Name: Prithvi Raj Gali

Professor Hieu Bui

Into to Computer Graphics (CSC_322)

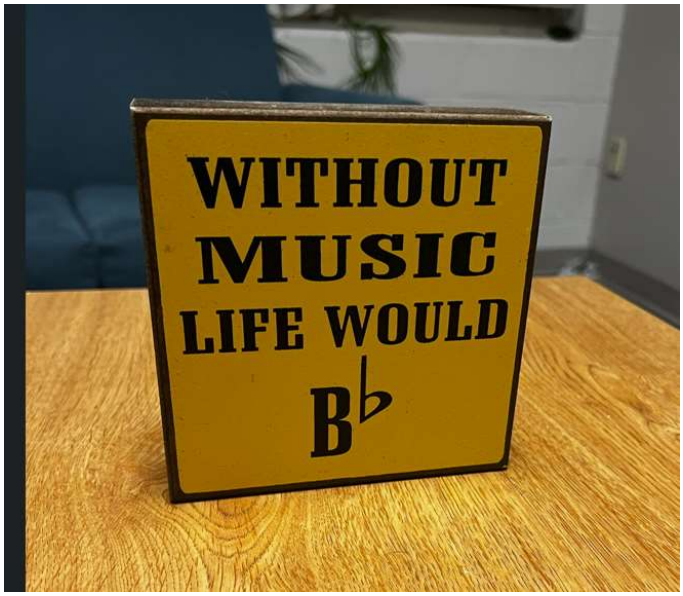
11/30/2022

Building a 3D model

Introduction

I have done this project because converting 2D images to 3D model is one of the best creation in computer graphics. Meshroom is an open-sourced 3D Reconstruction Software. The meshroom software is based on Alice Vision. It is a free download software; The website works on Windows and Linux operating systems. AliceVision is a Photogrammetric Computer Vision Framework that uses camera-tracking Algorithms to create 3D texture models. The camera can be either a Professional camera or a smartphone camera for capturing images of the targeted object. The Computer needs to have an NVIDIA CUDA- enabled GPU for this software to run on the Windows Operating system. There is another type of this software to run in the system that does not require a GPU to run this software. Meshlab is an open-source system for processing the input mesh we extracted from the meshroom. The mushroom is used to convert the 2D images of the different frames into the 3D Model, and then the meshlab helps to clear the unwanted obstacles in our 3D Model.

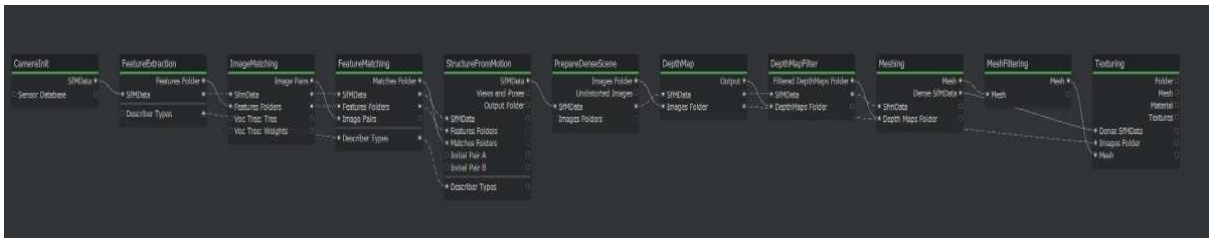
The Model I have used is a small wooden box-like structure, as shown below.



Working Of Project

The Basic working of the Project, The first step is to upload the images of the targeted object.

Then save the file in the meshroom cache. After that, we need to render the images. For that, we need to click on the start button in the meshroom. Different nodes show the different processes of the rendered process of the software shown in the below figure.

