TITLE OF THE INVENTION

An Augmented Reality Display System and Methods for Displaying Cognitive Parameters

- Overall good in new sections
- Claim improvements noted
- Spec improvements noted
- still not 100% clear on sensor determining range
- still not 100% on determy multiple cognitive parameters

Overall A

BACKGROUND OF THE INVENTION

[0001] The present invention generally relates to a communication system and methods. More particularly, the present invention relates to a communication system and methods having a server in communication with a display device.

[0002] Previously, augmented reality display devices have become popular with consumers in recent years, particularly augmented reality display devices for displaying objects and information to a user of an augmented reality display device within an environment. Many of these devices are eyewear or headgear-type devices that use sensors to measure the physical or neurological activity of a user of these devices. Other kinds of measurement devices for detecting neurological activity or brainwave data of a user of such a device have been used with non-brainwave data of a user, like a heartbeat or muscle contraction, to record perceptual experiences and other capabilities.

[0003] A method for measuring perceptual experiences of an individual is disclosed in Ayyad Pub. No. US 2020/0187841 A1. Ayyad discloses a method using a measurement device with a plurality of sensors for measuring brain activity signals of a user. The measured brain activity signals are processed through at least one deep learning module to produce at least one capability. One or more of the capabilities are used to generate and provide an output corresponding to a perceptual experience.

[0004] A system for collecting and analyzing bio-signal and non-bio-signal data is disclosed in Coleman Pub. No. US 2020/0218350 A1. The system for collecting bio-signal and non-bio-signal data is used to improve one or more biofeedback computer systems interacting with at least one individual. As more data is aggregated over time

from the bio-signal data and non-bio-signal data of an individual, both data is used in methods involving algorithms such as machine learning algorithms to associate the data with mental states of the individual.

[0005] A virtual try-on system for spectacles stored in a computer-readable medium is disclosed in Goldberg Pub. No. US 2020/0219326 A1. Goldberg discloses a system and methods of a virtual try-on interface for determining the positioning of virtual spectacles on a three-dimensional surface of a user's face. The size and position of the virtual spectacles is determined from the detection of a user's face and head position.

[0006] A system for providing a virtual object within an environment is disclosed in Furman Pub. No. US 2020/0356171 A1. Furman discloses methods for rapidly decoding neurological activity of a user of a brain computer interface (BCI) as the user interacts with the virtual object within an environment. Features of the virtual object are modulated based on the neurological activity of the user of the BCI. Other forms of digital content can be provided to the user of the BCI within the environment based on cognitive states of the user. The environment is an augmented reality display setting or a virtual reality setting.

BRIEF SUMMARY OF THE INVENTION

[0007] One or more of the embodiments of the present invention provides a system and methods for augmented reality display, including at least one measurement device, wherein the measurement device includes an electroencephalogram (EEG) sensor, a server, wherein the server includes a server processor and a memory storing at least one cognitive parameter dataset, a display device, wherein the display device includes an augmented reality display, a position sensor, and a memory storing at least one spatial position data. The EEG sensor detects brainwave signals of a user of the measurement device to determine an EEG signal. The measurement device transmits the EEG signal. The server receives the EEG signal from the measurement device, The server processor compares the EEG signal to the cognitive parameter dataset stored in the memory of the server to determine a current cognitive parameter data representing a cognitive state of the user of the measurement device. The server transmits the current cognitive parameter data. The display device receives the current cognitive parameter data from the server. The position sensor of the display device detects an angular position of the display device in a viewing field of the augmented reality display, representing an angular range centered on a current pointing angle of the display device, to determine a detected spatial position data. The current cognitive parameter data is displayed using the augmented reality display when the spatial position data stored in the display device memory matches the detected spatial position data.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Figure 1 illustrates an augmented reality display system according to an embodiment of the present invention.

[0009] Figure 2 illustrates a server memory and a display memory when a plurality of measurement devices are in communication with the augmented reality display system according to an embodiment of the present invention.

[0010] Figure 3A illustrates a cognitive parameter dataset according to an embodiment of the present invention.

[0011] Figure 3B illustrates a cognitive parameter dataset according to an embodiment of the present invention.

[0012] Figure 4 illustrates a user current cognitive parameter data and a display memory for inputting threshold cognitive parameter data according to an embodiment of the present invention.

[0013] Figure 5 illustrates a flowchart of a process for associating a plurality of users of measurement device with a spatial position data and a user profile.

[0014] Figure 6 illustrates a flowchart of a process for generating the user current cognitive parameter data and determining when the user current cognitive parameter data is displayed in the augmented reality display.

[0015] Figure 7 illustrates a display in the augmented reality display according to an embodiment of the present invention.

[0016] Figure 8 illustrates a display in the augmented reality display according to an embodiment of the present invention.

[0017] Figure 9 illustrates a user interface presented in the augmented reality display to a user of the display device according to an embodiment of the present invention.

[0018] Figure 10 illustrates a user interface presented in the augmented reality display to a user of the display device according to an embodiment of the present invention.

[0019] Figure 11 illustrates a user interface presented in the augmented reality display to a user of the display device according to an embodiment of the present invention.

[0020] Figure 12 illustrates a user interface presented in the augmented reality display to a user of the display device according to an embodiment of the present invention.

[0021] Figure 13 illustrates an augmented reality display of the display device according to an embodiment of the present invention.

[0022] Figure 14 illustrates an augmented reality display of the display device according to an embodiment of the present invention.

[0023] Figure 15 illustrates an augmented reality display of the display device according to an embodiment of the present invention.

[0024] Figure 16 illustrates an augmented reality display of the display device according to an embodiment of the present invention.

[0025] Figure 17 illustrates an augmented reality display of the display device according to an embodiment of the present invention.

[0026] Figure 18 illustrates an augmented reality display of the display device according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0027] Figure 1 illustrates an augmented reality display system 100 according to an embodiment of the present invention. The augmented reality display system 100 includes a measurement device 110, a server 130, and a display device 160. The measurement device 110 includes an electroencephalogram (EEG) sensor 111, a motion sensor 114, a unit identification (ID) data 115, a quick response (QR) code 116, and a measurement transceiver 117. The EEG sensor includes an analog to digital convertor (ADC) 112. The server 130 includes a server processor 134, a server memory 137, and a server transceiver 147. The server processor 134 includes a server internal clock 135. The server memory 137 includes a cognitive parameter dataset 138 and a user data storage unit 140. The user data storage unit 140 includes a user current cognitive parameter data 144, a unit ID data 115, and a user motion data 146. The display device 160 includes a camera 161, an augmented reality display 162, a touchpad 163, a user interface 164, a position sensor 165, a display processor 166, a display memory 169, and a display transceiver 176. The display processor 166 includes a display internal clock 167. The display memory 169 includes a user display profile 170. The user display profile 170 includes a unit ID data 115, a user photographic image data 171, a user position data 172, a user current cognitive parameter data 144, and a user name data 174.

[0028] In a preferred embodiment of the augmented reality display system 100, the measurement device 110 is in communication with the server 130 through a network connection 120. The EEG sensor 111 is electronically coupled with the ADC 112. The EEG sensor 111 is electronically coupled with the measurement transceiver 117. The motion sensor 114 is electronically coupled with the measurement transceiver 117. The

unit ID data 115 is electronically coupled with measurement transceiver 117. The server processor 134 is electronically coupled with the server internal clock 135. The server processor 134 is electronically coupled with the server transceiver 147. The server processor 134 is electronically coupled with the server memory 137. The server memory 137 is electronically coupled with the server transceiver 147.

[0029] In addition, the server 130 is in communication with the display device 160 through network connection 150. The camera 161 is electronically coupled with the display processor 166. The camera 161 is electronically coupled with the touchpad 163. The camera 161 is electronically coupled with the user interface 164. The camera 161 is electronically coupled with the display memory 169. The augmented reality display 162 is electronically coupled with the touchpad 163. The augmented reality display 162 is electronically coupled with the user interface 164. The augmented reality display 162 is electronically coupled with the display processor 166. The augmented reality display 162 is electronically coupled with the display memory 169. The touchpad 163 is electronically coupled with the user interface 164. The touchpad 163 is electronically coupled with the position sensor 165. The user interface 164 is electronically coupled with the display processor 166. The user interface 164 is electronically coupled with the display memory 169. The position sensor 165 is electronically coupled with the display processor 166. The position sensor 165 is electronically coupled with the display memory 169. The display processor 166 is electronically coupled with the display internal clock 167. The display processor 166 is electronically coupled with the display memory 169. The display processor 166 is electronically coupled with the display transceiver 176. The

display memory 169 is electronically coupled with the user display profile 170. The display memory 169 is electronically coupled with the display transceiver 176.

[0030] In operation, the augmented reality display system 100 involves three main components: the measurement device 110, the server 130, and the display device 160. The EEG sensor 111 detects brainwave signals of the user of the measurement device 110 using multiple EEG channels physically coupled to the head of the measurement device user 110. In one embodiment, there are five EEG channels physically coupled to the head of the measurement device user 110 at locations AF3, AF4, T7, T8, and Pz. The EEG sensor 111 determines an analog EEG signal from the detected brainwave signals of the user of the measurement device 110. The ADC component 112 of the EEG sensor 111 receives the analog EEG signal from the EEG sensor 111 and converts the analog EEG signal to a digital EEG signal by passing the analog EEG signal through a filter. In one embodiment, the filter is a 5^{th} order sinc filter. The EEG sensor 111 transmits the digital EEG signal to the measurement transceiver 117. The unit ID data 115 is transmitted to the measurement transceiver 117. The measurement transceiver 117 transmits the digital EEG signal and the unit ID data 115 to the server transceiver 147 through the network connection 120.

[0031] Further describing the operation, the server transceiver 147 transmits the digital EEG signal to the server processor 134. Upon receiving the digital EEG signal, the server processor 134 transmits a calculate cognitive parameter signal to the server memory 137. Upon receiving the calculate cognitive parameter signal, the server memory 137 transmits the cognitive parameter dataset 138 (see discussion of Figure 3A and 3B) to the server processor 134. The server processor 134 compares the digital EEG signal to

the cognitive parameter dataset 138 to determine a user current cognitive parameter data 144 representing a current cognitive state of the user of the measurement device 110 (see discussion of Figure 4). The server internal clock 135 of the server processor 134 generates clock cycles at a frequency of 0.1 Hertz (Hz). The user cognitive parameter data 144 is determined from the comparison of the digital EEG signal to the cognitive parameter dataset 138 at each clock cycle of the server internal clock 135. In the preferred embodiment, the user current cognitive parameter data 144 is in integer form and the integer is within a range of 0 to 100 calculated from the comparison of the digital EEG signal to the cognitive parameter dataset 138. The server processor 134 transmits the user current cognitive parameter data 144 to the server memory 137 and the server transceiver 147. The server transceiver 147 transmits the unit ID data 115 to the server memory 137. The server memory 137 stores the user current cognitive parameter data 144 and the unit ID data 115 in the user data storage unit 140. The server transceiver 147 transmits the unit ID data 115 and the user current cognitive parameter data 144 to the display transceiver 176 through the network connection 150.

