3-2 Milestone Two: Enhancement One: Software Design and Engineering

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The artifact I have chosen for Enhancement One: Software Design and Engineering is a 2D rendering vector of triangles. I designed and built the 2D rendering using Visual Studio an integrated development environment (IDE). To create the 2D rendering using this environment I incorporated OpenGL, an application programming interface (API). OpenGL requires a programming language to operate, I have chosen to use my language of choice, C++. My artifact was created during CS-330 Computer Graphics and Visualization class which took place in May of 2022 during my 22EW5 term at SNHU.

I determined this was the best project to enhance because I know OpenGL is a widely used API that has been around for a long time and is still used in top businesses and supported by current hardware. With most of the world still using OpenGL, I will have a larger pool of opportunities with my knowledge and skills I provide enhancing my artifact. I showcase an impressive amount of my abilities using C++ programming language with the OpenGL API. To enhance this artifact, I transformed my rendering of a 2D object into a 3D pyramid and I did this because as time goes on, we are introduced with new technology and more powerful hardware that really push graphics to new levels and when this happens the desire for realism increases.

While I was enhancing my 2D triangle I learned that to create 3D objects I needed to create shapes from my triangle. My pyramid needed a square base, to make a square I created another triangle and put them together. The sides of the pyramid were trickier, I learned and now know how to determine the position of each point, I created coordinates that show my ability to determine vertices to create the desired object. Finishing up the 3D pyramid I added texture to the sides. Like creating the pyramid, I found the coordinates to apply my texture. To display the texture correctly I used texture wrapping. With texture wrapping I was introduced to the modes

that become available with texture wrapping, for example: GL_CLAMP_TO_EDGE,
GL_CLAMP_TO_BORDER and GL_REPEAT and this allowed me to control the texture when
coordinates I am using are not in the standard range. Now I needed a way to load this image,
inputting the image with a simple line of C++ code doesn't exist and needs an additional library,
I was introduced to a library called stbimage and through becoming familiar and understanding
how stbimage library works I was able to load images from local files into OpenGL.

With the artifact now being a 3D pyramid with textures aligned to each side I programmed the
usage of the W, A, S, D keys and the mouse to control the scene the pyramid is in by using a
MODELVIEW matrix. While creating the functions and parameters for the keys when you push
and then release, I learned not all keys are called the same way, for example: the F1 through F12
keys are considered special keys and when using GLUT, you would use glutSpecialFunc and not
glutKeyboardFunc and a lot of the keys can be used with ASCII.

From this artifact's original state of a 2D object to the enhanced and improved 3D pyramid I
have showcased my knowledge and skills outlined in the course outcomes where I designed and
evaluated computing solutions that solve a given problem using algorithmic principles and
computer science practices and standards appropriate to its solution, while managing the trade-
offs involved in design choices, this outcome falls under the algorithm section where I had to
determine lighting calculations by calculating a surface normal. The outcome also falls under
data structures as the data stored for example: vectors, the algorithms will use that vector data
structure to solve which coordinate to use to position light in the correct direction. The second
course outcome I aligned with was achieved by demonstrating an ability to use well-founded and
innovative techniques, skills, and tools in computing practices for the purpose of implementing

computer solutions that deliver value and accomplish industry-specific goals. These are demonstrated with software engineering and design by my ability to follow programming standards in C++ and provide lines of clean and clear code that are commented and error free and easily readable by another programmer.

As I was creating my artifact, I learned a large amount about C++ and OpenGL that I was unaware of. I learned how to take advantage of the libraries I can include in my code to use callback functions, texture wrapping and being able to setup camera variables and learning out to use processInput to use inputs from a keyboard. My C++ knowledge is stronger, I am confident using algorithms that I have in place and using arrays of vertices. I have gained knowledge with using vertex buffer objects to manage large amounts of stored vertices, this is important as it can control efficiency. I did run into some challenging areas when working with the shaders and buffers as they are not easy to debug and you're given a empty screen that opens and immediately closes, I was able to overcome this challenge by correcting my ins and outs. I challenged myself with choosing to enhance this artifact pertaining to Software Design and Engineering and has given me a large amount of pride and confidence in my growing ability to succeed and gain knowledge in the Computer Science fields today.