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Declaration under Rule 4.17:
— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE,

(54) Title: STRATEGIC USE OF BIO-SENSOR INFORMATION IN MULTI-PLAYER COMPUTER GAME

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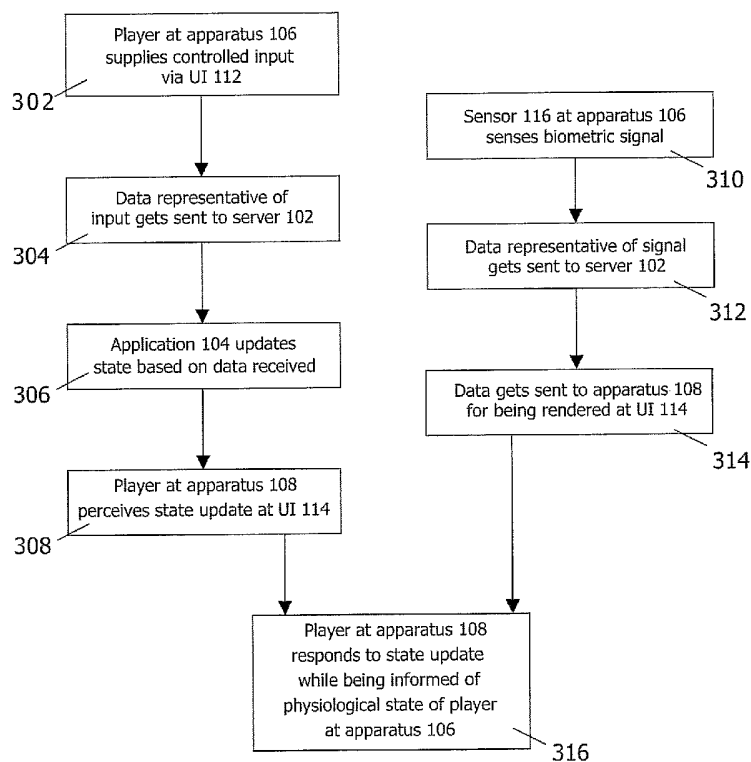
(57) Abstract: In a multi-player computer game, a physical quantity is sensed that is representative of a physiological state of a player. Another player is enabled to receive an indication representative of the physiological state as sensed so as to take advantage of this additional piece of information while playing the game. Preferably, a contactless sensor is being used in order to minimize interference with the user's sense of immersion.

AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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Strategic use of Bio-sensor information in multi-player computer game

The invention relates to a method of enabling interaction of a player with a multi-player computer game. The invention further relates to a multi-player computer game and to an apparatus for playing the game.

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Multiple-user computer games have become popular and are becoming increasingly more sophisticated, in a technical sense as well as from the strategy point of view. Examples and some aspects of such games are discussed in, e.g., the following patent documents, herein incorporated by reference:

10   -   US patent 6,025,801 (attorney docket PHA 23,155), entitled "Video game with local updates mitigates latency effects in wide area network", issued to Brad Beitel and incorporated herein by reference, relates to multiple users sharing a virtual environment through an interactive software application. State changes of a specific user are transmitted to one or more other users dependent on respective relative distances in the virtual environment

15   between the specific user and each respective one of the other users. This conditional transmission reduces message traffic and allows a virtual environment to scale indefinitely.

-          US patent 6,356,288 (attorney docket PHA 23,319), entitled "Diversion agent uses cinematographic techniques to mask latency", issued to Martin Freeman et al., and incorporated herein by reference, relates to a software agent that is a functional part of a user-

20   interactive software application running on a data processing system. The agent creates a user-perceptible effect in order to mask latency present in delivery of data to the user. The agent creates the effect employing cinematographic techniques.

-          US patent 6,475,090 (attorney docket US 018035), entitled "Compensating for network latency in a multi-player game", issued to Greg Roelofs and incorporated herein by

25   reference, relates to a method of compensating for high-latency computer clients in a multi-player electronic game played on a plurality of terminals connected by a network. The method includes: (a) determining a latency value for a plurality of computer clients operating said plurality of terminals; (b) determining a latency compensation factor from said determined latency value for each of said plurality of computer clients; and (c) adjusting a

playing modality for at least one of said plurality of computer clients responsive to said determined latency compensation factor.

