Implementation log of 5CC509 assignment

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Week 1: During week 1 the first thing I did was to simply create C++ Windows Desktop Application project called “Rasterizer”. Visual studio create default code for the application on which I worked later and modified it or added new classes and headers. The first thing that I created was a simple struct to hold the information about each rectangle on the screen.

Week 2: During week 2 I was tasked with creating a class that would connect straight lines on the screen after I click on 2 random positions on the screen and store that data. During the same week I modified this class and project in general in order to be able to draw on the screen while holding LMB.

Week 3: During week 3 I modified the Vertex class so it can hold w coordinates as well. After doing so I was able to create a method in Rasterizer class that would draw simple square on the window’s screen. Last thing I had to do in week 3 was a more difficult task, I had to create a Matrix class that would allow square transformation and let it move on the screen. I figured out how to do it with the help of lecture notes and Google/Stackoverflow 😊.

Week 4: During week 4 I had to modify the Matrix and Vertex classes so they can handle 3 dimensional objects/models. This task was also not that easy but with some self-research I managed to do that as well. After adding Z dimension to Vertex class and replacing 3x3 matrix to 4x4 matrix I was ready to move on to create another 2 classes, Polygon class and Model class. Polygon class was created to hold polygon information needed for models and Model class was created in order to handle md2 format 3D models. These 2 classes were easy to create with the help of lecture notes, nevertheless I still searched more related information in order to better understand some concepts. Also I had to create class that would load a model into memory.

Summary of week 1-4:

During this weeks, I was able to create more or less simple project that is able to handle 3 dimensional objects/models that can be transformed on the screen after rendering. The solution at this point is not able to display anything yet since the project needs more classes and work to be done but the solution at this point can load a model into the momory.

Week 5: Date: 10/11/22

Time spent: In general, I spent around 12 hours. In these 12 hours I spent the first 4 to read the notes, understand what I am being asked to do and search some additional information. I would like to note that in general I prefer to do work in 1 sit rather than splitting it in many sits. I feel more productive this way.

What I did: In order to load the model and display it, I had to modify the Model class so it can now store information about the transformations made to the model without transforming the original model.  
Basically the application will use the original vertices and add new parameters to it which will change the output.

I had to add 2 new methods to Model class, one that will apply transformation to original vertices and store that as new collection and another method that will apply transformation to that new collection. After that I had to add dehomogenize method to dehomogenize each vertex in the non-original collection. This took me quite a lot of effort, but internet is a great thing!

Next step was to create a Camera class that would give us functionality to set the camera matrix. This class is supposed to store camera position values and be able to change this values in order to change the position without re-programming the class. This take me approximately 1 hour to figure out since it is quite straightforward.

Later, following instructions I had to add 2 methods to the Rasterizer class to create perspective and screen matrices. This was very easy and didn’t took a lot of time.

After finalizing the previous task I had to create a method that would draw wire frame model on the screen. This method would retrieve vertices to draw the triangles of the model. It took me a lot of time because it required a lot of debugging and research in order to make this method functional.

The last thing I had to do for this week was the hardest. It required to update 2 of most important methods, Update and Render method and also to add quite a lot of code in general.

First thing to do was to add code to be able to rotate the model and after that call another 2 method for perspective matrix and view matrix in Update method. At this point the project got complex and I started spending a lot of time to reach the goals of this week.

Second thing to do was THE hardest and I also had to add a lot of code and modify the Render method.

The final result allowed to apply the model transform, apply the camera transform, apply the perspective transform, dehomogenize the transformed vertices, apply the view transform and finally the most important draw wire frame model.

Week 6: Date: 18/11/22

Time spent: In general it took me around 8 hours in general, at this point it was easier to understand the principles and theory since I have already researched a lot of information. Coding was also easier and more “transparent” for me.

What I did: During this week I had to implement “back face culling” and “depth sorting”.  
This would allow me to further improve the project and later allow me to apply shading and make the model more advanced by removing polygons that are not need to be render.

It was relatively easy to implement such functionality because there is a lot of information related to this subject. Youtube tutorials help me a lot to understand what I must do and how it works. I would like to note that the actual code was not that difficult but the debugging was time consuming because the project got complex, it now has a lot of functions, methods, values, parameters etc. and configuring that is not the easiest task. Patiently though, with the use of notes and examples, I completed this week too.

Week 7: Date: 30/11/22

Time spent: I started working on this week task just after I arrived form lecture with fresh knowledge. It took me around 2 days because I needed to research a lot of materials in order to understand light concepts.

What I did: The first 5-6 hours I watched plenty of videos on Youtube and read quite a lot of articles.

After that when I felt ready I started working with the project. The first thing I did was to fill the wire frame model with a fixed colour, and add Polygon function instead of GDI calls to draw the polygons with set of points. This was easy because I just had to modify a bit the wire frame function and add PEN and BRUSH functionality to draw and fill the polygons.

The lighting class thought required a lot of patience and reading. I spend around 1 day in total to create a the class with needed values and functions and then implement them on the model. It was particularly hard because there is more than one type of lighting, there is a lot of configurations values that have to be configured manually until the final product looks somewhat functional. Coding requires a lot of thinking and problem solving but as I said before internet and stackoverflow is a great thing! Also it took me a whole night to debug the entire project since I did a lot of changes and I had a lot of errors.

Week 8: Date 20/12/22

Time spent: For this week most of the time, around 4 days.

What I did: For this week I created the Flat Shading function which was also relatively easy to since it just required some modifications of existing classes and it took me around 1 day (6-8 hours). It took me 4 days in general though because I also tried to implement more functionality to the project and made it user friendly. During this time I cleared the code, tried to comment everything and tried to make it as good as possible. Unfortunately I run out of time and didn’t have the chance to further improve the assignment.

Conclusion:

This assignment was honestly hard to complete because it required a lot of effort and time to understand the core principles and then implement them. However I feel like it offered me a lot of knowledge in the programming sphere and I also realized how amazing and difficult now days technology is and how much effort people make to satisfy our needs.