Browser-Based Constructive Solid Geometry for Anatomical Models

Computer Integrated Surgery II
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Introduction

- One in 323 children are born with cerebral palsy in the US and 2 in 3 could walk if given proper orthosis. Fusiform has designed a method to streamline the process of creating custom orthosis. However, the orthosis design still takes about 10 hours.

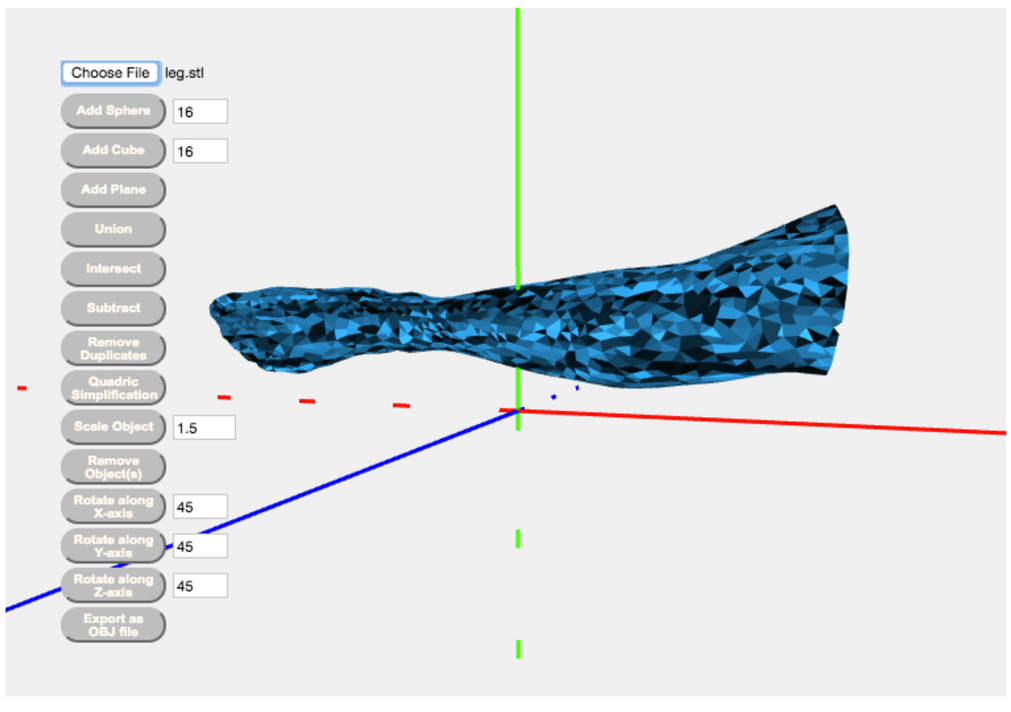
- Goal: To develop a browser-based constructive solid geometry application for the efficient creation of a 3D modular orthosis and reduce the current Fusiform design process by ten fold.

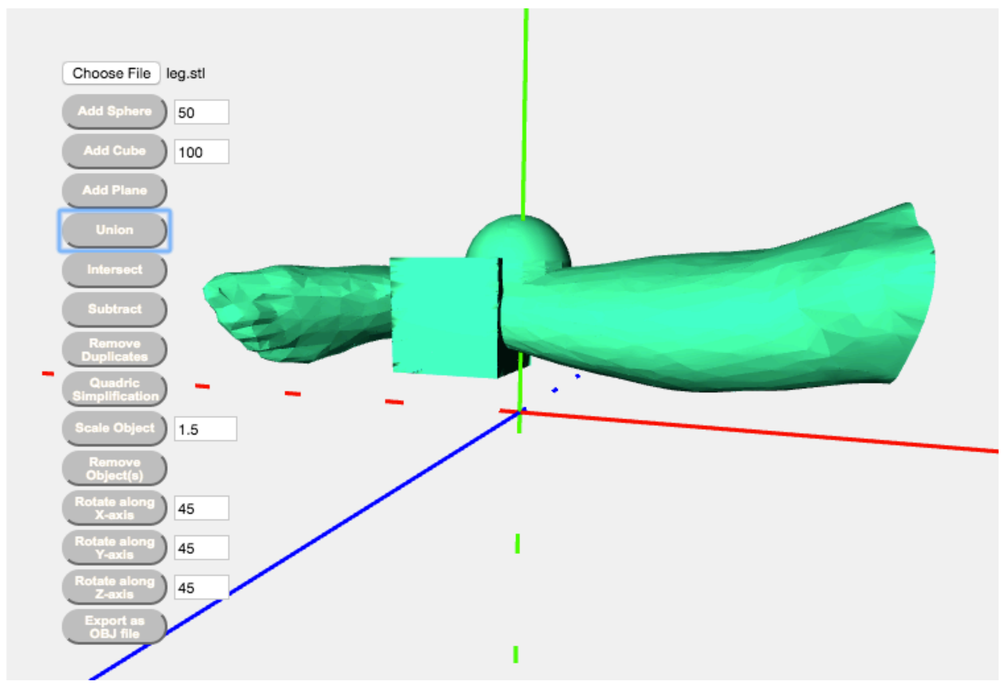
The Problem

- 1 in 323 children are born with cerebral palsy in the US
- 2 in 3 could walk if given proper orthosis
- Ankle foot orthotic devices – correct gait and prevent deformities
- Custom orthoses take 3-4 weeks to complete
- Fusiform creates orthotic devices using leg scan
- Problem: Fusiform process takes up to ten hours in SolidWorks and expertise in SolidWorks needed

The Solution

- Browser-based constructive solid geometry application
- Browser-based application is capable of:
  - Adding basic shapes (cube, sphere, plane)
  - Performing CSG operations (union, intersection, subtraction)
  - Performing mesh modification (cutting, smoothing, simplification, scaling)
  - Importing local STL files
  - Exporting creations as OBJ files
  - Removing objects from the scene





Outcomes and Results

- Browser-based platform to help further streamline orthosis design by removing many often unnecessary (for this task) features in standard 3D CSG software
- We are now able to provide software to clinicians that is more scalable and user-friendly than other 3D CSG software

Future Work

- Vikram will continue to work with Fusiform to finish any unmet deliverables and further improve the usability of the application

- Next steps: implement water tight algorithm, removal of extra points inside the mesh, and improve usability

Lessons Learned

- Learn new programming language – Javascript
- Translating C++ code to Javascript
- Integration of open source packages
- The importance of documentation in software design

Credits

- CSG Integration – Vikram Chandrashekhar
- Mesh modification– Nicole Ortega

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