Modelling a Camera in CAD and Performing Transformations using Coppeliasim

(Project 1 : MCT 301)

By

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(4th year, 122009154)

Abstract

A CAD model of a camera was constructed using FreeCAD, and imported into Coppeliasim to perform rotation and translation transformation operations.

Keywords: Coppeliasim, FreeCAD

Problem Statement

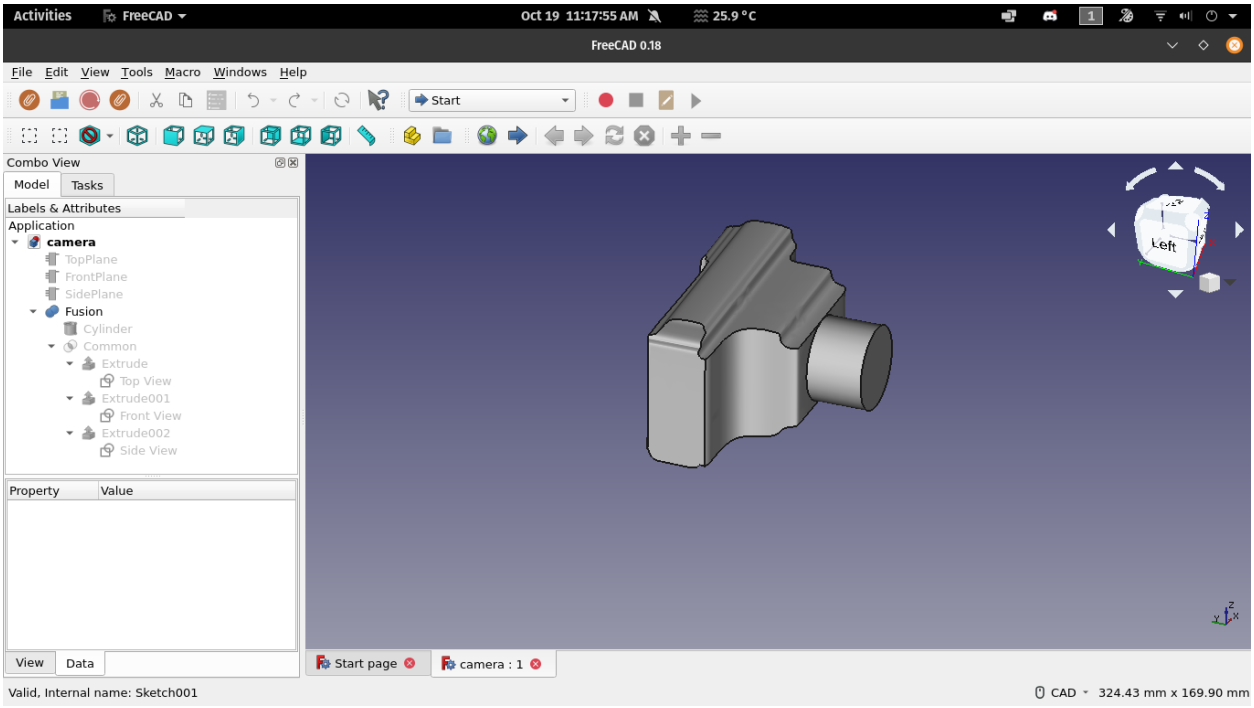
The problem statement was to model a 3d solid (camera), and then perform the following sequence of transformations on it:

1. **Ry(45deg),**
2. **Dz(-20 units),**
3. **Rx(45 deg), and**
4. **Rx(20 deg)**

Camera Model

First, I found a reference image of a Leica camera that had its front, top and side views clearly visible. Next, I extracted the three views and imported them into FreeCAD, and snapped each view to its appropriate axis. After that, I sketched the outline of each view, and extruded the sketches. I subsequently took the intersection of all three extrusions to get a rough camera model. Next, I added a cylindrical lens element to the camera, and finally exported it as an STL file.

