A Study on Automatic Space Analysis for Plant Facilities Based on 3D Octree Argorithm by Using Laser Scanning Information

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Abstract: While the plant projects grow bigger and global attention to the plant is increasing, efficient space arrangement is not working in plant project because of the complex structure in installing the equipment unlike the construction project. In addition to this, presently, problem in installation process caused by the disagreement between floor plan and real spot is rising. Therefore the target of this research is to solve the problems and reaction differences, caused by changing the space arrangement in installing the equipment of plant construction. And this research suggests the equipment arrangement method for construction and related processes. To solve the problem, 3D cloud point data of space and equipment is collected by 3D laser scanning and the space matching is operated. In processing the space matching, data is simplified by applying the octree algorithm. This research simplifies the 3D configuration data acquired by 3D scanner equipment through the octree algorithm, and by comparing this data, identifies the space for target equipment, and finally suggests the algorithm that makes the auto space arrangement of equipment possible in construction site and also suggests the process to actualize this algorithm.

Keywords: Octree algorithm, 3D shape scanning, Equipment placed

I. INTRODUCTION

1.1 Background and Objectives of the study

While the plant projects grow bigger and global attention to the plant is increasing, efficient space arrangement is not working in plant project because of the complex structure in installing the equipment unlike the construction project. In addition to this, presently, problem in installation process caused by the disagreement between floor plan and real spot is rising. Therefore the target of this research is to solve the problems and reaction differences, caused by changing the space arrangement in installing the equipment of plant construction. And this research suggests the equipment arrangement method for construction and related processes.

1.2 Scopes and Methods

This study presents the equipment / device placement space secured method in plant construction. The information obtained by the laser scanning to produce the 3-dimensional shape information. And establish a three-dimensional space model using three-dimensional shape information. After applying the algorithm it was used. The flow of the study is shown in Figure 1.

II. SPACE MATCHING PROCESS USING THE OCTREE ALGORITHM

2.1 Application of the octree algorithm

The octree algorithm is tree structure, and dividing the target area into eight rectangular. Figure 2 shows the octree algorithm.
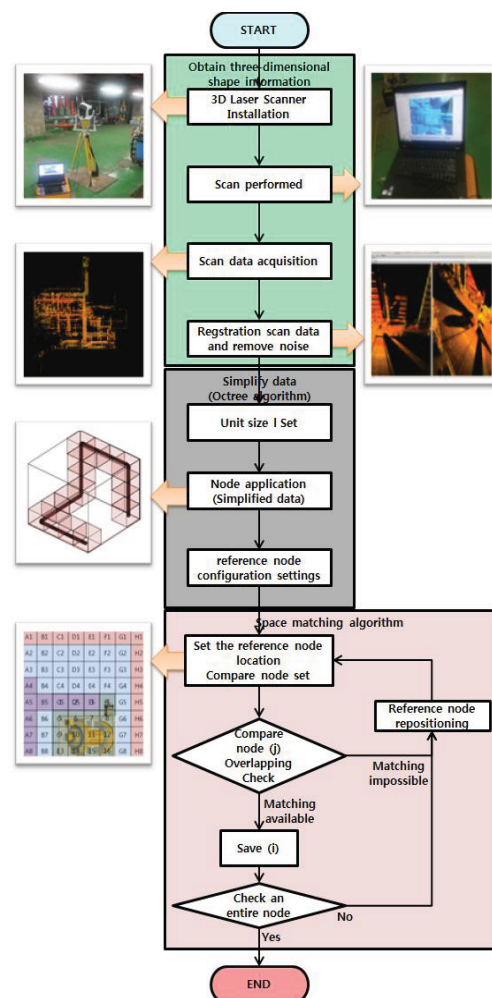

