Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2781638 A1 2011/06/03

(21) 2 781 638

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) Date de dépôt PCT/PCT Filing Date: 2010/11/24
(87) Date publication PCT/PCT Publication Date: 2011/06/03
(85) Entrée phase nationale/National Entry: 2012/05/23
(86) N° demande PCT/PCT Application No.: US 2010/058092
(87) N° publication PCT/PCT Publication No.: 2011/066452
(30) Priorité/Priority: 2009/11/24 (US61/264,219)

(51) Cl.Int./Int.Cl. *G06F 17/50* (2006.01), *G06F 21/24* (2006.01), *G06F 9/44* (2006.01)

(71) Demandeur/Applicant:
ICE EDGE BUSINESS SOLUTIONS INC., CA

(72) Inventeur/Inventor:
LOBERG, BARRY A., CA

(74) Agent: BENNETT JONES LLP

(54) Titre : PARTAGE SECURISE DE RENDUS DE CONCEPTION PAR LE BIAIS D'UN RESEAU
(54) Title: SECURELY SHARING DESIGN RENDERINGS OVER A NETWORK

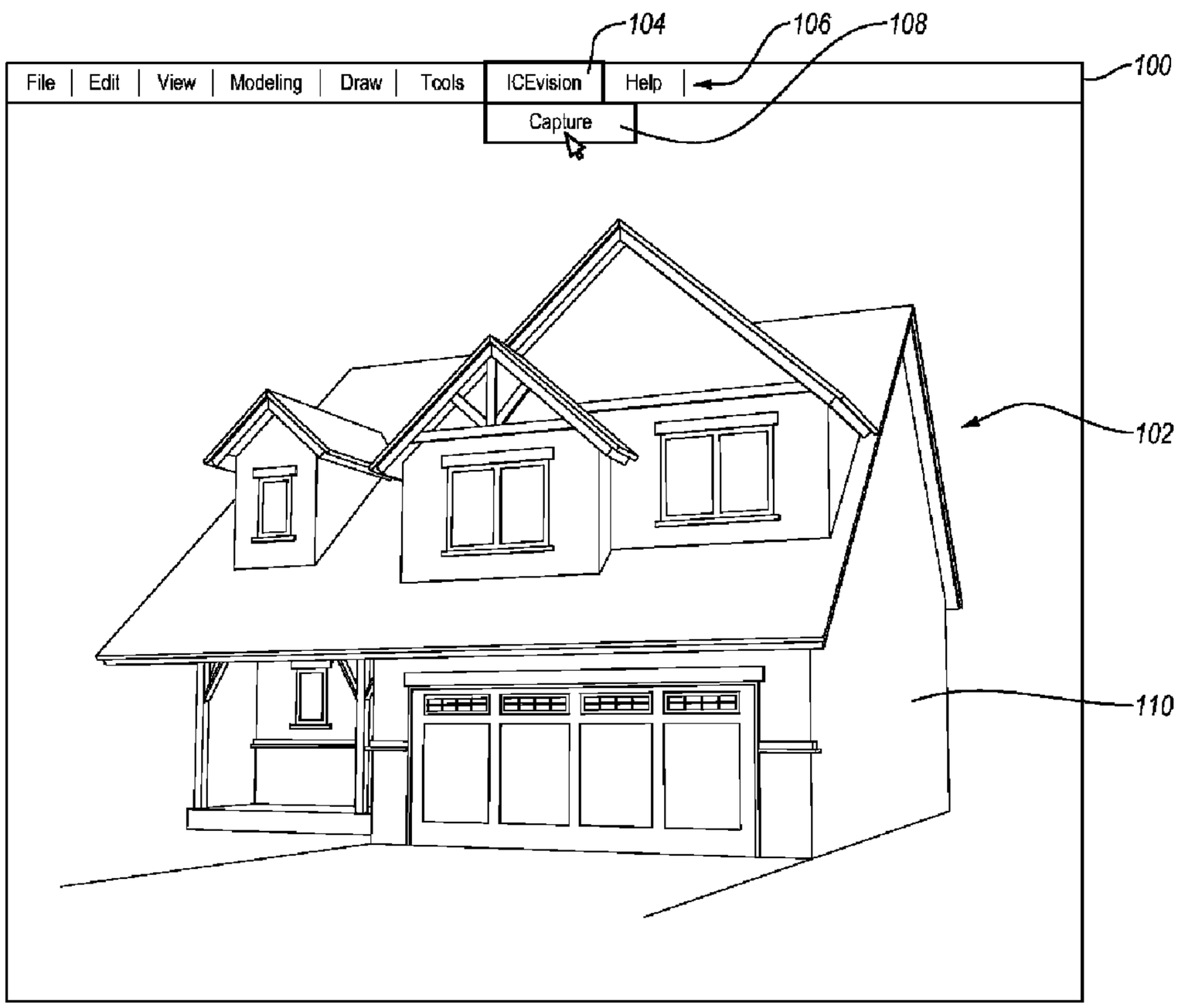

Fig. 1

(57) Abrégé/Abstract:
Systems, methods, and design software allow for easy and efficient rendering, displaying, navigation, and/or sharing of computer generated designs and models. One or more implementations allow a user to share the geometry and the graphical attributes of a

CA 2781638 A1 2011/06/03

(21) 2 781 638

(13) A1

(57) Abrégé(suite)/Abstract(continued):
three-dimensional model without sharing the source file or the proprietary details of the source file. In particular, the one or more implementations provide the ability to capture the geometry and the graphical attributes of a three- dimensional model, and share then captured geometry with others. Furthermore, one or more implementations can allow for sharing of the geometry and graphical attributes of a three-dimensional model without requiring the viewer to have the software used to create the three-dimensional model.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
3 June 2011 (03.06.2011)

PCT

(10) International Publication Number
WO 2011/066452 A3

(51) International Patent Classification:
G06F 17/50 (2006.01) *G06F 9/44* (2006.01)
G06F 21/24 (2006.01)

(21) International Application Number:
PCT/US2010/058092

(22) International Filing Date:
24 November 2010 (24.11.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/264,219 24 November 2009 (24.11.2009) US

(71) Applicant *(for all designated States except US)*: **ICE EDGE BUSINESS SOLUTIONS INC.** [US/US]; 4001 South 700 East, Suite 450, Salt Lake City, UT 84107 (US).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **LOBERG, Barrie, A.** [CA/CA]; Site 15, Box 10, RR1, Millarville, AB T0L 1K0 (CA).

(74) Agents: **FRODSHAM, Michael, J.** et al.; Workman Nydegger, 1000 Eagle Gate Tower, 60 E. South Temple, Salt Lake City, UT 84111 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(88) Date of publication of the international search report:
3 November 2011

(54) Title: SECURELY SHARING DESIGN RENDERINGS OVER A NETWORK

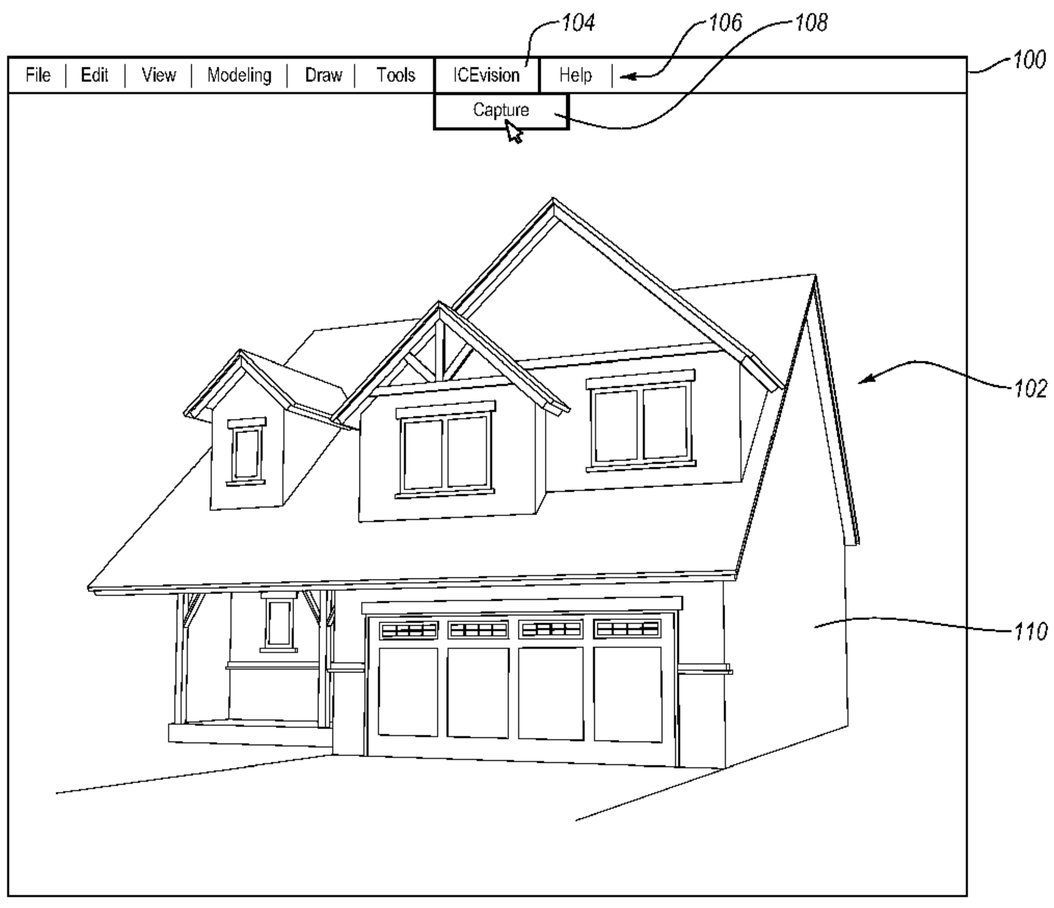

Fig. 1

(57) Abstract: Systems, methods, and design software allow for easy and efficient rendering, displaying, navigation, and/or sharing of computer generated designs and models. One or more implementations allow a user to share the geometry and the graphical attributes of a three-dimensional model without sharing the source file or the proprietary details of the source file. In particular, the one or more implementations provide the ability to capture the geometry and the graphical attributes of a three- dimensional model, and share then captured geometry with others. Furthermore, one or more implementations can allow for sharing of the geometry and graphical attributes of a three-dimensional model without requiring the viewer to have the software used to create the three-dimensional model.

WO 2011/066452 A3

SECURELY SHARING DESIGN RENDERINGS OVER A NETWORK

BACKGROUND OF THE INVENTION

The Field of the Invention

The present invention relates generally to computer-aided design or drafting software.

Background and Relevant Art

Many industries use computer-aided design ("CAD") software (such as AutoCAD, Revit, 3DS Max, SketchUp) to design and create three-dimensional computer models. Increasingly, users of conventional design software utilize this software to display three-dimensional models to clients, investors, and other individuals. The conventional focus of many conventional design software programs is on designing and creating three-dimensional computer models, and not on displaying, navigating, and sharing the three-dimensional models. As such, some conventional design software programs make displaying, navigating, and sharing the three-dimensional models difficult, inefficient, or ineffective.

For example, some conventional design software may render three-dimensional models for display that do not have a realistic appearance. In particular, the version of the three-dimensional model rendered by the conventional design software may not incorporate the full details of the three-dimensional model. For example, the rendered version of the model may not include details such as shading, color, finish, and transparency. Conventional design software that is able to create a realistic appearance by rendering and displaying sufficient details of a three-dimensional model can tend to require an excessive amount of computing power and time to display and navigate.

In addition, the navigational control tools that some conventional design software programs use to view three-dimensional models may not be natural or intuitive. The absence of intuitive navigational control tools in some conventional design software can make viewing and appreciating all aspects of a three-dimensional design difficult or time consuming. One will appreciate that the lack intuitive navigational control tools can make it particularly difficult for a person unfamiliar

with the software (i.e., clients, investors) to navigate a three-dimensional model quickly and effectively.

Conventional design software can also have limited ability to share three-dimensional models with individuals that are not in the same location as the designer. For example, some conventional design software requires the designer to save or export the model into a file and send file (e.g., by email) to a desired viewer. The size alone of some three-dimensional model files can make transferring and sharing of the model difficult.

Additionally, in order to open and view the three-dimensional model file, the viewer is often required to own and have installed on his or her computer the same software as the designer. Often, it is not practical for all desired viewers of a particular design to have the same design software. This is due, in part, to the fact that conventional design software can be rather expensive, the viewer may not be in the design business, or the viewer simply prefers a brand of design software that is not the same as the designer's.

Furthermore, even in the event that the desired viewer has the same design software as the designer, the designer may not want to provide others with a digital copy of the three-dimensional model. For instance, when sharing a three-dimensional model using some conventional design software, the saved or exported computer design file can contain the visual aspects of the design as well as proprietary data concerning the design. One will appreciate that sharing all of the data associated with a three-dimensional model can be undesirable because the data could easily be misappropriated by a viewer. Moreover, the viewer may also have the ability to make edits to the design data, thereby changing the design and the designer's original intent.

In order to avoid the security risks associated with conventional design software, including those identified above, many designers resort to simply capturing a limited number of selected static views of a three-dimensional model. In some cases, these views can be combined into a video file. The designers might then provide copies of the static views or the video file, either electronically or by hard copy, to the desired viewers. While sharing static images or a video of a three-dimensional model may resolve some of the complications and risks associated with conventional design software, there can be drawbacks with sharing only certain views of a three-dimensional model. For example, the viewer cannot navigate through the

three-dimensional model and see all of the different angles and lines that would be possible with a three-dimensional computer model.

