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(54) **3D VIDEOGAME SYSTEM**

(57) A 3D videogame system capable of displaying a left-right sequence through a different, independent VGA or video channel, with a display device sharing a memory in an immerse manner.

The system has a videogame engine controlling and validating the image perspectives, assigning textures, lighting, positions, movements and aspects associated with each object participating in the game; creates left and right backbuffers, creates images and presents de information in the frontbuffers.

The system allows handling the information of data associated to the xyz coordinates of the object's image in real-time, increases the RAM for the left-right back-buffer, with the possibility to discriminate and take the corresponding backbuffer, whose information is sent to the frontbuffer or additional independent display device sharing a memory in an immerse manner.

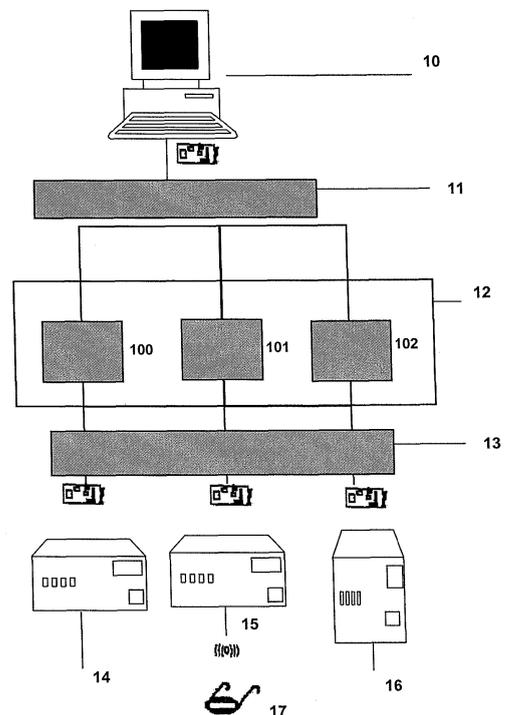


Fig. 1

Description**FIELD OF THE INVENTION**

5 **[0001]** The present invention is related to the display of three-dimensional television images, more specifically to a hardware and software design for viewing three-dimensional (3D) images, easy to be integrated to the existing television, personal computer and videogame system equipment.

BACKGROUND OF THE INVENTION

10 **[0002]** The visual man-machine interface is constantly trying to improve the images for a wide range of applications: military, biomedical research, medical imaging, genetic manipulation, airport security, entertainment, videogames, computing, and other display systems.

15 **[0003]** Three-dimensional (3D) information is the key for achieving success in critical missions requiring realistic three-dimensional images, which provide reliable information to the user.

20 **[0004]** Stereoscopic vision systems are based on the human eye ability to see the same object from two different perspectives (left and right). The brain merges both images, resulting in a depth and volume perception, which is then translated by the brain into distance, surface and volumes.

25 **[0005]** In the state-of-the-art, several attempts have been made in order to achieve 3D images, e.g., the following technologies have been used:

- Red-blue polarization
- Vertical-horizontal polarization
- Multiplexed images glasses.
- 25 - 3D virtual reality systems
- Volumetric displays
- Auto-stereoscopic displays

30 **[0006]** All of the aforementioned technologies have presentation incompatibilities, collateral effects and a lack of compatibility with the current existing technology, namely:

35 Red-blue polarization systems require, in order to be watched, a special projector and a large-size white screen; after a few minutes, collateral effects start appearing, such as headache, dizziness, and other symptoms associated to images displayed using a three-dimensional effect. This technology was used for a long time in cinema display systems but, due to the problems mentioned before, the system was eventually withdrawn from the market. Collateral symptoms are caused by the considerable difference in the content received by the left eye and the right eye (one eye receives blue-polarized information and the other receives red-polarized information), causing an excessive stress on the optical nerve and the brain. In addition, two images are displayed simultaneously. In order to be watched, this technology requires an external screen and the use of polarized color glasses. If the user is not wearing red-blue glasses, the three-dimensional effect cannot be watched, but instead only double blurry images are watched.

40 **[0007]** The horizontal-vertical polarization system merges two images taken by a stereoscopic camera with two lenses; the left and right images have a horizontal and vertical polarization, respectively. These systems are used in some new cinema theaters, such as Disney and IMAX3D theaters. This technology requires greatly expensive production systems and is restricted to a dedicated and selected audience, thus reducing the market and field of action. A special interest in the three-dimensional (3D) contents has grown during the past three years; such is the case of Tom Hanks' productions and Titanic, which have been produced with 3D content by IMAX3D technology. This technology also presents collateral effects for the user after a few minutes of display, requires an external screen and uses polarized glasses; if the user is not wearing these glasses, only blurred images can be watched.

45 **[0008]** Systems using multiplexed-image shutting glasses technology toggle left and right images by blocking one of these images, so it cannot get to the corresponding eye for a short time. This blocking is synchronized with the images display (in a monitor or TV set). If the user is not wearing the glasses, only blurred images are watched, and collateral effects become apparent after a few minutes. This technology is currently provided by (among others), BARCO SYSTEMS for Mercedes Benz®, Ford® and Boeing® companies, by providing a kind of "room" to create 3D images by multiplexing (shutter glasses) in order to produce their prototypes before they are assembled in the production line.

50 **[0009]** 3D virtual reality systems (VR3D) are computer-based systems that create computer scenes that can interact with the user by means of position interfaces, such as data gloves and position detectors. The images are computer generated and use vector, polygons, and monocular depth reproduction based images in order to simulate depth and

volume as calculated by software, but images are presented using a helmet as a displaying device, placed in front of the eyes; the user is immersed in a computer generated scene existing only in the computer and not in the real world. The name of this computer-generated scene is "Virtual Reality". This system requires very expensive computers, such as SGI Oxygen® or SGI Onyx Computers®, which are out of reach of the common user. Serious games and simulations are created with this technology, which generates left-right sequences through the same VGA or video channel, the software includes specific instructions for toggling video images at on-screen display time at a 60 Hz frequency. The videogame software or program interacts directly with the graphics card.

[0010] There is a technology called I-O SYSTEMS, which displays multiplexed images in binocular screens by means of a left-right multiplexion system and toggling the images at an 80 to 100 Hz frequency, but even then the flicker is perceived.

[0011] Only a few manufacturers, such as Perspectra Systems, create volumetric display systems®. They use the human eye capability to retain an image for a few milliseconds and the rotation of a display at a very high speed; then, according to the viewing angle, the device shows the corresponding image turning the pixels' color on and off, due to the display's high speed rotation the eye can receive a "floating image". These systems are very expensive (the "sphere" costs approximately 50,000 USD) and require specific and adequate software and hardware. This technology is currently used in military applications.

[0012] Auto-stereoscopic displays are monitors with semi-cylindrical lines running from top to bottom and are applied only to front and back images; this is not a real third dimension, but only a simulation in two perspective planes. Philips® is currently working in this three-dimension technology as well as SEGA® in order to obtain a technological advantage. Results are very poor and there is a resolution loss of 50%. This technology is not compatible with the present technological infrastructure and requires total replacement of the user's monitor. Applications not specifically created for this technology are displayed blurred, making them totally incompatible with the inconveniences of the current infrastructure. In order to watch a 3D image, the viewer needs to be placed at an approximate distance of 16" (40.64 cm), which varies according to the monitor's size, and the viewer must look at the center of the screen perpendicularly and fix his/her sight in a focal point beyond the real screen. With just a little deviation of the sight or a change in the angle of vision, the three-dimensional effect is lost.

[0013] In the state-of-the-art, there are several patents, which are involved in the development of this technology, namely:

USP No. 6,593,929, July 15th, 2003 and USP No. 6,556,197, April 29th, 2003, granted to Timothy Van Hook, et al., which refer to a low cost video game system which can model a three-dimensional world and project it on a two-dimensional screen, the images are based on interchangeable viewpoints in real-time by the user, by means of game controllers.

USP No. 6,591,019, July 8th 2003, granted to Claude Comair et al., uses the compression and decompression technique for the transformation of a matrix into 3D graphical systems generated by a computer, this technique consists in converting real numbers matrixes into integer matrixes during the zeroes search within the matrix. The compressed matrixes occupy a much smaller space in memory and 3D animations can be decompressed in real-time in an efficient manner.

USP No. 6,542,971, April 1st 2003, granted to David Reed, provides a memory access system and a method which uses, instead of an auxiliary memory, a system with a memory space attached to a memory which writes and reads once the data input from one or more peripheral devices.

USP No. 6,492,987, December 10th 2002, granted to Stephen Morein, describes a method and device for processing the elements of the objects represented; it starts by comparing the geometrical properties of at least one element of one object with representative geometric properties by a pixels group. During the representation of the elements of the object, a new representative geometric property is determined and is updated with a new value.

