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Systems and methods for inserting contextual advertisements into a virtual environment

Abstract

Systems and methods are described herein for inserting contextual advertisements into a virtual environment. While presenting a virtual environment, a media device receives speech input. The media device selects an advertisement from an advertisement database based on the speech. The media device then determines the current environment of the virtual environment and generates a virtual object that is related to the current environment. The media device overlays the selected advertisement over the generated virtual object and displays the generated virtual object in the virtual environment.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This application is a continuation of U.S. patent application Ser. No. 18/239,598, filed Aug. 29, 2023, which is a continuation of U.S. patent application Ser. No. 17/739,434, filed May 9, 2022, now U.S. Pat. No. 11,776,017, which is a continuation of U.S. patent application Ser. No. 17/218,846, filed Mar. 31, 2021, now U.S. Pat. No. 11,354,707, which is a continuation of U.S. patent application Ser. No. 16/226,955, filed Dec. 20, 2018, now U.S. Pat. No. 10,997,630. The disclosures of which are hereby incorporated by reference herein in their entireties.

BACKGROUND

(1) The present disclosure relates to content delivery and consumption systems and, more particularly, advertisement insertion in virtual environments.

SUMMARY

(2) Advertisement insertion in media content takes several forms. Preselected advertisements or targeted advertisements may be inserted into traditional forms of media content at predefined insertion points or triggered by user input. Virtual environments, however, do not easily lend themselves to traditional advertisement insertion techniques. A user may interact with a virtual reality video game in which the user may freely move about the game environment. Sudden and intrusive insertion of advertisements disrupts the user's experience. A user may be participating in a virtual meeting and cannot be distracted by traditional advertisements. Thus, a method of inserting advertisements into virtual environments in a natural, unobtrusive way is required.

(3) Systems and methods are described herein for generating a virtual object for insertion into a virtual environment on which a contextual advertisement may be placed. Virtual objects may be introduced into a virtual environment in a natural way. For example, if the environment displayed in the virtual environment is a city street, a new vehicle can be inserted as driving into view on the street. Such object insertion is unobtrusive and does not disrupt the user's experience. A contextual advertisement can then be displayed on the vehicle so that the user views the advertisement as the vehicle drives through the user's field of view.

(4) While presenting a virtual environment, a media device receives speech input. The media device selects an advertisement from an advertisement database based on the speech. The media device then determines the current environment of the virtual environment and generates a virtual object that is related to the current environment. The media device overlays the selected advertisement over the generated virtual object and displays the generated virtual object.

(5) The media device may identify a plurality of virtual objects currently being displayed in the virtual environment and retrieve metadata of one of the displayed virtual objects. The media device determines whether the metadata of the virtual object uniquely identifies a single environment. If so, the media device identifies the single environment as the current environment. If not, the media device retrieves metadata for additional virtual objects until a unique environment is identified. The media device may identify a unique environment from a single virtual object or may compare sets of environments identified by a number of virtual objects to find a single environment common to all the sets of environments.

(6) The media device may determine whether a virtual object currently displayed in the virtual environment is suitable for displaying the selected advertisement and generate a new virtual object only if no suitable virtual object is currently displayed. To determine if a suitable virtual object is currently being displayed, the media device identifies a plurality of virtual objects currently being displayed in the virtual environment, and further identifies a respective type of each of the virtual objects. The media device then determines whether any of the virtual objects is of a type that is suitable for displaying the selected advertisement.

(7) To display the selected advertisement on a virtual object, the media device identifies a surface of the virtual object suitable for displaying the selected advertisement and displays the selected advertisement on the identified surface. The media device may determine an orientation of the virtual object and transform an image of the selected advertisement to match the orientation of the virtual object.

(8) To select an advertisement, the media device identifies a category of advertisement related to the speech and determines a particular advertisement based on a user profile and the identified category. The media device then selects that particular advertisement from the advertisement database for display.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The above and other objects and advantages of the disclosure will be apparent upon consideration of the following detailed description, taken in conjunction with the accompanying drawings, in which like reference characters refer to like parts throughout, and in which:

(2) FIG. **1** shows a generalized embodiment of insertion of a contextual advertisement in a virtual environment in accordance with some embodiments of the disclosure;

(3) FIG. **2** shows a second generalized embodiment of insertion of a contextual advertisement in a virtual environment in accordance with some embodiments of the disclosure;

(4) FIG. **3** shows a third generalized embodiment of insertion of a contextual advertisement in a virtual environment in accordance with some embodiments of the disclosure;

(5) FIG. **4** shows a fourth generalized embodiment of insertion of a contextual advertisement in a virtual environment in accordance with some embodiments of the disclosure;

(6) FIG. **5** is a data flow diagram for insertion of a contextual advertisement in a virtual environment in accordance with some embodiments of the disclosure;

