US 20150243083A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2015/0243083 A1**

(43) **Pub. Date: Aug. 27, 2015**

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(54) **AUGMENTED REALITY BIOFEEDBACK DISPLAY**

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(21) Appl. No.: **14/432,177**

(22) PCT Filed: **Oct. 17, 2013**

(86) PCT No.: **PCT/US13/65482**

§ 371 (c)(1),
(2) Date: **Mar. 27, 2015**

Related U.S. Application Data

(60) Provisional application No. 61/744,606, filed on Oct. 1, 2012.

Publication Classification

(51) **Int. Cl.**

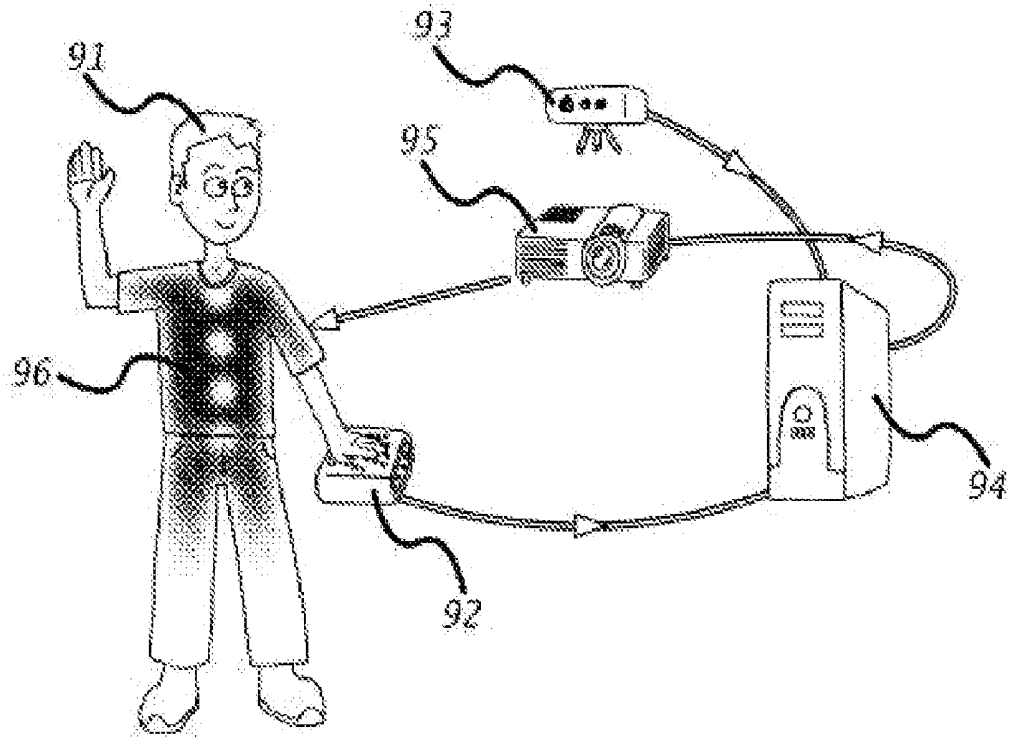
G06T 19/00	(2006.01)
A61B 5/0205	(2006.01)
A61B 5/00	(2006.01)
A61B 5/01	(2006.01)
A61B 5/053	(2006.01)
A61B 5/0476	(2006.01)
G06F 3/16	(2006.01)
A61B 5/145	(2006.01)

(52) **U.S. Cl.**

CPC ***G06T 19/006*** (2013.01); ***G06F 3/16*** (2013.01); ***A61B 5/0205*** (2013.01); ***A61B 5/14546*** (2013.01); ***A61B 5/01*** (2013.01); ***A61B 5/0533*** (2013.01); ***A61B 5/053*** (2013.01); ***A61B 5/0476*** (2013.01); ***A61B 5/14532*** (2013.01); ***A61B 5/7445*** (2013.01)

(57) **ABSTRACT**

A system and method where at least one user's biofeedback information is captured or recorded using biofeedback devices, while the information of their physical properties are captured or recorded using at least one camera. Both sets of information is sent to computers to be processed into at least one information stream in a style of the choice of the user. The information stream(s) are then outputted to at least one device which they can be consumed by the user, such as (but not limited to) viewed on two-dimensional or three-dimensional screens, televisions and monitors, viewed through virtual/augmented reality devices, viewed on mobile devices, printed with printers, created with three-dimensional model printers, created using product printing services, saved on the Cloud, uploaded to websites/blogs and shown using image projectors. This combined visual information stream will usually take the form of (among other things) a live video or still image showing the user(s) with their biofeedback information interpreted as colors surrounding them, painted onto a model of the user(s), as colors projected onto the user(s) themselves, or as a color field appearing to surround or project from the user's body or musical instrument.