USP No. 6,456,290, September 24th 2002, granted to Vimal Parikh et al., provides a graphical system interface for the application of a use and learning program. The characteristic includes the unique representation of a vertex which allows the graphic line to retain the vertex status information, projection matrix and immerse framebuffer commands are set.

[0014] Any videogame is a software program written in some computer language. Its objective is to simulate a non-existent world and take a player or user into this world, most are focused in enhancing the visual and manual dexterity, pattern analysis and decision taking, in a competitive and improvement (difficulty level) environment, and are presented in large scenarios with a high artistic content. As a game engine, most videogames are divided into the following structure: videogame, game library with graphics and audio engines associated, the graphical engine contains the 2D source code and the 3D source code, and the audio engine contains the effects and music code.

[0015] Every block of the game engine mentioned is executed in a cyclic way called a game loop, and each one of these engines and libraries is in charge of different operations, by example:

Graphics engine: displays images in general

2D source code: static images, "backs" and "sprites" appearing in a videogame screen.

3D source code: dynamic, real-time vector handled images, processed as independent entities and with xyz coordinates within the computer-generated world.

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[0016] Audio engine: sound playback

[0017] Effects code: when special events happen, such as explosions, crashes, jumps, etc.

[0018] Music code: background music usually played according to the videogame's ambience.

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[0019] The execution of all these blocks in a cyclic way allows the validation of current positions, conditions and game metrics; as a result of this information the elements integrating the videogame are affected.

15

[0020] The difference between game programs created for game consoles and computers is that originally, the IBM PC was not created for playing in it; ironically, many of the best games run under an IBM PC-compatible technology. If we compare the PCs of the past with the videogames and processing capabilities of the present, we could say that PCs were completely archaic, and it was only by means of a low-level handling (assembly language) that the first games were created, making direct use of the computer's graphics card and speaker. The situation has changed, the processing power and graphics capabilities of present CPUs, as well as the creation of cards specially designed for graphics processes acceleration (GPUs) have evolved to such a degree that they surpass by far the characteristics of the so-called supercomputers in the eighties.

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[0021] In 1996, a graphics acceleration system called HARDWARE ACCELERATION was introduced, consisting in including graphics processors capable of making mathematical and matrix operations at a high speed, thus reducing the main CPU's load by means of card-specific communications and a programming language, located in a layer called HAL (Hardware Abstraction Layer), which allows the information handling of data associated to real-time xyz coordinates, by means of coordinate matrixes and matrix mathematical operations, such as addition, scalar multiplication and floating point matrix comparison.

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BRIEF DESCRIPTION OF THE INVENTION

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[0022] An object of the present invention is to solve the incompatibility problems of the technologies in three-dimensional images display.

[0023] Another object of the present invention is to provide a multi-purpose technology which allows the final user to watch video images, computer graphics, videogames and simulations with the same device.

[0024] An additional object of the present invention is to provide a technology which eliminates the collateral effects produced after watching the three-dimensional images provided by the present technologies, even for hours of constant use.

35

[0025] It is an additional object of the present invention to provide a high-tech integration in software by the creation of a pair of buffers corresponding to the left eye and the right eye, hardware with an additional, independent display device which shares the memory in an immerse form, digital video image processors.

[0026] It is another object of the present invention to display the image physically on-screen by means of two front buffers created by graphics process units or GPUs.

40

[0027] Is still another object of the present invention to obtain brain perceptions of depth and volume with highly realistic images, even if they are created by computer graphics software.

[0028] Is still other object of the present invention to provide a TDVision® algorithm to create highly realistic computer images.

45

[0029] It is another object of the present invention to make changes in the current technological base to create a new digital imaging process with optical techniques in order to achieve a real image perception by setting the view of a right side camera.

[0030] It is another object of the present invention to achieve digital media convergence, wherein a DVD-playing computer, a movie-producing laptop, the video-image transmission capability of the internet, and PC and video game consoles can be used in the internet structure.

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[0031] It is another object of the present invention to provide a new assembly language algorithm, analog and digital hardware to obtain the best adaptation to the existing technologies' 3D equipment.

[0032] It is still another object of the present invention to provide three-dimensional visual computer systems for the generation of stereoscopic images by means of animation, display and software modeling.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0033]

Figure 1 shows the TDVision® videogame technology map.

Figure 2 shows the main structure for a videogame based on the previous art.

Figure 3 shows the essential three-dimensional element for constructing an object in a certain position in space.

5 Figure 4 shows the development outline of a videogame program based on the OpenGL and DirectX API functions technologies.

Figure 4a shows the block diagram of the algorithm for creating the left and right buffers, and additionally discriminating if TDVision technology is used.

10 Figure 4b shows the block diagram of the subroutine for setting the right camera view after drawing the image in the right backbuffer as a function of the right camera vector, it also discriminates if the TDVision technology format is used.

Figure 5 shows the block diagram of the computing outline of the modifications to the graphical adapter needed to compile the TDVision technology, in the other hand, it allows the communication and contains the programming language and allows the information handling of there data associated with the images set.

15 Figure 6 represents the block diagram of the algorithm which allows the drawing of information in the TDVision backbuffer and presenting it on-screen in DirectX 3D format.

Figure 7 shows the display sequence using the OpenGL format.

Figure 8 shows the block diagram of the on-screen information display by means of the left and right backbuffers using the OpenGL algorithm.

20 Figure 9 shows the changes needed in the video card used for the TDVision technology.

DETAILED DESCRIPTION OF THE INVENTION

25 **[0034]** Videogames are processes which start by providing a plurality of independently related logical states which include a set of programming options, where each programming option corresponds to different image characteristics. The generic program instructions can be compiled into a code by several computing devices, without having to independently generate the object codes for each device.

30 **[0035]** The computer devices, such as personal computers, laptops, videogames, etc., include a central processing units, memory systems, video graphical processing circuits, audio processing circuits and peripheral ports. Typically, the central unit processes a software in order to generate geometric data referring to the image to be displayed and provides the geometric data to the video graphics circuit, which generates the pixel data stored in a memory frame where the information is sent to the display device, the aforementioned elements as a whole are called the videogame engine. 2).

35 **[0036]** Some game engines are licensed to a third party, as in the case of the Quake III Arena program, which has the QUAKE ENGINE game engine; this engine was licensed to the VOYAGER ELITE FORCE game which uses the quake engine. This way, the game developers can concentrate in the game metrics, instead of having to develop a game engine from scratch. Originally, videogames used only two-dimensional images, called "sprites", which were the game's protagonists.

[0037] Most of the videogames and technologies evolved and allowed working with simulated objects in a three-dimensional environment or world, giving each object xyz position properties, surrounded by other objects with the same characteristics and acting together within a world with a (0,0,0) origin.

40 **[0038]** At first, videogame consoles, separated from the computer world, took the first step to incorporate 3D graphics as a physical graphics capability of said devices, techniques later adopted by the hardware used in PCs. A circumstance-analysis element is also included, usually known as videogame applied artificial intelligence, this element analyzes the situation, positions, collisions, game risks and advantages, and based on this analysis, generates a response action for each object participating in the videogame.

45 **[0039]** A backbuffer is used, which is a memory location where the image to be displayed is temporarily "drawn" without outputting it to the video card. If this is done directly on the video memory screen, a flicker on the screen would be observed; therefore the information is drawn and processed quickly in the backbuffer. This backbuffer is usually located within the physical RAM memory of the video or graphics acceleration card.

50 **[0040]** A typical sequence within a videogame's algorithm would be:

- 1) Display title screen
- 2) Load characters, objects, textures and sounds into memory
- 3) Create a memory location for temporary processing, called doublebuffer or backbuffer.
- 4) Display background
- 5) Record the image under each element participating in the game
- 6) Clean all elements from memory (doublebuffer)
- 7) User input verification and player's position update
- 8) Enemy position processing by means of artificial intelligence (AI)

- 9) Move every participant object to its new position
- 10) Objects collision verification
- 11) Animation frame increment
- 12) Draw objects in backbuffer memory
- 13) Transfer backbuffer data to the screen
- 14) Go back to step 5, unless the user wants to end the game (step 15)
- 15) Delete all objects from memory
- 16) End game.

10 **[0041]** The most commonly used devices in a video game console are: The CPU or Central Processing Unit, which handles the game loop, user input from the keyboard, mouse or game devices as a gamepad or joystick and the game's artificial intelligence processing.

[0042] The GPU or Graphics Processing Unit handles the polygon modeling, texture mapping, transformations and lighting simulation.

15 **[0043]** The audio DSP or Digital Signal Processor handles the background music, sound effects and 3D positional sounds.

[0044] The graphics engine is the game section in charge of controlling and validating perspectives, assigning textures (metal, skin, etc.), lighting, positions, movements and every other aspect associated to each object participating in the videogame, for a videogame console or PC. This images set is processed in relation to the assigned origin point and calculating the distance, depth and position perspectives. This is made in two steps, but it is a complex process due to the mathematical operations involved, namely, the object translation process (offset from origin), and the object rotation process (rotation angle in relation to the current position).

