

## 3 D MODELLING

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**Abstract:**

*This project is about the improvement of traditional methods for surveying, documenting and WBE (Web-based Education) for Archaeological Sites and Cultural Landscapes & Heritage (CLH); especially by synergy effects gained by the combination of ICT low-cost techniques as innovative practices under digital Photogrammetry. I used the PhotoModeler Scanner , the Direct –Digital RECTifier, PhotoScan Pro (Agisoft) and the Calib softwares, in order to practice and manage to create the 3d model of a Egyptian Building façade, of a Monument, of the Pillar, Sarcophagus ,Lion Statue and the Sphinx Sculpture .*

**Key words:** photogrammetry, 3d modeling, softwares

## INTRODUCTION

Photogrammetry is an estimative scientific method that aims at recovering the exact positions and motion pathways of designated reference points located on any moving object, on its components and in the immediately adjacent environment. Photogrammetry employs high-speed imaging and the accurate methods of remote sensing in order to detect, measure and record complex 2-D and 3-D motion fields. Photogrammetry belongs to measurement techniques, which aims to study and define precisely the shape, size and position in space of the objects, based on the measurements of one or more photos of the objects.

## MATERIALS AND METHODS

### Notebook

For all project calculations and operations, I used a laptop DELL model Inspiron 3521 (Figure 1).



Figure 1. Dell Inspiron 3521

### Camera

For the acquisition of the images for the photogrammetric analysis: NIKON COOLPIX S220 (Figure 2).



Figure 2. Nikon COOLPIX S220

### Total Station

For the measurements, I used a South NTS-350R Total Station (Figure 3).



Figure 3. South NTS-350R Total Station

### Direct –Digital RECTifier

Direct is a program which rectifies images. Rectifying is a transformation process used to project two-or-more images onto a common image plane. It corrects image distortion by transforming the image into a standard coordinate system.

### Photo Modeler Scanner

PhotoModeler Scanner provides the tools to

create accurate, high quality 3D models and measurements from photographs. The process is called photo-based 3D scanning. It provides results similar to a 3D laser scanner. This 3D scanning process produces a dense point cloud (Dense Surface Modeling, DSM) from photographs of textured surfaces of virtually any size.

PhotoModeler Scanner is a sophisticated tool to build accurate Dense Surface Models and get measurements from your photos. Use PhotoModeler Scanner to build:

Dense Surface Models where a large number of 3D points are needed.

Models that traditionally would require a 3D laser scanner

Scale-independent object modeling - model small objects or big scenes.

#### **PhotoScan Pro (Agisoft)**

Agisoft PhotoScan Pro allows generating high resolution georeferenced orthophotos and exceptionally detailed DEMs / textured polygonal models. The fully automated workflow enables a non-specialist to process thousands of aerial images on a desktop computer to produce professional class photogrammetric data. It also works with terrestrial photographs, enabling the use in archaeology and cultural heritage documentation.

## **RESULTS AND DISCUSSIONS**

### **1. Mosaic of the Egyptian Building Façade**

The Egyptian Building façade was made with Digital RECTifier. Photo-Modeler Scanner program was used in order to calibrate the camera and to create the 3D model of the War Memorial Monument and the Pillar. The creation of the 3D model of the Lion statue, the Sarcophagus and the Sphinx sculpture was made with Agisoft PhotoScan Professional.



Figure 4. Final version of the mosaic

### **2. Camera calibration**

In order, to calibrate the camera, the first and very important step is to turn off the auto-

focus setting in the camera. Then two (2) pictures, one (1) landscape or zero(0) degrees and one (1) portrait or ninety (90) degrees, have to be taken from each angle and each side of the calibration grid. The calibration grid should fill up the photo window frame as much as possible and the coded targets must be clearly seen in the photo taken. The calibration would be more accurate if there are no irrelevant noises in the photo. Finally the photos can be added in the PhotoModeler Scanner program and follow the next steps in order to begin the procedure.

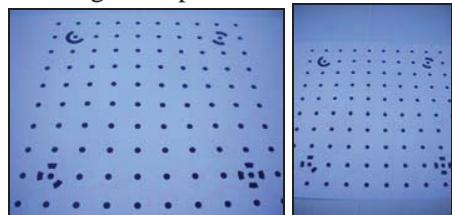


Figure 5. Landscape and portrait picture of the calibration grid

### **3. War Memorial Monument**

I had to create a 3D-model of the monument by using PhotoModeler Scanner Program. I took pictures all around the monument. From all taken photos I chose six to use for the project.

After inserting the pictures in the program, the images needed to be orientated. To do this, I spotted and referenced at least six common and significant points at two pictures until all of the six pictures were orientated and the significant points were referenced with each other.



Figure 6. The finished 3D-model of the War Monument

### **4. Pillar**

I also had to create a 3D-model of the pillar by using PhotoModeler Scanner Program. I took pictures all around the pillar. In the end, eleven photos were used for the process. The steps remain the same as for the Monument, such as spotting points and referencing them always on two pictures, getting surfaces and shaping them. The pillar represented a

challenge because of the special form, which is similar to a cylinder.