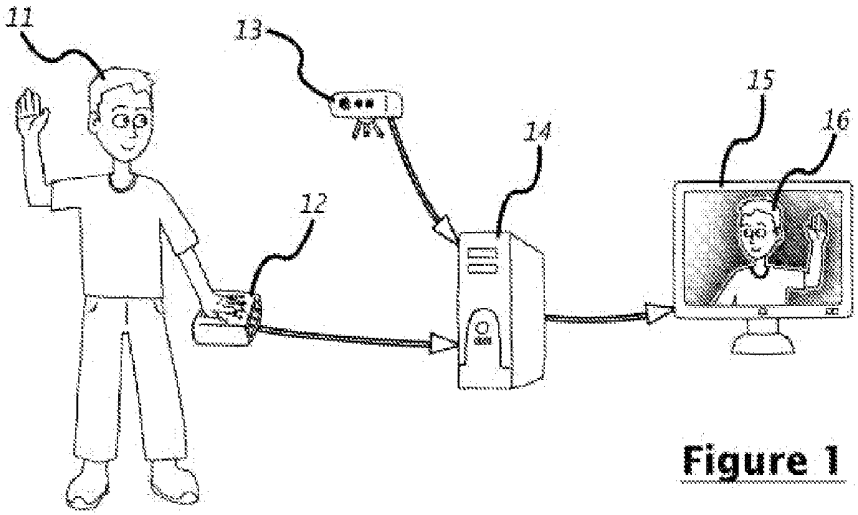


Figure 1

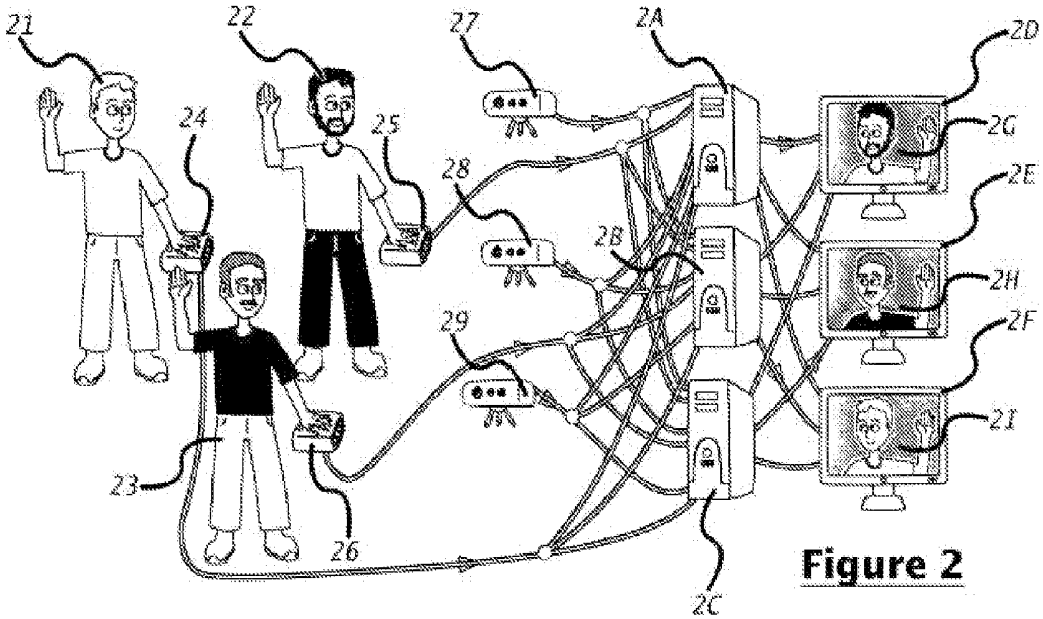


Figure 2

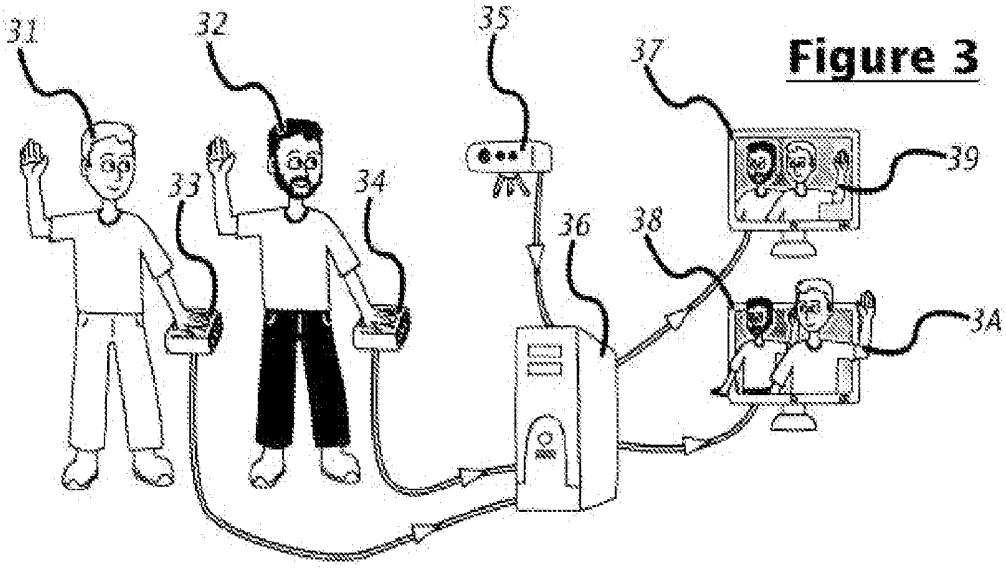


Figure 3

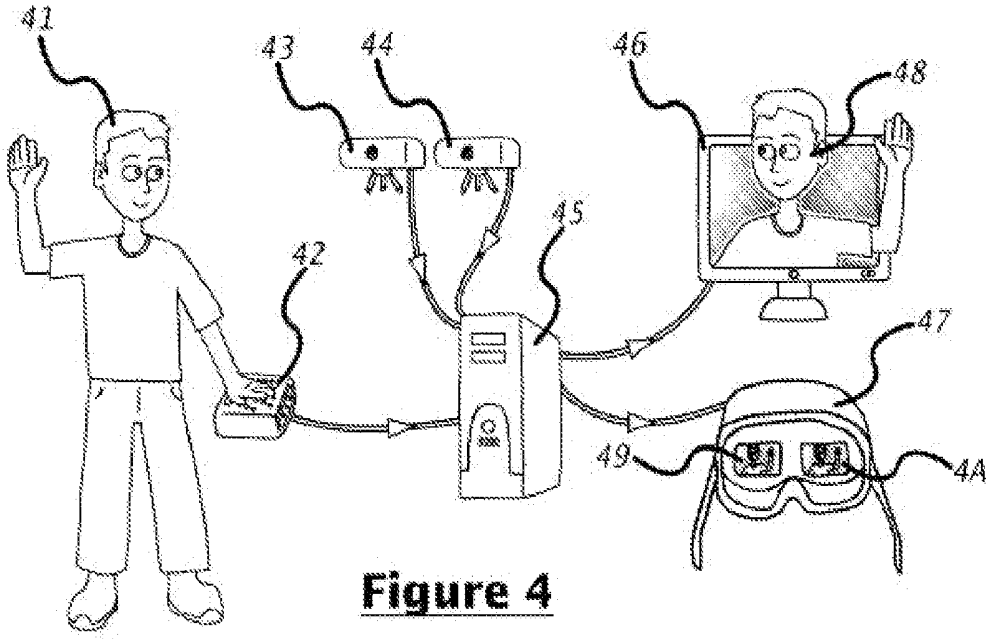


Figure 4

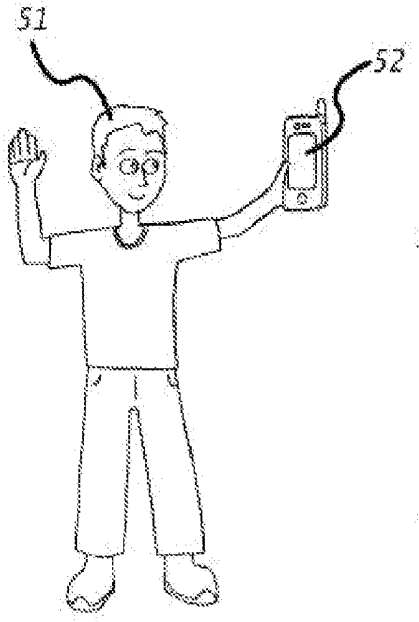


Figure 5a

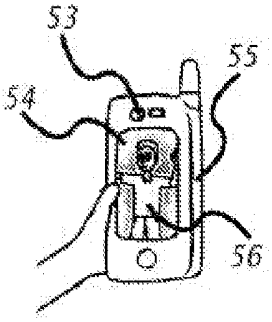


Figure 5b

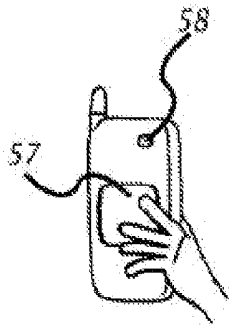
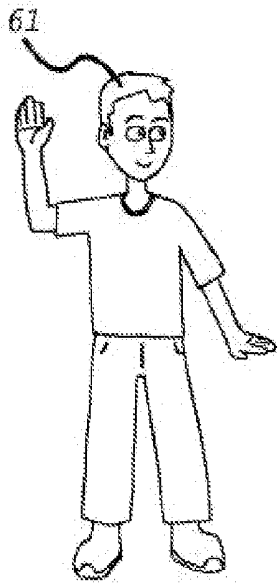