20 **[0045]** It is important to note that the minimum image units (fig. 3) are comprised of minimum control units called a "vertex", which represent one point in the xyz space. The minimum geometrical unit allowed is the triangle constructed by a minimum of three points in space; from the triangle base unit larger objects are formed, comprised of thousands of smaller triangles, as the Mario Sunshine character. This representation is called "Mesh" and texture, color and even graphical display characteristics can be associated to each mesh or even to each triangle. This information is denominated 3D graphics. It is very important to mention that even when it is called a 3d graphic due to its nature, constructed by xyz vectors, the final display to the user is generally in 2D, in a flat engine with content based on 3D vectors seen by the user as if they were in front of him, they only appear to have some intelligent depth and lighting characteristics, but for the brain they do not appear to have a volume in space.

25 **[0046]** Originally, it was necessary for the videogame programs to communicate directly with the graphics card to execute acceleration and complex mathematics operations, which meant that a game had to be practically rewritten in order to support a different video card. Facing this problem, Silicon Graphics® focused in developing a software layer (OpenGL®) which communicated directly with the hardware, with a series of useful functions and subroutines which, independently of the hardware, could communicate with it only in the graphical aspects. Microsoft® also developed a similar function group called DirectX 3D, very much like OpenGL® but with a more complete functionality, as it included sound control and network gaming areas, among others.

30 **[0047]** These functions and subroutines set are called Graphics Applications Programming Interface (GRAPHICS API). These APIs can be accessed from different programming languages, as C, C++, Visual .Net, C# and Visual Basic, among others.

[0048] Every virtual reality system mentioned, currently user a left-right sequence through the same VGA or video channel scheme, these systems require software which includes specific instructions for alternating video images at on-screen display time in the backbuffer, applying a known offset algorithm using offsets and simulation-like angles.

35 **[0049]** Additionally to the functions provided by the OpenGL® and DirectX® API, a series of graphics handling functions is available within an application-programming interface provided by Windows®, called WINDOWS API.

[0050] The development of a videogame program based on these technologies is shown in Figure 4, in which the videogame software developed in the present application by TDVision® Corp. implementation is included. Figure 4 shows a schematic of the flowchart starting with the software implementation with the adequate metrics for the videogame (40), the software is developed in any appropriate programming language (such as C, C++, Visual Basic, Others) (41), the source code for the videogame (42), game logic and object characteristics, sounds, events, etc. are entered. (43), in (44) the event selector is located, which does this by means of the Windows API (45), OpenGL (46), or DirectX (47), and is finally sent to the video display (48).

40 **[0051]** All of this refers to the software, something interesting is that DirectX provides many functions, and Microsoft® achieved that even when initially some functions required specific hardware, the DirectX API itself is capable of emulating the hardware characteristics by software, as if the hardware was actually present.

45 **[0052]** The present invention maximizes and optimizes the use of the OpenGL® and DirectX® technologies, resulting in a software with certain specific characteristics, algorithms and digital processes in order to meet the specifications

set by TDVision used in the present application.

[0053] Regarding the hardware, the HAL and the direct interface can be analyzed by drivers for each card, and in order to implement the TDVision technology it is necessary to analyze the minimum specifications and requirements, as well as any possible change in the technology which allows to obtain real 3D in TDVision's 3DVisors.

[0054] Regarding the display or representation systems, the information generated by the software and stored in the Graphic Device Context or Image Surface is transmitted directly to the last stage of the graphics card, which converts the digital video signal into analog or digital signals (depending on the display monitor), and the image is then displayed on screen.

[0055] The current display methods are:

- Analog monitor with digital computer signal
- Digital monitor
- Analog monitor with TV signal
- 3D virtual reality systems.

[0056] The output type(s) depend on the video card, which should be connected to a compatible monitor.

[0057] Figure 4a shows the creation of memory locations for the temporary graphics processing (left and right backbuffers) in which basically it adds an extra memory location, i.e., sets a right buffer in (400) and discriminates in (401) if TDVision technology is present; in an affirmative case, it sets the left buffer in (402) and ends in (403); when TDVision technology is not present the process ends at (403), as there was nothing to discriminate.

[0058] Figure 4b shows the flowchart for the discrimination and display of the left camera and right camera image; the left view is set in (410), the image is drawn in the left backbuffer (411) as a function of the camera position, the image is displayed in the left screen (412), then it is discriminated if it has TDVision format in (413) and in affirmative case the right view position coordinates are calculated (414), the image is drawn in the right backbuffer as a function of the left camera position (415), then the image is displayed in the right screen (416), the process ends at (417) if it is not necessary to discriminate in (413) as the image is provided in a current state-of-the-art format, the subroutine jumps to the final stage (417) and ends, as there was no need to calculate other coordinates and display a parallel information.

[0059] The novel part of the present application refers to the graphics-processing unit shown in Figure 5 (GPU HARDWARE), and to the graphics engine (GRAPHICS ENGINE, SOFTWARE)

[0060] The hardware modifications are:

- RAM increase for the left and right backbuffers
- Implementing an additional independent display device in the display buffer but sharing the memory in an immerse manner so it takes the corresponding backbuffer.

[0061] In this case it is necessary that the backbuffer's RAM memory and the video card's frontbuffer are large enough to support the left and right channels simultaneously. This makes necessary to have a minimum of 32 MB in order to support four buffers with a depth of 1024x768x4 color depth bytes each. Additionally, the video output signal is dual (two VGA ports), or it has the capability of handling multiple monitors, as it is the case of the ATI RADEON 9500® card, which has two output display systems, one VGA and one S-Video video ports to choose from. A graphics card is created which has a dual output only to meet the 60 frames per second display per left-right channel in order to be connected to a 3DVisor, these outputs are SVGA, S-Video, RCA or DVideo type outputs.

[0062] The computing scheme is presented with modifications for TDV compilation as described in Figure 5, a CPU (50), the memory driver (52), the extended memory (52), this memory feeds the audio driver (53) and the speakers (54), also the input and output driver (55) which in turn controls the disk ports (56) and the interactive elements with the user (57) as the mouse, keyboard, gamepad and joystick; on the other hand, the graphics driver interacts directly with the monitor (59) and the three-dimensional visors 3DVISORS (59 b).

[0063] Concerning specifically the graphics hardware (HAL), changes are needed to compile with the TDVision technology, the application (500) sending the information to the graphics drivers (501) operating due to the graphics hardware support (502) effectively needs physical changes to be compiled with the TDVision technology.

[0064] In order to implement the TDVision technology by means of OpenGL and DirectX, it is necessary to make modifications in parts of the software section of a videogame and as it was mentioned earlier, in some hardware sections.

[0065] Regarding the software, it is necessary to add some special characteristics within a typical work algorithm, as well as a call to a TDVision subroutine, as it is shown in Figure 6.

- Load surfaces information (600)
- Load meshes information (601)

- Create TDVision backbuffer (602) in which a left backbuffer is created in memory, if it is TDVision technology then it creates a right backbuffer in memory.
- Apply initial coordinates (603)
- Apply game logic (604)
- 5 - Validation and artificial intelligence (605)
- Position calculation (606)
- Collision verification (607)
- Drawing the information in TDVision backbuffer and display on screen (608), in which the right camera view must be set, drawing the image in the right backbuffer as a function of the current right camera vector, and displaying the image on the right screen (front buffer). If it is TDVision technology, then: Calculate the left pair coordinates, set the left camera view, draw the image in the left backbuffer as a function of the current vector of the left camera, display the information on the right screen (front buffer) which requires hardware modification.

15 **[0066]** Thus, a pair of buffers corresponding to the left eye and right eye are created, which, when evaluated in the game loop get the vectorial coordinates corresponding to the visualization of each right camera (current) and the left camera (complement calculated with the SETXYZTDV function) shown below.

20 **[0067]** It is important to mention that said screen output buffers or front buffers are assigned from the beginning to the video display surface (device context) or to the surface in question (surface), but for displaying the information in a TDVision 3Dvisor it is necessary that two video outputs are physically present, the right output (normal VGA) and the left output (additional VGA, digital complement or S-Video) in order to be compatible with TDVision. In the example DirectX is used, but the same process and concept can be applied to the OpenGL format.

25 **[0068]** Figure 7 shows an outline of the algorithm (70) conducting a display line of the graphical applications communications interface, effectively, by means of trigonometry (72) with the vertex operations (77), the image is constructed (71) and by means of pixel operations or image elements (75) through the commands (73), the display list (74) and a memory which assigns a texture to the image (76), resulting in the display (78) being sent to the memory frame (70F) by the operations (79). The Windows software (700) communicates with (702) and the graphic language card (701), which in turn contains a graphic information library, which is useful to feed (703) and (704).