[0032] Further describing the operation, the display transceiver 176 transmits the user current cognitive parameter data 144 and the unit ID data 115 to the display memory 169. The display memory 169 stores the user current cognitive parameter data 144 and the unit ID data 115 in the user display profile 170. When the measurement device 110 is brought into the viewing field of the augmented reality display 162, representing an angular range centered on a current pointing angle, the touchpad 163 is used by the user of the display device 160 to initiate the position sensor 165. In the preferred embodiment, the viewing field of the augmented reality display 160 is an angular range of 19 degrees

and the leftmost side pointing angle is 9.5 degrees less than the current pointing angle and the rightmost side pointing angle is 9.5 degrees more than the current pointing angle. Upon the position sensor 165 initiating, the position sensor 165 detects a current pointing angle from the current viewing field of the display device 160 in the center of the leftmost side pointing angle and the rightmost side pointing angle of the viewing field to determine a spatial position data 172 representing the current pointing angle of the display device 160. The position sensor 165 transmits the spatial position data 172 to the display memory 169. The display memory 169 stores the spatial position data 172 in the user display profile 170 of the display memory 169.

[0033] Further describing the operation, when the position sensor 165 of the display device 160 detects a current pointing angular range of the viewing field of the display device 160, the current pointing angular range is compared to the spatial position data 172 stored in the user display profile 170. When the spatial position data 172 of the user display profile 170 matches a pointing angle of the current pointing angular range of the viewing field of the display device 160, the display memory 169 transmits the user current cognitive parameter data 144 of the user display profile 170 to the augmented reality display 162. The augmented reality display 162 displays the user current cognitive parameter data 144 in integer form within the range of 0 to 100.

only 1 integer is enabled

[0034] In an alternative embodiment, a user of the display device 160 uses the touchpad 163 to input a threshold motion data in integer form representing an angle in degrees and a threshold time data in integer form representing a time in seconds through the user interface 164 presented in the augmented reality display 162. In one embodiment, the threshold motion data is in integer form as the integer 20 representing

the angle 20 in degrees. In one embodiment, the threshold time data is in integer form as the integer 30 representing the time 30 in seconds. The user interface 164 transmits the threshold motion data and the threshold time data to the display memory 169. The display memory 169 stores the threshold motion data and the threshold time data. The motion sensor 114 detects a current pointing angle of the of the measurement device 110 centered in the direction the measurement device is pointing to determine a user motion data 146 from the current pointing angle. In the preferred embodiment, the user motion data 146 is in integer form representing an angle in degrees. In one embodiment, the motion sensor 114 samples the user motion data 146 at a frequency of 64 Hertz (Hz).

[0035] Further describing the operation, the motion sensor 114 transmits the user motion data 146 to the measurement transceiver 117. The unit ID data 115 is transmitted to the measurement transceiver 117. The measurement transceiver 117 transmits the user motion data 146 and the unit ID data 115 to the server transceiver 147 through the network connection 120. The server transceiver 147 transmits the user motion data 146 and the unit ID data 115 to the server memory 137. The server memory 137 stores the user motion data 146 in the user data storage unit 140 when the unit ID data 115 stored in the user data storage unit 140 matches the transmitted unit ID data 115 from the server transceiver 147. The server transceiver transmits the user motion data 146 and the unit ID data 115 to the display transceiver 176 through the network connection 150. The display transceiver 176 transmits the user motion data 146 and the unit ID data 115 to the display memory 169. The display memory 137 stores the user motion data 146 in the user display profile 170 when the unit ID data 115 stored in the user display profile 140 matches the transmitted unit ID data 115 from the display transceiver 176. In one embodiment, a time

data in seconds is calculated as an integer using the display internal clock 166 in the display processor 166. When the user motion data 146 is above the threshold motion data, the time data adds seconds to its total. When the user motion data 146 is below the threshold motion data, the time data resets to zero 0 seconds. When the user motion data 146 is above the threshold motion data and the time data is above the threshold time data, the display memory 164 transmits a non-attention data 1410 to the augmented reality display 162. The augmented reality display 162 displays the non-attention data 1410 (see discussion of figure 14).

[0036] In an alternative embodiment, upon the touchpad 163 selecting the scan QR code button 1130 of the user interface 1100 (see discussion of Figure 11), the user interface 164 generates a camera initialization signal. The camera initialization signal is transmitted from the user interface 164 to the camera 161. The camera 161 receives the camera initialization signal and initializes a camera data feed. The QR code 116 is brought into the viewing field of the augmented reality display 162. The camera 161 detects the QR code 116 from the camera data feed and determines QR code data representing the QR code 116. The camera 161 transmits the QR code data to the display processor 166. The display processor 166 decodes the QR code data to generate the unit ID data 115 of the measurement device 110. The display processor transmits the unit ID data 115 to the display memory 169. The display memory 169 stores the unit ID data 115 in the user display profile 170.

[0037] Further describing the operation, upon the touchpad 163 selecting the scan classroom setup button 1040 of the user interface 1000 (see discussion of Figure 10), the user interface 164 generates a camera video initialization signal. The camera video

initialization signal is transmitted from the user interface 164 to the camera 161. The camera 161 receives the camera video initialization signal and initializes a camera video data feed. A user of the measurement device 110 is brought into the viewing field of the augmented reality display 162. The camera 161 detects a photographic image of the user of the measurement device 110 from the camera data feed and determines photographic image data representing the photographic image of the user of the measurement device 110. The camera 161 transmits the photographic image data to the display processor 166. The display processor 166 uses the photographic image data to determine an image file of arrays of integers representing the photographic image data.

[0038] Upon determining the image file, the display processor 166 transmits an initialize facial recognition signal to the display memory 169. Upon receiving the initialize facial recognition signal, the display memory 169 transmits the user photographic image data 171 of the user display profile 170 to the display processor 166. In one embodiment, the display processor 166 uses the user photographic image data 171 to determine a user image file of arrays of integers representing the user photographic image data 171. In one embodiment, android facial recognition is used to determine when the arrays of integers of the user image file matches the arrays of integers of the image file, the display processor 166 transmits a track position signal to the position sensor 165. The display processor 166 transmits the user photographic image data 171 to the display memory 169.

[0039] Upon the position sensor 165 receiving the track position signal, the position sensor 165 detects a current pointing angle from the current viewing field of the display device 160 in the center of the leftmost side pointing angle and the rightmost side

sensor is only 1 measurement. How are these 2 measurements determined

pointing angle of the viewing field to determine a spatial position data 172 representing the current pointing angle of the display device 160. The position sensor 165 transmits the spatial position data 172 to the display memory 169. The display memory 169 stores the spatial position data 172 in the user display profile 170 matching the user photographic image data 171 transmitted to the display memory 169.

[0040] Further describing the operation, when the position sensor 165 of the display device 160 detects a current pointing angular range of the viewing field of the display device 160, the current pointing angular range is compared to the spatial position data 172 stored in the user display profile 170. When the spatial position data 172 of the user display profile 170 matches a pointing angle of the current pointing angular range of the viewing field of the display device 160, the display memory 169 transmits the user current cognitive parameter data 144 of the user display profile 170 to the augmented reality display 162. The augmented reality display 162 displays the user current cognitive parameter data 144 in integer form within the range of 0 to 100.

[0041] In an alternative embodiment, when the position sensor 165 of the display device 160 detects a current pointing angular range of the viewing field of the display device 160, the current pointing angular range is compared to the spatial position data 172 stored in the user display profile 170. When the spatial position data 172 of the user display profile 170 matches a pointing angle of the current pointing angular range of the viewing field of the display device 160, the display memory 169 transmits the user current cognitive parameter data 144 to the display processor 166. The display internal clock 167 of the display processor 166 generates clock cycles at a frequency of 0.1 Hertz (Hz). At each clock cycle of the server internal clock 167, the display processor 166 reads

the integer value within a range of 0 to 100 of the user cognitive parameter data 144 to generate a bar graph data of arrays of pixel data scaled to the integer value within a range of 0 to 100 of the user cognitive parameter data 144. The display processor 166 transmits the bar graph data representing the user current cognitive parameter data 144 to the augmented reality display 162. The augmented reality display 162 displays the bar graph data representing the user current cognitive parameter data 144.

[0042] In an alternative embodiment, when the position sensor 165 of the display device 160 detects a current pointing angular range of the viewing field of the display device 160, the current pointing angular range is compared to the spatial position data 172 stored in the user display profile 170. When the spatial position data 172 of the user display profile 170 matches a pointing angle of the current pointing angular range of the viewing field of the display device 160, the display memory 169 transmits the user current cognitive parameter data 144 to the display processor 166 and to the augmented reality display 162. The display internal clock 167 of the display processor 166 generates clock cycles at a frequency of 0.1 Hertz (Hz). At each clock cycle of the server internal clock 167, the display processor 166 reads the integer value within a range of 0 to 100 of the user cognitive parameter data 144 to generate a bar graph data of arrays of pixel data scaled to the integer value within a range of 0 to 100 of the user cognitive parameter data 144. The display processor 166 transmits the bar graph data representing the user current cognitive parameter data 144 to the augmented reality display 162. The augmented reality display 162 displays the bar graph data representing the user current cognitive parameter data 144 and the user current cognitive parameter data 144 in integer form within the range of 0 to 100.

[0043] In an alternative embodiment, when the position sensor 165 of the display device 160 detects a current pointing angular range of the viewing field of the display device 160, the current pointing angular range is compared to the spatial position data 172 stored in the user display profile 170. When the spatial position data 172 of the user display profile 170 matches a pointing angle of the current pointing angular range of the viewing field of the display device 160, the display memory 169 transmits the user current cognitive parameter data 144 and the user name data 174 to the augmented reality display 162. The user name data 174 is inputted using the touchpad 163 and the enter name input field in the user interface 164 and stored in the user display profile 170 (see discussion of Figure 11). The augmented reality display 162 displays the user current cognitive parameter data 144 in integer form within the range of 0 to 100 and the user name data 174 in string form representing the name stored in the user display profile 170 with the matching spatial position data 172.

How does sensor detect range?

[0044] In an alternative embodiment, when the position sensor 165 of the display device 160 detects a current pointing angular range of the viewing field of the display device 160, the current pointing angular range is compared to the spatial position data 172 stored in the user display profile 170. When the spatial position data 172 of the user display profile 170 matches a pointing angle of the current pointing angular range of the viewing field of the display device 160, the display memory 169 transmits the user current cognitive parameter data 144 to the display processor 166 and the display memory 169 transmits the user name data 174 to the augmented reality display 162. The display internal clock 167 of the display processor 166 generates clock cycles at a frequency of 0.1 Hertz (Hz). At each clock cycle of the server internal clock 167, the

display processor 166 reads the integer value within a range of 0 to 100 of the user cognitive parameter data 144 to generate a bar graph data of arrays of pixel data scaled to the integer value within a range of 0 to 100 of the user cognitive parameter data 144. The display processor 166 transmits the bar graph data representing the user current cognitive parameter data 144 to the augmented reality display 162. The augmented reality display 162 displays the bar graph data representing the user current cognitive parameter data 144 and the user name data 174 in string form representing the name stored in the user display profile 170 with the matching spatial position data 172.

