

Automated Methodology for Linking BIM Objects with Cost and Schedule Information by utilizing Geometry Breakdown Structure (GBS)

Kwangjin Lee¹ and Youngsoo Jung²

Abstract: *There has been growing interests in life-cycle project management in the construction industry. A lot of attention is given to Building Information Modeling (BIM) which stores and uses a variety of construction information for the life cycle of project management. However, due to the additional workload arising from BIM, its expected effects versus its input costs are still under discussion in practice. As an attempt to address this issue, one of previous studies suggested an automated linking process by developing Standard Classification Numbering System (SCNS) and Geometry Breakdown Structure (GBS) to enhance the efficiency of integration process of BIM objects, cost, and schedule. Though SCNS and GBS facilitates identifying all different dataset, making object sets and linking schedule activities still needs to be manually done without having an automated tool. In this context, the purpose of this paper is to develop and validate a fully automated integration system for 3D-objects, cost, and schedule. A prototype system for single family homes (Hanok) was developed and tested in order to verify its efficiency.*

Keywords: *BIM, GBS, Cost, Schedule, Automated integration*

I. INTRODUCTION

Much attention has been recently increasing to management from the perspective of life cycle in the construction industry. For life cycle-based management, Building Information Modeling (BIM), which utilizes a variety of information on buildings from the stage of design to operation and maintenance is widely utilized. As this modeling is used in various sectors such as construction, civil engineering, and plant industry, its importance has increased.

However, in terms of carrying out BIM in various practices, requirements to conduct additional tasks and resulting expected effects compared to input costs are still under discussion, and it has been highlighted that research needs to be conducted to lift a burden in linking information from each different BIM-supported software products (Jung and Joo 2011). In one of previous researches as part of research for BIM-linked efficiency, BIM automated linking process based on Standard Classification Numbering System (SCNS) was presented to ensure efficiency in linking schedule, cost items, and information (non-graphic information) (Jung et al. 2013).

This study proposes the method for efficient automatic linking with schedule/cost information and 3D graphic information by using BIM automated linking process on the basis of Geometry Breakdown Structure (GBS) (Jung et al. 2013b) numbering system, which was presented in the previous research, and verifies efficiency through a case example of BIM for a small-sized wooden single family home.

II. VERIFICATION OF AUTOMATED PROCESS

To enhance efficiency, verification was conducted by each stage as shown in Figure 1.

At Step 1, users implement 3D modeling based on a 2D drawing by downloading an object template file with GBS numbers provided on the web.

At Step 2, users can automatically develop and download a project schedule by simply inputting the name of a project, duration, and square footage on the web-based program based on standard durations. The user can change the standard duration in order to incorporate specific conditions for his/her own home. After the schedule for each project is uploaded on the web and confirmed by web administrator, the schedule is stored in the historical DB.

At Step 3, users can download standard cost items by inputting the name of a project, duration, and square footage on the web-based program. In the standard cost items, users can enter the quantities of work items suitable for each project and also can modify unit costs. As conducted in the schedule, the cost items are uploaded on the web, confirmed by web administrator and stored in the historical DB. The stored cost data are used to integrate the cost and schedule.