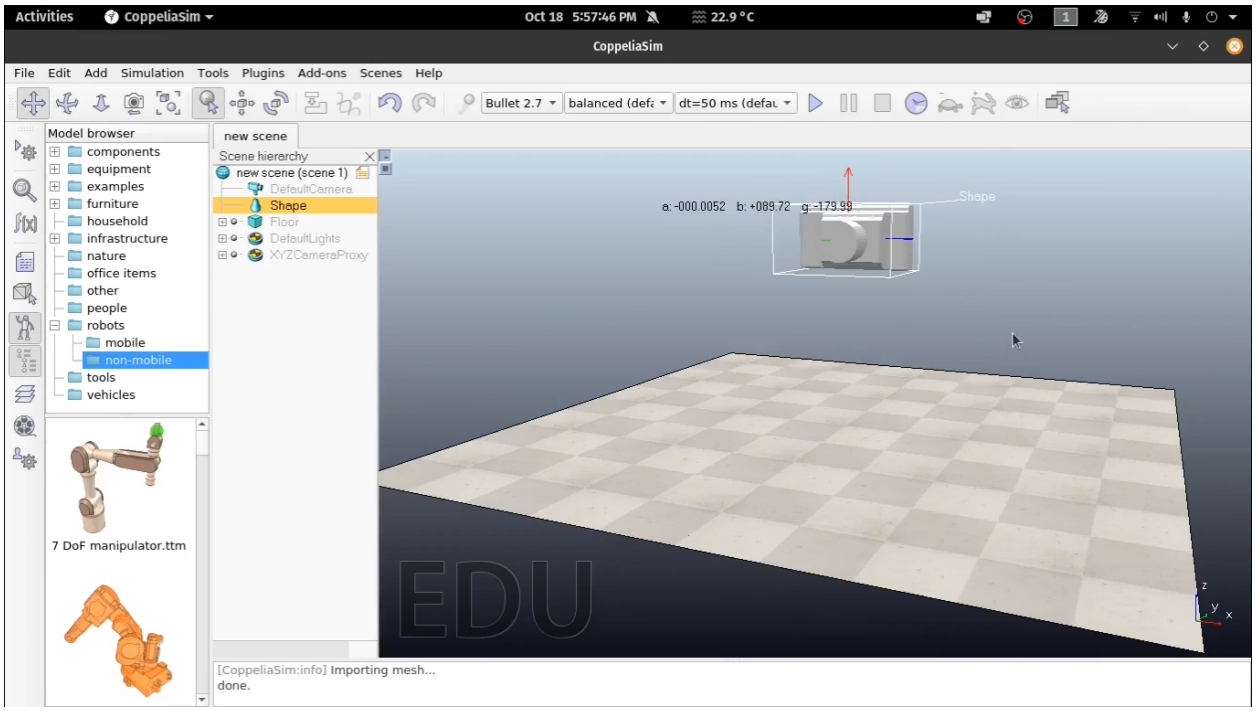
(Camera Views)



(Camera CAD model)

