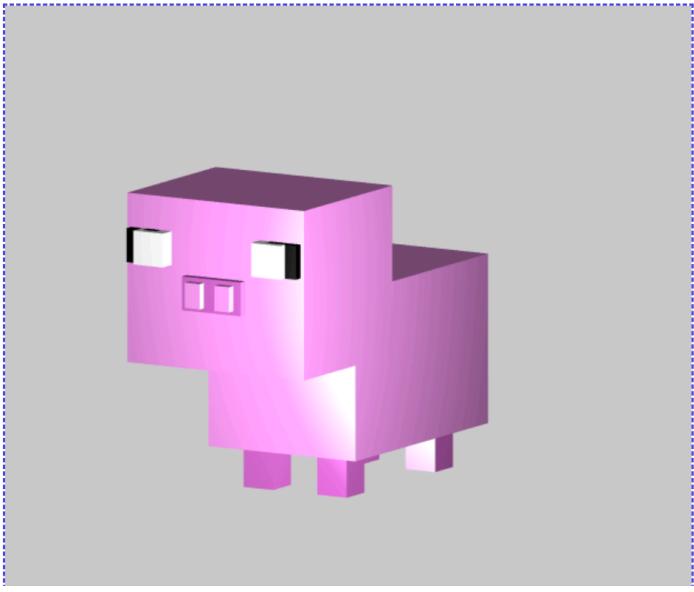
**Basic** Color:  Ambient Color:   
R:  G:  B:

**Phong** Shininess:  Ambient:  Diffuse:  Specular:

<b>Fitur</b>	Mode spot light
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"> <li>1. Ubah mode spot light pada light section</li> <li>2. Ubah posisi menggunakan slider</li> </ol>
<b>Hasil Pengujian</b>	Menampilkan spot light

### 13. Camera: Orthographic Projection

#### 3D MODEL WEBGL



The screenshot shows a 3D rendering of a pink pig model in a WebGL-based application. The pig is rendered with a simple, blocky mesh and has a white face with black eyes and a small mouth. It is positioned in a 3D space with a light gray background. To the right of the 3D view is a control panel titled "Model & Projection". The "Model" dropdown is set to "pig". Under "Projection", the "Orthographic" radio button is selected. Below these are sections for "Transformation" (Rotation, Translation, Scalation) and "Material" (Texture Mapping, Shading, Material type). The "Material" section shows "Phong" is selected. At the bottom of the panel are tabs for "Basic" and "Phong".

<b>Fitur</b>	Proyeksi Kamera Orthographic
<b>Langkah-Langkah</b>	1. Klik “Orthographic” radio button pada “Projection”
<b>Hasil Pengujian</b>	Menampilkan proyeksi kamera orthographic

## 14. Camera: Oblique Projection

All Bookmarks

### 3D MODEL WEBGL

Model & Projection

Model: pig

Projection:  Orthographic  Oblique  Perspective

Transformation

Rotation:

X	Y	Z
10.00	59.00	0.00

Translation:

X	Y	Z
0.00	0.00	0.00

Scalation:

X	Y	Z
1.00	1.00	1.00

Fitur	Proyeksi Kamera Oblique
Langkah-Langkah	1. Klik “Oblique” radio button pada “Projection”
Hasil Pengujian	Menampilkan proyeksi kamera oblique

## 15. Camera: Perspective Projection

All Bookmarks

### 3D MODEL WEBGL

**Model & Projection**

Model: pig

Projection:  Orthographic  Oblique  Perspective

**Transformation**

Rotation:

X: 10.00	Y: 59.00	Z: 0.00
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Translation:

X: 0.00	Y: 0.00	Z: 0.00
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Fitur	Proyeksi Kamera Perspective
Langkah-Langkah	1. Klik “Perspective” radio button pada “Projection”
Hasil Pengujian	Menampilkan proyeksi kamera perspective

## 16. Camera: Variasi Sudut Proyeksi Oblique

**3D MODEL WEBGL**

Rename  
Delete Current  
Export

Perspective Settings  
Radius: 5.00  
Oblique Angle: θ: 90 φ: 90

Current FPS: 59.88  
Current Model Frame: 0 Total Model Frames: 25

Default View

**3D MODEL WEBGL**

Rename  
Delete Current  
Export

Perspective Settings  
Radius: 5.00  
Oblique Angle: θ: 12 φ: 163

Current FPS: 59.52  
Current Model Frame: 0 Current Node Frame: 0 Total Model Frames: 25 Total Node Frames: 25 \* Current Frame start from index 0

Model & Projection  
Model: pig Save Load  
Projection:  Oblique  Orthographic  Perspective

