

Archaeological 3D GIS for Virtual Museum in Damascus

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ABSTRACT

The measurement of old architecture or the stone chamber in the mound tombs is very difficult. In Japan, it was used stereo photogrammetry or measurements by man themselves, but, these methods are needed much time and many steps to make maps. The land developments are increasing, the old architectures are also hearted year by year. In these conditions, the measurements of these archaeological or architectural monuments are needed for preservations or reconstruction. Out side view's measurement of these monuments are comparatively easier than inside of architectures and stone cambers. It is important that the measurement about the inside of these monument is found and established the real-time or rapid systems. In this paper, we developed new measurement for the inside of archaeological or architectural monuments using laser range finder and CAD system.

1, INTRODUCTION

Since the Ho-Ryu Ji (法隆寺) Temple is registered at World Cultural Heritage, the measurement of old architectures are increasing for the preservation or reconstruction. The other hand, the measurements of the inside of stone chambers in mound tombs also increasing before constructions that land development are increasing, in Japan.

The measurements of these cultural remains were used stereo photogrammetry or sketched by surveyor themselves. But, these methods were needed much time and many steps to make maps.

2, LASER RANGE FINDER

2-1, Laser Range Finder Measurement

The stereo photogrammetry needs stereo photos or images to make to maps, and needs many steps and expensive hard wares, for examples, plotting machines, etc.

And also, the stone cambers in mound tombs in Japan, the width of stone cambers are become narrower to the top. Then, we could not take pictures if we could not take fully distance from the objects, we needed many stereo pea photos or images to make maps.

The laser range finder, made by Optech Inc. in Canada, was

developed for the measurement of the cavity monitoring. Then, this system is called Cavity Monitoring System (CMS). That is able to measure each 20 points per second, and 280 degrees in horizon angle, 360 degrees in vertical angle.



