

Submission Document - heikousen

The submission is pretty bare-bones due to time management issues, and we could not finish our goals.

State of mandatory effects:

- Lightmaps are working and baked by the Quake 3 mapping tool, using radiosity. We chose the Quake 3 mapping tool, since it generates a BSP tree which we are using for the BSP effect (and consequently depth sorting).
- BulletPhysics has been integrated and is working
- HUD is barebones, but using multi-channel signed distance fields to render fonts, see the text shaders for details. Following the feedback, it shows japanese characters when in replay mode.
- Wireframe display and Frametime output (to console) are working with F3 and F2. F5 toggles Depth of Field, F6 toggles Normal Mapping, F8 and F11 change the Depth of Field Focal Width, F9 and F10 the Depth of Field Focal Distance.
- Frustum Culling does not work.
- We were not able to fix the replay system, which is core to our gameplay. It is working, but very imprecise, but weren't able to change it because of the physics implications.
- Depth of Field is implemented by blurring through circles of confusion. Our code is based on this blogpost (<http://tuxedolabs.blogspot.com/2018/05/bokeh-depth-of-field-in-single-pass.html>), but adjusted for our rendering pipeline and performance improvements (as trade-in for quality).

Additional Features:

- We use a deferred rendering approach, in order to render all 16 lights and to handle our post processing effects easier. Transparency is done in a forward-pass.
- Levels can be created with GtkRadiant, the Quake level editor. They can be added by being dropped into the maps folder, and selected via the config file. The only restriction is on the number of lights, which is limited to 16.
- We did start to implement a scripting engine using v8, but scrapped it in favor of the depth of field effect.

Effect Implementation

Points	Effect	Implemented
0.5	Separate Textures for Lightmapping	Working
1.5	Depth of Field	Working, but not adaptive
1	HDR rendering and tone mapping	Working, but not adaptive
0.5	Simple Normal Mapping	Working, not in tangent space
1	BSP Trees	Working
1	Scripting Engine	Working, but not used
	Frustum Culling	No
	HUD	Working, but no useful information

Gameplay

The goal is to reach the end of the level (a blue portal). You start off in record mode: all your actions are being recorded and will be replayed once you reach the portal. In the replay mode, dynamic physics effects will still trigger.

Controls

W, S	Thrust forward/backward
A, D	Thrust left/right
R, F	Thrust up/down
Q, E	Yaw left/right
Mouse up/down	Pitch up/down
Mouse left/right	Roll left/right
Y	Counteract angular momentum
X	Counteract linear momentum
Space	Activate the Replay

Used Dependencies

- debug_trap: <https://github.com/nemequ/portable-snippets>
- TinyglTF, STB Image: <https://github.com/syoyo/tinygltf>
- JSON Parser: <https://github.com/nlohmann/json>
- V8: <https://developers.google.com/v8/>
- INI Reader: <https://github.com/benhoyt/inih>
- Bullet Physics: <https://github.com/bulletphysics/bullet3>
- GLM: <https://github.com/g-truc/glm>
- GLFW: <http://www.glfw.org/>
- Vulkan SDK: <https://www.lunarg.com/vulkan-sdk/>
- Memory Allocator:
<https://github.com/GPUOpen-LibrariesAndSDKs/VulkanMemoryAllocator>
- Quake3 BSP Format <http://www.mralligator.com/q3/>
- Used Textures:
<http://polycount.com/discussion/74895/pk02-sci-fi-texture-set-released>