Standard Review

3D laser scanning and photogrammetric measurement of Akhan caravansaray

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A caravansaray is a roadside inn where travellers can rest and recover from the day's journey. Caravansarais supported the flow of commerce, information and people across the network of trade routes covering Asia, North Africa, and South-Eastern Europe. Akhan caravansaray which has been known as “Wite Han” for the white marble used on the front door was built by the governor of the denizli Seyfettin Karasungur. Akhan is 7 km far from the Denizli city and it is at the side of Denizli Afyon Road. Akhan is the last caravasaray at the west of the Anatolia. It was built in 1253 years. This Han was built as a charitable institution funded by Governor Seyfettin Karasungur ibn Abdullah, Emir of Ladik. He was the governor of Denizli for over 20 years, and was a brother to Celaleddin Karatay. In this study laser scanning methods have been used to obtain 3D model of the Akhan caravasaray. In this stage only exterior facades have been scanned and obtained 3D model. But at the same time, close range photogrammetric measurement also completed for 3D drawings of caravansaray. Both photogrammetric and laser scanning results will have been at this presentation.

Key words: Laser scanning, photogrammetry, 3D modelling, caravansaray.

INTRODUCTION

For the past few years, 3D (three dimensional) terrestrial laser scanning systems have been employed very successfully in many engineering applications. These scanning systems allow the user to survey structural surfaces and 3D bodies. The data is then transferred to computer where it is converted into accurate three dimensional models. The high quantity and precision of the measured points enable the user to generate realistic, 3D illustrations of complex structures (Shulz and Inge- sand, 2004; Fröhlich and Mettenleiter, 2004; Impyeong and Yunsoo, 2004). 3D terrestrial laser scanning techniques are an effective method of creating complete, 3D documentation of the spatial geometries of an object. They yield a maximum of information and have unsur- passed accuracy to within a few millimeters. The recording techniques are hands-free which allows hazar-
the same object several times from different
observation points, it is impossible to record the very
same points in these repeated surveys. Therefore,
deviations can only be noticed after objects have been
extracted from the point clouds and modelled. If the
geometric properties of the object are known, however,
the deviation of single points from the object’s surface
may be an indication for the accuracy. Using a plane
surface would be the simplest case, but cylinders,
spheres or irregular surfaces can also be considered
(Ingesand et al., 2003).
Terrestrial laser scanning technology seems to be a
very promising alternative for many kind of surveying
applications. Terrestrial laser scanners allow to acquire
very quickly a huge amount of 3D data which can be often
profitably combined with colour high resolution digital
images to provide a 3D representation of the environment
where we live. As a major advantage of this approach,
real objects can be represented more adequately than
through a single picture or collection of pictures, by
providing a higher level of detail together with a good
metric accuracy. These models are currently used for
cultural heritage, industrial, land management or also
medical applications. In the cultural heritage field, 3D
models represent an interesting tool for as-built document-
tation and interactive visualization purposes, e.g. to create
virtual reality environments (Bornaz and Rinaudo, 2004).
In some cases (El-Hakim, 2001) 3D models obtained by
laser scanning were used to fill a virtual environment with
real objects, in order to get a faithful copy of a real
environment, such as the interior of a museum or
historical building. Nowadays, the use of laser scanner
based 3D models in VR systems (that is a cave) opens
new perspectives both for entertainment applications and
for scientific research, though a different information
content is required. Indeed, while in the former case the
interest is pointed mainly towards to the visual appealing
(viewing quality) of the model, for scientific applications
the geometric accuracy of the 3D plays the main role,
regardless the size and shape complexity of surveyed
object.
Laser scanning means the deflection of a laser beam
by moving (sweeping or rotating) mirrors, the reflection of
the laser beam on object surfaces, and the receiving of
the reflected laser beam. In opposite to measurements on
reflectors, the accuracy of distance measurements
depends on the intensity of the reflected laser beam.
Physical laws describe the functionality between accuracy
and intensity. Main parameters in these functions are the
distance, the angle of incidence, and surface properties
(Shulz and Ingesand, 2004; Impyeong and Yunsoo,
2004).

SITE DESCRIPTION

Study area is at the Denizli city in Turkey Denizli is in
southwestern Turkey, in the country’s Aegean Region.
The city has a population of about 400,000 (2006 census)
and is the capital city of Denizli Province.
Denizli attracts many visitors to the nearby mineral-
coated hillside hot spring of Pamukkale, and the ancient
ruined city of Hierapolis, as well as ruins of the city of
Laodicea on the Lycus, the ancient metropolis of Phrygia.
Also in the depending of Honaz, about 10 miles west of
Denizli is what was in the 1st century A.D., the city of
Colossae (Figure 1).
CASE STUDY AND FIELD WORK

In this study OPTECH laser scanner have been used to make scanning process. Optech’s ILRIS Laser Scanner is a fully portable, laser-based, ranging and imaging system for the commercial survey, engineering, mining and industrial markets. A compact and highly integrated instrument with digital image capture and sophisticated software tools, the ILRIS Laser Scanner is a laser imaging system that addresses the three-dimensional data capture needs of commercial users.

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.

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 eyesafe
- On-board 6 megapixel 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

Easily hand carried and deployed by a single operator (Figure 2).

This project has two steps. First scanning of exterior façade. Second scanning of inside of caravansaray. When completed exterior and interior scanning, combining of exterior and interior scanning will be completed. In this study 10 scanning station have been used to scan all exterior facade of AKHAN caravansaray. In this project only exterior of caravansaray has been scanned. About 15 0000 number points have been surveyed. Polyworks software has been used to align the point clouds (Figure 3).

Conclusion

3D terrestrial laser scanning is more economical and faster than conventional techniques. All measurements can
be carried out on the model. 3D coordinates in terrestrial laser scanning are obtained as point clouds. Many 3D coordinates on an object's surface is measured in a very short time. Objects, such as corner points or edges, are not directly recorded; instead they have to be modeled from the point clouds in a separate process. All 3D measurement can be made from the obtained model. In this study Akhan caravansaray scanning has been completed. Conservation process will start in this cultural heritage. Laser scanning data will be used to prepare conservation Project and to make all needed measurement.

REFERENCES

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