(7) FIG. **6** is a diagram showing selection of an advertisement for insertion based on user preferences in accordance with some embodiments of the disclosure;

(8) FIG. **7** is a block diagram representing control circuitry and data flow within a media device for insertion of a contextual advertisement in a virtual environment in accordance with some embodiments of the disclosure;

(9) FIG. **8** is a flowchart representing a process for inserting a contextual advertisement in a virtual environment in accordance with some embodiments of the disclosure;

(10) FIG. **9** is a flowchart representing a process for identifying a current environment in accordance with some embodiments of the disclosure;

(11) FIG. **10** is a flowchart representing a second process for identifying a current environment in accordance with some embodiments of the disclosure;

(12) FIG. **11** is a flowchart representing a process for determining whether to generate a new virtual object for display of a contextual advertisement in accordance with some embodiments of the disclosure;

(13) FIG. **12** is a flowchart representing a process for displaying a contextual advertisement on a virtual object in accordance with some embodiments of the disclosure;

(14) FIG. **13** is a flowchart representing a process for placing a contextual advertisement on a virtual object in accordance with some embodiments of the disclosure;

(15) FIG. **14** is a flowchart representing a process for selecting a contextual advertisement for insertion in accordance with some embodiments of the disclosure; and

(16) FIG. **15** is a flowchart representing a process for selecting a virtual object on which to display a contextual advertisement in accordance with some embodiments of the disclosure.

DETAILED DESCRIPTION

(17) FIG. **1** depicts a virtual environment **100** as viewed from a user's perspective on a media device. Virtual environment **100** may be a video game in which the user is participating with several other users. The users may communicate **102** with each other through the video game, either vocally or with text messages. During gameplay, a user may ask other users if, for example, they should break from the video game to order pizza. The media device monitors the communications and detects a keyword **104** “pizza.” In response to detecting the keyword, the media device retrieves an advertisement for a product matching the keyword from an advertisement database. The specific advertisement retrieved may be influenced by the preference of a particular user. For example, in response to the keyword “pizza,” a first user's media device may retrieve an advertisement for “Joe's Pizza” while a second user's media device may retrieve an advertisement

for “Bob's Pizza.” The virtual environment **106**, presented on the first user's media device, is modified by the first media device to include a new virtual object on which is displayed the “Joe's Pizza” advertisement **110**. Likewise, the virtual environment **108**, presented on the second user's media device, is modified by the second media device to include a new virtual object on which is displayed the “Bob's Pizza” advertisement **112**. It should be noted that while FIG. **1** depicts insertion of the same virtual object in both virtual environments **106** and **108**, each media device may select any appropriate virtual object on which to display the selected advertisement, as described below.

(18) FIG. **2** depicts a virtual environment **200**, which is a virtual meeting. During the meeting, a participant may, for example, suggest **202** breaking for coffee. As above, the media device through which the meeting is being presented monitors the participants' speech for keywords and detects the keyword **204** “coffee.” In response to detecting the keyword, the media device retrieves a coffee advertisement from an advertisement database and generates a new virtual object on which to display the advertisement. The virtual object **208** is then displayed.

(19) FIG. **3** depicts an augmented reality display on a media device **300**. A user may enter a search **302** on media device **300** for nearby restaurants. Media device **300** may access an advertisement database and retrieve an advertisement for a local restaurant. Media device **300** may use user preferences to determine a type of restaurant for which an advertisement should be retrieved. For example, media device **300** may determine that the user likes pizza and retrieves an advertisement for “Joe's Pizza” from the advertisement database. Media device **300** captures an image of the surrounding environment using a built-in camera and determines an appropriate virtual object to overlay over the image. For example, media device **300** determines that the user is on a city street. Based on the determined environment, media device **300** selects a delivery bicycle **304** on which to display the retrieved advertisement **306**. Media device **300** overlays the bicycle with the advertisement over the captured image. The position of the virtual object may be static or animated so as to move along the street. Animation of the virtual object may be linked to movement of the media device **300** in order to keep the virtual object displayed for a longer period of time.

(20) FIG. **4** depicts a virtual environment **400** with which users cannot interact, such as a cutscene in a video game, or broadcast video content. In response to detecting the keyword “pizza,” as above, the media device on which the virtual environment is presented determines the currently depicted environment and selects a virtual object to insert into the virtual environment on which to display an advertisement. In the example of FIG. **4**, the environment is a race. A runner is displayed running past a crowd of spectators. The media device determines that a barrier **404** may be placed between the runner and the spectators and provides a suitable surface on which to display the selected advertisement **406**.