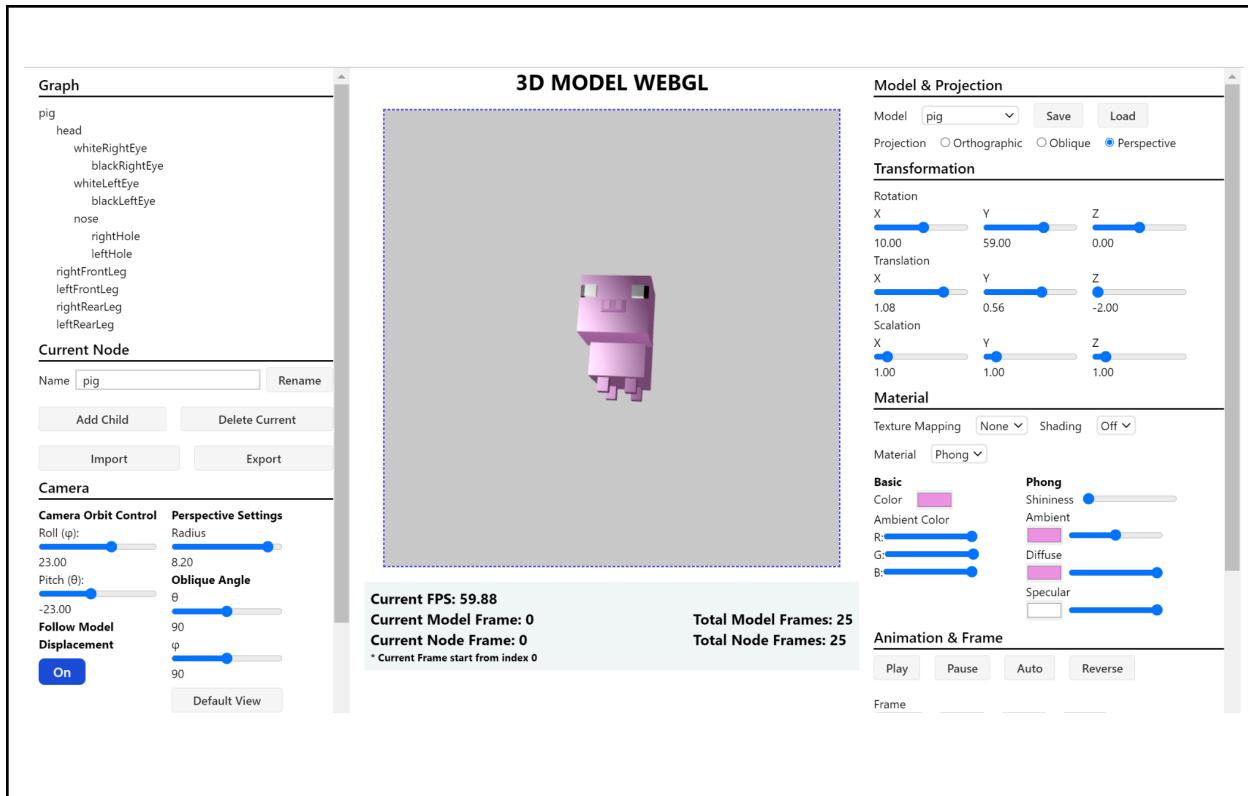
Transformation  
Rotation X: 10.00 Y: 59.00 Z: 0.00  
Translation X: 0.73 Y: 0.00 Z: -0.47  
Scalation X: 1.00 Y: 1.00 Z: 1.00

Material  
Texture Mapping: None Shading: Off  
Material: Phong  
Basic Color: #FF0000 Ambient Color: #000000 R: 255 G: 0 B: 0  
Phong Shininess: 100 Ambient: 100 Diffuse: 100 Specular: 100

