Adapting C3D solid modelling kernel for aerospace applications

C3D Labs

Skoltech
Skolkovo Institute of Science and Technology

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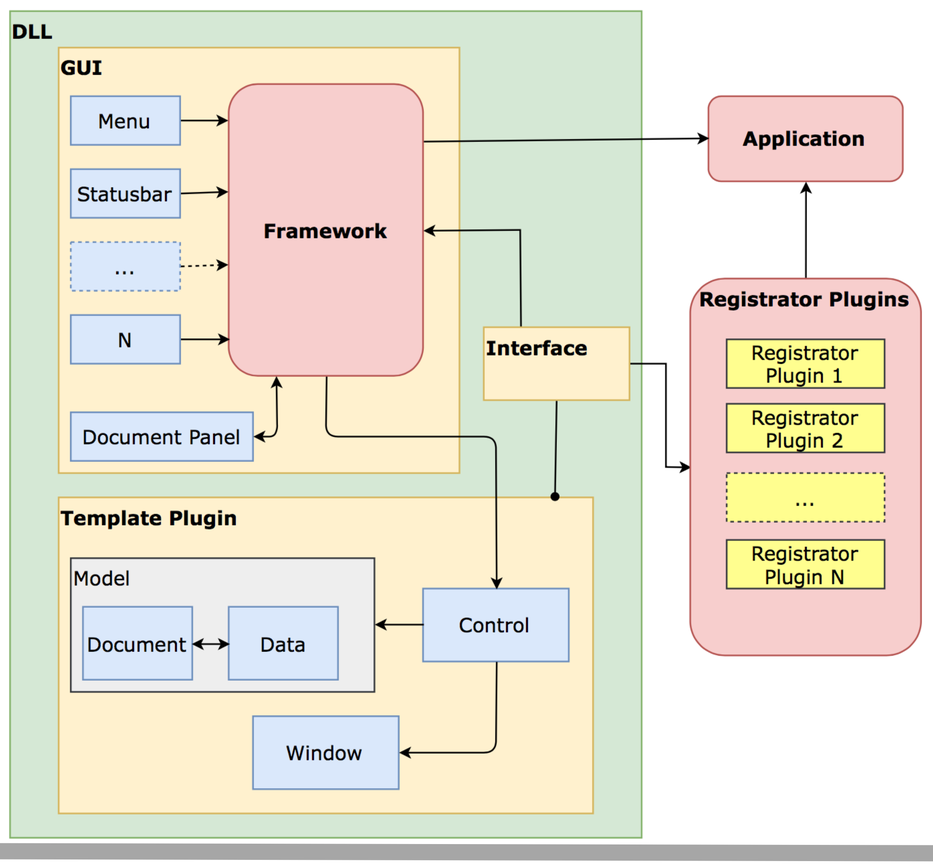
Task Description

To test the capabilities of C3D Modeler and C3D Vision by creating a software for aerospace applications. Before that, knowledge essential for using C3D Kernel had to be obtained.

The Background of the Task

C3D Labs is a company developing the C3D geometric modeling kernel and a resident of the Skolkovo Innovation Center. **C3D Geometric Kernel** is a 3D solid modeling software component used in computer-aided design (**CAD**), computer-aided manufacturing (**CAM**), and computer-aided engineering (**CAE**) systems. The majority of Russian companies developing such systems are using C3D Kernel. 3D solid modeler is a key element to developing the **digital economy** for advanced manufacturing.

A



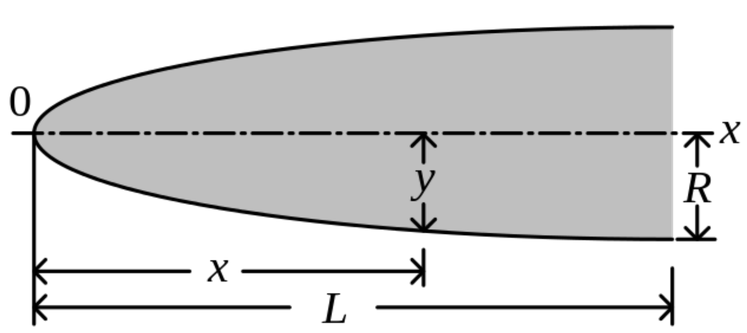
What was done and how?

