gaining information and services. Apparatus and methods implementing these features are described with respect to FIGS. **1-12**.

[**0046**] To utilize a virtual 3-D gaming environment for a game presentation or other gaming activities on a gaming machine, a 2-D view of the virtual 3-D gaming environment is rendered. The 2-D view captures some portion of the surfaces modeled in the virtual 3-D gaming environment. The captured surfaces define a 3-D object in the 3-D gaming environment. The captured surfaces in 2-D view are defined in the 3-dimensional coordinates of the virtual 3-D gaming environment and converted to a 2-dimensional coordinate system during the capturing process. As part of a game presentation, the 2-D view may be presented as a video frame on a display screen on the gaming machine. In some ways, the two-dimensional view is analogous to a photograph of a physical 3-D environment taken by a camera where the photograph captures a portion of the physical 3-D surfaces existing in the physical 3-D environment. However, the photograph from a camera is not strictly analogous to a 2-D view rendered from a virtual 3-D gaming environment because many graphical manipulation techniques may be applied in a virtual 3-D gaming environment that are not available with an actual camera.

[**0047**] In the present invention, the 2-D view is generated from a viewpoint within the virtual 3-D gaming environment. The viewpoint is a main factor in determining what surfaces of the 3-D gaming environment defining a 3-D object are captured in the 2-D view. Since information about the 3-D gaming environment is stored on the gaming machine, the viewpoint maybe altered to generate new 2-D views of objects within the 3-D gaming environment. For instance, in one frame, a 2-D view of an object modeled in the 3-D gaming environment, such as a front side of a building (e.g. the viewpoint captures the front side of a building), may be generated using a first viewpoint. In another frame, a 2-D view of the same object may be generated from another viewpoint (e.g. the backside of the building).

[**0048**] A disadvantage of current gaming machines is that the 2-D views used as video frames in game presentations are only rendered from 2-D objects and information about the multi-dimensional nature of the objects rendered in the 2-D views, such as the viewpoint used to generate the 2-D view, are not stored on the gaming machine. Historically, due to the regulatory environment of the gaming industry, gaming software used to present a game of chance has been designed to "run in place" on an EPROM installed on the gaming machine. Using an EPROM, it was not feasible to store large amounts of game data relating to a complicated 3-D model. Thus, only 2-D object information used to render the 2-D view was stored on the gaming machine.

[**0049**] However, 2-D games rendered on gaming machines have also become more sophisticated and often employ complex animations. When complicated animations are used in a 2-D system, such as playing movies on a 2-D object, a 3-D system can actually can save memory because more types of animation can be used with a 3-D system versus a 2-D system without resorting to using movies which are memory intensive. In a 2-D system without using movies, the animation properties that may be used are simple two-dimensional movement and color cycling using color palettes which provide a limited visual appeal.

[**0050**] When only 2-D information about a 3-D object is available, it is not possible to generate new 2-D views from different viewpoints of the 3-D object. For instance, when a picture of a playing card is rendered on current gaming machines, 3-D information, such as the thickness of the card is not stored. Thus, it is not possible to generate a 2-D view of the playing card from an edge-on viewpoint, because the thickness of the card is not known. As another example, frames from a movie may be used as part of a game presentation on a gaming machine. Each frame of the movie represents a 2-D view from a viewpoint of a camera used to film each frame. If the frame included a picture of a building viewed from the front (e.g., the viewpoint captures the front of the building), it is not possible to generate a new 2-D view of the back of the building using because information regarding the back of the building is not known.

[**0051**] One advantage of the present invention is the potential game playing area used to present a game of chance modeled in a 3-D gaming environment is greater than the potential game playing area of a 2-D gaming environment. For instance, a game of chance may be presented on each of the six sides of a cube modeled in a virtual gaming environment. To play the game chance, 2-D views of the cube from different viewpoints in the 3-D gaming environment may be rendered in real-time and presented to the player. As described below, in some embodiments, the player may even select the viewpoint in the 3-D gaming environment used to generate the 2-D view.

[**0052**] On current gaming machine, the cube would be rendered as a 2-D object generated from the 3-D cube as seen from a particular viewpoint. The particular viewpoint is selected when the game is developed and only 2-D information about the cube as viewed from the selected viewpoint would be stored on an EPROM on the gaming machine. Thus, a game of chance could be presented on the sides of the cube rendered from the 2-D object that was generated from the selected viewpoint of the 3-D cube and stored on the EPROM. However, unless additional 2-D objects were generated from different viewpoints, it is not possible to present a game of chance on the sides of the cube not visible from the selected viewpoint because the 2-D object does not store information regarding the sides of the cube not visible from the selected viewpoint. Further, even if multiple 2-D objects were generated, it is difficult and time consuming to generate enough 2-D objects to allow smooth transitions between viewpoints captured by the 2-D objects. It is also difficult to a scale a 2-D object, either smaller or larger, without introducing distortion effects.

[**0053**] Distortion is also generated when scaling 3-D objects. However, it is easier to deal with using specialized 3-D graphics cards because the card applies a bilinear filtering process to the texels at render time. Without special hardware, such as a 3-D graphics card, it would be difficult to correct for distortion in real-time.

[**0054**] Finally, in a typical 2-D gaming system, due to the limited flexibility of 2D, outcomes for a game of chance rendered in 2D and displayed on a gaming machine have to be quantified and pre-rendered i.e. canned animations. Due to the flexibility of a 3-D gaming system the outcomes can be determined through user input giving an unlimited number of animations in response to the players input. By not having to make a series of pre-canned animations but instead