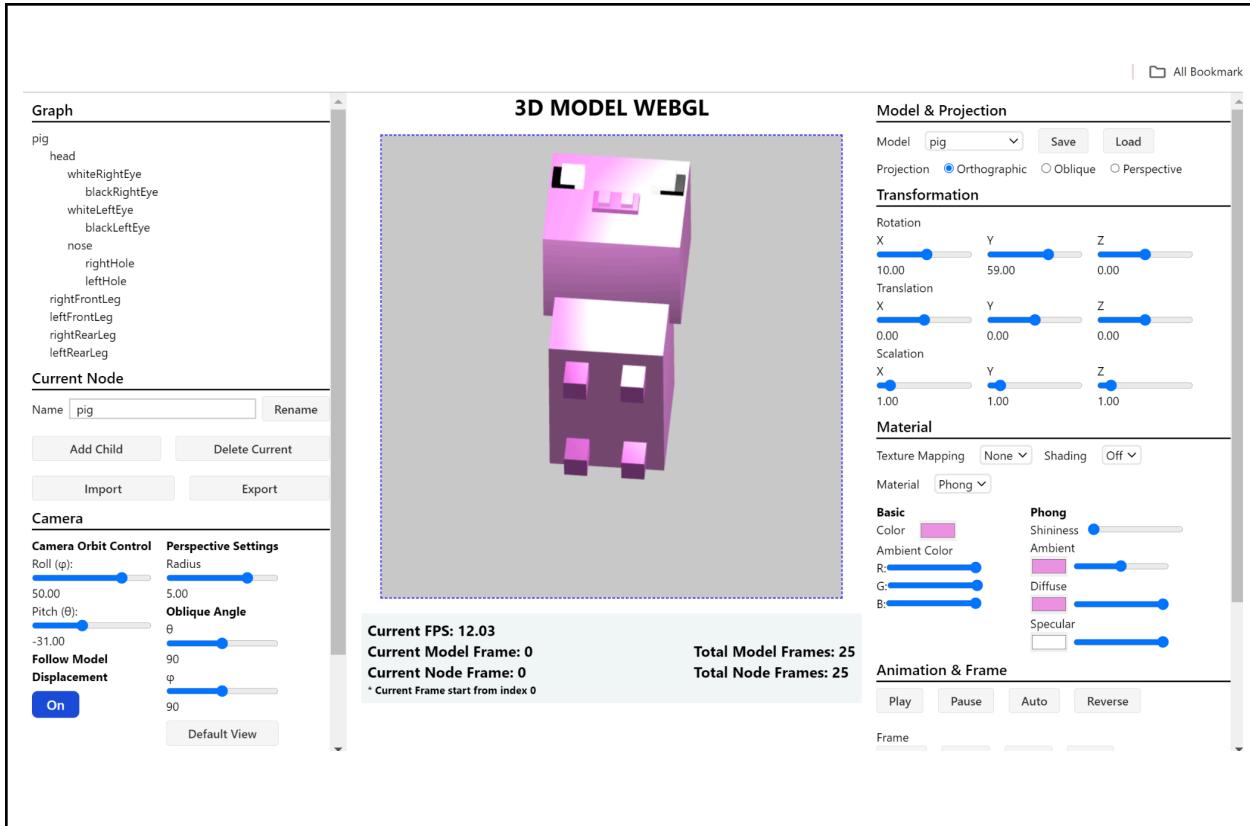
Animation & Frame

<b>Fitur</b>	Mengubah Orientasi Sudut Oblique
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"> <li>1. Pastikan telah memilih proyeksi kamera jenis “Oblique”</li> <li>2. Gerakan sudut theta dan phi pada slider pada bagian “Oblique Angle”</li> </ol>
<b>Hasil Pengujian</b>	Berhasil mengubah Orientasi Sudut Oblique

## 17. Camera: Variasi Orientasi Proyeksi Perspective

	
<b>Fitur</b>	Mengubah Orientasi Sudut dan Radius Kamera terhadap Model
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"> <li>1. Pastikan telah memilih proyeksi kamera jenis “Perspective”</li> <li>2. Gerakan slider radius untuk menjauhkan atau mendekatkan kamera dari objek</li> </ol>
<b>Hasil Pengujian</b>	Berhasil mengubah Orientasi Sudut Oblique

## 18. Camera: Camera Orbit Control



**Graph**

```
graph TD
    pig --> head
    head --> whiteRightEye
    head --> blackRightEye
    head --> whiteLeftEye
    head --> blackLeftEye
    head --> nose
    nose --> rightHole
    nose --> leftHole
    rightHole --> rightFrontLeg
    leftHole --> leftFrontLeg
    rightFrontLeg --> rightRearLeg
    leftFrontLeg --> leftRearLeg
```

**Current Node**

Name:  Rename

Add Child Delete Current Import Export

**Camera**

Camera Orbit Control

Roll ( $\varphi$ ):	Radius:
50.00	5.00
Pitch ( $\theta$ ):	Oblique Angle:
-31.00	90
Follow Model Displacement	<input checked="" type="button" value="On"/>
Default View	

**Model & Projection**

Model:  Save Load

Projection:  Orthographic  Oblique  Perspective

**Transformation**

X: 10.00	Y: 59.00	Z: 0.00
X: 0.00	Y: 0.00	Z: 0.00
X: 1.00	Y: 1.00	Z: 1.00

**Material**

Texture Mapping: None Shading: Off

Material:

<b>Basic</b>	<b>Phong</b>
Color: <input type="color" value="#FF0000"/>	Shininess: <input type="range" value="100"/>
Ambient Color: <input type="color" value="#000000"/>	Ambient: <input type="range" value="100"/>
R: <input type="range" value="100"/>	Diffuse: <input type="range" value="100"/>
G: <input type="range" value="100"/>	Specular: <input type="range" value="100"/>
B: <input type="range" value="100"/>	

**Animation & Frame**

Play Pause Auto Reverse

Frame:

**3D MODEL WEBGL**

**Current FPS: 12.03**

**Current Model Frame: 0**

**Current Node Frame: 0**

\* Current Frame start from index 0

**Total Model Frames: 25**

**Total Node Frames: 25**

<b>Fitur</b>	Menggerakan kamera untuk mengitari model
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"> <li>1. Gerakan slider orientasi <i>roll</i> untuk melakukan rotasi terhadap sumbu horizontal layar relatif terhadap objek</li> <li>2. Gerakan slider orientasi <i>pitch</i> untuk melakukan rotasi terhadap sumbu horizontal layar relatif terhadap objek</li> </ol>
<b>Hasil Pengujian</b>	Berhasil menjalankan <i>orbit control</i>

## 19. Animation: Play

**3D MODEL WEBGL**

Transformation

Rotation X	42.00	Y	-55.00	Z	27.00
Translation X	0.00	Y	0.00	Z	0.00
Scalation X	1.00	Y	1.00	Z	1.00

Material

Texture Mapping: None | Shading: Off | Material: Phong

Basic Color	Phong Shininess
Ambient Color	Ambient
R: 1.00	Diffuse
G: 1.00	Specular
B: 1.00	

Animation & Frame

Play | Pause | Auto | Reverse | Frame: Next | Prev | First | Last

Manage Your Animation

Current FPS: 59.88  
Current Model Frame: 0  
Current Node Frame: 0  
\* Current Frame start from index 0