According, there are a number of problems in the art that can be addressed.

BRIEF SUMMARY OF THE INVENTION

Implementations of the present invention overcome one or more problems in the art with systems, methods, and apparatus configured to allow easy and efficient rendering, displaying, navigation, and/or sharing of computer generated designs and models. In particular, one or more implementations of the present invention provide the ability to capture the geometry and the graphical attributes of a three-dimensional model. One or more implementations also allow for easy and intuitive navigation of the captured geometry. Additionally, one or more implementations allow a user to share the geometry and the graphical attributes of a three-dimensional model without sharing the source file or proprietary details of the source file. Furthermore, one or more implementations can allow for sharing of the geometry and graphical attributes of a three-dimensional model without requiring the viewer to have the software used to create the three-dimensional model.

For example, a computer program storage product can have computer-executable instructions stored thereon that, when executed, cause one or more processors to perform acts of identifying one or more files corresponding to a three-dimensional computer model created by a design software application and stored within a database associated with the design software application. The acts can additionally involve identifying geometry data and graphical aspect data of the three-dimensional computer model in the one or more files. Additionally, the acts can involve extracting the geometry data and graphical aspect data from the one or more files corresponding to the three-dimensional computer model. Also, the acts can involve storing the geometry data and graphical aspect data in a storage module unassociated with the design software application. Furthermore, the acts can involve providing an accurate three-dimensional view of the geometry and graphical aspects of the three-dimensional computer model at a display device using a capture and render software application unassociated with the design software application.

Additionally, a method from the perspective of a web server can involve receiving, from a first remote client computer system, geometry data and graphical aspect data extracted from a three-dimensional computer model created using a design

software application. The method can also involve storing the geometry data and graphical aspect data in one or more geometric computer model files at a web server. Furthermore, the method can involve receiving one or more requests for the one or more geometric computer model files from a second remote client computer system. Also, the method can involve sending the one or more geometric computer model files and one or more viewer application files from the web server to the second remote client computer system. The one or more viewer application files can be configured to launch a temporary viewer application on the second remote client computer system. The temporary viewer application is configured to display the geometry data and graphical aspect data of the one or more geometric computer model files.

In addition to the foregoing, a method from the perspective of a client computer system can involve sending one or more requests to a web server for one or more geometric computer model files comprising geometry data and graphical aspect data extracted from a three-dimensional computer model created using a design software application. Also, the method can involve opening a temporary viewer application hosted by the web server. The method can additionally involve receiving the one or more geometric computer model files from the web server. Furthermore, the method can involve displaying an accurate three-dimensional view of the geometry and graphical aspects of the three-dimensional computer model at a display device using the temporary viewer application

This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

Additional features and advantages of the invention will be set forth in the description which follows, and in part will be obvious from the description, or may be learned by the practice of the invention. The features and advantages of the invention may be realized and obtained by means of the instruments and combinations particularly pointed out in the appended claims. These and other features of the present invention will become more fully apparent from the following description and

appended claims, or may be learned by the practice of the invention as set forth hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to describe the manner in which the above-recited and other advantages and features of the invention can be obtained, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. It should be noted that the figures are not drawn to scale, and that elements of similar structure or function are generally represented by like reference numerals for illustrative purposes throughout the figures. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

Figure 1 illustrates a schematic diagram of a computer model within an interface of an exemplary design software application with which an implementation of the present invention can integrate to capture the geometry of the computer model;

Figure 2 illustrates a schematic diagram of an interface within which a geometric computer model, which includes the geometry and graphical aspects of the computer model of Figure 1, is displayed in accordance with an implementation of the present invention;

Figure 3 illustrates a schematic diagram of the interface of Figure 2 and illustrates exemplary controls for navigating the geometric computer model within the interface in accordance with an implementation of the present invention;

Figure 4 illustrates a schematic diagram of an interface for creating a guided tour of a geometric computer model in accordance with an implementation of the present invention;

Figure 5 illustrates a schematic diagram of an interface for publishing a graphic computer model in accordance with an implementation of the present invention;

Figure 6 illustrates a schematic diagram of an interface for sharing a graphic computer model in accordance with an implementation of the present invention;

Figure 7 illustrates a schematic diagram of a viewer interface within which the geometric computer model of Figure 2 is displayed in accordance with an implementation of the present invention;

Figure 8 illustrates an architectural schematic diagram of a system for capturing and sharing a geometric computer model in accordance with an implementation of the present invention;

Figure 9 illustrates a flowchart of a series of acts in a method in accordance with an implementation of the present invention of capturing the geometry and graphical aspects of a computer model; and

Figure 10 illustrates a flowchart of methods from the perspective of client computer systems and of a web server in accordance with an implementation of the present invention for capturing and securely sharing the geometry and graphical aspects of a computer model.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Implementations of the present invention extend to systems, methods, and apparatus configured to allow easy and efficient rendering, displaying, navigation, and/or sharing of computer generated designs and models. In particular, one or more implementations of the present invention provide the ability to capture the geometry and the graphical attributes of a three-dimensional model. One or more implementations also allow for easy and intuitive navigation of the captured geometry. Additionally, one or more implementations allow a user to share the geometry and the graphical attributes of a three-dimensional model without sharing the source file or proprietary details of the source file. Furthermore, one or more implementations can allow for sharing of the geometry and graphical attributes of a three-dimensional model without requiring the viewer to have the software used to create the three-dimensional model.

For example, at least one implementation relates to capturing the geometry and the graphical attributes of a three-dimensional computer model created using a design software application, such as, for example, REVIT, AUTOCAD, SKETCHUP, 3DS MAX ("design software"). The systems, software, and methods of the present invention can store the geometry and graphical aspects of the computer model as a geometric computer model file. In one or more implementations, the geometric computer model can include only the geometry and graphical aspects of the computer

model. In other words, the geometric computer model may not include dimensional information, part information, or other work product information associated with the original computer model. Thus, as used herein, the term "geometric computer model file" refers to a computer file containing substantially only the geometry and graphical aspects of a three-dimensional computer model created using design software, such as those mentioned above.

Once captured, the designer (as well as another user/viewer discussed hereinafter) can use a viewer application to explore the three-dimensional geometric computer model in a dynamically rendered virtual reality environment. The rendering techniques, in addition to the viewer interface, can allow the designer (or other user) to easily and effectively display and navigate the three-dimensional design. As explained in greater detail below, both the configuration of the geometric computer model and the viewer application can allow for seamless, intuitive navigation of a geometric computer model without requiring excessive computing power.

In addition, one or more implementations of the present invention allow the designer to securely share the geometric computer model over a network (such as a LAN, WAN, intranet, or the internet, etc.). For instance, implementations of the present invention can allow a designer to automatically publish the geometric computer model in a way that it is accessible by others through the network. Furthermore, implementations of the present invention can provide a temporary viewer application to allow for the display and navigation of the geometric computer model without requiring the design software used to create the original computer model. As used herein, a "temporary viewer application" refers to a viewer application unassociated with the design software used to create the original three-dimensional model, which is automatically installed and removed from a viewer's computer to allow secure viewing of captured geometry.

Although the viewer application can display and allow a viewer to navigate and explore the rendered geometric computer model, it is important to note that, in at least one implementation, the viewer application cannot change the three-dimensional model. Moreover, in such an implementation, the viewer does not have the original design file, which can contain proprietary and work product information the designer does not want to share with the viewer. Thus, one or more implementations can protect the designer's work product and intellectual property by making the work

product otherwise inaccessible to the other users/viewers to whom the designer shares the model. This, in turn, enables the designer to freely share and show other viewers the three-dimensional model without fear they will misappropriate the design.

Referring now to the Figures, Figure 1 depicts a schematic diagram of a three-dimensional computer model of a house 102 within an interface 100 of an exemplary design software application. As indicated above, some design software applications provide limited visualization and navigation capabilities without requiring large computing resources. For example, Figure 1 shows a three-dimensional house rendering 102 that is displayed without shading, color, or other design details due to the fact that including such details may require excessive computer resources.

As mentioned above, implementations of the present invention can allow the designer to capture the geometry and graphical attributes of a three-dimensional computer model in a format that allows for efficient and effective display. In particular, one or more implementations provide a software plug- in configured to interact with the design software. The software plug-in can create an additional menu item or items in the design software. For example, Figure 1 illustrates an additional menu item 104 within a tool bar 106 of the design software interface 100.

In one implementation, the menu item 104 created by the software plug-in can provide a drop-down selection that provides the designer with one or more options relating to the capture and rendering of the three-dimensional design. For example, the menu item 104 can include a selectable capture function that initiates the capture and/or rendering of the three-dimensional design. Additionally, the menu item can include other selectable functions such as “Link,” which can initiate a bridge between the design software and the capture and render software application. The bridge can allow the capture and render software application to capture the geometry and graphical aspects from a three-dimensional computer model created by the design software.

An end user or designer can obtain the software plug-in described above through a variety of means. For example, the designer can download and/or install the software plug-in from an online source, such as a website. Of course, the designer can also install the software plug-in can from any other traditional means, such as a CD-ROM, a portable memory device, file sharing, etc. Moreover, the software plug-in can integrate with most, if not all, design software, including, but not limited to,

those mentioned above. One will appreciate that the plug-in provided can be based upon the particular type of design software. Thus, the plug-in for REVIT can be different than the plug-in for 3DS MAX, etc.

Once the designer has installed the software plug-in on the designer's computer system, the designer can then capture a three-dimensional design in a format that allows for efficient and effective display. In one implementation of the invention, for example, the designer can first open the three-dimensional computer model 102 in an interface 100 of the design software used to create the design. The designer can then select the menu item 104 from the menu bar 106 that was added upon installing the software plug-in, and select a function. For example, the designer can select the "Capture" function 108, as shown in Figure 1. Of course, in other implementations of the invention, the designer need not open the three-dimensional computer model 102; rather, the designer can select the three-dimensional computer model 102 based on the file name from a directory.

Upon selection of the "Capture" function 108, a capture and render software application can automatically open. The capture and render software application can then automatically capture the three-dimensional geometry and graphical aspects of the three-dimensional computer model 102 into a geometric computer model. Furthermore, the capture and render software application can render the geometric computer model into a virtual format, and display the geometric computer model in a viewer interface, as explained in greater detail below.

More specifically, in at least one implementation upon selection of the "Capture" function, the plug-in can send a request to a server (web-based or otherwise) for the capture and render software application. Upon receiving the request, the server can send the capture and render software application to the designer's computer system. For example, the server can send one or more Java application files or other executable instructions. Upon receipt of the application files, the designer's computer system can extract and launch the capture and render software application.

Thus, in at least one implementation, the capture and render software application can be hosted on a web server. In such implementations, at least the first time a designer selects the "Capture" function 108 during a session, the web server can send the capture and render software application to the designer's computer

system. Upon receipt of the capture and render software application from the web server, the designer's computer system can launch the capture and render software application. One will appreciate in light of the disclosure herein that hosting the capture and render software application on a web server can ensure that the designer has the latest version of the capture and render software application each time the designer seeks to capture a three-dimensional computer model 102.

In an alternative implementation, the capture and render software application can be stored directly on the designer's computer system. In such implementations, the designer's computer system can launch the capture and render software application directly without requiring files from the web server. In yet further implementations, the capture and render software application and/or plug-in can require connection with, and instruction from, the web server in order to launch the capture and render software application, irrespective of whether the capture and render software application is stored locally on the designer's computer system or on the web server.

In any event, once the designer selects the "Capture" feature 108, the designer's computer system can launch the capture and render software application, if the designer has not already opened the capture and render software application. Once the capture and render software application has launched, the capture and render software application can capture the geometry and graphical aspects of the three-dimensional computer model 102. For example, in one implementation the capture and render software application automatically sends an export command to the design software application. The design software application then exports the file(s) comprising the three-dimensional computer model 102. The capture and render software application then imports the file(s) comprising the three-dimensional computer model 102. During, or after, the importation of the file(s) comprising the three-dimensional computer model 102, the capture and render software application can parse the file(s) and save only the data necessary to recreate the geometry and graphical aspects of the three-dimensional computer model 102. In alternative implementations, the capture and render software application can run through the database of the design software and extract and save only the data necessary to recreate the geometry and graphical aspects of the three-dimensional computer model

102. Additionally, the capture and render software application can save or extract a context tag that indicates what type of component each piece of geometry comprises.

In one or more implementations the capture and render software application can extract and/or save the only the relevant geometry and relevant graphical aspects of the three-dimensional computer model 102 (in contrast to all of the geometry and graphical aspects). Specifically, the capture and render software application can extract and/or save the only the data or files associated with the viewable surface (for example, outer surfaces) of the three-dimensional computer model 102. Thus, the capture and render software application can recognize components and/or surfaces of the three-dimensional computer model that are not viewable and exclude data associated with such components and/or surfaces from the extracted data or not save such data.

