

Applied Digital Workflow: Project Report

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Planning

Problem Statement

The original problem statement was:

"How to make it easier for individuals to import sketchup models into an AR environment?"

This project was meant to help David Aasterud with the more technical stuff like programming on making a prototype program for his master project, but unfortunately the toolkit for creating an augmented reality is heavily outdated and is currently not available for Windows 7 and is hard to install on the newest Visual Studio installments. David Aasterud found an alternative to use and we discussed what I could do for him and decided that I should find a tool to change format of 3D models. So my new problem statement became:

"How to change file format of 3D models?"

To convert file format of a 3D model you need a program. In this case a program that preferably can be run from the command line with arguments so you can make an automated process through a script.

Research Questions

Original Questions:

What libraries are most efficient to use when loading Sketchup models and making them ready for OpenGL? What is the best way to import 3D models into the program, should one be able to choose folder or should it be preset and static?

Questions after change of problem statement:

Is there an existing command line tool that can change format of 3D models?

Methods

Searching for a tool or tools to change file formats.
Scripting to automate workflow.

Tools

These was the planned tools for the original project:

C++ as programming language to build the program.
Visual Studio as workspace and compiler.
GLUT is an OpenGL toolkit which works well with ARtoolkit.
ARtoolkit (osgART) to create and draw in an augmented environment.
Sketchup to create and save 3D models.
Sketchup SDK to use the Sketchup models.
Doxygen to properly document code in latex style.
Subversion for version control.

None of these tools were used in the new task. The tools that were used to make the new workflow was:

Multiverse Model Conversion tool is a program that can convert from COLLADA format to a multiverse format.
Notepad to create a batch file in windows to create the automated workflow.

Milestones

Original Milestones:

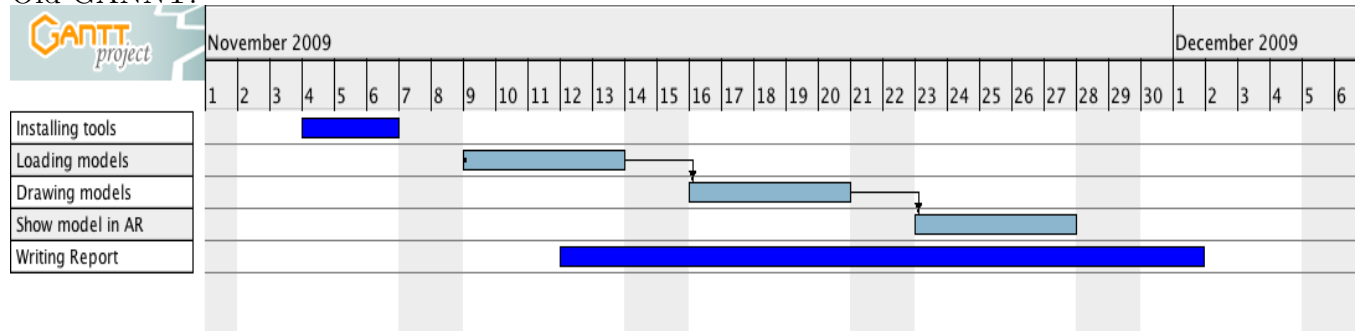
Loading Sketchup models, 15. november.
Make data ready for OpenGL and drawing them, 22. november.
Draw models in augmented reality and tweaking, 30. november.
Writing final report and documenting code, 2. december.

Milestones after change of problem statement:

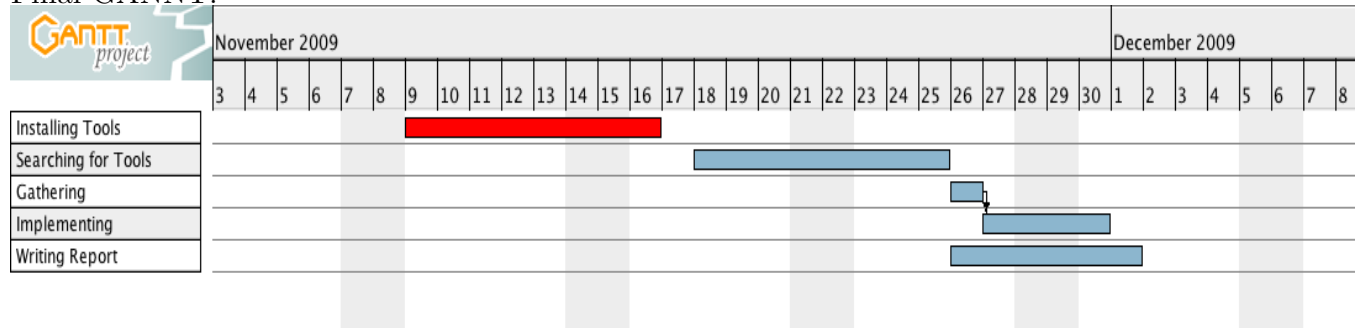
Find a format conversion tool as fast as possible.
Make a script that automates workflow before 2. december.
Write final report before 2. december.

GANNT chart

Old GANNT:



Final GANNT:



Installing Tools (in red) shows the time used to try to install and compile the tools needed for the first problem statement, which failed.

Searching for Tools is the time used to find a tool that can convert file format of 3D models.

Gathering is the time used to gather some test 3D models.

