

3D MODELING OF SILLE AYA-I ELENİ CHURCH WITH LASER TECHNOLOGY

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ABSTRACT:

In recent years, the use of Photogrammetric applications with the development of the laser scanning technology has gained a new dimension. Thousands of points on the object surface with a laser scanning are obtained more economical and less time required than 3-dimensional measurement technique based on the classic methods.

In this study, inner and outer surfaces of Silile Ayai Eleni Church (Konya) were scanned from various stations by laser scanning. All measurements are combined with Polyworks software and drawings were carried out with Z-map software. Moreover, the photographs are taken with a calibrated digital camera. As a result, the 3D modelling of outer and inner surfaces of Silile Ayai Eleni Church (Konya) were evaluated and the 3D modelling of surfaces of Silile Ayai Eleni Church (Konya) were obtained in the way based on rolove studies.

1. INTRODUCTION

Cultural, natural, historical and touristic heritage is one of the most important connections from the past to the future for any nation. Transferring of these heritages to the future generations is also the most important task for us. These cultural heritages are damaged by many factors that are natural and non-natural. Therefore, obtaining of the inventory information for these heritages and protection of the information is essential. If they damaged by any reason, their restoration must be done. Therefore, their documentation must have been previously done. There are various methods for documentation of cultural heritages. They can be listed as the traditional manual method, topographical methods, Photogrammetric methods and laser scanning method.

Terrestrial Photogrammetric methods plays an important role for the archiving of the cultural heritage, in the restoration and rolove work, in the displayed as a digital, in the 3D scanning and modelling, in the generation of legal, technical and tissue information.

Terrestrial Photogrammetric methods have been also used for archaeological and historical documentation for years. With the development of Digital Photogrammetry techniques, this method has become more efficient and economical in conservation and documentation of architectural and historical cultural heritages

In recent years, the use of Photogrammetric applications with the development of the laser scanning technology has gained a new dimension. Thousands of points on the object surface with a laser scanning are obtained more economical and less time required than 3-dimensional measurement technique based on the classic methods.

In this study, inner and outer surfaces of Silile Ayai Eleni Church (Konya) were scanned from various stations by laser scanning. All measurements are combined with Polyworks software and drawings were carried out with Z-map software. Moreover, the photographs are taken with a calibrated digital camera. As a result, the 3D modelling of outer and inner surfaces of Silile Ayai Eleni Church (Konya) were evaluated and the 3D modelling of surfaces of Silile Ayai Eleni Church (Konya) were obtained in the way based on rolove studies.

2. MATERIAL AND METHOD

2.1 Silile Aya-i Eleni Church (Konya)

Silile is a special place, which has a significant centre for early Christiyanity period, and has a special meaning for Anatolia civilization where different cultures were living in peace. After Christ in 327, Byzantium Emperor Constantine's mather Helena whilst she was going to Quds for pilgrimage stoped off in Konya had saw the significant carved temples from the early Christianity period, she then had decided to have a temple constructed. By applying many constructions during centuries, Ayai Eleni Church reached the present days. Over the inner gate there is a inscription which is telling the history of the church in Greek Alphabeth. Another three lined inscription indicates that the church restored at Sultan Mejit's time. During the its construction, the smooth hewn stone was used Rooms that were carved in its courtyard are available. Nartex is approached through the north gate of the church. The women mahfil, which bidirectional stone stairs lead to, are located here. The church's main dome is situated on four elephant feet, it has three nefl. Within the church, the wooden preaching seat (throne-like)

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which its top was decorated with gypsum and a wooden gypsumed latticework which devides the main hall are an art masterpiece. On the columns of the domes passing places, there are pictures of Christ, holy Mary and apostles URL.1).

2.2 ILRIS-3D Terrestrial Laser Scanner

Optech's ILRIS-3D Intelligent Laser Ranging and Imaging System is a complete, fully portable, laser-based imaging and digitizing system for the commercial survey, engineering, mining and industrial markets(URL2).

