

Introduction

The project consists of using photogrammetric techniques of image processing to convert 2D images of an object to a 3D model. This will then be integrated with the QbiQ project developed by Sehwan Lee under the supervision of Professor Mark Lanthier. QbiQ is a simulation of small block robots which construct into any 3D shape. This project will enhance the capabilities of QbiQ so that any object can be constructed by the simulation.

The project will take inputs in the form of images of the object to be converted to 3D. It will use epipolar geometry, triangulation and photogrammetry to make a 3D model of the object and use this model as an input to QbiQ.

Implementation

The first part of the project will involve capturing images of the object you want to convert to a 3D model. This can be done by using any camera, however for the purpose of the project I will be using the same camera to capture the images. This will ensure that the internal parameters of the camera are calculated accurately as camera calibration is a key component in 2D to 3D conversion. Two images of the object will be required from each side in order to calculate the depth. After the image is captured, it will be processed to remove noise and smooth edges.

The second component of the project is to calculate the depth of the object. This is done by calculating the distance of each point in the object to the camera. Using epipolar geometry and triangulation, we can find corresponding points between the two images. Corresponding points will allow the application to calculate the depth of the object by using the points of intersection of the same point in the two images.

After the depth of the object in the image is calculated, this will be repeated across all sides of the object in order to create a full 3D model of the object. Using methods of image registration 3D mesh of each side of the object will be stitched into one. The final step of the project is to convert the 3D model into a form usable by the QbiQ code.

Language and Libraries

The project will be done using Python and will use libraries such as OpenCV, numpy and scipy. Python was chosen as the programming language for this project as it offers a wide variety of features in the image processing field. After the 3D model is recovered, it will be converted to Processing code in order to successfully merge it with the QbiQ project.

Dates and Deadlines

Week of	Contents to be completed
1-15 September	Research and Set-up of required programs, tools and libraries
15-30 September	Image capturing and image processing in order to find correspondences between the two images
1 – 15 October	Using epipolar geometry to find correspondences between the two images
15-31 October October 29 – Mid term report	Finding the depth of each point in the image using the corresponding points
1 – 15 November	Merging multiple images to make a 3D model of the object
15-30 November November 29 – First draft of final report	Transforming the 3D model into a form usable by the QbiQ project
1 – 13 December December 13 – Final Submission	Code clean up and final modifications