For example, the files that form a wall 110 of the three-dimensional computer model 102 can include data corresponding to the interior components of the wall 110 (i.e., beams, framing, insulation, electrical and plumbing components), part manufacturer data, part cost data, dimensional data, etc. In one or more implementations, the capture and render software application can recognize and understand the attributes of the wall and all of the components associated with the wall. The capture and render software application can parse the data pertaining to the wall 110 and save only the relevant geometry and graphical aspects (in this case outer wall geometry, the finish texture and color data). Thus, in one or more implementations, the capture and render software application will recognize the interior components of the wall as unnecessary or irrelevant with respect to reproducing the outer or viewable geometry (i.e., the outer surfaces of the wall 110) and will not save the geometry data and graphical aspect data associated with such interior components.

In one example implementation, the capture and render software application can run on default parameters. More specifically, the capture and render software application can automatically capture geometry and graphical aspects of the three-dimensional computer model 102 upon a single selection of the “Capture” function 108. Alternatively, upon selection of the “Capture” function 108, the capture and render software application can open a parameter menu box. The parameter menu box can include several selections and options that dictate what features of the three-

dimensional computer model 102 will be captured. Additionally, the parameter menu box can include several additional selections and options that dictate how the captured geometry and graphical aspects of the three-dimensional computer model 102 will be rendered. For example, the capture and render software application can allow for the capture of any number of graphical attributes, including, but not limited to, colors, shading, images (such as jpegs or bitmaps), finishes, object transparency, and the like.

The capture and render software application can save the geometry, graphical aspects, and context tags as a geometric computer model file. The geometric computer model file can comprise a file type that is compatible with the capture and render software application, but not with the design software. In at least one implementation, the capture and render software application saves or stores the geometric computer model file only in the memory (i.e., volatile storage) of the designer's computer system. In such implementations, the capture and render software application does not cache or store the geometric computer model file in the non-volatile memory of the designer's computer system. In alternative implementations, the capture and render software application can store the geometric computer model file in the non-volatile memory of the designer's computer system.

Once the geometric computer model file corresponding to the three-dimensional computer model 102 is captured, the capture and render software application can render the geometry and graphical aspects of the geometric computer model accordingly. In particular, capture and render software application can render and display the three-dimensional geometry in a viewer interface. For example, Figure 2 illustrates a viewer interface 200 of the capturing and rendering software application. The viewer interface 200 displays a rendered geometric computer model 202 that includes the geometry and graphical aspects of the three-dimensional computer model 102. As explained in greater detail below, the viewer interface 200 can include a tool bar 203 that provides the designer with various functions or features, including "Browse Designs" 204, "Publish" 206, "Bookmarks" 208, and "Share" 210.

The capture and render software application can recognize the length, width, and height of objects in the three-dimensional computer model 102. Moreover, the capture and render software application can recognize graphical attributes, in addition to the dimensions, such as color, shading, finishes, transparency, images, and the like.

Furthermore, capture and render software application can render the geometry and graphical aspects of the geometric computer model in a detailed and realistic-appearing view. Also, the user can navigate different visual effects of different angles for the design elements throughout the three-dimensional view without needing to wait for additional processing. Thus, the capture and render software application can provide a much richer viewing experience to the user regarding how various geometry of the geometric computer model will look in a real-world environment, in much quicker time.

In particular, because the geometric computer model file is much smaller than the design software files corresponding to the three-dimensional computer model 102, the capture and render software application can render and allow for much quicker navigation than that possible with the design software. Furthermore, because the capture and render software application processes and only renders the geometry and graphical aspects of the three-dimensional computer model 102, the computing resources used to render and navigate the geometric computer model are minimal. One will appreciate in light of the disclosure herein that in the implementations in which only the relevant geometry and relevant graphical aspects are saved, the capture and render software application can further optimize the size of the geometric computer model file and the ease of displaying the geometry.

For example, Figure 3 illustrates a view of the viewer interface 200 and rendered geometric computer model 202, in which the viewer has changed the viewing position of the geometric computer model 202. Figure 3 further illustrates some exemplary controls 300 for navigating the geometric computer model 202. In particular, the viewer interface 200 is capable of providing the designer or viewer with the ability to explore the geometric computer model 202 in an intuitive natural manner. For example, the viewer interface can include an intuitive video-game like navigational configuration that changes the viewer's viewpoint, rather than moving the three-dimensional design in design space. The result is an increased ability to efficiently and effectively display all aspects of the three-dimensional model.

As mentioned, the navigational configuration of the viewer interface 200 can be video-game like, such that the designer controls the view point of the viewer using a computer mouse and/or keyboard. For example, in one or more implementations the designer can virtually "navigate" around (or through) the geometric computer

model 202 by clicking the left mouse button while moving the mouse in any direction. In addition, in one or more implementations the designer can maintain a position with respect to the building, and then look (i.e., as if the user is moving his head on his neck in the virtual environment) in any direction by clicking the right mouse button while moving the mouse in any direction. Furthermore, in one or more implementations the transparency of windows can allow the viewer to look through the window at a representation of what the interior of the house would look like from the perspective from outside the window. Additionally, in one or more implementations the viewer can pass through door, windows, and/or walls to allow navigation of the interior of a structure, as if the designer where actually in the structure. In yet further implementations, the designer can customize the navigational controls (i.e., assign functions to buttons) to allow for intuitive navigation according to the designer's individual preferences.

As illustrated in both Figures 2 and 3, the rendered three-dimensional geometric computer model 202 appears in virtual environment akin to a video-game like environment. In other words, the capture and render software application can incorporate not only the three-dimension geometry of the three-dimensional computer model 102 of Figure 1, but also incorporates graphical attributes such as the outside building color, the window transparency, and interior features such as color and shading that were specified in the design software, but were not displayed due to using excessive computer resources.

In one implementation, the capture and render software application can use context-based ambient occlusion as a method for providing shading and lighting effects on the geometric computer model 202 to provide a realistic viewing experience. In particular, the capture and render software application can use the context tags captured from the three-dimensional computer model 102 to provide more realistic rendering and displaying of the geometric computer model 202. More specifically, the capture and render software application can use the context of a three-dimensional shape to determine how to shade the shape or adjacent shapes.

For example, the capture and render software application can calculate a lighting value (value that indicates how bright or dark to make a vertex or surface) for one or more of the vertices of the geometric computer model 202 and tie the lighting value to the vertices. In determining the lighting value, the capture and render

software application can determine if other features or geometry will cause the particular vertices to fall within a shadow, and provide the vertex with an appropriate lighting value. Furthermore, the capture and render software application can analyze the context of other features or geometry and determine based on their context whether to change the lighting value of a particular vertex.

For instance, in determining the lighting value of a wall section adjacent a door, the capture and render software application can determine what geometry is adjacent the wall section. Thus, the capture and render software application can recognize the geometry of a door trim adjacent, or in front of, the wall section. Once adjacent geometry has been recognized, the capture and render software application can determine the context of the adjacent geometry (i.e., what the geometry comprises (in this case door trim)). Based at least in part on the context of the adjacent geometry, the capture and render software application provide the wall section with a lighting value. For example, the capture and render software application can ignore the effect of the door trim or a transparent table or window to reduce shading errors.

Once the geometry, graphical aspects, and lighting values have been determined, the capture and render software application can send this predetermined data to a graphical processing unit ("GPU") of a computerized system, along with any other relevant information. In general, GPU and related hardware is often more able to handle the demands that may be needed for some cases of accurate graphical rendering. The GPU then processes the data separately from other processing components in the computer system, and sends the processed data (e.g., pixel information) to a display device. Since much of the detailed rendering of the visual effects has been done previously, the GPU can produce a fairly accurate data stream from the template without requiring a significant amount of additional processing resources and processing time.

Additionally, the GPU, in conjunction with the capture and render software application, can allow a user to navigate the geometric computer model 202 (i.e., under objects, around corners, through ceilings, etc.), while still effectively providing the expected visual effects. For example, the user can use the navigational controls, which changes X/Y/Z viewing information for the design space. This input can cause the capture and render software application to provide additional data to the GPU or processing, or can simply tell the GPU to pull other previously-processed data from

cache. Thus, the capture and render software application can provide real-time lighting effects to the geometric computer model 202 as it is navigated within the viewer interface 200.

In addition to the example views illustrated in Figures 2 and 3, the capture and render software application can generate almost any number of views as the designer virtually navigates around and in the geometric computer model 202. Moreover, the designer can create a virtual tour using a bookmarks feature included in at least one implementation of the present invention. For example, the designer can select the "Bookmarks" feature 208 from the tool bar 203 of the viewer interface 200. Upon selection of the "Bookmarks" feature 208, the capture and render software application can open a bookmarks window 400, as shown in Figure 4.

The bookmarks window 400 can provide the designer with the ability to save a series of views in a particular order and then replay those views in virtual tour format. For example, the designer can locate a desired view and then click on the "Bookmarks" feature 208. The bookmarks window 400 can then allow the designer to save the particular desired view as a bookmark. After saving one or more desired views 402, 404, 406, 408, the designer can then create a virtual tour of the geometric computer model 202. The capture and render software application can also allow the designer to re-order or delete views to modify the tour. Furthermore, the capture and render software application can allow the designer to add notations to each of the views, as well as select the order in which the views will appear during the virtual tour. Additionally, in one or more implementations, the designer can control the lapse time between any one bookmarked view and another, and how long the tour will pause at any given bookmarked view.

As previously mentioned, the capture and render software application can save the file(s) or data corresponding to the geometric computer model 202 in the memory of the designer's computer system. These files or data can also include the bookmarks and virtual tour files. The capture and render software application can provide the designer with an option of publishing the geometric computer model 202. Specifically, the designer can select the "Publish" 206 feature provided by the viewer interface 200. Upon selection of the "Publish" 206 feature, the capture and render software application can open a publish window 500, as shown by Figure 5.

As shown by Figure 5, the publish window 500 can allow the designer to optionally name the geometric computer model 202, and provide a description of the geometric computer model 202. The publish window 500 can also provide the option to publish the geometric computer model 202. In particular, upon selecting the publish icon 502, the capture and render software application can save the geometric computer model 202, and any associated bookmarks and virtual tour data to a server. In one or more implementations, the server can comprise a web server. In particular, the capture and render software application can save the geometric computer model 202 to a specific web address. As explained in greater detail below, once saved to the web server, the capture and render software application can allow the designer to securely share the geometric computer model 202.

The capture and render software application can allow the designer to publish the geometric computer model 202 in a format that allows for viewing on mobile devices, such as the IPHONE, as shown by Figure 5. Additionally, the capture and render software application can allow the designer to also optionally save the geometric computer model 202 to a local or network specific location (non-volatile storage) by selecting a local save option 504. One will appreciate in light of the disclosure herein, that in at least one implementation, the geometric computer model 202 will not be saved to a local file (non-volatile storage) unless the local save option 504 is selected. Specifically, in such implementations, the capture and render software application will save the geometric computer model 202 to the designer's memory (i.e., volatile storage), unless the publish option is selected. Thus, in at least one implementation, once the designer closes the capture and render software application, the geometric computer model 202 will be automatically deleted from the designer's computer system.

When the local save option 504 is used, the capture and render software application can provide the designer the ability to use the captured geometry and graphical aspects of a three-dimensional computer model in other design software applications, without sharing the native design file. For example, a designer can design a piece of furniture or other model in a first design software application, capture and render the design of the furniture using capture and render software application. After saving the geometric computer model to a local file, the designer can then import the geometric computer model into another design using a second

design software application. This allows the designer to share the general concept of the design, no matter the other designers' choice of design software, and without the designer sharing any work product or other proprietary information. In at least one implementation, the imported geometric computer model is in a read-only format.

Implementations of the present invention can also provide a shared web-based database that provides any designer the ability to browse all geometric computer models that the designer has saved or published to the web server. Additionally, the shared web-based database can allow a designer to view any geometric computer models made publicly available or shared with the designer by others. For example, the designer or user can select the "Browse Designs" option 204 in provided by the viewer interface 200. Upon selection of the Browse Designs" option 204, the capture and render software application can send a request to the web server, which can provide a list of available geometric computer models.

In any event, after publishing the geometric computer model 202, the capture and render software application can allow a designer to share the geometric computer model 202 with others. In particular, the designer can select the "Share" feature 210 feature provided by the viewer interface 200. Upon selection of the "Share" feature 210, the capture and render software application can open a sharing window 600, as shown by Figure 6.

The sharing window 600 can allow the designer to share a published geometric computer model 202. In particular, after selecting the specific geometric computer model 202, the designer can then enter one or more email addresses in an email field 602, with the option of including a subject line and message. The capture and render software application can then send an email to each email address listed that provides a link to the published geometric computer model 202.

In one or more implementations, the designer can choose whether or not to provide the viewer with the capability to share the geometric computer model 202 with other users. To facilitate this choice, the sharing window 600 can allow the designer to choose between a "Quick Share" 608 or a "Secure Share" 606. When the designer selects the "Quick Share" option 608, the capture and render software application will forward a link that the viewer can in turn forward, and which allows any user or computer system with the link to gain access to the geometric computer model 202 through the web server. Alternatively, if the designer selects the "Secure

Share" option 606, the email sent to the viewer is formatted such that only the viewer whose email address the designer entered can use the hyperlink in the email to view geometric computer model 202.

In any event, when the viewer receives the email and clicks on the link, the viewer can be directed to the appropriate website, which can confirm that the viewer agrees with the terms of the use agreement. Upon agreeing, the appropriate website can send a launching file to the viewer's computer system. In one or more implementations, the launching file can comprise a JAVA network launching protocol file. Upon opening the launching file, the viewer's computer system can send a request to the web server for a capture and render software temporary viewer application, which is hosted on the web server.

