2-B-5-양-3
특허등록

BIM 모델에서의 파라펫 자동 생성 방법

2025. 11.

과 제 명	인공지능 기반의 건축설계 자동화 기술개발		
주 관 기 관	경북대학교 산학협력단		
총 연 구 기 간	2021. 04 . 01 - 2025. 12 . 31(4년 9개월)		
해당연도(5차년)	2025. 01 . 01 - 2025. 12 . 31(1년)		
구 성 기 술 명	구성기술 2	설계 생산성 향상을 위한 지능형 상세설계 자동화 기술 개발	
세 부 과 제 명	2-B	인공지능 기반 건축 상세설계 자동화 기술개발(Ⅱ)	
공 동 연 구 기 관	-		
연 구 기 관	서울과학기술대학교 산학협력단	**연구책임자**	구본상

ipdana2

보낸 사람: Automated Email <noreply@blackhillsip.com>
보낸 날짜: 2025년 6월 3일 화요일 오전 12:44
받는 사람: ipdana@danapat.com
참조: rplotkin@blueshiftip.com; mail@blueshiftip.com
제목: For Your Records: Formal Papers Filed (Our Ref: DAN.1012US; Your Ref: G25E10B0673PUS)
첨부 파일: Documents Filed with USPTO.pdf

U.S. App. No: 19/216,824
Title: METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL
Filing Date: May 23, 2025
Our Ref: DAN.1012US
Your Ref: G25E10B0673PUS

Dear Darby Park,

We have submitted the attached formal papers to the U.S. Patent and Trademark Office (USPTO). These papers will now become part of the public record of the patent application at the USPTO.

If you provided us with original documents, our office will return those documents to you, since our office does not maintain physical file records.

For Robert Plotkin, Founding Partner, Software Patent Attorney

Blueshift IP: Software Patent Experts
1 Broadway, 14th Floor
Cambridge, MA 02142 USA
Phone: 617-207-6141
www.blueshiftip.com
mail@blueshiftip.com

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
19/216,824	**05/23/2025 08:59:08 AM Z ET**	**DAN.1012US**

Title of Invention

METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	6463	FILED BY	TRACY KIMMEL
PATENT CENTER #	70558199	FILING DATE	-
CUSTOMER #	144359	FIRST NAMED INVENTOR	Bon Sang KOO
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Robert Plotkin

Documents

TOTAL DOCUMENTS: 5

DOCUMENT		PAGES	DESCRIPTION	SIZE (KB)
DAN.1012US Specification-APP.TEXT.docx		27	Application body structured text document	37 KB
Warning: Document has [Balance SBCS characters and DBCS characters] option enabled and may result in reduction of pages, however, no data or text has been modified.				
DAN.1012US Application_signed_filed.pdf		26	-	9842 KB
DAN.1012US Application_signed_filed-ADS.pdf	(1-10)	10	Application Data Sheet	178 KB
DAN.1012US Application_signed_filed-DRW.pdf	(11-20)	10	Drawings-only black and white line drawings	2736 KB

DAN.1012US Application_signed_filed-OATH.pdf	(21-26)	6	Oath or Declaration filed	6961 KB
DAN.1012US Specification_filing.pdf		27	Auxiliary PDF of Application	198 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
DAN.1012US Specification-APP.TEXT.docx	AFC8C8C2B9AE04E46EB2EB23B85647C7D30D6956001FE924DEF203AA67A7722B6D1CDC4F46F318816481AD5952B944C87EE9FDC66734B9A8FF47A5BC0CD20D45
DAN.1012US Application_signed_filed.pdf	5A47592EF84BBEB7DC2B1D078BC77DC5454101CEE945CCCF3F406C82A2F6435940C04BE7B580516FF9FAA2BB0211C4233597A2B5C2E2C9CA80883DEB1F5925AD
DAN.1012US Application_signed_filed-ADS.pdf	93F4FB7DCB1643AD7D8566063BF471D71550CC9B5205D0795381B66AD15566F560D599C6ED38AAC318D27975A3FB0E2414196A0FA73F8A78BC5A957CDB339FCC
DAN.1012US Application_signed_filed-DRW.pdf	DC81DEFEB156CA9C5E65E31A1199A6A8DF8CB4C97C4EF90E80EEE271C0A82C4D9A1CFF012632A2471E0FAAE83BB715A71DB75CC30B9F9AC724C1FDAC2BB81919
DAN.1012US Application_signed_filed-OATH.pdf	D4906D6ABB4E83A2B1528B39B534137915AAE904514B38099D74CF4C07FDCD5821233B4B9717EF2E9F7F701C6CF8810DACF4558318730AC568F729FDEFE4E1BD
DAN.1012US Specification_filing.pdf	8F15E8D49CD2BB79EAE0ABCDEDD8C665627926FD22ECE67F18675B3A4B30A1903F448EE55D4FE28719263995E1CEE6486517E4A719EE8EE56439AAEF4ED6F384

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security,

and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES
PATENT AND TRADEMARK OFFICE

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Alexandria, VA 22313 - 1450
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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
19/216,824	**05/23/2025 08:59:08 AM Z ET**	**DAN.1012US**

Title of Invention

METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	6463	FILED BY	TRACY KIMMEL
PATENT CENTER #	70558199	AUTHORIZED BY	Robert Plotkin
CUSTOMER #	144359	FILING DATE	-
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Bon Sang KOO

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 2005	E20255M000515506	TRACY KIMMEL

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
4011	BASIC FILING FEE- UTILITY	70.00	1	70.00
2111	UTILITY PATENT APPL. SEARCH FEE	308.00	1	308.00
2311	EXAMINATION OF ORIGINAL PATENT APPLICATION	352.00	1	352.00
			TOTAL AMOUNT:	**$730.00**

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement

Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT ASSIGNMENT COVER SHEET

Assignment ID: 1038416

Electronic Version v1.1
Stylesheet Version v1.2

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
Bon Sang KOO	05/20/2025
Young Su YU	05/20/2025
Si Hyun KIM	05/20/2025
Won Bok LEE	05/20/2025
Yoon Jae SUNG	05/20/2025
Gu Take KIM	05/21/2025
Kyung Gon RYU	05/21/2025

RECEIVING PARTY DATA

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Internal Address:	Nowon-gu
City:	Seoul
State/Country:	KOREA, DEMOCRATIC PEOPLE'S REPUBLIC OF
Postal Code:	01811

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Internal Address:	Seocho-gu
City:	Seoul
State/Country:	KOREA, DEMOCRATIC PEOPLE'S REPUBLIC OF
Postal Code:	06657

PROPERTY NUMBERS Total:1

Property Type	Number
Application Number:	19216824

CORRESPONDENCE DATA

Phone:	617-207-6141
Email:	paralegal@blackhillsip.com

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Correspondent Name:	Robert Plotkin
Address Line 1:	Blueshift IP, LLC
Address Line 2:	1 Broadway, 14th Floor
Address Line 4:	Cambridge , MASSACHUSETTS 02142

ATTORNEY DOCKET NUMBER:	DAN.1012US
NAME OF SUBMITTER:	TRACY KIMMEL
Signature:	/TRACY KIMMEL/
Date:	05/23/2025

TOTAL ATTACHMENTS: 1
source= DAN.1012US Executed Assignment.pdf

PTO/AIA/14 (01-22)
Approved for use through 05/31/2024. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DAN.1012US
	Application Number	
Title of Invention	METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Bon	Sang	KOO	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence	KR

Mailing Address of Inventor:

Address 1	#307, Areum Hall
Address 2	Gongneung-ro, Nowon-gu

City	Seoul	State/Province	
Postal Code	01811	Country	KR

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Young	Su	YU	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence	KR

Mailing Address of Inventor:

Address 1	#207, Areum Hall
Address 2	232 Gongneung-ro, Nowon-gu

City	Seoul	State/Province	
Postal Code	01811	Country	KR

Inventor 3 Remove

Legal Name

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DAN.1012US
	Application Number	
Title of Invention	METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL	

Prefix	Given Name	Middle Name	Family Name	Suffix
	Si	Hyun	KIM	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence [i]	KR

Mailing Address of Inventor:

Address 1	#207, Areum Hall		
Address 2	232 Gongneung-ro, Nowon-gu		
City	Seoul	State/Province	
Postal Code	01811	Country [i]	KR

Inventor 4 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Won	Bok	LEE	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence [i]	KR

Mailing Address of Inventor:

Address 1	#207, Areum Hall		
Address 2	232 Gongneung-ro, Nowon-gu		
City	Seoul	State/Province	
Postal Code	01811	Country [i]	KR

Inventor 5 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Yoon	Jae	SUNG	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence [i]	KR

Mailing Address of Inventor:

Address 1	#207, Areum Hall		
Address 2	232 Gongneung-ro, Nowon-gu		
City	Seoul	State/Province	
Postal Code	01811	Country [i]	KR

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DAN.1012US
	Application Number	
Title of Invention	METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL	

Inventor 6 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Gu	Taek	KIM	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence	KR

Mailing Address of Inventor:

Address 1	#302, 74 Myeongdal-ro 22-gil		
Address 2	Seocho-gu		
City	Seoul	**State/Province**	
Postal Code	06657	**Country**	KR

Inventor 7 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Kyung	Gon	RYU	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence	KR

Mailing Address of Inventor:

Address 1	#302, 74 Myeongdal-ro 22-gil		
Address 2	Seocho-gu		
City	Seoul	**State/Province**	
Postal Code	06657	**Country**	KR

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	144359		
Email Address	mail@blueshiftip.com	Add Email	Remove Email

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DAN.1012US
	Application Number	
Title of Invention	METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL	

Application Information:

Title of the Invention	METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL		
Attorney Docket Number	DAN.1012US	**Small Entity Status Claimed**	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	10	**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	144359		

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DAN.1012US
	Application Number	
Title of Invention	METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL	

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

			Remove
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2024-0145041	KR	2024-10-22	7B9B

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DAN.1012US
	Application Number	
Title of Invention	METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DAN.1012US
	Application Number	
Title of Invention	METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

◉ Assignee	○ Legal Representative under 35 U.S.C. 117	○ Joint Inventor
○ Person to whom the inventor is obligated to assign.	○ Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:	

If the Applicant is an Organization check here. ☒

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DAN.1012US
	Application Number	
Title of Invention	METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL	

Applicant 2

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(◉) Assignee	( ) Legal Representative under 35 U.S.C. 117	( ) Joint Inventor
( ) Person to whom the inventor is obligated to assign.	( ) Person who shows sufficient proprietary interest	

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DAN.1012US
	Application Number	
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See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Robert Plotkin/			Date (YYYY-MM-DD)	2025-05-23
First Name	Robert	Last Name	Plotkin	Registration Number	43861

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METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to and the benefit of Korean Patent Application No. 10-2024-0145041, filed on October 22, 2024, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND

1. Technical Field

The present invention relates to a technique for automatically generating or updating a parapet using a building information modeling (BIM).

2. Discussion of Related Art

In recent years, the application of a building information modeling (BIM) technology has been expanded in the construction and civil engineering industry, and the efficiency of structure design and construction has been greatly improved.

The BIM is a system that integrates and manages information necessary for the design, construction, and maintenance of a building based on a three-dimensional model, thereby simulating and optimizing various elements of the building.

A parapet installed on a roof of a building or an outermost part of the building is located above an outer wall, and is a structural element that protects against rain and wind and improves aesthetics.

However, the design and installation of parapets require careful design to fit the exterior walls and roof, water-resistant layers, and the like, which may be time-consuming with existing CAD-based design schemes. Utilizing BIM may automate or standardize such parapet generation, thereby preventing design errors and process issues in advance.

In the existing parapet design work, the user has to manually input information such as the location and height of the wall, the location of the water-resistant layer, and the like, which has a problem that the result may vary according to the experience and skill of the operator. In addition, parapet designs require different designs depending on the combination of various components (e.g., surbase, water-resistant layer, protective mortar, etc.), and there is an inconvenience that manual operations should be performed again with each design change.

SUMMARY

The present invention is a technology for automatically generating or updating a parapet by using a BIM model, thereby minimizing inconveniences and errors that may occur in a process of manually generating a parapet.

In the existing method, a designer has to manually perform a modeling operation in consideration of dimensions or components of a parapet one by one, which is time-consuming and may affect accuracy of a design.

In order to solve this problem, the present invention provides a method for automatically extracting parameters based on geometric information of a wall member in a BIM

model, and additionally receiving necessary configuration information from a user to automatically generate a parapet or easily update an existing parapet.

In this way, the present invention aims at maximizing the efficiency of the design and improving the design quality by quickly reflecting various components based on user input.

A method for automatically generating a parapet according to an embodiment is a method for automatically generating a parapet using a BIM model, the method may include: a step of automatically extracting, in the BIM model, a first type parameter value related to geometry information of a wall member for which a parapet is to be generated; a step of receiving, from a user, a second type parameter value for at least one configuration configuring a parapet; and a step of generating a new parapet or updating an existing parapet in the BIM model based on the extracted first type parameter value and the second type parameter value received from the user.

In some embodiments, the step of automatically extracting a first type parameter value may include: a step of generating a virtual solid using a height of a structural wall of the wall member; a step of identifying an outer wall adjacent to the structural wall based on the virtual solid; and a step of extracting a parameter value of the structural wall and the outer wall.