Total Model Frames: 111  
Total Node Frames: 100

**3D MODEL WEBGL**

Transformation

Rotation X	42.00	Y	-55.00	Z	27.00
Translation X	0.54	Y	0.00	Z	0.00
Scalation X	1.00	Y	1.00	Z	1.00

Material

Texture Mapping: None | Shading: Off | Material: Phong

Basic Color	Phong Shininess
Ambient Color	Ambient
R: 1.00	Diffuse
G: 1.00	Specular
B: 1.00	

Animation & Frame

Play | Pause | Auto | Reverse | Frame: Next | Prev | First | Last

Manage Your Animation

Current FPS: 59.88  
Current Model Frame: 28  
Current Node Frame: 28  
\* Current Frame start from index 0

Total Model Frames: 111  
Total Node Frames: 100

<b>Fitur</b>	Menjalankan Animasi
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"><li>1. Klik Tombol Play pada Bagian Animation &amp; Frame</li><li>2. Frame untuk model keseluruhan</li></ol>

	<p>terdapat pada deskripsi <i>Current Model Frame</i></p> <ol style="list-style-type: none"> <li>3. Frame untuk model keseluruhan terdapat pada deskripsi <i>Current Model Frame</i></li> <li>4. Frame untuk komponen yang terpilih pada <i>Scene Graph</i> terdapat pada deskripsi <i>Current Node Frame</i></li> <li><b>5. Catatan:</b> index dimulai dari 0, sehingga Frame maksimal animasi saat ini = Total Model Frame - 1</li> </ol>
<b>Hasil Pengujian</b>	Animasi model berhasil dijalankan dari Frame Pertama

## 20. Animation: Pause & Continue

**3D MODEL WEBGL**

**Transformation**

- Rotation
  - X: 42.00
  - Y: -55.00
- Translation
  - X: 0.52
  - Y: 0.00
- Scalation
  - X: 1.00
  - Y: 1.00

**Material**

- Texture Mapping: None
- Shading
- Material: Phong
- Basic
  - Color: yellow
  - Ambient Color: orange
  - R: 255
  - G: 100
  - B: 0
- Phong
  - Shininess: 100
  - Ambient: orange
  - Diffuse: yellow
  - Specular: white

**Animation & Frame**

- Play
- Continue
- Auto
- Frame
  - Next
  - Prev
  - First
  - Last

Current FPS: 30.03  
 Current Model Frame: 27  
 Current Node Frame: 27  
 Total Model Frames: 111  
 Total Node Frames: 100  
 \* Current Frame start from index 0

**Manage Your Animation**

<b>Fitur</b>	Stop Animasi yang Sedang Berjalan
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"> <li>1. Klik Tombol Pause saat animasi berjalan</li> </ol>

	2. Klik Tombol Continue untuk memulai kembali animasi
<b>Hasil Pengujian</b>	Melakukan mekanisme Pause & Play pada animasi

## 21. Animation: Auto & Reverse

**3D MODEL WEBGL**

Transformation

Rotation  
X: 42.00, Y: -55.00, Z: 27.00  
Translation  
X: 0.70, Y: 0.00, Z: 0.00  
Scalation  
X: 1.00, Y: 1.00, Z: 1.00

Material

Texture Mapping: None, Shading: Off  
Material: Phong

Basic  
Color: [Color Swatch], Ambient Color: [Color Swatch]  
R: [Slider], G: [Slider], B: [Slider]  
Phong  
Shininess: [Slider], Ambient: [Slider], Diffuse: [Slider], Specular: [Slider]

Animation & Frame

Play, Pause, Stop Auto, Stop Reverse  
Frame  
Next, Prev, First, Last

Current FPS: 59.88  
Current Model Frame: 45  
Current Node Frame: 34  
\* Current Frame start from index 0