Upon receiving the request, the web server can send the capture and render software temporary viewer application to the viewer's computer system. For example, the web server can send one or more Java application files or other executable instructions. Upon receipt of the application files, the viewer's computer system can extract and launch the capture and render software temporary viewer application.

In at least one implementation of the present invention, the web server can also send executable instructions to the viewer's computer system, which when executed by a processor, cause the capture and render software temporary viewer application to be stored within the memory (i.e., volatile storage) of the viewer's computer system. The viewer's computer system can then launch the capture and render software temporary viewer application. Once launched, or during the launching, the capture and render software temporary viewer application can send a request to the web server for the geometric computer model 202. The web server can send the geometric computer model 202 to the client's computer system where is it is stored in the memory (i.e., volatile storage) of the viewer's computer system.

In alternative implementations, the capture and render software temporary viewer application and/or the geometric computer model 202 can be stored within the non-volatile storage of the viewer's computer system. One will appreciate in light of the disclosure herein; however, that in at least one implementation the capture and render software temporary viewer application and the geometric computer model file 202 will only be stored in the memory (i.e., volatile storage) of the viewer's computer

system. In such implementations, the capture and render software temporary viewer application and the geometric computer model file 202 will automatically be removed the viewer's computer upon the closing of the capture and render software temporary viewer application.

In at least one implementation, the published and subsequently viewable geometric computer model 202 does not allow the viewer to have access to the original design file(s) used to create the three-dimensional computer model 102. Moreover, the geometric computer model 202 does not contain any dimensional or other work product information about the three-dimensional computer model 102. Therefore, the designer can confidently share the geometric computer model 202 with other users knowing that the other users will not have access to work product or other proprietary information related to the original three-dimensional computer model 102.

Moreover, implementations of the present invention allow the user to share the geometric computer model 202 with a viewer, no matter if the viewer has the same version, or any version, of design software used to create the original three-dimensional computer model 102. Indeed, one or more implementations do not require that the viewer have any type of design software or computer model viewer software prior to receiving the link from the web server. Specifically, when the viewer clicks on the provided link, the capture and render software temporary viewer application is automatically downloaded, thus allowing the viewer to view and explore the geometric computer model 202 as described above.

For example, Figure 7 depicts a capture and render software temporary viewer application 700 displaying the geometric computer model 202. One will appreciate that capture and render software viewer 700 can render and display the geometric computer model 202 using the same methods and techniques described above in relation to the viewer interface 200. At this point the viewer is free to navigate through geometric computer model 202 using the intuitive navigational controls described herein above.

The capture and render software viewer 700 can further allow the viewer to view any bookmarked tours, and generally view the all aspects of the three-dimensional model. For example, the capture and render software viewer 700 can include a play-button 702 or similar graphic device can be displayed in the viewer interface 200. A viewer can select the play-button 702, at which point the capture and

render software viewer 700 can automatically move from one bookmarked view to the next in a format that allows the viewer to continue to see the three-dimensional geometric computer model 202 while "moving" from one view to the next. During the virtual tour, as each bookmarked view is reached, the capture and render software viewer 700 can display the notations (if any) associated with each view. Additionally, the capture and render software viewer 700 can provide the viewer with the ability to pause, stop, rewind, or fast forward the bookmarked tour.

Figure 8 illustrates an architectural schematic diagram of a system 800 for capturing and rendering the geometry and graphical aspects of a three-dimensional computer model. In particular, Figure 8 shows that user 802 sends one or more user requests 804a, 804b, 804c to one or more processers 806 of a designer computer system 808. "Requests" can comprise any client-side instructions, or even server-side, that, when executed, cause the one or more processors 806 to process computerized instructions associated with requests. The designer 802 (or viewer 826) can send the request using one or more input devices (i.e., microphone, joy stick, game pad, satellite dish, scanner, or the like).

Thus, the designer can make a request 804a to capture the geometry and graphical aspects of a three-dimensional computer model 102 created by a design software application 810. Upon receiving the one or more requests 804a, the one or more processors 806 can send one or more requests 812a to a web server 814 for a capture and render software application 816 hosted on the web server 814. In response, to the one or more requests 812a, the web server 814 can send data or one or more message 818 comprising the capture and render software application 816. For example, the one or more messages 818 can include executable instructions that cause the designer computer system 808 to receive and launch the capture and render software application 816. In at least one implementation, the capture and render software application 816 is stored within non-volatile memory of the designer computer system 808.

Once launched, the capture and render software application 816 can cause the one or more processors 806 to automatically send a request to the design software application 810 to export the file(s) corresponding to the three-dimensional computer model 102. The design software application 810 can then cause one or more processors 806 to export the file(s) corresponding to the three-dimensional computer

model 102. At this point, the capture and render software application 816 can cause the one or more processors 806 to import and parse the file(s) corresponding to the three-dimensional computer model 102 such that only the geometry, graphical aspects, and one or more context tags are saved by the capture and render software application 816. Alternatively, once launched, the capture and render software application 816 can cause the one or more processors 806 to run through a database 818 associated with the design software 810 and extract and save only the data necessary to recreate the geometry and graphical aspects of the three-dimensional computer model 102. In any event, the capture and render software application 816 can cause the one or more processors 806 to save the geometry, graphical aspects, and context tags as a geometric computer model file in the volatile storage of the designer's computer system 808.

The capture and render software application 816 can cause the one or more processors 806 to render the geometry and graphical aspects of the geometric computer model 202 accordingly. In particular, the capture and render software application 816 can cause the one or more processors 806 to determine the geometry, graphical aspects, and lighting values as explained above. The capture and render software application 816 (or the one or more processors 806) can send this predetermined data to a GPU 820. The GPU 820 then processes the data separately from other processing components in the computer system 808, and sends the processed data (e.g., pixel information) to a display device 822.

The designer 802 can also send one or more requests 804b to publish the geometric computer model 202. Upon receipt of the one or more requests 804b, the capture and render software application 816 can cause the one or more processors 806 to send the file(s)/data associated with the geometric computer model 202 to the web server 814. Upon receipt of such files/data, the web server 814 can store the file(s) in one or more data bases 824.

The designer 802 can also send one or more requests 804c to share the geometric computer model 202. Upon receipt of the one or more requests 804b, the capture and render software application 816 can cause the one or more processors 806 to send one or more requests 812c to the web server 814 to share the geometric computer model 202 with a particular email address belonging to a viewer 826. The web server 814 can then prepare an email with one or more links to the web server

814. The web server 814 can then send the email to a server (not shown) associated with the email address.

The viewer 826 can use a viewer computer system 828 to open the email sent by the web server 814. Then the viewer 826 can the send one or more requests 830a to one or more processors 832 of the viewer computer system 828 to open the link. The one or more processors 832 can in turn send one or more requests 834a to the web server 814 to open the link. The web server 814 can then send data or one or more message 836a to the one or more one or more processors 832, such as for example, a launching file. Upon opening the launching file, the one or more processors 832 can send a request 834b to the web server 814 for a capture and render software temporary viewer application 838, which is hosted on the web server 814.

In response, to the one or more requests 834b, the web server 814 can send data or one or more message 836b comprising the capture and render viewer software application 816. For example, the one or more messages 836b can include executable instructions that cause the viewer computer system 888 to receive and launch the capture and render viewer software application 838. In at least one implementation, the capture and render software temporary viewer application 838 is stored within non-volatile memory of the viewer computer system 828.

Once launched, or during the launching, the capture and render software temporary viewer application 838 can send a request 834c to the web server 814 for the geometric computer model 202. The web server 814 can send the geometric computer model 202 to the viewer computer system 828 where is it is stored in the memory (i.e., volatile storage) of the viewer computer system 828.

The capture and render software temporary viewer application 838 can cause the one or more processors 832 to render the geometry and graphical aspects of the geometric computer model 202. In particular, the capture and render software temporary viewer application 838 can cause the one or more processors 832 to determine the geometry, graphical aspects, and lighting values as explained above. The capture and render software temporary viewer application 838 (or the one or more processors 832) can send this predetermined data to a GPU 840. The GPU 840 can then process the data separately from other processing components in the client computer system 828, and send the processed data (e.g., pixel information) to a display device 842.

Accordingly, Figures 1-8 provide a number of schematics and mechanisms for capture, rendering, navigating, sharing, and viewing geometry and graphical aspects of a computer design model. In addition to the foregoing, implementations of the present invention can also be described in terms of flowcharts comprising one or more acts in a method for accomplishing a particular result. For example, Figure 9 illustrates a method of capturing the geometry and graphical aspects of a computer model. Similarly, Figure 10 illustrates a method from the perspective of several client computer systems and of a web server for capturing and securely sharing the geometry and graphical aspects of a computer model. The acts of Figures 9 and 10 are discussed more fully below with respect to the components and diagrams of Figures 1-8. Of course, as a preliminary matter, one of ordinary skill in the art will recognize that the methods explained in detail herein can be modified. For example, various acts of the method described can be omitted or expanded, and the order of the various acts of the method described can be altered as desired.

For example, Figure 9 shows that a method in accordance with in implementation of the present invention can comprise an act 900 of identifying one or more files corresponding to a three-dimensional computer model. In at least one implementation, the three-dimensional computer model 102 was created by a design software application 810 and is stored within a database 818 associated with the design software application 810. For example, act 900 can include receiving a request 804a to capture the geometry and graphical aspects of a three-dimensional computer model 102 created by a design software application 810.

Figure 9 also shows that a method in accordance with an implementation of the present invention can comprise an act 910 of identifying geometry data and graphical aspect data of the three-dimensional computer model. For example, act 910 can include parsing the one or more files corresponding to a three-dimensional computer model 102 for data/files relating to the geometry, graphical aspects, and one or more context tags.

Furthermore, Figure 9 shows that a method in accordance with an implementation of the present invention can comprise an act 920 extracting the geometry data and graphical aspect data from the one or more files corresponding to the three-dimensional computer model. Act 920 can include sending a request to the design software application 810 to export the one or more files corresponding to a

three-dimensional computer model 102. Act 920 can then involve importing and parsing the geometry data and graphical aspect data from the exported files. Alternatively, act 920 can include searching and extracting the geometry data and graphical aspect data from a database 818 associated with the design software 810 for the one or more files corresponding to a three-dimensional computer model 102.

In addition, Figure 9 shows that a method in accordance with an implementation of the present invention can comprise an act 930 of storing the geometry data and graphical aspect data. For example, act 930 can include storing the geometry data and graphical aspect data of the three-dimensional computer model 102 in a storage module unassociated with the design software application 810. In at least one implementation, act 930 can involve storing the geometry data and graphical aspect data in volatile memory.

As shown by Figure 9, the method can also comprise an act 940 of providing an accurate three-dimensional view of the geometry and graphical aspects of the three-dimensional computer model. For example, act 940 can also include providing an accurate three-dimensional view of the geometry and graphical aspects of the three-dimensional computer model 102 at a display device 822 through communication with a graphical processing unit 820. In at least one implementation, act 940 can include identifying one or more geometries that surround one or more vertices associated with the three-dimensional view of the geometry and graphical aspects of the three-dimensional computer model; and providing a lighting value to one or more vertices based on the one or more surrounding geometries. Act 940 can also include determining the lighting value based at least in part upon the one or more context tags. Still further act 940 can include using the lighting value to providing real-time shading of the three-dimensional view as three-dimensional view changes based on navigational input.

Additionally, Figure 10 shows that a method from the perspective of designer computer system 808 for capturing and securely sharing the geometry of a three-dimensional computer model 102 can comprise an act 1000 of receiving one or more requests. For example, act 1000 includes requesting through a client computer system 808 to capture the geometry and graphical aspects of a three-dimensional computer model 102. In particular, act 1000 can include opening a design software application 810 used to create the three-dimensional computer model 102. Act 1000 can also

include selecting a "Capture" feature 108 of a plug-in integrated into the design software application 810.

Figure 10 shows that a method from the perspective of designer computer system 808 can comprise an act 1010 of opening a capture and render software application. For example, act 1010 can include sending a request 812a to a web server 814 for a capture and render software application 816 hosted on the web server 814. Act 1010 can further include receiving one or more application files and/or one or more executable instructions that cause the designer computer system 808 to receive and launch the capture and render software application 816.

Additionally, act 1010 can include sending one or more requests to the design software application 810 to export the file(s) corresponding to the three-dimensional computer model 102. Act 1010 can also include exporting the file(s) corresponding to the three-dimensional computer model 102. Furthermore, act 1010 can include importing and parsing the file(s) corresponding to the three-dimensional computer model 102 for the geometry, graphical aspects, and one or more context tags. Alternatively, act 1010 can include analyzing a database 818 associated with the design software 810 and extracting the geometry, graphical aspects, and one or more context tags of the three-dimensional computer model 102. In any event, act 1010 can further include saving the geometry, graphical aspects, and one or more context tags in volatile storage of the designer computer system.

Additionally, Figure 10 shows a method from the perspective of designer computer system 808 can comprise an act 1020 of sending one or more geometric computer model files. For example, act 1020 can include sending the file(s)/data associated with the geometric computer model 202 (i.e., the geometry, graphical aspects, and one or more context tags) to the web server 814. Act 1020 can optionally also include deleting the file(s)/data associated with the geometric computer model 202 (i.e., the geometry, graphical aspects, and one or more context tags) from the volatile memory of the designer computer system 808.