In some embodiments, the step of generating a virtual solid may include: a step of calculating a direction vector of the structural wall of the wall member by using a location curve class when an input for selecting the wall member is received; a step of moving a location curve located at a centerline of the structural wall to an outermost part of the structural wall based on

the direction vector; and a step of generating the virtual solid based on the location curve moved to the outermost part and the height of the structural wall.

In some embodiments, the step of receiving a second type parameter value from a user may include: a step of receiving a user input selecting either a first type parapet or a second type parapet; a step of receiving parameters for surbase, water resistance, and protective mortar of the parapet when the first type parapet is chosen; and a step of receiving parameters for surbase, water resistance, protective mortar, a masonry wall, and a water-resistant raised unit of the parapet when the second type parapet is chosen.

In some embodiments, the step of updating an existing parapet may include: removing, when a pre-generated parapet having parameters identical to the first type parameter and the second type parameter is present, a wall sweep included in the pre-generated parapet, and updating the parapet by receiving additional parameters.

According to the present invention, since a parapet may be automatically generated or updated in a BIM model, efficiency and accuracy are greatly improved compared to the existing method of manually designing a parapet.

The present invention may be expected to increase the productivity of BIM-based architectural design and construction and reduce the construction time and cost.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a schematic diagram of a parapet generation module according to an

embodiment.

FIG. 2 shows a flowchart of an operation of extracting a first type parameter value in an automatic parapet generation module driving process.

FIG. 3 shows a flowchart of an operation of receiving a second type parameter value in an automatic parapet generation module driving process.

FIG. 4 shows a flowchart of a parapet automatic modeling operation using a wall sweep in an automatic parapet generation module driving process.

FIG. 5 shows an example diagram of extracting a first type parameter value.

FIG. 6 shows an example diagram of a first type parapet (type A) and a second type parapet (type B).

FIG. 7 shows an example diagram of a parameter input UI of a first type parapet (type A).

FIG. 8 shows an example diagram of a parameter input UI of a second type parapet (type B).

FIG. 9 shows a schematic diagram of generation of a first type parapet (type A).

FIG. 10 shows a schematic diagram of generation of a second type parapet (type B).

DETAILED DESCRIPTION

Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings.

However, the technical idea of the present disclosure is not limited to the described embodiments, but may be implemented in various forms different from each other, and one or more of the components may be selectively combined and replaced between the embodiments within the scope of the present disclosure.

In addition, terms (including technical and scientific terms) used in the embodiments of the present invention may be interpreted as meanings that may be generally understood by those skilled in the art in the technical field to which the present invention belongs, unless clearly and specifically defined and described, and terms that are generally used, such as terms defined in advance, may be interpreted in consideration of their meanings in the context of the related art.

In addition, the terminology used in the embodiments of the present disclosure is for describing the embodiments and is not intended to limit the present disclosure.

As used herein, the singular forms may include the plural forms as well, unless the context clearly indicates otherwise, and may include one or more of any and all combinations that may be combined into A, B, and C when described as "at least one (or one or more) of A, and (as well as) B and C."

In addition, the terms "first," "second," "A," "B," " (a)," " (b)," and the like may be used to describe the components of the embodiments of the present invention.

These terms are only used to distinguish the components from other components and the nature, sequence, or order of the components is not limited by the terms.

Furthermore, when an component is described as being "connected," "coupled," or "accessed" to another component, it may include not only cases where the component is directly connected, coupled, or accessed to the other component, but also cases where the component is "connected," "coupled," or "accessed" by another component between the component and the other component.

In addition, when an component is described as being formed or disposed "on (above) or under (below)" another component, the "on" or "under" includes not only cases where two components are in direct contact with each other, but also cases where one or more other components are formed or disposed between the two components. Furthermore, the expression "on (above) or under (below)" may include not only an upward direction but also a downward direction with respect to one component.

Hereinafter, embodiments will be described in detail with reference to the accompanying drawings, and the same or corresponding components will be denoted by the same reference numerals regardless of the reference numeral, and redundant description thereof will be omitted.

FIG. 1 shows a schematic view of a parapet generation module according to an embodiment.

Referring to FIG. 1, a parapet generation module 100 according to an embodiment of the present invention operates in connection with a BIM server 200. The parapet generation module 100 receives necessary data from the BIM server 200, and performs a function of

automatically generating a parapet based thereon.

The BIM server 200 stores and manages various information related to architectural design, and supports the parapet generation module 100 to efficiently extract a first type parameter value (or a first parameter value) required for design, that is, geometric data of a wall, such as a height, a thickness, a length, and a location of the wall. These geometric elements are used as basic data of parapet generation, and the system automatically identifies a location curve, a reference line, and the like of a wall member, and performs parameter extraction based thereon.

Thereafter, a second type parameter value inputted by a user, that is, a detailed specification of a height, a width, a material, a finishing method, and the like of the parapet, is further inputted, and the parapet generation module 100 reflects the values to the generation of a new parapet in a BIM model. This configuration contributes to maintaining data consistency in the design process and improving design productivity through the automated parapet generation process.

The parapet generation module 100 may include at least one command or instruction capable of performing an operation according to an embodiment of the present invention, and may be implemented in a software or hardware manner. Further, integration with the BIM server may facilitate design and review of the overall construction, thereby providing immediate feedback on the location and shape at which the parapet is automatically generated.

According to some embodiments, the parapet generation module 100 may be installed as a centralized server or a cloud server, which is configured separately from the BIM server

200.

In another embodiment, the parapet generation module 100 may be implemented in the form of a software module or control device embedded in a user terminal (e.g., smartphone, laptop, tablet, personal computer, wearable device, etc.).

The parapet generation module 100 may include a processor, a communication unit, a memory, and an input/output interface (e.g., display, touch display, etc.).

The processor may be implemented as hardware, software, or a combination thereof, and may execute control logic, for example, in the form of a microcontroller, a field-programmable gate array (FPGA), or an application-specific integrated circuit (ASIC).

The communication unit may include an interface for transmitting and receiving data to and from the BIM server 200 via a wired or wireless network, and may be used to transmit and receive various types of data associated with the present invention.

The communication unit may support short-range communication, a global navigation satellite system (GNSS) module (e.g., GPS module), optical communication, broadcasting transmission and reception, and intelligent transport system (ITS) communication.

Furthermore, the communication unit may perform long-distance communication with the BIM server 200 and cloud-based interworking by using a mobile communication module such as LTE or 5G and a wireless internet module to enable real-time data reception and synchronization with the cloud.

The memory may serve as a storage device for storing data and programs required for

operation of the parapet generation module 100, and may include one or more instructions executed by the processor.

The instructions may include interworking logic configured to: automatically extract a first type of parameter value associated with the geometry of a wall member in the BIM model to which a parapet is to be applied; receive, from the user, a second type of parameter value corresponding to at least one component forming the parapet; and generate a new parapet or update an existing parapet in the BIM model based on the extracted first type of parameter value and the user-input second type of parameter value.

The memory may include non-volatile memory (e.g., hard disk drive, flash memory, EEPROM, SRAM, FRAM, PRAM, MRAM, etc.) and volatile memory (e.g., DRAM, SDRAM, DDR-SDRAM, etc.), and a combination thereof may be used to construct a memory system with various capacities and performance characteristics.

FIG. 2 shows a flowchart of an operation of extracting a first type parameter value in an automatic parapet generation module driving process.

Referring to FIG. 2, a driving process of the automatic parapet generation module according to an embodiment of the present disclosure includes the following steps.

First, in step S210, a user selects a wall member for which a parapet is to be made. For example, a program (e.g., Revit) provided by the BIM server 200 may be executed to display objects including multiple wall members, and a specific wall member may be selected according to user input. At this time, the parapet generation module 100 reviews a family type

to confirm whether the selected wall member is a structural wall where a parapet may be generated. The parapet generation module 100 may determine whether the parapet is an installable wall by identifying a family type of the structural wall.

Next, in step S220, the parapet generation module 100 extracts a location curve of the structural wall and moves it.

When an input for selecting the wall member is received, the parapet generation module 100 may calculate a direction vector of the structural wall of the wall member by using a location curve class.

The location curve class in the present invention defines the centerline and geometric elements of the wall within the building information modeling (BIM) model, and serves to determine the location and direction of the wall required for parapet generation. The location curve class tracks a centerline or an outline of the wall, and automatically calculates a location at which the parapet is to be installed according to a geometric arrangement of the wall, so as to provide location data in three-dimensional space. This location curve class may perform at least one of the following operations: extracting the centerline of the wall, calculating the direction vector, moving to the outermost part, extending and combining curves, providing coordinates for the parapet design, and updating the location curves.

For example, a location curve is defined with reference to a centerline of the wall. This curve moves along the center of the wall, and the coordinates of the curve are determined by reflecting the height and width of the structural wall. This location curve is then used to form

the outermost part of the wall.

Specifically, the parapet generation module 100 calculates the direction vector of the structural wall to move the location curve by half the width of the structural wall, thereby deriving the outermost part of the structural wall. This step is a procedure that clarifies the geometrical shape of the structural wall and establishes accurate wall boundaries for later parapet generation.

In step S230, the parapet generation module 100 filters an outer wall member. The parapet generation module 100 collects the wall members in the whole BIM model by using the filtering class, and selects and returns only the outer wall member type among the wall members that intersect with a generated solid. This process is necessary to clearly understand the relationship between the structural wall and the outer wall, and serves to analyze the external elements that affect parapet generation.

In the present invention, a filtering class is a technical tool used to efficiently select a wall member required for parapet generation in a BIM model, and to distinguish a structural wall and an outer wall member to extract an accurate parameter value. The filtering class is an algorithm that automatically filters an element that meets specific conditions among wall members, and serves to maximize design efficiency and remove unnecessary data.

Finally, in step S240, the parapet generation module 100 automatically extracts parameter values of the structural wall and the outer wall. These extracted parameter values include various geometrical elements such as distance, angle, and locational relationship

between the structural wall and the outer wall, and are utilized as information necessary for a parapet design. The extracted parameter values are automatically passed to the parapet generation module, based on which the parapet is automatically generated or updated in the BIM model.

Through this series of processes, the automatic parapet generation module automates operations from wall member selection to parameter value extraction, thereby increasing design efficiency and improving accuracy and speed of the design process.

FIG. 3 shows a flowchart of an operation of receiving a second type parameter value (for example, a second parameter value) in an automatic parapet generation module driving process.

Referring to FIG. 3, a driving process of the parapet generation module 100 according to an embodiment of the present disclosure includes the following steps.

First, in step S310, the parapet generation module 100 determines whether a water-resistant raised unit or a masonry wall is required. This determination may be determined by user input. The user reviews whether a water-resistant raised unit or a masonry wall is needed to suit the design environment, and then makes a decision thereon.

When a water-resistant raised unit or a masonry wall is not required, a first type parapet (type A) is determined in step S320. This type of parapet has a relatively simple structure and is mainly focused on basic components such as surbase, water resistance, and protective mortar.

In some cases, the term "surbase" may be used interchangeably with "thickness", particularly where both represent the dimensional depth of a structural or sub-structural layer. Also, depending on the context, material composition, or environmental conditions, the distinction between "waterproof" and "water-resistant" may not be absolute. As such, the terms may be used interchangeably to describe components that exhibit sufficient resistance to water ingress for the intended application.

In the subsequent step S330, the parapet generation module 100 receives parameter values of surbase, water resistance, and protective mortar. The surbase finishes the top of the parapet and plays a functional and aesthetic role, the water resistance is an element that enhances the structural stability of the parapet, and the protective mortar is responsible for the durability and protective function of the parapet. The user may input the height, material, finishing method, and the like of each of these elements to define the detailed characteristics of the parapet.

On the other hand, when it is determined that a water-resistant raised unit or a masonry wall is necessary, a second type parapet (type B) is determined in step S340. The second type parapet includes additional elements, such as water-resistant raised units and masonry walls, to meet more complex design needs.

In step S350, the parapet generation module 100 receives the parameter values of surbase, water resistance, and protective mortar, and in step S360, the parapet generation module 100 further receives parameter values of a water-resistant raised unit and a masonry

wall. The water-resistant raised unit serves to prevent water and moisture from entering between the parapet and the outer wall, and the masonry wall serves to enhance the durability and stability of the parapet. A user may define the size, material, installation method, and the like of each element.

Through this process, a user may select a parapet type that meets design requirements, and automatically generate a parapet by inputting required parameter values. The automated parapet generation process of the present invention helps to quickly and accurately design the parapet within the BIM model, reflecting the user's input.

FIG. 4 shows a flowchart of a parapet automatic modeling operation using a wall sweep in an automatic parapet generation module driving process.

Referring to FIG. 4, a driving process of the automatic parapet generation module according to an embodiment of the present disclosure includes the following steps.

First, in step S410, the parapet generation module 100 checks a parameter input value input by a user. Here, the parapet generation module 100 checks whether there is a missing value or an erroneous value in second type parameter values (height, width, material, finishing, etc. of the parapet) input by the user. The step of checking the accuracy of these input values is a procedure that prevents errors in the subsequent automatic modeling process and allows the design to proceed as desired.