[0045] In an alternative embodiment, when the position sensor 165 of the display device 160 detects a current pointing angular range of the viewing field of the display device 160, the current pointing angular range is compared to the spatial position data 172 stored in the user display profile 170. When the spatial position data 172 of the user display profile 170 matches a pointing angle of the current pointing angular range of the viewing field of the display device 160, the display memory 169 transmits the user current cognitive parameter data 144 to the display processor 166 The display memory 169 transmits the user name data 174 and the user current cognitive parameter data 144 to the augmented reality display 162. The display internal clock 167 of the display processor 166 generates clock cycles at a frequency of 0.1 Hertz (Hz). At each clock cycle of the server internal clock 167, the display processor 166 reads the integer value within a range of 0 to 100 of the user cognitive parameter data 144 to generate a bar graph data of arrays of pixel data scaled to the integer value within a range of 0 to 100 of the user cognitive parameter data 144. The display processor 166 transmits the bar graph data representing the user current cognitive parameter data 144 to the augmented reality display 162. The

augmented reality display 162 displays the bar graph data representing the user current cognitive parameter data 144, the user current cognitive parameter data 144 in integer form within the range of 0 to 100, and the user name data 174 in string form representing the name stored in the user display profile 170 with the matching spatial position data 172. (see discussion of Figure 7).

[0046] In an alternative embodiment, the network connection 120 is a Bluetooth connection, a Wi-Fi connection, or other similar connection

[0047] In an alternative embodiment, the network connection 150 is a Bluetooth connection, a Wi-Fi connection, or other similar connection.

[0048] In an alternative embodiment, the augmented reality display system 100 further includes a computing device. The computing device includes the user interface 164 and is in communication with the display device through a network connection such as Bluetooth connection or a Wi-Fi connection.

[0049] In an alternative embodiment, the measurement device 110 is but not limited to an EMOTIV MN8. The EEG sensor 111 detects brainwave signals of the user of the measurement device 110 using multiple EEG channels physically coupled to the ears of the user. The EEG sensor 111 is positioned on two earbuds attaching to the ears of the user of the measurement device 110 with each earbud including 2 EEG channels physically coupled to the ears of the user of the measurement device 110 (further described in figure 3B).

[0050] In an alternative embodiment, the measurement device 110 is an EMOTIV Insight.

[0051] In an alternative embodiment, the server 130 is an Amazon Web Services Cloud Server.

[0052] In an alternative embodiment, the display device 160 is a Vuzix Blade® Smart Glasses.

[0053] In an alternative embodiment, the display memory 169 is a Micro SD storage slot.

[0054] In an alternative embodiment, the camera 161 is an 8-megapixel, autofocus camera.

[0055] In an alternative embodiment, the augmented reality display 162 is a full color see through DLP based display.

[0056] In an alternative embodiment, the motion sensor 114 is a 9-axis motion sensor.

[0057] In an alternative embodiment, the display processor 166 is a Quad Core ARM CPU.

[0058] Figure 2 illustrates a server memory 137 and a display memory 169 when a plurality of measurement devices 110 are in communication with the augmented reality display system 100 according to an embodiment of the present invention. The server memory 205 includes a user data storage unit database 210. The display memory 225 includes a user display profile database 230. The user data storage unit database 210 includes a user data storage unit 220 for each of the measurement devices 110 in communication with the augmented reality display system 100. The user display profile

database 230 includes a user display profile 240 for each of the measurement devices 110 in communication with the augmented reality display system 100.

[0059] In operation, a user of the display device 160 is presented the user interface 1000 in the augmented reality display 162 (see discussion of Figure 10). A user of the display device 160 uses the touchpad 163 to select one of the plurality of user profile buttons 1010 representing one of the plurality of user display profiles 240. Upon selection of one of the plurality of user profile buttons 1010, the user interface 1000 switches to the user interface 1100. A user of the display device 160 uses the touchpad 163 to select the Scan QR code button 1130. Upon selecting the Scan QR code button 1130 (see discussion of Figure 11), the user interface 164 generates a camera initialization signal. The user interface 164 transmits the camera initialization signal to the camera 161. The camera 161 receives the camera initialization signal and initializes a camera data feed. The QR code 116 is brought into the view of the camera 161. The camera 161 detects the QR code 116 from the camera data feed and determines QR code data representing the QR code 116. The camera 161 transmits the QR code data to the display processor 166. The display processor 166 decodes the QR code data to generate the unit ID data 115 of the measurement device 110. The display processor transmits the unit ID data 115 to the display memory 225. The display memory 225 stores the unit ID data 115 in the user display profile 240 associated with the selected user profile button 1010. Each of the plurality of user profile buttons 1010 is associated with a QR code 116.

[0060] Further describing the operation, after all the QR codes 116 of the plurality of measurement devices 110 have been detected and associated with a user display profile 240, a user of the display device 160 is presented the user interface 1000

in the augmented reality display 162. A user of the display device 160 uses the touchpad 163 to select the classroom setup button 1040. Upon selection of the classroom setup button 1040, the user interface 164 generates a camera video initialization signal. The camera video initialization signal is transmitted from the user interface 164 to the camera 161. The camera 161 receives the camera video initialization signal and initializes a camera video data feed. A user of one of the plurality of measurement devices 110 is brought into the viewing field of the augmented reality display 162. The camera 161 detects a photographic image of the user of one of the measurement devices 110 from the camera data feed and determines photographic image data representing the photographic image of the user of the measurement device 110. The camera 161 transmits the photographic image data to the display processor 166. The display processor 166 uses the photographic image data to determine an image file of arrays of integers representing the photographic image data.

[0061] Upon determining the image file, the display processor 166 transmits an initialize facial recognition signal to the display memory 225. The display memory 225 queries the display memory 225 for a user photographic image data 171 of one of the user display profiles 240. The display memory 225 transmits the user photographic image data 171 to the display processor 166. In one embodiment, the display processor 166 uses the user photographic image data 171 to determine a user image file of arrays of integers representing the user photographic image data 171. In one embodiment, android facial recognition is used to determine when the arrays of integers of the user image file matches the arrays of integers of the image file, the display processor 166 transmits a track position signal to the position sensor 165. The display processor 166 transmits the

user photographic image data 171 to the display memory 225. When the arrays of integers of the user image file does not match the arrays of integers of the image file, the display processor 166 queries the display memory 225 for another photographic image data 171 of a user display profile 240.

[0062] Upon the position sensor 165 receiving the track position signal, the position sensor 165 detects a current pointing angle from the current viewing field of the display device 160 in the center of the leftmost side pointing angle and the rightmost side pointing angle of the viewing field to determine a spatial position data 172 representing the current pointing angle of the display device 160. The position sensor 165 transmits the spatial position data 172 to the display memory 225. The display memory 225 stores the spatial position data 172 in the user display profile 240 matching the user photographic image data 171 transmitted to the display memory 225. Each of the users of the plurality of measurements devices 110 are associated with a spatial position data 172.

[0063] Further describing the operation, when the position sensor 165 of the display device 160 detects a current pointing angular range of the viewing field of the display device 160, the current pointing angular range is compared to the spatial position data 172 stored in one of the user display profiles 240 (See discussion of Figure 6). When the spatial position data 172 of a user display profile 240 matches a pointing angle of the current pointing angular range of the viewing field of the display device 160, the display memory 240 transmits the user current cognitive parameter data 144 of the user display profile 240 matching the spatial position data 172 of a user display profile 240 to the augmented reality display 162. The augmented reality display 162 displays the user current cognitive parameter data 144 as an integer within the range of 0 to 100.

[0064] In an alternative embodiment, the touchpad 163 is used to focus the zoom of the camera 161.

[0065] In an alternative embodiment, when the video data feed of the camera 161 does not detect photographic image data of one of the user of the plurality of measurement devices 110 from the camera data feed, the touchpad 163 generates a track position signal and transmits the track position signal to the position sensor 165.

[0066] In an alternative embodiment, the display device 160 further includes an external drive such as a universal serial bus (USB) drive for uploading the user photographic image data 172 from a computing device such as a computer, a smartphone, or a server.

[0067] Figure 3A illustrates a cognitive parameter dataset 138 according to an embodiment of the present invention. The cognitive parameter dataset 305 includes a focus cognitive parameter dataset 310, an engagement cognitive parameter dataset 320, an interest cognitive parameter dataset 330, an excitement cognitive parameter dataset 340, a stress cognitive parameter dataset 350, and a relaxation cognitive parameter dataset 360. The focus cognitive parameter dataset 310 represents a machine learning determined data transformation based on data derived from multiple experiments validated in independently peer-reviewed studies wherein subjects were induced into a focus cognitive state (verified by physical measurements such as heartbeats, blood volume flow, blood pressure, skin impedance, and eye tracking) and the EEG signals derived from the subject's measured brainwave activity were determined and recorded as the focus cognitive parameter dataset 310. The engagement cognitive parameter dataset 320 represents a machine learning determined data transformation based on data derived

from multiple experiments validated in independently peer-reviewed studies wherein subjects were induced into a engagement cognitive state (verified by physical measurements such as heartbeats, blood volume flow, blood pressure, skin impedance, and eye tracking) and the EEG signals derived from the subject's measured brainwave activity were determined and recorded as the engagement cognitive parameter dataset 320.

[0068] In addition, The interest cognitive parameter dataset 330 represents a machine learning determined data transformation based on data derived from multiple experiments validated in independently peer-reviewed studies wherein subjects were induced into a interest cognitive state (verified by physical measurements such as heartbeats, blood volume flow, blood pressure, skin impedance, and eye tracking) and the EEG signals derived from the subject's measured brainwave activity were determined and recorded as the interest cognitive parameter dataset 330. The excitement cognitive parameter dataset 340 represents a machine learning determined data transformation based on data derived from multiple experiments validated in independently peer-reviewed studies wherein subjects were induced into a excitement cognitive state (verified by physical measurements such as heartbeats, blood volume flow, blood pressure, skin impedance, and eye tracking) and the EEG signals derived from the subject's measured brainwave activity were determined and recorded as the excitement cognitive parameter dataset 340.

[0069] Additionally, The stress cognitive parameter dataset 350 represents a machine learning determined data transformation based on data derived from multiple experiments validated in independently peer-reviewed studies wherein subjects were

induced into a stress cognitive state (verified by physical measurements such as heartbeats, blood volume flow, blood pressure, skin impedance, and eye tracking) and the EEG signals derived from the subject's measured brainwave activity were determined and recorded as the stress cognitive parameter dataset 350. The relaxation cognitive parameter dataset 360 represents a machine learning determined data transformation based on data derived from multiple experiments validated in independently peer-reviewed studies wherein subjects were induced into a relaxation cognitive state (verified by physical measurements such as heartbeats, blood volume flow, blood pressure, skin impedance, and eye tracking) and the EEG signals derived from the subject's measured brainwave activity were determined and recorded as the relaxation cognitive parameter dataset 360.