Implementing is the time used to write the batch file (including reading up on how the converting tool works and how to write a batch file).

Resources

Computer with above mentioned tools.

Multiverse tools are available from this webpage: [Multiverse Tools Download](#) (Registration is required to install the tools)

Internet for collecting models and information.

Webcam to have a reality to augment (for the old problem statement).

Legal Issues

The Multiverse platform is free for non-commercial use.

OpenGL does not need to be licensed for application developers.

ARToolKit and osgART is freely available for non-commercial use under the terms of the GNU General Public License.

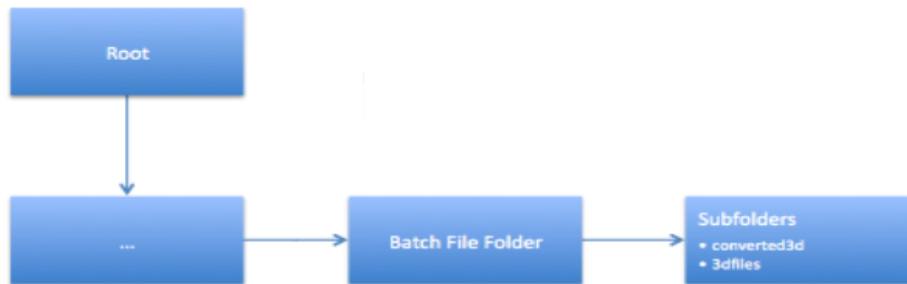
I couldn't find a specific license for Sketchup SDK, but in the terms of service it reads that I am not allowed to put source code in any redistributable file.

More research needs to be done about the Sketchup SDK license and I might have to find an alternative to Sketchup SDK. Otherwise the licenses are not an obstacle for the project.

As for 3D models it will either be models that are free to use or models I create myself to avoid any legal conflicts.

Implementation

The implementation of the batch file is fairly simple, it contains a for loop which list up all files in a subdirectory called 3dfiles(where the COLLADA files that are to be converted is), then for each file that is listed it uses the model conversion tool to make a multiverse 3d model and puts it in the subfolder called converted3d. Also the batch file needs access to the model conversion tool to be able to work.



Model: How the filesystem is set up.

The automation in this workflow lets the user convert many COLLADA files into multiverse format files with very little effort.

End Product

Code

Program 1 Batch File

```
for /f %%a IN ('dir 3dfiles /b')
do conversiontool --3ds
--dst_dir converted3d 3dfiles/%%a
```

This means that the for loop traverses through the files in the 3dfiles directory and makes a list of them.

The /f defines that it should only use files (and not directories) as variable.

The %%a is the variable where the file names are stored.

('dir 3dfiles /b') defines how the list is made, dir is the command for making the list, 3dfiles is the subfolder that should be traversed and /b means that dir should only return filenames (and not extra information about the file).

The next step is where the model conversion tool is implemented.

The -3ds is used if you are converting from a left handed system, this must be manually set inside batch file wether it is to be used or not.

The -dst_dir sets where the new converted file should be put, in this case it is the converted3d subfolder.

3dfiles/%%a is the file that is going to be converted, where %%a is the variable set earlier in the for loop.

Error

The conversion tool is not a very powerful tool, it is slow and cannot handle a high number of vertices. When tested with a high polygon 3D model, the conversion tool crashed and gave the following error:

```
ERROR [2009-11-29 19:07:31,383] Convert Error converting files:
Error in the application.
-2005530516 (D3DERR_INVALIDCALL)
at Microsoft.DirectX.Direct3D.VertexBuffer..ctor(Device device, Int32 sizeOfBufferInBytes, Usage usage, VertexFormats vertexFormat, Pool pool)
at Axiom.RenderSystems.DirectX9.D3DHardwareVertexBuffer..ctor(Int32 vertexSize, Int32 numVertices, BufferUsage usage, Device device, Boolean useSystemMemory, Boolean useShadowBuffer)
at Axiom.RenderSystems.DirectX9.D3DHardwareBufferManager.CreateVertexBuffer(Int32 vertexSize, Int32 numVerts, BufferUsage usage, Boolean useShadowBuffer)
at Multiverse.Serialization.HardwareBufferHelper.AllocateBuffer(VertexData vertexData, UInt16 bindIdx, List<1> dataList, BufferUsage vertexBufferUsage, Boolean useVertexShadowBuffer)
```

Conclusion

Process

The process in this project did not go smooth at all. The original project was to create a program that mixes reality and computer generated graphics. ARtoolkit is outdated and would not work with newer versions of Visual Studio or Windows 7, after searching for a solution for some time I found information reading that it would not work with Windows 7 at all at this time.

After a meeting with the master student David Aasterud we decided that I would make a 3D model format conversion script. I would have liked to have found a command line tool that could convert from any format to any format, but I could not find such a tool. And with some help from Aasterud we found the model conversion tool from multiverse at a relatively late date. After this there was not much time left and ended up with a small product and some new knowledge.

Product

The product differs alot from the original problem statement for reasons mentioned multiple times in this document. It could probably have been polished more if there was time, like setting it up to only try to convert files that is of the file type .dae and maybe add metadata like who converted the files.

Suggested Future Work

Creating a command line tool that can change file format of any 3D format to any 3D format, not absolutely any format, but at least the most popular ones.