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 eyesafe
- On-board 6-megapixel digital camera and large-format LCD viewfinder
- Ruggedly designed for demanding field applications
- Battery operated
- No leveling, retro-reflectors, or mirrors required

Dynamic scanning range	3 m - 1,500 m to an 80% target 3 m - 800 m to an 20% target 3 m - 350 m to an 4% target
Data sampling rate (actual measurement rate)	2,500 points per second
Beam divergence	0.00974°
Minimum spot step (X and Y axis)	0.00115°
Raw range accuracy	7 mm @ 100 m
Raw positional accuracy	8 mm @ 100 m
Laser wavelength	1,500 nm
Laser class (IEC 600825-1)	Class 1
Digital camera	Integrated digital camera (CMOS sensor) optional external camera
Scanner field of view	-20° through 90° (V) x 360° (H)
	-90° through 20° (V) x 360° (H)
Scanner field of view	40° x 40°

Table.1 Some technical properties of ILRIS-3D Terrestrial Laser Scanner

3. RESULT

Both inner and the outer surface of Sille Ayai Eleni Church were scanned by different views. All measurements are matched by Polyworks Software. Moreover, drawings of surfaces are realized by Z-Map Software. Not only point cloud but also images taken with Nikon D80 digital camera calibrated are used during drawing.

Inner and outer space of Sille Ayai Eleni Church is scanned from all direction and caried out 3D modelling.

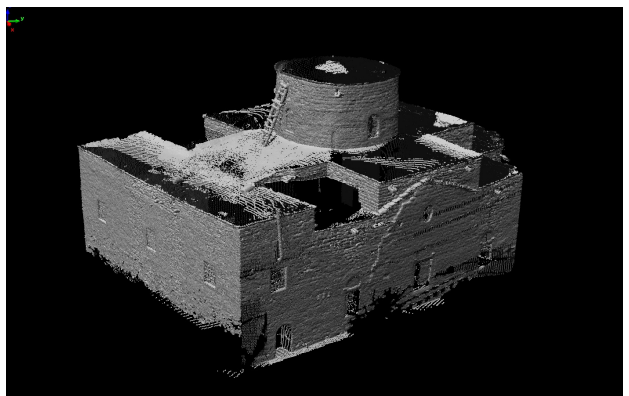
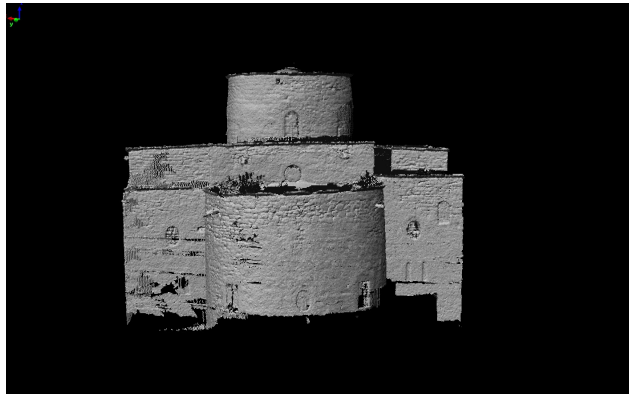


Figure 1. Different views obtained from point cloud of outer facades of Sille Ayai Eleni Church

Orthophotos and drawings of outer facade are obtained from Ployworks and Z Map Software(Figure 2).



Figure 2. Orthophotos and drawings of outer facade

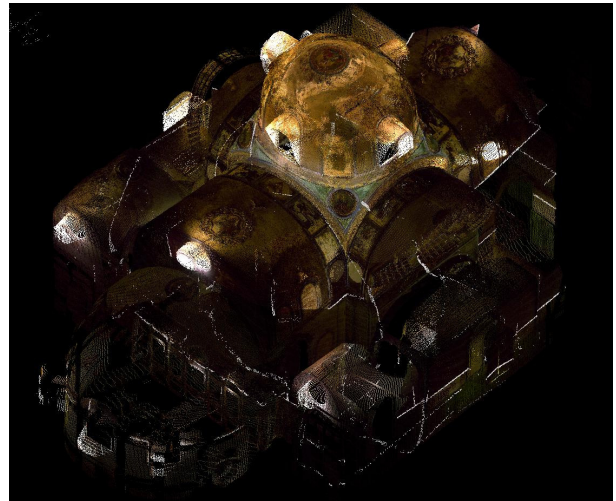


Figure 3. Different views obtained from point cloud of inner facades of Sille Ayai Eleni Church

Digital Elevation Model and orthophoto of dome are obtained from point cloud(Fig 4,5,6).

