Programming Project Report #4

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Problem Statement:

For our fourth project we were tasked with the job of generating a 3D model of a penny from a provided 2D image. The project was broken down into several tasks which included:

- Accessing, reading, and storing the depth values and color values of each pixel in the image.
- Generating a wire frame mesh using lines.
- Generating a colored penny using polygons.
- Applying Phong shading to the colored penny.

Design:

In order to make the penny properly visible with the wireframe, both the penny thickness and the number of lines drawn had to be adjusted by trial and error. Without doing this, the penny would either be too thick, or having too many lines would make the details become obscured. Using this mesh as a foundation, the colored penny and the Phong shaded penny was created. Another design decision made was to remove the white background from the image to display only the penny itself. This was also done by trial and error, adjusting the threshold to remove just the white parts of the penny.

Implementation:

The development of the project began by first accessing and reading the two provided text files and storing the information into arrays. With this information, the next step was to generate the wire frame and display it. After this, keyboard inputs were added for rotating the penny and allowing the ability to view the penny from different angles to ensure that the wire frame looked right. Next, the wire frame function was duplicated and modified to create the colored penny by using polygons and the RGB values. Then, the provided “surface4.cpp” sample code was modified to use only certain functions like the init_normals() function and “shading.cpp” was included to handle the lighting and materials. Lastly, the ability to switch between the three different display modes was added as well as the ability to toggle the white background for the colored penny and phong shaded penny.

Testing:

The program was tested after completing each individual step to ensure that any bugs introduced in that step were solved immediately. This allowed for easier debugging and changes to the newly implemented functions. Since there isn't much inputs for the program, it was easy to test all the cases and see what needed to be fixed. Each step of the project was not started until all the bugs were fixed for the previous steps. Below are images of the different viewing modes of the penny.

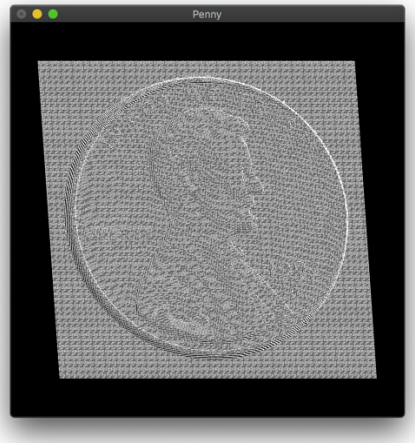

Image showing wire frame penny

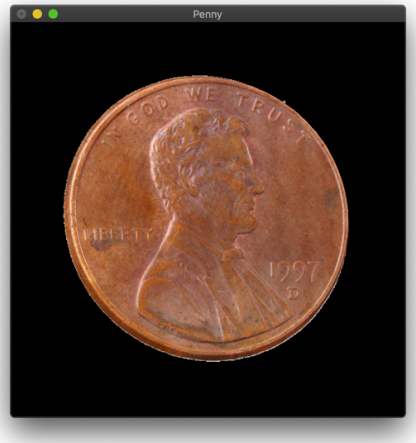

Image showing colored penny

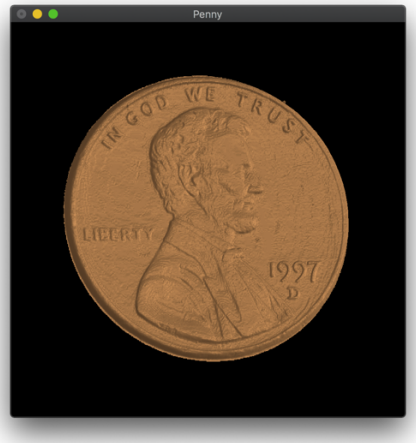

Image showing penny with Phong shading

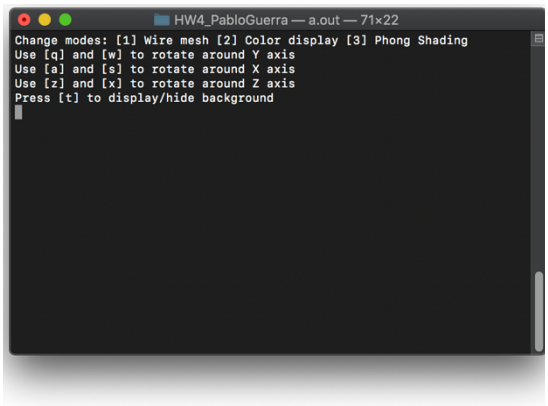

Image showing program controls

Conclusions:

Overall, the program works as intended and the penny is visible in all three viewing modes. This program went through several different versions each with different data structures for storing values and different methods of applying certain features. This was the final program that provided the best results and the penny looks great. This was a long project compared to the others but also was the most interesting and most challenging.