Next, in step S420, the parapet generation module 100 checks whether the wall type specified by the user is present in the BIM model. When the wall type is not present, in step

S430, the parapet generation module 100 replicates the existing similar wall type to generate a new wall type in step S440. This is a function that allows new design elements to be added according to the user's needs, thereby providing flexibility in design.

On the other hand, when the wall type is already present, in step S450, the parapet generation module 100 removes a sweep of the previously generated wall. The sweep is an element that defines the shape of the parapet generated along the top or outline of the wall, and the process of removing the existing sweep is part of the task of changing the shape of the wall to meet new design requirements.

Thereafter, in step S460, the parapet generation module 100 adds a new sweep. In this step, the shape of the parapet is newly defined according to the input parameter value, and a sweep reflecting this is added to the wall. The sweep is used in the process of automatically modeling the parapet at the top or outline of the wall, and accurately defines the height and shape of the parapet.

Finally, in step S470, automatic parapet modeling is performed to finally generate a parapet. At this time, the parapet is automatically designed in the BIM model on the basis of the previously entered parameter values and the sweep generated for the wall type.

Through this series of processes, a user has the flexibility to add new design elements while maintaining the existing wall type, or to remove existing elements and replace them with new elements as needed. This increases the efficiency of the design process while providing the ability to flexibly adapt to various parapet design needs.

FIG. 5 shows an example diagram of extracting a first type parameter value.

Referring to FIG. 5, a driving process of an automatic parapet generation module according to an embodiment of the present disclosure starts with a step of automatically extracting parameter values of a structural wall and an outer wall.

First, the direction vector (xyz) of the structural wall is calculated by using a location curve (LocationCurve) of the structural wall, and through this, the location curve is moved by half the width of the structural wall to derive the outermost part of the structural wall. This is a process of clearly understanding the actual boundary of the structural wall and then determining where the parapet is to be generated. The movement of the location curve defines the outer line of the structural wall, and this data is used as basic information for parapet generation.

Thereafter, a virtual solid is generated using the moved location curve and the height of the selected structural wall to confirm the intersection with other surrounding elements. This virtual solid visually represents the physical relationship between the structural wall and the outer wall, and forms a three-dimensional model to be referenced in a parameter extraction process.

Specifically, in the present invention, the virtual solid is a three-dimensional shape generated based on geometric characteristics of a wall in a BIM environment. The virtual solid is generated based on geometric parameter values such as height, thickness, length, and location of the wall member, which serves as a structural reference point referenced in parapet generation.

First, when a wall member is selected, a centerline and a direction vector of the wall

are extracted. These centerline and direction vector provide the basic coordinate data that determines the location and direction of the wall, on the basis of which the outermost part of the wall may be extracted. The outermost part of the wall then reflects the actual physical boundary of the wall and becomes an important reference for generating a virtual solid.

More specifically, as shown in FIG. 5, the parapet generation module 100 collects the wall members in the entire model by using a filtering (FilteredElementCollector) class, and selects and returns only an outer wall member type among the wall members that intersect with the generated solid, to find the outer wall member that is adjacent to the structural wall. Through this filtering process, the surrounding outer wall members are efficiently identified, and the accuracy of parameter extraction is improved.

Through this process, the parameter values of the selected structural wall and outer wall, that is, information such as width and height, are automatically extracted, and the parapet generation module 100 derives information required for parapet design. These parameter values are utilized as the basic data required for the profile modeling for configuring the parapet, and serve to reflect the physical characteristics and design needs of the parapet.

This automated parameter extraction process allows the designer to accurately perform parapet modeling according to the structural characteristics of the wall and perform fast and consistent design work within the BIM environment.

FIG. 6 shows an example diagram of a first type parapet (type A) and a second type parapet (type B).

Referring to FIG. 6, an automatic parapet generation module according to an embodiment of the present disclosure provides two types of parapets.

Type A is composed of surbase, water resistance, and protective mortar, and is mainly used in medium-sized buildings or commercial buildings. This type of parapet focuses on practicality and functionality, and on leak prevention and structural stability rather than appearance. The surbase is an element that covers the top of the parapet, providing both aesthetic completion and functionality of the parapet. Water resistance prevents water from penetrating through the parapet, and protective mortar serves to prevent physical damage and enhance durability of the parapet.

Type B meets more complex structural requirements, with the addition of water-resistant raised units and masonry walls to the basic components of type A. This type of parapet is suitable for high-rise buildings or complex structures and provides enhanced water resistance and structural stability. The water-resistant raised unit is an additional device that prevents water ingress from the outside, and play a particularly important role in high-rise structures. The masonry wall reinforces the foundation structure of the parapet to improve the overall stability and enhance the durability of the parapet.

Each parapet type is designed in consideration of the thickness and height of the structural wall and the outer wall of the building, and a user may input the parameters of each profile through the module UI to increase the flexibility of the design. This configuration allows a user to select and design a parapet that meets the requirements of a particular building, and

input parameters to apply the automatically generated parapet within the BIM model.

FIG. 7 shows an example diagram of a parameter input UI of a first type parapet (type A).

Referring to FIG. 7, a parameter input UI of an automatic parapet generation module according to an embodiment of the present disclosure provides an interface for inputting detailed parameters for profiles such as surbase, water resistance, protective mortar, and the like. A user may input parameters such as thickness, width, height of surbase, and select the material of each profile.

For example, the parameter of surbase, consisting of x, y, a, b, and c, is used to define the geometric property of the surbase. For example, the thickness of surbase, defined as x, and y, is an element for ensuring the structural stability of the surbase. In addition, the functionality of the parapet may be enhanced by inputting the width and material of the water resistance and protective mortar.

This UI allows a user to finely adjust the parapet to the design requirements and increases the flexibility of the design. In this way, the user may adjust the thickness of the water-resistant layer or change the material of the protective mortar according to a specific environment or condition, so as to automatically implement a more efficient and customized design.

FIG. 8 shows an example diagram of a parameter input UI of a second type parapet (type B).

Referring to FIG. 8, a parameter input UI of an automatic parapet generation module according to an embodiment of the present invention is shown. This UI is configured to allow a user to select the parapet type B and input detailed parameters of each profile.

The UI includes an input field for inputting the width and material for each profile of surbase, water resistance, protective mortar, a water-resistant raised unit, and a masonry wall. For example, the width of the surbase may be set to 100 mm, the width of water resistance may be set to 80 mm, and the width of protective mortar may be set to 20 mm. In addition, the height of the masonry wall is inputted as 300 mm, and the interval between the water-resistant raised units may also be set.

At the bottom of FIG. 8, a cross-section of the parapet is shown, where the location and size of each profile is visually represented. It is composed of surbase, water resistance, protective mortar, a water-resistant raised unit, and a masonry wall in this order, and the thickness and location of each profile are indicated. Through this UI, the user may finely adjust the parapet according to the design requirement, and the input parameter values are utilized in a later automatic parapet generation process.

Through this parameter input process, a user may increase the flexibility of the design and automatically implement a more efficient and customized parapet design.

FIG. 9 shows a schematic diagram of generation of a first type parapet (type A).

Referring to FIG. 9, a parapet of type A generated through an automatic parapet generation module according to an embodiment of the present invention is shown. Type A is a

basic parapet type consisting of surbase, water resistance, and protective mortar, and is designed to enhance water-resistant and protective functions. As may be seen in FIG. 9, the top of the parapet has surbase, below which the water-resistant layer and the protective mortar are arranged one after the other. Such a configuration is mainly used in a medium-sized building or a commercial building, and is suitable for a building in which functionality is more important than appearance.

FIG. 10 shows a schematic diagram of generation of a second type parapet (type B).

Referring to FIG. 10, a Type B generation example of an automatic parapet generation module according to an embodiment of the present invention is shown. Type B is suitable for high-rise buildings or complex structures in a form that includes a masonry wall and a water-resistant raised unit to enhance structural stability and water-resistant function.

As shown in FIG. 10, the water-resistant raised unit is located at the top of the parapet and serves to prevent moisture penetration from the outside, and the masonry wall is located at the bottom of the parapet to provide structural support and stability. These components may be finely adjusted through each parameter value, and a user may input the width, height, and material of each profile through the module UI to generate a parapet tailored to the design requirements.

Such an automated parapet generation manner contributes to maintaining consistency in design change, improving design quality, and increasing work efficiency.

The term "unit" used in this embodiment refers to software or hardware components

such as a field-programmable gate array (FPGA) or an ASIC, and the "unit" performs certain roles. However, the term "unit" is not limited to software or hardware. The "unit" may be configured to be in an addressable storage medium or may be configured to reproduce one or more processors. Thus, by way of example, the "unit" includes components such as software components, object-oriented software components, class components, and task components, as well as processes, functions, attributes, procedures, subroutines, segments of program code, drivers, firmware, microcode, circuitry, data, databases, data structures, tables, arrays, and variables. Functionality provided within components and "units" may be combined into a smaller number of components and "units" or further separated into additional components and "units." Further, the components and "units" may be implemented to play one or more CPUs in a device or secure multimedia card.

Although the foregoing has been described with reference to the preferred embodiments of the present invention, it will be understood by those skilled in the art that various modifications and changes may be made to the present invention without departing from the spirit and scope of the invention as set forth in the following claims.

WHAT IS CLAIMED IS:

1. A method for automatically generating a parapet using a building information modeling (BIM) model, the method comprising:

a step of automatically extracting, in the BIM model, a first type parameter value related to geometry information of a wall member for which a parapet is to be generated;

a step of receiving, from a user, a second type parameter value for at least one configuration configuring a parapet; and

a step of generating a new parapet or updating an existing parapet in the BIM model based on the extracted first type parameter value and the second type parameter value received from the user.

2. The method of claim 1,

wherein the step of automatically extracting a first type parameter value includes:

a step of generating a virtual solid using a height of a structural wall of the wall member;

a step of identifying an outer wall adjacent to the structural wall based on the virtual solid; and

a step of extracting a parameter value of the structural wall and the outer wall.

3. The method of claim 2,

wherein the step of generating a virtual solid includes:

a step of calculating a direction vector of the structural wall of the wall member by using a location curve class when an input for selecting the wall member is received;

a step of moving a location curve located at a centerline of the structural wall to an outermost part of the structural wall based on the direction vector; and

a step of generating the virtual solid based on the location curve moved to the outermost part and the height of the structural wall.

4. The method of claim 1,

wherein the step of receiving a second type parameter value from a user includes:

a step of receiving a user input selecting either a first type parapet or a second type parapet;

a step of receiving parameters for surbase, water resistance, and protective mortar of the parapet when the first type parapet is chosen; and

a step of receiving parameters for surbase, water resistance, protective mortar, a masonry wall, and a water-resistant raised unit of the parapet when the second type parapet is chosen.

5. The method of claim 1,

wherein the step of updating an existing parapet comprises:

a step of removing, when a pre-generated parapet having parameters identical to the first type parameter and the second type parameter is present, a wall sweep included in the pre-generated parapet; and

a step of updating the parapet by receiving additional parameters.

ABSTRACT

A method for automatically generating a parapet in a BIM model is disclosed. A method for automatically generating a parapet according to one embodiment is a method for automatically generating a parapet using a BIM model, the method including: a step of automatically extracting, in the BIM model, a first type parameter value related to geometry information of a wall member for which a parapet is to be generated; a step of receiving, from a user, a second type parameter value for at least one configuration configuring a parapet; and a step of generating a new parapet or updating an existing parapet in the BIM model based on the extracted first type parameter value and the second type parameter value received from the user.