[0070] In operation, once the digital EEG signal is received by the server processor 134, the server memory 137 transmits the cognitive parameter dataset 305 to the server processor 134. The server processor 134 compares the digital EEG signal to the focus cognitive parameter dataset 310 to determine a current focus cognitive parameter data 405 in integer form within a range of 0 to 100 representing the focus cognitive state of the user of the measurement device 110. The server processor 134 compares the digital EEG signal to the engagement cognitive parameter dataset 320 to determine a current engagement cognitive parameter data 410 in integer form within a range of 0 to 100 representing the engagement cognitive state of the user of the measurement device 110. The server processor 134 compares the digital EEG signal to the interest cognitive parameter dataset 330 to determine a current interest cognitive parameter data 415 in integer form within a range of 0 to 100 representing the interest

cognitive state of the user of the measurement device 110. The server processor 134 compares the digital EEG signal to the excitement cognitive parameter dataset 340 to determine a current excitement cognitive parameter data 420 in integer form within a range of 0 to 100 representing the excitement cognitive state of the user of the measurement device 110. The server processor 134 compares the digital EEG signal to the stress cognitive parameter dataset 350 to determine a current stress cognitive parameter data 425 in integer form within a range of 0 to 100 representing the stress cognitive state of the user of the measurement device 110. The server processor 134 compares the digital EEG signal to the relaxation cognitive parameter dataset 360 to determine a current relaxation cognitive parameter data 430 in integer form within a range of 0 to 100 representing the relaxation cognitive state of the user of the measurement device 110 (further discussed in figure 4).

[0071] Figure 3B illustrates a cognitive parameter dataset 138 according to an embodiment of the present invention when the measurement device is the EMOTIV MN8 (see discussion of figure 1). The cognitive parameter dataset 365 includes a focus cognitive parameter dataset 310 and a distraction cognitive parameter dataset 370.

[0072] In operation, once the digital EEG signal is received by the server processor 134, the server memory 137 transmits the cognitive parameter dataset 365 to the server processor 134. The server processor 134 compares the digital EEG signal to the focus cognitive parameter dataset 310 to determine a current focus cognitive parameter data 405 in integer form within a range of 0 to 100 representing the focus cognitive state of the user of the measurement device 110. The server processor 134 compares the digital EEG signal to the distraction cognitive parameter dataset 370 to

determine a current distraction cognitive parameter data in integer form within a range of 0 to 100 representing the distraction cognitive state of the user of the measurement device 110.

[0073] Figure 4 illustrates a user current cognitive parameter data 138 and a display memory 169 for inputting threshold cognitive parameter data according to an embodiment of the present invention. The user current cognitive parameter data 402 includes a current focus cognitive parameter data 405, a current engagement cognitive parameter data 410, a current interest cognitive parameter data 415, a current excitement cognitive parameter data 420, a current stress cognitive parameter data 425, and a current relaxation cognitive parameter data 430. The display memory 432 includes a user display profile database 230, a threshold focus cognitive parameter data 435, a threshold engagement cognitive parameter data 440, a threshold interest cognitive parameter data 445, a threshold excitement cognitive parameter data 450, a threshold stress cognitive parameter data 455, and a threshold relaxation cognitive parameter data 460.

[0074] In operation, when the server processor 134 determines the current focus cognitive parameter data 405, the current engagement cognitive parameter data 410, the current interest cognitive parameter data 415, the current excitement cognitive parameter data 420, the current cognitive parameter data 425, and the current relaxation cognitive parameter data 430 (see discussion of figure 3), the server processor 134 transmits the user current cognitive parameter data 402 to the server transceiver 147. The server transceiver 147 transmits the user current cognitive parameter data 402 and the unit ID data 115 to the display transceiver 176 through the network connection 150. The display transceiver 176 transmits the user current cognitive parameter data 402 and the unit ID

data 115 to the display memory 432. The display memory 432 stores the user current cognitive parameter data 402 in the user display profile 170 of the user display profile database 230 matching the unit ID data 115 transmitted to the display memory 432.

[0075] Further describing the operation, the touchpad 163 selects the display focus button 1205, the display engagement button 1210, the display interest button 1215, the display excitement button 1220, the display stress button 1225, and the display relaxation button 1230 in the user interface 1200 presented in the augmented reality display 162 (further described in figure 12). When the position sensor 165 of the display device 160 detects an angular position to determine a detected spatial position data matching the spatial position data 172 of the user display profile 170, the display memory 432 transmits the user current cognitive parameter data 402 to the display processor 166. The display memory 432 transmits the user name data 174 and the user current cognitive parameter data 432 to the augmented reality display 162.

[0076] Further describing the operation, the display internal clock 167 of the display processor 166 generates clock cycles at a frequency of 0.1 Hertz (Hz). At each clock cycle of the server internal clock 167, the display processor 166 reads the six integer value within a range of 0 to 100 of the current focus cognitive parameter data 405, the current engagement cognitive parameter data 410, the current interest cognitive parameter data 415, the current excitement cognitive parameter data 420, the current cognitive parameter data 425, and the current relaxation cognitive parameter data 430 to generate six bar graph data of arrays of pixel data scaled to the integer value within a range of 0 to 100 representing the current focus cognitive parameter data 405, the current engagement cognitive parameter data 410, the current interest cognitive parameter data

415, the current excitement cognitive parameter data 420, the current cognitive parameter data 425, and the current relaxation cognitive parameter data 430. The display processor 166 transmits the six bar graph data representing the user current cognitive parameter data 402 to the augmented reality display 162. The augmented reality display 162 displays the six bar graph data representing the user current cognitive parameter data 402, the user current cognitive parameter data 402 in integer form within the range of 0 to 100, and the user name data 174 in string form representing the name of the user of the measurement device 110 (see discussion of figure 8).

[0077] In an alternative embodiment, the touchpad 163 selects three of the six of the display focus button 1205, the display engagement button 1210, the display interest button 1215, the display excitement button 1220, the display stress button 1225, and the display relaxation button 1230 in the user interface 1200 presented in the augmented reality display 162 (further described in figure 12). The present embodiment represents the default display when three of the selected current cognitive parameter data of the user current cognitive parameter data 402, three bar graph data representing the three selected current cognitive parameter data of the user current cognitive parameter data 402, and the user name data 174 are displayed in the augmented reality display 162. (see discussion of figure 13).

[0078] In an alternative embodiment, a user of the display device 160 uses the touchpad 163 to select the display below threshold button 1270 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162 (see discussion of figure 12). A user of the display device 160 uses the touchpad 163 to input the threshold focus cognitive parameter data 435 in the threshold focus input field 1235,

the threshold engagement cognitive parameter data 440 in the threshold engagement input field 1240, the threshold interest cognitive parameter data 445 in the threshold interest input field 1245, the threshold excitement cognitive parameter data 450 in the threshold excitement input field 1250, the threshold stress cognitive parameter data 455 in the threshold stress input field 1255, and the threshold relaxation cognitive parameter data 460 in the threshold relaxation input field 1260. Upon inputting the threshold focus cognitive parameter data 435, the threshold engagement cognitive parameter data 440, the threshold interest cognitive parameter data 445, the threshold excitement cognitive parameter data 450, the threshold stress cognitive parameter data 455, and the threshold relaxation cognitive parameter data 460 in the user interface 1100, the user interface 164 transmits the threshold focus cognitive parameter data 435, the threshold engagement cognitive parameter data 440, the threshold interest cognitive parameter data 445, the threshold excitement cognitive parameter data 450, the threshold stress cognitive parameter data 455, and the threshold relaxation cognitive parameter data 460 to the display memory 432.

[0079] Further describing the operation, the display memory 432 stores the user the threshold focus cognitive parameter data 435, the threshold engagement cognitive parameter data 440, the threshold interest cognitive parameter data 445, the threshold excitement cognitive parameter data 450, the threshold stress cognitive parameter data 455, and the threshold relaxation cognitive parameter data 460. In the present embodiment, the threshold focus cognitive parameter data 435, the threshold engagement cognitive parameter data 440, the threshold interest cognitive parameter data 445, the threshold excitement cognitive parameter data 450, the threshold stress cognitive

parameter data 455, and the threshold relaxation cognitive parameter data 460 are in integer form as the integer 50 representing the threshold cognitive parameter data.

[0080] Further describing the operation, when one of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display is below the associated threshold cognitive parameter data, the position sensor 165 of the display device 160 detects an angular position to determine a detected spatial position data in the viewing field of the augmented reality display 162. When the spatial position data 172 of the user display profile 170 matches the detected spatial position data, the display memory 432 transmits the user current cognitive parameter data 402 to the augmented reality display 162. When the user current cognitive parameter data 402 is transmitted to the augmented reality display 162, the current cognitive parameter data of the user current cognitive parameter data 402 selected for display through the display buttons are highlighted and displayed in the augmented reality display 162 (see discussion of figure 15). The present embodiment represents the default display when three of the selected current cognitive parameter data of the user current cognitive parameter data 402, three bar graph data representing the three selected current cognitive parameter data of the user current cognitive parameter data 402, and the user name data 174 are displayed and highlighted in the augmented reality display 162 (see discussion of figure 15).

[0081] In an alternative embodiment, a user of the display device 160 uses the touchpad 163 to select the display above threshold button 1265 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162 (see discussion of figure 12). When one of the current cognitive parameter data of the user

current cognitive parameter data 402 selected for display is above the associated threshold cognitive parameter data, the position sensor 165 of the display device 160 detects an angular position to determine a detected spatial position data in the viewing field of the augmented reality display 162. When the spatial position data 172 of the user display profile 170 matches the detected spatial position data, the display memory 432 transmits the user current cognitive parameter data 402 to the augmented reality display 162. When the user current cognitive parameter data 402 is transmitted to the augmented reality display 162, the current cognitive parameter data of the user current cognitive parameter data 402 selected for display through the display buttons are highlighted and displayed in the augmented reality display 162 (see discussion of figure 15).

[0082] In an alternative embodiment, a user of the display device 160 uses the touchpad 163 to select the display below threshold button 1270 and the alerts display mode button 1275 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162 (see discussion of figure 12). When one of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display is below the associated threshold cognitive parameter data, the position sensor 165 of the display device 160 detects an angular position to determine a detected spatial position data in the viewing field of the augmented reality display 162. When the spatial position data 172 of the user display profile 170 does not match the detected spatial position data, the display memory 432 transmits the spatial position data 172 to the augmented reality display 162. The augmented reality display 162 displays a directional indicator represented as an arrow pointing in the direction of the spatial position data 172. (see discussion of figure 16).

[0083] In an alternative embodiment, a user of the display device 160 uses the touchpad 163 to select the display above threshold button 1265 and the alerts display mode button 1275 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162 (see discussion of figure 12). When one of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display is above the associated threshold cognitive parameter data, the position sensor 165 of the display device 160 detects an angular position to determine a detected spatial position data in the viewing field of the augmented reality display 162. When the spatial position data 172 of the user display profile 170 does not match the detected spatial position data, the display memory 169 transmits the spatial position data 172 to the augmented reality display 162. The augmented reality display 162 displays a directional indicator represented as an arrow pointing in the direction of the spatial position data 172. (see discussion of figure 16).