-           US patent application publication US20030157985 (attorney docket US 028015), entitled "Virtual IPR system in electronic game environment", filed for Eugene Shteyn and incorporated herein by reference, relates to the following. A player who comes up with an innovative strategy in an electronic game is given benefits in the game environment and/or in the players' community because of creating this strategy. This extra dimension stimulates the involvement of the players and contributes to the evolution of the game.

-           US patent application publication US20030144044 (attorney docket US 028007), entitled "game-specific standard-task automation for computer and console video games", filed for Vladimir Pisarsky and incorporated herein by reference, relates to a video game that comprises several parts that require attention and response from the user. Interaction with a part that allows for an algorithmic solution can be delegated to a separate controller, thus freeing bandwidth for the user to concentrate on other parts so as to optimize the score.

        The present invention addresses the issue of influencing a computer game through the physiological state of a player. A system that allows doing this is known from US patent application publication US 20010056225, entitled "Method and apparatus for measuring and analyzing physiological signals for active or passive control of physical and virtual spaces and the contents therein", filed for Drew DeVito, and incorporated herein by reference. This document relates to a method and an apparatus for measuring and performing real-time FFT (fast Fourier transform) analysis of bioelectrical signals such as electroencephalogram signals (EEG) and electromyogram signals (EMG) for the control of systems. An embodiment of the known system uses EEG signals in an interactive game control environment. EEG signals, picked up from the subject playing the game, and processed to control the video game. A commercially available Interactive Brainwave Visual Analyzer (IBVA) device includes a plurality of physiological sensors, more specifically three electrodes in contact with the subject's forehead to pick up the EEG signals. The sensed EEG signals are then transmitted to a computer for analysis. The system can have more than one subject although some mediation between subjects may be required. The EEG signals, which are representative of the subject's emotions or state of mind, alter the game environment according to the subject's sensed state.

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In the known system, appropriate game-specific signals are derived from the bioelectrical information as sensed and are supplied to the game software in order to control or influence the latter. This approach requires that the game considered be designed so as to allow a meaningful evolution under combined control of a deliberate user input and the

5   bioelectrical information. Conditional storyline-branching would be an example of such a game, wherein the conditions are determined by the physiological information sensed, which complicates the design considerably. Besides, such a game requires a calibration per individual user in advance. Typical games currently commercially available on the market do not have this extra dimension of allowing bioelectrical input for control purposes, and the

10   complexity of a game design does not seem to readily allow the integration of supplementary bioelectrical control as an after-market add-on.

An example of a game that does take biofeedback into account is "Journey to the Wild Divine" from startup technology innovator, game developer and music label The Wild Divine Project. A hardware platform measures skin conductance level (SCL) and heart

15   rate variability through three sensors attached to the user's fingers. The measurements are registered and fed back to the user through biofeedback "events" on the screen. Characters within game help the user learn to control his/her body's reactions. By increasing, decreasing or synchronizing body rhythms, through techniques the characters will teach the user, the user quickly learns to master the "events" and progress in the game.

20   The inventor now suggests an alternative approach that allows a multi-player game to evolve under control of, or in dependence of, such physiological input, possibly without the need for conditional branching or calibration.

To this end, the invention provides a method of enabling a sensing of a physical quantity, representative of a physiological state of a player in a multi-player

25   computer game, to influence an evolution of the game in operational use. The method comprises enabling another player to receive an indication representative of the physiological state as sensed. Accordingly, the other player has extra information available, in addition to the perceived behavior of the first user interacting through the game, on the basis of which the other player may determine his/her appropriate response. In this manner, information

30   about the physiological state of each player, or state changes, is communicated to the other players. A player receiving this information may decide to ignore or use it. The information could be provided as interpreted by the game itself or another agent. For example, the information is supplied as a message that a specific player has become more relaxed or

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tenser; or is getting tired and is loosing concentration etc. Alternatively, the receiving player
gets the raw data and has to figure out a pattern on his/her own.

The invention also relates to a data processing apparatus configured for
enabling a sensing of a physical quantity, representative of a physiological state of a player in
5   a multi-player computer game. This may influence an evolution of the game in operational
use, as the apparatus is configured to enable another player to receive an indication
representative of the physiological state as sensed. The apparatus may comprise a sensor for
sensing the quantity, e.g., brain activity. Preferably, the apparatus comprises an interpreter for
interpreting the indication.