Import Model into Coppeliasim

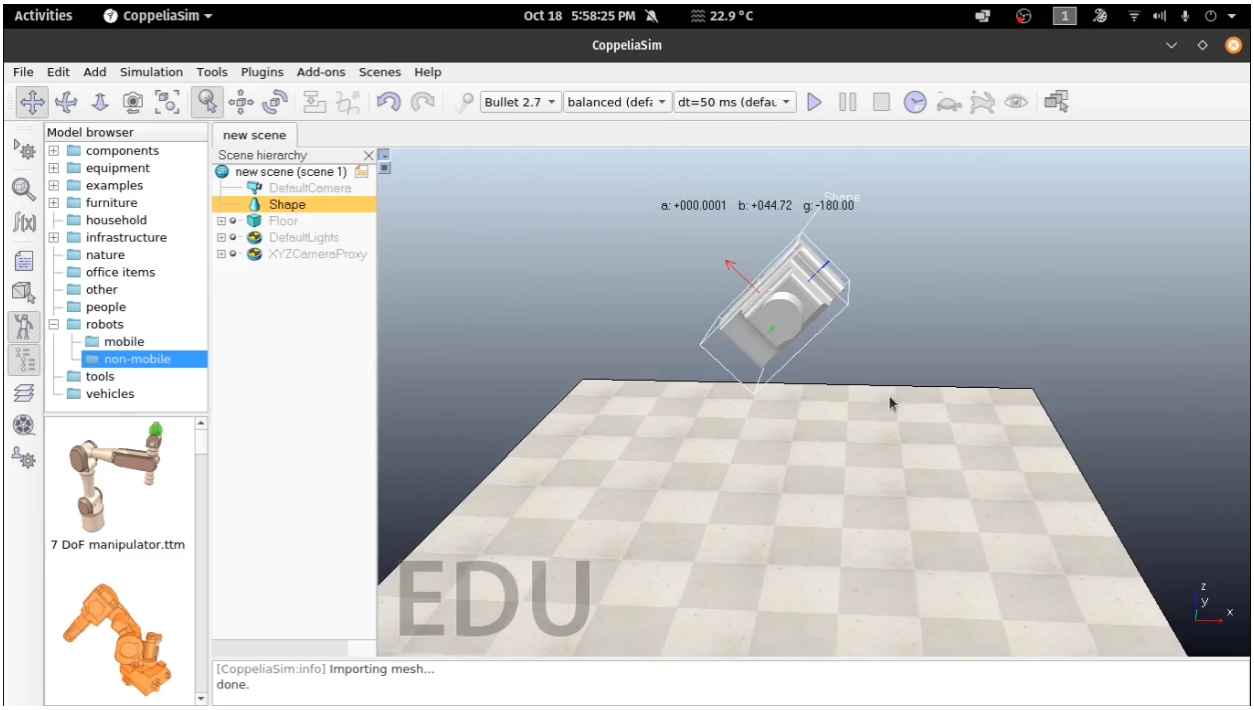
The STL file from FreeCAD was imported into Coppeliasim, and the object's position was adjusted such that it stays above the base plane.



Next, the following sequence of transformations was performed on the object:

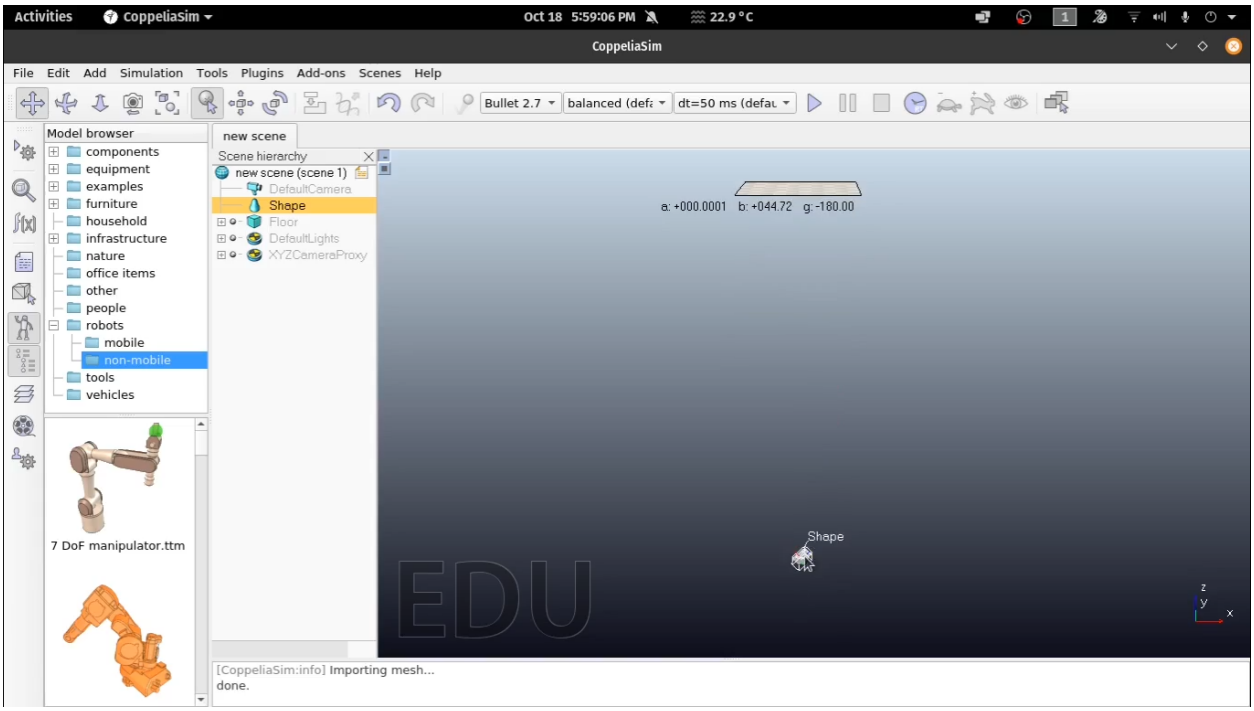
1. **Ry(45deg)**

   This rotation operation was executed by selecting the 'rotation' widget. A command to rotate the object by 45 degrees along the y-axis was given. The output of this transformation can be seen below.



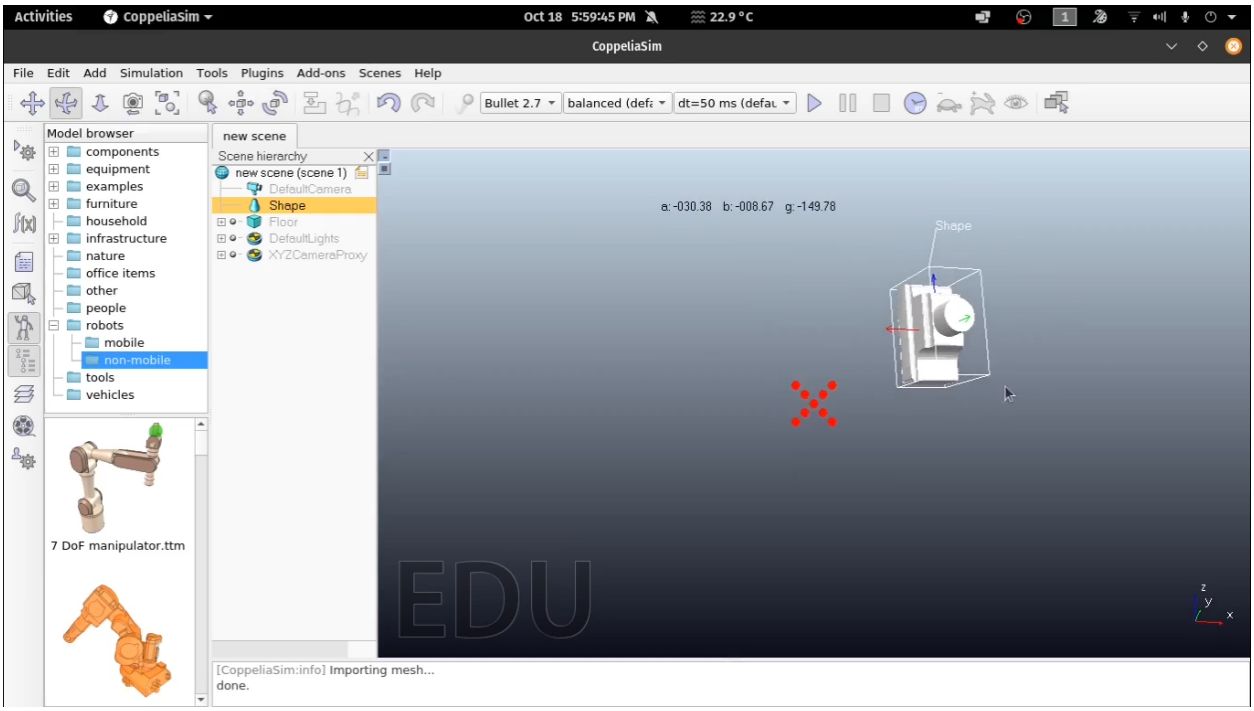
2. Dz(-20 units)

This translation operation was executed by selecting the ‘translation’ widget. A command to translate the object by 20 units along the negative z-axis was given. The output of this transformation can be seen below.