Total Model Frames: 111  
Total Node Frames: 100

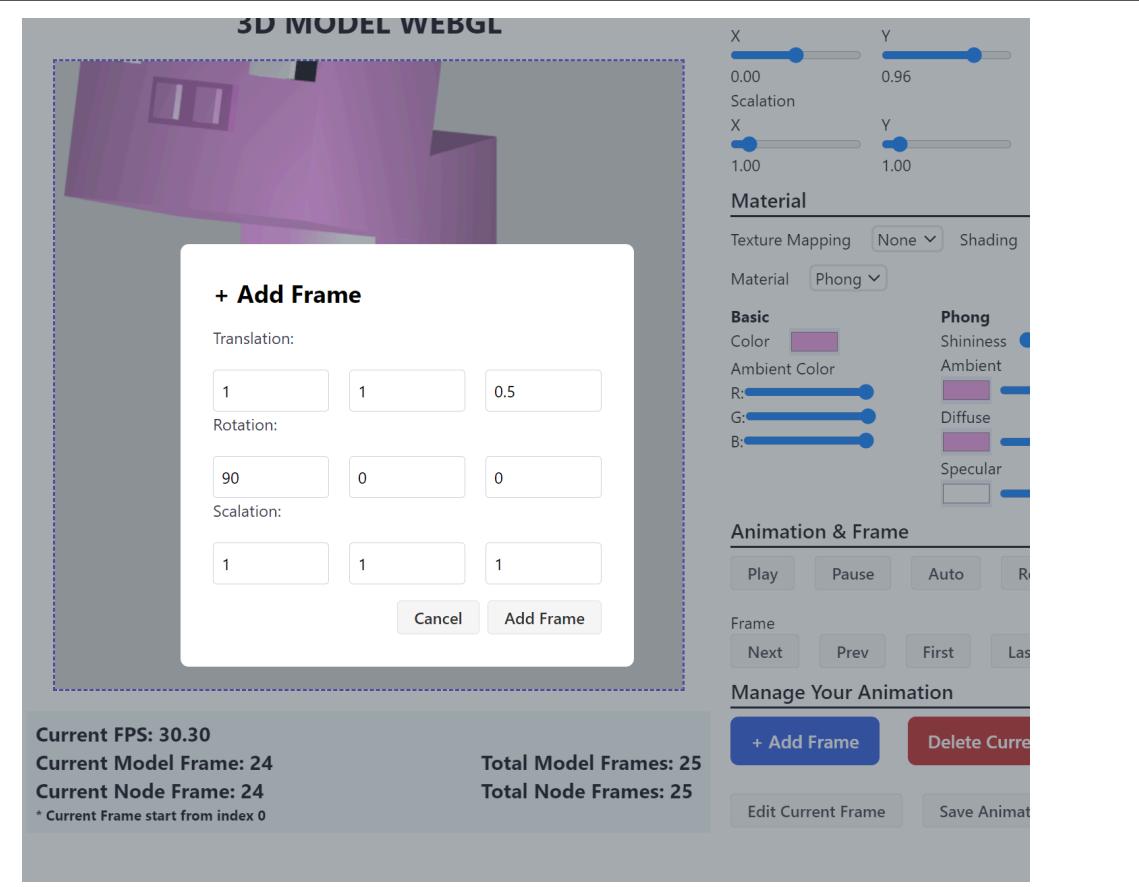
<b>Fitur</b>	Menjalankan Animasi terus menerus yang dapat dikonfigurasi apakah dapat memajukan/memundurkan animasi
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"> <li>Tombol “Auto“ ditekan pada saat menjalankan animasi untuk menjalankan animasi secara terus</li> </ol>

	<p>menerus. Untuk mengehentikannya, klik “Stop Auto”</p> <ol style="list-style-type: none"> <li>2. Tombol “Reverse” dapat ditekan untuk menjalankan animasi secara mundur ketika animasi sedang dijalankan, klik tombol “Stop Reverse” untuk menjalankan animasi secara maju.</li> </ol>
<b>Hasil Pengujian</b>	Berhasil melakukan mekanisme <i>Auto &amp; Reverse</i>

## 22. Animation: Next, Prev, First, & Last

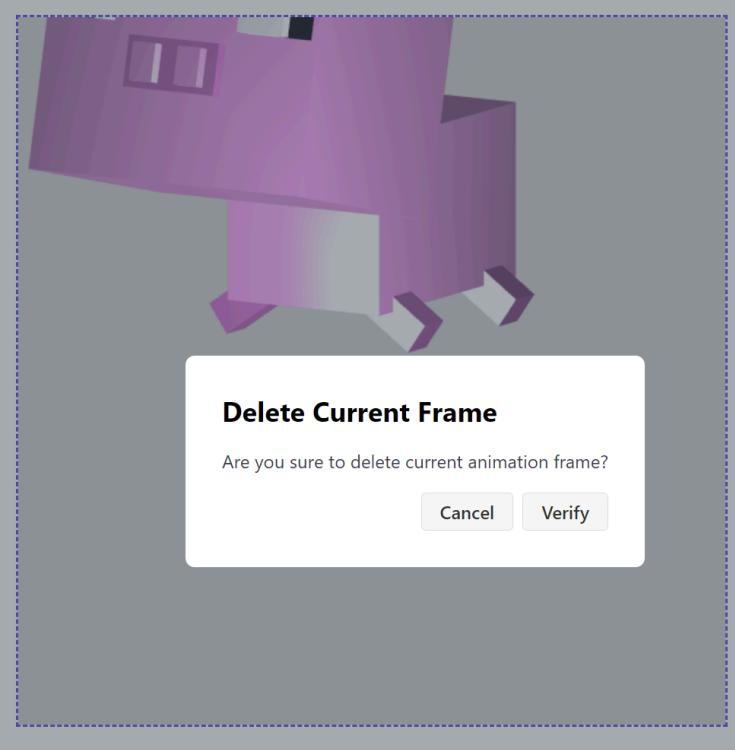
	
<b>Fitur</b>	Mengubah Frame Animasi saat ini ke Frame tertentu
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"> <li>1. Tombol Next untuk memajukan Frame saat ini pada animasi ke Frame Selanjutnya</li> <li>2. Tombol Prev untuk memundurkan Frame saat ini pada animasi ke Frame Sebelumnya</li> <li>3. Tombol First mengubah ke frame pertama animasi</li> <li>4. Tombol Last mengubah ke frame terakhir animasi</li> </ol>
<b>Hasil Pengujian</b>	Berhasil