Figure 5c



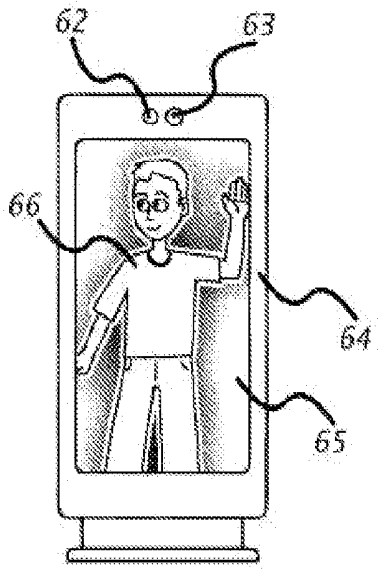


Figure 6

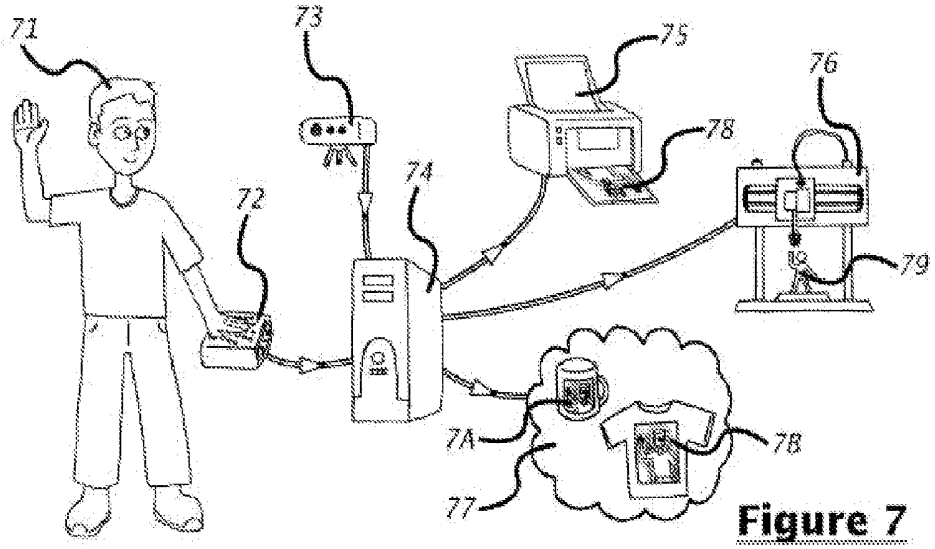


Figure 7

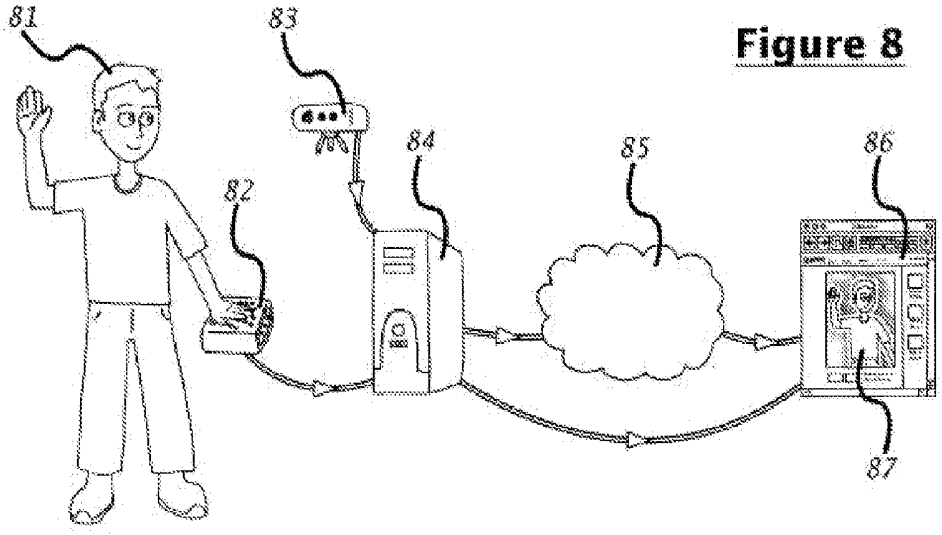


Figure 8

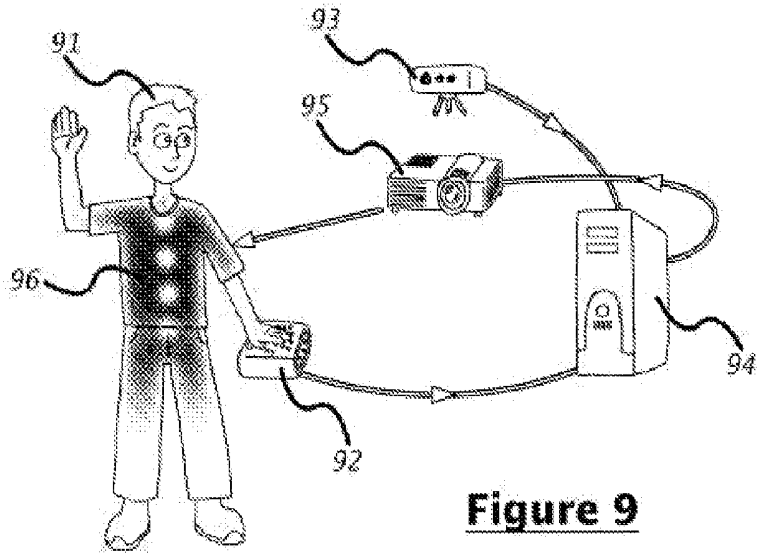


Figure 9

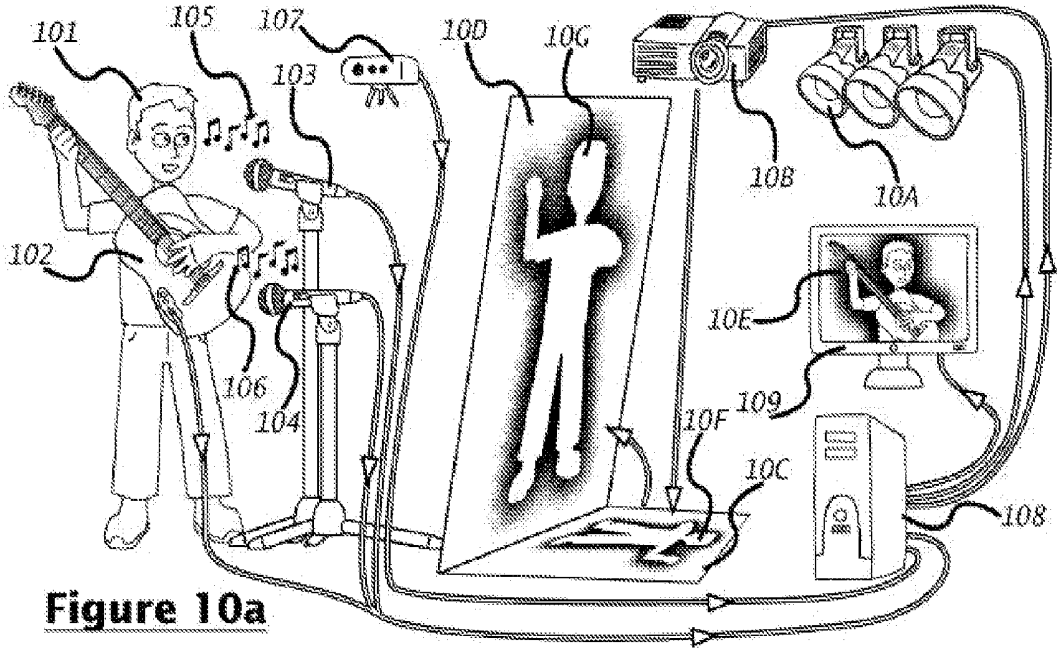


Figure 10a

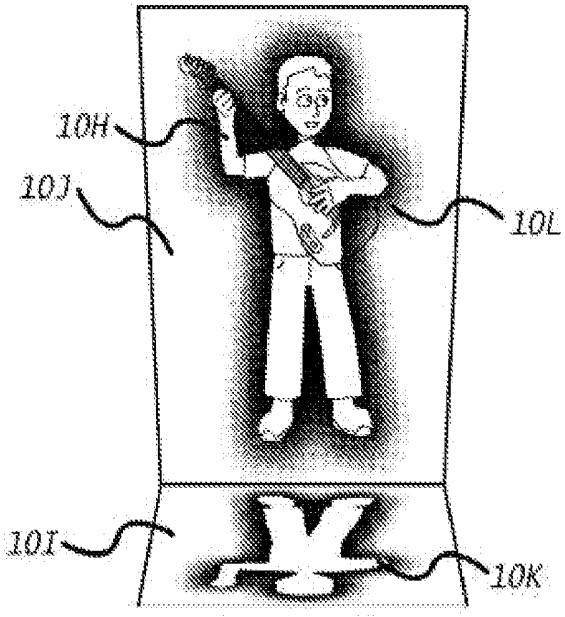


Figure 10b

AUGMENTED REALITY BIOFEEDBACK DISPLAY

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application takes priority from PCT Application No. PCT/US13/65482, filed Oct. 17, 2013, which claims the benefit of U.S. provisional patent application No. 61/744,606, filed Oct. 1, 2012, which are incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates generally to augmented reality displays, and more specifically to augmented reality displays that incorporate biofeedback or sonic information.

[0004] 2. Background

[0005] Biofeedback visual and photographic technology has been around for over forty years. In that time however, all of the available devices can only project their visual data in 2D without stereo 3D. Furthermore, all of the available devices usually require the user to not move at all from in front of the video camera recording the video of the user. On top of that, the device used to capture the user's biofeedback data is a stationary box on which the user must leave his or her hand, which further ties the user to a stationary position. All in all, this limits users from viewing their visual biofeedback data outside of a basic, limited, stationary position. This method of capturing and sharing biofeedback data is beginning to become more of an archaic inconvenience for users.

[0006] Augmented reality technology provides a way to enhance a user's real-time view of a physical, real-world environment by introducing virtual elements into the real-world scene. It is highly useful and desirable to introduce virtual elements into a real-world scene that are based on biofeedback information from a person or animal in the real-world scene. Such virtual elements enhance communication by providing useful information, or enhance the quality of a musical performance by displaying visual elements based on biofeedback or sonic information received from the performer.

SUMMARY OF THE INVENTION

[0007] An object of the present invention is to provide a system and method for displaying biofeedback-based information as augmented reality.

[0008] Another object of the present invention is to enhance a musical performance by displaying visual information based on the musical sound in an augmented reality system.

[0009] In an embodiment, the present invention is a system comprising a camera that continuously captures a real-world scene including a user, a biofeedback sensor that continuously measures a biological parameter of the user, a computer that processes the information provided by the biofeedback sensor into visual information, and detects the location of the user's body, and a display module that displays the real-world scene with the visual information overlaid on top, or around, the user's body. The display module can be a smartphone screen, a tablet screen, a computer screen, a television, a projector, a wearable display such as virtual-reality glasses, a 3D display, or any other device capable of displaying the visual information and the real-world scene. The display module can also project the visual information directly onto the user's body. The biofeedback sensor can measure any biological parameter, such as body temperature, skin conductance, galvanic resistance, brainwaves, heart rate and rate variation, muscle signals, brain waves, or blood pressure.

[0010] In another embodiment, the present invention comprises multiple biofeedback sensors that measure biological parameters of multiple users and display them to other users.

[0011] In another embodiment, the present invention is a system comprising a camera that continuously captures a real-world scene including a user or a musical instrument, a music sensor that continuously senses musical sound or musical information produced by the user or by the user's musical instrument, a computer that processes the information provided by the music sensor into visual information and detects the location of the user's body in the real-world scene, and a display module that displays the real world scene with the visual information overlaid on top, or around, the user's body. The display module can be a projection screen such as are used in live music performance, a wearable display such as virtual-reality glasses, a smartphone screen, a tablet screen, a computer screen, a television, a projector, a 3D display, or any other device capable of displaying the visual information and the real-world scene. The display module can also project the information directly onto the user's body. The visual information can be presented as a color field that appears to surround the user's body, musical instrument, or both.