In addition to the foregoing, Figure 10 shows a method from the perspective of designer computer system 808 can comprise an act 1030 of displaying an accurate three-dimensional view. One will appreciate that act 1030 can be performed before or after act 1020. Act 1030 can include displaying an accurate three-dimensional view of the geometry and graphical aspects of the three-dimensional computer model 102

at a display device 822 using the capture and render software application 816. Act 1030 can include using ambient occlusion to give a lighting value to one or more vertices associated with the three-dimensional view of the geometry and graphical aspects of the three-dimensional computer model 102.

Furthermore, a method from the perspective of designer computer system 808 can comprise an act of receiving one or more requests 804b to share the geometric computer model 202. The method can further comprise sending one or more requests 812b to the web server 814 to share the geometric computer model 202. Specifically, the method can include sending one or more email addresses associated with a viewer 826 to the web server 814.

Figure 10 also shows that a method from the perspective of web server 814 for capturing and securely sharing the geometry of a three-dimensional computer model 102 can comprise an act 1040 of receiving one or more model files. For example, act 1040 can include receiving, from a first remote client computer system (i.e., the designer computer system 808), geometry data and graphical aspect data extracted from a three-dimensional computer model 102 created using a design software application 810.

Figure 10 shows that a method from the perspective of web server 814 can comprise an act 1050 of storing the one or more files. For example, act 1050 can include storing the geometry data and graphical aspect data in one or more geometric computer model files at a web server 814.

Additionally, Figure 10 shows that a method from the perspective of web server 814 can comprise an act 1060 of receiving one or more requests. For example, act 1060 can include receiving one or more requests for the one or more geometric computer model files from a second remote client computer system (i.e., viewer computer system 828). Additionally, or alternatively, act 1060 can include receiving one or more requests from a viewer computer system 828 for a capture and render software temporary viewer application 838. Still further act 1060 can include receiving one or more requests from a designer computer system 808 for a capture and render software application 816.

Figure 10 also shows that a method from the perspective of web server 814 can comprise an act 1070 of sending one or more files. For example, act 1070 can include sending the one or more geometric computer model files and one or more

viewer application files from the web server 814 to the second remote client computer system (i.e., viewer computer system 828). The one or more viewer application files can be configured to launch a temporary viewer application 838 on the second remote client computer system (i.e., viewer computer system 828). The temporary viewer application 838 can be configured to display the geometry data and graphical aspect data of the one or more geometric computer model files. In at least one implementation, the geometric computer model files consist essentially of the geometry and the one or more graphical aspects of the three-dimensional computer model 102, and one or more context tags.

Act 1070 can also include sending one or more executable instructions and one or more application files from the web server 814 to a remote client computer system 828 or 808. The one or more executable instructions can cause one or more processors to launch a capture and render software temporary viewer application 838 or a capture and render software application 816 on the second remote client computer system 828 or 808. Furthermore, act 1070 can include sending one or more executable instructions configured to cause the second remote client computer system 828 or 808 to store the geometric computer model files and/or the one or more application files in volatile memory.

Still further act 1070 can include sending one or more executable instructions configured to cause the second remote client computer system 808 or 828 to delete the one or more geometric computer model files upon the closing of the capture and render software temporary viewer application 838 or the capture and render software application 816. Still further act 1070 can include sending a hyperlink containing the location of the one or more geometric computer model files from the web server 814 to an email address associated with an intended viewer 826.

Figure 10 additionally shows a method from the perspective of viewer computer system 828 for capturing and securely sharing the geometry of a three-dimensional computer model 102 can comprise an act 1080 of sending one or more requests. For example, act 1080 can include sending one or more requests 834c to a web server 814 for one or more geometric computer model files comprising geometry data and graphical aspect data extracted from a three-dimensional computer model 102 created using a design software application 810.

Additionally, Figure 10 shows that a method from the perspective of viewer computer system 828 can comprise an act 1090 of opening a temporary viewer application. For example, act 1090 can include opening a temporary viewer application 838 hosted by the web server 814. In at least one implementation, act 1090 can include receiving one or more executable instructions and one or more viewer application files from the web server 814.

Figure 10 additionally shows that a method from the perspective of viewer computer system 828 can comprise an act 1092 of receiving the one or more files. For example, act 1092 can include receiving the one or more geometric computer model files from the web server 814. Act 1092 can also include storing the one or more geometric computer model files in volatile memory.

In addition to the foregoing, Figure 10 shows a method from the perspective of viewer computer system 828 can comprise an act 1094 of displaying an accurate three-dimensional view. Act 1094 can include displaying an accurate three-dimensional view of the geometry and graphical aspects of the three-dimensional computer model 102 at a display device 842 using temporary viewer application 838. Act 1094 can include using ambient occlusion to give a lighting value to one or more vertices associated with the three-dimensional view of the geometry and graphical aspects of the three-dimensional computer model 102.

Accordingly, Figures 1-10 provide a number of components, schematics, and mechanisms for providing for the capture, rending, displaying, navigating and/or viewing of the geometry of one or more three-dimensional models. Additionally, one or more implementations allow a user to share the geometry and the graphical attributes of a three-dimensional model without sharing the source file or proprietary details of the source file. Furthermore, one or more implementations can allow for sharing of the geometry and graphical attributes of a three-dimensional model without requiring the viewer to have the software used to create the three-dimensional model.

The embodiments of the present invention may comprise a special purpose or general-purpose computer including various computer hardware components, as discussed in greater detail below. Embodiments within the scope of the present invention also include computer-readable media for carrying or having computer-executable instructions or data structures stored thereon. Such computer-readable

media can be any available media that can be accessed by a general purpose or special purpose computer.

By way of example, and not limitation, such computer-readable media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to carry or store desired program code means in the form of computer-executable instructions or data structures and which can be accessed by a general purpose or special purpose computer. When information is transferred or provided over a network or another communications connection (either hardwired, wireless, or a combination of hardwired or wireless) to a computer, the computer properly views the connection as a computer-readable medium. Thus, any such connection is properly termed a computer-readable medium. Combinations of the above should also be included within the scope of computer-readable media.

Computer-executable instructions comprise, for example, instructions and data which cause a general purpose computer, special purpose computer, or special purpose processing device to perform a certain function or group of functions. Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. For example, the computer model 102 shown and described was the model of a house. One will appreciate that the present invention is not so limited. Indeed, the present invention can be used to capture and share not only architectural models, but any three-dimensional model. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

CLAIMS

I claim:

1. In a computerized environment including a computer system and a design software application, a computer program storage product having computer-executable instructions for a separate capture and rendering software application stored thereon that, when executed, cause one or more processors on the computer system to perform the acts comprising:

identifying one or more files corresponding to a three-dimensional computer model created by a design software application and stored within a database associated with the design software application;

identifying geometry data and graphical aspect data of the three-dimensional computer model in the one or more files;

extracting the geometry data and graphical aspect data from the one or more files corresponding to the three-dimensional computer model;

storing the geometry data and graphical aspect data in a storage module unassociated with the design software application; and

providing an accurate three-dimensional view of the geometry and graphical aspects of the three-dimensional computer model at a display device using a capture and render software application unassociated with the design software application.

2. The computer program storage product as recited in claim 1, further comprising providing an accurate three-dimensional view of the geometry and graphical aspects of the three-dimensional computer model at a display device through communication with a graphical processing unit.

3. The computer program storage product as recited in claim 1, further comprising:

identifying one or more geometries that surround one or more vertices associated with the three-dimensional view of the geometry and graphical aspects of the three-dimensional computer model; and

providing a lighting value to one or more vertices based on the one or more surrounding geometries.

4. The computer program storage product as recited in claim 3, further comprising storing one or more context tags associated with the three-dimensional computer model in the storage module unassociated with the design software application.

5. The computer program storage product as recited in claim 4, further comprising determining the lighting value based at least in part upon the one or more context tags.

6. The computer program storage product as recited in claim 1, further comprising:

analyzing the one or more files corresponding to a three-dimensional computer model stored in the database associated with the design software application; and

extracting and saving only the data necessary to recreate the geometry and graphical aspects of the three-dimensional computer model.

7. The computer program storage product as recited in claim 4, further comprising:

identifying navigational input that changes the three-dimensional view; and

providing real-time shading of the three-dimensional view as three-dimensional view changes.

8. The computer program storage product as recited in claim 1, wherein extracting the geometry data and graphical aspect data comprises extracting only the geometry data and graphical aspect data relevant to outer or otherwise viewable surfaces of the three-dimensional computer model.

9. The computer program storage product as recited in claim 8, further comprising:

recognizing geometry data associated with at least one interior component; and

excluding the geometry data associated with the at least one interior component from the extracted geometry data.

10. At a web server in a computerized environment including a first remote client computer system that creates a three-dimensional computer model with a design software application, and a second remote client computer system, a method for securing sharing the geometry and graphical aspects of a three-dimensional computer model at the second remote client computer system without requiring the second client computer system to have the design software application installed thereon, comprising the acts of:

receiving, from a first remote client computer system, geometry data and graphical aspect data extracted from a three-dimensional computer model created using a design software application;

storing the geometry data and graphical aspect data in one or more geometric computer model files at a web server;

receiving one or more requests for the one or more geometric computer model files from a second remote client computer system; and

sending the one or more geometric computer model files and one or more viewer application files from the web server to the second remote client computer system;

wherein:

the one or more temporary viewer application files are configured to launch a temporary viewer application on the second remote client computer system; and

the temporary viewer application is configured to display the geometry data and graphical aspect data of the one or more geometric computer model files.

11. The method as recited in claim 10, further comprising:

sending one or more executable instructions from the web server to the second remote client computer system,

wherein the one or more executable instructions are configured to cause one or more processors to automatically launch the temporary viewer application on the second remote client computer system.

12. The method as recited in claim 11, wherein the one or more executable instructions are configured to cause the second remote client computer system to store the one or more geometric computer model files in volatile memory at the second remote client computer system.

13. The method as recited in claim 11, wherein the one or more executable instructions are configured to cause the second remote client computer system to store the one or more temporary viewer application files in volatile memory at the second remote client computer system.

14. The method as recited in claim 10, wherein the one or more geometric computer model files consist essentially of the geometry data, the graphical aspect data, and one or more context tags.

15. The method as recited in claim 10, further comprising sending a hyperlink containing the location of the one or more geometric computer model files from the web server to an email address associated with an intended viewer.

16. The method as recited in claim 11, wherein the one or more executable instructions are configured to cause the second remote client computer system to delete the one or more geometric computer model files from the second remote client computer system upon the closing of the temporary viewer application.

17. The method as recited in claim 10, wherein the extracted geometry data and graphical aspect data excludes geometry data and graphical aspect data associated with at least one interior or otherwise unviewable surface of the three-dimensional computer model.

18. At a client computer system in a computerized environment including a web server that hosts the a three-dimensional computer model created by a design software application, a method for viewing the geometry and graphical aspects of the three-dimensional computer model without requiring the design software application, comprising the acts of:

sending one or more requests to a web server for one or more geometric computer model files comprising geometry data and graphical aspect data extracted from a three-dimensional computer model created using a design software application;

opening a temporary viewer application hosted by the web server;

receiving the one or more geometric computer model files from the web server; and

displaying an accurate three-dimensional view of the geometry and graphical aspects of the three-dimensional computer model at a display device using the temporary viewer application.

19. The method as recited in claim 18, further comprising receiving one or more executable instructions and one or more temporary viewer application files from the web server.

20. The method as recited in claim 18, further comprising storing the one or more geometric computer model files in volatile memory.

21. The method as recited in claim 20, further comprising automatically deleting the one or more geometric computer model upon closing of the temporary viewer application.

22. The method as recited in claim 19, further comprising automatically deleting the one or more executable instructions and the one or more temporary viewer application files upon closing of the temporary viewer application.

23. The method as recited in claim 18, wherein the extracted geometry data and graphical aspect data consists essentially of geometry data and graphical aspect data associated with outer or other otherwise viewable surface of the three-dimensional computer model.

24. The method as recited in claim 18, further comprising:

identifying one or more geometries that surround one or more vertices associated with the three-dimensional view of the geometry and graphical aspects of the three-dimensional computer model; and

providing a lighting value to one or more vertices based on the one or more surrounding geometries.