10   The invention further relates to a multi-player computer game configured to
enable a sensing of a physical quantity, representative of a physiological state of a player in a
multi-player computer game. This allows an evolution of the game to be influenced in
operational use. The game is configured to enable another player to receive an indication
representative of the physiological state as sensed. The sensing may be continuous or
15   repetitive. The game may allow the other player to control the sensing, e.g., time at which to
sense or what quantity to sense. Alternatively, the sensing is controlled by the game itself and
may depend on the stage of evolution of the game or on the behavioral pattern of one or more
players, etc.

20

The invention is explained in further detail, by way of example and with
reference to the accompanying drawing wherein:

Figs.1 and 2 are block diagrams of a system in the invention; and

Fig.3 is a process diagram of a method in the invention.

25   Throughout the figures, same reference numerals indicate similar or
corresponding features.

Fig.1 is a block diagram of a system 100 in the invention. System 100
30   comprises a server 102 that runs a multi-player game software application 104. System 100
further comprises multiple game consoles or apparatus 106, ..., 108, e.g., PCs or dedicated
gaming machines, that communicate with server 102 via a data network 110, e.g., the
Internet. Apparatus 106 comprises a user interface (UI) 112 that enables the player at
apparatus 106 to interact with game 104 by deliberate input through user manipulation of a

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data input device (not shown) such as a keyboard, a joystick, a dedicated control device with grips and/or pedals, a speech input device, or any other manipulable data input means. Preferably, UI 112 also comprises a display monitor and loudspeakers for visual and auditory information. Apparatus 108 likewise comprises a UI 114 enabling its player to interact with

5   game 104. The input thus generated at each of apparatus 106-108 is sent as a state update to server 102 via data network so as to affect the evolution of the interaction among the players via software 104. For example, software 104 makes available a virtual environment wherein the players at apparatus 106-108 are represented by their avatars. A player controls the behavior of his/her avatar via the corresponding one of UI 112 and UI 114. Other players

10   may then respond to the avatar's perceived behavior by likewise controlling the behavior of their respective avatars.

In this example, apparatus 106 and 108 each comprise a sensor 116 and 118, respectively, that senses a respective physical quantity representative of a physiological state of the respective player. As for sensors 116 and 118, these are known devices used in a

15   system for obtaining information about the emotional state of a person by the measurement of physiological parameters, such as EMG, blood volume pressure, heart-rate variability, skin conductivity and respiration. In another example, not shown, only one or not all of apparatus 106-108 accommodates a sensor. The methods of obtaining information about the physiological, e.g., emotional, state by the measurement of physiological parameters, such as

20   EMG, blood volume pressure, skin conductivity and respiration rate, may use sensors in contact with the person under test. See, for example, US patent 6,167,298, US patent application publication 20030151516, and US patent application publication 20020183644. Recently developed contactless ECG/EMG/EEG sensors allow obtaining information about the person's emotional state in an unobtrusive way. An example of such a contactless sensor

25   is described in Appl. Phys. Lett.81 (2002) p3284. A description of the electrical circuitry involved is given in Meas. Sci. Technol. 11-2000-291. The brain waves sensed are analyzed in order to determine, e.g., whether or not the user is alert or drowsy, excited or relaxed, afraid or fearless, etc. Such a sensor can be equipped with a transceiver to become part of a wireless body sensor network or can be mounted in or at apparatus 106 and 108. Using

30   contactless EEG, and/or EMG and/or ECG sensors, the heart rate and muscle tension/usage of the game player is monitored.

In an embodiment of the invention, interpreter computer programs 120 and 122, resident at apparatus 106 and 108, respectively, are used to interpret the measurement data from sensors 116 and 118, respectively, to obtain an indication of the current

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physiological state, e.g., excitement level, of the relevant player. The indication is then sent
to server 102 for distribution to the other players. In another embodiment the sensors supply
their raw data directly to server 102 where the data is interpreted. The interpretation is then
sent as indication to the relevant players. In yet another embodiment, the sensor data

5   generated at one of apparatus 106-108 is sent "as is" to the other console without processing
by, or even without intervention of, server 102. The data as received is rendered so as to
show the relative changes in magnitude of a physical quantity sensed. The receiving player
may infer the state of the other player from the pattern of changes over time, correlating the
pattern with the behavior observed. Preferably, sensors 116 and 118 transmit their data

10   repetitively so as to, e.g., enable a receiving player to monitor the development of the other
player's mental state as the game or interaction progresses.