Nikita Letov was sent for 2 months to C3D Labs. He studied the way the C3D kernel works, in order to clearly understand how the future software should work. The first week was dedicated to building software architecture **[See Figure A]**. Then, a specific use case for the application was clarified. It was decided to enhance a design process of a **rocket nose cone** by creating a specialized application. During the next 3 weeks of the work, a **framework** was developed using the **C++** programming language. The algorithm for creation of various types of nose cones was developed. During the last month, after the algorithms were developed, they were implemented in the application using **C3D Kernel**. The student received a positive feedback.

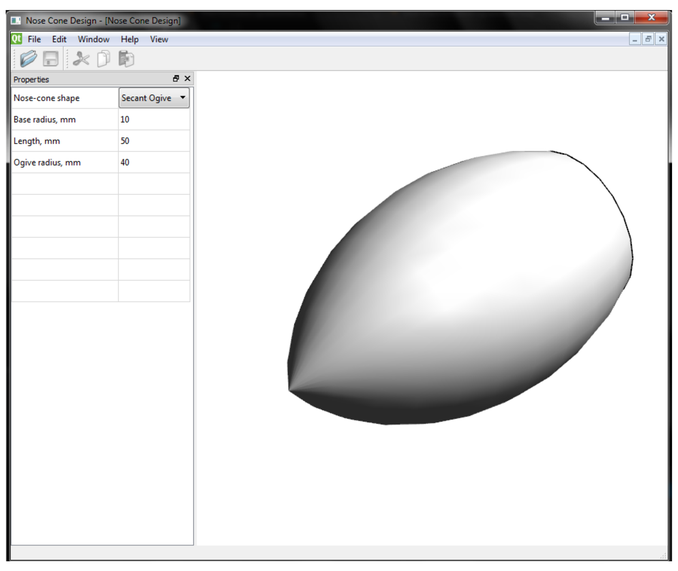
Basics of nose cone design

In all of the nose cone shape equations, $\boldsymbol{L}$ is the overall length of the nose cone and $\boldsymbol{R}$ is the radius of the base of the nose cone. $\boldsymbol{y}$ is the radius at any point $\boldsymbol{x}$, as $\boldsymbol{x}$ varies from 0, at the tip of the nose cone, to $\boldsymbol{L}$. These kinds of equations define the 2-dimensional profile of the nose shape **[See Figure B]**. The full body of revolution of the nose cone is formed by rotating the profile around the centerline ($\boldsymbol{C/L}$).

B



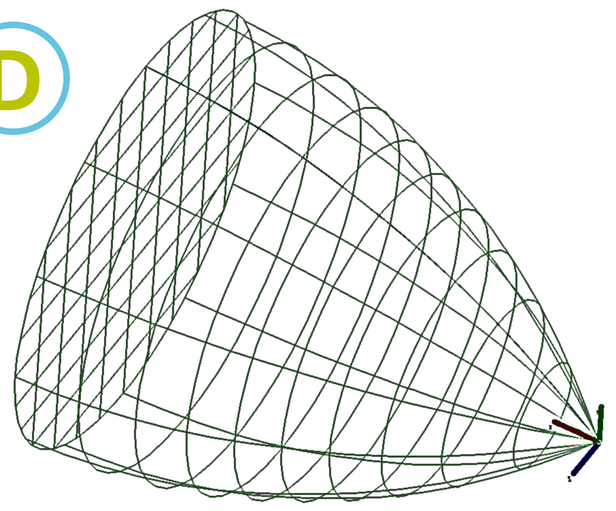
C



What was accomplished?

The application developed **[See Figure C]** has a potential to be further developed to enhance a nose cone design process, and was a test of C3D Kernel and C3D Vision capabilities. The mesh of a nose cone is generated using the triangulation method in C3D Kernel **[See Figure D]**. The knowledge essential for using C3D Kernel further for the purpose of modeling was obtained.

D



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