FIG. 1

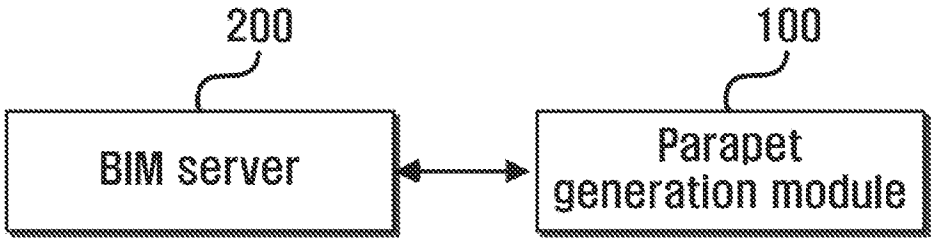


FIG. 2

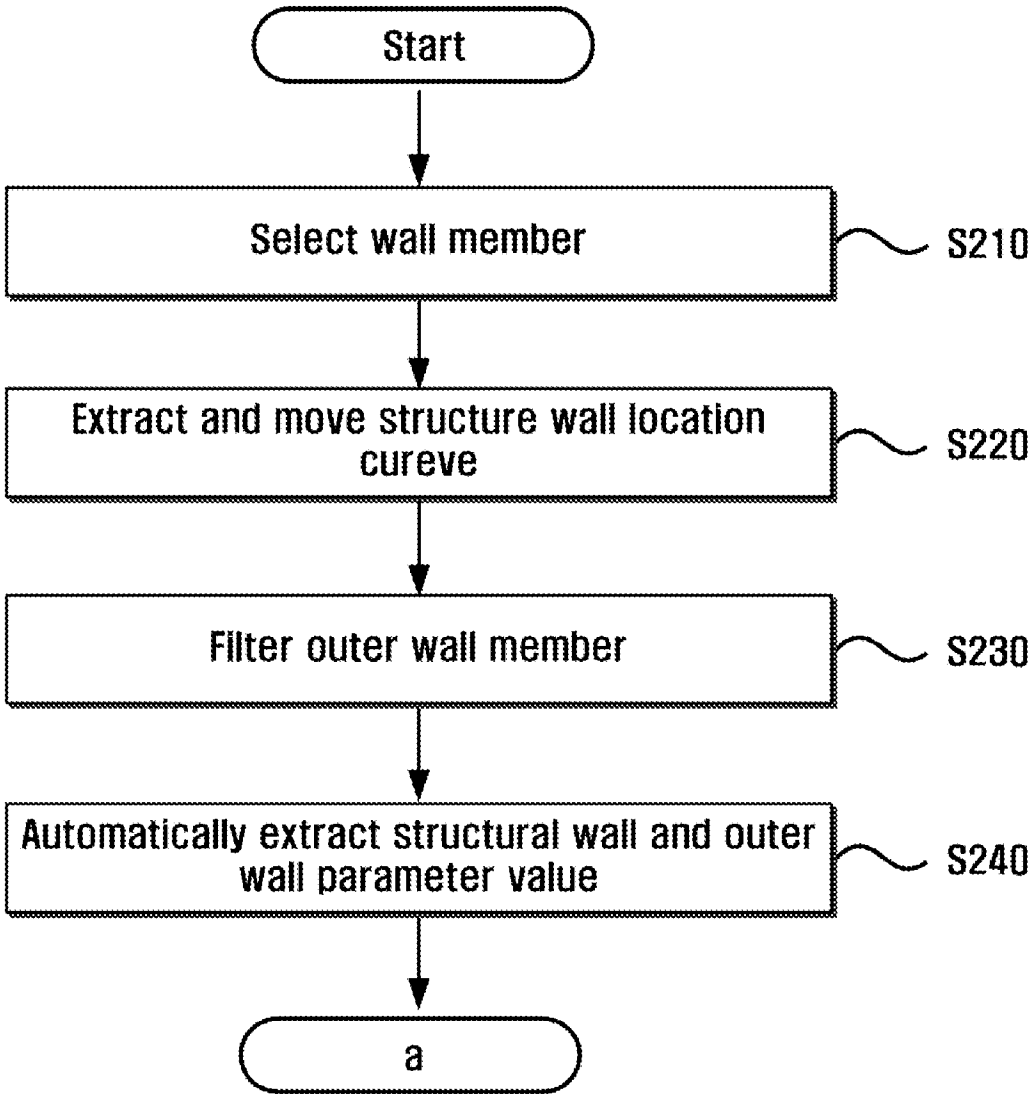


FIG. 3

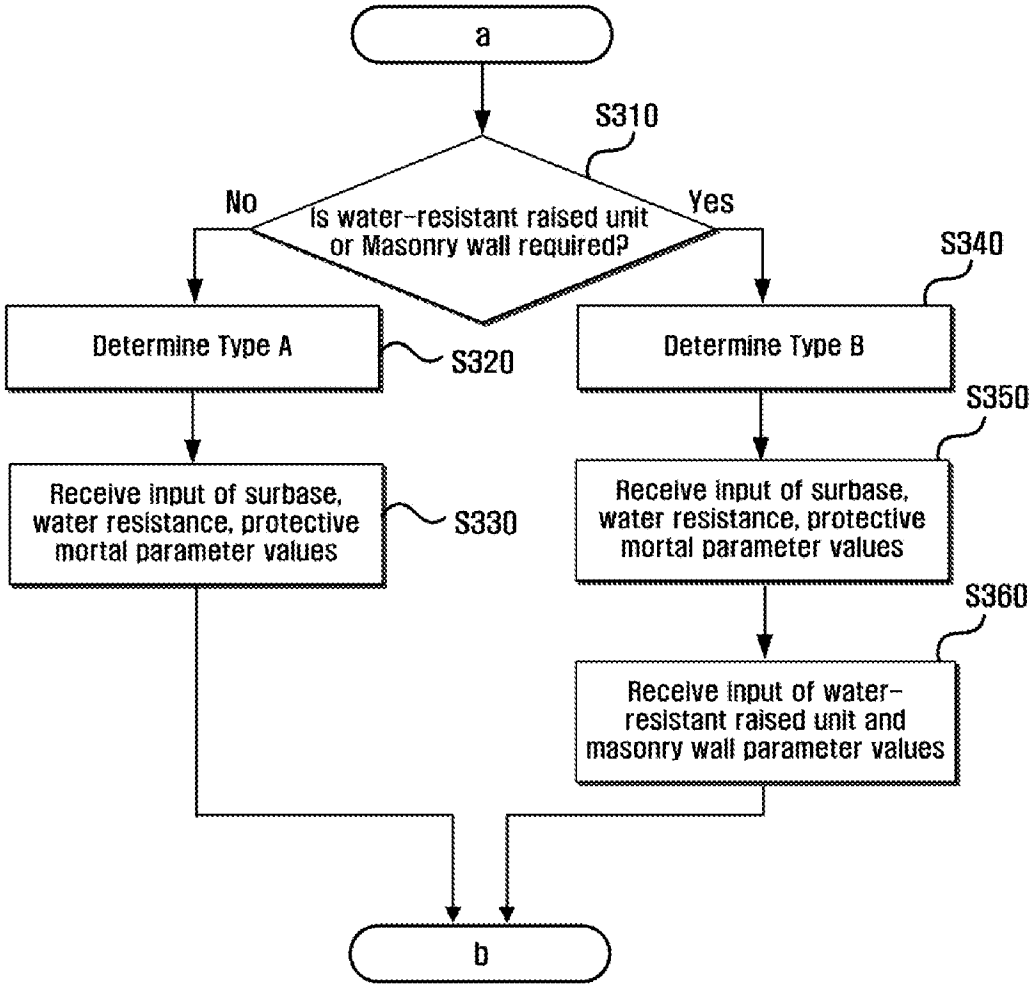


FIG. 4

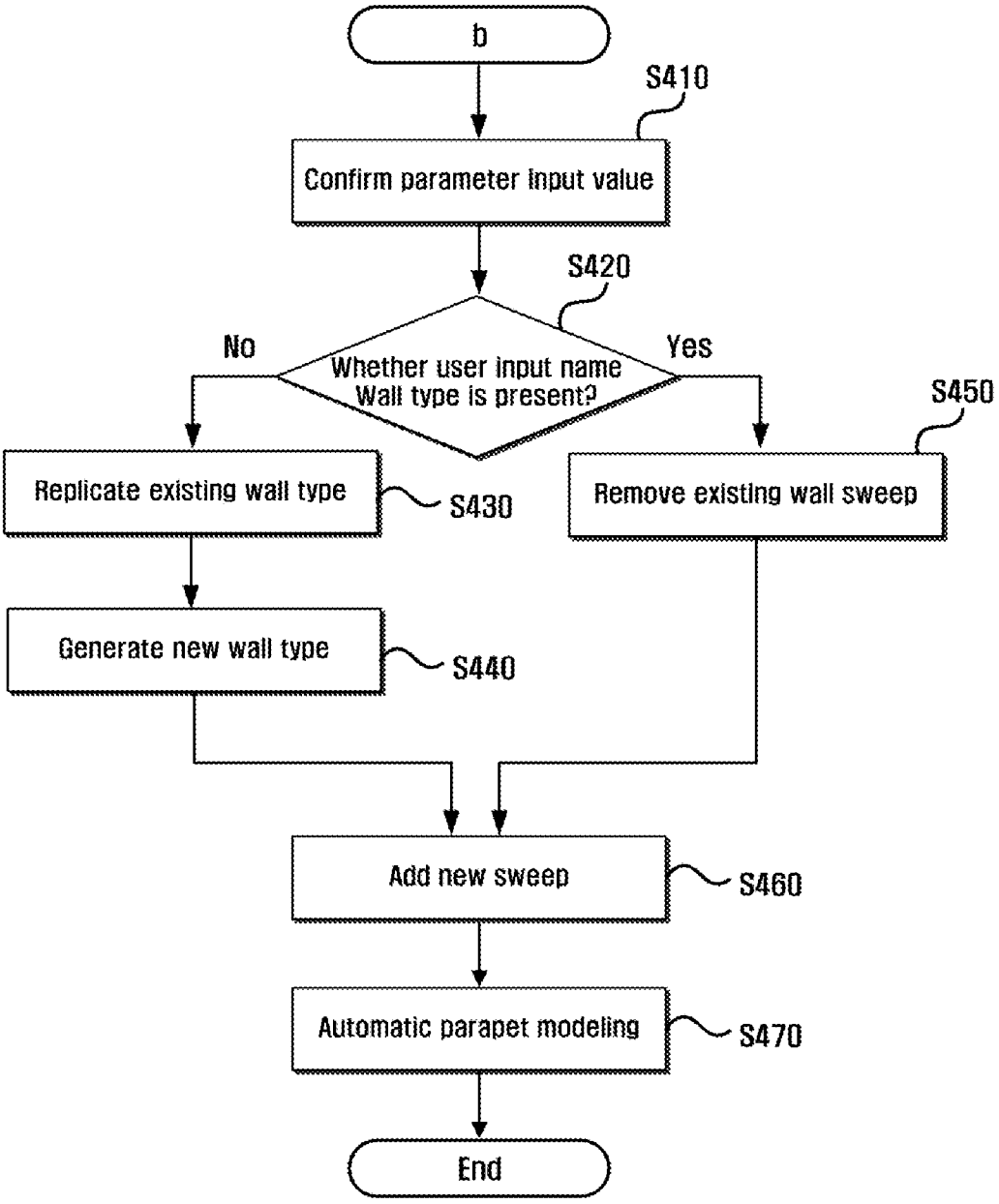


FIG. 5

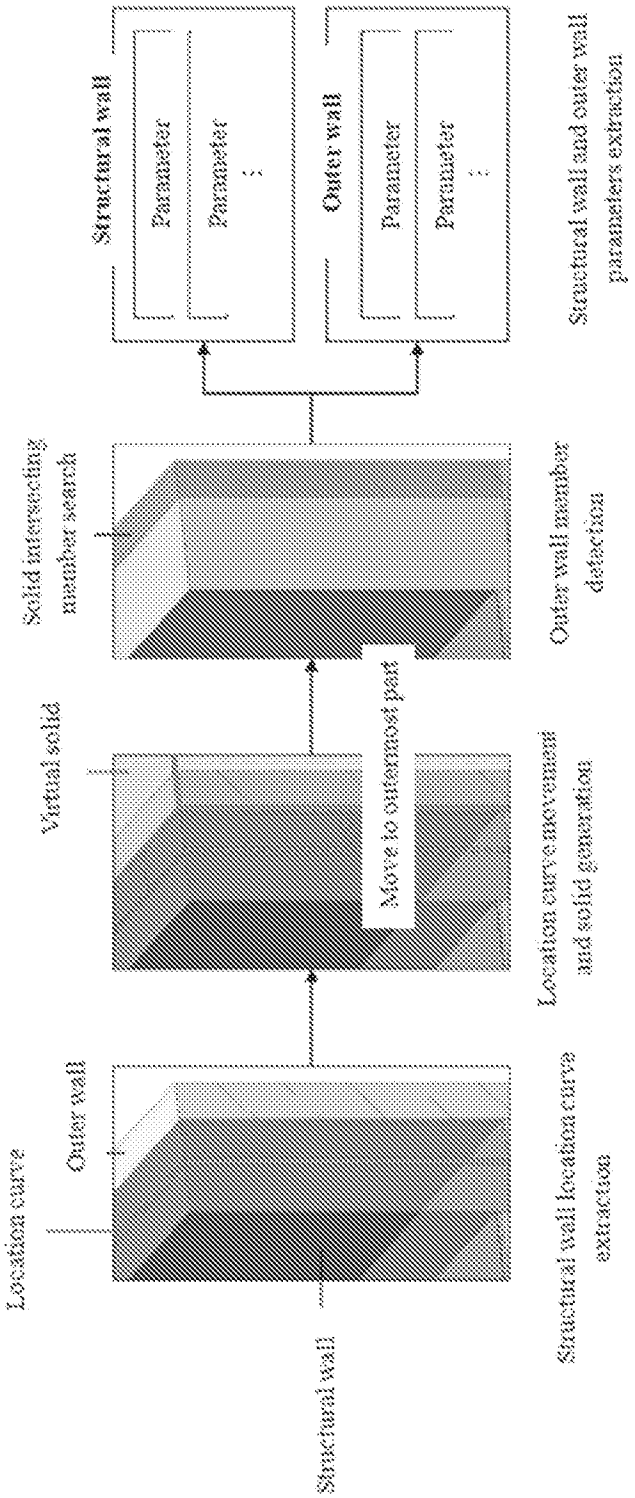


