SURVEYING AND DOCUMENTATION OF DETAILED HISTORICAL HERITAGE BY LASER SCANNING

C. Altuntas*, F. Yildiz, H. Karabork, M. Yakar, L. Karasaka

Selcuk University Engineering Faculty Geodesy and Photogrammetry Engineering Konya-TURKEY
caltuntas@selcuk.edu.tr, fyildiz@selcuk.edu.tr, hkarabork@selcuk.edu.tr, yakar@selcuk.edu.tr, lutfiye@selcuk.edu.tr

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ABSTRACT:

In this research, surveying and documentation of historical heritage has been aimed by using laser scanning. Developing technologies has brought out in surveying and documentation of historical heritage. Laser scanning which is the last technology in survey is proper in particularly detailed small objects. Traditional survey techniques have some limitation representation detailed object particularly elements characterized by plastic forms and complex geometrical forms. Laser scanner quickly measures with desired interval of concern object in form x,y,z coordinates. With obtaining point cloud, all decorative details of objects are visualization by enough accuracy and desired form with proper software. In this paper, Sidamara's grave in Archeological Museum of Konya, which have been detailed, has been measured and modeled. The surface models generated from point clouds have been visualization in color and gray scale mode

1. INTRODUCTION

The last developing in measurement technologies has possibility very precission and very quickly at the historical and cultural heritage particularly. Especially, in detailed based object, drawing of all details on the object is very strong and expend to time. However, especially curve details of the object isn't draw in form object resemble. It is cause that very density points which is imitation of the details are not surveying. Traditional heritage recording methods like terrestrial photogrammetry are not suitable for all kinds of objects Laser scanners can survey 3D coordinates of a large amounts points in a short time (Gruen and Akca 2005).

Obtained data by laser scanner is represent to object details with scale factor 1:1 in 3D mode (Scaioni 2002). In addition, laser scanners are measurement to object with RGB (Red, Green Blue) and intensitys value. RGB visiliazition of the object is provide more information about the object. The object is represent by point clouds (Lichti and Gordon 2004). Every points of the point clouds have been x,y,z coordinates and RGB or intensity values. Therefore, information about of details of the object can be acquired with real value. The point clouds can be visualization by different mode in 3D.

In this study, we was scanned Sidamara's grave by laser scanner in Archeological Museum of Konya. The grave is typical of sidamara and belongs to Roma period 250-260 A.D. Point clouds obtained from different stand points were registered into a unique object reference system and, 3D model has been obtained in different mode.

2. LASER SCANNING OF THE SIDAMARA GRAVE

The object dimensions are 2.5mx1.3mx1.5m (lxwxh) approximately and, it has been detailed with figure demonstrate human and animal on the object. Laser scanning was acquisitioned from four stand positions.

Figure 1. Laser scanning of Sidamara's grave by Optech Ilris 3D

* corresponding autor

For laser scanning, Optech Ilris 3D laser scanner was used (Figure.1). Its some technical specifications have been given on Table 1.

Table 1. Optech Ilris 3D laser scanner's some technical specifications (Url1).

Range	3m-1500m(80%ref)
Target regist. accuracy	4mm
Modelling accuracy	3mm
Depth resolution	3mm
Spot size	29mm @ 100m
Velocity	2500 point/sec.
Min.spot step(XandY axis)	0.00115°
Beam divergence	0.00974°

Sidamara's grave has scanned at three hours approximately. Spot step (x and y direction) was selected in 1.6mm and collected to total 7000000 points.

3. 3D MODELLİNG and OUTPUT

The measurement acquisition of laser scanner is local coordinate whose origin has been instrument. "The output of a scan from a given station is a3D point cloud (a sort of photogrammetric model with scale factor 1:1), whose coordinates refer in principle to an instrumental reference system, which therefore changes from station to station. All the model points must be put together, transforming their coordinates into unique object reference system" (Scaioni 2002). For this purpose, first point cloud was selected reference coordinate system and other point clouds were transformed into its coordinate system. Point clouds were transformed into reference coordinate system used by Polyworks software (ver.9.1.8) and formed 3D model by combined. Transformation was done with at least three point select which was seen detail on every point cloud by used iterative closest point (ICP) method. Statistics with combined of the all scans have been given in figure 2.