30 **[0069]** Figure 8 shows the TDVision technology using the OpenGL algorithm (80) to display the left and right image for the object, it cleans the backbuffer (81), gets the pointer for the backbuffer (82), closes the backbuffer (83), redraws the scene (84), opens the backbuffer (85), unlocks the backbuffer pointer (86), sends the image to the left display surface; in (800) it discriminates if it is TDVision technology and in an affirmative case it cleans the memory (801) and gets a pointer for the backbuffer (802), closes the backbuffer (803), gets the coordinates for the new perspective (804), redraws the scene (805), opens the memory (806), unlocks the backbuffer pointer (807), and sends the image to the right display surface (808).

35 **[0070]** Figure 9 shows the changes (90) necessary in the video card to compile TDVision technology, namely, the left normal backbuffer (91) preceding the normal left primary backbuffer (92) which in turn is connected to the monitor's VGA output (95) and should have another VGA output so it can receive the right primary backbuffer (94), which in turn has the TDVision technology backbuffer as a precedent. Both left and right backbuffers can be connected to a 3Dvisor (96) with a dual VGA input to receive and display the information sent by the backbuffers (91) and (93).

40 **[0071]** This software modifications use the following API functions in Direct X:

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TDVision backbuffer creation:

FUNCTION CREATE BACKBUFFERTDV()

5

Left buffer

Set d3dDevice =

10

d3d.CreateDevice(D3DADAPTER_DEFAULT, _

D3DDEVTYPE_HAL, hWndL, _

15

D3DCREATE_SOFTWARE_VERTEXPROCESSING,

d3dpp)

If GAMEISTDV then

20

Right Buffer

Set d3dDeviceRight =

25

d3d.CreateDevice(D3DADAPTER_DEFAULT, _

D3DDEVTYPE_HAL, hWndR, _

30

D3DCREATE_SOFTWARE_VERTEXPROCESSING,

d3dpp2)

Endif

35

END SUB

Draw image in TDVision backbuffer:

FUNCTION DRAWBACKBUFFERTDV()

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```

    DRAW LEFT SCENE
5      d3dDevice.BeginScene
      d3dDevice.SetStreamSource0,    poly    1_vb,
Len(poly1.v1)
10     d3dDevice.DrawPrimitive
D3DPT_TRIANGLELIST,0,1
      d3dDevice.EndScene
15
      Copy    backbuffer    to    frontbuffer,
20    screen
      D3dDevice.Present By Val 0,By Val 0,
0, By Val 0
25     'VERIFIES IF IT IS A TDVISION PROGRAM
BY CHECKING THE FLAG
      IF GAMEISTDV THEN
30     'CALCULATE    COORDINATES    RIGHT
CAMERA
      SETXYZTDV ()
35     ' Draw right scene
      d3dDevice2.BeginScene
40     d3dDevice2.Set    StreamSource
0, poly2_vb, Len(poly1,v1)
      d3dDevice2.DrawPrimitive
45    D3DPT_TRIANGLELIST,0,1
      d3dDevice2.EndScene
      d3dDevice2.Present    ByVal
50    0, ByVal 0, 0, ByVal
      END SUB.
55
```

Modifications to xyz camera vector:

```

5           VecCameraSource.z = z position
           D3DXMatrixLook      AtLH      matView,
10  vecCameraSource, _
           VecCameraTarget,      CreateVector
           (0,1,0)
15           D3DDevice 2.SetTransform D3DTS_VIEW,
           matView
20           VecCameraSource.x = x position
           D3DXMatrixLook      AtLH      matView,
           vecCameraSource, _
25           VecCameraTarget,      CreateVector
           (0,1,0)
30           D3DDevice 2.SetTransform D3DTS_VIEW,
           matView
           VecCameraSource.y = y position
35           D3DXMatrixLook      AtLH      matView,
           vecCameraSource, _
40           VecCameraTarget,      CreateVector
           (0,1,0)
45           D3DDevice 2.SetTransform D3DTS_VIEW,
           matView

```

[0072] Thus, a pair of buffers corresponding to the left eye and right eye are created, which, when evaluated in the game loop get the vectorial coordinates corresponding to the visualization of the right camera and the left camera (complement calculated with the SETXYZTDV function) by means of the usual coordinate transform equations.

[0073] It is important to mention that said screen output buffers or front buffers are assigned from the beginning to the device context or to the surface in question, but for displaying the information in a TDvision 3Dvisor it is necessary that two video outputs are physically present, the right output (normal VGA) and the left output (additional VGA, digital complement or SVIDEO) in order to be compatible with TDvision.

[0074] The example was made using DirectX, but the same process and concept can be applied for the OpenGL format shown in Figure 8.

[0075] In this case it is necessary that the backbuffer's RAM memory and the video card's frontbuffer are large enough

to support the left and right channels simultaneously. This makes necessary to have a minimum of 32 MB in order to support four backbuffers with a color depth of 1024x768x4 bytes each. As it was mentioned before, the video output signal must be dual (two VGA ports), or have the capability to handle multiple monitors, as it is the case of the ATI RADEON 9500® card, which has two output display systems, one VGA and one S-Video and one DVideo port to choose from.

[0076] A graphics card is created which has a dual output only to meet the 60 frames per second display per left-right channel in order to be connected to a 3Dvisor, these outputs can be SVGA, S-Video, RCA or DVideo type outputs.

[0077] Therefore, we can get the images corresponding by software to the camera viewpoint in both left and right perspectives can be obtained and the hardware will recognize the information to be displayed in two different and independent video outputs, without multiplexing and displayed in real-time. Presently, all the technologies use multiplexion and software simulation, in the technology proposed by the present application real information can be obtained and while using the 3Dvisors the image can be displayed from two different perspectives and the brain will associate the volume it occupies in space, without any flickering on screen, effect associated to the current state-of-the-art technologies.

[0078] Coordinate calculation method of the secondary stereoscopic camera (SETXYZTDV()) which allows obtaining three-dimensional computer visual systems for the generation of stereoscopic images by animation, display and modeling in software programs. This method allows to obtain spatial coordinates (x, y, z) that must be assigned to two computer-generated virtual visualization cameras to obtain a stereoscopic vision by the use of any software program that simulates the third dimension and generates the images by means of the object's movement, or by the "virtual camera" movement observed at that moment by the computer-generated object, as: Autocad, Micrografix Simply 3D, 3Dmax Studio, Point, Dark Basic, Maya, Marionette, Blender, Excel, Word, Paint, Power, Corel Draw, Photo paint, Photoshop, etc.; but all of these programs are designed to display only one camera with one fixed or moving perspective.