FIG. 6

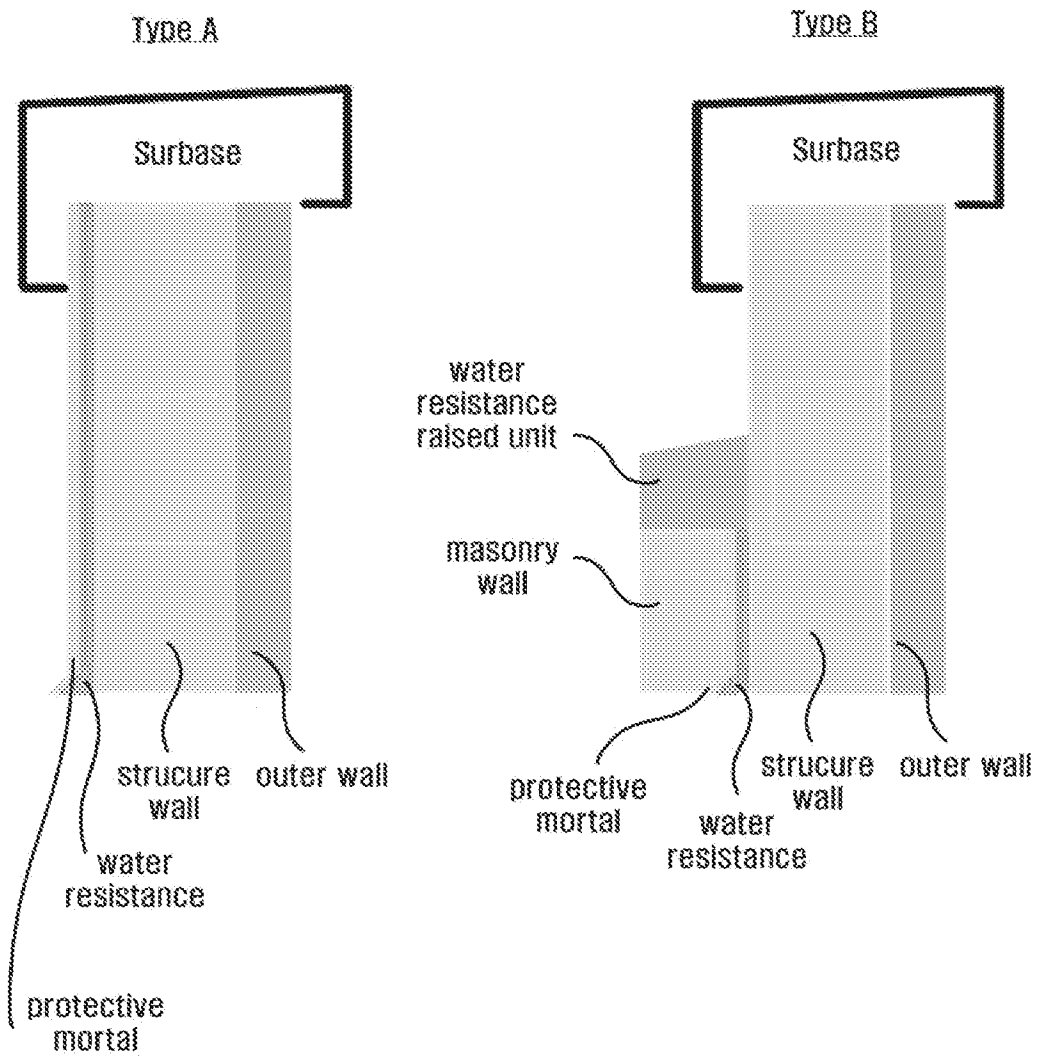


FIG. 7

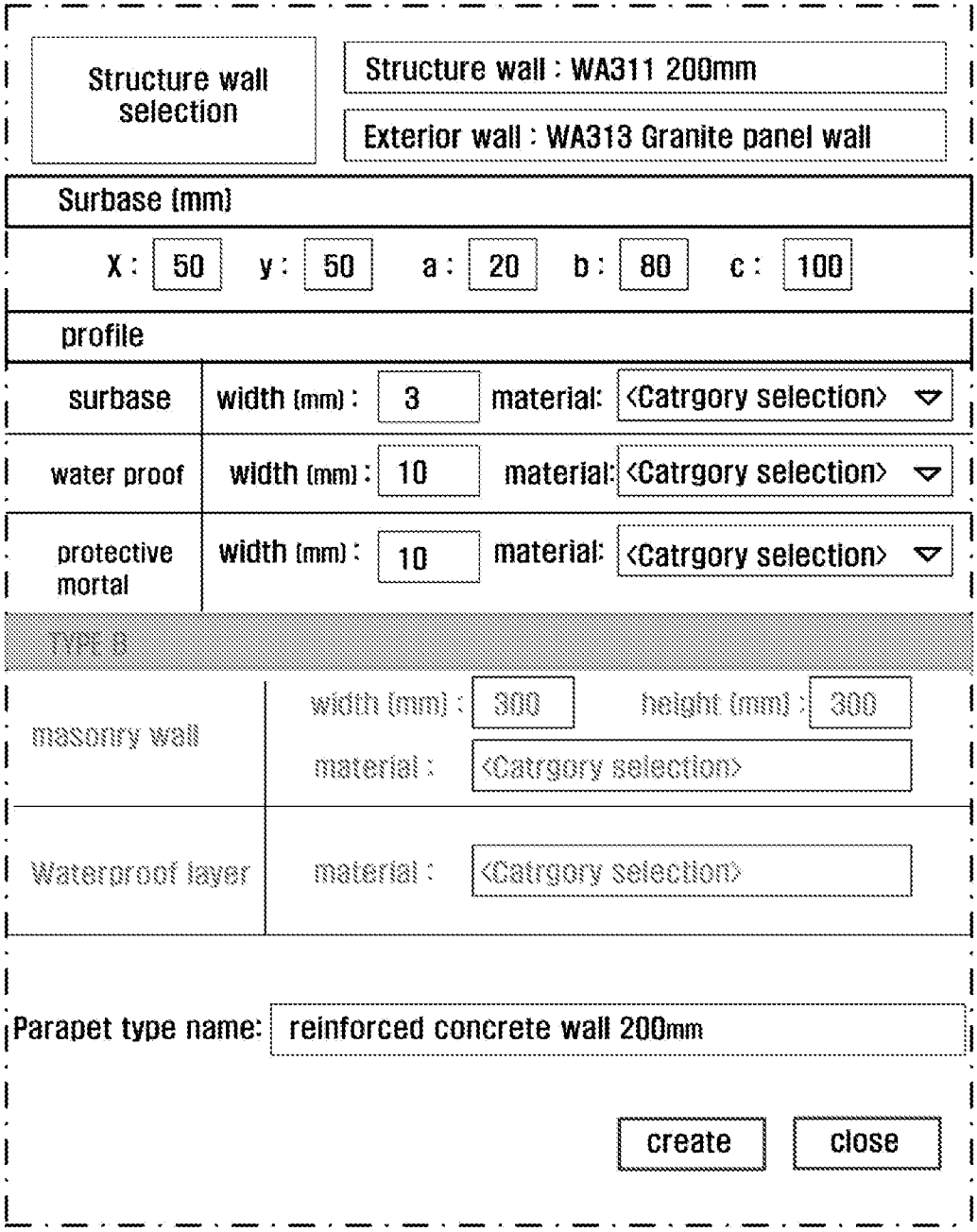


FIG. 8

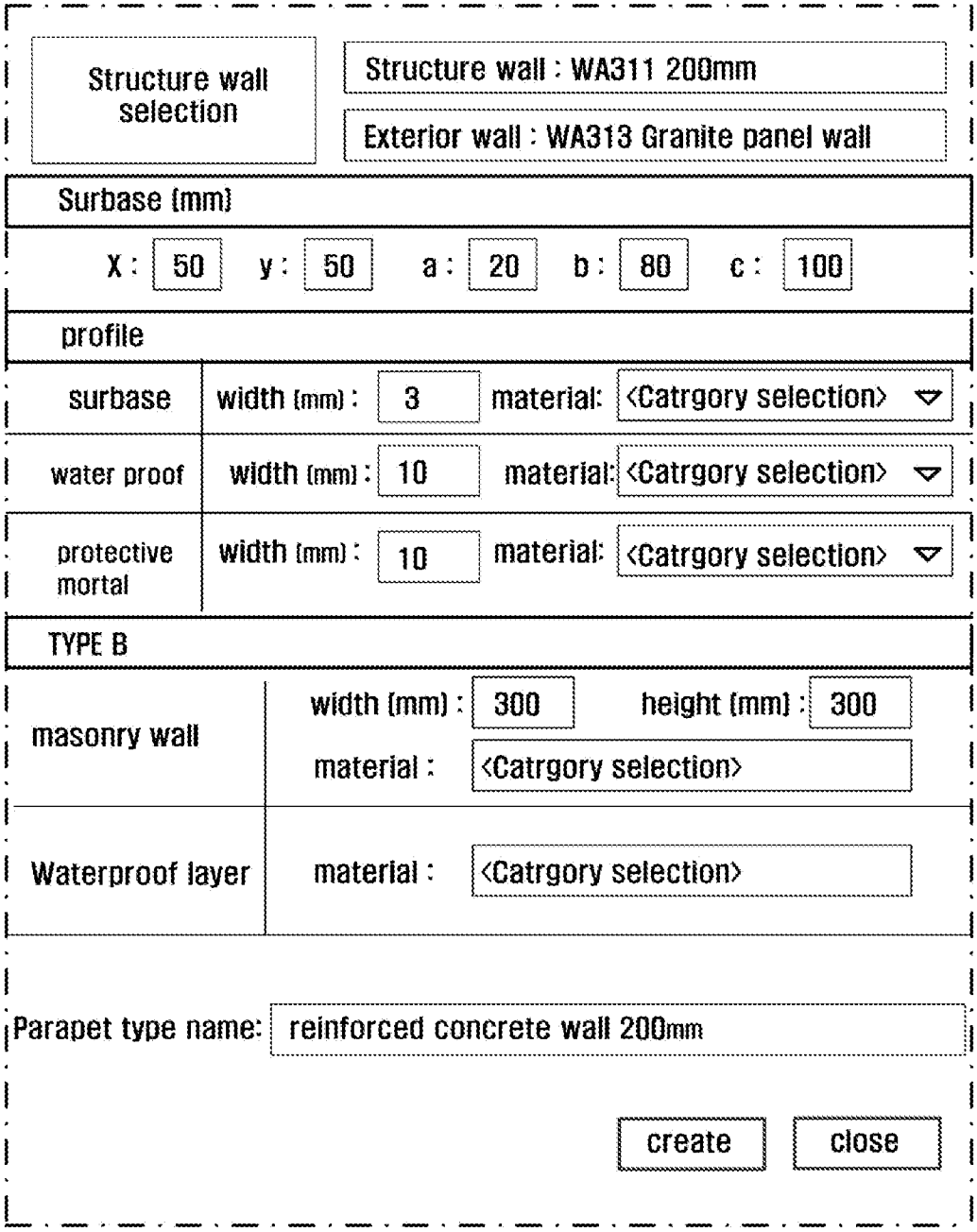
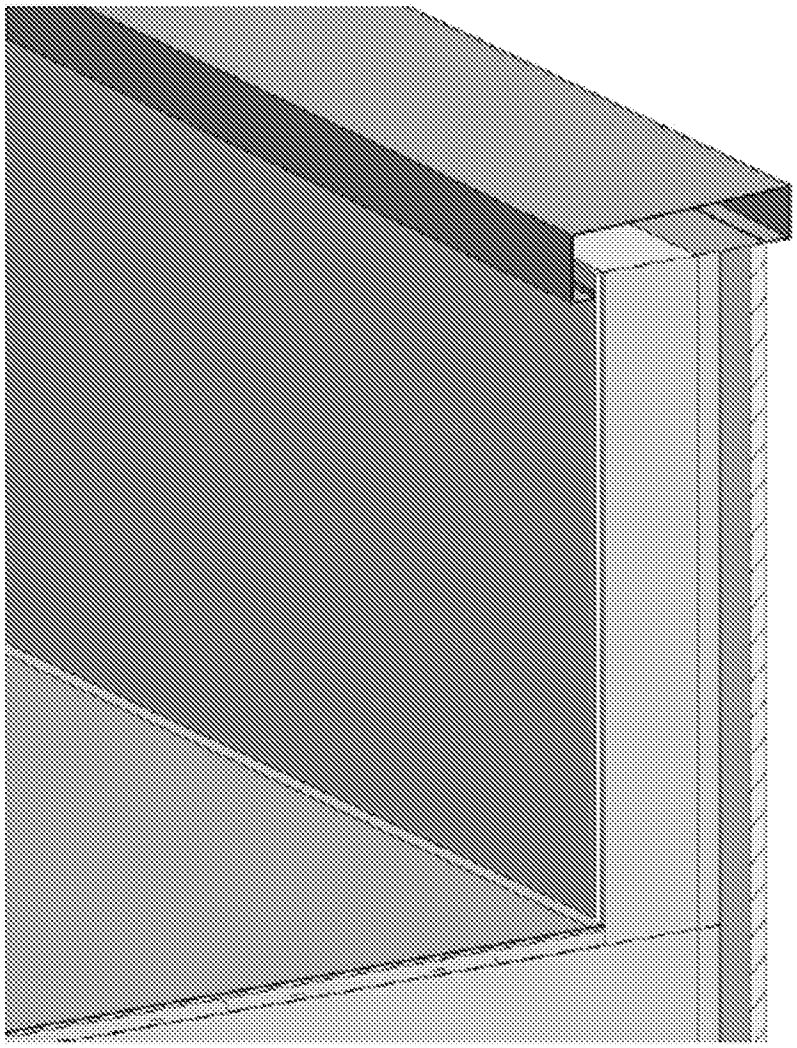
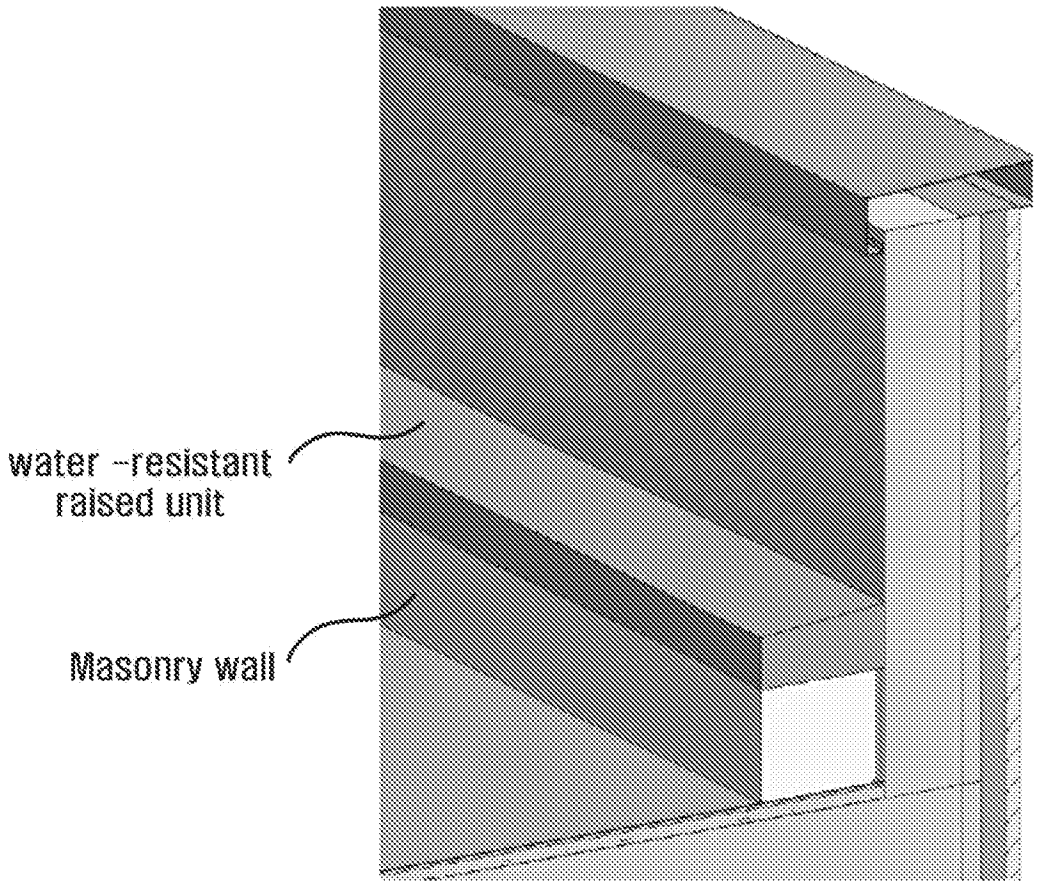