100
102
110
108
106
104
Help
ICEvision
Capture
File
Edit
View
Modeling
Draw
Tools

Fig. 1

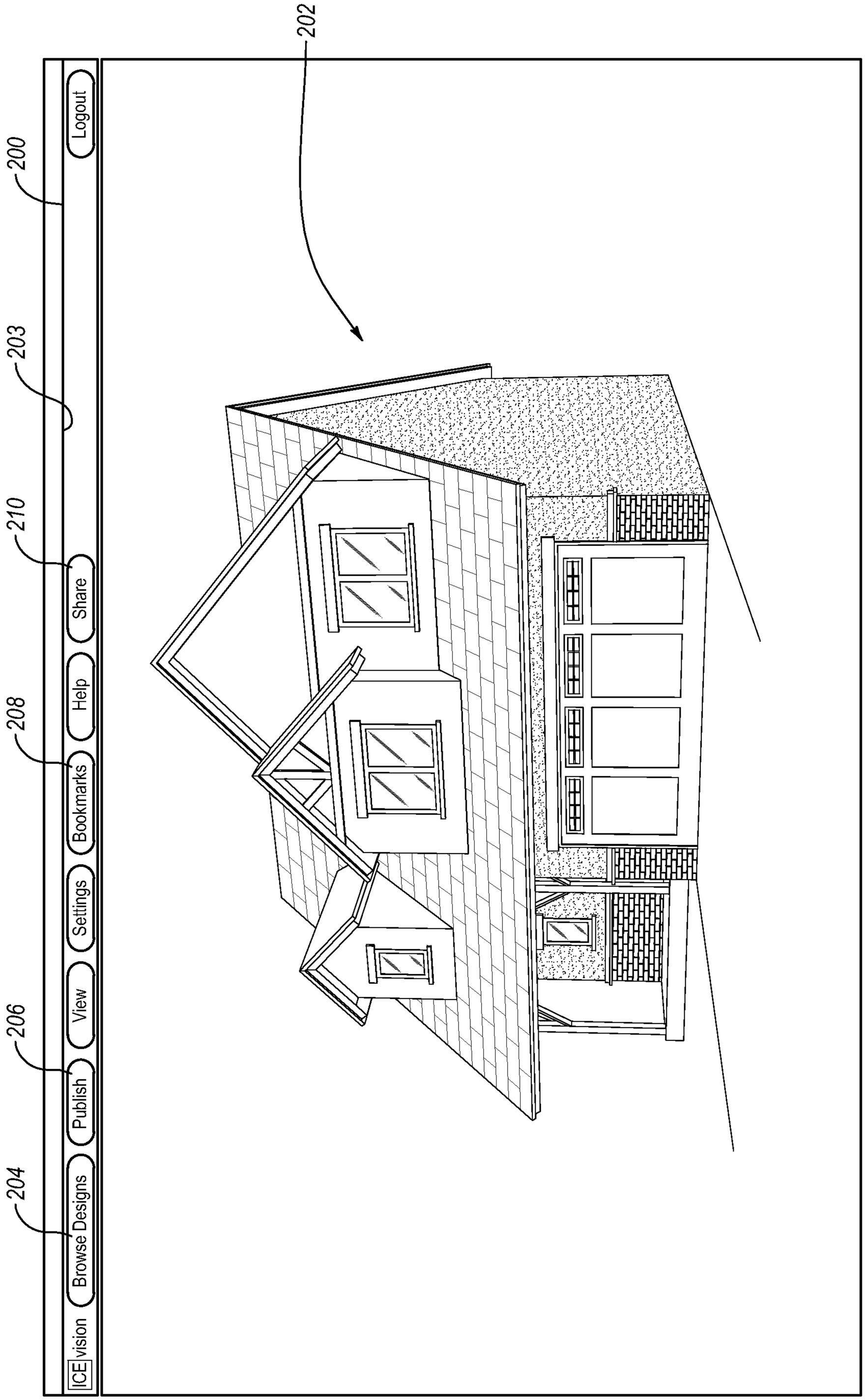
200
202
203
210
208
206
204
ICE vision
Browse Designs
Publish
View
Settings
Bookmarks
Help
Logout
Share

Fig. 2

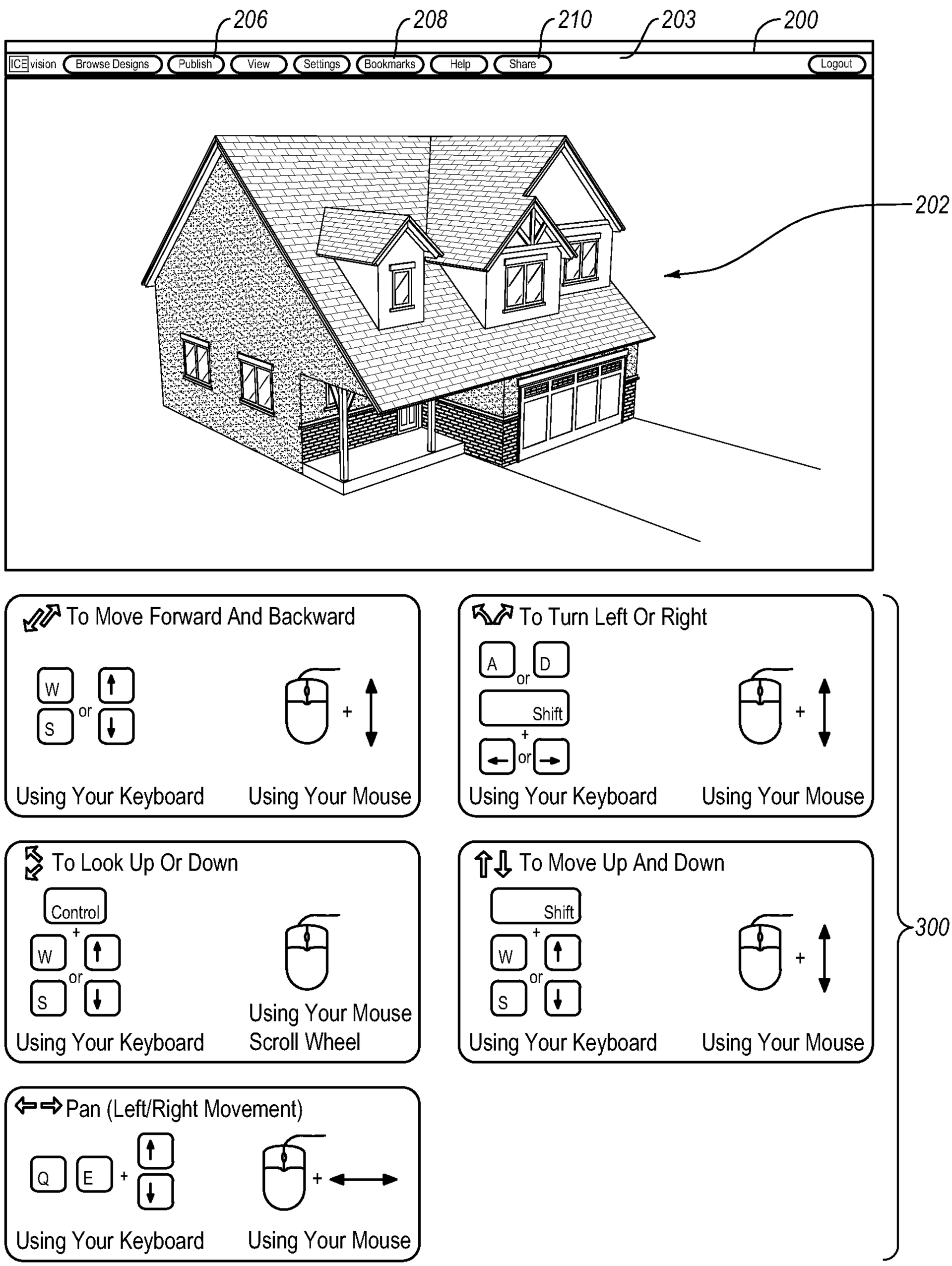
206
208
210
203
200
ICE vision
Browse Designs
Publish
View
Settings
Bookmarks
Help
Share
Logout
202
To Move Forward And Backward
W
S
or
+
Using Your Keyboard
Using Your Mouse
To Turn Left Or Right
A
or
D
Shift
+
or
+
Using Your Keyboard
Using Your Mouse
To Look Up Or Down
Control
+
W
S
or
Using Your Keyboard
Using Your Mouse
Scroll Wheel
To Move Up And Down
Shift
+
W
S
or
+
Using Your Keyboard
Using Your Mouse
300
Pan (Left/Right Movement)
Q
E
+
+
Using Your Keyboard
Using Your Mouse

Fig. 3

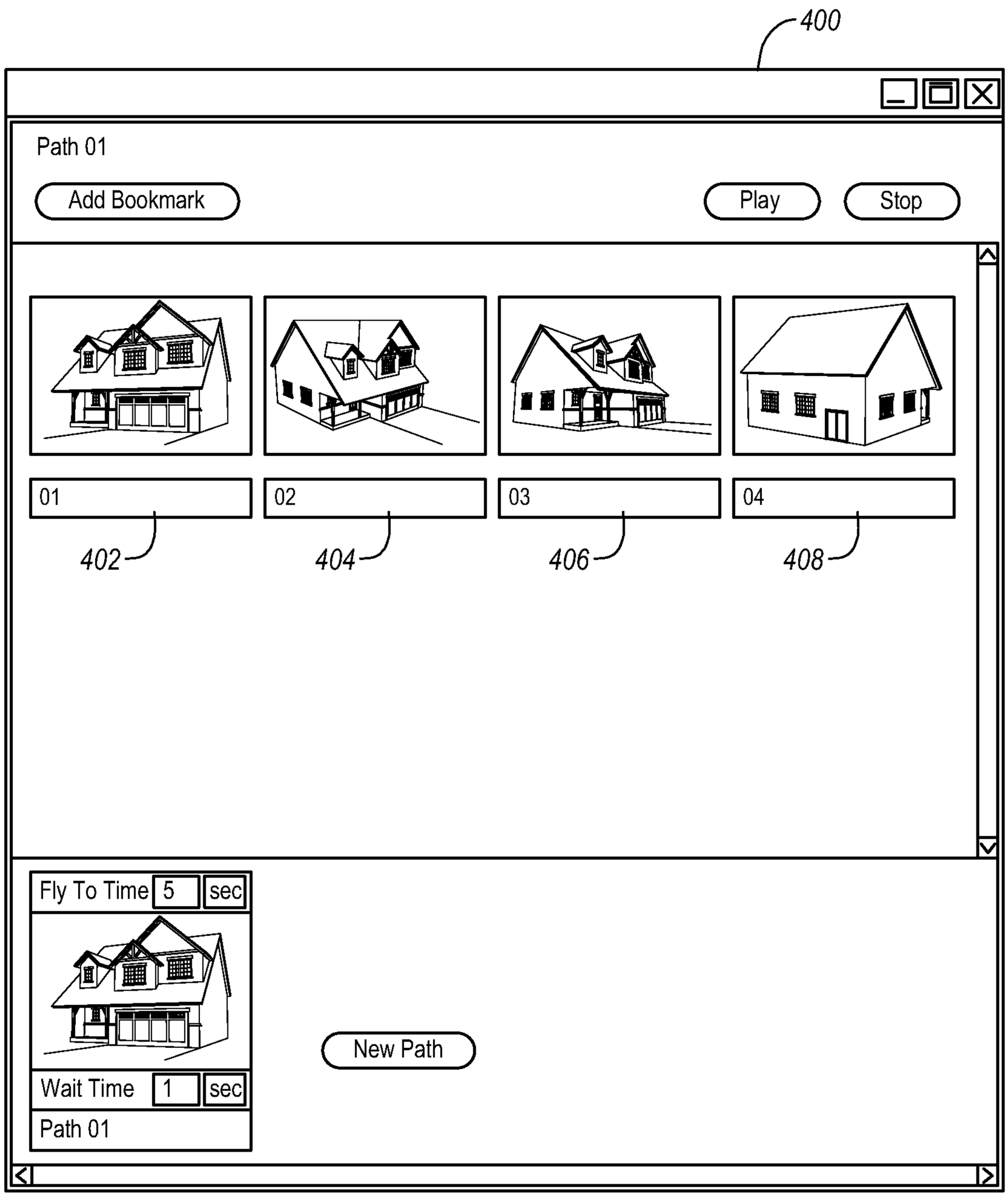
400
Path 01
Add Bookmark
Play
Stop
01
02
03
04
402
404
406
408
Fly To Time
5
sec
Wait Time
1
sec
Path 01
New Path

Fig. 4

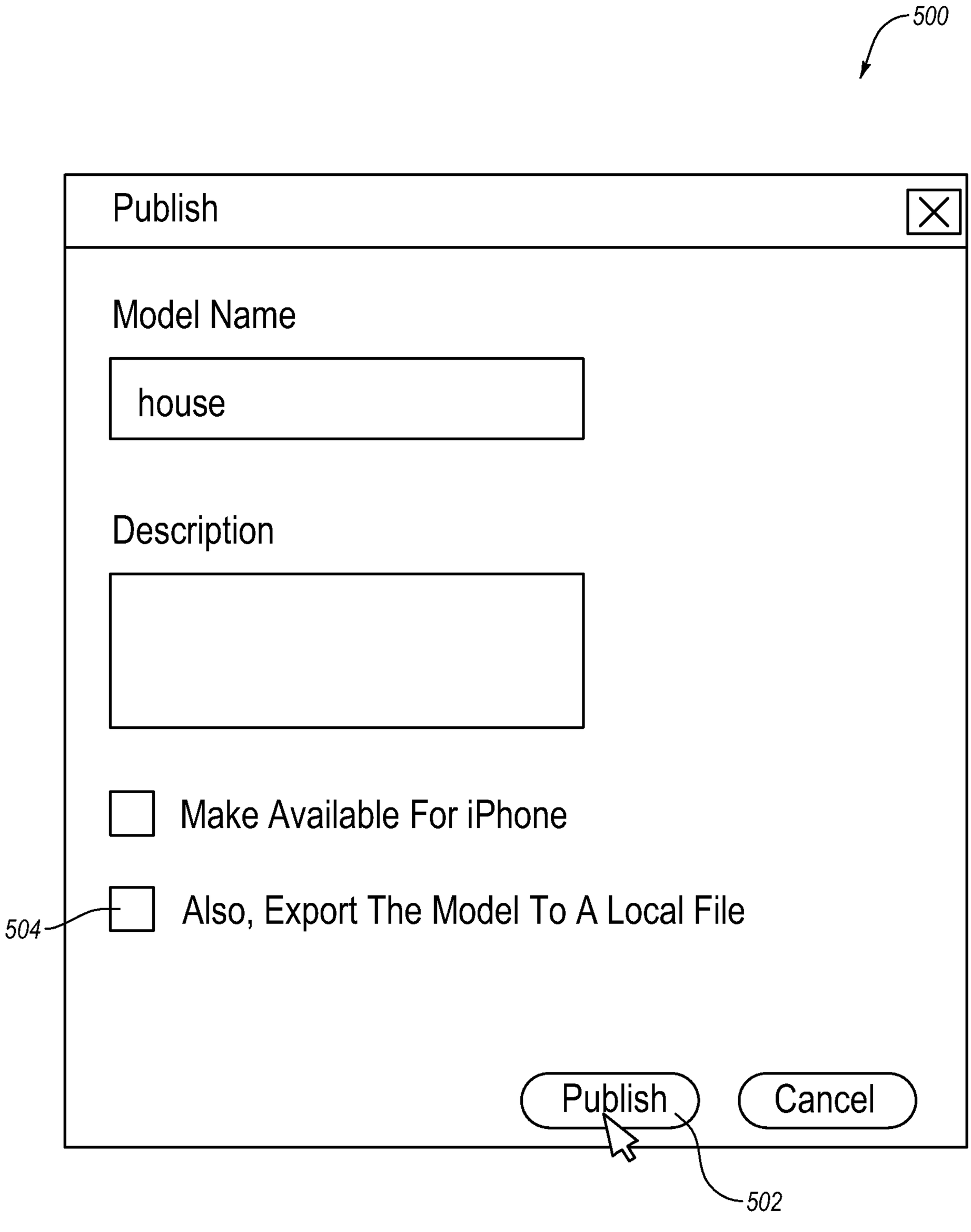
500
Publish
Model Name
house
Description
Make Available For iPhone
Also, Export The Model To A Local File
504
Publish
Cancel
502