[0079] An additional 3D modeling and animation characteristic is added to the previous programs, in fact, the exact position is calculated for the second camera or secondary camera, directly linked to the first camera and by this means two simultaneous images are obtained from different perspectives simulating the human being's stereoscopic visual perspective. This procedure, by means of an algorithm, calculates in real-time the position of the secondary camera to place it in the adequate position, and to obtain the modeling image and representation of the second camera, achieved using the coordinate transforming equations, taking the camera to the origin the angle and distance between the secondary camera and the object or objective are calculated, then the primary camera, objective and secondary camera are repositioned in the obtained position. Then, seven parameters need to be known, namely, the first coordinates (X_p , Y_p , Z_p) of the primary camera in the original coordinate system, the fourth parameter is the equivalent distance to the average separation of the eyes (6.5 to 7.0 cm), and the three coordinates of the objective's position when observed by the cameras.

[0080] The output parameters will be the coordinates of the secondary camera observing the same objective point, i.e., (X_s , Y_s , Z_s), obtained following these steps:

- Knowing the coordinates of the primary camera in the original coordinate system (X_p , Y_p , Z_p),
Knowing the objective's coordinates (x_t , y_t , z_t)
- Only the "x" and "z" coordinates are transformed, as the coordinate and/or height of the camera is kept constant (there is no visual deviation for the observer)

[0081] The coordinates for the primary camera are taken to the (0, y_s , 0) position.

[0082] The objective is also translated

[0083] The slope for the line connecting the camera and the objective is calculated

[0084] The angle between the axis and the vector joining the primary camera with the objective is created.

[0085] The quadrant to which it belongs for the application of special considerations in the angle's calculation is classified by an inverse tangent function.

[0086] New coordinates are obtained, rotating the whole coordinate system from its axis in the same angle between the axis and the vector, a new coordinate system is obtained in which the object is placed on the 'z' axis and the primary camera will remain at the origin of the new coordinate system.

[0087] The coordinates of the secondary camera are obtained by placing it in the human eyes' average distance position

[0088] These coordinates are rotated in the same initial angle

[0089] The "x" and "z" offsets are added, which were originally subtracted to take the primary camera to the origin

[0090] Finally, these two new X_s y Z_s coordinates are assigned to the secondary camera and the y_p coordinate is maintained, which determines the height for the same value of a final coordinates point (X_s , Y_p , Z_s) to be assigned to the secondary camera.

[0091] The procedure can be implemented in languages as Delphi, C, C++, Visual C++, Omnis, etc., but the result will be the same.

