Escape the University

Submission 2 Documentation Document
June 19, 2017

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Class: 186.831 UE Computergraphics

Contents

1 Development Status and Bugs

We will try to get rid of all bugs before the 28.06.2017!

- Bullet buggy since openGL world and bullet world are asynchronous in their positions.
- Hence for now only partiality collision detection
- Inside a light volume everything is culled, no light volumnes in use.
- Not much gameplay because the effect point implementations took so much time.

2 Controls

Key	**Function**
W/Upper arrow	Move forwards
S/Lower arrow	Move backwards
A/Left arrow	Move left
D/Right arrow	Move right
Left click	interaction
Right click	?
Print	Screenshot
Escape/End	Close game
F1	Help
F2	Toggle FPS and triangle count
F3	Toggle wireframe
F4	Texture-Sampling-Quality: Off/Nearest Neighbor/Bilinear
F5	Mip Maping-Quality: Off/Nearest Neighbour/Linear
F6	Depth buffer visualization
F7	Toggle pause game
F8	Toggle view frustum culling
F9	Toggle blending
F10	Toggle stenicl buffer usage
F11	Fullscreen
Scroll Lock	Toogle bounding volume edges
#	Toggle cam pos/front/right/up values
ß	Toggle light source bounding sphere rendering
Num Enter	Toggle shadow map rendering
Num +	Increase ambient light
Num -	Decrease ambient light

All other keys may have surprises for you.

3 Implemented Effect Points

For implementation references and explanation see section 8.

Name	Description	Value
Vertex skinning	A complete bone structure is loaded from a model file and assigned to the model according to weighted indices. The skinning is done on the GPU.	2
Deferred Shading	Use the Deferred Shading technique to speed up lighting for many light sources. It uses several render targets and processes light information (shadows etc) in a post process effect (decoupling it from the scenes geometry). Transparency, however, is more difficult to handle	1
Shadow Maps (with PCF)	As presented in the lectures, shadow maps calculate the shadows via rendering the scene from the light source. PCF samples the shadow map several times to improve quality. Make sure to counter all artifacts.	1.5
Summary	**-**	**4.5**

4 Gameplay

You find yourself in the middle of an university room. You need to get out of the building without being detected. Open the doors and find yourself a way towards the paved floor. Do not open the wrong door, otherwise you encounter a professor and you are busted! This is just a trial run... consider yourself planning your escape for the real experience that will follow. Explore the building, get the floor plane into your head. It will help your real escape in the near future.

5 Camera

The free moving camera is implemented as on the tutorial on camera from learnOpenGL.com with slight modification to suit our needs, e.g. scroll speed, include all depth values on movement etc.

6 Moving Objects

- Opening and closing doors.
- Moving character animated with vertex skinning.
- Chairs

7 Texture Mapping

- Door + door handle + doorframe
- Lamps and switches
- Table + chairs + Posters + book (shelfs)
- Trashbin, student work bench
- Character
- Whole building

- Paved pathwalk outside the building

8 Features

- Usage of FBOs, VAOs, VBOs, EBOs, and UBOs as stated in [3].
- Deferred shading from [3], learnopengl.com deferred shaing tutorial, and light volumes form tutorial number 36 and 37 from ogldev.atspace.co.uk all with changes of our own.
- Point Shadow Mapping with PCF from learnopengl.com with changes of our own.
- Text rendering on screen with signed distance fields as in [1] with changes of our own.
- Own implemented scene graph and different node type usage.
- Radar frustum culling from a lighthouse3d.com tutorial and [2] with a lot of changes. All objects and lights are tested for culling with a scaled bounding sphere all with changes of our own.
- Physics done with bullet physics.
- Automatic minimum collision shape generation from meshes with VHACD.
- Vertex skinning from drivenbynostalgia.com with changes of our own.

9 Simple Lighting and Materials

9.1 Light Sources

All objects are now illuminated with blinn phong lighting from a blinn phong tutorial on learnOpenGL.com. Deferred shading form [3], learnopengl.com deferred shaing tutorial, and lighthouse3d.com openGL framebuffer objects. Point lights done with the light casters tutorial on learnOpenGL.com. There are currently 10 light-sources in use, distributed among the playfield.

9.2 Textures and Blender Models

For creating and as well as modifying our objects, we used Blender 2.78c freely available from `https://www.blender.org/features/2-78/`. All objects (except Animated Female Cyborg)have been reviewed for minimized triangle count. The game playground contains 183 objects, containing 275.378 triangles (according to Blender).