## 23. Manage Animation: Add Frame



<b>Fitur</b>	Menambah Frame Animasi untuk komponen yang dipilih saat ini
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"> <li>1. Klik komponen/node yang ingin dipilih pada <i>Scene Graph</i></li> <li>2. Klik “+ Add Frame” pada bagian <i>Manage Your Animation</i></li> <li>3. Isi variabel transformasi dari Frame node tersebut</li> <li>4. Untuk membatalkan, klik <i>cancel</i>. Untuk menambahkan, klik <i>Add Frame</i></li> </ol>
<b>Hasil Pengujian</b>	Berhasil menambahkan Frame Animasi

## 24. Manage Animation: Delete Frame



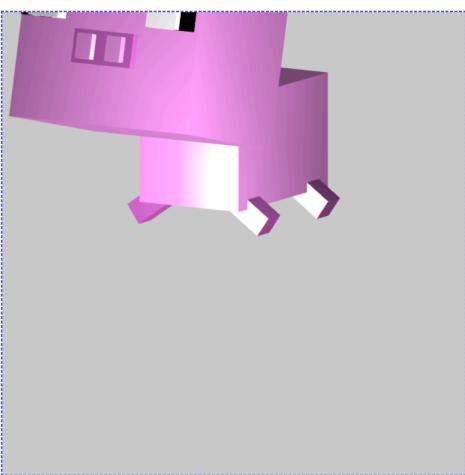
**Delete Current Frame**

Are you sure to delete current animation frame?

**Cancel** **Verify**

**Setelah Frame Dihapus:**

**3D MODEL WEBGL**



Translation X: 0.00 Y: 0.92 Z: 0.00  
Scalation X: 1.00 Y: 1.00 Z: 1.00

**Material**

Texture Mapping: None Shading: Off

Material: Phong

**Basic**  
Color: #E996EB  
Ambient Color: #F0F0F0  
R: 0.00 G: 0.00 B: 0.00

**Phong**  
Shininess: 100  
Ambient: #F0F0F0 Diffuse: #E996EB Specular: #FFFFFF

**Animation & Frame**

Play Pause Auto Reverse

Frame Next Prev First Last

**Manage Your Animation**

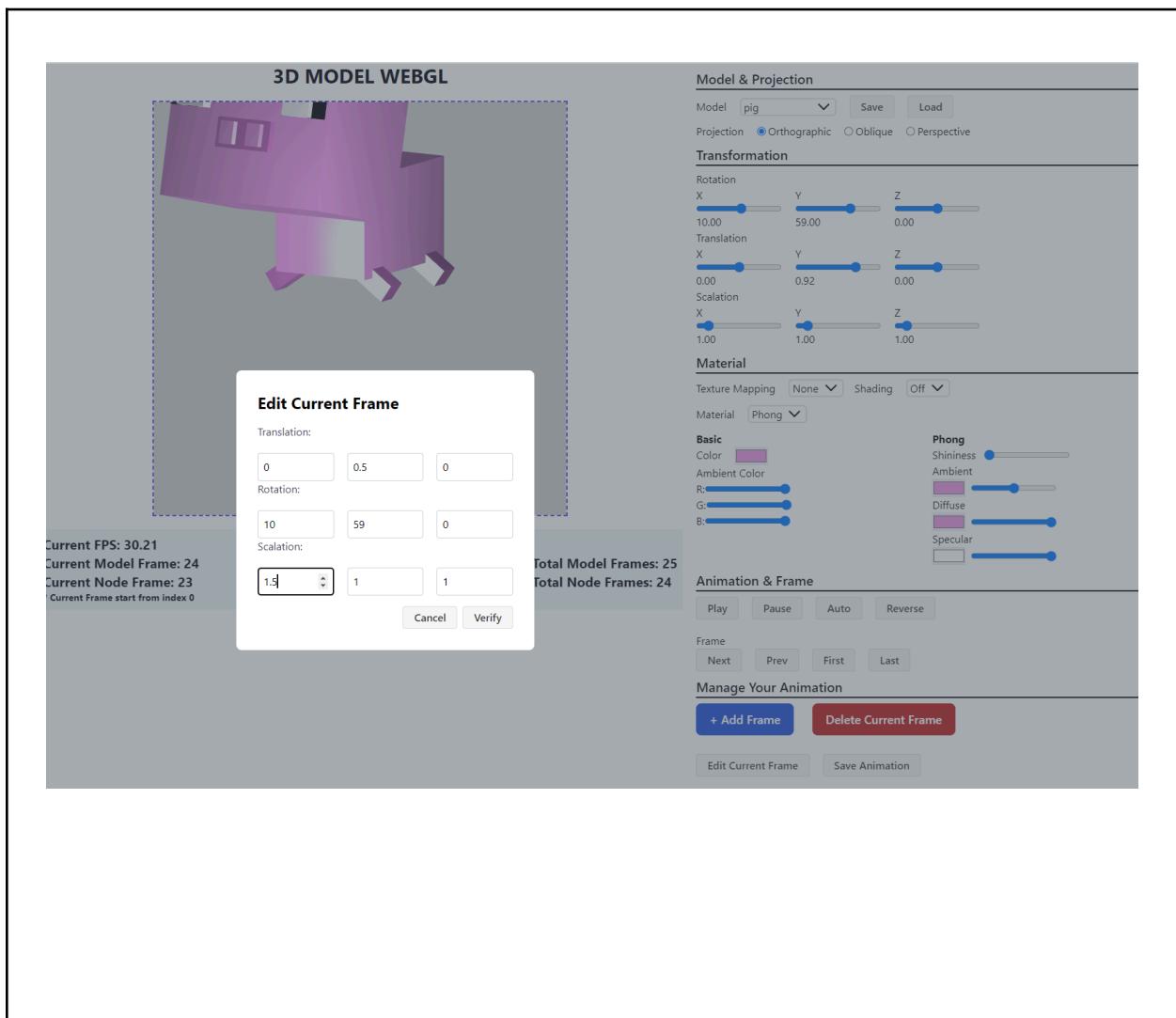
Current FPS: 59.88  
Current Model Frame: 24  
Current Node Frame: 23  
Total Model Frames: 25  
Total Node Frames: 24  
\* Current Frame start from index 0