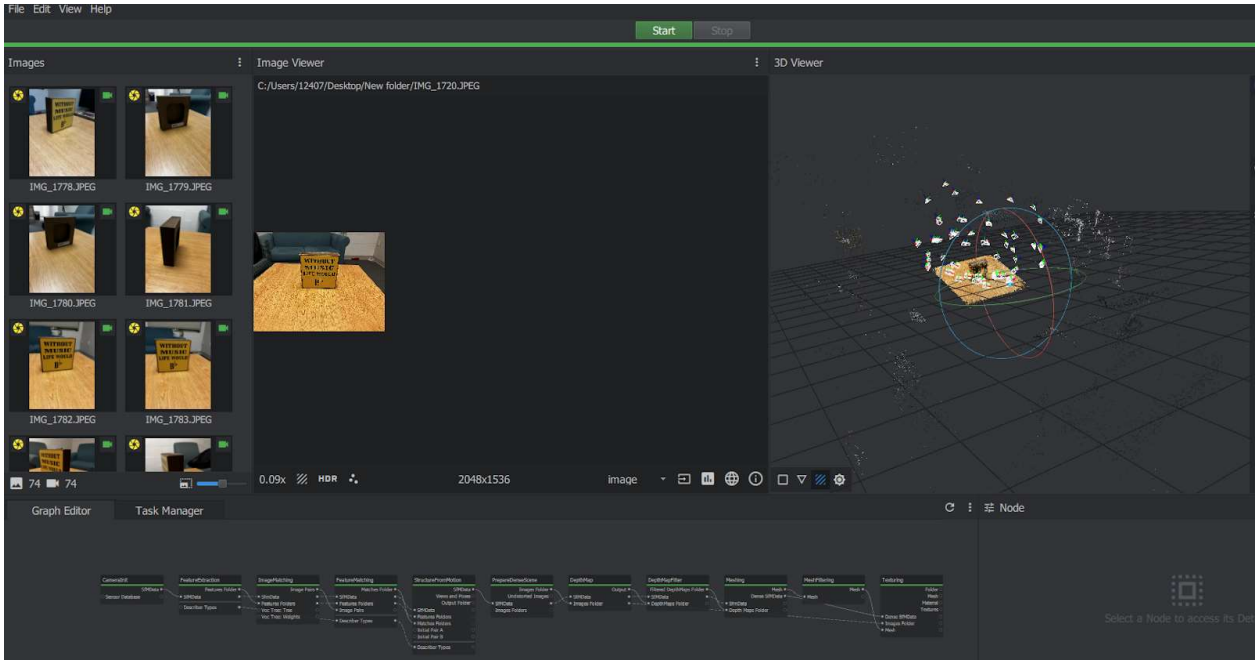


The nodes are cameraInit, FeatureExtraction, ImageMatching, FeatureMatching, StructureFromMotion, PrepareDenseScene, DepthMap, DepthMapFilter, Meshing, MeshFilter, and Texturing. Each node is connected from one to another. In these nodes, we can change the nodes' settings as the User wishes by changing the node's connection leads to different outputs of the same input file. When the Model is being processed, it goes through all of this and checks. If we get the orange line means that the node is getting executed and if we get the green line means that the execution of that node is completed. If there is any error, then it will show the redline at that time. We need to change the photos or need to change some node connections. After creating the basic Model from the meshroom, we need to edit unwanted obstacles shown in the extracted file and remove those unwanted obstacles through meshlab.

In this report I have mention the Method Of Approach, Implementation ,Problems and conclusion.

Method Of Approach

I started this project by watching some videos on Alicevision photogrammetry. Like how to take photos of the object. I have spent lots of time making the photos and understanding the steps after getting the extracted file. In the beginning, I used different objects smaller than the Wooden Box. I took images of that smaller object, and then, after rendering, the Model had lots of errors. Understanding the error took a lot of time, and then I came to know the mistakes that I had made. Then I used the knowledge in the Wooden Box object. For Better photos, I took the images by putting the wooden Box in the center of the Rotatable wheel. Then I used the phone camera stand to hold the phone. Once the setup was done, I started taking photos of the wooden Box by rotating the circular wheel slowly. Then I changed the angle of the camera and took some more pictures. I took 74 pictures of the wooden Box and uploaded all these images into meshroom, and clicked the start button. I used the default condition for the nodes setting to create the 3D Model. As shown in the below figure



Implementation

Meshroom uses all the nodes step by step to render the model. To get a proper model, we need to make sure that image objects are in order. The quality of the images depends on the light, shadows, and weather of an object. If the images are not proper, Meshroom will have difficulty creating the model. Once the process of the StructureFromMotion node is done, then we can see the small structure of the model and the cameras that are covering it. For the model, I had 74 perspective cameras. When all the nodes are processed successfully, we can see our model views once we close the StructureFromMotion and Meshing View. There will be lots of obstacles that are not required. Here the obstacles mean extra vertices and extra faces. We will get a .obj file. To edit the file, we need open it in Meshlab. In Meshlab, we can delete all the unwanted faces and reduce the obj file size by decreasing the obstacles using the filters. After removing the obstacles, we will export this edited .obj file to the original location. After exporting, we are

going to upload our model in P3D. We need to upload all other files that are saved along the obj file from this method. We have got the 3D model of the real-time object.

Problems and Discussion

Meshroom is easy and convenient overall, but I encountered some challenges doing the project. The main problem with this model was the images I took for it. When I took images of the object, I learned that I should not change the focal length of the object, or else the image would not render properly. After researching, I bought the phone stand and the rotatable wheel for this project. Due to this, I captured better images keeping the focal length constant. Another Problem that I have faced is that the rendered model stopped after some time because my laptop does not have a good graphics card. Later I used my friend's laptop for the meshroom. Since the meshroom requires NVIDIA CUDA -enabled GPU for better rendering of the images.

Sometimes the Rendered model will only be in half due to some malfunction in the Meshroom. So I had to render that again cases, and it took a longer period of time than usual and led crashing of the system. The solution for this is to clear the cache memory and keep the ram memory unoccupied this will definitely increase the time efficiency for the rendering the model.

Conclusion

Meshroom is a very convenient software for creating a real 3D model. I have learned a lot of things about making this model. Meshroom can be used to create 3D models. After this project, I am confident to use this software and explore it in the future . This project will be used in various fields, such as in Amazon to view the products, customers can view the 3D image of the product. One of the benefits of the meshroom is that it is open source, so anyone can use it. I was very interested to know when the meshlab could remove the extra vertices and faces. There is a lot to try in this project by changing the node connection and seeing the output of the project, making a much better model I have learned about the p3d, where we can upload our model and see other models. This model has given me a more clear idea about the computer graphics that we have learned in class.

Reference

“Loading...” AliceVision, https://alicevision.org/#meshroom.

How to 3D Photoscan Easy and Free! - Youtube.

https://www.youtube.com/watch?v=k4NTf0hMjtY.

“Meshlab.” MeshLab, https://www.meshlab.net/.

Wirtz, Bryan, and About Bryan WirtzA graduate of Penn State University and a Philadelphia native. “The Step-by-Step Meshroom Tutorial for Beginners.” The Beginners Guide to Meshroom: Learn to Create Models the Smart Way, 25 June 2021, https://www.gamedesigning.org/learn/meshroom-tutorial/.

3D Scanning for Free with Meshroom - YouTube.

https://www.youtube.com/watch?v=vU6PoarLEzs.

Github:

https://github.com/Prithvi-1/csc322fa22-/tree/main/Csc_322_Project

P3D link :

https://p3d.in/JOVMB