[0084] In an alternative embodiment, a plurality of spatial position data 172 is stored in each of the user display profiles 240 of the user display profile database 230 of display memory 432. A user of the display device 160 uses the touchpad 163 to select the display below threshold button 1270 and the alerts display mode button 1275 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162 (see discussion of figure 12). When a plurality of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display of a plurality of the user display profiles 230 are below the associated threshold cognitive parameter data, the position sensor 165 of the display device 160 detects a plurality of angular positions to determine a plurality of detected spatial position data in the viewing

field of the augmented reality display 162. When a plurality of spatial position data 172 of the user display profiles 230 does not match any of the plurality of detected spatial position data, the display memory 432 transmits the plurality of spatial position data 172 to the augmented reality display 162. The augmented reality display 162 displays a plurality of directional indicators represented as a plurality of arrows with each arrow pointing in the direction of one of the plurality of spatial position data 172 (see discussion of figure 17).

[0085] In an alternative embodiment, a plurality of spatial position data 172 is stored in each of the user display profiles 240 of the user display profile database 230 of display memory 432. A user of the display device 160 uses the touchpad 163 to select the display above threshold button 1265 and the alerts display mode button 1275 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162 (see discussion of figure 12). When a plurality of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display of a plurality of the user display profiles 230 are above the associated threshold cognitive parameter data, the position sensor 165 of the display device 160 detects a plurality of angular positions to determine a plurality of detected spatial position data in the viewing field of the augmented reality display 162. When a plurality of spatial position data 172 of the user display profiles 230 does not match any of the plurality of detected spatial position data, the display memory 432 transmits the plurality of spatial position data 172 to the augmented reality display 162. The augmented reality display 162 displays a plurality of directional indicators represented as a plurality of with each arrow pointing in

the direction of one of the plurality of spatial position data 172 (see discussion of figure 17).

[0086] In an alternative embodiment, a plurality of spatial position data 172 is stored in each of the user display profiles 240 of the user display profile database 230 of display memory 432. A user of the display device 160 uses the touchpad 163 to select the display below threshold button 1270 and the alerts display mode button 1275 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162 (see discussion of figure 12). When a plurality of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display of a plurality of the user display profiles 230 are below the associated threshold cognitive parameter data, the position sensor 165 of the display device 160 detects a plurality of angular positions to determine a plurality of detected spatial position data in the viewing field of the augmented reality display 162. When any of the plurality of spatial position data 172 of the user display profiles 230 matches any of the plurality of detected spatial position data, the display memory 432 transmits each of the user current cognitive parameter data 402 of the user display profiles 230 matching any of the plurality of detected spatial position data to the augmented reality display 162. When any of the plurality of spatial position data 172 of the user display profiles 230 does not match any of the plurality of detected spatial position data, the display memory 432 transmits any of the plurality of spatial position data 172 not detected to the augmented reality display 162. The augmented reality display 162 displays a plurality of directional indicators represented as a plurality of arrows pointing in the direction of each of the plurality of spatial position data 172 not detected and displays each of the user current cognitive

parameter data 402 of the user display profiles 230 matching any of the plurality of detected spatial position data (see discussion of figure 18).

[0087] In an alternative embodiment, a plurality of spatial position data 172 is stored in each of the user display profiles 240 of the user display profile database 230 of display memory 432. A user of the display device 160 uses the touchpad 163 to select the display above threshold button 1265 and the alerts display mode button 1275 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162 (see discussion of figure 12). When the plurality of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display of a plurality of the user display profiles 230 are above the associated threshold cognitive parameter data, the position sensor 165 of the display device 160 detects a plurality of angular positions to determine a plurality of detected spatial position data in the viewing field of the augmented reality display 162. When any of the plurality of spatial position data 172 of the user display profiles 230 matches any of the plurality of detected spatial position data, the display memory 432 transmits each of the user current cognitive parameter data 402 of the user display profiles 230 matching any of the plurality of detected spatial position data to the augmented reality display 162. When any of the plurality of spatial position data 172 of the user display profiles 230 does not match any of the plurality of detected spatial position data, the display memory 432 transmits any of the plurality of spatial position data 172 not detected to the augmented reality display 162. The augmented reality display 162 displays a plurality of directional indicators represented as a plurality of arrows pointing in the direction of each of the plurality of spatial position data 172 not detected and displays each of the user current cognitive

parameter data 402 of the user display profiles 230 matching any of the plurality of detected spatial position data (see discussion of figure 18).

[0088] Figure 5 illustrates a flowchart 500 of a process for associating a plurality of users of measurement device 110 with a spatial position data 172 and a user profile 240.

[0089] At the first step 503, a user of the display device 160 uses the touchpad 163 to select the create new classroom button 910. Next, at step 506, when all the user photographic image data 171 and user name data 174 are already uploaded in the display memory 225, the process proceeds to step 510. When not already uploaded, the process proceeds to step 507. At step 507 a user of the display device 160 uses the touchpad 163 to select the create student profile button 1020 and the process proceeds to step 508. At step 508, a user of the display device 160 uses the touchpad 163 to select the capture photographic image data button 1120 and the camera 161 initializes a camera data feed. The camera 161 detects a photographic image of a user of one of the measurement devices 110 and determines a photographic image data 171. The photographic image data 171 is stored in a user display profile 240 in display memory 225. Next, at step 509, a user name data 171 in string form is inputted in the enter name input field 1110 using the touchpad 163 and stored in the user display profile 240 in display memory 225 and the process proceeds to step 506.

[0090] At step 510, when all measurement devices are assigned by scanning a QR code 116, the process proceeds to step 516. At step 510, when all measurement devices are not assigned by scanning a QR codes 116, the process proceeds to step 511. At step 511, the touchpad 163 selects one of the user profile buttons 1010 and the process

proceeds to step 512. At step 512, a user of the display device 160 uses the touchpad 163 selects the Scan QR code button 1130 and the process proceeds to step 513. At step 513, the user interface 164 generates a camera initialization signal. The user interface 164 transmits the camera initialization signal to the camera 161. The camera 161 receives the camera initialization signal and initializes a camera data feed and the process proceeds to step 514. At step 514, a QR code 116 of a measurement device 110 is brought into the viewing field of the augmented reality display 162. The camera 161 detects the QR code 116 from the camera data feed and determines QR code data representing the QR code 116. The camera 161 transmits the QR code data to the display processor 166. The display processor 166 decodes the QR code data to generate the unit ID data 115 of the measurement device 110 and the process proceeds to step 515. At step 515, the display processor 166 transmits the unit ID data 115 to the display memory 225. The display memory 225 stores the unit ID data 115 in the user display profile 240 associated with the selected user profile button 1010 and the process proceeds to step 510.

[0091] At step 516, a user of the display device 160 uses the touchpad 163 to select the classroom setup button 1040 the process proceeds to step 517. At step 517, the user interface 164 generates a camera video initialization signal. The camera video initialization signal is transmitted from the user interface 164 to the camera 161. The camera 161 receives the camera video initialization signal and initializes a camera video data feed and the process proceeds to step 518. At step 518, when each user of the plurality of measurement devices 110 are identified in the data feed, the process proceeds to step 536. At step 518, when each user of the plurality of measurement devices 110 are not identified in the data feed, the process proceeds to step 519. At step 519, a user of one

of the plurality of measurement devices 110 is brought into the viewing field of the augmented reality display 162. Next, at step 520, the camera 161 detects a photographic image of the user of one of the measurement devices 110. Next, at step 521, the camera 161 determines photographic image data representing the photographic image of the user of the measurement device 110. Next, at step 522, the camera 161 transmits the photographic image data to the display processor 166. Next, at step 523, the display processor 166 uses the photographic image data to determine an image file of arrays of integers representing the photographic image data.

[0092] Next, at step 524, the display processor 166 transmits an initialize facial recognition signal to the display memory 225. The display memory 225 queries the display memory 225 for a user photographic image data 171 of one of the user display profiles 240. The display memory 225 transmits the user photographic image data 171 to the display processor 166. Next, at step 527, the display processor 166 uses the user photographic image data 171 to determine a user image file of arrays of integers representing the user photographic image data 171 and the process proceeds to step 530. At step 530, when the arrays of integers of the user image file matches the arrays of integers of the image file, the process proceeds to step 531. At step 530, when the arrays of integers of the user image file does not match the arrays of integers of the image file, the process proceeds to step 524. At step 531, the display processor 166 transmits a track position signal to the position sensor 165.

[0093] Next, at step 532, receiving the track position signal, the position sensor 165 detects an angular position of the display device 160 in relation to the orientation of the measurement device 110. Next, at step 533, the position sensor 165 determines a

spatial position data 172 from the detected angular position. Next, at step 534, the position sensor 165 transmits the spatial position data 172 to the display memory 225. Next, at step 535, the display memory 225 stores the spatial position data 172 in the user display profile 240 matching the user photographic image data 171 transmitted to the display memory 225. At step 536, a user of the display device 160 is presented with the user interface 1000 in the augmented reality display 162.

[0094] Figure 6 illustrates a flowchart 600 of a process for generating the user current cognitive parameter data 144 and determining when the user current cognitive parameter data 144 is displayed in the augmented reality display 162.

[0095] At the first step 603, a user of the display device 160 uses the touchpad 163 to select the teaching mode button 1030. Next, at step 607, the EEG sensor 111 detects brainwave signals of the user of the measurement device 110 using multiple EEG channels physically coupled to the head of the measurement device user 110. In one embodiment, there are five EEG channels physically coupled to the head of the measurement device user 110 at locations AF3, AF4, T7, T8, and Pz. Next, at step 608, the EEG sensor 111 determines an analog EEG signal from the detected brainwave signals of the user of the measurement device 110. Next, at step 609, the ADC component 112 of the EEG sensor 111 receives the analog EEG signal from the EEG sensor 111 and converts the analog EEG signal to a digital EEG signal by passing the analog EEG signal through a filter. In one embodiment, the filter is a 5^{th} order sinc filter. Next, at step 615, the EEG sensor 111 transmits the digital EEG signal to the measurement transceiver 117. The unit ID data 115 is transmitted to the measurement transceiver 117. Next, at step 617, the measurement transceiver 117 transmits the digital

EEG signal and the unit ID data 115 to the server transceiver 147 through the network connection 120.

[0096] Next, at step 620, the server transceiver 147 transmits the digital EEG signal to the server processor 134. Next, at step 624, receiving the digital EEG signal, the server processor 134 transmits a calculate cognitive parameter signal to the server memory 137. Upon receiving the calculate cognitive parameter signal, the server memory 137 transmits the cognitive parameter dataset 138 to the server processor 134. The server processor 134 compares the digital EEG signal to the cognitive parameter dataset 138 to determine a user current cognitive parameter data 144. The server internal clock 135 of the server processor 134 generates clock cycles at a frequency of 0.1 Hertz (Hz). The user cognitive parameter data 144 is determined from the comparison of the digital EEG signal to the cognitive parameter dataset 138 at each clock cycle of the server internal clock 135. In the preferred embodiment, the user current cognitive parameter data 144 is in integer form and the integer is within a range of 0 to 100 calculated from the comparison of the digital EEG signal to the cognitive parameter dataset 138. Next, at step 630, the server processor 134 transmits the user current cognitive parameter data 144 to the server transceiver 147. Next, at step 632, the server transceiver 147 transmits the unit ID data 115 and the user current cognitive parameter data 144 to the display transceiver 176 through the network connection 150.