[0012] In another embodiment of the present invention, the biofeedback sensor is a medical sensor designed to measure the level of a medication in a patient's bloodstream or some other medical parameter such as blood sugar level, blood oxygen level, pain levels, and so on. The medical parameter can then be displayed to a doctor or nurse as an "aura" around the patient, as text "attached" to the patient's body, or as animated images. The biofeedback sensor could also be used to measure the level of alcohol or other recreational drugs in the user's blood.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. **1** is a typical single-user implementation of the present invention;

[0014] FIG. **2** is a multiple user, multiple connection implementation of the present invention;

[0015] FIG. **3** is a multiple 2D- and 3D-screen implementation of the present invention;

[0016] FIG. **4** is a multi-camera, multiple 3D viewer implementation of the present invention;

[0017] FIG. **5***a* is a mobile implementation of the present invention;

[0018] FIG. **5***b* is a detailed front view of the individual elements in the mobile implementation of FIG. **5***a;*

[0019] FIG. **5***c* is a back view of the individual elements in the mobile implementation of FIG. **5***a;*

[0020] FIG. **6** is a kiosk implementation of the present invention;

[0021] FIG. **7** is a multiple printer implementation of the present invention;

[0022] FIG. **8** is an internet/online implementation of the present invention;

[0023] FIG. **9** is a projection implementation of the present invention;

[0024] FIG. **10***a* is a live music concert implementation of the present invention;

[0025] FIG. **10***b* is a straight-on view of the projection element in the live music concert implementation of FIG. **10***a*.

DETAILED DESCRIPTION OF THE INVENTION

[0026] Referring now to the invention in more detail, in FIGS. **1** to **10**, there is shown at least one user **11**, **21**, **22**, **23**, **31**, **32**, **41**, **51**, **61**, **71**, **81**, **91**, **101**, **10**H, whose biofeedback information is captured or recorded using biofeedback devices **12**, **24**, **25**, **26**, **33**, **34**, **42**, **57**, **62**, **72**, **82**, **92** or other equipment that can be used to simulate biofeedback responses **102**, **103**, **104**, while the information of their physical properties are captured or recorded using cameras **13**, **27**, **28**, **29**, **35**, **43**, **44**, **53**, **58**, **63**, **73**, **83**, **93**, **107**. Both sets of information is sent to computers **14**, **2**A, **2**B, **2**C, **36**, **45**, **55**, **64**, **74**, **84**, **94**, **108**, to be processed into at least one information stream in a style of the choice of the user **11**, **21**, **22**, **23**, **31**, **32**, **41**, **51**, **61**, **71**, **81**, **91**, **101**, **10**H. The information stream(s) are then sent to various devices which can be consumed by the user **11**, **21**, **22**, **23**, **31**, **32**, **41**, **51**, **61**, **71**, **81**, **91**, **101**, **10**H, such as (but not limited to) viewed on two-dimensional or three-dimensional screens, television and monitors **15**, **2**D, **2**E, **2**F, **37**, **38**, **46**, **65**, **109**, viewed through virtual/augmented reality devices **47**, viewed on mobile devices **52**, **54**, printed with printers **75**, created with three-dimensional model printers **76**, created using product printing services **77**, saved on the Cloud **85**, uploaded to websites/blogs **86**, and shown using image projectors **95**, or projected via a "Pepper's Ghost" system **10**C, **10**D, **10**I, **10**J. This combined visual information stream will usually take the form of (among other things) a live video or still image showing the user or users **11**, **21**, **22**, **23**, **31**, **32**, **41**, **51**, **61**, **71**, **81**, **91**, **101**, **10**H with their biofeedback information interpreted as colors surrounding them **16**, **2**G, **2**H, **2**I, **39**, **3**A, **48**, **49**, **4**A, **56**, **66**, **78**, **7**A, **7**B, **87**, **10**E, painted onto a model of the user or users **79**, or as colors projected onto the user or users themselves **96** or towards the user or users themselves **10**F, **10**G, **10**K, **10**L.