        In a further embodiment of the invention, the player at apparatus 106 is
enabled to control or directly influence sensor 118 at apparatus 108. For example, sensor 118
is controllable with regard to the rate of updates, detection range or resolution (e.g., through

15   filtering, noise reduction/cancellation, Fourier transform, far-field/near-field separation,
jamming). In another example, sensor 118 includes a battery of sensors each for sensing the
current value of a respective one of multiple physiological parameters. Sensor control enables
then, e.g., to switch between the data from the individual sensors. Control over sensors at one
or more of the other player may be made dependent on reaching a certain stage of game 104,

20   e.g., on acquiring a certain score or on having performed a certain game-related task
successfully.

        Fig.2 is a block diagram of a system 200 in the invention. Here, apparatus 106
and 108 communicate with each other without the intervention of a server. For example,
communication between apparatus 106 and 108 uses a wireless link 202 such as infrared (IR)

25   or radio frequency (RF). As another example, link 202 comprises a data network that enables
apparatus 106 and 108 to operate in a peer-to-peer (P2P) fashion via the network. Multi-
player game software is now distributed between consoles 106 and 108 and comprises game
software applications 204 and 206 that control the evolution of the game based on input from
the players. For example, via link 202 applications 204 and 206 exchange game state updates,

30   caused by the players' manipulation of UI 112 and UI 114. In addition, sensors 116 and 118
sense the value of a physical quantity representative of the physiological, e.g., emotional,
state of the player at the relevant one of consoles 106 and 108. Data representative of the
state sensed is communicated via link 202 to the other console(s). The player at the other
console may use this data to determine his/her response to the action of the player whose

physiological state got communicated. Embodiments and details discussed with reference to system 100 of Fig.1 are also applicable here.

Fig.3 is a diagram 300 to illustrate some events in system 100. In a step 302, the player at apparatus 106 generates an input by means of manipulating the controls at UI

5   112. In a step 304, data that is representative of this input is sent to server 102 via network 110. In a step 306, game software application 104 receives the input data and updates its state. For example, the player at apparatus 106 manipulated the controls at UI 112 to move his/her avatar in a virtual world and the corresponding data received by application 104 causes a state update of the virtual world that represents the avatar moving accordingly. The

10   player at apparatus 108 communicating with game application 104 perceives the state update at his/her UI 114 in a step 308 and can decide to respond by moving his/her own avatar based on the update perceived. However, additional information is available to the player at apparatus 108. In a step 310, sensor 116 at apparatus 106 has registered the biometric signal representative of the physiological state of the player at apparatus 106. Preferably, the signal

15   registered is representative of the player's state at the moment of his supplying the input at step 302. In a step 314 data representative of the signal is sent to apparatus 108 for being rendered at UI 114. In an embodiment of the invention, this data is sent to apparatus 108 via server 102 as in a step 312, for example for routing purposes or for being interpreted whereupon the interpretation is forwarded to apparatus 108. In another embodiment, the data

20   from sensor 116 is sent without intervention of server 102 directly to apparatus 108. Now, the user at apparatus 108 has available information of the state change as well as information about the mood of the player at apparatus 106. The latter information item may affect the decision by the player at apparatus 108 of how to respond, in a step 316, to the state change perceived. For example, if the biometric information is interpreted as that the player at

25   apparatus 106 is not alert, the player at apparatus 108 may use that to assist the first player in a cooperative game, or to take advantage of the first player's lack of alertness in a competitive game.

In an embodiment of the invention, step 310 is carried out more or less continuously, or at least repetitively, to provide the player at apparatus 108 with a context of

30   the current behavior of the player at apparatus 106 as perceived through the state changes of game 104.

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CLAIMS:

1.   A method of enabling a sensing of a physical quantity, representative of a physiological state of a player in a multi-player computer game, to influence an evolution of the game in operational use, the method comprising enabling another player to receive an indication representative of the physiological state as sensed.

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2.   The method of claim 1, wherein the sensing is repetitive.