[0092] The generalized application of this algorithm will be used in any program requiring to obtain in real-time the

position of a secondary camera.

[0093] This algorithm must be implemented in any existing software which handles two dimensions but has been developed for stereoscopic vision applications.

[0094] The particular embodiments of the invention have been illustrated and described, for the technical experts it will be evident that several modifications or changes can be made without exceeding the scope of the present invention. The attached claims intend to cover the aforementioned information so that all the changes and modifications are within the scope of the present invention.

Claims

1. A 3D videogame system capable of processing a video data stream by means of a graphic engine processing the 3D graphics requirements code, **characterized by** comprising:

creating a pair of buffers of physical memory lines, corresponding to the left eye and the right eye;
 creating left backbuffer in the memory;
 discriminatin if it is TDVisison technology;
 creating right backbuffer in memory;
 setting the right camera view;
 drawing the image in the right backbuffer as a function of the current vector of the right camera;
 displaying the image on the right frontbuffer (screen);
 calculating the left pair coordinates;
 setting the left camera view;
 drawing the image in the left backbuffer as a function of the current vector of the left camera;
 displaying the information on the TDVisison screen in real time (left, right) or current by means of a serie of graphic drive functions into the one programming interface.

2. A 3D videogame system according to Claim 1, **characterized by** the backbuffer or RAM physical of the video card draw temporary and quick way , without outputting it to the video card,the set of images is processing regard to the origen calculating and assigning the distance, depth and position perspective, by means of 3D rotation and translation object.

3. A 3D videogame system according to Claim 1, **characterized by** the graphic engine controlling and validating the object perspectives, assigning textures, lighting, positions, mouvements and every other aspects associated to each object participating in the 3D videogame.

4. A 3D videogame system according to Claim 1, **characterized by** the software implementation of the TDVisison videogame is developed in any programming language using one source of game's code and logic that respond to th event and actions of user althoutg of a serie of functions of graphic handling into of one programming interface as a OpenGL or DirecTx that send the image to the surface representation.

5. A 3D videogame system according to Claim 1, **characterized by** setting the left backbuffer, discriminates if it is TDVisison technology, setting the right backbuffer.

6. A 3D videogame system according to Claim 1, **characterized by** the drawing on the TDVisison backbuffer consisting the steps:

creating left view;
 drawing on the left backbuffer as a function of the camera position;
 displaying the image in the left frontbuffer (screen);
 discriminating if it is TDVisison format technology;
 calculating the coordinates of right pair;
 drawing in the backbuffer as a function of the left camera position;
 displaying the information in the right front buffer (screen).

7. A 3D videogame system according to Claim 1, **characterized by** algorithm for the image representation from the backbuffer to the screen, consisting of the following steps:

cleaning the backbuffer;
getting a pointer for the backbuffer;
closing the backbuffer
redraws the scene;
5 opening the backbuffer;
unlocking the pointer to the backbuffer;