- If not explicit declared otherwise, textures have been taken from `https://lva.cg.tuwien.ac.at/textures/` or painted by ourself (single color textures mostly).
- Trash bin from `https://www.blendswap.com/blends/view/81654` under fullfillment of stating the corresponding author *miguelromeroh* `https://www.blendswap.com/user/miguelromeroh`. Model has been slightly adjusted for texturing.
- Brushed metal for Trash bin form `https://www.sketchuptextureclub.com/public/texture_d/0010-stainless-brushed-metal-texture-hr.jpg` in compliance to `https://www.sketchuptextureclub.com/terms-of-use`.

- The garden table model as well as its textures have been taken from the freely available download-package (after sign-up with email) from the website http://www.chocofur.com/. It has been modified in order to have the correct display behaviour in OpenGL as well as a reduced triangle load.
- The textures for the doors & door frames are also from the previously mentioned download package. The model was designed by ourselves.
- White roughcast texture for Walls from https://freestocktextures.com/texture/seamless-roughcast-wall,812.html.
- Key from https://www.cgtrader.com/free-3d-models/household/other/worn-key in respect to editorial / non-commercial license.
- Book inside a shelf in respect to editorial / non-commercial license from https://www.cgtrader.com/free-3d-models/furniture/cabinets-storage/bookshelf.
- University chair from https://www.cgtrader.com/free-3d-models/furniture-set/other/university-portfolio in respect to the general license. Model has been modified and is therefore not distributed in the way it has been downloaded.
- Table in respect to the general license from https://www.cgtrader.com/free-3d-models/architectural-details/decoration/wood-table-13cac5a4-f11f-4b36-9a77-af84a5f4c914. Model has been modified and is therefore not distributed in the way it has been downloaded.
- Flowerpot from http://archive3d.net/?a=download&id=e9325e5e#. In agreement to point "4. This model may be freely modificated or elaborated."" of Archive3D.net
- Office chair from https://resources.blogscopia.com/2010/04/22/office-chair-download/ adapted and used in compliance with the Creative Commons 3.0 Unported license.
- School bench from https://www.cgtrader.com/3d-models/interior/office/school-desk-206e3 Model has been purchased and is used in compliance with the Royalty Free License.
- We Want You - Poster with some adaptions from https://free3d.com/3d-model/poster-quotwe-want-youquot-88757.html.
- Laptop from with a modified texture from https://free3d.com/download-page.php?url=notebook-low-poly-version-57341.
- Animated Female Cyborg from https://www.dropbox.com/s/mimglhfvlqdnelf/pers.zip?dl=0 mentioned in https://github.com/leonardo98/TexturedAssimp3DAnimationsOpenGL. Upon request, the question of the source of the model https://www.mixamo.com was answered and is therefore compliant with the announcement of https://community.mixamo.com/hc/en-us/community/posts/206715697-Mixamo-is-free-.
- Books-on-a-shelf from https://www.blendswap.com/blends/view/75450 under fullfillment of stating the corresponding author *Archemi* https://www.blendswap.com/user/archemi. Model has been slightly adjusted for texturing.
- All used poster pictures are from pixabay.com with an CC0 Public Domain license except the pilgrim society poster wtich is from pilgrimsociety.org.

10 Additional Libraries

- GLFW
- GLEW
- DevIL
- irrKlang
- GLM
- Assimp
- Bullet Physics
- VHACD

11 Sounds

If not stated below the sounds where recorded by the authors of this document.

- EAT - Oh Mom Elevator Mix with an Attribution-Share Alike 3.0 United States License
- TMHECTOR_-_16_-_The_Elevator with an Creative Commons Attribution 3.0 License
- The last ones by Jahzzar with an Attribution-ShareAlike 3.0 International License.

References

[1] Chris Green. Improved alpha-tested magnification for vector textures and special effects. In *ACM SIGGRAPH 2007 Courses*, SIGGRAPH '07, pages 9–18, New York, NY, USA, 2007. ACM.

[2] Kim Pallister. *Game Programming Gems 5*, volume 5. Hingham, Mass., Charles River Media, 2005.

[3] Graham Sellers, Richard S. Wright Jr., and Nicholas Haemel. *OpenGL SuperBible, Comprehensive Tutorial and Reference*, volume 7. Addison Wesley, 2016.