3.   The method of claim 1, comprising enabling the other player to control the sensing.

10

4.   The method of claim 1, wherein the physical quantity relates to brain activity.

5.   The method of claim 1, comprising interpreting the indication.

15   6.   The method of claim 1, wherein the sensing uses a contactless sensor.

7.   The method of claim 1 wherein the physiological state is indicative of the player being at least one of: alert or drowsy, excited or relaxed, afraid or fearless.

20   8.   A data processing apparatus configured for enabling a sensing of a physical quantity, representative of a physiological state of a player in a multi-player computer game, to influence an evolution of the game in operational use, the apparatus being configured to enable another player to receive an indication representative of the physiological state as sensed.

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9.   The apparatus of claim 8, comprising a sensor for sensing the quantity.

10.   The apparatus of claim 8, wherein the quantity relates to brain activity.

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11.   The apparatus of claim 8, comprising an interpreter for interpreting the indication.

12.   The apparatus of claim 8, wherein the sensor comprises a contactless sensor.

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13.   A multi-player computer game configured to enable a sensing of a physical quantity, representative of a physiological state of a player in a multi-player computer game, to influence an evolution of the game in operational use, the game being configured to enable another player to receive an indication representative of the physiological state as sensed.

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14.   The game of claim 13, wherein the sensing is repetitive.

15.   The game of claim 13, enabling the other player to control the sensing.

15   16.   The game of claim 13, wherein the physical quantity relates to brain activity.