(21) FIG. **5** is a data flow diagram for insertion of a contextual advertisement in a virtual environment. A media device, such as media device **300**, receives user speech at speech input **500**. The media device identifies and extracts from the speech a keyword and, at **502**, uses the keyword to retrieve an advertisement from advertisement database **504**. At **506**, at advertisement related to the keyword is transferred from the advertisement database **504** to an object insertion API **508**. At **510**, an identifier of the current virtual environment is retrieved by the object insertion API **508** from the current environment **512**. At **514**, the object insertion API **508** selects a virtual object related to the current environment using the identifier of the current environment and places the retrieved advertisement on the selected virtual object. At **516**, object insertion API **508** inserts the virtual object into the displayed content **518**.

(22) FIG. **6** is a diagram showing selection of an advertisement for insertion based on user preferences. Table **600** represents a set of user preferences for various products. User preferences may be learned from monitoring user behaviors, such as Internet shopping, Internet search histories, content consumption histories, and the like. User preferences may be stored on a media device or on a remote server accessible by a media device. Stored user preferences may include

product **602**, specific brands **604** for each product, and an expiration date or time **606** for each product/brand association. For example, for the product “pizza” **608**, a user may prefer “Joe's Pizza” **610**, which may be learned from the user's order history using services such as Seamless®, GrubHub® or Uber Eats®. The media device may monitor the time of such orders and determine that the user never orders pizza after 10:00 PM. The media device therefore sets the expiration **612** for “Joe's Pizza” as 10:00 PM to prevent pizza advertisements from being presented to the user at times when the user would not order pizza.

(23) FIG. **7** is an illustrative block diagram representing circuitry and data flow within a media device **700** in accordance with some embodiments of the disclosure. Media device **700** may be any device for accessing the content described above, such as a television, a Smart TV, a set-top box, an integrated receiver decoder (IRD) for handling satellite television, a digital storage device, a digital media receiver (DMR), a digital media adapter (DMA), a streaming media device, a DVD player, a DVD recorder, a connected DVD, a local media server, a BLU-RAY player, a BLU-RAY recorder, a personal computer (PC), a laptop computer, a tablet computer, a WebTV box, a personal computer television (PC/TV), a PC media server, a PC media center, a handheld computer, a stationary telephone, a personal digital assistant (PDA), a mobile telephone, a portable video player, a portable music player, a portable gaming machine, a smart phone, or any other television equipment, computing equipment, or wireless device, and/or combination of the same. Media device **700** comprises input circuitry **702**. Input circuitry **702** may include a microphone and voice processing circuitry for receiving voice commands. Media device **700** also comprises control circuitry **704** and storage **706**. Control circuitry **704** may be based on any suitable processing circuitry and comprises control circuits and memory circuits that may be disposed on a single integrated circuit or may be discrete components. As referred to herein, processing circuitry should be understood to mean circuitry based on one or more microprocessors, microcontrollers, digital signal processors, programmable logic devices, field-programmable gate arrays (FPGAs), application-specific integrated circuits (ASICs), etc., and may include a multi-core processor (e.g., dual-core, quad-core, hexa-core, or any suitable number of cores). In some embodiments, processing circuitry may be distributed across multiple separate processors or processing units, for example, multiple of the same type of processing units (e.g., two Intel Core i7 processors) or multiple different processors (e.g., an Intel Core i5 processor and an Intel Core i7 processor). Some control circuits may be implemented in hardware, firmware, or software. Input circuitry **702** may be integrated with control circuitry **704**. Storage **706** may be any device for storing electronic data, such as random-access memory, read-only memory, hard drives, optical drives, digital video disc (DVD) recorders, compact disc (CD) recorders, BLU-RAY disc (BD) recorders, BLU-RAY 3D disc recorders, digital video recorders (DVR, sometimes called a personal video recorder, or PVR), solid state devices, quantum storage devices, gaming consoles, gaming media, or any other suitable fixed or removable storage devices, and/or any combination of the same.

(24) Control circuitry **704** comprises virtual content processing circuitry **708**. Virtual content processing circuitry **708** processes two- and three-dimensional video content and associated audio content, which may be received via a physical RF channel over a cable television connection or terrestrial broadcast, or may be received over an Internet connection from an over-the-top (OTT) service using a wired connection (e.g., Ethernet) or wireless connection (e.g., 802.11a/b/g/n (WiFi), WiMax, GSM, UTMS, CDMA, TDMA, 3G, 4G, 4G LTE, or any other suitable type of wireless data transmission). Virtual content processing circuitry **708** transfers audio data **710** and video data **712** of the virtual content to audio output circuitry **714** and video output circuitry **716**, respectively.