Fig.-1 Cavity Monitoring System

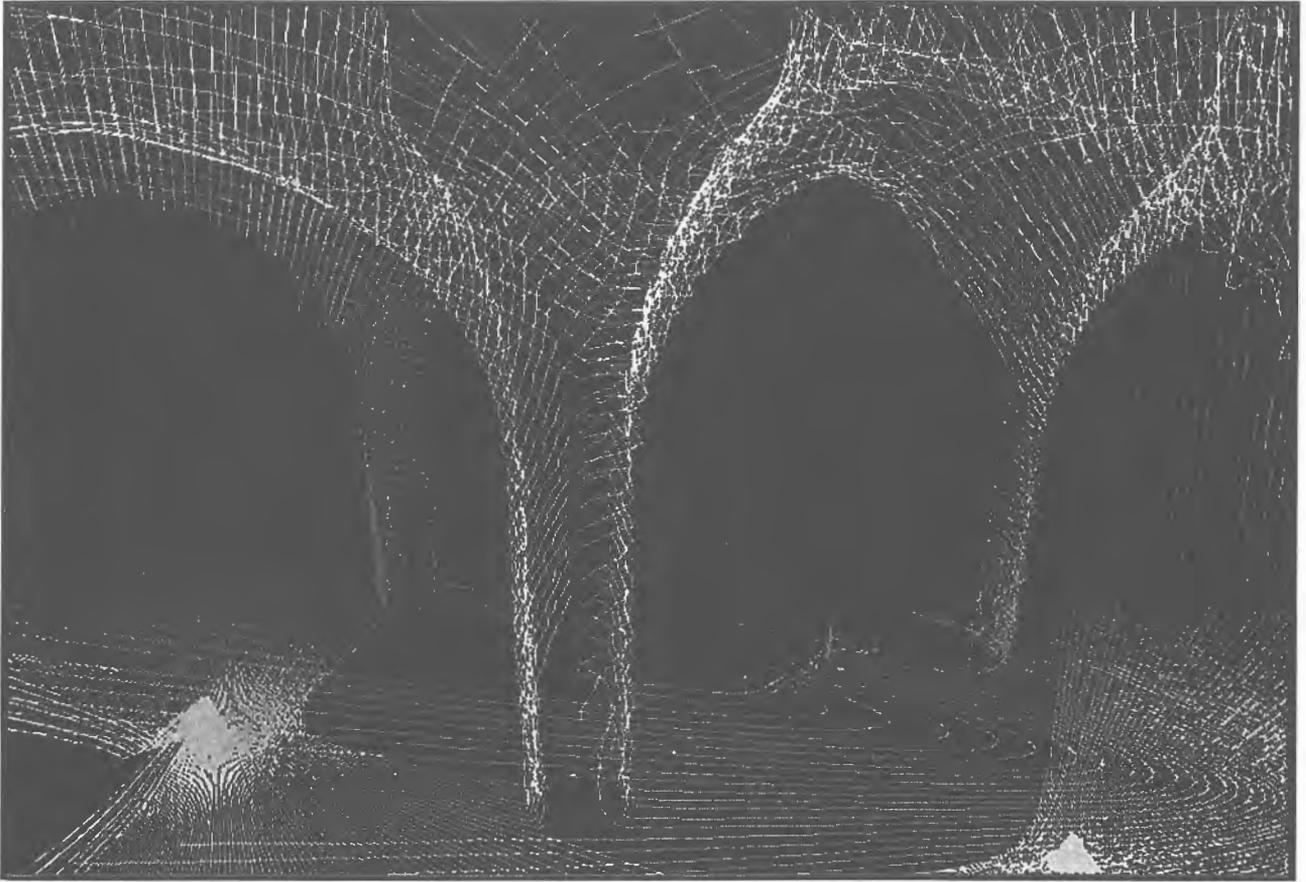


Fig.-2 Raw Data from CMS system

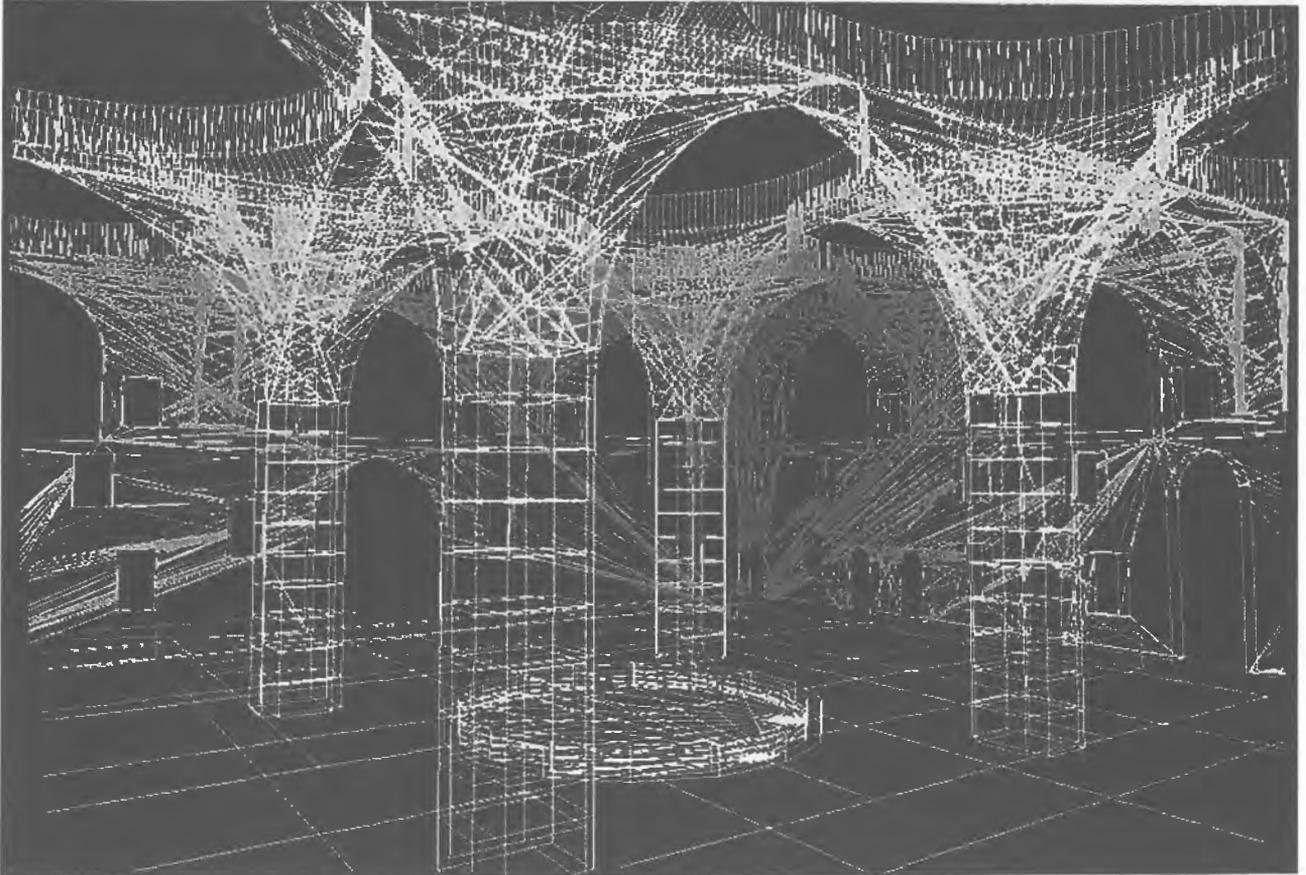


Fig.-3 Data Attribute Model

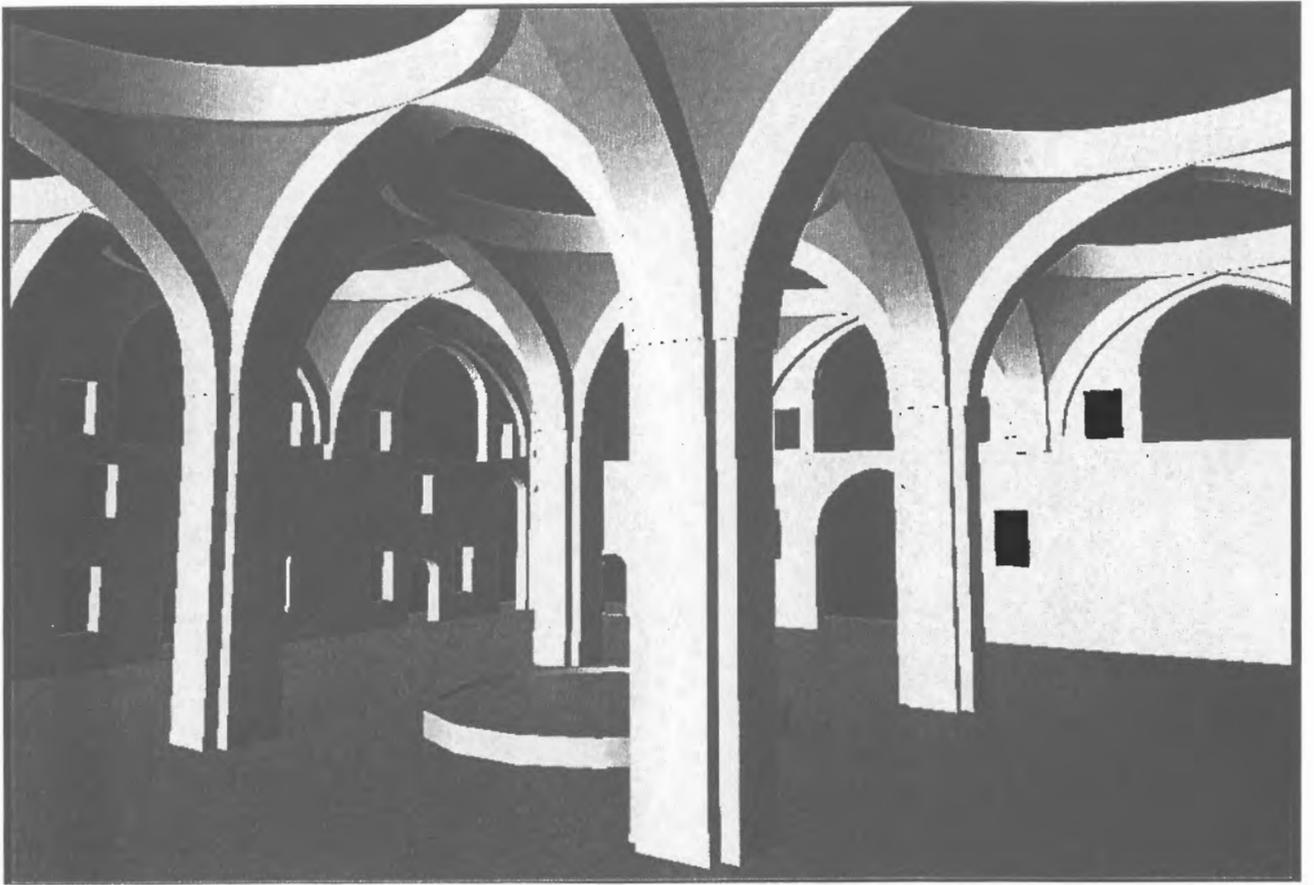


Fig.-4 Shading Model

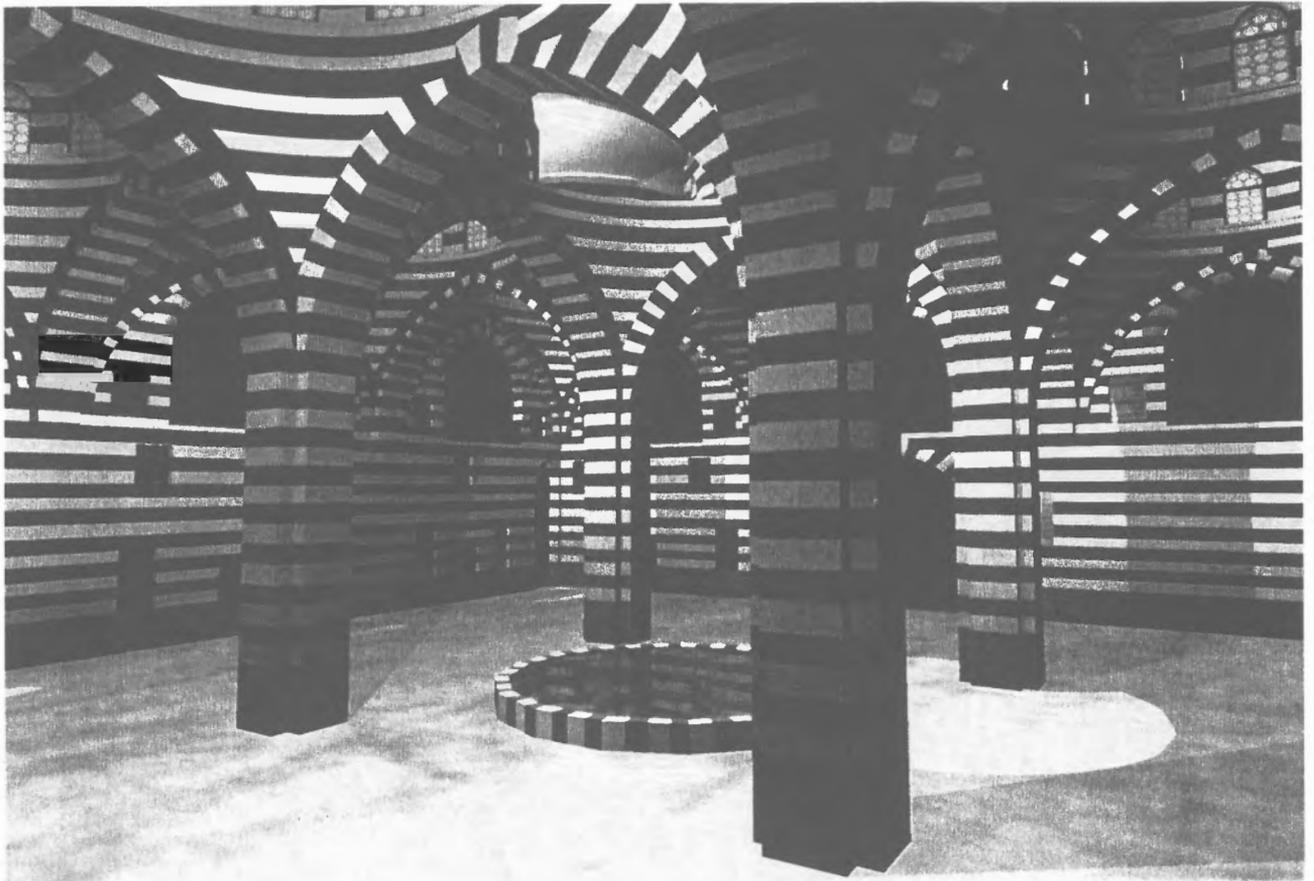


Fig.5 Texturing Model

It needs 30 seconds to get each one round data, for example, we set each one degree round, we need 70 minutes from 0 degree to 140 degree.

2-2, The Measurement of Han As'sad Bacha in Damascus

Han As'sad Bacha is the one of World Cultural Heritage in Damascus, is the inn or trading center for tourists (Caravan-sary). This building are 50m*50m wide, and has 9 domes on the roof, and they are supported 4 poles. This building is said to built about 2000 years ago, and the Government of Syria Arab Republic has the plan to remake to Natural Historical Museum. In order to this purpose, the Government of Syria Arab Republic requested to the Government of Japan, how to remake without reconstructing, and the ideas for the museum exhibitions, it needs real information and images of Caravan-sary, without the contact measurement.