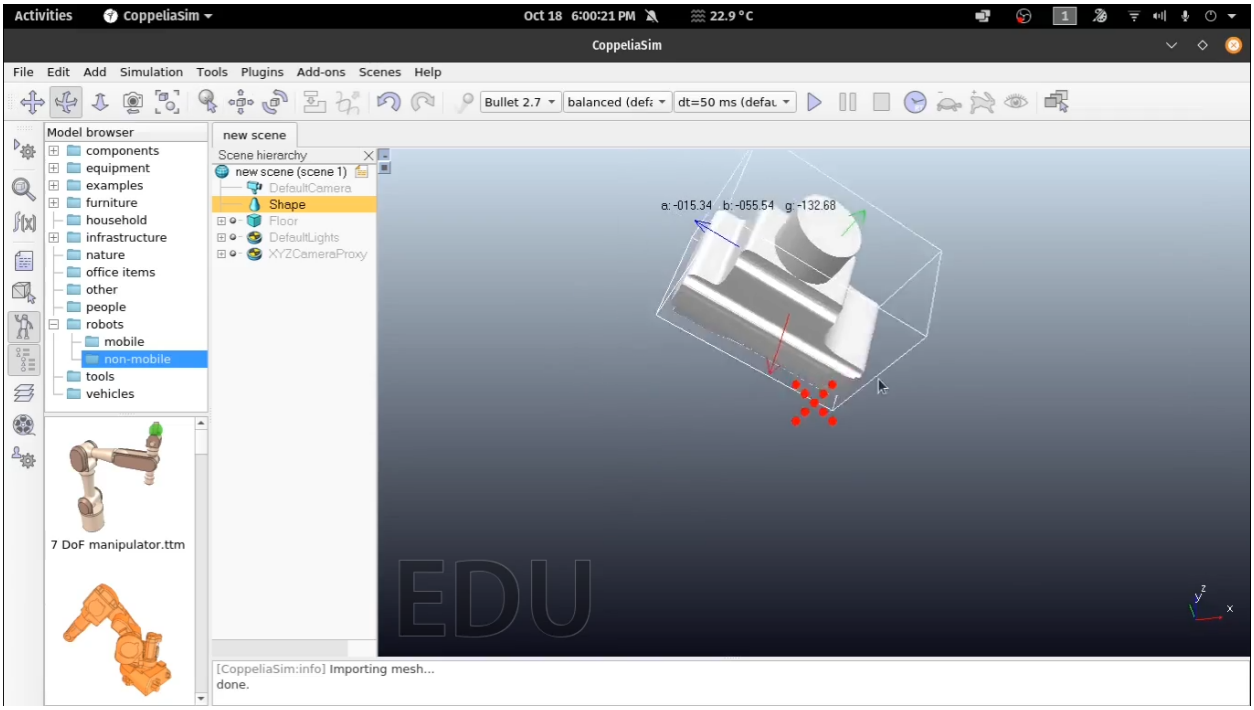
3. Rx(45 deg)

This rotation operation was executed by selecting the ‘rotation’ widget. A command to rotate the object by 45 degrees along the x-axis was given. The output of this transformation can be seen below.



4. Rx(20 deg)

This rotation operation was executed by selecting the ‘rotation’ widget. A command to rotate the object by 20 degrees along the x-axis was given. The output of this transformation can be seen below.



Conclusion

Through means of this project, I gained an understanding of how we can use FreeCAD to model an object quickly, and also how we can make use of Coppeliasim for visualising simple transformations.

Links and Resources

1. https://www.coppeliarobotics.com/helpFiles/en/importExport.htm
2. https://www.youtube.com/watch?v=swisAL1IXlw
3. https://www.youtube.com/watch?v=KAnU4GK-0iM
4. https://github.com/Naimish240/Industrial-Robotics-Assignments