(25) During presentation of the virtual content, input circuitry **702** receives user speech. Input circuitry **702** transfers **718** the speech to control circuitry **704** where it is received by language processing circuitry **720**. Language processing circuitry **720** processes the speech using any known suitable speech processing technique to identify individual words. Language processing circuitry **720** compares **722** the identified words to product-related keywords in user preferences **724** stored

in storage **706**. If a keyword is detected in the speech, control circuitry **704** accesses **726** advertisements database **728** in storage **706**. For example, language processing circuitry **720** uses the detected keyword to query the advertisements database **728** for an advertisement related to the detected keyword. The query may also contain a specific brand identified by user preferences **724** as being associated with the keyword. An advertisement is then selected and returned **730** from the advertisements database **728** to control circuitry **704**, where it is received by image processing circuitry **732**.

(26) Control circuitry **704**, using virtual content processing circuitry **708**, determines a current environment of the virtual content. For example, virtual content processing circuitry **708** may access metadata of the virtual environment to identify a current environment (e.g., mountain, beach, city street, etc.). Alternatively, virtual content processing circuitry **708** may identify a number of virtual objects currently being displayed in the virtual environment. Virtual content processing circuitry **708** may access metadata or other identifying information for each displayed virtual object to determine an environment in which the respective virtual object belongs. For example, a stop sign may be displayed on a city street while a jellyfish may be displayed at a beach. Once the current environment has been identified, virtual content processing circuitry **708** selects a virtual object on which to display the selected advertisement. In some cases, a currently displayed object may be suitable for displaying the selected advertisement. If no currently displayed object is suitable for displaying the selected advertisement, virtual content processing circuitry **708** may select a suitable object appropriate to the current environment from a library of objects. Virtual content processing circuitry transfers the selected virtual object, or geometric and topological parameters thereof, to image processing circuitry **732**. Image processing circuitry **732** processes the selected advertisement for display on a surface of the selected virtual object. For example, image processing circuitry **732** may transform the selected advertisement to match the tilt, skew, or viewing angle of a surface of the selected virtual object and place it on the surface. The modified virtual object is then transferred **736** from image processing circuitry **732** to virtual content processing circuitry **708** for insertion to the virtual environment.

(27) FIG. **8** is a flowchart representing an illustrative process for inserting a contextual advertisement in a virtual environment in accordance with some embodiments of the disclosure. The process **800** represented in FIG. **8** may be implemented on control circuitry **704**, and one or more actions of process **800** may be incorporated into or combined with one or more actions of any other process or embodiment described herein.

(28) At **802**, control circuitry **704** receives, from input circuitry **702**, audio input representing speech. For example, input circuitry **702** may include a microphone for receiving audio input from users. Alternatively or additionally, input circuitry **702** may include wireless receiver circuitry for receiving analog and/or digital audio signals via radio, Bluetooth, WiFi, or any other suitable transmission protocol. Input circuitry **702** transfers the audio signal to control circuitry **704** for processing. Control circuitry **704**, using language processing circuitry **720**, processes the audio signal to identify individual words contained in the speech. Language processing circuitry **720** may use any suitable speech processing technique.

(29) At **804**, control circuitry **704** compares the words contained in the speech to a list of keywords. Control circuitry **704** accesses a list of keywords from storage **706**. The keywords may be stored as part of user preferences **724**. For example, certain generic product types such as “car,” “game,” or “pizza” may be keywords. At **806**, control circuitry **704** determines whether the speech contains a keyword. If not, control circuitry **704** continues to monitor received speech. If a keyword is contained in the speech, then, at **808**, control circuitry **704** determines whether the context of the keyword indicates that an advertisement should be inserted. For example, language processing circuitry **720** analyzes the sentence in which the keyword was detected. If the keyword was the subject of a question, such as “Should we order pizza?”, language processing circuitry **720** determines that an advertisement for pizza should be inserted. However, if the keyword was said in

passing, such as “I had pizza for dinner last night”, language processing circuitry **720** determines that an advertisement for pizza should not be inserted.

(30) If an advertisement should be inserted, then, at **810**, control circuitry **704** selects an advertisement from an advertisement database based on the keyword. Control circuitry **704** may query the advertisement database for ad advertisement related to the keyword “pizza.” Control circuitry **704** may also access user preferences **724** to retrieve a specific brand associated with the keyword. For example, user preferences may associate “Joe's Pizza” with the keyword “pizza.” Control circuitry **704** therefore queries the advertisement database for a “Joe's Pizza” advertisement.

(31) At **812**, control circuitry **704** determines a current environment of the virtual environment. Control circuitry **704**, using virtual content processing circuitry **708**, determines a particular environment or setting (e.g., city street, beach, mountain) being displayed in the virtual environment. This may be accomplished by accessing metadata of the virtual environment, or by using methods described below in connection with FIGS. **9** and **10**.