discriminating if it is TDVisison format;
displaying the image in the left screen;
if it is TDVisison format, then;
10 cleaning the backbuffer;
getting a pointer for the backbuffer;
closing the backbuffer;
getting the point coordinates;
redraws the scene;
15 opening the backbuffer;
unlocking the pointer of the backbuffer;
displaying the image on the right screen.

- 20 **8.** A 3D videogame system according to Claim 1, **characterized by** the dates stream of the digital video is a video stream in real time, the graphic engine includes a control for displaying, the digital video stream in real time of the right and left images on the respective monitors.
- 25 **9.** A 3D videogame system with one independent and additional VGA or video displaying device (frontbuffer) sharing a memory in an inmerse manner and is capable for displaying left and right sequence for different and independent channel.
- 10.** A 3D videogame system according to claim 9, **characterized by** increasing the RAM for the left backbuffer.
- 30 **11.** A 3D videogame system according to claim 9, **characterized by** increasing the RAM for the right backbuffer.
- 12.** - A 3D videogame system according to claim 9, **characterized by** it has the possibility of discriminating and taking the corresponding backbuffer.

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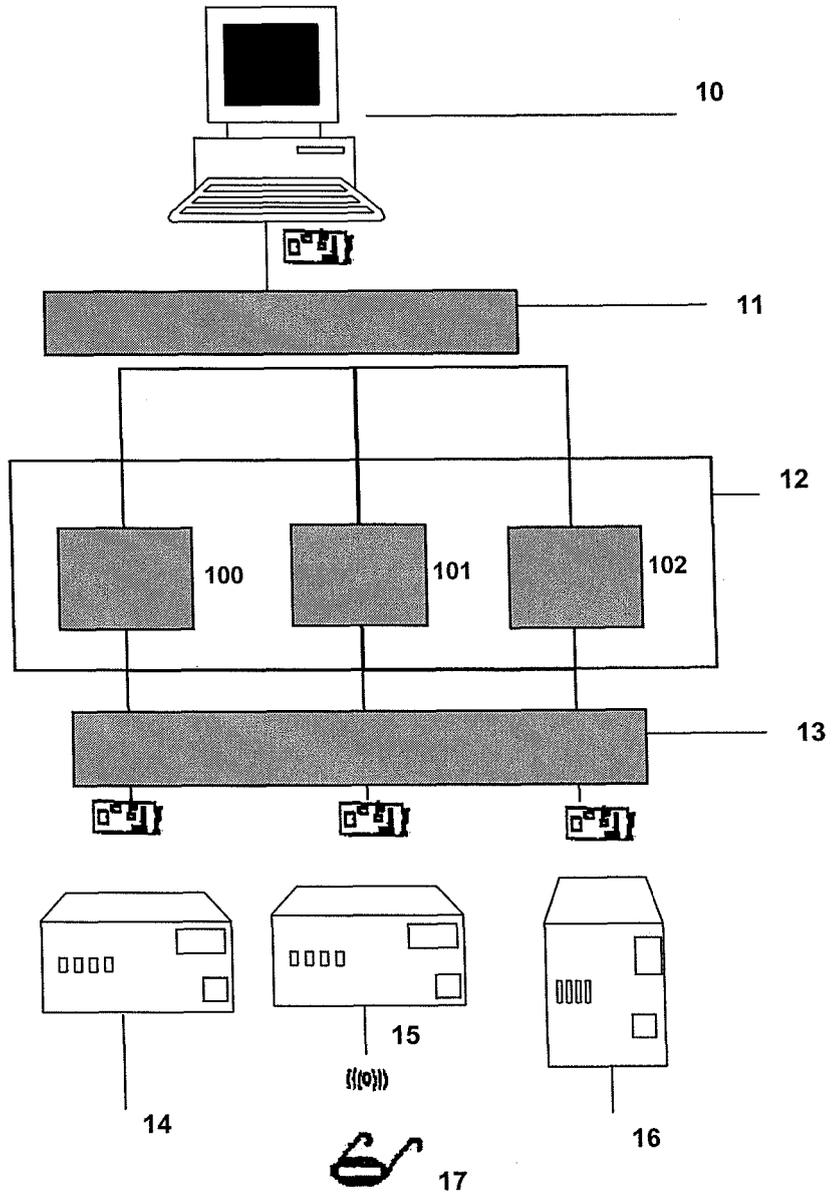


Fig. 1

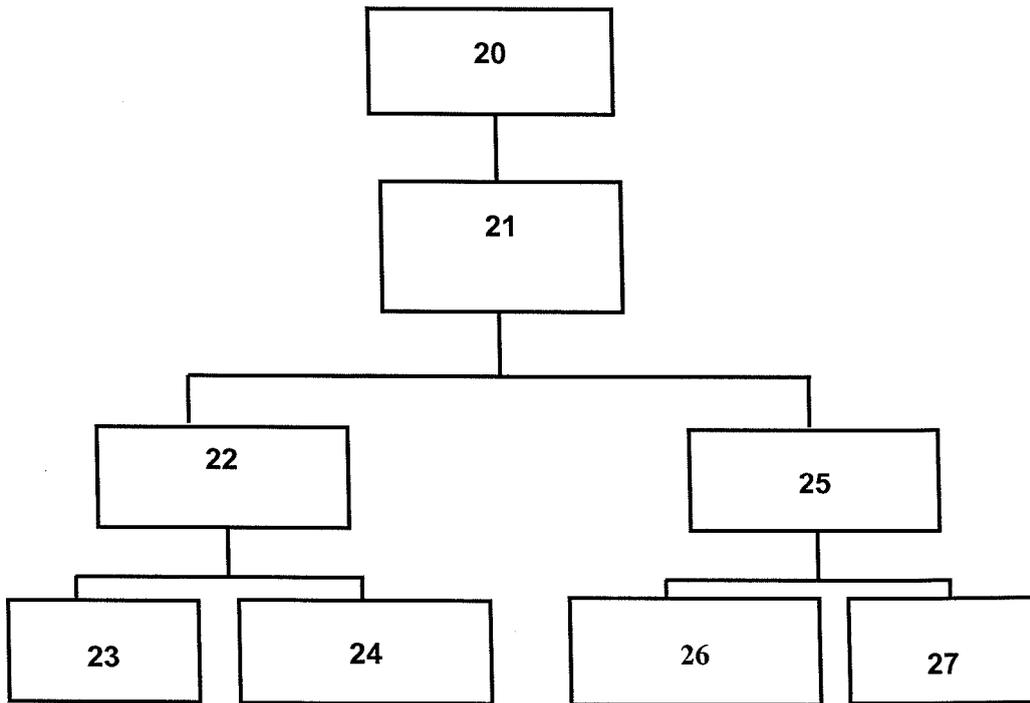


Fig. 2

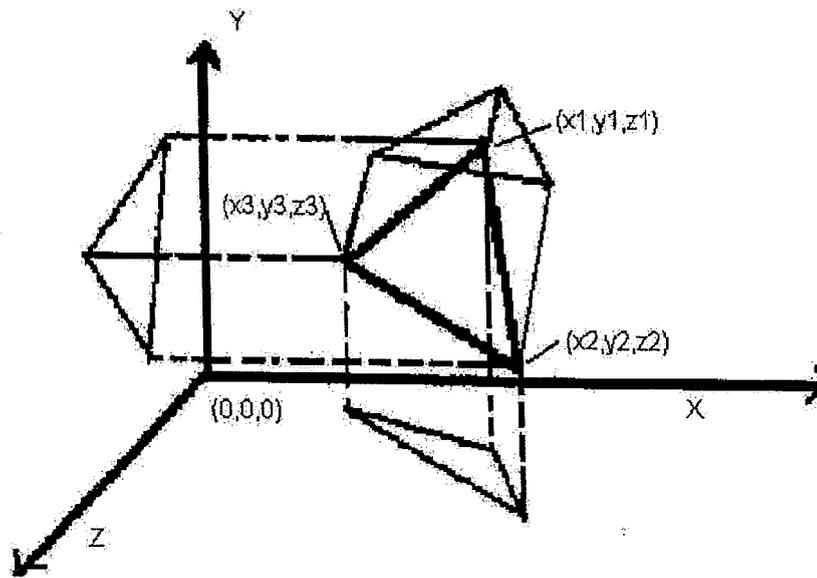


Fig. 3

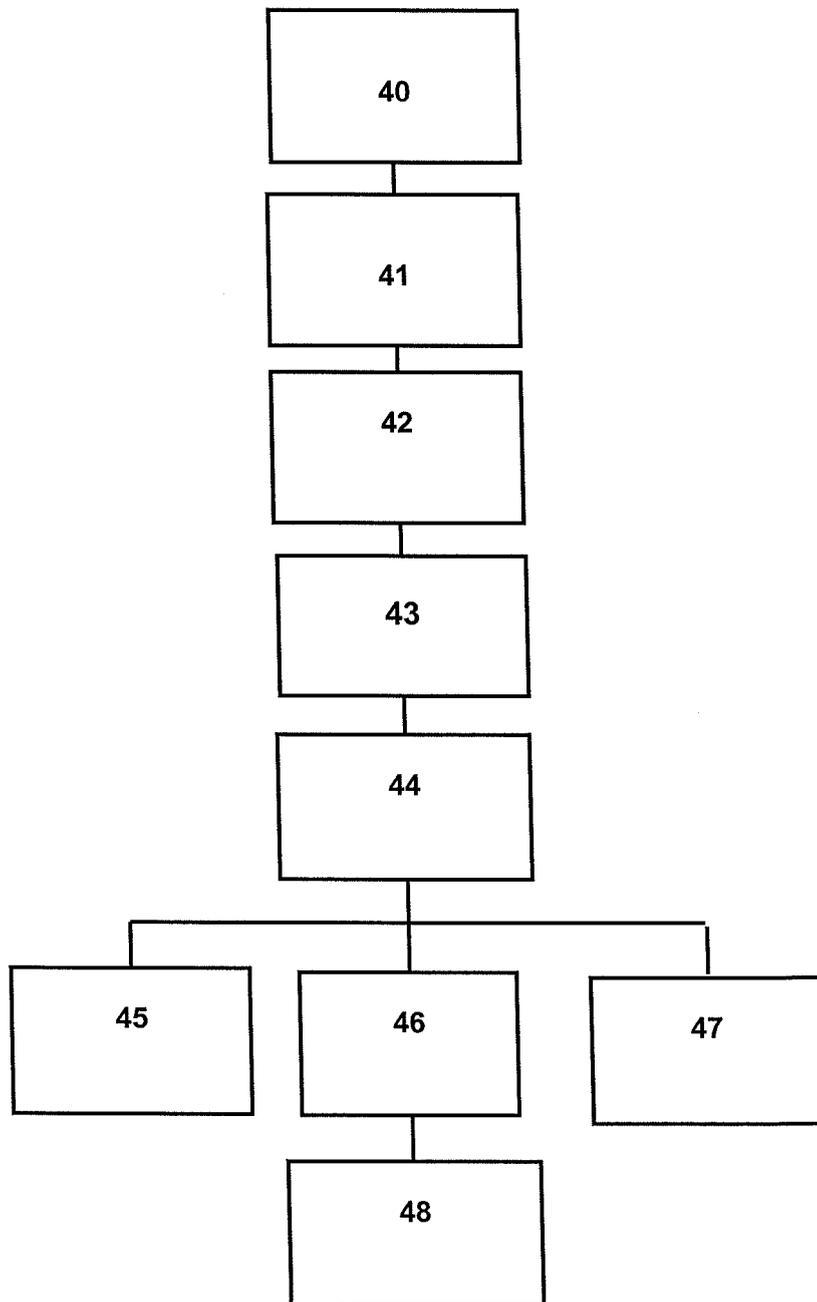


Fig. 4

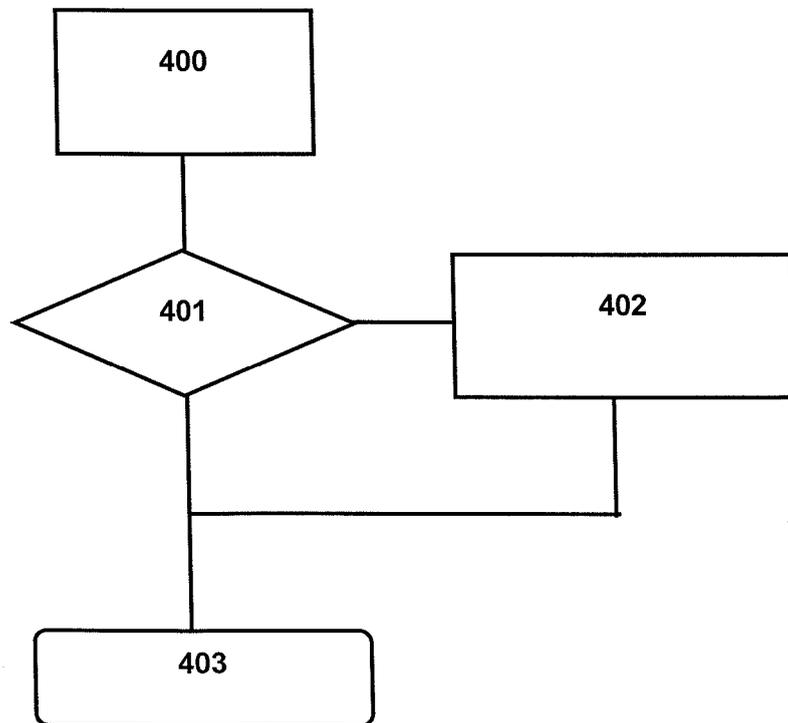


Fig. 4a

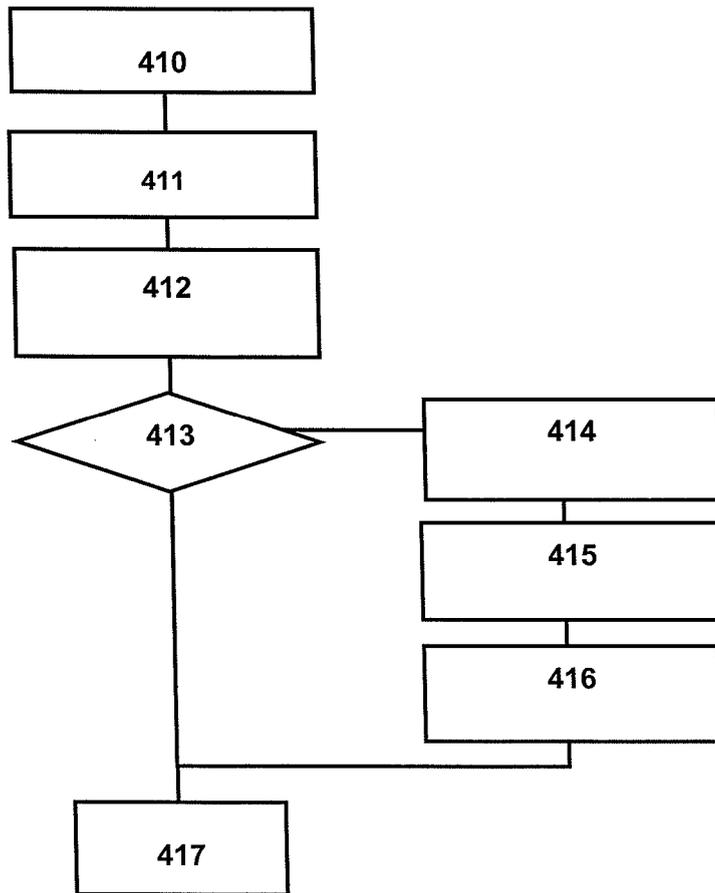
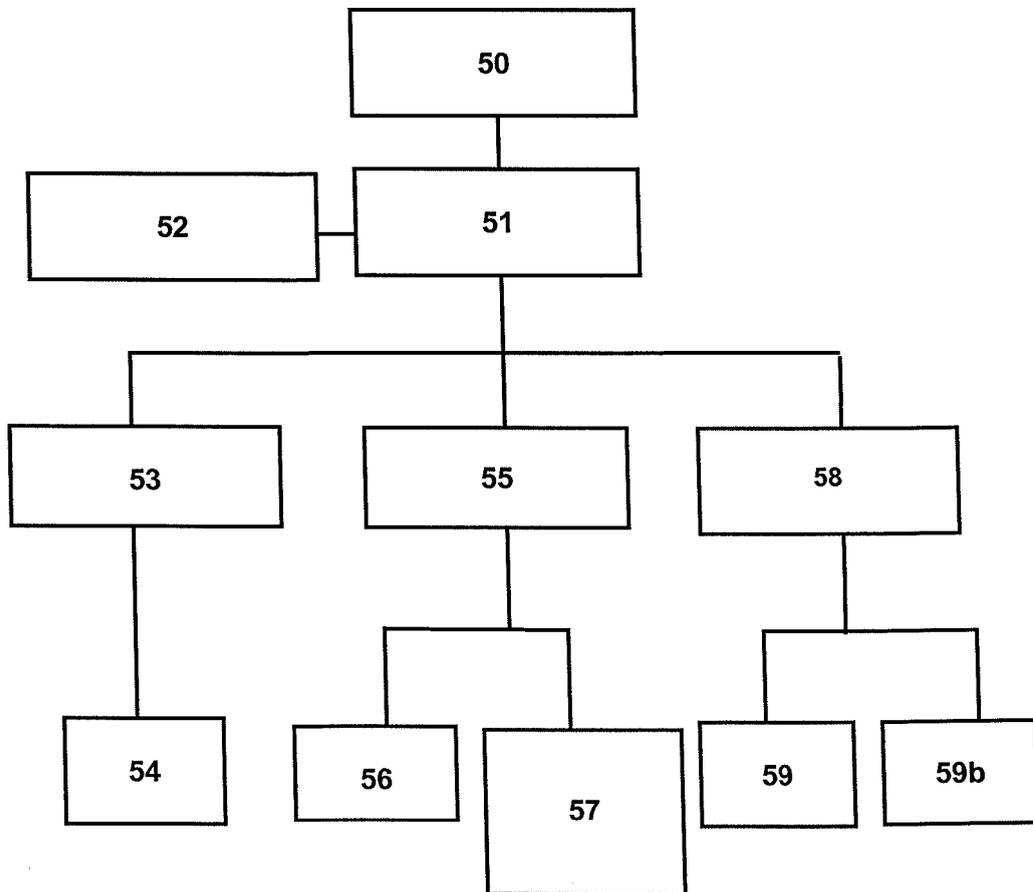


Fig. 4b

Fig. 5a



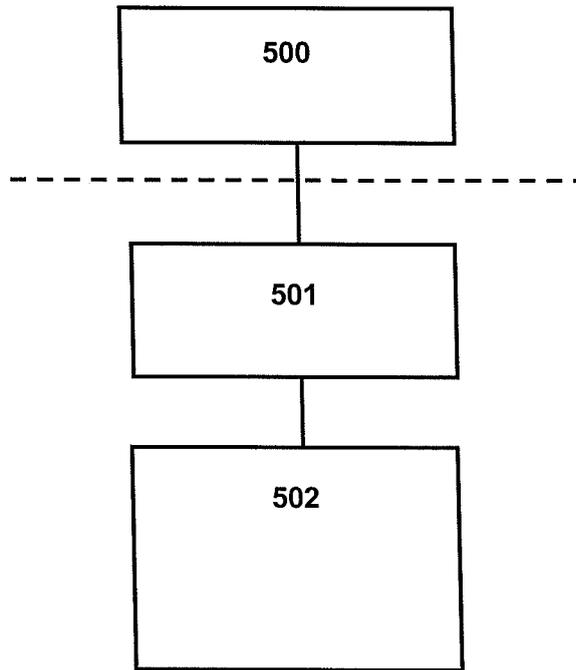


Fig. 5b

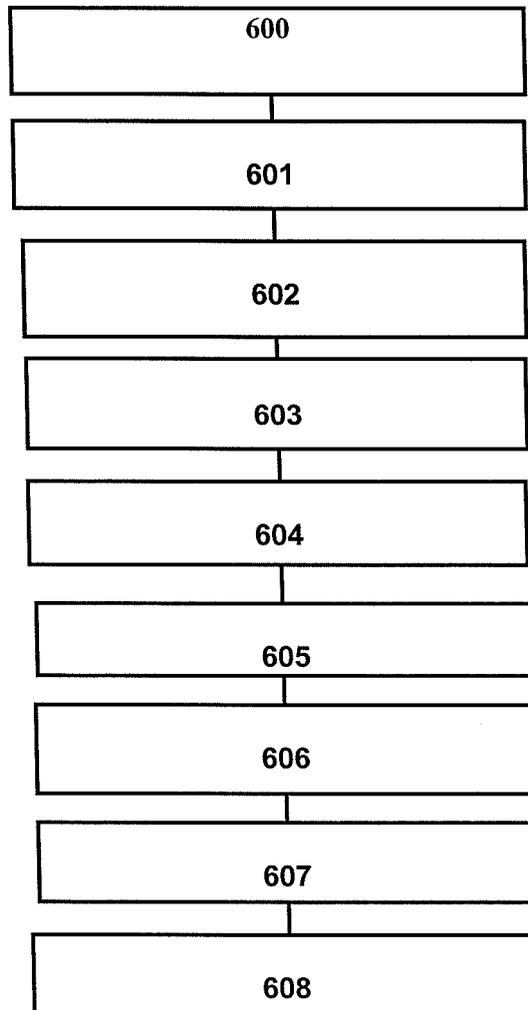


Fig. 6

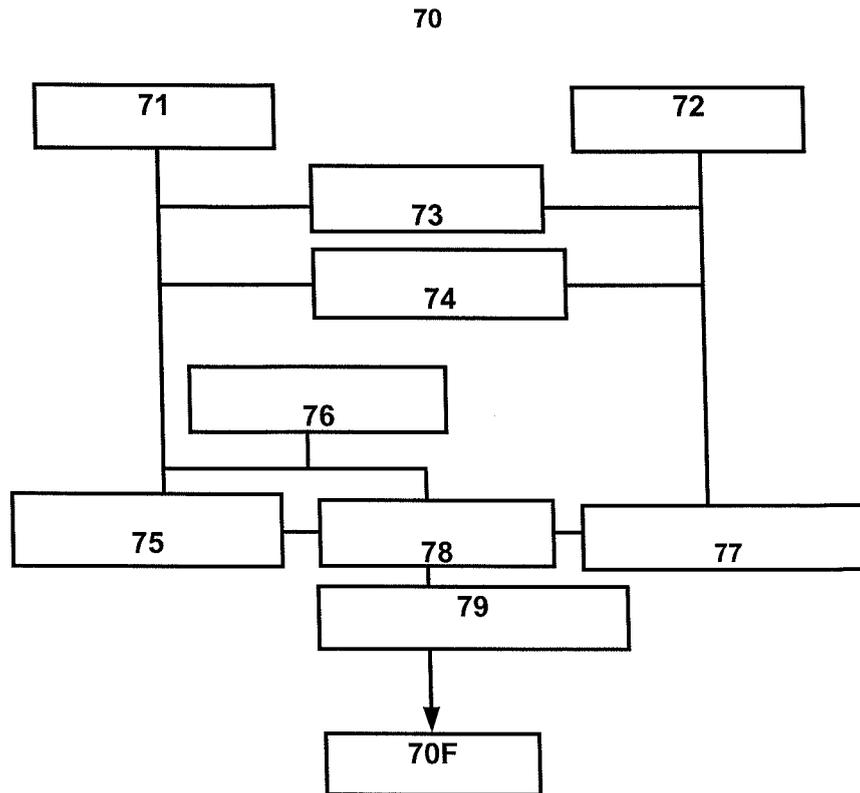


Fig. 7a

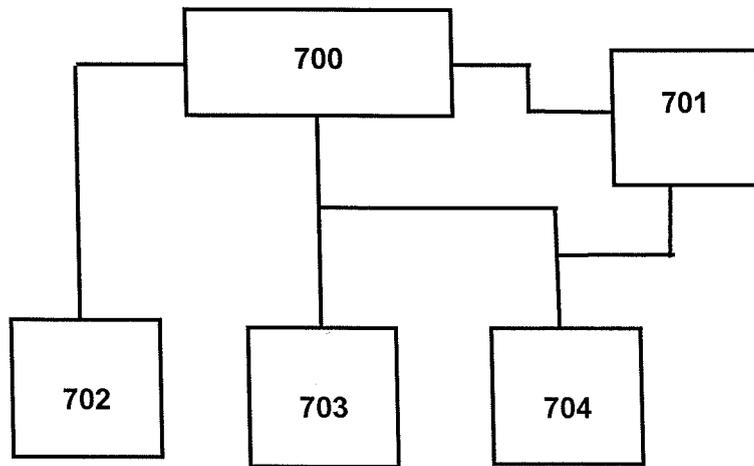


Fig. 7b

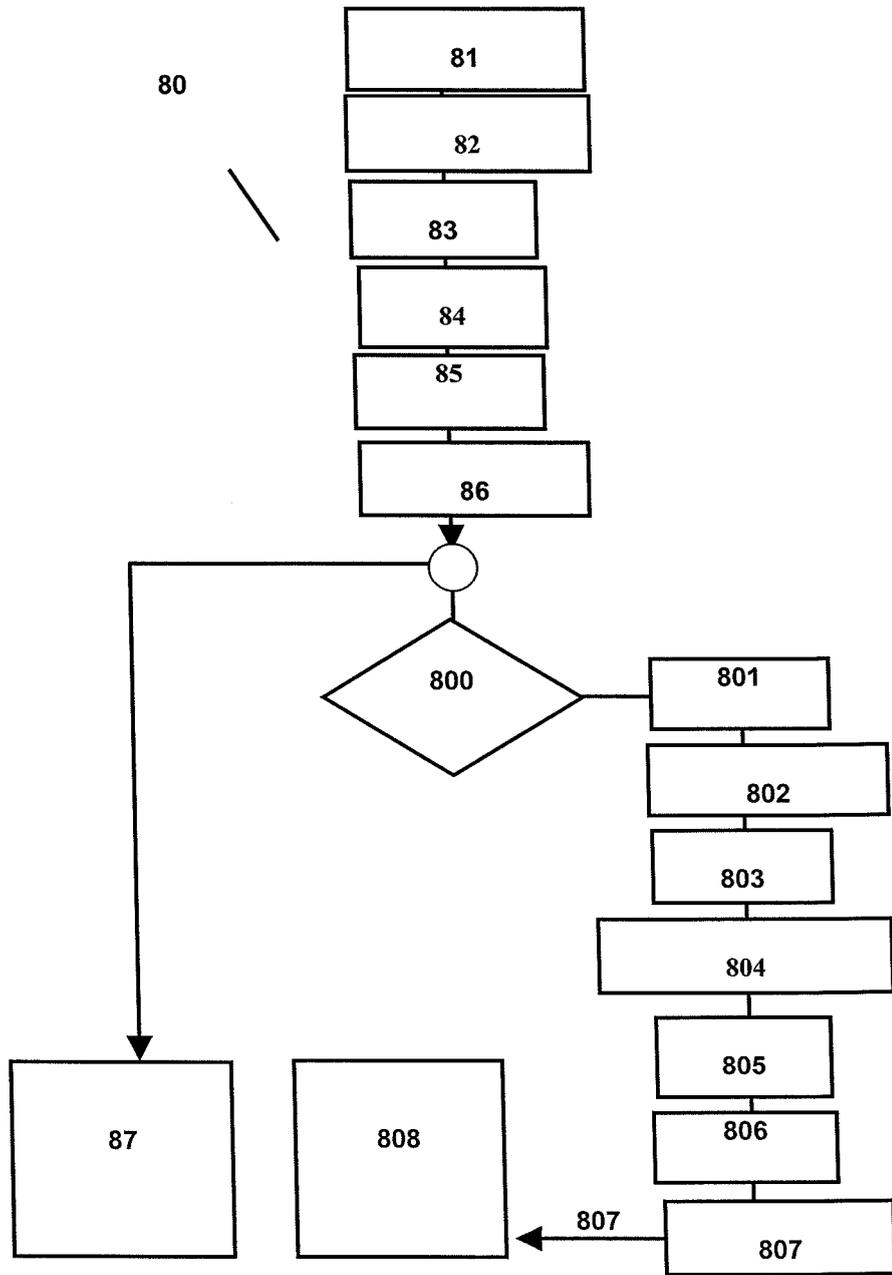


Fig. 8

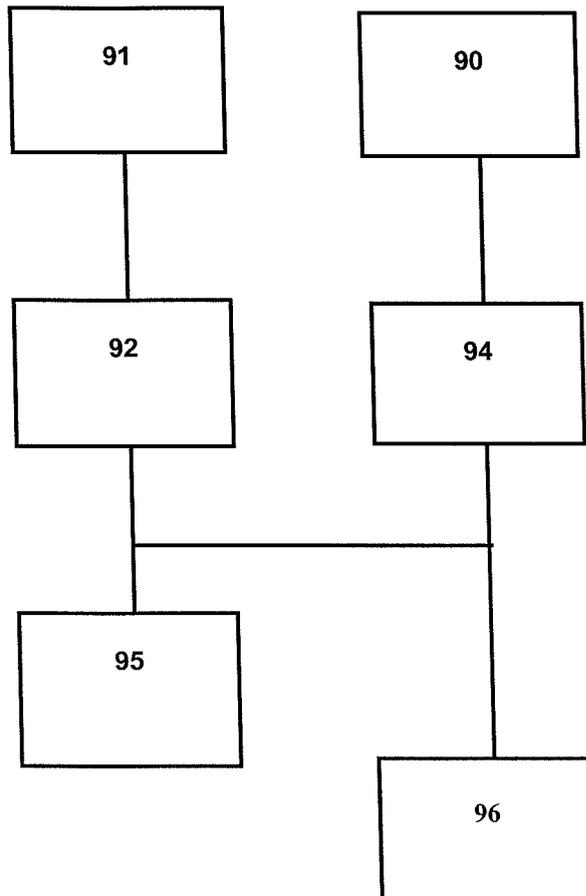


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/MX03/00112

A. CLASSIFICATION OF SUBJECT MATTER IPC7 G06T 15/00, H04N 13/00, A63F 13/00 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC7 G06T+, H04N+, A63F+ Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CIBEPAT, EPODOC, WPI, PAJ, INSPEC		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US6496183 B (GUY BAR-NAHUM) 17.12.2002, column 3, line 16- column 9, line 37; figures.	1-9
A		10-12
A	JP8149519 A (MATSUSHITA ELECTRIC WORKS LTD.) 07.06.1996, abstract figures. retrieved from EPO PAJ Database.	1
A	JP2003067784 A (MIXED REALITY LAB INC et al.) 07.03.2003, abstract , figures. retrieved from EPO PAJ Database.	1
A	DE19806547 A (HEWLETT-PACKARD CO.) 05.11.1998, abstract , figures. retrieved from World Patent Index en Epoque Database	1
A	JP2109493 A (NEC CORP.) 23.04.1990, abstract , figures. retrieved from EPO PAJ Database.	1
<input type="checkbox"/> Further documents are listed in the continuation of Box C.		<input checked="" type="checkbox"/> See patent family annex.
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed		"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
Date of the actual completion of the international search 28 May 2004 (28.05.04)	Date of mailing of the international search report 08 June 2004 (08.06.04)	
Name and mailing address of the ISA/ SPTO	Authorized officer	
Facsimile No.	Telephone No.	

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EP 1 727 093 A1

INTERNATIONAL SEARCH REPORT
Information on patent family members

International Application No
PCT/MX03/00112

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