We set the Cavity Monitoring System at 6 points on the floor of Caravan-sary, in order to put out the blind parts of buildings (Fig.-1). But, it was not clearly put out the blind parts, therefor this building is too complex and large. We made up for the lack parts to put on the data from the same part's informations. Especially, the top domes were needed these informations.

We needed 2days to get the coordinate data of whole of Caravan -sary using CMS. The raw data images from CMS shows circle and radial (Fig.-2).

3, DATA TRANSLATION

3-1, Data Translation

The raw data from CMS must change from circle and radial data to right angle coordinate data in order to make shading model or texturing of images. CMS data that were taken from 6 positions in Caravan-sary have to be combined to right angle coordinate data.

All of coordinate data from all surface of the roof, wall, and floor of Caravan-sary were not taken from CMS only, so, we must put for any data on the lack parts from the same parts, that it is considerable the same parts are similar.

3-2, Data Attribute Determination

Inside of Caravan-sary are painted, one more attribute that is coloring, the edge of the shape, and the boudoir coordinate of coloring are important for the 3D modeling. After the adding of data attribute, we made shaping model (Fig.-3).

3-3, Shading Model

All of these attribute and data were combined with CAD system. Then, we constructed shading model from the CAD data (Fig.-4).

4, TEXTURING AND MODERING

4-1, Texturing

In this time, we got the images by steel camera, but, it is the best way that taking by radio-controlled CCD camera with CMS together. Now, we are developing this system.

Texturing of inside images of Caravan-sary is, at first, the positioning between the fitting points of steel images and the fitting points of the shading model. We used these fitting points that the corner of the walls or the step of the poles (Fig.-5).

The lacks of images were put for the same images of same parts, as same as the lack coordinates.

4-2, Computer Graphics Modeling and Animation

After the texturing, we made computer graphics at the each parts of Caravan-sary, using popular software to make shadows, reflectors, and sunlight images, etc.

It is possible to make the animation to join these computer graphics each 1/30 Or 1/60 second. Some short animation were made from these computer graphics images to use the presentation of Caravan-sary.

5, CONCLUSION

These method are useful to appear the architectural monuments or the archaeological remains, especially, in Japan, we must excavate many stone chambers in the mound tombs before the constructions.

The cross section maps of these stone chambers are very difficult to make by stereo photogrammetry. It needs many stereo models and the wide and depth space for taking stereo pictures or images. Japanese stone chambers are narrow width on top, so, we could not take long distance from object. In these cases, CMS system is available to make maps and 3D GIS, and useful to Virtual Museum that we can see any scenes, if we could not get those real places.