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The Problem The Software Should Solve

Our objective is to find pre-existing software to teach people how to use calipers and to evaluate them on how effective the training was.

In most companies, employee training can be costly. Constructing a training system that is efficient, re-usable, and user friendly is certainly worthwhile - in the long run, training cost will be cut down greatly. Such a training system can help people learn new skills, given that said system can be re-used in a multitude of ways.

Our software that we choose has to be able to:

- Design and model simulations
    - Blocks, cylinders, and tools should be able to be ported to the program.
- Display the simulations through a training module
    - Either through a browser or separate software
- Validate that the the training worked
    - Using some sort of testing or data validation service

Software to use

1. Simulink 3D animation - https://www.mathworks.com/products/3d-animation.html
    a. Simulink and MATLAB are not open source, however they can be used to design standalone applications
2. Google Forms (Web Service) - https://www.google.com/forms/about/
    a. Google Forms is fairly simple, but will allow us to quiz users and determine if they understand how to use the tool.

Relevant Simulink Documentation

Animation: https://www.mathworks.com/products/3d-animation.html
CAD support: https://www.mathworks.com/help/sl3d/import-cad-and-robot-models.html
Client/server architecture: http://docshare04.docshare.tips/files/9439/94393559.pdf

Some other softwares that we were considering were ACIS, Unity 3D, and GrabCAD. While ACIS is the industry standard in 3D modeling, Simulink is the preferable option because ACIS cannot manage user interactivity with the animation. Unity3D is a very robust option, however it is primarily a game engine, not animation software. As such, it cannot automatically read in CAD files, and user interaction must be coded in by the programmer. Simulink already has user interaction capabilities built into it. GrabCAD was also considered, but it is not really used for animation and simulation; it is used for the management of CAD files for activities like 3D printing.

With the “quizzing” portion of the software, our initial thoughts were to use Canvas due to its modules functionality and use of quizzes. However, we instead decided on using Google Forms because it is a lot simpler and cheaper to design and use as a “quiz” than Canvas.

Steps:

1. Runthrough animation
    a. Overview of the entire process
    b. Can also be reviewed after the walkthrough
2. Interactive runthrough (animation/audio/prompts)
    a. Step by step walkthrough with animations, audio descriptions, and visual prompts
3. Real-life caliper quiz in Google Forms
    a. Evaluate effectiveness of the tutorial
    b. Take measurements of the cnc drill parts with dimensions known by the form

Justifications and Requirements Fulfilled:

We needed to find a software component that would allow the displaying and interaction of CAD models in a 3D environment. The best candidate for this would be Simulink 3D Animation, which when combined with MATLAB acts as a standalone application system that allows for custom 3D environments and fine manipulation of 3D objects. This software will be able to import CAD data, and have custom scripts written for it that will guide the user through animations as to how to use a caliper. The software will need to be configured with custom animations and scripts to sequence the training step by step. Additionally, this software is able to be run on Linux, macOS, and Microsoft Windows operating systems.

For data validation, we needed something that would not only get us data validation, but would also be simple and cost effective. Google Forms is a Web Service that is not only free to use but is also easy to format. Developers of our system can simply create a new assessment using multiple choice, check mark, and short answer questions.

Upon completion of training, a user will need to take the quiz. They will then be asked to identify the parts of a caliper, briefly explain how to use it, and provide some measurements they obtained from the cnc drill that they are attempting to assemble.

These two components fulfill our requirements for a system that will allow us to design and display a simulation, as well as validate that the training worked.