(32) At **814**, control circuitry **704** determines whether a currently displayed virtual object is suitable for displaying the selected advertisement. This may be accomplished using methods described below in connection with FIG. **11**. If no currently displayed virtual object is suitable for displaying the selected advertisement then, at **816**, control circuitry **704** generates a virtual object that is related to the current environment for display of the selected advertisement. This may be accomplished using methods described below in connection with FIG. **15**. At **818**, control circuitry **704** overlays the selected advertisement on either the generated virtual object or the suitable currently displayed virtual object. At **820**, control circuitry **704** displays the virtual object with the selected advertisement overlaid on it.

(33) The actions or descriptions of FIG. **8** may be used with any other embodiment of this disclosure. In addition, the actions and descriptions described in relation to FIG. **8** may be done in suitable alternative orders or in parallel to further the purposes of this disclosure.

(34) FIG. **9** is a flowchart representing an illustrative process for identifying a current environment in accordance with some embodiments of the disclosure. The process **900** represented in FIG. **9** may be implemented on control circuitry **704**, and one or more actions of process **900** may be incorporated into or combined with one or more actions of any other process or embodiment described herein.

(35) At **902**, control circuitry **704** identifies the number of virtual objects currently being displayed and initializes a counter variable i with a value of 0. To identify the number of virtual objects being displayed, control circuitry **704** may poll, query, or otherwise request from virtual content processing circuitry **708** an index, list, array, database, or other data structure containing at least one identifier of each virtual object currently being processed by virtual content processing circuitry **708** for display in the virtual environment. At **904**, control circuitry **704** retrieves metadata of i.sup.th virtual object. Control circuitry **704** may retrieve metadata from the virtual content directly or may retrieve an identifier of the virtual object and query a virtual object library database using the identifier.

(36) At **906**, control circuitry **704** determines whether the metadata of the virtual object identifies a single environment. For example, metadata for a palm tree may identify a beach environment but may also identify a city street environment in a tropical climate. A surfer on a surfboard, however, might identify only a beach because no other environment would include such an object. If a single environment is identified, then processing proceeds to **814** above. If more than one environment is identified, then, at **808**, control circuitry determines whether metadata for all currently displayed virtual objects has been retrieved. If not, then, at **910**, control circuitry increments the value of i, and processing returns to **904**. If metadata for all currently displayed objects has been retrieved, then processing return to **902**, where control circuitry **704** again identifies a number of virtual objects currently displayed.

(37) The actions or descriptions of FIG. **9** may be used with any other embodiment of this disclosure. In addition, the actions and descriptions described in relation to FIG. **9** may be done in suitable alternative orders or in parallel to further the purposes of this disclosure.
(38) FIG. **10** is a flowchart representing a second illustrative process for identifying a current environment in accordance with some embodiments of the disclosure. The process **1000** represented in FIG. **10** may implemented on control circuitry **704**, and one or more actions of process **1000** may be incorporated into or combined with one or more actions of any other process or embodiment described herein.
(39) At **1002**, control circuitry **704** retrieves a first set of environments identified by metadata of a first virtual object. At **1004**, control circuitry **704** retrieves a second set of environments identified by metadata of a second virtual object. These steps may be accomplished as described above in connection with FIG. **9**. At **1006**, control circuitry **704** compares the two sets of environments and, at **1008**, determines whether there is a single common environment between the two sets of environments. If there is no single common environment between the two sets of environments, then, at **1010**, control circuitry **704** retrieves another set of environments identified by metadata of another virtual object. Processing then returns to **1006**, where control circuitry **704** compares all retrieved sets of environments to identify a single common environment between them. If there is a single common environment between the sets of environments, then, at **1012**, control circuitry **704** identifies the single common environment as the current environment of the virtual environment.
(40) It is contemplated that the actions or descriptions of FIG. **10** may be used with any other embodiment of this disclosure. In addition, the actions and descriptions described in relation to FIG. **10** may be done in alternative orders or in parallel to further the purposes of this disclosure.
(41) FIG. **11** is a flowchart representing an illustrative process for determining whether to generate a new virtual object for display of a contextual advertisement in accordance with some embodiments of the disclosure. The process **1100** represented in FIG. **11** may be implemented on control circuitry **704**, and one or more actions of process **1100** may be incorporated into or combined with one or more actions of any other process or embodiment described herein.
(42) At **1102**, control circuitry **704** identifies a number of virtual objects currently being displayed. This may be accomplished using methods described above in connection with FIG. **9**.
(43) At **1104**, control circuitry **704** identifies a respective type of each virtual object currently being displayed. For example, control circuitry **704** may identify from metadata associated with each respective virtual object whether the respective virtual object is a foreground object or a background object. Control circuitry **704** may alternatively or additionally determine from the metadata whether the respective virtual object is a static object (i.e., the position of the object does not change relative to background objects) or an animated object (i.e., the position of the object changes relative to background objects independently of a user's movement within the virtual environment). Control circuitry **704** may also identify whether the respective virtual object represents a natural object or a man-made object.
(44) At **1106**, control circuitry **704** determines whether any object currently being displayed is of a type suitable for displaying the selected advertisement. For example, in determining whether a virtual object represents a natural object (e.g., a tree, cloud, grass, bird, face, etc.) or a man-made object (e.g., building, vehicle, billboard, T-shirt, etc.), control circuitry **704** may further determine whether the object represented by a particular virtual object would normally include an advertisement. If a virtual object currently being displayed is of a type suitable for displaying the selected advertisement, then, at **1108**, control circuitry **704** selects the object of a suitable type for display of the selected advertisement. If no virtual objects of a suitable type are currently being displayed, then, at **1110**, control circuitry **704** generates a new virtual object related to the current environment as described above in connection with FIG. **8**.
(45) It is contemplated that the actions or descriptions of FIG. **11** may be used with any other embodiment of this disclosure. In addition, the actions and descriptions described in relation to

