Homework 3

boss homework

Game Graphics Programming
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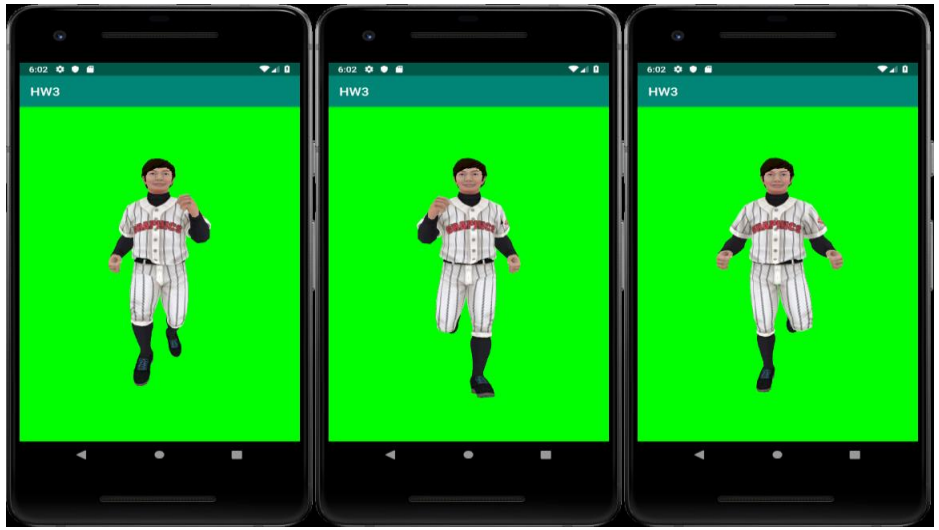
HW3 Goal

Basic goal

1) To animate the skeleton using forward kinematics (+2 points)
2) To apply skinning on the mesh (+2 points)
3) To interpolate the animation between key frames (+2 points)



Advanced goal

1) To make a flat plane where character is standing (+2 points)
2) To cast a shadow on the plane (+2 points)

Skeleton data

- The skeleton data will be provided in binary/skeleton.h header file.
  - It has 28 joints including the root.
  - jNames[*i*] : the name of *i*-th joint
  - jParentss[*i*] : the index of the parent of of *i*-th joint
  - jOffset[*i*] : the offset between *i*-th joint and its parent joint

Animation data

- The animation data will be provided in binary/animation.h header file.
  - The animation has 25 key frames.
- Each frame consists of $6 \times 1 + 3 \times 27 = 87$ numbers.
  - The first 6 numbers are (XYZ translation, XYZ rotation) of the root.
  - Next, every 3 numbers are (XYZ rotation) of each joint.
  - The rotation order is YXZ i.e. $\hat{v} = R_Z R_X R_Y v$ for an arbitrary vector v.

Mesh data

- The mesh data will be provided in binary/player.h header file.
  - playerTexles : the square texture
  - playerSize : the resolution of playerTexels
  - playerVertices : the mesh
  - playerIndices : the index of the mesh
- Vertex structure is slightly modified for skinning.
  - Vertex.bone : the index of skinned skeleton
  - Vertex.weight : the weight of skinning

Problem

- Write the code in Scene::update(float deltaTime) function.
  - Use prevFrame and nextFrame to repeat the animation every 5 seconds.
  - Convert the animation from Euler angles to quaternions
  - Interpolate the animation.
  - Update VBO and IBO of the object.
  - Apply the skinning with the weight blending.

Tip

- Visualize the skeleton first.
  - The object with the line drawer will be provided.
  - Fill the VBO and IBO to visualize the skeleton.

Tip

- Overlap the skeleton and the mesh.
  - If the skeleton and the mesh view the different direction, the result will be weird.
- Apply the skinning without the weight blending.
  - The result is good enough.
- The mesh and the skeleton are too big.
  - Note that the mesh is scaled down to 1/3.

Tip

- Step 1: Make the skeleton
  - Define two matrices without the animation
  - *bone2world*(i) : From the *i*-th joint space to the world space.
  - *world2bone*(i): From the world space to the *i*-th joint space.

- Step 2: Animate the skeleton
  - Define two matrices with the animation
  - *bone2world*(i) : From the *i*-th joint space to the world space.
  - *world2bone*(i): From the world space to the *i*-th joint space.

- Step 3: Skinning the mesh
  - Use two matrices, animated one and non-animated one.
  - *bone2world*(i) : From the *i*-th joint space to the world space.
  - *world2bone*(i): From the world space to the *i*-th joint space.

Submission

Deadline

- 6. 26. 23:50 (50% deduction if you miss the deadline.)

Upload followings to klas and your git repository.

- Git: Generate a .gif file with your results.
  Then upload it to your github and show your result on the main page.
  (e.g. https://github.com/siamiz88/-GameGraphics-_Homework3)
- Klas: {student_number}_{name}.zip including git URL and scene.cpp.
  - **If you solve the advanced topic, please upload every file you have changed.
  - ** Do not submit the whole project files!! (Penalty: 1 point of homework 3 score can be deducted)

TA

- 이정은 (jeunlee0306@khu.ac.kr) – Please send your questions to TA first.

Office hour

- Monday, Wednesday 2:00 PM ~ 6:00 PM
- Contact TA by email before you visit.