

Rapid 3D Modeling

Implementation Guide



Developed by:

The teachers, students, and mentors in the
Gaming Research Integration for Learning Laboratory™ (GRILL™)
Summer 2014

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1. CHALLENGE PROBLEMS: RAPID 3D MODELING

The goal of Rapid 3D Modeling is to create complex 3D models quickly and efficiently. Creating a complex model, like a human, in 3D modeling applications can be very time consuming and requires a great deal of skill; but with Rapid 3D Modeling, the time it takes to generate a model can be reduced significantly and flexibility with what can be modeled increases enormously. This challenge provides students with the opportunity to utilize off-the-shelf technologies and computer software to create 3D models rapidly.

The Microsoft Kinect is a camera used with the Xbox 360 that allows the user to use their body as the controller. In this project, however, it is used as a 3D scanning tool to quickly generate a 3D model of the desired object.



2. IMPLEMENTATION GUIDE AND INSTRUCTIONAL RESOURCES

This implementation guide provides a brief overview of the tools and tutorials available for each challenge problem. The challenge problems included in this Teacher's guide are stand-alone problems, meaning students do not need to solve them in a particular order. The associated tutorials were developed by Wright Scholars during summer internships at the GRILL™. Consistent with the philosophy of challenge problems, teachers should not give these resources and tutorials directly to students; this will help ensure students actively engage in the learning and problem-solving process. The resources and tutorials are a tool for teachers to help foster these processes and skills in students.

2.1. ENGINEERING LOGBOOKS

Students should use engineering logbooks as a personal reference about project learning and results. Logbooks help monitor and control where students have invested their time, knowledge learned, resources, and problem solving. Educators can also use logbooks as a resource for grades for educators. Teachers should have the following general expectations for logbook entries:

- Date for each entry
- Log of personal activity, communications, and team activity
- Research and engineering analysis
- Reviewing of individual/team performance
- Include everything contributed towards the solution
- Sketches
- Class notes
- Meeting notes
- Math calculations
- Design process
- Project reflections
- Rationale for decisions
- Decision criteria
- Design alternatives
- Project requirements
- Links to helpful resources

Note: Include everything contributed towards the solution; the good, the bad, and the ugly.

2.2. HARDWARE AND SOFTWARE

Each challenge problem requires some combination of hardware and/or software. Table 1 illustrates possible application of various tools to solve each of the problems. Do not use this list as the sole solution to the challenge problem, but as an example of a solution students may implement.

Table 1: Hardware and Software Tool Options for each challenge problem

Challenge Problem	Tools
1- Print an action figure	3D scanner, scanner software, 3D modeling and processing software, 3D printer
2- Animate a Figure in a Gaming Engine	3D scanner, scanner software, 3D modeling and processing software, game engine

Approximate costs and links to information regarding each of the potential tools are summarized in Table 2. We collected these estimates at the time we prepared this content. Accordingly, teachers implementing this content should verify the costs with the makers of each tool for planning purposes.

Table 2: Tools and Approximate Costs

Name	Type of Tool	Link	Cost
Kinect for Windows	3D scanner	http://www.cdwg.com/shop/products/Microsoft-Kinect-for-Windows-Academic/2849923.aspx	\$170
Kinect SDK	Scanner software	http://www.microsoft.com/en-us/kinectforwindows/develop/developer-downloads.aspx	\$0
Skaneect	Scanner software	http://skanect.manctl.com/download/	\$129
MeshLab	3D image processing	http://meshlab.sourceforge.net/	\$0
SketchUp	3D modeling	http://google-sketchup.en.softonic.com/	\$0
SketchUp STL	File converter	https://sites.google.com/site/jimfoltz/my-sketchup-plugins/stl-importer	\$0

Importer

SketchUp STL Exporter	File converter	http://helioslabs.blogspot.com/2013/02/sketchup-8-stl-files-for-3d-printing.html	\$0
Zorro2 Plug-in	3D image processing	http://rhin.crai.archi.fr/rld/plugin_details.php?id=623	\$0
Thingiverse	3D image warehouse	http://www.thingiverse.com	\$0
Cube 3D	3D printer	http://www.cubify.com	\$1300
Ultimaker	3D printer	http://www.ultimaker.com	\$1560
Buccaneer	3D printer	http://www.pirate3d.com	\$400
Unity 4.x	Game engine	http://unity3d.com/unity/download/	\$0
Mixamo	Auto-rigger	http://www.mixamo.com/	\$0-22

2.3. RESOURCES TO GUIDE AND SCAFFOLD INSTRUCTION

Users and participants have used the resources listed in this section to help solve the Full Throttle STEM Challenge problems. These resources are neither exhaustive nor comprehensive and *should not be treated as complete tutorials*. Teachers should use these resources to help familiarize themselves with the relevant tools and to guide and scaffold instruction.

Table 3: Educational Resources for M&S

Title	URL	Brief Description
Design Thinking for Educators Toolkit	http://designthinkingforeducators.com/	This toolkit has been adapted by IDEO to meet the context of K-12 education. These processes, methods, and tools help tackle complex challenges.
A Primer of Modeling and Simulation	http://www.corporatepress.com/clientfiles/ntsa/	Primer includes definitions, history, applications, value, and future of modeling and simulation.

Table 4: Modeling Resources

Title	URL	Brief Description
SketchUp Tutorials	http://www.sketchup.com/learn	Various self-paced tutorials in a variety of formats including reference cards, videos, and documents to guide users step by step on concepts of modeling.
Google STL Plugin	http://helioslabs.blogspot.com/2013/02/sketchup-8-stl-files-for-3d-printing.html	Instructions for installing STL plugin to SketchUp for 3D printing.

Table 5: Skanect Resources

Title	Link	Brief Description
Skanect tutorials	http://skanect.manctl.com/support/	Videos demonstrating a variety of Skanect's capabilities.
Skanect forum	http://skanect.manctl.com/forum/	A good resource for finding answers to questions or solving problems encountered during use.

Table 6: MeshLab Resources

Title	URL	Brief Description
MeshLab Tutorials	http://www.youtube.com/user/MPMeshLabTutorials	Videos demonstrating a variety of Skanect's capabilities.

Table 7: Unity Resources

Title	URL	Brief Description
Get Started in Games & Simulations	http://www.youtube.com/watch?v=ry4ie_O4Bqc	An introduction to Unity including use in creating simulations and games. 2:25 is where introduction begins.
Unity Tutorial Modules	http://unity3d.com/learn/tutorials/modules	Unity's modules on various topics and difficult level. Users can sort through content to meet specific needs or complete modules step by step to create an example game.
Unity Reference Manual	http://docs.unity3d.com/Documentation/Components/index.html	Reference Manual for components for specific platforms including OSX, iOS, Windows, and Android.

Title	URL	Brief Description
Mecanim Tutorial	http://video.unity3d.com/video/7362044/unity-40-mecanim-animation-tutorial	Mecanim video tutorial shows how to animate imported characters in Unity.
Distance Tool	http://the3dninja.com/blog/?p=1104	The distance tool provides the ability to measure objects in the scene and has the option to show a ratio between object scale in pixels and in distance units. This can help define proper texture resolution.