FIG. **11** may be done in alternative orders or in parallel to further the purposes of this disclosure.
(46) FIG. **12** is a flowchart representing an illustrative process for displaying a contextual advertisement on a virtual object in accordance with some embodiments of the disclosure. The process **1200** represented in FIG. **12** may be implemented on control circuitry **704**, and one or more actions of process **1200** may be incorporated into or combined with one or more actions of any other process or embodiment described herein.
(47) At **1202**, control circuitry **704** determines the number of surfaces of a virtual object and initializes a counter variable i with a value of 0. To determine the number of surfaces of a virtual object, control circuitry **704** may retrieve geometric and/or topological parameters of the virtual object. If the virtual object is a polygon, control circuitry **704** may count the faces of the polygon to determine the number of surfaces. If the virtual object is an irregular object (e.g., an object with curved surfaces), control circuitry **704** may use topological data to determine the number of surfaces.
(48) At **1204**, control circuitry **704** determines whether the i.sup.th surface of the virtual object is suitable for displaying the selected advertisement. For example, control circuitry **704** determines whether the i.sup.th surface is currently facing the user, determines the size of the surface, determines the curvature of the surface, and/or determines the lighting of the surface in order to identify whether the surface is suitable for displaying the selected advertisement. If so, then, at **1210**, control circuitry **704** displays the selected advertisement on the i.sup.th surface. If not, then, at **1206**, control circuitry **704** determines whether all the surfaces of the virtual object have been considered. If not, control circuitry **704**, at **1208**, increments the value of i and processing returns to **1204**.
(49) It is contemplated that the actions or descriptions of FIG. **12** may be used with any other embodiment of this disclosure. In addition, the actions and descriptions described in relation to FIG. **12** may be done in alternative orders or in parallel to further the purposes of this disclosure.
(50) FIG. **13** is a flowchart representing an illustrative process for placing a contextual advertisement on a virtual object in accordance with some embodiments of the disclosure. The process **1300** represented in FIG. **13** may be implemented on control circuitry **704**, and one or more actions of process **1300** may be incorporated into or combined with one or more actions of any other process or embodiment described herein.
(51) At **1302**, control circuitry **704**, using virtual content processing circuitry **708**, determines a currently displayed viewing angle relative to a fixed reference position in the virtual environment. Virtual content processing circuitry **708** identifies a fixed reference position from which all virtual objects are arrayed in a sphere around the user's position within the virtual environment. Any point in the virtual environment can thus be identified by a set of coordinates describing a number of degrees From the reference point in the horizontal plane, a number of degrees above or below the reference point in the vertical plane. Virtual content processing circuitry **708** identifies the coordinates of the point in the center of the user's field of view and calculates the angle between the point and the reference position.
(52) At **1304**, control circuitry **704**, using virtual content processing circuitry **708**, determines an orientation of the virtual object relative to the reference position. For example, a single point, surface edge, or vertex of the virtual object may be tracked by virtual content processing circuitry **708** as a reference point from which to display the virtual object. Virtual content processing circuitry **708** may compare the virtual object reference point with the reference position to determine the orientation of the virtual object.
(53) At **1306**, control circuitry **704**, using virtual content processing circuitry **708**, calculates the currently displayed angle of the surface of the virtual object on which the selected advertisement is to be displayed. Virtual content processing circuitry **708** uses geometry or trigonometry to calculate a position and viewing angle of the virtual object relative to the center of the user's field of view. Then, at **1308**, control circuitry **704**, using image processing circuitry **732**, calculates an image

transformation matrix that matches the currently displayed angle of the surface of the virtual object. At **1310**, image processing circuitry **732** transforms an image of the selected advertisement using the transformation matrix so that the selected advertisement may seamlessly be displayed on the virtual object.