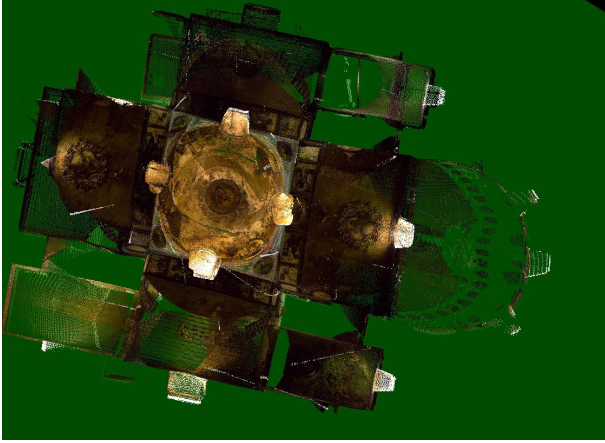


Figure 4. Point Cloud of Dome

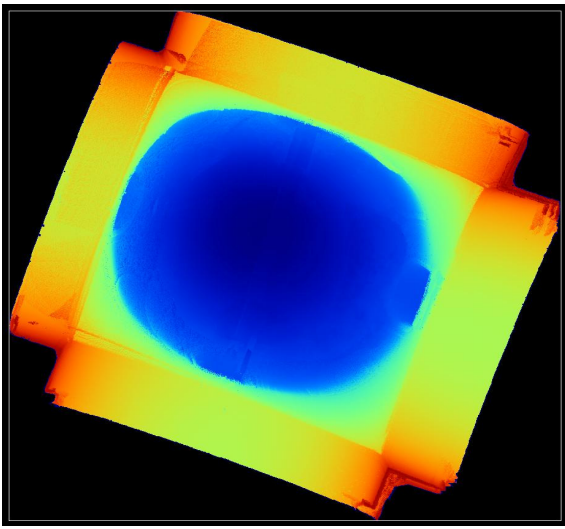


Figure 5. Digital Elevation Model of Dome

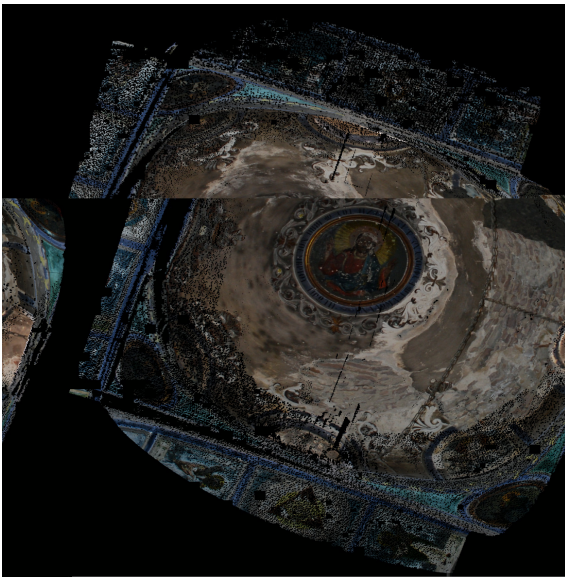


Figure 6. Orthophoto of Dome

4. CONCLUSION

Cultural heritages are damaged by many factors that are natural and non-natural. Therefore, obtaining of the inventory information for these heritages and protection of the information is essential. If they damaged by any reason, their restoration must be done. Therefore, their documentation must have been previously done.

Sille which has a special meaning for Anatolia civilization and was a place where different cultures were living in peace and a significant centre for early Christianity period.

In recent years, the use of Photogrammetric applications with the development of the laser scanning technology has gained a new dimension. High accuracy measurement is realized by laser scanning technology. Thousands of points on the object surface with a laser scanning are obtained more economical and less time required than 3-dimensional measurement technique based on the classic methods.

Inner and outer surface of Sille Ayai Eleni Church are successfully scanned by ILRIS-3D Terrestrial Laser Scanner. 3D models, orthophotos and drawings of them are obtained from point clouds. Finally, Sille Aya-i Eleni Church is modelled and digitally archived.

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