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DEVELOPMENT OF BIM/GIS INTEROPERABLE PLATFORM FOR FACILITY MANAGEMENT IN KOREA

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ABSTRACT

South Korea is making facility design using Building Information Modeling (BIM) mandatory and expanding the use of BIM. However, BIM technology has been used limitedly only from the design to construction phases but it has rarely been applied to the maintenance phase in Korea. To overcome this problem, data management and related technologies are needed during the entire life cycle of the facility construction process.

This study developed a platform by which BIM data at the construction phase and geographic information system (GIS) data at the operation and service phase can be interoperable for integrated management during the entire life cycle of facility construction data.

Keywords: *BIM, GIS, Platform, 3D Visualization, Facilities maintenance*.

I. INTRODUCTION

Facilities construction data are important not only in the design and construction phases but also in the maintenance and operation phases. It is also useful in construction and update of the national base map[1]. Moreover, it is highly useful data in terms of construction of the three-dimensional (3D) national base map that is currently becoming an issue [2]. However, facilities construction data at the pre-construction phase are not yet utilized up to the post-construction phase, which is a fundamental problem. To overcome this problem, data management and related technologies are needed during the entire life cycle of the facility construction process.

Furthermore, as facilities are becoming high-rise and large scaled in terms of spatial information, the importance of database construction and utilization about indoor space has become more important than ever. Thus, it is necessary to develop a technology to manage and integrate the data effectively. That is, a technical foundation that can facility efficient operation and services from building level to regional level is needed to enable interlinking utilization between facility construction and spatial data.

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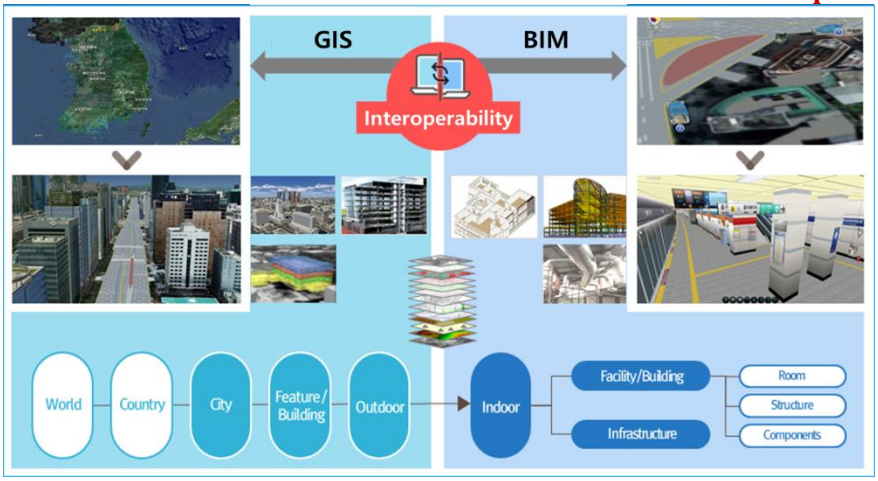

Figure 1:Conceptual Diagram: BIM/GIS interoperable platform

This study developed a platform by which BIM data at the construction phase and GIS data at the operation and service phase can be interoperable. Figure1 shows conceptual diagram for BIM/GIS interoperable platform.More specifically, 3D visualization software of BIM/GIS interoperable platform and indoor and outdoor spatial information linked utilization technology were developed.

II. DEVELOPMENT OF 3D VISUALIZATION TECHNOLOGY OF BIM/GIS PLATFORM

Development of 3D visualization algorithm of large amount data

The adaptive level-of-detail (LOD) concept was employed to interlink BIM data concentrated at a facility level and GIS data at a regional level [3].Figure 2 shows a process that structures the configuration adaptive LOD and creates texture coordinate information of each shape information. The information obtained through the extraction algorithm of adaptive LOD shape information is basic data to interlink a large number and amount of BIM data with the platform. The lightweight process of external data is conducted from the left to right side as shown in the below figure 2. Furthermore, texture coordinate information can be created simultaneously.