(54) The above calculations and transformations can also be made using a projected position at which newly generated virtual object may be placed within the virtual environment.

(55) It is contemplated that the actions or descriptions of FIG. **13** may be used with any other embodiment of this disclosure. In addition, the actions and descriptions described in relation to FIG. **13** may be done in alternative orders or in parallel to further the purposes of this disclosure.

(56) FIG. **14** is a flowchart representing an illustrative process for selecting a contextual advertisement for insertion in according with some embodiments of the disclosure. The process **1400** represented in FIG. **14** may be implemented on control circuitry **704**, and one or more actions of process **1400** may be incorporated into or combined with one or more actions of any other process or embodiment herein.

(57) At **1402**, control circuitry **704** identifies a category of advertisement related to the speech. For example, the speech may include the keyword “slice” and, using language processing circuitry **720**, control circuitry **704** may genericize this keyword to the category of food. At **1404**, control circuitry **704** determines whether a user profile associates a particular advertisement with the category. Continuing the above example, control circuitry may determine whether user preferences **724** include a particular brand (e.g., “Joe's Pizza”) or other specific advertisement identifier in the category of food. If the user profile does associate a particular advertisement with the category, then, at **1406**, control circuitry **704** retrieves an identifier of the particular advertisement and, at **1408**, selects the particular advertisement from an advertisement database using the retrieved identifier. If no advertisement is associated with the category, then, at **1410**, control circuitry selects an advertisement related to the category from the advertisement database at random.

(58) It is contemplated that the actions or descriptions of FIG. **14** may be used with any other embodiment of this disclosure. In addition, the actions and descriptions described in relation to FIG. **14** may be done in alternative orders or in parallel to further the purposes of this disclosure.

(59) FIG. **15** is a flowchart representing an illustrative process for selecting a virtual object on which to display a contextual advertisement. The process **1500** represented in FIG. **15** may be implemented on control circuitry **704**, and one or more actions of process **1500** may be incorporated into or combined with one or more actions of any other process or embodiment described herein.

(60) At **1502**, control circuitry **704** identifies a number of virtual objects related to the current environment. For example, control circuitry **704** may access a virtual object library and filter the virtual objects to those related to the current environment. At **1504**, control circuitry **704** identifies a type of each identified virtual object. This may be accomplished using methods described above in connection with FIG. **11**. At **1506**, control circuitry initializes a counter variable N with a value of 0, and, at **1508**, determines whether the N.sup.th object is of a type suitable for displaying the selected advertisement. This may be accomplished using methods described above in connection with FIG. **11**. If the object is not of a suitable type, then, at **1510**, control circuitry determines whether there are more virtual objects to consider. If so, then, at **1512**, control circuitry increments the value of N and processing returns to **1508**. If the N.sup.th object is of a suitable type for displaying the selected advertisement then, at **1514**, control circuitry **704** selects the N.sup.th virtual object to display the selected advertisement.

(61) It is contemplated that the actions or descriptions of FIG. **15** may be used with any other embodiment of this disclosure. In addition, the actions and descriptions described in relation to FIG. **15** may be done in alternative orders or in parallel to further the purposes of this disclosure.

(62) The processes described above are intended to be illustrative and not limiting. One skilled in the art would appreciate that the steps of the processes discussed herein may be omitted, modified,

combined, and/or rearranged, and any additional steps may be performed without departing from the scope of the invention. More generally, the above disclosure is meant to be exemplary and not limiting. Only the claims that follow are meant to set bounds as to what the present invention includes. Furthermore, it should be noted that the features and limitations described in any one embodiment may be applied to any other embodiment herein, and flowcharts or examples relating to one embodiment may be combined with any other embodiment in a suitable manner, done in different orders, or done in parallel. In addition, the systems and methods described herein may be performed in real time. It should also be noted that the systems and/or methods described above may be applied to, or used in accordance with, other systems and/or methods.