Fig. 5

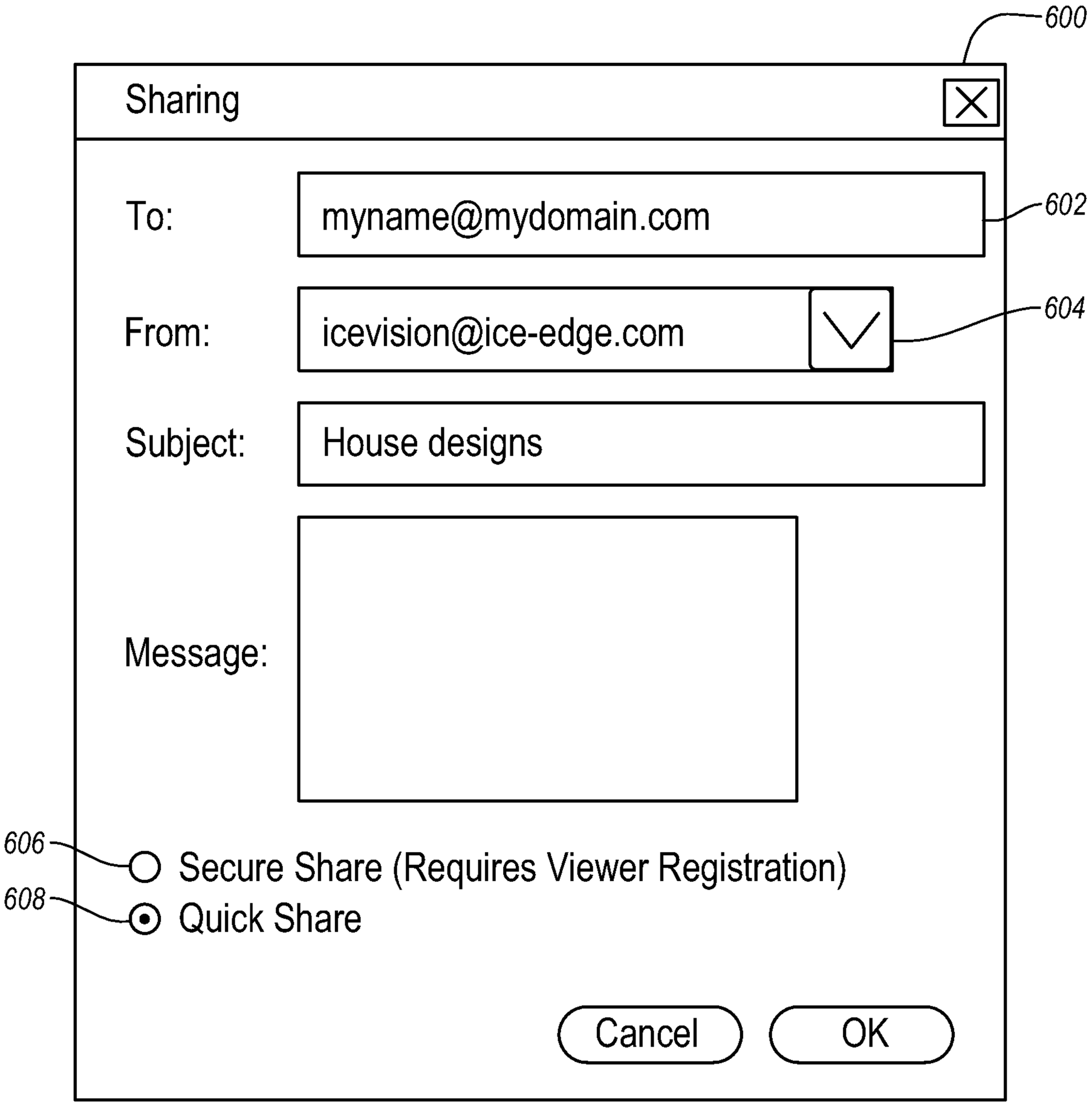
600
Sharing
To:
myname@mydomain.com
602
From:
icevision@ice-edge.com
604
Subject:
House designs
Message:
606
Secure Share (Requires Viewer Registration)
608
Quick Share
Cancel
OK

Fig. 6

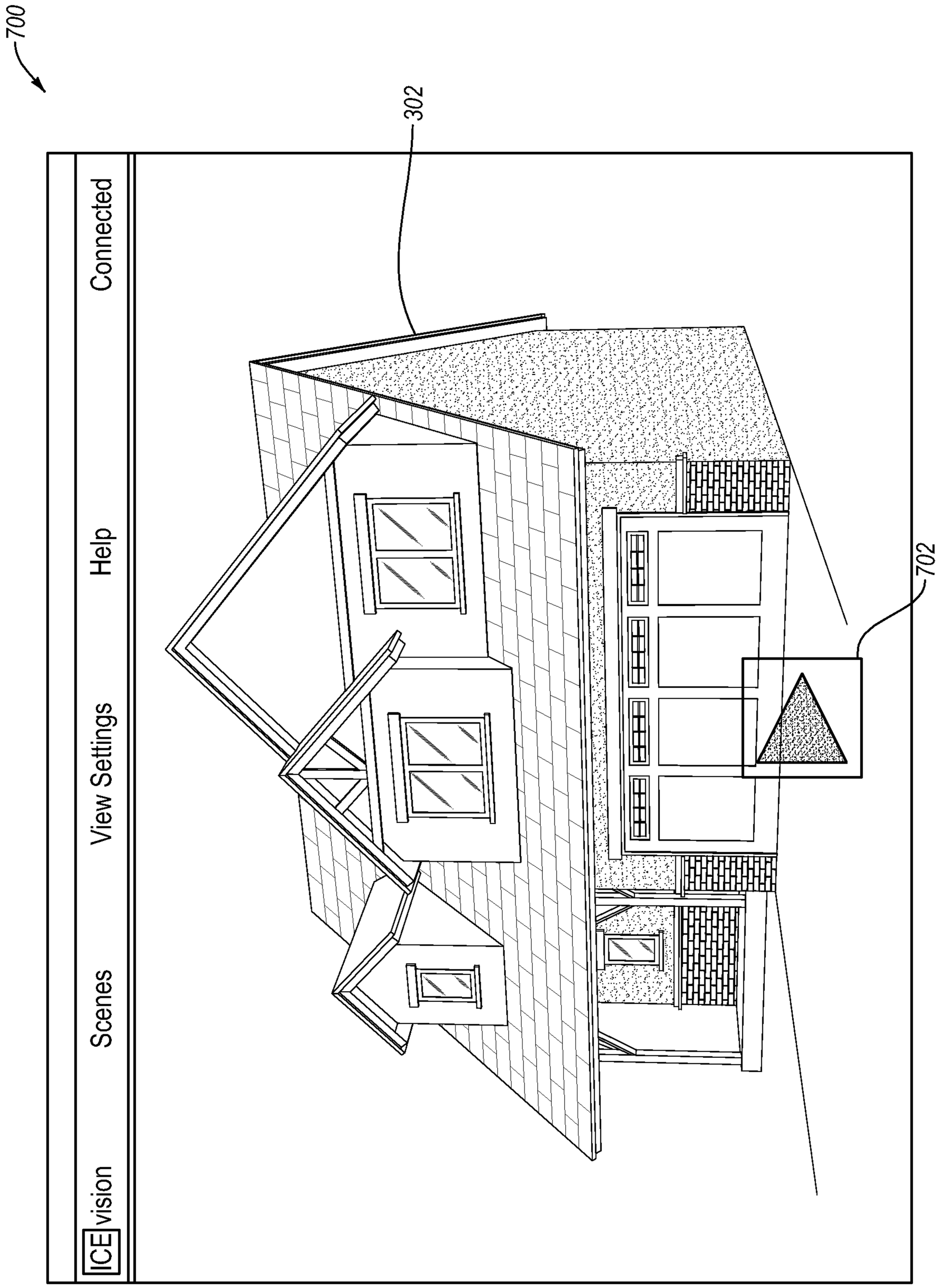

Fig. 7

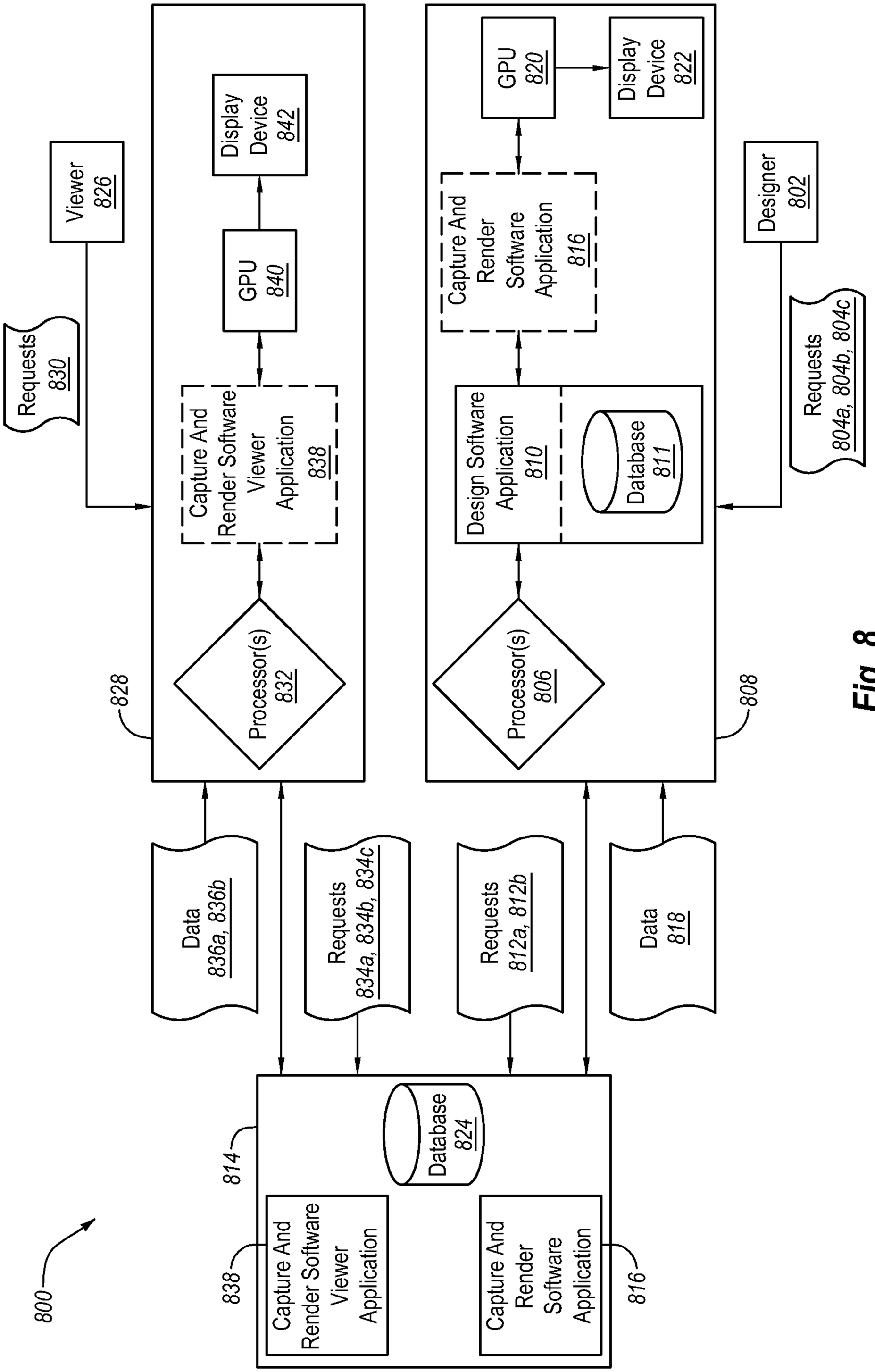
800
828
Processor(s) 832
Capture And Render Software Viewer Application 838
GPU 840
Display Device 842
Viewer 826
Requests 830
Data 836a, 836b
Requests 834a, 834b, 834c
808
Processor(s) 806
Design Software Application 810
Database 811
Capture And Render Software Application 816
GPU 820
Display Device 822
Designer 802
Requests 804a, 804b, 804c
Requests 812a, 812b
Data 818
814
Database 824
Capture And Render Software Viewer Application
Capture And Render Software Application