[0027] In more detail, referring to the invention of FIG. **1**, the user **11** will be attached to any sort of biofeedback device **12**; it itself can be a stationary device or something that the user can "wear" (such as a glove, shoe, hat or other article of clothing) which moves along with the user. The physical properties of the user **11**—their visual information itself, distance relative to other objects in the same room, etc—which isn't captured by the biofeedback device **12** will be captured by a camera **13**. Both the biofeedback device **12** and the camera **13** will send their information to a computer **14**, either as a live data stream or as a single "snapshot" of the user **11** at that specific moment in time. The computer will then take both data streams and process that in a specific way that the user **11** specifies. In FIG. **1**, both data streams are combined into a single stream of visual information **16** and projected onto a computer monitor **15**, allowing the user **11** to see both data streams in the way they specified.

[0028] Referring now to FIG. **2**, multiple users **21**, **22**, **23** can be attached to at least one biofeedback device **24**, **25**, **26**, which records their biofeedback data, while cameras **27**, **28**, **29** capture data about their physical properties. The data from the biofeedback devices **24**, **25**, **26** and cameras **27**, **28**, **29** can then all be sent to multiple computers **2**A, **2**B, **2**C. The computers **2**A, **2**B, **2**C can then process all six data streams from the biofeedback devices **24**, **25**, **26** and cameras **27**, **28**, **29**, each in a unique way as the users **21**, **22**, **23** wish to assign to them. The computers **2**A, **2**B, **2**C can then send their completed processed information to each of the three computer monitors **2**D, **2**E, **2**F which allows the users **21**, **22**, **23** to view the different data streams **2**G, **2**H, **2**I created by each of the computers **2**A, **2**B, **2**C.

[0029] Referring now to FIG. **3**, multiple users **31**, **32** can be attached to at least one biofeedback device **33**, **34**, which records their biofeedback data, while a single camera **35** captures data about both of their physical properties. Both of these data streams are then sent to a computer **36** which is able to determine which biofeedback data stream from the two biofeedback devices **33**, **34** belong to which of the two users **31**, **32** recorded by the single camera **35**. This information is then processed by the computer **36** in a manner determined by the users **31**, **32**, and the processed data stream is sent to two different monitors, a two-dimensional monitor **37** and a three-dimensional monitor **38**, which can be viewed by the users **31**, **32** in their respective formats (either as a 2D image **39** or as a 3D image **3**A).

[0030] Referring now to FIG. **4**, a user **41** is attached to at least one biofeedback device **42**. The physical properties of the user **41** is recorded by two cameras **43**, **44**. Both data from the biofeedback device **42** and the cameras **43**, **44** are sent to a computer **45**. The computer **45** processes all three data streams in a manner determined by the user **41**, and sent to two different devices capable of allowing the user **41** to view images as a three-dimensional image. The three-dimensional monitor **46** will project the combined data stream as a single 3D image **48**. The virtual/augmented reality device **47** will allow the user **41** to interpret two separate data streams **49**, **4**A as a single 3D image.

[0031] Referring now to FIG. **5***a*, a user **51** is holding a mobile device **52** in a certain way, which allows the mobile device **52** to process data in the manner of the present invention.

[0032] Referring now to FIG. **5***c*, which is the back view of the mobile device **52**, there is at least one biofeedback device **57** that the user **51** can access. There is also another camera **58** which allows the user **51** to take a picture of themselves.

[0033] Referring now to FIG. **5***b*, which is a zoomed-in view of the mobile device **52**, there is a camera **53** which can be used to capture data about the user **51**. With the biofeedback data coming in from the biofeedback device **57** and visual data coming in from the camera(s) **53**, **58**, that data is then sent to the internal computer/processor **55** on the mobile device **52**. The internal computer/processor **55** processes both data streams in a method which the user **51** chooses, and that data is then sent to the screen **54** of the mobile device **52**. On the screen **54** is a visual representation **56** of both data streams from the biofeedback device **57** and the camera(s) **53**, **58**.

[0034] Referring now to FIG. **6**, a user **61** walks in the vicinity of a freestanding, self-contained kiosk. The kiosk contains both a camera **62** and a form of biofeedback device **63** (which may or may not require physical contact from the user **61**). The combined camera **62** and biofeedback device **63** data feed is sent to the internal computer **64** within the kiosk. The computer then processes the data of the two data feeds according to the settings provided either by the owner of the kiosk (which in that case cannot be changed by a user **61**), or by the user **61** themselves through some manner via the kiosk's (touch)screen **65**. Either way, the finalized processed data stream of the camera **62** and biofeedback device **63** is revealed on the screen **65** of the kiosk in the form of some kind of visual data **66**. This data **66** can be seen live (as if the user **61** is in front of a mirror) or can be used to reveal certain kinds

of advertisement according to the data gathered by the biofeedback device **63**; either way, it is treated is something that can be "consumed" by the user **61**.

[0035] Referring now to FIG. **7**, a user **71** is attached to at least one biofeedback device **72**, and whose physical properties are captured by a camera **73**. Both data streams from both devices are sent to a computer **74** to be processed in a manner according to the preferences of the user **71**. This can include a printer **75** which prints out a snapshot **78** of the way the data from the biofeedback device **72** and the camera **73** is interpreted together, or a 3D model **79** created by a 3D printer **76**, or as elements **7**A, **7**B on various merchandise which are created, stored and/or distributed by some form of merchandise creation system **77**.

[0036] Referring now to FIG. **8**, a user **81** is attached to at least one biofeedback device **82**, and whose physical properties are captured by a camera **83**. Both data streams from both devices are sent to a computer **84** to be processed in a manner according to the wishes of the user **81**. The combined data stream **87** can then be uploaded to the Cloud **85**, or immediately onto a website **86**, or stored on the Cloud **85** for later updating to a website **86**. The kind of data streams **87** that are saved and/or uploaded can include single still images or video backups of a session, or a live recording of a session for saving to video sites like YouTube, or as a live video feed through video-chatting services like Skype or Chat Roulette.

[0037] Referring now to FIG. **9**, a user **91** is attached to at least one biofeedback device **92**, and whose physical properties are captured by a camera **93**. Both data streams from both devices are sent to a computer **94** to be processed in a manner according to the preferences of the user **91**. The completed data stream can then be sent to a projector **95**, which then can be projected **96** in any form onto a blank wall or the user **91** themselves. The camera **93** may then also record the projected image **96** over the user **91** and saved as a video file or single image onto a computer **94**.