[0097] Next, at step 635, the display transceiver 176 transmits the user current cognitive parameter data 144 and the unit ID data 115 to the display memory 225. Next, at step 640, the display memory 225 stores the user current cognitive parameter data 144 in the user display profile 240 with the same unit ID 115 stored in the user display profile

240. Next, at step 643, the position sensor 165 detects an angular position in the viewing filed of the augmented reality display 162. Next, at step 646, the position sensor determines a detected spatial position data from the detected angular position in the viewing field of the augmented reality display 162 and the process proceeds to step 650.

[0098] At step 650, when the detected spatial position data matches the spatial position data 172 stored in the user display profile 240, the process proceeds to step 654. At step 530, when the detected spatial position data does not match the spatial position data 172 stored in the user display profile 240, the process proceeds to step 660. At step 654, the display memory 240 transmits the user current cognitive parameter data 144 of the user display profile 240 matching the spatial position data 172 with the detected spatial position data to the augmented reality display 162. Next, at step 656, the augmented reality display 162 displays the user current cognitive parameter data 144 as an integer within the range of 0 to 100. At step 660, the display memory 240 does not transmit the user current cognitive parameter data 144 to the augmented reality display 162

[0099] Figure 7 illustrates a display in the augmented reality display 162 according to an embodiment of the present invention. The display image data 700 includes a user current cognitive parameter image data 710 and a user name image data 720. The user current cognitive parameter image data 710 represents the user current cognitive parameter data 144 in integer form and as a bar graph. The user name image data 710 represents the user name data 174 in string form.

[00100] In operation, the display memory 169 transmits the user name data 174 and the user current cognitive parameter data 144 to the augmented reality display 162.

The display memory 169 transmits the user current cognitive data 144 to the display processor 166. Upon the display processor 166 generating a bar graph data representing the user cognitive parameter data 144 (see discussion of figure 1), the display processor 166 transmits the bar graph data representing user current cognitive parameter data 144 to the augmented reality display 162. The augmented reality display 162 displays the display image data 700 representing the user current cognitive parameter image data 710 and the user name image data 720.

[00101] In an alternative embodiment, the user current cognitive parameter data display 710 represents the current focus cognitive parameter data 405, the current engagement cognitive parameter data 410, the current interest cognitive parameter data 415, the current excitement cognitive parameter data 420, the current stress cognitive parameter data 425, or the current relaxation cognitive parameter data 430.

[00102] Figure 8 illustrates a display in the augmented reality display 162 according to an embodiment of the present invention. The display image data 800 includes a user current cognitive parameter image data 810 and a user name image data 820. The user current cognitive parameter image data 810 represents the current focus cognitive parameter data 405, the current engagement cognitive parameter data 410, the current interest cognitive parameter data 415, the current excitement cognitive parameter data 420, the current stress cognitive parameter data 425, and the current relaxation cognitive parameter data 430 of the user current cognitive parameter data 402 as six integers and as six bar graphs. The user name image data 810 represents the user name data 174 in string form.

[00103] In operation, the display memory 432 transmits the user name data 174 and the user current cognitive parameter data 402 to the augmented reality display 162. The display memory 432 transmits the user current cognitive data 402 to the display processor 166. Upon the display processor 166 generating six bar graph data representing the current focus cognitive parameter data 405, the current engagement cognitive parameter data 410, the current interest cognitive parameter data 415, the current excitement cognitive parameter data 420, the current stress cognitive parameter data 425, and the current relaxation cognitive parameter data 430 of the user cognitive parameter data 402 (see discussion of figure 4), the display processor 166 transmits the six bar graph representing user current cognitive parameter data 402 to the augmented reality display 162. The augmented reality display 162 displays the display image data 800 representing the user current cognitive parameter image data 810 and the user name image data 820.

[00104] In an alternative embodiment, the display image data 800 is represented in a plurality of customizable colors.

[00105] Figure 9 illustrates a user interface 164 presented in the augmented reality display 162 to a user of the display device 160 according to an embodiment of the present invention. The user interface 900 is an interactive display and includes a create new classroom button 910.

[00106] In operation, a user of the display device 160 is presented the user interface 900 in the augmented reality display 162 at step 503. A user of the display device 160 uses the touchpad 163 to select the create new classroom button 910. The create new classroom button 910 is a visual representation of data representing a

command for the process to switch from user interface 900 to user interface 1000. Upon selecting the create new classroom button 910, the user interface 900 switches to user interface 1000 in the augmented reality display 162 to proceed from step 503 to step 506.

[00107] Figure 10 illustrates a user interface 164 presented in the augmented reality display 162 to a user of the display device 160 according to an embodiment of the present invention. The user interface 1000 is an interactive display and includes a plurality of user profile buttons 1010, a create student profile button 1020, a teaching mode button 1030, a classroom setup button 1040 and a display control menu button 1050.

[00108] In operation, upon selection of the create new classroom button 910 (see discussion of figure 9) or the return to classroom button 1140 (see discussion of figure 11), a user of the display device 160 is presented the user interface 1000 in the augmented reality display 162. A user of the display device 160 uses the touchpad 163 to select either one of the plurality of user profile buttons 1010, the create student profile button 1020, the teaching mode button 1030, the classroom setup button 1040, or the display control menu button 1050. Each one of the plurality of user profile buttons 1010 is a visual representation of data representing a command for the process to switch from user interface 1000 to user interface 1100 at step 511. Upon selecting one of the of the user profile buttons 1010, the user interface 1000 switches to user interface 1100 in the augmented reality display 162 to proceed from step 511 to step 512. The create student profile button 1020 is a visual representation of data representing a command for the process to switch from user interface 1000 to user interface 1100 at step 507. Upon

selecting the create student profile button 1020, the user interface 1000 switches to user interface 1100 in the augmented reality display 162 to proceed from step 507 to step 508.

[00109] Further describing the operation, the teaching mode button 1030 is a visual representation of data representing a command for the process to proceed from step 603 to step 607 (see discussion of figure 6). Upon selecting the teaching mode button 1020, the position sensor 165 detects detected spatial position data and the EEG sensor 111 detects detected brainwave data of the user of the measurement device 110 (see discussion of figure 6). The classroom setup button 1040 is a visual representation of data representing a command for the process to proceed from step 516 to step 517 (see discussion of figure 5). Upon selecting the classroom setup button 1020, the user interface 164 generates a camera video initialization signal. The camera video initialization signal is transmitted from the user interface 164 to the camera 161. The camera 161 receives the camera video initialization signal and initializes a camera video data feed. The display control menu button 1050 is a visual representation of data representing a command for the process to switch from user interface 1000 to user interface 1200. Upon selecting the display control menu button 1020, the user interface 1000 switches to user interface 1200 in the augmented reality display 162.

[00110] Figure 11 illustrates a user interface 164 presented in the augmented reality display 162 to a user of the display device 160 according to an embodiment of the present invention. The user interface 1100 is an interactive display and includes an enter name input field 1110 for inputting the user name data 115 of a user display profile 170, a capture photographic image button 1120, a scan QR code button 1130, and a return to

classroom button 1140. In the preferred embodiment the enter name input field 1110 represents the name of a user of a measurement device 110 as a string.

[00111] In operation, upon selection of either one of the plurality of user profile buttons 1010 or the create student profile button 1020 (see discussion of figure 10), a user of the display device 160 is presented the user interface 1100 in the augmented reality display 162. A user of the display device 160 uses the touchpad 163 to input a name of a measurement device 110 user in the enter name input field 1110 in string format using letters on a virtual keyboard. Upon inputting the name of a measurement device user 1110 representing a user name data 174, the user interface 164 transmits the user name data 174 to the display memory 169. The display memory 169 stores the user name data 174 in the user display profile 170 represented in the user interface 1100.

[00112] Further describing the operation, a user of the display device 160 uses the touchpad 163 to select either the capture photographic image button 1120, the scan QR code button 1130, or the return to classroom button 1140. The capture photographic image button 1120 is a visual representation of data representing a command for the process to detect photographic image data at step 508 (see discussion of figure 5). Upon selecting the capture photographic image button 1120 the user interface 164 generates a camera initialization signal. The user interface 164 transmits the camera initialization signal to the camera 161. The camera 161 receives the camera initialization signal and initializes a camera data feed (see discussion of figure 5). The Scan QR code button 1130 is a visual representation of data representing a command for the process to proceed from step 512 to step 513 (see discussion of figure 5). Upon selecting the scan QR code button 1130, the user interface 164 generates a camera initialization signal. The user interface

164 transmits the camera initialization signal to the camera 161. The camera 161 receives the camera initialization signal and initializes a camera data feed (see discussion of figure 5). The return to classroom button 1140 is a visual representation of data representing a command for the process to switch from user interface 1100 to user interface 1000 at step 509 or step 515. Upon selecting the return to classroom button 1140, the user interface 1100 switches to user interface 1000 in the augmented reality display 162 to proceed from step 509 to step 506 or to proceed from step 515 to step 510.

[00113] Figure 12 illustrates a user interface 164 presented in the augmented reality display 162 to a user of the display device 160 according to an embodiment of the present invention. The user interface 1200 is an interactive display and includes a display focus button 1205, a display engagement button 1210, a display interest button 1215, a display excitement button 1220, a display stress button 1225, a display relaxation button 1230, a threshold focus input field 1235 for inputting the threshold focus cognitive parameter data 435, a threshold engagement input field 1240 for inputting the threshold engagement cognitive parameter data 440, a threshold interest input field 1245 for inputting the threshold interest cognitive parameter data 445, a threshold excitement input field 1250 for inputting the threshold excitement cognitive parameter data 450, a threshold stress input field 1255 for inputting the threshold stress cognitive parameter data 455, a threshold relaxation input field 1260 for inputting the threshold relaxation cognitive parameter data 460, a display above threshold button 1265, a display below threshold button 1270, and an alerts display mode button 1275. In the preferred embodiment the enter threshold input fields represent the threshold cognitive parameter data of display memory 432 as integers (see discussion of figure 4).

[00114] In operation, upon selection of the display control menu button 1050 (see discussion of figure 10), a user of the display device 160 is presented the user interface 1200 in the augmented reality display 162. A user of the display device 160 uses the touchpad 163 to select either the display focus button 1205, the display engagement button 1210, the display interest button 1215, the display excitement button 1220, the display stress button 1225, or the display relaxation button 1230. The display focus button 1205 is a visual representation of data representing a command for the process to display current focus cognitive parameter data 405 in the augmented reality display 162. Upon selecting the display focus button 1205, when the user current cognitive parameter data 402 is transmitted to the augmented reality display 162, the current focus cognitive parameter data 405 is displayed in the augmented reality display 162. When the display focus button 1205 is not selected, the current focus cognitive parameter data 405 is not displayed in the augmented reality display 162. The display engagement button 1210 is a visual representation of data representing a command for the process to display current engagement cognitive parameter data 410 in the augmented reality display 162. Upon selecting the display engagement button 1210, when the user current cognitive parameter data 402 is transmitted to the augmented reality display 162, the current engagement cognitive parameter data 410 is displayed in the augmented reality display 162. When the display engagement button 1210 is not selected, the current engagement cognitive parameter data 410 is not displayed in the augmented reality display 162. The display interest button 1215 is a visual representation of data representing a command for the process to display current interest cognitive parameter data 415 in the augmented reality display 162. Upon selecting the display interest button 1215, when the user current

cognitive parameter data 402 is transmitted to the augmented reality display 162, the current interest cognitive parameter data 415 is displayed in the augmented reality display 162. When the display interest button 1215 is not selected, the current interest cognitive parameter data 415 is not displayed in the augmented reality display 162.