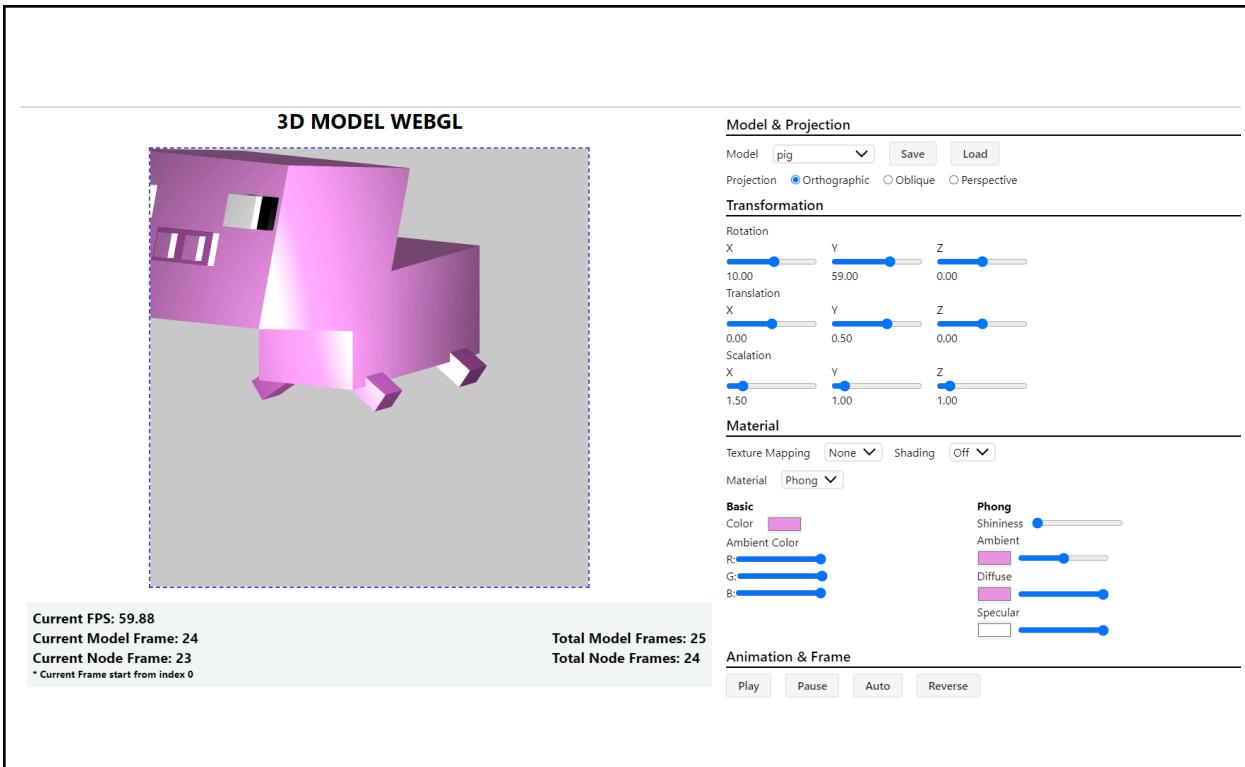
+ Add Frame **Delete Current Frame** Edit Current Frame Save Animation

Fitur	Menghapus Frame Animasi untuk komponen
-------	--

	yang dipilih saat ini
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"> <li>1. Pilih komponen yang ingin dihapus pada <i>Scene Graph</i></li> <li>2. Klik tombol “Delete Current Frame”</li> <li>3. Klik “verify” untuk menghapus frame saat ini pada <i>node</i> yang terpilih, klik “cancel” untuk membatalkan</li> </ol>
<b>Hasil Pengujian</b>	Berhasil menghapus Frame Animasi pada <i>node</i> terpilih

## 25. Manage Animation: Edit Frame





<b>Fitur</b>	Mengubah Orientasi dari Frame Animasi Untuk <i>Node/Komponen</i> yang dipilih
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"> <li>1. Pilih <i>Node</i> pada <i>Scene Graph</i> yang ingin diubah</li> <li>2. Klik tombol “edit current frame”</li> <li>3. Klik “verify” untuk mengubah frame saat ini pada <i>node</i> yang terpilih, klik “cancel” untuk membatalkan</li> </ol>
<b>Hasil Pengujian</b>	Berhasil mengubah Frame Animasi saat ini pada <i>node</i> terpilih