[0038] Referring now to FIG. **10***a*, a user **101** is in the presence of acoustic-related devices **102**, **103**, **104** which can interpret the user's sound producing capabilities as a biofeedback data stream. The user **101** may hold any musical instrument **102**, and the sound of their voice **105** and/or musical instrument **106** is picked up by either a microphone **103**, **104** or by the instrument **102** itself. Their physical properties are captured by a camera **107**. Both sound/biofeedback and camera data streams are sent to a computer **108** to be processed in a manner according to the preferences of the user **101**. The processed data stream can be sent either to a screen **109** in the form of some manner of visual data **10**E, sent to a concert lighting system **10**A, or sent to a projector **10**B where the visual data **10**F will be projected towards the user **101** via a "Pepper's Ghost"-style system **10**C, **10**D; specifically, the projector **10**B will project its visual data **10**F towards a reflector plate **10**C, which will then reflect the visual data **10**F projected onto it towards an adequately-sized, transparent sheet of glass **10**D, which then will make the reflected visual data **10**G appear to be in front of the user **101**.

[0039] Referring now to FIG. **10***b*, the "Pepper's Ghost"-style system of reflective materials **10**I, **10**J are shown at a straight-on view, showing how the reflected visual data **10**K would be reflected off one reflective plate **10**I towards the transparent reflective sheet of glass **10**J such that the reflected image **10**L would appear in front of the user **10**H.

[0040] In further details, referring now to FIGS. **1-4** and FIG. **7-10**, the user **11**, **21**, **22**, **23**, **31**, **32**, **41**, **51**, **61**, **71**, **81**, **91**, **101**, **10**H must be in regular contact with the biofeedback device **12**, **24**, **25**, **26**, **33**, **34**, **42**, **72**, **82**, **92** or a comparable device **102**, **103**, **104** which can simulate biofeedback responses in order for the biofeedback data of the user **11**, **21**, **22**, **23**, **31**, **32**, **41**, **51**, **61**, **71**, **81**, **91**, **101**, **10**H to be properly recorded. However the user **11**, **21**, **22**, **23**, **31**, **32**, **41**, **51**, **61**, **71**, **81**, **91**, **101**, **10**H can be at any distance away from the camera **13**, **27**, **28**, **29**, **35**, **43**, **44**, **73**, **83**, **93**, **107**, so long as the software on the computer **14**, **2**A, **2**B, **2**C, **36**, **45**, **74**, **84**, **94**, **108** is able to adequately interpret the visual data from the camera **13**, **27**, **28**, **29**, **35**, **43**, **44**, **73**, **83**, **93**, **107** and recognize it as being from/of the user **11**, **21**, **22**, **23**, **31**, **32**, **41**, **51**, **61**, **71**, **81**, **91**, **101**, **10**H. However, the camera **13**, **27**, **28**, **29**, **35**, **43**, **44**, **73**, **83**, **93**, **107**, biofeedback device **12**, **24**, **25**, **26**, **33**, **34**, **42**, **72**, **82**, **92** (or its comparable device **102**, **103**, **104**), computer **14**, **2**A, **2**B, **2**C, **36**, **45**, **74**, **84**, **94**, **108**, screen (and other visual devices) **15**, **2**D, **2**E, **2**F, **39**, **3**A, **46**, **47**, **95**, **109**, **10**B, other lighting systems **10**A and/or printers **75**, **76**, **77** may or may not be actually physically connected with one another or even in one another's physical presence such that the user **11**, **21**, **22**, **23**, **31**, **32**, **41**, **51**, **61**, **71**, **81**, **91**, **101**, **10**H has physical access to them; what matters is that there is a connection between each of the necessary systems.

[0041] Referring now to FIGS. **1-10**, the camera **13**, **27**, **28**, **29**, **35**, **43**, **44**, **53**, **58**, **62**, **73**, **83**, **93**, **107** can be of any resolution, just so long as the screen (and other visual devices) **15**, **2**D, **2**E, **2**F, **39**, **3**A, **46**, **47**, **54**, **65**, **95**, **109**, **10**B, website **86** and/or printers **75**, **76**, **77** is capable of adequately rendering the visual data to the preference of the user **11**, **21**, **22**, **23**, **31**, **32**, **41**, **51**, **61**, **71**, **81**, **91**, **101**, **10**H. The camera **13**, **27**, **28**, **29**, **35**, **43**, **44**, **53**, **58**, **62**, **73**, **83**, **93**, **107** can also be either a 2D, a "2D plus distance", a 3D, a "3D plus distance" or any other camera that is capable of recording physical data about a user **11**, **21**, **22**, **23**, **31**, **32**, **41**, **51**, **61**, **71**, **81**, **91**, **101**, **10**H. Likewise, the screen (and other visual devices) **15**, **2**D, **2**E, **2**F, **39**, **3**A, **46**, **47**, **54**, **65**, **95**, **109**, **10**B and/or printers **75**, **76**, **77** can be of any resolution or quality, so long as the user **11**, **21**, **22**, **23**, **31**, **32**, **41**, **51**, **61**, **71**, **81**, **91**, **101**, **10**H is able to adequately see their visual data to their preferences. The biofeedback devices **12**, **24**, **25**, **26**, **33**, **34**, **42**, **57**, **62**, **72**, **82**, **92** (or its comparable device **102**, **103**, **104**) also don't necessarily need to be in direct contact with the user **11**, **21**, **22**, **23**, **31**, **32**, **41**, **51**, **61**, **71**, **81**, **91**, **101**, **10**H; what matters is that the biofeedback devices **12**, **24**, **25**, **26**, **33**, **34**, **42**, **57**, **62**, **72**, **82**, **92** (or its comparable device **102**, **103**, **104**) are capable of recording the necessary physiological data of the user **11**, **21**, **22**, **23**, **31**, **32**, **41**, **51**, **61**, **71**, **81**, **91**, **101**, **10**H (which is the primary characteristic of "biofeedback devices"). The camera **13**, **27**, **28**, **29**, **35**, **43**, **44**, **53**, **58**, **62**, **73**, **83**, **93**, **107** and biofeedback devices **12**, **24**, **25**, **26**, **33**, **34**, **42**, **57**, **62**, **72**, **82**, **92** (or its comparable device **102**, **103**, **104**) can also either passively capture their respective data and send that raw data to the computer(s) **14**, **2**A, **2**B, **2**C, **36**, **45**, **55**, **64**, **74**, **84**, **94**, **108** for further processing, or they can process the data within themselves and send that processed data to the computer(s) **14**, **2**A, **2**B, **2**C, **36**, **45**, **55**, **64**, **74**, **84**, **94**, **108** without requiring much (if any) further processing. Either way, the computers **14**, **2**A, **2**B, **2**C, **36**, **45**, **55**, **64**, **74**, **84**, **94**, **108** must also be of sufficient processing capability as to handle at least two independent data streams from at least one biofeedback device(s) **12**, **24**, **25**, **26**, **33**, **34**, **42**, **57**, **62**, **72**, **82**, **92** (or its comparable device **102**, **103**, **104**) and at least one camera(s) **13**, **27**, **28**, **29**, **35**, **43**, **44**, **53**, **58**, **63**, **73**, **83**, **93**, **107** (whether those data streams are raw, processed or other-

wise), as well as exporting those two data streams—either as a single, combined stream, or simply forwarding the streams as is, or converting them to any other forms—to at least one of the following: two-dimensional or three-dimensional screens, television and monitors **15**, 2D, 2E, 2F, **37**, **38**, **46**, **65**, **109**, viewed through virtual/augmented reality devices **47**, viewed on mobile devices **52**, **54**, printed with printers **75**, created with three-dimensional model printers **76**, created using product printing services **77**, saved on the Cloud **85**, uploaded to websites/blogs **86**, and shown using image projectors **95**, 10B or lighting systems 10A. The computers **14**, 2A, 2B, 2C, **36**, **45**, **55**, **64**, **74**, **84**, **94**, **108** may also have software on it that allows the user **11**, **21**, **22**, **23**, **31**, **32**, **41**, **51**, **61**, **71**, **81**, **91**, **101**, 10H to save still images or video of the data feed **16**, 2G, 2H, 2I, **39**, 3A, **48**, **56**, **66**, **87**, **96**, 10E, 10G, 10L.