Name	Im 6
Mean	-3.39e-005
Std Devia	0.00332337
Minimum	-0.01
Maximum	0.01
Peak	2877
Number of Points	186821

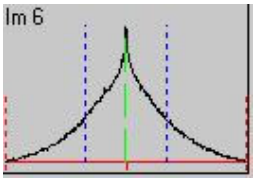
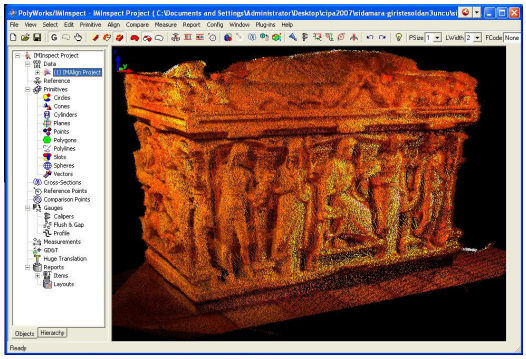
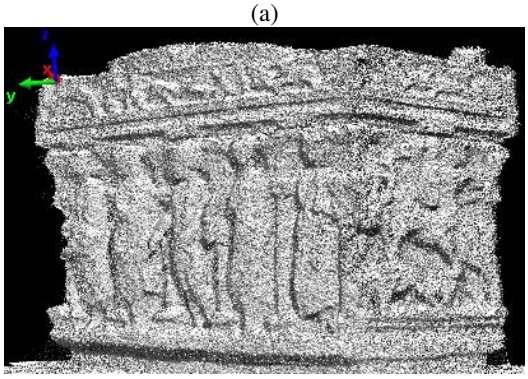


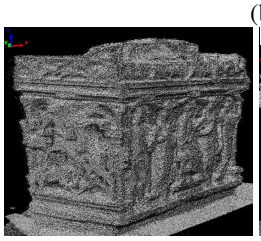
Figure 2. Statistics of combination with point cloud (in meter units)



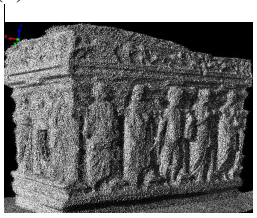
(a)



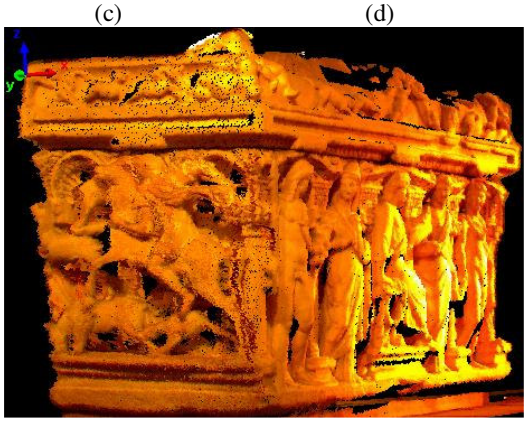
(b)



(c)



(d)



(e)

Figure 3. 3D models in gray scale (b,c,d) and color (a,e) mode.

The object's 3D model has obtained in RGB and gray scale mode. Object animation was done for video format.

4 CONCLUSION

Laser scanners are very effective method for cultural and archeological heritage survey. It can measure directly 3D coordinates of a large amounts of points and colors in a short time period. Its geometrical and color data are provided more information about of the object. Especially, detail based object such as the object can be surveyed and documentation in sort time. 3D model of the object can use for information system for and virtual museum.

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