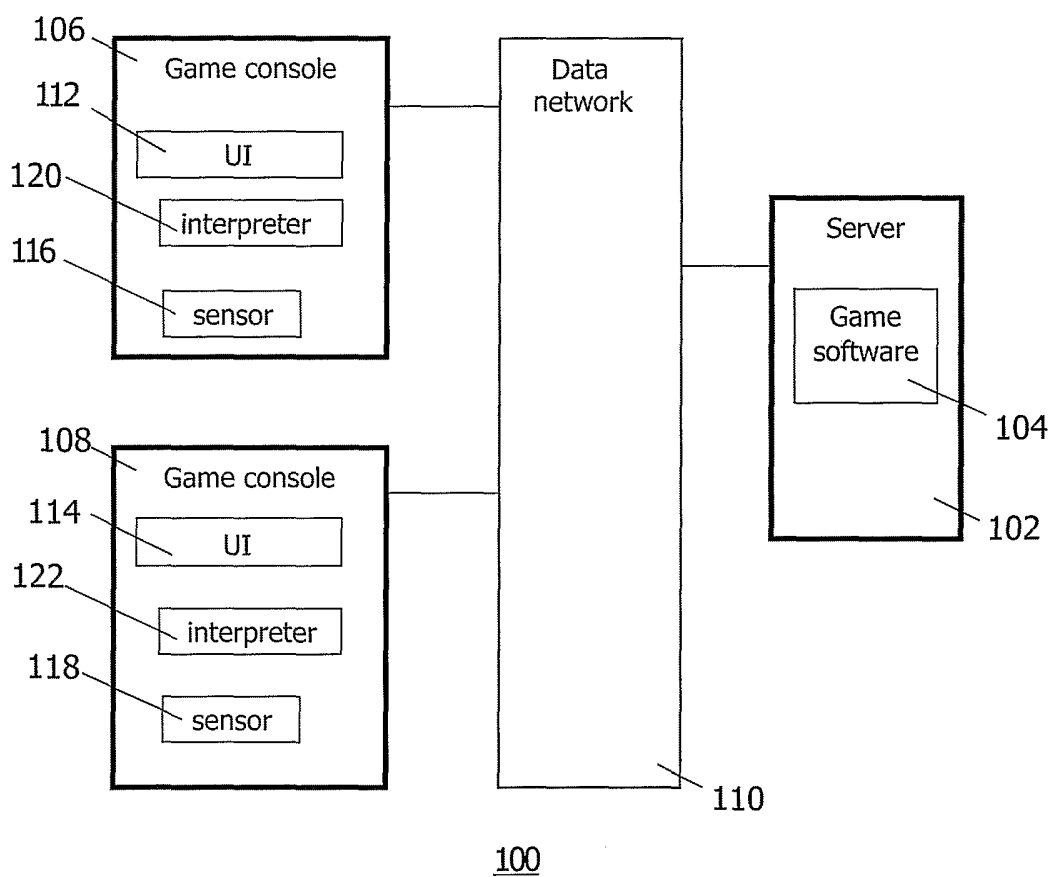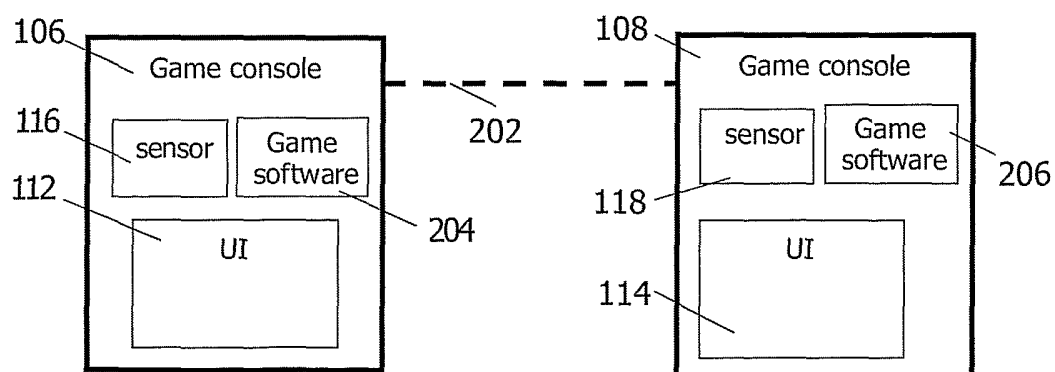17.   The game of claim 13, wherein the sensing is controlled by the game.
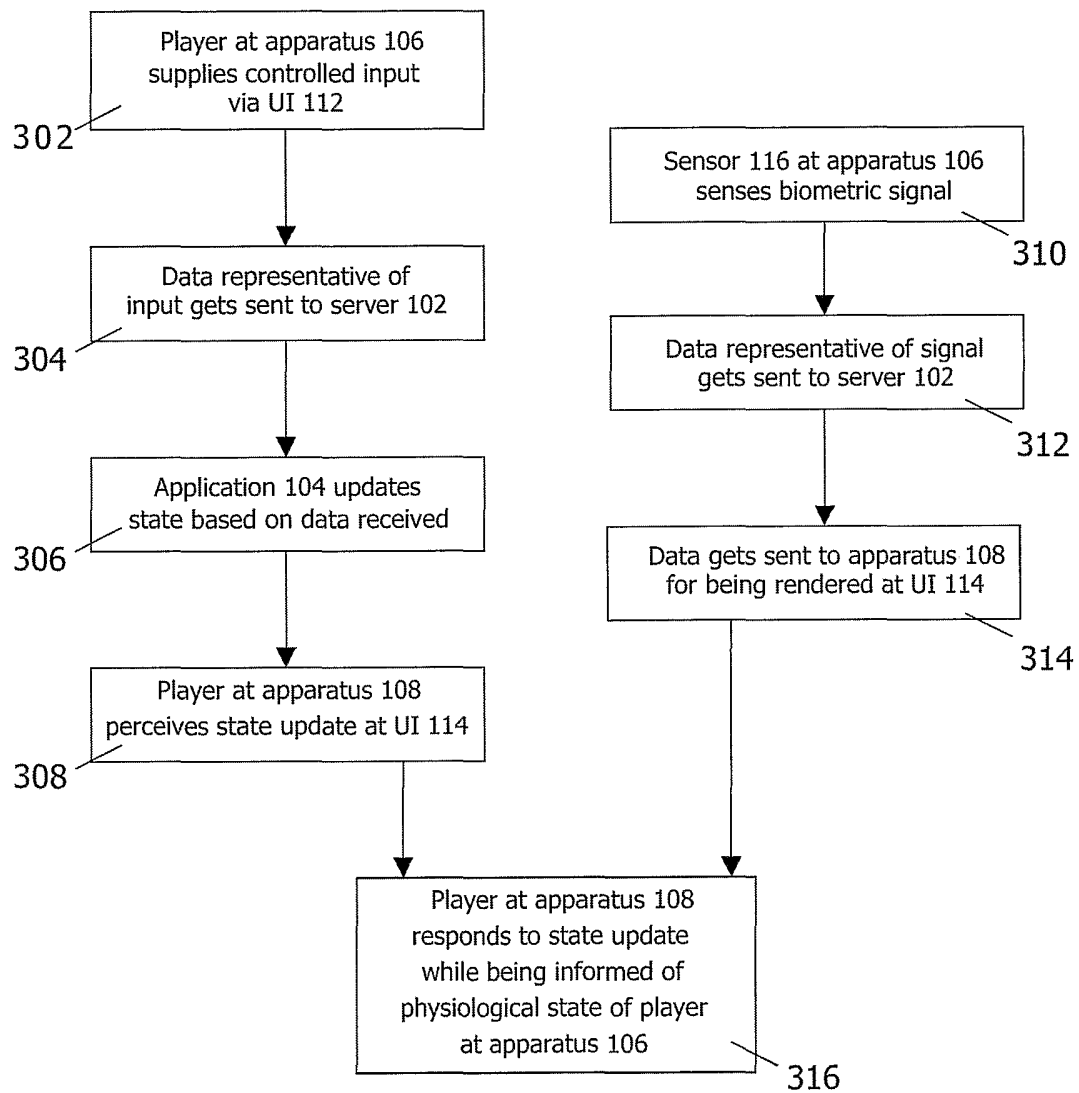
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FIG.1

