# 3D Project

## Introduction

A website has developed to display 3D models of objects which can be rotated and zoomed by users. The website uses a python backend running on the [Django](https://www.djangoproject.com/) web framework and uses [WebGL](http://www.khronos.org/webgl/) to display the 3D models.

## Aim

The purpose of this document is to detail the processes involved in generating a model and uploading it to the website so that it can be viewed.

## Generating a Model

#### Take photos of the object to be modelled

The details for taking photos

### 3D Point Cloud Generation

There are numerous methods to generate a 3D point cloud from the photos. This document will outline 3 methods, each with their own strengths and weaknesses. [VisualSFM](http://ccwu.me//vsfm/) is a visual tool that will construct a point cloud on a local computer. It gives a visual representation of the reconstructed point cloud, and also reconstructs the position of the cameras. It allows control over which cameras are included in the generation of the model by deleting cameras that are producing erroneous data. It is free to use for non-commercial purposes, but closed source. It is also possible to script the generation of models, however that removes the ability to review the accuracy of the model while generating the point cloud.

The [Python Photogrammetry Toolbox](http://www.arc-team.homelinux.com/arcteam/ppt.php) also runs on a local computer and runs a lot of the same processes that VisualSFM does, but is open source. It does not provide a visual representation of the model as it is being generated. It has the benefit of being able to be used over remote desktop to run models, and since

The process of generating the 3D point clouds on a local computer is very processor and memory intensive. The computer used while generating the initial models is a Intel Xeon W3670 (3.2GHz) with 12GB of Ram and a NVIDIA Quadro FX 1800 video card. Depending on the complexity of the model and number of photographs, model generating can take over 4 hours with the CPU maxed at 100% and the entire RAM used.

### Arc3D

The workflow for generating a model is as follows:

* Take photos of the object to be modelled
* Upload the photos to the [ARC3D](http://www.arc3d.be/) web service and wait for the model to be generated
* Import the model into [MeshLab](http://meshlab.sourceforge.net/)
* Convert the textures into vertex colours
* Clean the mesh
* Export the model as an OpenCTM model
* Upload the OpenCTM model to the web server and configure the new model on web site administration page

The details for each step are outlined below.

#### Generating the Model from the ARC3D Web Service

The [ARC3D](http://www.arc3d.be/) web service accepts a series of photos of the object and constructs a 3D model from them (Tingdahl & Van Gool, 2011; Vergauwen & Van Gool, 2006).

### 3D Scanner

* Using artec studio 9.2
* Scan the object
  + Best to keep the object steady and move the scanner around the object
* In tools, run sharp fusion

## Risks

The key risk in the processing workflow is the [ARC3D](http://www.arc3d.be/) web service. It is not an open source solution, so if the web service is taken offline there is no way to easily replace it.

## References

Cole, Keenan. 2012. Converting a 3D Model to OpenCTM In Meshlab for WebGL.CAST Technical Publications Series. Number 11015. http://gmv.cast.uark.edu/modeling/converting-a-3d-model-to-openctm-in-meshlab-for-webgl/. [Date accessed: 23 August 2013].

David Tingdahl and Luc Van Gool, "A Public System for Image Based 3D Model Generation", Computer Vision/Computer Graphics Collaboration Techniques 5th International Conference, MIRAGE 2011.

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