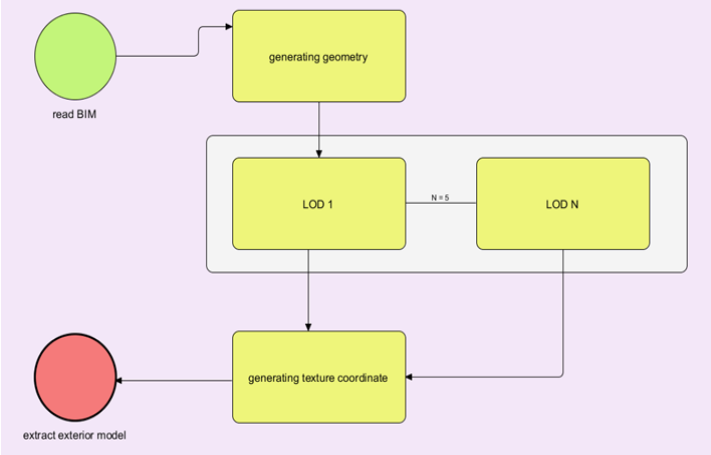

Figure 2:Business process Diagram for configuration adaptive LOD and creates texture coordinate information

Development of 3D visualization technology of large amount data

This study developed a light map technique to increase visibility of the BIM/GIS interoperable platform. Figure 3 shows the experiment result before and after applying the light map to BIM data.

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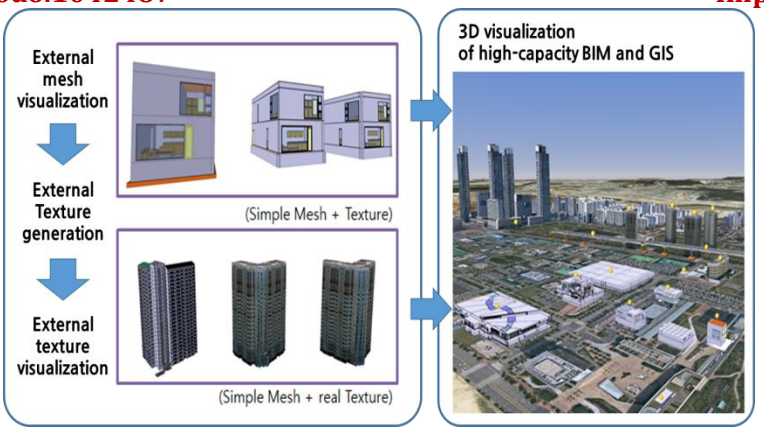

Figure 3:3D Visualization of high-capacity BIM and GIS data

The image at the left side is actually visualized example in the BIM/GIS interoperable platform in which color and edge are applied to the basic mesh structure. The image at the right side after applying the light map is an example that shows the basic mesh structure applied with color and light map instead of edge. As shown in the example that applied the light map, a light source was given to lighting in the indoor so that visibility was improved by creating and applying the light map more than existing edge mode did. Moreover, no significant difference in data volume was found between edge and light map. Thus, it did not affect a size of data as well. Figure 4 shows the visualization of bridge using the visualization technology developed in this study.

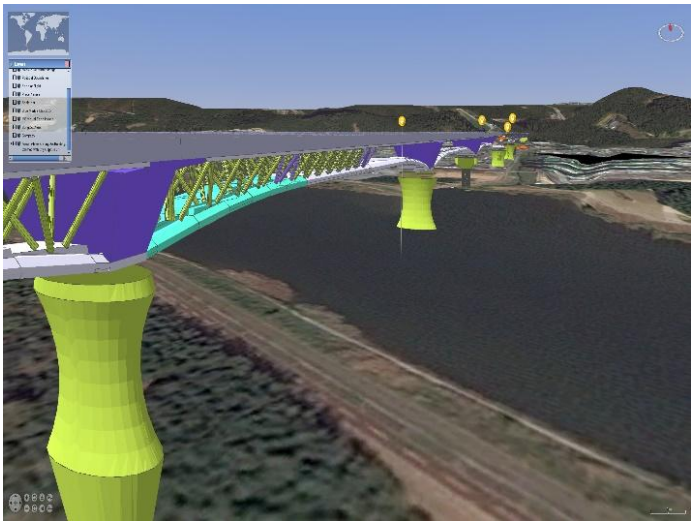

Figure 4:3D Visualization of high-capacity BIM and GIS data

III.DEVELOPMENT OF UTILIZATION TECHNOLOGY THAT INTERLINKS INDOOR AND OUTDOOR SPATIAL INFORMATION

Optimization of correction module function of 3D coordinate in the platform

For direct interoperability of indoor and outdoor spatial data, local coordinates in the BIM/GIS spatial interlink model was automatically converted to 3D coordinate of GIS, and the user-friendly correction module was developed in an optimized manner. That is, a module that can convert geometric information of BIM expressed in a single coordinate into absolute coordinate in the GIS was developed.

