Requirements Document for Better Graphics For A Robotics Grasping GUI

Shady Robots

CS461: Senior Software Engineering Project

Fall 2016

February 2, 2017

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Abstract: Our customer is using a simulation to create visuals that are used for online data collection. This simulation is using outdated libraries which result in outdated graphics. We, as the supplier define the requirements necessary to accomplish our customer's request. The request being to update the simulation's graphics with warm cool shaders, shadows and silhouettes.

Keywords: OpenInventor, OpenGL, OpenRave, shaders, warm cool shaders, silhouettes, shadows, robotic simulation, geometry, visualization, render, vertex lines, software requirements specification, system requirements specifications

INTRODUCTION

Currently, our client is using visualizations, of a robot hand grasping objects, to collect data online. These visualizations are created from a simulation program (OpenRave), the data collected is used to create a model of the human grasp. However, the current graphics in the simulation are outdated. It is hard to see and understand the shapes and contact points represented in the scene. Because of this, users aren't confident in giving proper responses to the simulation. Thus, the graphics need to be updated to allow meaningful data to be collected.

PARTICIPANTS

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Contents

1 OVERVIEW

This document describes requirements needed to enhance the current OpenRave simulation. Clause 2 lists the references made to other documents. Clause 3 provides definitions of specific terms used. Clause 4 lists the specific requirements that will be met. This includes the external interface requirements, functional requirements, performance requirements, design constraints, software system attributes, and other requirements.

2 REFERENCES

Gooch Shading [1]

IEEE Std 830-1998, IEEE Recommended Practice for Software Requirements Specifications [2]

Shadow Mapping [3]

Silhouette Extraction [4]

3 DEFINITIONS

Contract: A legally binding document agreed upon by the customer and supplier. This includes the technical and organizational requirements, cost, and schedule for a product. A contract may also contain informal but useful information such as the commitments or expectations of the parties involved.

Customer: The person, or persons, who pay for the product and usually (but not necessarily) decide the requirements. In the context of this recommended practice the customer and the supplier may be members of the same organization.

Supplier: The person, or persons, who produce a product for a customer.

User: The person, or persons, who operate or interact directly with the product. The user(s) and the customer(s) are often not the same person(s).

Modern Computer: Modern computer defined by the Oregon State University (OSU) EECS minimum laptop requirements: Intel Core i5 or i7, or AMD A8 and AMD A10 APU 8GB RAM

1. ECGLAB. Gooch Shading. Retrieved from: https://lva.cg.tuwien.ac.at/ecg/wiki/doku.php?id=students:gooch

2. IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA.

3. Shadow Mapping. LearnOpenGL. Retrieved from: http://learnopengl.com/#!Advanced-Lighting/Shadows/Shadow-Mapping

4. Gooch, Bruce. Silhouette Extraction. Retrieved from: http://www.cs.rutgers.edu/ decarlo/readings/gooch-sg03c.pdf

4 SPECIFIC REQUIREMENTS

4.1 External interface requirements

The purpose of the software's output is to give a visual understanding of the robot's grasping capabilities. The software will accept an input simulation file (.py file) through the console. The software will then output a simulation onto a new window.

4.2 Functional requirements

The system shall render the scene and output to a new window. The rendered scene shall include all 3D objects to be displayed in the scene with correct geometry. No objects should have clashing vertex lines, and all shapes should be drawn as intended by the user. Refer to Fig. 1 below.

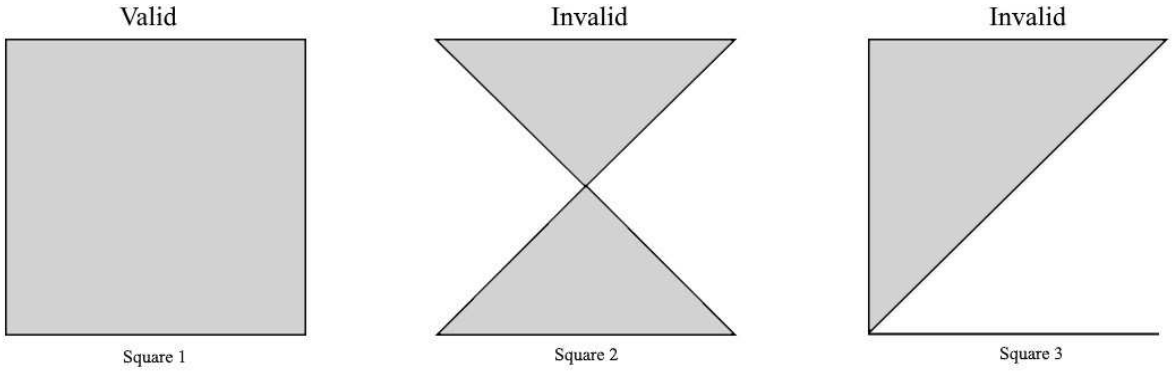


Fig. 1.
Square 1: Vertex lines drawn correctly resulting in desired geometry.
Square 2: Vertex lines cross resulting in undesired geometry.
Square 3: Incorrect vertex line drawing resulting in undesired geometry.

The scene shall include:

4.2.1 Warm cool shaders

Refer to ”Description” section of Gooch Shading listed in this document's references section.

4.2.2 Shadows

A dark area or shape produced by a body coming between rays of light and a surface.