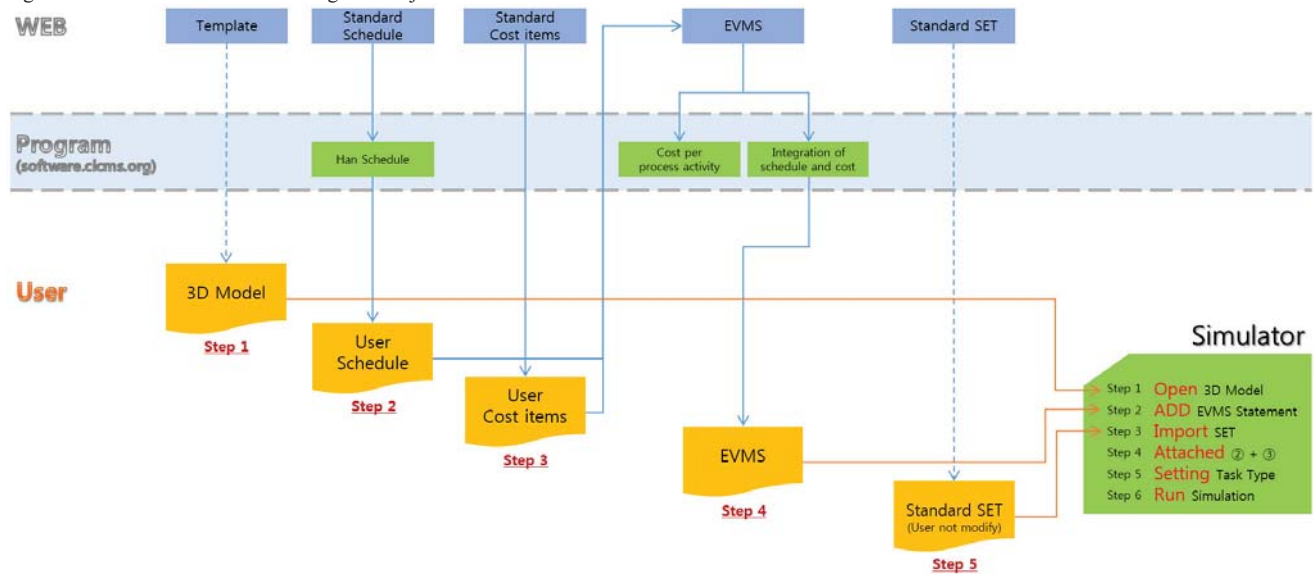
At Step 4, the result of integrated cost and schedule is drawn based on the results of the precedent steps by using a web-based program; as a result, a table for total cost amount for each activity and statements of Earned Value Management System (EVMS), which is used in a simulator program.

At Step 5, the simulator prepares linking a 3D model with the EVMS statements. For this purpose, users need to download pre-defined set-file for EVMS from the web.

¹ M.S Candidate, College of Architecture, Myongji University, Yong-in, Korea, dynasty86@nate.com

² Professor, College of Architecture, Myongji University, Yong-in, Korea, yjung97@mju.ac.kr (*Corresponding Author)

Figure 1 Process for automated linking BIM objects



At Step 6, when the 3D model, EVMS statements, and set-file are all prepared, works at the simulator for the next step are implemented. First, the 3D model is brought in with adding the EVMS statements to the program, and the standard set-file which was downloaded on the web is taken. For the next step, items with the same name of the EVMS statements and set-file are linked. Manual tasks have been usually conducted inefficiently for each item by clicking and dragging items with the same name; however, in this study, automatic linking with same items is implemented as well as automatic set-up based on user-designated task types.

Through all these steps of the process, users can run 3D model simulations where schedule and cost-items are applied.

III. CONCLUSION

For life cycle-based management, BIM with a variety of information on buildings has been increasingly used and gained much attention; however, it still has efficient matters. In addition, BIM currently has the environment more suitable for experts than non-experts. Under these circumstances, this study suggests the efficient BIM process which can be easily utilized by non-experts.

First, it is allowed to download and use a template file, standard process table, and standard statement where GBS numbers are applied on the web. With a simple web-based program, EVMS statements are also provided by integrating process and cost items. Further, a set-file which does not need revision for use on the simulator is provided. The simulator applies previously-processed files and enables automatic linking with its programs.

The proposed method in this study was validated by applying to modernized hanok, which is a small building. Thus, this study has a limitation in need of verification for the larger size and more complex construction such as power plants. For BIM automatic linking, it is planned to test based on models in various sizes.

ACKNOWLEDGEMENTS

This study was supported by the Ministry of Land, Transport and Maritime Affairs (MLTM) of the Korean Government under Grant No. 14AUDP-B070934-02 (Development of modernized HANOK technology).

REFERENCES

- [1] Jung, Y., Kim, M., Lee, Y., "Unified Geometry Breakdown Structure (uGBS) for BIM: Variables For Theory And Implementation", Proceedings of 30th International Conference on Applications of IT in the AEC Industry, CIB W78, Beijing, China, pp. 183-189, 2013.
- [2] Jung, Y., Lee, Y., Kim, Y., and Kim, M. "System for Creating Building Information Modeling (BIM) Geometry Breakdown Structure (GBS) and Method Therefor", Korean Patent Registration: 10-1293662, 2013a.
- [3] Jung, Y., Lee, Y., Kim, Y., and Kim, M. "System and Method for Creating Building Information Modeling (BIM) Geometry Breakdown Structure (GBS)", US Patent Pending: 13/830,705, 2013b.
- [4] Jung, Y., Joo, M., "Building Information Modeling (BIM) Framework for Practical Implementation", Automation in Construction, Elsevier, vol. 20, no. 2, pp. 126-133, 2011.