MODELING AND VISUALIZATION USING LASER SCANNER IN DOCUMENTATION OF CULTURAL HERITAGE

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ABSTRACT:

Laser scanning technology has deeply modified the approach to surveying cultural heritage. The documentation of cultural heritage with laser scanning is both easier and faster than other methods. The aim of this work is to produce digital surface models, orthophoto, and visualization of a cultural heritage using point cloud. In this paper, the surveying of the sarcophagus obtained by laser scanner technique. The Sarcophagus is typical of paphylia and belongs to Roman Period III. Century A.D. To obtain the model of sarcophagus, several scanning have been made in all facade of sarcophagus. The integration of point cloud of all facades was conducted by Polyworks commercial software. Modeling, orthophoto and visualization has been carried out by the software.

1. INTRODUCTION

Laser scanning technology with its automated capture capabilities is bringing new perspectives and can satisfy most requirements of cultural heritage type of applications (Haddad and Akasheh, 2005). One of the main features of the laser scanning technique is to a collect a great data amount and to give a detailed 3D model of the object (Fiani and Siani, 2005). The demand for 3D models of historical objects is continuously growing in the field of archaeological and architectural applications. Currently, in addition to traditional manual methods of survey, the two main sources of data that can provide detailed and reliable 3D surface models are the photogrammetric processing of digital images and laser scanning point clouds (Ioannidis et al., 2005). The recording and documentation of historic objects can be greatly enhanced in terms of speed and accuracy of data collection using close range photogrammetry and laser scanning. Laser scanning and close range photogrammetry records an object and supplies measurement data, texture, color and geometry defining object (Murphy et al., 2005). Traditional heritage recording methods like terrestrial photogrammetry are not suitable for all kinds of objects. Particularly when the objects have very irregular surfaces and not a clearly defined structure, scanning will probably yield better results than photogrammetry. The main difference between scanning and photogrammetry is obvious: While photogrammetric surveying is an indirect data acquisition method, scanning produces 3D points directly (Haddad and Akasheh, 2005).
The main goal of this work is to study and experiment the use of the laser scanning technique to survey a cultural heritage.

2. MATERIAL AND METHOD

2.1 The Sarcophagus

In this study, the surveying of the sarcophagus is obtained by laser scanner technique. The Sarcophagus is typical of paphylia and belongs to Roman Period III. Century (A.D.) (Fig.1).

Figure.1 The Sarcophagus

2.2 Laser Scanning (ILRIS-3D)

ILRIS-3D is a compact, fully portable and highly integrated package with digital image capture and sophisticated software tools, ideal for the commercial survey, engineering, mining and industrial markets(Fig.2).

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Figure.2 ILRIS-3D and measurement of sarcophagus

About the size of a motorized total station, ILRIS-3D has a visual interface similar to that of a digital camera.

Features:

- High resolution and high accuracy
- Highest dynamic range available on the market: from 3 m to beyond 1 km
- Class 1 laser rating: completely eye safe
- On-board 6 mega pixel digital camera and large-format LCD viewfinder
- Ruggedly designed for use in demanding field applications
- Battery operated
- No leveling, retro-reflectors, or mirrors required
- Compact and easy-to-use

ILRIS-3D specifications

Data sampling rate (actual measurement rate)	2500 points per second
Beam divergence	0.00974^0
Minimum spot step (X and Y axis)	0.00115^0
Raw range accuracy	7 mm@ 100 m
Raw positional accuracy	8 mm@ 100 m
Laser wavelength	1500 nm
Digital camera	Integrated high resolution digital camera Optional external camera
Scanner field of view	40^0 x 40^0

Table.1 ILRIS-3D specifications

3. RESULTS

The Four scan positions are used for scanning sarcophagus. A distance resolution of 2 mm was chosen for each of 4 scan positions. 1 million points, 1.5 million points, 1.4 million points and 1.4 million points were measured at each laser position, respectively. The integration of point cloud of all facades was conducted by the Polyworks commercial software. Integration process of measurement was iterative technique (Fig.3).

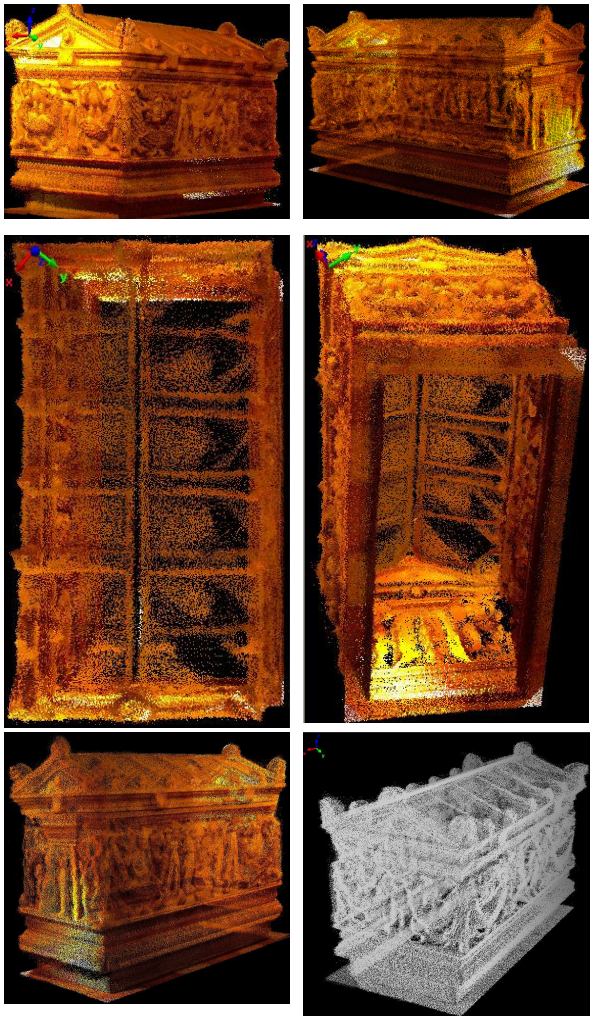

Figure 3. View of sarcophagus

4. DISCUSSION

Laser scanning technology is to facilitate demand for creating 3D models of historical objects. Laser scanning provides dense 3D information that can be implemented for the DEM. Therefore, we can easily achieve orthophoto, modeling and visualization of object. The using laser scanning is also not more time costuming process.

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5. REFERENCES

Fiani,M., Siani, N., 2005. Comparison of Terrestrial Laser Scanners in Production of DEMS for Cetara Tower, The CIPA International Archives for Documentation of Cultural Heritage Volume XX-2005, pp. 277-281.

Haddad, N., Akasheh,T., 2005. Documentation of Archaeological Sites and Monuments: Ancient Theatres in

Jeash, The CIPA International Archives for Documentation of Cultural Heritage Volume XX-2005, pp. 350-355.

Ioannidis, Ch., Demir, N., Soile, S., Tsakiri, M., 2005. Combination of Laser Scanner Data and Simple Photogrammetric Procedures for Surface Reconstruction of Monuments, The CIPA International Archives for Documentation of Cultural Heritage Volume XX-2005, pp. 372-377.

Murphy, M., McGovern, E., Olwill, R., Pavia, S., 2005. Identification of Historic Methods of Construction Using Digital Photogrammetry and Laser Scanning, The CIPA International Archives for Documentation of Cultural Heritage Volume XX-2005, pp. 466-469.

http://www.optech.ca/pdf/Brochures/ilris_36d.pdf (accessed 28 May. 2007)