Fig. 8

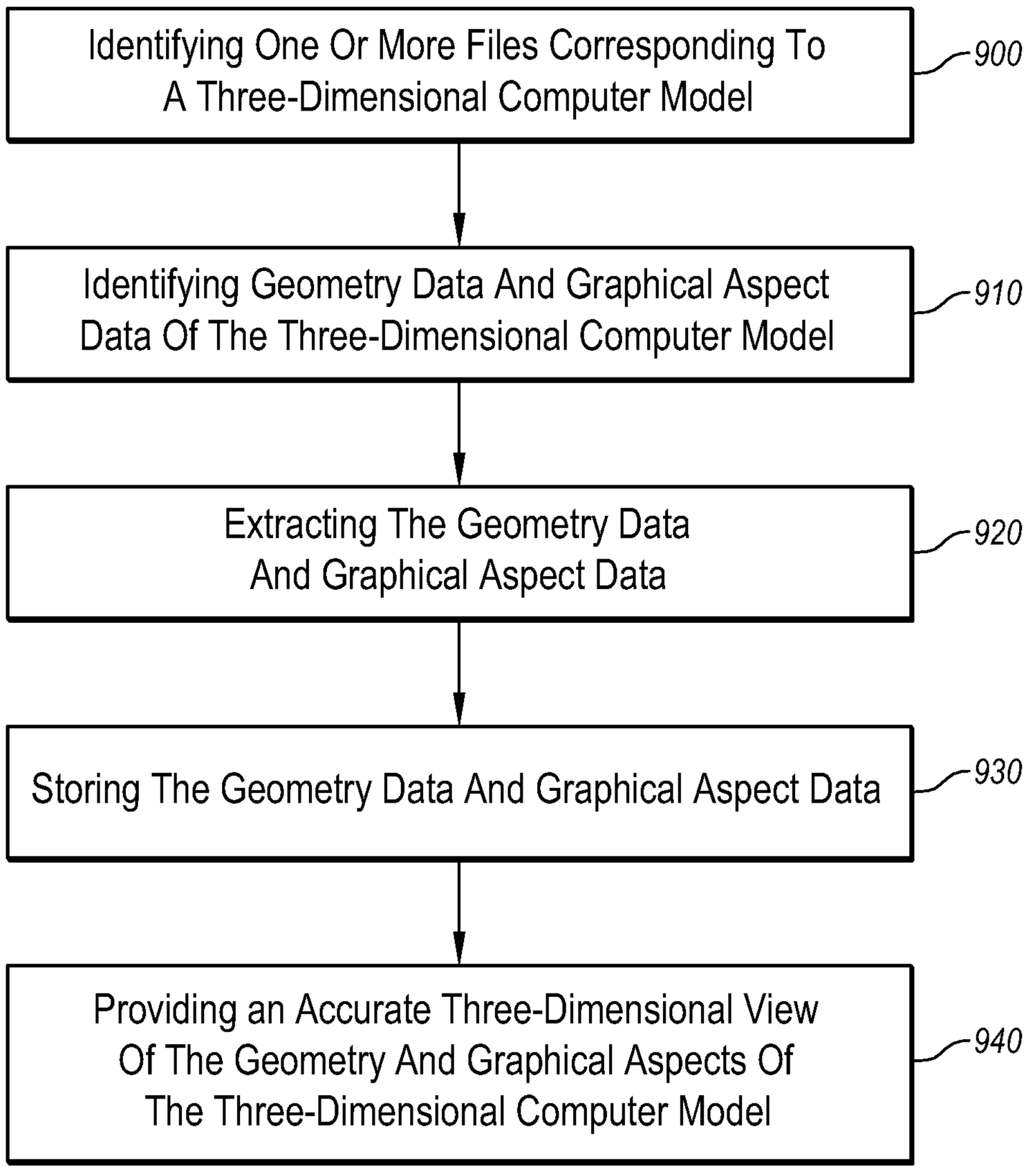
Identifying One Or More Files Corresponding To A Three-Dimensional Computer Model
900
Identifying Geometry Data And Graphical Aspect Data Of The Three-Dimensional Computer Model
910
Extracting The Geometry Data And Graphical Aspect Data
920
Storing The Geometry Data And Graphical Aspect Data
930
Providing an Accurate Three-Dimensional View Of The Geometry And Graphical Aspects Of The Three-Dimensional Computer Model
940

Fig. 9

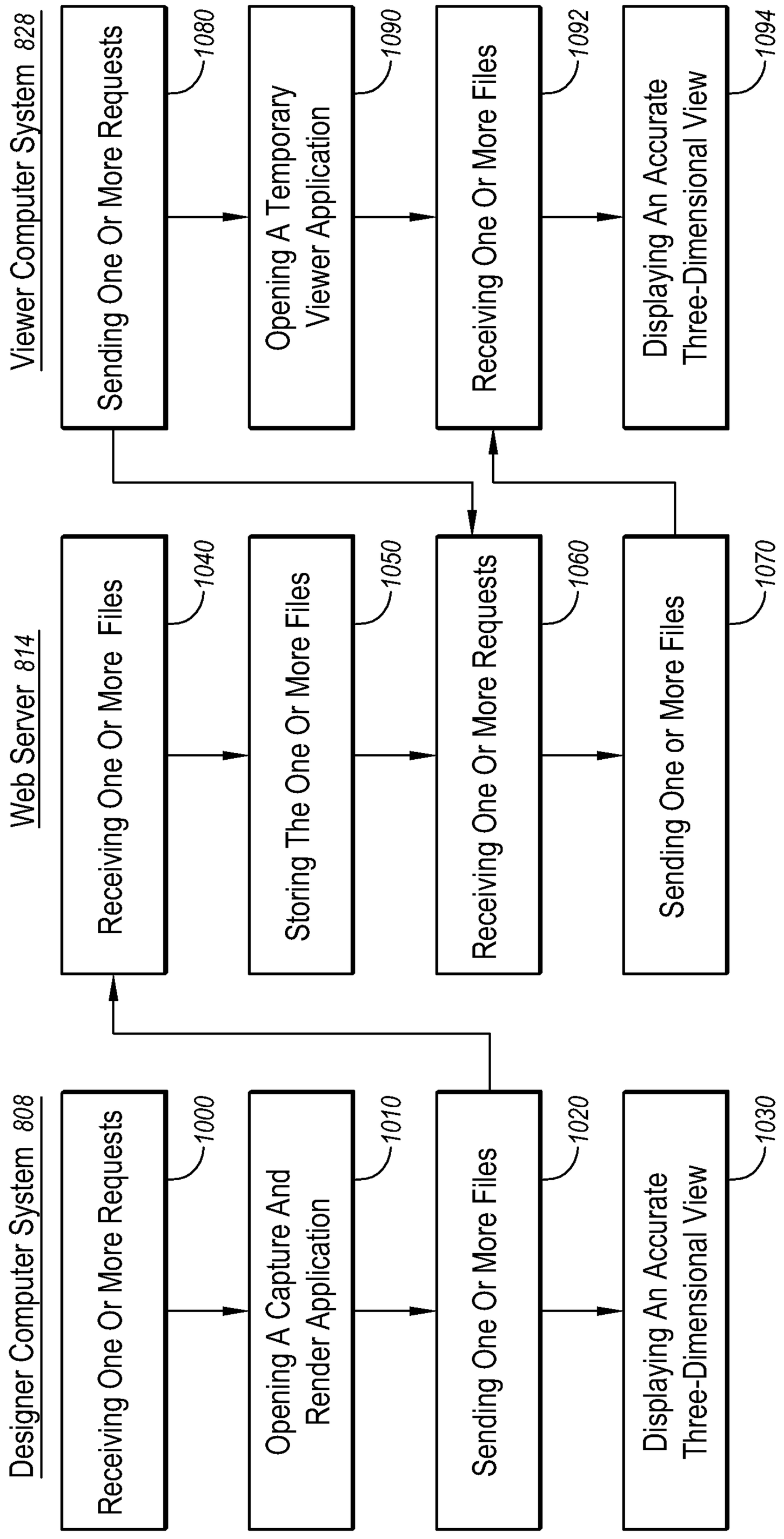
Designer Computer System 808
Receiving One Or More Requests
1000
Opening A Capture And Render Application
1010
Sending One Or More Files
1020
Displaying An Accurate Three-Dimensional View
1030
Web Server 814
Receiving One Or More Files
1040
Storing The One Or More Files
1050
Receiving One Or More Requests
1060
Sending One or More Files
1070
Viewer Computer System 828
Sending One Or More Requests
1080
Opening A Temporary Viewer Application
1090
Receiving One Or More Files
1092
Displaying An Accurate Three-Dimensional View
1094

Fig. 10

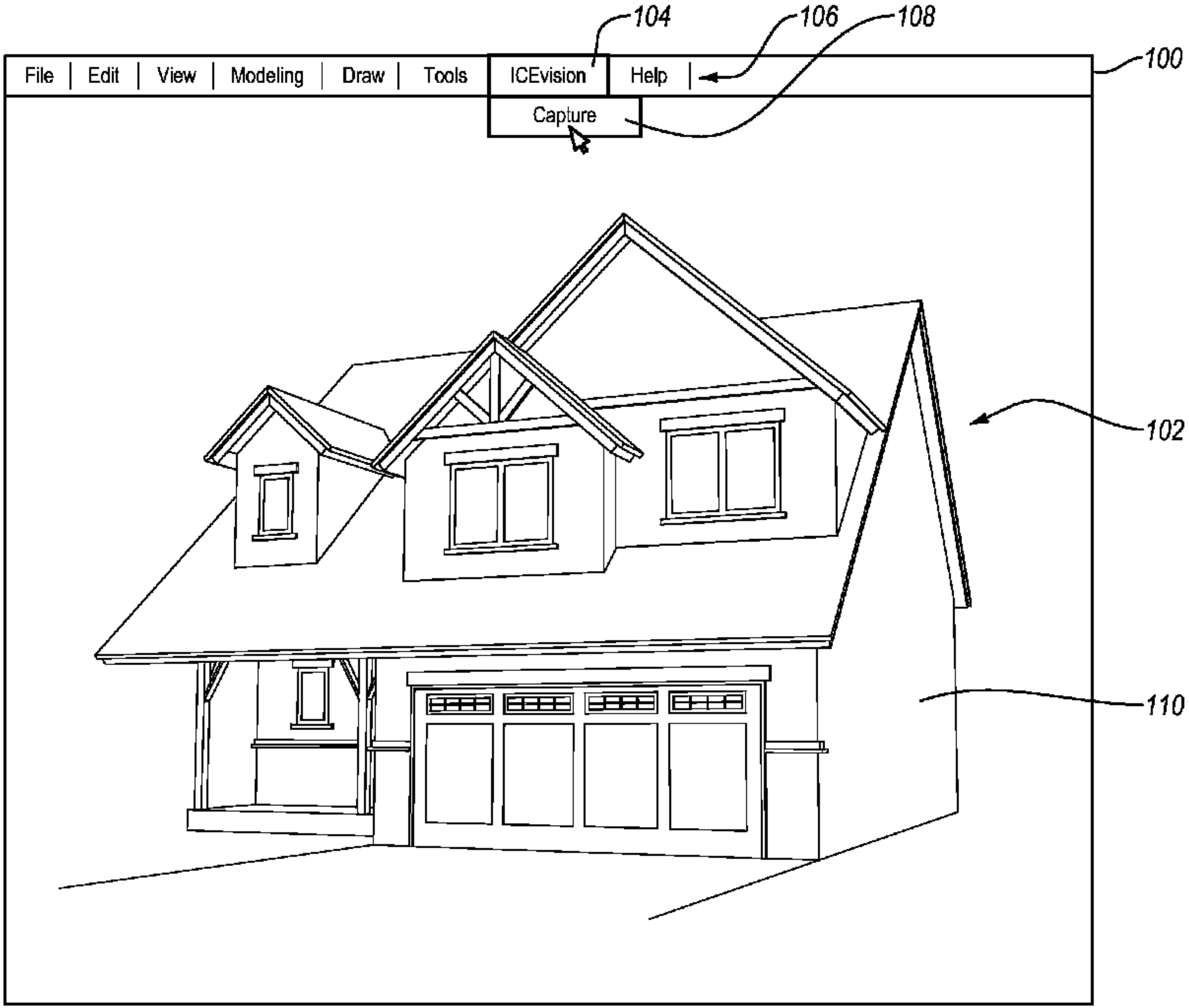
104
106
108
100
File
Edit
View
Modeling
Draw
Tools
ICEvision
Help
Capture
102
110

Fig. 1