4.2.3 Silhouettes

Refer to ”Definition of a Silhouette” section of Silhouette Extraction listed in this document's references section.

The system shall continuously re-render the scene until completion of the simulation or software termination.

4.3 Performance requirements

- The system output should maintain a minimum stable 30FPS on an average modern computer.
  - Modern computer defined by the Oregon State University (OSU) EECS minimum laptop requirements: Intel Core i5 or i7, or AMD A8 and AMD A10 APU 8GB RAM
- The system will only run one simulation per window.
- The initial scene will be rendered within the first 30 seconds after accepting an input file.

4.4 Design constraints

- The system currently utilizes outdated OpenGL libraries.
- The location of the main render loop is not known to the customer.
- OpenRave is not open sourced.

4.5 Software system attributes

4.5.1 Reliability

The system shall always run properly created simulations.

4.5.2 Maintainability

The system shall:

- Be easily maintained and upgraded.
- Have well documented and easily testable functions.
- Have functions with single, clear purposes; they should not overlap in what they do.

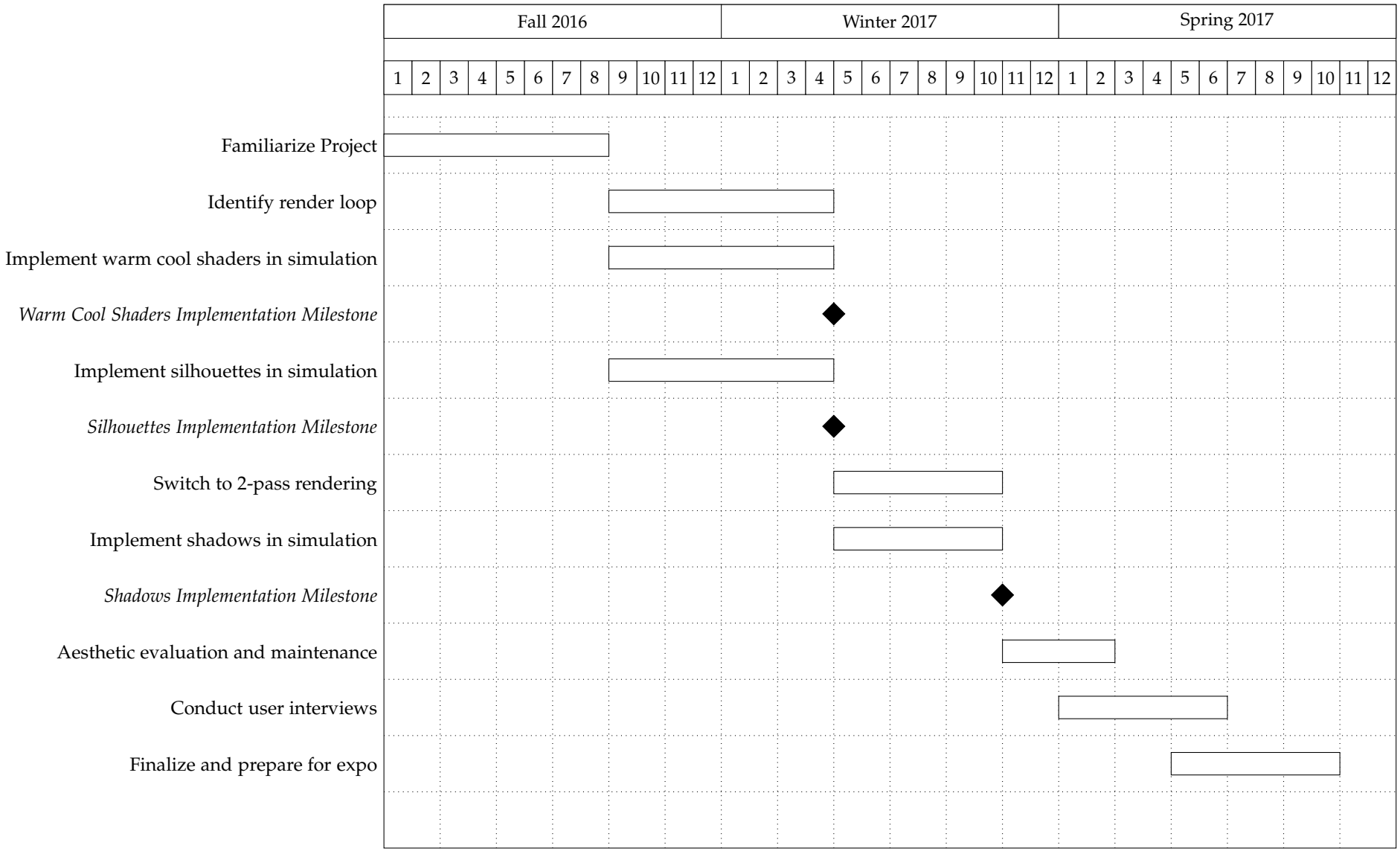
4.5.3 Portability

The system shall work on Linux operating systems.

4.6 Other requirements

The outdated OpenGL libraries will be updated to utilize OpenGL 3.0 libraries.

5 GANTT CHART



Gantt Chart for Shady Robots' Senior Design Project

Cindy Grimm	Date
Justin Bibler	Date
Matthew Huang	Date
Daniel Goh	Date