[00115] Further describing the operation, the display excitement button 1220 is a visual representation of data representing a command for the process to display current excitement cognitive parameter data 420 in the augmented reality display 162. Upon selecting the display excitement button 1220, when the user current cognitive parameter data 402 is transmitted to the augmented reality display 162, the current excitement cognitive parameter data 420 is displayed in the augmented reality display 162. When the display excitement button 1220 is not selected, the current excitement cognitive parameter data 420 is not displayed in the augmented reality display 162. The display stress button 1225 is a visual representation of data representing a command for the process to display current stress cognitive parameter data 425 in the augmented reality display 162. Upon selecting the display stress button 1225, when the user current cognitive parameter data 402 is transmitted to the augmented reality display 162, the current stress cognitive parameter data 425 is displayed in the augmented reality display 162. When the display stress button 1225 is not selected, the current stress cognitive parameter data 425 is not displayed in the augmented reality display 162. The display relaxation button 1230 is a visual representation of data representing a command for the process to display current relaxation cognitive parameter data 430 in the augmented reality display 162. Upon selecting the display relaxation button 1230, when the user current cognitive parameter data 402 is transmitted to the augmented reality display 162,

the current relaxation cognitive parameter data 430 is displayed in the augmented reality display 162. When the display relaxation button 1230 is not selected, the current relaxation cognitive parameter data 430 is not displayed in the augmented reality display 162.

[00116] Further describing the operation, a user of the display device 160 uses the touchpad 163 to input the threshold focus cognitive parameter data 435 in the threshold focus input field 1235, the threshold engagement cognitive parameter data 440 in the threshold engagement input field 1240, the threshold interest cognitive parameter data 445 in the threshold interest input field 1245, the threshold excitement cognitive parameter data 450 in the threshold excitement input field 1250, the threshold stress cognitive parameter data 455 in the threshold stress input field 1255, and the threshold relaxation cognitive parameter data 460 in the threshold relaxation input field 1260. Upon inputting the threshold focus cognitive parameter data 435, the threshold engagement cognitive parameter data 440, the threshold interest cognitive parameter data 445, the threshold excitement cognitive parameter data 450, the threshold stress cognitive parameter data 455, and the threshold relaxation cognitive parameter data 460 in the user interface 1100, the user interface 164 transmits the threshold focus cognitive parameter data 435, the threshold engagement cognitive parameter data 440, the threshold interest cognitive parameter data 445, the threshold excitement cognitive parameter data 450, the threshold stress cognitive parameter data 455, and the threshold relaxation cognitive parameter data 460 to the display memory 432. The display memory 432 stores the user the threshold focus cognitive parameter data 435, the threshold engagement cognitive parameter data 440, the threshold interest cognitive parameter data 445, the threshold

excitement cognitive parameter data 450, the threshold stress cognitive parameter data 455, and the threshold relaxation cognitive parameter data 460.

[00117] Further describing the operation, a user of the display device 160 uses the touchpad 163 to select either the display above threshold button 1265, the display below threshold button 1270, or the alerts display mode button 1275. The display above threshold button 1265 is a visual representation of data representing a command for the process to highlight any of the current cognitive parameter data of the user current cognitive parameter data 402 displayed in the augmented reality display 162 when above any of the associated threshold cognitive parameter data. Upon selecting the above threshold button 1265, when the user current cognitive parameter data 402 is transmitted to the augmented reality display 162, any of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display through the display buttons are highlighted and displayed in the augmented reality display 162. The display below threshold button 1270 is a visual representation of data representing a command for the process to highlight any of the current cognitive parameter data of the user current cognitive parameter data 402 displayed in the augmented reality display 162 when below any of the associated threshold cognitive parameter data. Upon selecting the below threshold button 1270, when the user current cognitive parameter data 402 is transmitted to the augmented reality display 162, any of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display through the display buttons are highlighted and displayed in the augmented reality display 162.

[00118] Further describing the operation, the alerts display mode button 1275 is a visual representation of data representing a command for the process to display a

directional indicator represented as an arrow pointing in the direction of a spatial position data 172. Upon selection of the alerts display mode button 1275, the alerts display mode button 1275 is coupled with either the above threshold button 1265 or the below threshold button 1270 when the above threshold button 1265 or the below threshold button 1270 is selected in the user interface 1200. When the display alerts mode button 1275 is coupled with the above threshold button 1265, any of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display is compared to the threshold cognitive parameter data associated with any of the current cognitive parameter data selected for display. When one of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display is above an associated threshold cognitive parameter data, and the position sensor does not detect a spatial position data in the augmented reality display 162 matching the spatial position data 172 stored in the user display profile, the display memory 169 transmits the spatial position data 172 to the augmented reality display 162. The augmented reality display 162 displays a directional indicator represented as an arrow pointing in the direction of the spatial position data 172.

[00119] Further describing the operation, when the display alerts mode button 1275 is also selected with the below threshold button 1270, any of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display is compared to the threshold cognitive parameter data associated with any of the current cognitive parameter data selected for display. When one of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display is below an associated threshold cognitive parameter data, and the position sensor does not

detect a spatial position data in the augmented reality display 162 matching the spatial position data 172 stored in the user display profile, the display memory 169 transmits the spatial position data 172 to the augmented reality display 162. The augmented reality display 162 displays a directional indicator represented as an arrow pointing in the direction of the spatial position data 172.

[00120] Figure 13 illustrates an augmented reality display 162 of the display device 160 according to an embodiment of the present invention. The augmented reality display 1300 includes a display image data 1310. In the present embodiment, the display image data 1310 represents three of the selected current focus cognitive parameter data 405, the current engagement cognitive parameter data 410, the current interest cognitive parameter data 415, the current excitement cognitive parameter data 420, the current stress cognitive parameter data 425, or the current relaxation cognitive parameter data 430 of the user current cognitive parameter data 402 as three integers and as three bar graphs and the user name data 174 in string form.

[00121] In operation, the touchpad 163 selects three of the six of the display focus button 1205, the display engagement button 1210, the display interest button 1215, the display excitement button 1220, the display stress button 1225, and the display relaxation button 1230 in the user interface 1200 presented in the augmented reality display 162 (further described in figure 12). The display memory 432 transmits the user name data 174 and the user current cognitive parameter data 402 to the augmented reality display 162. The display memory 432 transmits the user current cognitive data 402 to the display processor 166. Upon the display processor 166 generating six bar graph data representing the current focus cognitive parameter data 405, the current engagement cognitive

parameter data 410, the current interest cognitive parameter data 415, the current excitement cognitive parameter data 420, the current stress cognitive parameter data 425, and the current relaxation cognitive parameter data 430 of the user cognitive parameter data 402 (see discussion of figure 4), the display processor 166 transmits the six bar graph representing user current cognitive parameter data 402 to the augmented reality display 162. The augmented reality display 1300 displays the display image data 1300 representing the three selected current cognitive parameter data of user current cognitive parameter data 402 as three integers and three bar graph data, and the user name data 172 as a string.

[00122] Figure 14 illustrates an augmented reality display 162 of the display device 160 according to an embodiment of the present invention. The augmented reality display 1400 includes a non-attention data 1410. In the present embodiment, the non-attention data 1410 is in string format.

[00123] In operation, a time data in seconds is calculated as an integer using the display internal clock 166 in the display processor 166. When the user motion data 146 is above the threshold motion data, the time data adds seconds to its total (see discussion of Figure 1). When the user motion data 146 is below the threshold motion data, the time data resets to zero 0 seconds. When the user motion data 146 is above the threshold motion data and the time data is above the threshold time data, the display memory 164 transmits a non-attention data 1410 to the augmented reality display 162. The augmented reality display 1400 displays the non-attention data 1410.

[00124] Figure 15 illustrates an augmented reality display 162 of the display device 160 according to an embodiment of the present invention. The augmented reality

display 1500 includes a display highlighted image data 1510 and display non-highlighted data 1520. In the present embodiment, the display highlighted image data 1510 represents three selected current cognitive parameter data of the user current cognitive parameter data 402 when at least one of the selected current cognitive parameter data is above or below the associated threshold cognitive parameter data. The display highlighted image data 1510 is displayed as three integers, three bar graphs and the user name data 174 in string form. In the present embodiment, the display non-highlighted image data 1520 represents the selected current cognitive parameter data of the user current cognitive parameter data 402 when none of the selected current cognitive parameter data is above or below the associated threshold cognitive parameter data. The display non-highlighted image data 1520 is not highlighted in the augmented reality display 1500.

[00125] In operation, a user of the display device 160 uses the touchpad 163 to select the display below threshold button 1265 and the alerts display mode button 1275 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162 (see discussion of figure 12). When one of the current cognitive parameter data of the user current cognitive parameter data 402 of a user display profile 240 selected for display is below the associated threshold cognitive parameter data, the position sensor 165 of the display device 160 detects two angular positions to determine two detected spatial position data in the viewing field of the augmented reality display 162. When the two spatial position data 172 of the user display profiles 240 matches the two detected spatial position data, the display memory 432 transmits the user current cognitive parameter data 402 of both the user display profiles 240 to the augmented reality display 162. The display highlighted image data 1510 representing the user current

cognitive parameter data 402 below the threshold is highlighted in the augmented reality display 1500. The display non-highlighted image data 1520 representing the user current cognitive parameter data 402 not below the threshold is not highlighted in the augmented reality display 1500.

[00126] In an alternative embodiment, a user of the display device 160 uses the touchpad 163 to select the display above threshold button 1270 and the alerts display mode button 1275 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162.

[00127] Figure 16 illustrates an augmented reality display 162 of the display device 160 according to an embodiment of the present invention. The augmented reality display 1600 includes a directional indicator 1610 represented as an arrow.

[00128] In operation, a user of the display device 160 uses the touchpad 163 to select the display below threshold button 1265 and the alerts display mode button 1275 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162 (see discussion of figure 12). When one of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display is below the associated threshold cognitive parameter data, the position sensor 165 of the display device 160 detects a current pointing angular range of the viewing field of the display device 160, the current pointing angular range is compared to the spatial position data 172 stored in the user display profile 170. When the spatial position data 172 of the user display profile 170 does not match a pointing angle of the current pointing angular range of the viewing field of the display device 160, the display memory 432 transmits the spatial position data 172 to the augmented reality display 162. The augmented reality

display 1600 determines the direction to point a directional indicator 1610 by comparing the spatial position data 172 to the current pointing angular range of the viewing field of the display device 160. The augmented reality display 1600 displays the directional indicator 1610 represented as an arrow pointing in the direction of the spatial position data 172.

[00129] In an alternative embodiment, a user of the display device 160 uses the touchpad 163 to select the display above threshold button 1270 and the alerts display mode button 1275 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162.

[00130] Figure 17 illustrates an augmented reality display 162 of the display device 160 according to an embodiment of the present invention. The augmented reality display 1700 includes a plurality of directional indicator 1710 represented as arrows.