Claims

1. A method comprising: generating a set of advertisement placement restrictions based on a user's purchase history related to a particular product, wherein the set of advertisement placement restrictions include restrictions relating to displaying of the particular product; receiving audio input that includes a keyword associated with the particular product during presentation of a virtual environment; in response to receiving the audio input, identifying a first advertisement related to the particular product; determining whether placement of the first advertisement in the virtual environment violates the restrictions relating to displaying of the particular product; and in response to determining that placement of the first advertisement in the virtual environment does not violate the restrictions relating to displaying of the particular product: determining a first surface, from a plurality of surfaces, and an angle of the first surface of a virtual object displayed in the virtual environment for placement of the first advertisement; calculating an image transformation matrix that matches the determined angle of the displayed virtual object; transforming an image of the first advertisement using the image transformation matrix to match the determined angle; and displaying the virtual object with the transformed image of the first advertisement overlaid over the first surface of the virtual object.
2. The method of claim 1, wherein generating the set of advertisement placement restrictions comprises: monitoring the user's purchase history related to the particular product; determining, based on the monitoring, that the particular product was previously ordered by the user on an online platform; and in response to determining that the particular product was previously ordered by the user on the online platform: determining a time of day when the particular product was not ordered; and placing a first restriction in the set of advertisement placement restrictions to not display the first advertisement at the time of day when the particular product was not ordered.
3. The method of claim 2, wherein the first restriction is associated with an expiration of time after which the first advertisement is not to be displayed to the user.
4. The method of claim 2, wherein the time of day when the particular product was not ordered is determined based on the particular product's order history that includes at least more than one previous order.
5. The method of claim 1, wherein the first surface of the virtual object is facing the user at a fixed reference position.
6. The method of claim 5, wherein determining the angle of the first surface of the virtual object displayed in the virtual environment comprises: determining an orientation of the virtual object relative to the fixed reference position; calculating a currently-displayed angle of the first surface of the virtual object.
7. The method of claim 1, wherein the first surface is determined for placement of the first advertisement, from the plurality of surfaces associated with the virtual object based on (a) lighting of the first surface and (b) curvature of the first surface, as viewed from a perspective of the user.
8. The method of claim 1, wherein the first surface is determined for placement of the first advertisement in response to detecting that other surfaces of the virtual object are not suitable for

the placement of the first advertisement based on a size of the other surfaces, as viewed from a perspective of the user.
9. The method of claim 1, wherein the virtual object is a static or an animated object.
10. The method of claim 1, further comprising, identifying the virtual environment based on a set of coordinates describing a number of degrees from a reference point in a horizontal plane and a number of degrees above or below the reference point in a vertical plane, as viewed from a perspective of the user.
11. A system comprising: control circuitry configured to: generate a set of advertisement placement restrictions based on a user's purchase history related to a particular product, wherein the set of advertisement placement restrictions include restrictions relating to displaying of the particular product; receive audio input that includes a keyword associated with the particular product during presentation of a virtual environment; in response to receiving the audio input, identify a first advertisement related to the particular product; determine whether placement of the first advertisement in the virtual environment violates the restrictions relating to displaying of the particular product; and in response to determining that placement of the first advertisement in the virtual environment does not violate the restrictions relating to displaying of the particular product: determine a first surface, from a plurality of surfaces, and an angle of the first surface of a virtual object displayed in the virtual environment for placement of the first advertisement; calculate an image transformation matrix that matches the determined angle of the displayed virtual object; transform an image of the first advertisement using the image transformation matrix to match the determined angle; and display the virtual object with the transformed image of the first advertisement overlaid over the first surface of the virtual object.
12. The system of claim 11, wherein generating the set of advertisement placement restrictions comprises, the control circuitry configured to: monitor the user's purchase history related to the particular product; determine, based on the monitoring, that the particular product was previously ordered by the user on an online platform; and in response to determining that the particular product was previously ordered by the user on the online platform: determine a time of day when the particular product was not ordered; and place a first restriction in the set of advertisement placement restrictions to not display the first advertisement at the time of day when the particular product was not ordered.
13. The system of claim 12, wherein the first restriction is associated with an expiration of time after which the first advertisement is not to be displayed to the user.
14. The system of claim 12, wherein the time of day when the particular product was not ordered is determined by the control circuitry based on the particular product's order history that includes at least more than one previous order.
15. The system of claim 11, wherein the first surface of the virtual object is facing the user at a fixed reference position.
16. The system of claim 15, wherein the control circuitry configured to determine the angle of the first surface of the virtual object displayed in the virtual environment is further configured to: determine an orientation of the virtual object relative to the fixed reference position; calculate a currently-displayed angle of the first surface of the virtual object.
17. The system of claim 11, wherein the first surface is determined by the control circuitry for placement of the first advertisement, from the plurality of surfaces associated with the virtual object, based on (a) lighting of the first surface and (b) curvature of the first surface, as viewed from a perspective of the user.
18. The system of claim 11, wherein the first surface is determined by the control circuitry for placement of the first advertisement in response to detecting that other surfaces of the virtual object are not suitable for the placement of the first advertisement based on a size of the other surfaces, as viewed from a perspective of the user.
19. The system of claim 11, wherein the virtual object is a static or an animated object.

20. The system of claim 11, further comprising, the control circuitry configured to identify the virtual environment based on a set of coordinates describing a number of degrees from a reference point in a horizontal plane and a number of degrees above or below the reference point in a vertical plane, as viewed from a perspective of the user.