Figure 1 Study process

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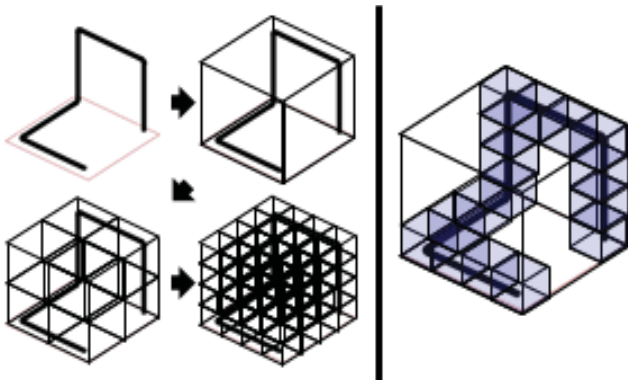www.iccepm2015.org

Figure 2 Octree algorithm

2.2 Identify the possibility of matching the three-dimensional shape information

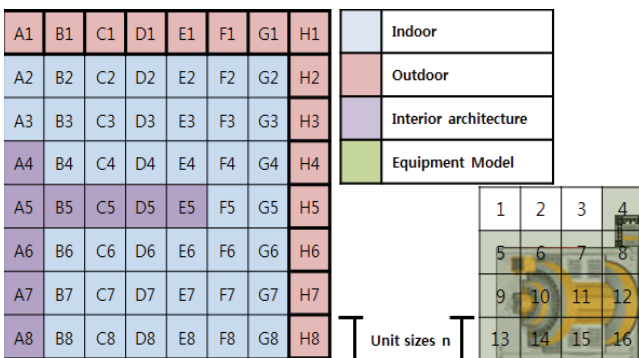A top view of the device according to the virtual room octree algorithm is as follows.

Figure 3 Uint Size Setting and Data Simplification

Matching of the room and equipment can be identified separately in four criteria based on the presence of data.

TABLE I Matching conditions and space and unit

space	unit	Matching to availability	Matching example (Figure 5)	
			space	unit
○	○	Available	A2	1
○	●	Available	A2	5
●	○	Available	E5	1
●	●	Impossibility	E5	5

○: Data Absence / ● : Data Exists

2.3 Implementation of space-matching algorithms

Algorithm was applied to the actual cloud point data. Space data have been output, only the corner portions. Equipment data may be output to the color of the surface.
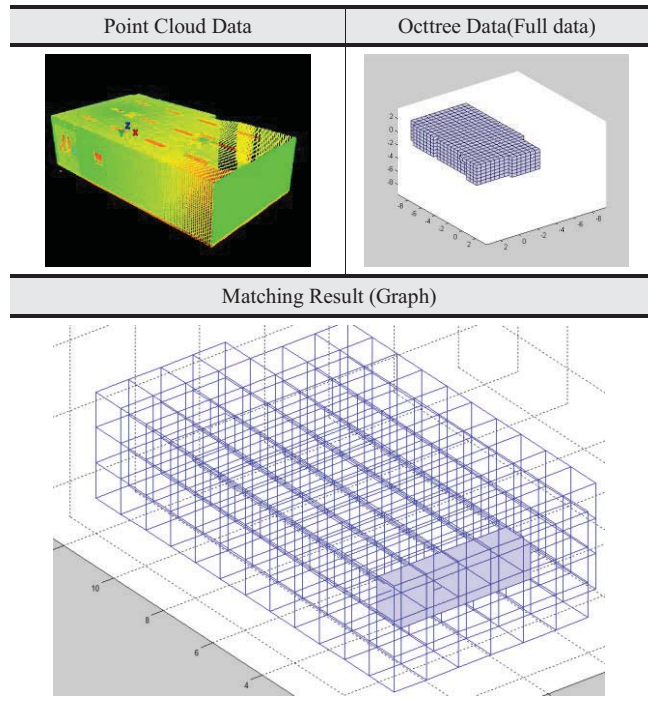

Point Cloud Data	Octtree Data(Full data)

Matching Result (Graph)

Figure 4 Octree Algorithm Application

III. CONCLUSION

The purpose of this study was to simplify spaces and equipment. It has been developed two kinds of data is an algorithm to determine whether to be matched. And it developed in this process. By using the above process, it is expected to be possible to solve the problems and the differences of reactions for the space rearrangement.

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