FIG.2

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          ┌─────────────────────────┐
          │   Player at apparatus 106 │
          │   supplies controlled input│
          │        via UI 112         │
 302 ─────┤                         │
          └────────────┬────────────┘                    ┌─────────────────────────┐
                       │                                   │  Sensor 116 at apparatus 106│
                       │                                   │   senses biometric signal │
                       ▼                                   │                         │
          ┌─────────────────────────┐                     └────────────┬────────────┘
          │    Data representative of │                                 │        310
          │  input gets sent to server 102│                             │
 304 ─────┤                         │                                   ▼
          └────────────┬────────────┘                     ┌─────────────────────────┐
                       │                                   │ Data representative of signal│
                       │                                   │  gets sent to server 102  │
                       ▼                                   │                         │
          ┌─────────────────────────┐                     └────────────┬────────────┘
          │     Application 104 updates│                                │        312
          │  state based on data received│                             │
 306 ─────┤                         │                                   ▼
          └────────────┬────────────┘                     ┌─────────────────────────┐
                       │                                   │ Data gets sent to apparatus 108│
                       │                                   │  for being rendered at UI 114│
                       ▼                                   │                         │
          ┌─────────────────────────┐                     └────────────┬────────────┘
          │     Player at apparatus 108│                                │        314
          │ perceives state update at UI 114│                          │
 308 ─────┤                         │                                   │
          └────────────┬────────────┘                                   │
                       │                                                 │
                       │          ┌─────────────────────────┐           │
                       │          │   Player at apparatus 108 │           │
                       └─────────▶│  responds to state update │◀──────────┘
                                  │   while being informed of │
                                  │ physiological state of player│
                                  │     at apparatus 106      │
                                  └─────────────────────────┘  316
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FIG.3

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   A63F13/12

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)

IPC 7   A63F   A61B

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 practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/01478 A (EMOTRA AB; THORELL, LARS-HAAKAN) 3 January 2002 (2002-01-03) page 7, line 23 - line 31 page 8, line 21 - line 28 page 12, line 13 - line 16 page 13, line 22 - line 25	1,2,4,5, 7-11,13, 14,16,17
Y		3,6,12, 15
Y	US 2002/082724 A1 (HENNION BERNARD) 27 June 2002 (2002-06-27) paragraph '0053!	3,15
Y	US 2002/100867 A1 (YAMAMOTO TSUYOSHI ET AL) 1 August 2002 (2002-08-01) paragraph '0009!	6,12

☐	Further documents are listed in the continuation of box C.	X	Patent family members are listed in annex.

Date of the actual completion of the international search	Date of mailing of the international search report
15 September 2005	23/09/2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Sindic, G

INTERNATIONAL SEARCH REPORT

Information on patent family members

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
WO 0201478	A	03-01-2002	AU	7115301 A	08-01-2002
US 2002082724	A1	27-06-2002	EP	1207448 A1	22-05-2002
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