[0042] Referring now to FIG. **3**, the three-dimensional monitor **38** can be of any form, such as (but not limited to) a monitor that requires specialty glasses in order to see the 3D image 3A, or a monitor that can be viewed without specialty glasses.

[0043] Referring now to FIG. **4**, the cameras **43**, **44** can be any distance away from one another, although if the intent is to create a 3D image **48**, **49**, 4A, then it is recommended that the two cameras not be too far apart (ideally the general distance between one's own eyes). The virtual/augmented reality device **47** can be of any form, including (but not limited to) actual "goggles" you have to wear, as a simple HUD display device (such as "Google Glasses"), or as software on a mobile or video game system (such as the "Nintendo 3DS").

[0044] Referring now to FIG. 5*a*-5*c*, the user **51** must be in regular contact with the mobile device **52** and its biofeedback device **57**. By virtue of that, the user **51** will also be in close proximity to the camera **53**, **58** which will record the visual data of the user. The user **51** may change the distance between themselves and the mobile device **52**, which won't affect the function of the invention. The mobile device **52** must also be of a type that has at least one camera (either front facing **53** or back facing **58**), have some manner of biofeedback interaction **57**—which may be one of the cameras **53**, **58** or the phone's (touch)screen **54**—and an internal computer/processor **55** which can handle live video and biofeedback data feeds as well as the processing of them into a single or multiple data feed **56**. The mobile device **52** must also be able to accept the installation of software onto it, namely the software necessary to process both camera **53**, **58** and biofeedback device **57** data feeds into a manner which the user **51** prefers. However, whether or not the mobile device **52** is capable of cellular or wi-fi communication is a non-issue; it should be able to do everything covered in this invention without the use of cellular or wi-fi communication.

[0045] Referring now to FIG. **6**, the user **61** must be within a close enough range to the kiosk that would allow both the camera **62** and the biofeedback device **63** to capture data about the user **61**. If either the camera **62** or the biofeedback device **63** is not capable of accurately capturing data about the user **61**, then both will not work. The internal computer **64** must also have the capability to interpret both data feeds from the camera **62** and the biofeedback device **63** and either show the user **61** a visual interpretation of the combined data feeds **66**, or show specific other imagery—advertising, commercials, text, etc—which are related to how both data feeds are interpreted. The kiosk must also be of a particular size in order for the attention of the user **61** to be caught by the kiosk and drawn to it to interact with it.

[0046] Referring now to FIG. **7**, the printed materials **77**, **78**, **79**, can be of any shape, size or quality. The printed merchandise **77** can be printed and sent to a user **71** immediately, or saved for later printing and/or purchase.

[0047] Referring now to FIG. **8**, both the Cloud **85** and the website **86** (access to and from) must be of sufficient speed to handle a regular data feed sent by the computer **84**. The final data stream **87** should also be in a graphics or video format which the Cloud **85** and/or the website **86** is capable of properly processing.

[0048] Referring now to FIG. **9**, the projector **95** should be a proper distance away from the user **91** such that the image it projects **96** lines up where the user **91** feels it should. It is also likewise ideal for the projector **95** to be stationary as the camera **93** and the software on the computer **94** should be able to keep proper track of the user **91** without requiring the projector **95** to move to ensure that the image that it projects **96** remains projected onto the user. However, this does not prevent the user **91** from using a kind of projector **95** that is able to track the user **91** so that the user **91** never moves outside of the visual range of the projector **95**.

[0049] Referring now to FIG. 10*a*, the user **101** can use any musical instrument **102** they wish, or they could not even use one at all. The core idea is that the user's current physiological state, as in, the subjective "strength" of their musical "spark" for that day can be affected by—or can affect—their physiological state at that present moment, and thus would be reflected in their physical voice **105** and/or their physical interaction with a musical instrument to produce sound from it **106**. Therefore, this data can be interpreted as biofeedback data. As such, the acoustic-related equipment doesn't have to be actual microphones **103**, **104** or a musical instrument **102** capable of sending an audio feed out from it, but any device that is capable of "listening" to the sounds **105**, **106** that a user **101** makes, whether from their own physical voice or their physical actions and interactions with a musical instrument **102**. Furthermore, audio recognizing/recording devices can be of any size or distance from the user **101**, physically connected with the user **101** or simply in the vicinity of the user **101**, so long as those audio recognizing/recording devices can properly "listen" to the user **101** and the sounds **105**, **106** they can produce. The "Pepper's Ghost"-style system 10B, 10C, 10D can also be of any system or method that simply allows the projected visual data 10F, 10G to appear as if it was "surrounding" and "moving with" the user **101**. The screen **109** can also be either a live video feed sent to any receptive device (such as a live internet video feed or a video recording device), or it can be hooked up as part of a musical performance's "light show" where the combined data stream would be displayed on a giant screen behind the user **101**. The overhead lighting 10A can either project certain images and/or colors based on the manner of how the computer **108** interprets the audio-based biofeedback data stream of the user's **101** voice **105** and/or instrument playing ability **106**.

[0050] In this embodiment of the invention, any parameter of the sound may be interpreted as biofeedback variables, to create "artificial synesthesia" for the user. For example, the pitch of the sound may be correlated with different colors, as a simulation of "perfect pitch". A musician, for example, may wear a wearable computer display and instantly see a color that correlates with the pitch of a sound they are hearing. This

would assist the musician in playing along with other musicians or with recorded music. An audience member, too, would find their music listening experience to be enhanced by being able to identify the musical pitch or key of the piece.

[0051] In another embodiment, finer distinctions in pitch may be correlated with colors; for example, a musician may use a wearable computer display in helping them tune an instrument by watching for the right color, or in helping them sing in tune.

[0052] Other musical parameters may also be used. For example, the visual display may be correlated with the volume of the sound—i.e. getting brighter when the sound gets louder, and getting more muted when the sound gets softer. Different colors may also be correlated with different timbres of sound—i.e. a different color or set of colors for a violin sound than for a piano sound. This will enhance the audience's listening experience.

[0053] Other applications of the present invention may also be possible and desirable. For example, a biofeedback sensor may be designed to measure the level of a medication in a patient's bloodstream, and display it as an "aura" when a doctor or nurse looks at the patient. The present invention may also be connected to a pulse oximeter to visually display the patient's oxygen level, a blood sugar sensor to visually display a diabetic patient's blood sugar, or to any other medical sensor to display any sort of medical parameter visually. In another application, the sensor may be a brain wave sensor to measure levels of consciousness in a coma patient, or levels of pain in a chronic pain patient. Multiple sensors may be used as well, for patients with more complex medical needs. In this embodiment of the present invention, the display unit is preferably a portable device such as a smartphone or a wearable display device such as Google Glass. The information may be displayed as a colored "aura" as text, or even as animations (dancing animated sugar cubes to indicate blood sugar levels, or dancing pink elephants to indicate the levels of a psychiatric medication, alcohol, or recreational drugs in a patient's bloodstream). The advantage of this sort of display is that a doctor can perceive instantly whether or not a patient is in need of help, and that the patient does not even need to verbalize their need (which may help in cases where the patient is unable to speak).