FIG. 9



Type A generation example

FIG. 10



Type B generation example

Declaration

Equivalent to USPTO Form PTO/AIA/08

Application Number:	
Title:	METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL
Atty. Dkt. No.:	DAN.1012US
Filing Date:	
First Named Inventor:	Bon Sang KOO
Examiner Name:	
Art Unit:	

Each below-named inventor hereby declares that:

1. Application

The above-referenced application:

☒ is attached hereto; or

☐ was filed on the filing date indicated above.

2. Declaration

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this Declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

3. Duty of Disclosure

I hereby acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

4. Warning

The undersigned is/are cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. The undersigned is/are advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

5. Signature(s)

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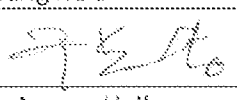
Signature:		Date:	2025-05-20
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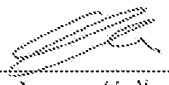
Signature:		Date:	2025. 05. 20
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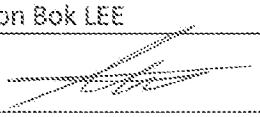
Signature:		Date:	2025. 05. 20
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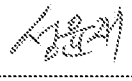
Signature:		Date:	2025.05.20
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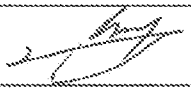
Signature:		Date:	2025. 05. 21
Correspondence Address:	#302, 74 Myeongdal-ro 22-gil Seocho-gu		
City:	Seoul	State:	
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Residence Country:	KR	Citizenship:	KR

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Residence Country:	KR	Citizenship:	KR

METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to and the benefit of Korean Patent Application No. 10-2024-0145041, filed on October 22, 2024, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND

1. Technical Field

The present invention relates to a technique for automatically generating or updating a parapet using a building information modeling (BIM).

2. Discussion of Related Art

In recent years, the application of a building information modeling (BIM) technology has been expanded in the construction and civil engineering industry, and the efficiency of structure design and construction has been greatly improved.

The BIM is a system that integrates and manages information necessary for the design, construction, and maintenance of a building based on a three-dimensional model, thereby simulating and optimizing various elements of the building.

A parapet installed on a roof of a building or an outermost part of the building is located above an outer wall, and is a structural element that protects against rain and wind and improves aesthetics.

However, the design and installation of parapets require careful design to fit the exterior walls and roof, water-resistant layers, and the like, which may be time-consuming with existing CAD-based design schemes. Utilizing BIM may automate or standardize such parapet generation, thereby preventing design errors and process issues in advance.

In the existing parapet design work, the user has to manually input information such as the location and height of the wall, the location of the water-resistant layer, and the like, which has a problem that the result may vary according to the experience and skill of the operator. In addition, parapet designs require different designs depending on the combination of various components (e.g., surbase, water-resistant layer, protective mortar, etc.), and there is an inconvenience that manual operations should be performed again with each design change.

SUMMARY

The present invention is a technology for automatically generating or updating a parapet by using a BIM model, thereby minimizing inconveniences and errors that may occur in a process of manually generating a parapet.

In the existing method, a designer has to manually perform a modeling operation in consideration of dimensions or components of a parapet one by one, which is time-consuming and may affect accuracy of a design.

In order to solve this problem, the present invention provides a method for automatically extracting parameters based on geometric information of a wall member in a BIM

model, and additionally receiving necessary configuration information from a user to automatically generate a parapet or easily update an existing parapet.

In this way, the present invention aims at maximizing the efficiency of the design and improving the design quality by quickly reflecting various components based on user input.

A method for automatically generating a parapet according to an embodiment is a method for automatically generating a parapet using a BIM model, the method may include: a step of automatically extracting, in the BIM model, a first type parameter value related to geometry information of a wall member for which a parapet is to be generated; a step of receiving, from a user, a second type parameter value for at least one configuration configuring a parapet; and a step of generating a new parapet or updating an existing parapet in the BIM model based on the extracted first type parameter value and the second type parameter value received from the user.

In some embodiments, the step of automatically extracting a first type parameter value may include: a step of generating a virtual solid using a height of a structural wall of the wall member; a step of identifying an outer wall adjacent to the structural wall based on the virtual solid; and a step of extracting a parameter value of the structural wall and the outer wall.

In some embodiments, the step of generating a virtual solid may include: a step of calculating a direction vector of the structural wall of the wall member by using a location curve class when an input for selecting the wall member is received; a step of moving a location curve located at a centerline of the structural wall to an outermost part of the structural wall based on

the direction vector; and a step of generating the virtual solid based on the location curve moved to the outermost part and the height of the structural wall.

In some embodiments, the step of receiving a second type parameter value from a user may include: a step of receiving a user input selecting either a first type parapet or a second type parapet; a step of receiving parameters for surbase, water resistance, and protective mortar of the parapet when the first type parapet is chosen; and a step of receiving parameters for surbase, water resistance, protective mortar, a masonry wall, and a water-resistant raised unit of the parapet when the second type parapet is chosen.

In some embodiments, the step of updating an existing parapet may include: removing, when a pre-generated parapet having parameters identical to the first type parameter and the second type parameter is present, a wall sweep included in the pre-generated parapet, and updating the parapet by receiving additional parameters.

According to the present invention, since a parapet may be automatically generated or updated in a BIM model, efficiency and accuracy are greatly improved compared to the existing method of manually designing a parapet.

The present invention may be expected to increase the productivity of BIM-based architectural design and construction and reduce the construction time and cost.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a schematic diagram of a parapet generation module according to an

embodiment.

FIG. 2 shows a flowchart of an operation of extracting a first type parameter value in an automatic parapet generation module driving process.

FIG. 3 shows a flowchart of an operation of receiving a second type parameter value in an automatic parapet generation module driving process.

FIG. 4 shows a flowchart of a parapet automatic modeling operation using a wall sweep in an automatic parapet generation module driving process.

FIG. 5 shows an example diagram of extracting a first type parameter value.

FIG. 6 shows an example diagram of a first type parapet (type A) and a second type parapet (type B).

FIG. 7 shows an example diagram of a parameter input UI of a first type parapet (type A).

FIG. 8 shows an example diagram of a parameter input UI of a second type parapet (type B).

FIG. 9 shows a schematic diagram of generation of a first type parapet (type A).

FIG. 10 shows a schematic diagram of generation of a second type parapet (type B).

DETAILED DESCRIPTION

Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings.

However, the technical idea of the present disclosure is not limited to the described embodiments, but may be implemented in various forms different from each other, and one or more of the components may be selectively combined and replaced between the embodiments within the scope of the present disclosure.

In addition, terms (including technical and scientific terms) used in the embodiments of the present invention may be interpreted as meanings that may be generally understood by those skilled in the art in the technical field to which the present invention belongs, unless clearly and specifically defined and described, and terms that are generally used, such as terms defined in advance, may be interpreted in consideration of their meanings in the context of the related art.

In addition, the terminology used in the embodiments of the present disclosure is for describing the embodiments and is not intended to limit the present disclosure.

As used herein, the singular forms may include the plural forms as well, unless the context clearly indicates otherwise, and may include one or more of any and all combinations that may be combined into A, B, and C when described as "at least one (or one or more) of A, and (as well as) B and C."

In addition, the terms "first," "second," "A," "B," " (a)," " (b)," and the like may be used to describe the components of the embodiments of the present invention.

These terms are only used to distinguish the components from other components and the nature, sequence, or order of the components is not limited by the terms.

Furthermore, when an component is described as being "connected," "coupled," or "accessed" to another component, it may include not only cases where the component is directly connected, coupled, or accessed to the other component, but also cases where the component is "connected," "coupled," or "accessed" by another component between the component and the other component.

In addition, when an component is described as being formed or disposed "on (above) or under (below)" another component, the "on" or "under" includes not only cases where two components are in direct contact with each other, but also cases where one or more other components are formed or disposed between the two components. Furthermore, the expression "on (above) or under (below)" may include not only an upward direction but also a downward direction with respect to one component.

Hereinafter, embodiments will be described in detail with reference to the accompanying drawings, and the same or corresponding components will be denoted by the same reference numerals regardless of the reference numeral, and redundant description thereof will be omitted.

FIG. 1 shows a schematic view of a parapet generation module according to an embodiment.

Referring to FIG. 1, a parapet generation module 100 according to an embodiment of the present invention operates in connection with a BIM server 200. The parapet generation module 100 receives necessary data from the BIM server 200, and performs a function of

automatically generating a parapet based thereon.

The BIM server 200 stores and manages various information related to architectural design, and supports the parapet generation module 100 to efficiently extract a first type parameter value (or a first parameter value) required for design, that is, geometric data of a wall, such as a height, a thickness, a length, and a location of the wall. These geometric elements are used as basic data of parapet generation, and the system automatically identifies a location curve, a reference line, and the like of a wall member, and performs parameter extraction based thereon.

Thereafter, a second type parameter value inputted by a user, that is, a detailed specification of a height, a width, a material, a finishing method, and the like of the parapet, is further inputted, and the parapet generation module 100 reflects the values to the generation of a new parapet in a BIM model. This configuration contributes to maintaining data consistency in the design process and improving design productivity through the automated parapet generation process.

The parapet generation module 100 may include at least one command or instruction capable of performing an operation according to an embodiment of the present invention, and may be implemented in a software or hardware manner. Further, integration with the BIM server may facilitate design and review of the overall construction, thereby providing immediate feedback on the location and shape at which the parapet is automatically generated.

According to some embodiments, the parapet generation module 100 may be installed as a centralized server or a cloud server, which is configured separately from the BIM server

200.

In another embodiment, the parapet generation module 100 may be implemented in the form of a software module or control device embedded in a user terminal (e.g., smartphone, laptop, tablet, personal computer, wearable device, etc.).

The parapet generation module 100 may include a processor, a communication unit, a memory, and an input/output interface (e.g., display, touch display, etc.).

The processor may be implemented as hardware, software, or a combination thereof, and may execute control logic, for example, in the form of a microcontroller, a field-programmable gate array (FPGA), or an application-specific integrated circuit (ASIC).

The communication unit may include an interface for transmitting and receiving data to and from the BIM server 200 via a wired or wireless network, and may be used to transmit and receive various types of data associated with the present invention.