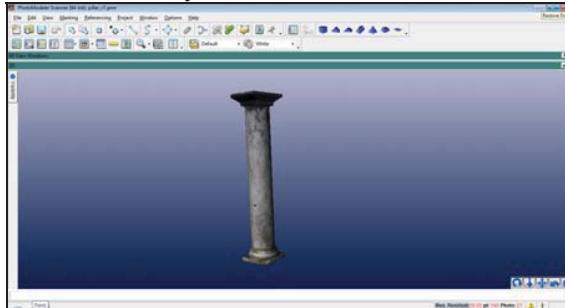


Figure 7. The finished pillar with “Quality textures” on the surfaces

## 5. Sarcophagus

### 6. Lion Statue

### 7. Sphinx Sculpture

For every project, Sarcophagus, the Lion Statue and the Sphinx Sculpture, I did in Photoscan, the steps remain the same:

Add all photos ;

Select “Workflow → Align Photos”;

Select “Workflow → Build Dense Cloud”;

Select “Workflow → Build Mesh”;

Select “Workflow → Build Texture”;

Add Scales;

Delete outliers.

For the model of the sarcophagus, I used 19 images in total. I tried to take photographs from all sides around the object, as well as some pictures showing the inside between the two vertical stone plates.

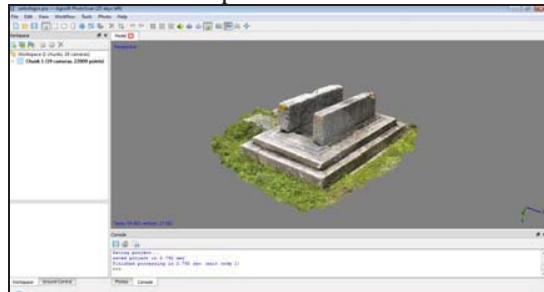


Figure 8. Finished 3D-model of Sarcophagus

The model of the lion statue in front of the Museum of Archeology was created by using 15 images from all around.

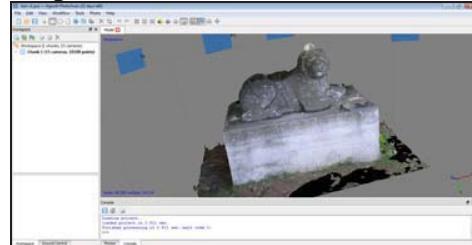


Figure 9. Finished 3D-model of the Lion Statue

Inside the Museum, I took several images of a sphinx sculpture in order to create a model. All in all, I used 23 of these images in the software.

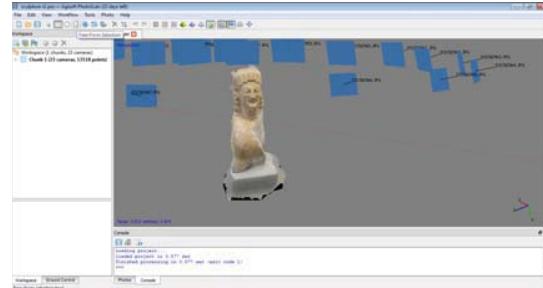


Figure 10. Finished 3D-model of the Sphinx Sculpture

Because of these programs, I was able to produce 3D-models with low-cost hardware (-> 10 MP camera) that can easily be used. Despite the non-expensive equipment, the output and final product was quite satisfying and surprisingly nice looking. Obviously, the accuracy was not always very good especially regarding the pillar. This is caused by the amateur equipment.

## CONCLUSIONS

Among the benefits of 3Dmodels with PhotoModeler Scanner, I mention the followings:

opportunity of real image acquisition with very realistic 3D models, that are applied in a large variety of fields;

less time for field work, more time for data processing;

minimizes the probability of unscanned zones due to shadowing effect of roughness elements and overhanging zones due to proximity to the target and the possibility of scanning from different angles and overlapping the scanning results;

providing high precision and complex data; using 3D technology, 3D models can be created; can be combined with other well established high precision surveying techniques; All in all, I definitely got deeper in topics of photogrammetry by applying programs to nice objects in reality.

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## REFERENCES

- Maricel Palamariu, Levente Dimen, 2003, "Notions of terrestrial photogrammetry ", Didactica Publishing House, Alba-Iulia, p. 5  
<http://en.wikipedia.org/wiki/Photogrammetry>  
<http://www.nikonusa.com/en/Nikon-Products/Product-Archive/Compact-Digital-Cameras/COOLPIX-S220.html>  
<http://comprevIEWS.about.com/od/budgetnote/fr/Dell-Inspiron-15-3521.html>  
<http://www.shambhaviimpex.com/total-station.html>  
<http://www.photomodeler.com/products/scanner/default.html>  
<http://www.agisoft.ru/products/photoscan/professional/nal/>  
Lessons about 3 D modelling, Greece