[0054] The present invention may also be used as an assistive device for people with disabilities. For example, an autistic person may be unable to perceive a person's mood, interest, or engagement level when communicating with them. A biofeedback sensor can measure all of these things and provide the autistic person with a visual or textual indicator of how interested the other person is in their conversation and what kind of mood the other person is in. As another example, a deaf person may benefit from having the sound of a person's voice displayed visually as an aura around the person, which may enhance lipreading ability and improve communication.

[0055] The advantages of the present invention are that it enables biofeedback data to be displayed visually. This may enhance communication by providing instant visual indication of a person's mood or other biofeedback parameters, provide entertainment by providing visual accompaniment to a musical performance, or enhance perception by providing visual indications of parameters that a user is unable to perceive directly—for example, the amount of medication in a patient's bloodstream, the pitch of a musical note (for those without perfect pitch), the mood or interest level of a person (for autistic users), and so on.

[0056] In broad embodiment, the present invention is a system and method that allows a computer to record and save data about at least one user's outward physical and inward biological state in real time, and then translate that data into augmented reality form for the user themselves and/or any other interested person(s).

[0057] While the foregoing written description of the invention enables one of ordinary skill to make and use what is considered presently to be the best mode thereof, those of ordinary skill will understand and appreciate the existence of variations, combinations, and equivalents of the specific embodiment, method, and examples herein. The invention should therefore not be limited by the above described embodiment, method, and examples, but by all embodiments and methods within the scope and spirit of the invention.

1. A system for displaying biofeedback information, comprising:

a first biofeedback sensor module for continuously capturing biological information from a human, animal, or plant first user;

a first camera for continuously capturing a real-world scene that includes the first user;

a first biofeedback processing module for processing information received from the first biofeedback sensor module into visual information;

a first image analysis module for detecting the location of the first user's body;

a first display unit that overlays the visual information on the real-world scene in such a way that the location of the visual information depends on the location of the first user's body.

2. The system of claim **1**, where the display unit is one of the following: a computer screen, a television screen, a smartphone screen, a tablet screen, virtual-reality glasses, wearable display, image projector, 3D display, printer, 3D printer.

3. The system of claim **1**, where the display unit projects the visual information onto the user's body.

4. The system of claim **1**, where the biofeedback sensor module is a sensor that measures at least one of the following parameters: body temperature, skin conductance, galvanic resistance, brainwaves, heart rate and rate variation, muscle signals, blood pressure, blood sugar, blood oxygen level, blood alcohol content.

5. The system of claim **1**, where the biofeedback sensor module is a sensor that measures the levels of a medication in a user's bloodstream.

6. The system of claim **1**, where the first biofeedback processing module and the first image analysis module are contained within a computer.

7. The system of claim **1**, where the first biofeedback processing module and the first image analysis module are contained within the first camera.

8. The system of claim **1**, where the visual information comprises a color field that appears around the image of the first user's body or musical instrument.

9. The system of claim **1**, where the visual information comprises advertisements.

10. The system of claim **1**, where the visual information comprises text.

11. The system of claim **1**, further comprising:

at least one second biofeedback sensor module for continuously capturing biological information from at least one second user;

at least one second camera for continuously capturing a real-world scene that includes at least one second user;

at least one second biofeedback processing module for processing information received from the second biofeedback sensor module into visual information;

at least one second image analysis module for detecting the location of the at least one second user's body;

at least one second display unit that overlays the visual information on the real-world scene in such a way that the location of the visual information depends on the location of the at least one second user's body,

such that the at least one second display unit can be viewed by the first user and the first display unit can be viewed by the at least one second user.

12. The system of claim **10**, where the at least one second biofeedback processing module, the at least one second image analysis module, the first biofeedback processing module, and the first image analysis module are contained within a computer.

13. The system of claim **10**, where the first biofeedback processing module and the first image analysis module are contained within a first computer, and the at least one second biofeedback processing module and the at least one second image analysis module are contained within at least one second computer.

14. A system for enhancing a musical performance, comprising:

a sound sensor module for continuously capturing musical sound made by a source of musical sound;

a camera for continuously capturing a real-world scene that includes the source of musical sound;

a computer capable of processing information received from the sound sensor module into visual information, and capable of detecting the location of the user's body in the real-world scene;

a display unit that displays the visual information overlaid on top of the real-world scene in such a way that the location of the visual information depends on the location of the source of musical sound.

15. The system of claim **13**, where the display unit is one of the following: a computer screen, a television screen, a smartphone screen, a tablet screen, virtual-reality glasses, image projector, 3D display.

16. The system of claim **13**, where the display unit projects the visual information onto a user's body.

17. The system of claim **13**, where the sound sensor module gathers data from a musical instrument.

18. The system of claim **13**, where the visual information comprises a color field that appears to surround a user's body.

19. The system of claim **13**, where the information received from the sound sensor module comprises pitch information.

20. The system of claim **13**, where the information received from the sound sensor module comprises timbre information.

* * * * *

专利名称(译)	增强现实生物反馈显示		
公开(公告)号	US20150243083A1	公开(公告)日	2015-08-27
申请号	US14/432177	申请日	2013-10-17
[标]申请(专利权)人(译)	科金斯GUY		
申请(专利权)人(译)	科金斯，家伙		
当前申请(专利权)人(译)	科金斯，家伙		
[标]发明人	COGGINS GEORGE GUY		
发明人	COGGINS, GEORGE GUY		
IPC分类号	G06T19/00 A61B5/0205 A61B5/00 A61B5/01 A61B5/053 A61B5/0476 G06F3/16 A61B5/145		
CPC分类号	G06T19/006 G06F3/16 A61B5/0205 A61B5/14546 A61B5/7445 A61B5/0533 A61B5/053 A61B5/0476 A61B5/14532 A61B5/01 A61B5/02055 A61B5/14551 A61B5/744 G06T11/00 G06T13/205 G06T19/20 G06T2215/16 G06T2219/2012		
优先权	61/744606 2012-10-01 US		
外部链接	Espacenet USPTO		

摘要(译)

一种系统和方法，其中使用生物反馈装置捕获或记录至少一个用户的生物反馈信息，同时使用至少一个相机捕获或记录其物理属性的信息。两组信息被发送到计算机，以便以用户选择的样式处理成至少一个信息流。然后将信息流输出到用户可以使用的至少一个设备，例如（但不限于）在二维或三维屏幕，电视和监视器上观看，通过虚拟/观看增强现实设备，在移动设备上查看，使用打印机打印，使用三维模型打印机创建，使用产品打印服务创建，保存在云上，上传到网站/博客并使用图像投影仪显示。这种组合的视觉信息流通常采用（除其他之外）实时视频或静止图像的形式，其显示用户将其生物反馈信息解释为围绕它们的颜色，绘制到用户的模型上，如投射到用户自身上的颜色，或者作为出现在用户身体或乐器周围或投射的颜色区域的颜色。