The communication unit may support short-range communication, a global navigation satellite system (GNSS) module (e.g., GPS module), optical communication, broadcasting transmission and reception, and intelligent transport system (ITS) communication. Furthermore, the communication unit may perform long-distance communication with the BIM server 200 and cloud-based interworking by using a mobile communication module such as LTE or 5G and a wireless internet module to enable real-time data reception and synchronization with the cloud.

The memory may serve as a storage device for storing data and programs required for

operation of the parapet generation module 100, and may include one or more instructions executed by the processor.

The instructions may include interworking logic configured to: automatically extract a first type of parameter value associated with the geometry of a wall member in the BIM model to which a parapet is to be applied; receive, from the user, a second type of parameter value corresponding to at least one component forming the parapet; and generate a new parapet or update an existing parapet in the BIM model based on the extracted first type of parameter value and the user-input second type of parameter value.

The memory may include non-volatile memory (e.g., hard disk drive, flash memory, EEPROM, SRAM, FRAM, PRAM, MRAM, etc.) and volatile memory (e.g., DRAM, SDRAM, DDR-SDRAM, etc.), and a combination thereof may be used to construct a memory system with various capacities and performance characteristics.

FIG. 2 shows a flowchart of an operation of extracting a first type parameter value in an automatic parapet generation module driving process.

Referring to FIG. 2, a driving process of the automatic parapet generation module according to an embodiment of the present disclosure includes the following steps.

First, in step S210, a user selects a wall member for which a parapet is to be made. For example, a program (e.g., Revit) provided by the BIM server 200 may be executed to display objects including multiple wall members, and a specific wall member may be selected according to user input. At this time, the parapet generation module 100 reviews a family type

to confirm whether the selected wall member is a structural wall where a parapet may be generated. The parapet generation module 100 may determine whether the parapet is an installable wall by identifying a family type of the structural wall.

Next, in step S220, the parapet generation module 100 extracts a location curve of the structural wall and moves it.

When an input for selecting the wall member is received, the parapet generation module 100 may calculate a direction vector of the structural wall of the wall member by using a location curve class.

The location curve class in the present invention defines the centerline and geometric elements of the wall within the building information modeling (BIM) model, and serves to determine the location and direction of the wall required for parapet generation. The location curve class tracks a centerline or an outline of the wall, and automatically calculates a location at which the parapet is to be installed according to a geometric arrangement of the wall, so as to provide location data in three-dimensional space. This location curve class may perform at least one of the following operations: extracting the centerline of the wall, calculating the direction vector, moving to the outermost part, extending and combining curves, providing coordinates for the parapet design, and updating the location curves.

For example, a location curve is defined with reference to a centerline of the wall. This curve moves along the center of the wall, and the coordinates of the curve are determined by reflecting the height and width of the structural wall. This location curve is then used to form

the outermost part of the wall.

Specifically, the parapet generation module 100 calculates the direction vector of the structural wall to move the location curve by half the width of the structural wall, thereby deriving the outermost part of the structural wall. This step is a procedure that clarifies the geometrical shape of the structural wall and establishes accurate wall boundaries for later parapet generation.

In step S230, the parapet generation module 100 filters an outer wall member. The parapet generation module 100 collects the wall members in the whole BIM model by using the filtering class, and selects and returns only the outer wall member type among the wall members that intersect with a generated solid. This process is necessary to clearly understand the relationship between the structural wall and the outer wall, and serves to analyze the external elements that affect parapet generation.

In the present invention, a filtering class is a technical tool used to efficiently select a wall member required for parapet generation in a BIM model, and to distinguish a structural wall and an outer wall member to extract an accurate parameter value. The filtering class is an algorithm that automatically filters an element that meets specific conditions among wall members, and serves to maximize design efficiency and remove unnecessary data.

Finally, in step S240, the parapet generation module 100 automatically extracts parameter values of the structural wall and the outer wall. These extracted parameter values include various geometrical elements such as distance, angle, and locational relationship

between the structural wall and the outer wall, and are utilized as information necessary for a parapet design. The extracted parameter values are automatically passed to the parapet generation module, based on which the parapet is automatically generated or updated in the BIM model.

Through this series of processes, the automatic parapet generation module automates operations from wall member selection to parameter value extraction, thereby increasing design efficiency and improving accuracy and speed of the design process.

FIG. 3 shows a flowchart of an operation of receiving a second type parameter value (for example, a second parameter value) in an automatic parapet generation module driving process.

Referring to FIG. 3, a driving process of the parapet generation module 100 according to an embodiment of the present disclosure includes the following steps.

First, in step S310, the parapet generation module 100 determines whether a water-resistant raised unit or a masonry wall is required. This determination may be determined by user input. The user reviews whether a water-resistant raised unit or a masonry wall is needed to suit the design environment, and then makes a decision thereon.

When a water-resistant raised unit or a masonry wall is not required, a first type parapet (type A) is determined in step S320. This type of parapet has a relatively simple structure and is mainly focused on basic components such as surbase, water resistance, and protective mortar.

In some cases, the term "surbase" may be used interchangeably with "thickness", particularly where both represent the dimensional depth of a structural or sub-structural layer. Also, depending on the context, material composition, or environmental conditions, the distinction between “waterproof” and “water-resistant” may not be absolute. As such, the terms may be used interchangeably to describe components that exhibit sufficient resistance to water ingress for the intended application.

In the subsequent step S330, the parapet generation module 100 receives parameter values of surbase, water resistance, and protective mortar. The surbase finishes the top of the parapet and plays a functional and aesthetic role, the water resistance is an element that enhances the structural stability of the parapet, and the protective mortar is responsible for the durability and protective function of the parapet. The user may input the height, material, finishing method, and the like of each of these elements to define the detailed characteristics of the parapet.

On the other hand, when it is determined that a water-resistant raised unit or a masonry wall is necessary, a second type parapet (type B) is determined in step S340. The second type parapet includes additional elements, such as water-resistant raised units and masonry walls, to meet more complex design needs.

In step S350, the parapet generation module 100 receives the parameter values of surbase, water resistance, and protective mortar, and in step S360, the parapet generation module 100 further receives parameter values of a water-resistant raised unit and a masonry

wall. The water-resistant raised unit serves to prevent water and moisture from entering between the parapet and the outer wall, and the masonry wall serves to enhance the durability and stability of the parapet. A user may define the size, material, installation method, and the like of each element.

Through this process, a user may select a parapet type that meets design requirements, and automatically generate a parapet by inputting required parameter values. The automated parapet generation process of the present invention helps to quickly and accurately design the parapet within the BIM model, reflecting the user's input.

FIG. 4 shows a flowchart of a parapet automatic modeling operation using a wall sweep in an automatic parapet generation module driving process.

Referring to FIG. 4, a driving process of the automatic parapet generation module according to an embodiment of the present disclosure includes the following steps.

First, in step S410, the parapet generation module 100 checks a parameter input value input by a user. Here, the parapet generation module 100 checks whether there is a missing value or an erroneous value in second type parameter values (height, width, material, finishing, etc. of the parapet) input by the user. The step of checking the accuracy of these input values is a procedure that prevents errors in the subsequent automatic modeling process and allows the design to proceed as desired.

Next, in step S420, the parapet generation module 100 checks whether the wall type specified by the user is present in the BIM model. When the wall type is not present, in step

S430, the parapet generation module 100 replicates the existing similar wall type to generate a new wall type in step S440. This is a function that allows new design elements to be added according to the user's needs, thereby providing flexibility in design.

On the other hand, when the wall type is already present, in step S450, the parapet generation module 100 removes a sweep of the previously generated wall. The sweep is an element that defines the shape of the parapet generated along the top or outline of the wall, and the process of removing the existing sweep is part of the task of changing the shape of the wall to meet new design requirements.

Thereafter, in step S460, the parapet generation module 100 adds a new sweep. In this step, the shape of the parapet is newly defined according to the input parameter value, and a sweep reflecting this is added to the wall. The sweep is used in the process of automatically modeling the parapet at the top or outline of the wall, and accurately defines the height and shape of the parapet.

Finally, in step S470, automatic parapet modeling is performed to finally generate a parapet. At this time, the parapet is automatically designed in the BIM model on the basis of the previously entered parameter values and the sweep generated for the wall type.

Through this series of processes, a user has the flexibility to add new design elements while maintaining the existing wall type, or to remove existing elements and replace them with new elements as needed. This increases the efficiency of the design process while providing the ability to flexibly adapt to various parapet design needs.

FIG. 5 shows an example diagram of extracting a first type parameter value.

Referring to FIG. 5, a driving process of an automatic parapet generation module according to an embodiment of the present disclosure starts with a step of automatically extracting parameter values of a structural wall and an outer wall.

First, the direction vector (xyz) of the structural wall is calculated by using a location curve (LocationCurve) of the structural wall, and through this, the location curve is moved by half the width of the structural wall to derive the outermost part of the structural wall. This is a process of clearly understanding the actual boundary of the structural wall and then determining where the parapet is to be generated. The movement of the location curve defines the outer line of the structural wall, and this data is used as basic information for parapet generation.

Thereafter, a virtual solid is generated using the moved location curve and the height of the selected structural wall to confirm the intersection with other surrounding elements. This virtual solid visually represents the physical relationship between the structural wall and the outer wall, and forms a three-dimensional model to be referenced in a parameter extraction process.

Specifically, in the present invention, the virtual solid is a three-dimensional shape generated based on geometric characteristics of a wall in a BIM environment. The virtual solid is generated based on geometric parameter values such as height, thickness, length, and location of the wall member, which serves as a structural reference point referenced in parapet generation.

First, when a wall member is selected, a centerline and a direction vector of the wall

are extracted. These centerline and direction vector provide the basic coordinate data that determines the location and direction of the wall, on the basis of which the outermost part of the wall may be extracted. The outermost part of the wall then reflects the actual physical boundary of the wall and becomes an important reference for generating a virtual solid.

More specifically, as shown in FIG. 5, the parapet generation module 100 collects the wall members in the entire model by using a filtering (FilteredElementCollector) class, and selects and returns only an outer wall member type among the wall members that intersect with the generated solid, to find the outer wall member that is adjacent to the structural wall. Through this filtering process, the surrounding outer wall members are efficiently identified, and the accuracy of parameter extraction is improved.

Through this process, the parameter values of the selected structural wall and outer wall, that is, information such as width and height, are automatically extracted, and the parapet generation module 100 derives information required for parapet design. These parameter values are utilized as the basic data required for the profile modeling for configuring the parapet, and serve to reflect the physical characteristics and design needs of the parapet.

This automated parameter extraction process allows the designer to accurately perform parapet modeling according to the structural characteristics of the wall and perform fast and consistent design work within the BIM environment.

FIG. 6 shows an example diagram of a first type parapet (type A) and a second type parapet (type B).

Referring to FIG. 6, an automatic parapet generation module according to an embodiment of the present disclosure provides two types of parapets.

Type A is composed of surbase, water resistance, and protective mortar, and is mainly used in medium-sized buildings or commercial buildings. This type of parapet focuses on practicality and functionality, and on leak prevention and structural stability rather than appearance. The surbase is an element that covers the top of the parapet, providing both aesthetic completion and functionality of the parapet. Water resistance prevents water from penetrating through the parapet, and protective mortar serves to prevent physical damage and enhance durability of the parapet.

Type B meets more complex structural requirements, with the addition of water-resistant raised units and masonry walls to the basic components of type A. This type of parapet is suitable for high-rise buildings or complex structures and provides enhanced water resistance and structural stability. The water-resistant raised unit is an additional device that prevents water ingress from the outside, and play a particularly important role in high-rise structures. The masonry wall reinforces the foundation structure of the parapet to improve the overall stability and enhance the durability of the parapet.

Each parapet type is designed in consideration of the thickness and height of the structural wall and the outer wall of the building, and a user may input the parameters of each profile through the module UI to increase the flexibility of the design. This configuration allows a user to select and design a parapet that meets the requirements of a particular building, and

input parameters to apply the automatically generated parapet within the BIM model.

FIG. 7 shows an example diagram of a parameter input UI of a first type parapet (type A).

Referring to FIG. 7, a parameter input UI of an automatic parapet generation module according to an embodiment of the present disclosure provides an interface for inputting detailed parameters for profiles such as surbase, water resistance, protective mortar, and the like. A user may input parameters such as thickness, width, height of surbase, and select the material of each profile.

For example, the parameter of surbase, consisting of x, y, a, b, and c, is used to define the geometric property of the surbase. For example, the thickness of surbase, defined as x, and y, is an element for ensuring the structural stability of the surbase. In addition, the functionality of the parapet may be enhanced by inputting the width and material of the water resistance and protective mortar.

This UI allows a user to finely adjust the parapet to the design requirements and increases the flexibility of the design. In this way, the user may adjust the thickness of the water-resistant layer or change the material of the protective mortar according to a specific environment or condition, so as to automatically implement a more efficient and customized design.

FIG. 8 shows an example diagram of a parameter input UI of a second type parapet (type B).

Referring to FIG. 8, a parameter input UI of an automatic parapet generation module according to an embodiment of the present invention is shown. This UI is configured to allow a user to select the parapet type B and input detailed parameters of each profile.