## 26. Manage Animation: Save Animation

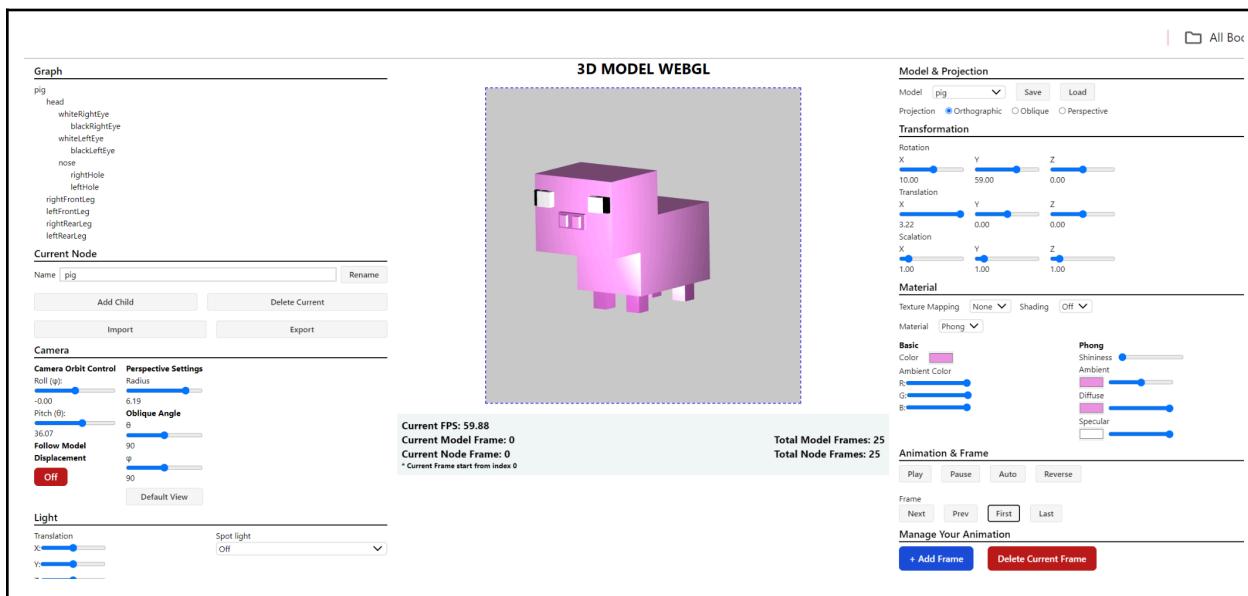


The screenshot shows a 3D rendering of a purple pig model in a 3D space. A dialog box titled "Save Model Animation" is open in the center. It contains the text: "Animation is included when you export/save the model" and an "Ok" button. To the left of the dialog, there is some text: "59.88", "Model Frame: 24", "Scene Frame: 23", and "start from index 0". To the right, it says "Total Model Frames: 2" and "Total Node Frames: 24". Below the dialog, there is a toolbar with icons for search, star, save, load, and others. The "Save" icon is highlighted. Underneath the toolbar, there is a section titled "Model & Projection" with a dropdown menu set to "pig", and "Save" and "Load" buttons. It also shows projection settings: "Orthographic" is selected, while "Oblique" and "Perspective" are unselected. Below this is a "Transformation" section with three groups: "Rotation", "Translation", and "Scalation", each with X, Y, and Z sliders and numerical values.

Fitur	Melakukan Penyimpanan Terhadap Animasi
Langkah-Langkah	<ol style="list-style-type: none"><li>Untuk menyimpan animasi, simpan model seperti biasa pada tombol save. <b>Mekanisme ini termasuk menyimpan animasi dari model yang dipilih.</b></li></ol>

	2. Apabila mencoba klik tombol “save model animation”, akan diarahkan untuk melakukan mekanisme save model seperti biasa.
<b>Hasil Pengujian</b>	Berhasil menyimpan animasi model

## 27. Simple Character Controller: Menggerakan Model via Keyboard



<b>Fitur</b>	<i>Simple Character Controller</i> untuk menggerakan model dengan keyboard
<b>Langkah-Langkah</b>	<ol style="list-style-type: none"> <li>Untuk menggerakan karakter secara horizontal terhadap layar (sumbu-x), tekan tombol <i>Right Arrow Key</i> atau <i>Left Arrow Key</i> pada Keyboard</li> <li>Model digerakkan secara vertikal terhadap layar (sumbu-y) dengan mekanisme loncatan yang mirip dengan efek gravitasi. Tekan tombol <i>Space</i> pada keyboard untuk membuat model meloncat</li> <li>Untuk mengatur kedalaman karakter terhadap layar (sumbu-z), tekan tombol <i>Up Arrow Key</i> atau <i>Down Arrow Key</i> pada Keyboard. <b>Pastikan proyeksi kamera dijalankan pada</b></li> </ol>

	<p><i>Perspective mode</i> untuk melihat hasilnya.</p> <p>4. Nyalakan “<i>Follow Model Displacement</i>” pada bagian Camera agar kamera mengikuti model relatif terhadap pergerakan translasi model (model tetap di tengah dari kanvas; metode ini menggunakan pendekatan <i>third-person view</i>)</p>
<b>Hasil Pengujian</b>	Berhasil menggerakan model dengan mekanisme <i>Simple Character Controller</i>