



OREGON STATE UNIVERSITY
COLLEGE OF ENGINEERING

CS 461 SENIOR SOFTWARE ENGINEERING PROJECT

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Requirements Document

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ABSTRACT

Working with Computer-aided Designs (CADs) and 3D printing, our tasks include: creating a statistical optimization software using design of experiments techniques, 3D printing models to experiment on and optimize, and our main focal point of automating the process of the experiments and optimization when able to: inputting parameters into a CAD and creating the variable designs, etc. With these challenges, we will have to become familiar with a variety of different technologies and techniques which include: multi-factor design of experiments, machine learning, CADs and design, CAD programming languages, statistical programming and logic, and any resource that we may stumble upon throughout this project.

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I. REQUIREMENTS

The client, Will Allen of HP Labs, would like us to start small. Our first step for this term is to familiarize ourselves with SolidWorks, the programming language inside of it (if applicable), and Design of Experiments software. The first benchmark we are to turn in is a simple object designed in SolidWorks that has three variables which can be adjusted. The requirements for this benchmark is that it must be an object with the volume of a baseball, and it must have a way to measure its performance. An example that Will suggested was an 'L' shaped object, where we would then adjust the variables of the hanging segment (height, width, thickness) in order to find the most efficient parameters to pass in which would cause the least amount of displacement when a weight is hung off of it. He also suggested possibly using a rotor on an airplane to see which measurements would cause it to fly the farthest distance, or a parachute that would maximize the amount of time spent in the air.

II. GOAL

Our final submittable should be a piece of software that would create and queue up several different instances of a given object, each with unique parameters passed in for the variables, to 3D print, and statistically find the most efficient design of the given object with the given volume. If we have time left over, Will would like us to include more complex variables, for example if designing a bridge we could account for the number of X-shaped support structure boxes in a truss bridge (fewer boxes with thicker girders, or more boxes with thinner girders), but he has made clear that it is only a "stretch goal", and the focus is mostly on getting the software to automate the process of creating the CAD designs so users do not have to manually enter new variables for the given object and will save time, focusing solely on the hardware instead of the software.

III. USER STORIES

A. Computer-Aided Design

As a client, I want a basic design that's easy to do experiments on. This can range from an "L" shape to a propeller; the only requirement is that I can determine variables and constraints on the object, and I can run experiments on variations of this object such that I can hone in on an optimal solution via statistics.

B. Automation Software

As a client, I want an add-on program that utilizes SolidWorks API. This add-on should be able to automate various tasks from: generating new objects within a range of variables and constraints, to being able to load different objects and their variables from SolidWorks itself. This add-on should be well-integrated into SolidWorks, easy to understand, and error free. This add-on should have a feature that creates a CSV file with the variables, constraints, and different model variations that is easily able to be loaded into SolidWorks as well as the optimizations program.

C. Optimization Software

As a client, I want the script to statistically find the best possible combination of variables using the results of the created parts from the automation software in order to maximize the performance metric we are testing for. (e.g. which set of length, width, height, will be able to support the most weight without displacement?)

