

Measurement and Expression of a 3D Terrain and the Volume Calculation

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Abstract. In this paper, we proposed the algorithm computes the volume of the 3D object shape. Multi camera measurement was performed to measure the object and the algorithm was proposed to calculate the volume. The proposed algorithm can be not only used as the volume calculation of a 3D object.

Keywords: Volume Calculation, Camera Sensing, Calibration, Volume Calculation

1 Introduction

The reliability of the national waste landfill volume management and the accuracy of the capacity are required. Due to the difference of measurement units of the import waste weight (tons) and the landfill volume (m³) there are errors in statistics accuracy. There are problems where information show low reliability at areas such as landfill management where reclamation is possible. Monitoring for waste landfills in real-time operations management and follow-up management is required[1][2].



Fig.1. The objective of research and development

Especially, work information related to waste landfill and information of reclamation progress can become an appropriate landfill management data or can become a basic data if using the landfill post-lot. Therefore it is necessary to keep the information [3].

The purpose of this research is to produce and express external information (landfill geometric information) and internal information (Analysis of difference according to the change of point of view, landfill capacity and volumetric information) and build '3D landfill geometric information expression system'. Also to analyze the accuracy of the landfill geometric information and to meet the level of accuracy the waste landfill asks by conducting 'Research of maintaining management of 3-dimensional landfill geometric information accuracy'.

2 The Proposed Method for Volume Calculation

Stage 1: Camera interface

Stage 2: Stereo Calibration.

Stage 3: Stereo image input

Stage 4: Image merging the three-dimensional point cloud

Stage 5: To obtain three dimensional system mashing use triangle meshes.

(a) As a calculation method use the red soil surface or the bottom as a flat surface to reference the plane.

(b) Display the selected grating on the surface of the criteria. For this purpose, calculate the average height for the center of each grid. When there are more TIN (triangular irregular network) calculate the total volume by multiplying the average height for the area of the standard plan

3 Test

Figure 2 shows two stacked boxes which are photogrammetry targets. Figure 3 shows images taken of two stacked boxes and calculated the point clouds and made applied a non-uniform triangular mesh. In Figure 3, the vertical and horizontal lengths are measured from photogrammetry.



Fig. 2. Two rectangular boxes for experiment(left

Fig.3. The non-uniform triangular mesh model for two boxes(right)

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Table 1. The Measurement comparison of two boxes with two methods

	<i>Bog box</i>			<i>Small box</i>		
	Measured by a scale	Measured by photogram	Error%	Measured by a scale	Measured by photogram	Error %
Left length (mm)	505	501	0.8	265	260	1.19
Width length(mm)	404	399	1.2	245	232	1.22
H eight(mm)	175	172	1.7	115	119	3.48
Volume(mm ³)	35,791,875	34,382,628	3.9%	7,466,375	7,178,080	3.86%

4 Conclusion

This paper considers the problem of measuring the 3D object terrain such as landfill facility. To do this, multi camera was performed to measure the surface of a 3D object terrain and the point cloud was obtained which is commercially available. Before calculation of a real 3D object, computer simulation was performed to carry out the volume calculation of a 3D terrain model. As a result, the computer simulation showed the validity of the proposed 3D volume calculation method. Applying the proposed method, we can get the volume of a 3D object such as the volume of a landfill facility.

Acknowledgments. This work is supported by EI project - the real time measurement and analysis of -the institute of environment technology under ministry of environment of Korea.

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