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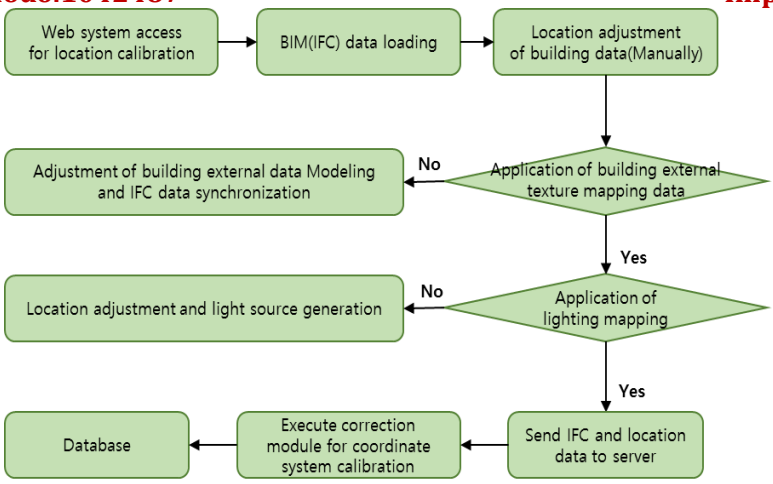

Figure 5:Concept flow - correction module function

Element technology for utilization services that interlinks indoor and outdoor spatial information based on the platform

Efficient visualization technology is important for utilization services that interlinks indoor and outdoor spatial information. To do this, this study applied BIM data to texture mapping-based building shape modeling technology. It also applied lighting mapping to BIM indoor spatial information (Figure 6).

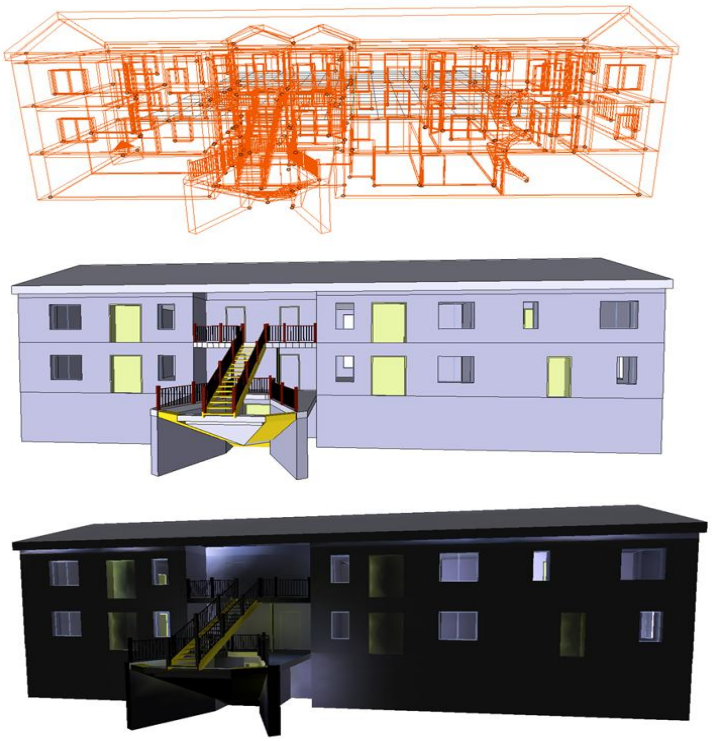

Figure 6:Example of applied Light Map based on shape information (color mapping)

Furthermore, the light map where indoor light source can be processed was applied to improve visibility of indoor spatial information of buildings. The visualization of lighting source and shadow can be now possible from simple shape information through color mapping by object used previously thereby providing more augmented visualization than simple shape information through color mapping by object.

Tables and figures should be placed close after mentioning them in the main text. All figures and tables should be numbered with Arabic numerals. Table headings should be left justified above the tables. Figure captions should be centred below the figures. Minimum figures' resolution: 150dpi.

IV. CONCLUSION AND EFFECT

Currently the expansion of BIM is an international trend. In Korea, design via BIM has been mandatory for public buildings whose project budget is KRW 50 billion since 2012 and a range of BIM-applied public buildings has been expanding.

In addition, technical test and standardization work are underway to interlink and integrate BIM and GIS at the Open Geospatial Consortium (OGC), Building Smart, and the ISO, which are well-known international standardization organizations. One of the typical examples is a case for integration of CityGML, which is 3D city model standard of Industry Foundation Classes (IFC), which is the industrial standard of BIM, and GIS.

However, BIM technology in Korea has been used limitedly only from the design to construction phases but it has rarely been applied to the maintenance phase. To overcome this problem, data management and related technologies are needed during the entire life cycle of the construction process.

Figure 7:3D visualization of BIM/GIS interoperable platform

This study developed a platform by which Building Information Modelling (BIM) data at the construction phase and geographic information system (GIS) data at the operation and service phase can be interoperable for integrated management during the entire life cycle of construction data. More specifically, 3D visualization software of BIM/GIS interoperable platform and indoor and outdoor spatial information linked utilization technology were developed.

V. ACKNOWLEDGEMENTS

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