The UI includes an input field for inputting the width and material for each profile of surbase, water resistance, protective mortar, a water-resistant raised unit, and a masonry wall. For example, the width of the surbase may be set to 100 mm, the width of water resistance may be set to 80 mm, and the width of protective mortar may be set to 20 mm. In addition, the height of the masonry wall is inputted as 300 mm, and the interval between the water-resistant raised units may also be set.

At the bottom of FIG. 8, a cross-section of the parapet is shown, where the location and size of each profile is visually represented. It is composed of surbase, water resistance, protective mortar, a water-resistant raised unit, and a masonry wall in this order, and the thickness and location of each profile are indicated. Through this UI, the user may finely adjust the parapet according to the design requirement, and the input parameter values are utilized in a later automatic parapet generation process.

Through this parameter input process, a user may increase the flexibility of the design and automatically implement a more efficient and customized parapet design.

FIG. 9 shows a schematic diagram of generation of a first type parapet (type A).

Referring to FIG. 9, a parapet of type A generated through an automatic parapet generation module according to an embodiment of the present invention is shown. Type A is a

basic parapet type consisting of surbase, water resistance, and protective mortar, and is designed to enhance water-resistant and protective functions. As may be seen in FIG. 9, the top of the parapet has surbase, below which the water-resistant layer and the protective mortar are arranged one after the other. Such a configuration is mainly used in a medium-sized building or a commercial building, and is suitable for a building in which functionality is more important than appearance.

FIG. 10 shows a schematic diagram of generation of a second type parapet (type B).

Referring to FIG. 10, a Type B generation example of an automatic parapet generation module according to an embodiment of the present invention is shown. Type B is suitable for high-rise buildings or complex structures in a form that includes a masonry wall and a water-resistant raised unit to enhance structural stability and water-resistant function.

As shown in FIG. 10, the water-resistant raised unit is located at the top of the parapet and serves to prevent moisture penetration from the outside, and the masonry wall is located at the bottom of the parapet to provide structural support and stability. These components may be finely adjusted through each parameter value, and a user may input the width, height, and material of each profile through the module UI to generate a parapet tailored to the design requirements.

Such an automated parapet generation manner contributes to maintaining consistency in design change, improving design quality, and increasing work efficiency.

The term “unit” used in this embodiment refers to software or hardware components

such as a field-programmable gate array (FPGA) or an ASIC, and the "unit" performs certain roles. However, the term "unit" is not limited to software or hardware. The "unit" may be configured to be in an addressable storage medium or may be configured to reproduce one or more processors. Thus, by way of example, the "unit" includes components such as software components, object-oriented software components, class components, and task components, as well as processes, functions, attributes, procedures, subroutines, segments of program code, drivers, firmware, microcode, circuitry, data, databases, data structures, tables, arrays, and variables. Functionality provided within components and "units" may be combined into a smaller number of components and "units" or further separated into additional components and "units." Further, the components and "units" may be implemented to play one or more CPUs in a device or secure multimedia card.

Although the foregoing has been described with reference to the preferred embodiments of the present invention, it will be understood by those skilled in the art that various modifications and changes may be made to the present invention without departing from the spirit and scope of the invention as set forth in the following claims.

WHAT IS CLAIMED IS:

1. A method for automatically generating a parapet using a building information modeling (BIM) model, the method comprising:

a step of automatically extracting, in the BIM model, a first type parameter value related to geometry information of a wall member for which a parapet is to be generated;

a step of receiving, from a user, a second type parameter value for at least one configuration configuring a parapet; and

a step of generating a new parapet or updating an existing parapet in the BIM model based on the extracted first type parameter value and the second type parameter value received from the user.

2. The method of claim 1,

wherein the step of automatically extracting a first type parameter value includes:

a step of generating a virtual solid using a height of a structural wall of the wall member;

a step of identifying an outer wall adjacent to the structural wall based on the virtual solid; and

a step of extracting a parameter value of the structural wall and the outer wall.

3. The method of claim 2,

wherein the step of generating a virtual solid includes:

a step of calculating a direction vector of the structural wall of the wall member by using a location curve class when an input for selecting the wall member is received;

a step of moving a location curve located at a centerline of the structural wall to an outermost part of the structural wall based on the direction vector; and

a step of generating the virtual solid based on the location curve moved to the outermost part and the height of the structural wall.

4. The method of claim 1,

wherein the step of receiving a second type parameter value from a user includes:

a step of receiving a user input selecting either a first type parapet or a second type parapet;

a step of receiving parameters for surbase, water resistance, and protective mortar of the parapet when the first type parapet is chosen; and

a step of receiving parameters for surbase, water resistance, protective mortar, a masonry wall, and a water-resistant raised unit of the parapet when the second type parapet is chosen.

5. The method of claim 1,

wherein the step of updating an existing parapet comprises:

a step of removing, when a pre-generated parapet having parameters identical to the first type parameter and the second type parameter is present, a wall sweep included in the pre-generated parapet; and

a step of updating the parapet by receiving additional parameters.

ABSTRACT

A method for automatically generating a parapet in a BIM model is disclosed. A method for automatically generating a parapet according to one embodiment is a method for automatically generating a parapet using a BIM model, the method including: a step of automatically extracting, in the BIM model, a first type parameter value related to geometry information of a wall member for which a parapet is to be generated; a step of receiving, from a user, a second type parameter value for at least one configuration configuring a parapet; and a step of generating a new parapet or updating an existing parapet in the BIM model based on the extracted first type parameter value and the second type parameter value received from the user.

Assignment of Patent Application

Patent Application

Title:	METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL
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Assignment

I/we, the undersigned Assignor(s), have agreed and hereby agree to assign to the Assignees, jointly, in exchange for good and valuable consideration and in furtherance of my/our obligations to the Assignees and their respective subsidiaries and affiliates, and do hereby assign and transfer to the Assignees, their successors and assigns, the entire right, title and interest, including the right of priority, in, to and under:

- the Patent Application;
- any patent application that claims domestic and/or foreign priority rights from the Patent Application, either directly or indirectly, such as but not limited to continuations, continuations- in-Part (CIPs), and divisionals of the Patent Application, and utility patent applications claiming the benefit of the Patent Application or converted from the Patent Application in the event that the Patent Application is a provisional patent application;
- any other patent application that describes and/or claims subject matter described and/or claimed in the Patent Application, whether or not the other patent application claims

priority rights from the Patent Application;

- any Letters Patent, in any country, that is issued from any of the patent applications specified above, and any reissues, reexaminations, or extensions of such Letters Patent; and
- any invention described and/or claimed in any patent application and/or Letters Patent specified above, and any improvement thereto.

I/we additionally authorize the Assignees to file applications in my/our name for Letters Patent in any country, to be held and enjoyed jointly by the Assignees, their successors, assigns, nominees or legal representatives, to the full end of the term or terms for which said Letters Patent respectively may be granted, reissued or extended, as fully and entirely as the same would have been held and enjoyed by me/us had this Assignment, and transfer not been made.

I/we hereby covenant that I/we have full right to convey the entire interest herein assigned, and that I/we have not executed and will not execute any agreement in conflict herewith, and I/we further covenant and agree that I/we will, each time a request is made, and without undue delay, execute and deliver all such papers as may be necessary or desirable to perfect the title to said invention(s) or improvement(s), said application and said Letters Patent, to the Assignee, its successors, assigns, nominees or legal representatives, and I/we agree to communicate to the Assignees, or to their nominee, all known facts respecting said invention(s) or improvement(s), said application and said Letters Patent, to testify in any legal proceedings, to sign all lawful papers, to execute all disclaimers and divisionals, continuations, CIPs, reissue and foreign applications, to make all rightful oaths and declarations, and generally to do everything possible to aid the Assignees, their successors, assigns, nominees and legal representatives to obtain and enforce, for its or their own benefit, proper patent protection for said invention(s) or improvement(s) in any and all countries provided the expenses which may be incurred by me/us in lending such cooperation and assistance are paid by the Assignees.

I/we hereby authorize and request the Commissioner of Patents and Trademarks of the United States and any official of any country of countries foreign to the United States whose duty it is to issue patents on applications as aforesaid, to issue to the Assignees, as assignee of the entire right, title and interest, any and all Letters Patent for said invention(s) or improvement(s), including any and all Letters Patent of the United States which may be issued and granted on or as a result of the application aforesaid, in accordance with the terms of this Assignment.

I/we further authorize and direct the attorney(s) of record to insert into this Assignment the serial number and filing date of the Patent Application as soon as the same shall have been made known by the United States Patent and Trademark Office.

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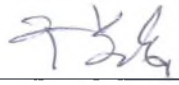
Signature:		**Date:**	2025.05.20
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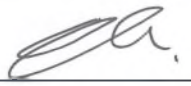
Signature:		**Date:**	2025.05.20
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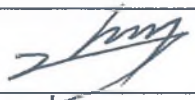
Signature:		**Date:**	2025.05.21
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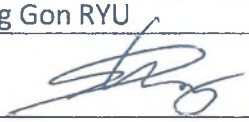
Signature:		**Date:**	2025.05.21
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제목: For Your Records: Patent Application Filing Receipt Received (Our Ref: DAN.1012US; Your Ref: G25E10B0673PUS)
첨부 파일: Receive Filing Receipt.pdf

U.S. App. No: 19/216,824
Title: METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL
Filing Date: May 23, 2025
Our Ref: DAN.1012US
Your Ref: G25E10B0673PUS

Dear Darby Park,

We have received the official Filing Receipt for the above-referenced patent application from the U.S. Patent and Trademark Office (USPTO). The Filing Receipt indicates that the USPTO has received the application and assigned it the serial number indicated above. The Filing Receipt serves as an official record that the patent application has been filed with the USPTO.

For Robert Plotkin, Founding Partner, Software Patent Attorney

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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
19/216,824	05/23/2025		730	DAN.1012US	5	1

CONFIRMATION NO. 6463

UPDATED FILING RECEIPT

144359
Blueshift IP LLC
1 Broadway, 14th Floor
Cambridge, MA 02142

OC00000089833122

Date Mailed: 06/10/2025

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

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Assignment For Published Patent Application

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Power of Attorney: The patent practitioners associated with Customer Number 144359

Domestic Applications for which benefit is claimed - None.

A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2024-0145041 10/22/2024 Access Code Provided

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 06/03/2025

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 19/216,824**

Projected Publication Date: 04/23/2026

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application

serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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ipdana2

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제목: For Your Records: Notice of Recordation of Assignment Received (Our Ref: DAN.1012US; Your Ref: G25E10B0673PUS)
첨부 파일: Receive Notice of Recordation of Assignment Docs.pdf

App. No: 19/216,824
Title: METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL
Filing Date: May 23, 2025
Our Ref: DAN.1012US
Your Ref: G25E10B0673PUS

Dear Darby Park,

We have received a Notice of Recordation of Assignment from the United States Patent and Trademark Office (USPTO) in connection with the above-referenced patent application. The Notice serves as an official record that the Assignment that we previously submitted to the USPTO has been recorded at the USPTO. We attach a copy of the Notice for your records.

The Notice indicates that the Assignment was recorded at the USPTO on May 23, 2025, at Reel 071343 and Frame 0208. We, and members of the public, may use this information to access the Assignment in the USPTO's patent assignment database.

For Robert Plotkin, Founding Partner, Software Patent Attorney

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UNITED STATES PATENT AND TRADEMARK OFFICE

UNDER SECRETARY OF COMMERCE FOR INTELLECTUAL PROPERTY AND
DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

JUNE 9, 2025

PTAS

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509203109

UNITED STATES PATENT AND TRADEMARK OFFICE
NOTICE OF RECORDATION OF ASSIGNMENT DOCUMENT

THE ENCLOSED DOCUMENT HAS BEEN RECORDED BY THE ASSIGNMENT RECORDATION BRANCH OF THE U.S. PATENT AND TRADEMARK OFFICE. A COMPLETE COPY IS AVAILABLE AT THE ASSIGNMENT SEARCH ROOM ON THE REEL AND FRAME NUMBER REFERENCED BELOW.

PLEASE REVIEW ALL INFORMATION CONTAINED ON THIS NOTICE. THE INFORMATION CONTAINED ON THIS RECORDATION NOTICE REFLECTS THE DATA PRESENT IN THE PATENT AND TRADEMARK ASSIGNMENT SYSTEM. IF YOU SHOULD FIND ANY ERRORS OR HAVE QUESTIONS CONCERNING THIS NOTICE, YOU MAY CONTACT THE ASSIGNMENT RECORDATION BRANCH AT 571-272-3350. PLEASE SEND REQUEST FOR CORRECTION TO: U.S. PATENT AND TRADEMARK OFFICE, MAIL STOP: ASSIGNMENT RECORDATION BRANCH, P.O. BOX 1450, ALEXANDRIA, VA 22313.

RECORDATION DATE: 05/23/2025

REEL/FRAME: 071343/0208
NUMBER OF PAGES: 10

BRIEF: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

DOCKET NUMBER: DAN.1012US

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APPLICATION NUMBER: 19216824 FILING DATE: 05/23/2025
PATENT NUMBER: ISSUE DATE:
TITLE: METHOD FOR AUTOMATICALLY GENERATING PARAPET IN BIM MODEL

ASSIGNMENT RECORDATION BRANCH
PUBLIC RECORDS DIVISION