[00131] In operation, a plurality of spatial position data 172 is stored in each of the user display profiles 240 of the user display profile database 230 of display memory 432. A user of the display device 160 uses the touchpad 163 to select the display below threshold button 1265 and the alerts display mode button 1275 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162 (see discussion of figure 12). When a plurality of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display of a plurality of the user display profiles 230 are below the associated threshold cognitive parameter data, the position sensor 165 of the display device 160 detects a current pointing angular range of the viewing field of the display device 160, the current pointing angular range is compared to the spatial position data 172 stored in the user display profiles 230. When a

plurality of spatial position data 172 of the user display profiles 230 does not match a pointing angle of the current pointing angular range of the viewing field of the display device 160, the display memory 432 transmits the plurality of spatial position data 172 to the augmented reality display 162. The augmented reality display 1600 determines the direction to point each plurality of directional indicators 1610 by comparing the spatial position data 172 of the user display profiles 230 to the current pointing angular range of the viewing field of the display device 160. The augmented reality display 1700 displays a plurality of directional indicators 1710 represented as a plurality of arrows with each arrow pointing in the direction of one of the plurality of spatial position data 172.

[00132] In an alternative embodiment, a user of the display device 160 uses the touchpad 163 to select the display above threshold button 1270 and the alerts display mode button 1275 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162.

[00133] Figure 18 illustrates an augmented reality display 162 of the display device 160 according to an embodiment of the present invention. The augmented reality display 1800 includes a plurality of directional indicators 1810 represented as arrows, a plurality of display highlighted image data 1820, and a plurality of display non-highlighted image data 1830. In the present embodiment, the plurality of display highlighted image data 1820 represents three selected current cognitive parameter data of a user current cognitive parameter data 402 when at least one of the selected current cognitive parameter data is above or below the associated threshold cognitive parameter data. The plurality of display highlighted image data 1820 are displayed as three integers, three bar graphs and the user name data 174 in string form. In the present embodiment,

the plurality of display non-highlighted image data 1830 represents the selected current cognitive parameter data of a user current cognitive parameter data 402 when none of the selected current cognitive parameter data is above or below the associated threshold cognitive parameter data. The plurality of display non-highlighted image data 1830 is not highlighted in the augmented reality display 1800.

[00134] In operation, a user of the display device 160 uses the touchpad 163 to select the display below threshold button 1265 and the alerts display mode button 1275 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162 (see discussion of figure 12). When a plurality of the current cognitive parameter data of the user current cognitive parameter data 402 selected for display of a plurality of the user display profiles 230 are below the associated threshold cognitive parameter data, the position sensor 165 of the display device 160 detects a current pointing angular range of the viewing field of the display device 160, the current pointing angular range is compared to the spatial position data 172 stored in the user display profiles 230. When a plurality of spatial position data 172 of the user display profiles 230 does not match a pointing angle of the current pointing angular range of the viewing field of the display device 160, the display memory 432 transmits the plurality of spatial position data 172 to the augmented reality display 162. The augmented reality display 1600 determines the direction to point each plurality of directional indicators 1610 by comparing the spatial position data 172 of the user display profiles 230 to the current pointing angular range of the viewing field of the display device 160. When any plurality of spatial position data 172 of the user display profiles 230 matches a pointing angle of the current pointing angular range of the viewing field of the display device 160, the

display memory 432 transmits each of the user current cognitive parameter data 402 of the user display profiles 230 matching any of the plurality of detected spatial position data to the augmented reality display 162.

[00135] Further describing the operation, the augmented reality display 1800 displays a plurality of directional indicators 1810 represented as a plurality of arrows with each arrow pointing in the direction of one of the plurality of spatial position data 172. The plurality of display highlighted image data 1820 representing the user current cognitive parameter data 402 below the threshold are highlighted in the augmented reality display 1800. The plurality of display non-highlighted image data 1830 representing the user current cognitive parameter data 402 not below the threshold is not highlighted in the augmented reality display 1800.

[00136] In an alternative embodiment, a user of the display device 160 uses the touchpad 163 to select the display above threshold button 1270 and the alerts display mode button 1275 in the user interface 1200 presented to a user of the display device 160 in the augmented reality display 162.

[00137] Existing augmented reality display systems are not able to track angular position data to associate cognitive outputs of measurement devices with a location in a viewing field of an augmented reality display. Existing augmented reality display systems are also not able to display the cognitive outputs when the location of the measurement device is in the viewing field of the augmented reality display. The present invention of an augmented reality display system and methods for displaying cognitive parameters is used in a classroom setting wherein students are the users of the measurement devices

and the teach is the user of the display device to track student cognitive parameters during class.

[00138] While particular elements, embodiments, and applications of the present invention have been shown and described, it is understood that the invention is not limited thereto because modifications may be made by those skilled in the art, particularly in light of the foregoing teaching. It is therefore contemplated by the appended claims to cover such modifications and incorporate those features which come within the spirit and scope of the invention.

You can add more specifics about how the invention would be great in this environment. This is your opportunity to "sell"

Good Job!
I can see improvement from claim
- see office action for more comments

CLAIMS

1. A system comprising:

a measurement device including an electroencephalogram (EEG) sensor, wherein said EEG sensor detects brainwave signals of a user of said measurement device to determine an EEG signal, wherein said measurement device transmits said EEG signal;

a server including a server processor and a memory storing a cognitive parameter dataset, wherein said server receives said EEG signal from said measurement device, wherein said server processor compares said EEG signal to said cognitive parameter dataset to determine a current cognitive parameter data representing a cognitive state of said user of said measurement device, wherein said server transmits said current cognitive parameter data; and

a display device including an augmented reality display, a position sensor, and a memory storing a spatial position data, wherein said display device receives said current cognitive parameter data from said server, wherein said position sensor detects an angular position of said display device in a viewing field of said augmented reality display, representing an angular range centered on a current pointing angle of the display device, to determine a detected spatial position data, wherein said current cognitive parameter data is displayed using said augmented reality display when said spatial position data matches said detected spatial position data.

2. The system of claim 1, wherein said current cognitive parameter data is an integer.

3. The system of claim 1, wherein said current cognitive parameter data is a bar graph.

4. The system of claim 1, further including a plurality of measurement devices and a user of each said plurality of measurement devices.

5. The system of claim 1, said server further including a plurality of cognitive parameter datasets, wherein a plurality of current cognitive parameter data is determined from comparing said EEG signal to each said plurality of cognitive parameter datasets.

6. The system of claim 1, wherein said measurement device further includes a motion sensor, wherein said motion sensor detects an angular position of a user of said measurement device to determine a motion data representing an angle in degrees.

7. The system of claim 1, further including a plurality of measurement devices and a user of each said plurality of measurement devices, wherein said display device further includes a database, wherein said database includes a plurality of display profiles, wherein each of said plurality display profiles stores a spatial position data and a current cognitive parameter data for a measurement device of the said plurality of measurement devices.

8. A method comprising:

detecting a quick response (QR) code of a measurement device using a camera of a display device;

determining a QR code data from said QR code;

decoding said QR code data into a unit identification (ID) data of said measurement device using a display processor of said display device;

storing said unit ID data in a display profile stored in a memory of said display device, wherein said display profile includes said unit ID data, a first photographic image data, and a spatial position data;

detecting a detected photographic image using said camera;

determining a second photographic image data from said detected photographic image using said camera;

detecting an angular position of said display device using a position sensor of said display device when said first photographic image data matches said second photographic image data;

determining said spatial position data from said angular position using said position sensor; and

storing said spatial data in said display profile.

9. The method of claim 8, said display device further including a database, wherein said database includes a plurality of display profiles.

10. The method of claim 8, further including a plurality of measurement devices, wherein each of the plurality of measurement devices includes a QR code, wherein each of the plurality of measurement devices has a user.

11. The method of claim 8, wherein said display device further includes a touchpad, wherein said touchpad controls the zoom of the camera.

12. The method of claim 8, wherein said display device further includes a touchpad, wherein said touchpad to initialize the position sensor to detect said angular position.

13. The method of claim 8, further comprising detecting a user photographic image using said camera;

determining said first photographic image data from said user photographic image; and

storing said first photographic image in said display profile.

14. A method, comprising:

detecting brainwave signals of a user of a measurement device using an EEG sensor of said measurement device;

determining an EEG signal from said brainwave signals;

transmitting said EEG signal and a unit ID data of said measurement device using said measurement device;

receiving said EEG signal and said unit ID data using a server; wherein said server includes a server processor and a cognitive parameter dataset;

determining a current cognitive parameter data representing a cognitive state of said user of said measurement device from comparing said EEG signal to said cognitive parameter dataset using said server processor;

transmitting said current cognitive parameter data and said unit ID data using said server;

receiving said current cognitive parameter data and said unit ID data using a display device, wherein said display device includes a position sensor, an augmented reality display, and a display profile, wherein said display profile includes a stored unit ID data, a spatial position data, and a current cognitive parameter data;

storing said current cognitive parameter data in said display profile when said unit ID data matches said stored unit ID data;

detecting an angular position of said display device in a viewing field of said augmented reality display using said position sensor;

determining a detected spatial position data from said angular position using said position sensor; and

displaying said current cognitive parameter data using said augmented reality display when said spatial position data matches said detected spatial position data.

15. The method of claim 14, further comprising not displaying said current cognitive parameter data using said augmented reality display when said spatial position data does not match said detected spatial position data.

16. The method of claim 14, further comprising setting a threshold cognitive parameter value;

Displaying and highlighting said current cognitive parameter data using said augmented reality display when said spatial position data matches said detected spatial position data and said current cognitive parameter data is below said threshold cognitive parameter value.

17. The method of claim 14, further comprising setting a threshold cognitive parameter value;

Displaying and not highlighting said current cognitive parameter data using said augmented reality display when said spatial position data matches said detected spatial position data and said current cognitive parameter data is not below said threshold cognitive parameter value.

18. The method of claim 14, further comprising setting a threshold cognitive parameter value;

Displaying a directional indicator representing an arrow in the direction of said spatial position data using said augmented reality display when said spatial position data is not in the viewing field of the augmented reality display and said current cognitive parameter data is below said threshold cognitive parameter value.

19. The method of claim 14, further comprising setting a threshold cognitive parameter value;

Displaying and highlighting said current cognitive parameter data using said augmented reality display when said spatial position data matches said detected spatial position data and said current cognitive parameter data is above said threshold cognitive parameter value.

20. The method of claim 14, further comprising setting a threshold cognitive parameter value;

Displaying a directional indicator representing an arrow in the direction of said spatial position data using said augmented reality display when said spatial position data is not in the viewing field of the augmented reality display and said current cognitive parameter data is above said threshold cognitive parameter value.

ABSTRACT

A method and system is provided which for augmented reality display using a measurement device for measuring electroencephalogram (EEG) signals and transmitting and receiving the EEG signals at a server. A server processor of the server compares the EEG signals to a cognitive parameter dataset stored in the server memory to generate at least one cognitive parameter data representing a cognitive state of the user of the measurement device. The cognitive parameter data is transmitted and displayed in an augmented reality display of a display device. Another embodiment of the invention is a method for associating a measurement device user with an angular position in the augmented reality display using a position sensor of the display device. Another embodiment of the invention is a method for displaying stored cognitive parameter data when an angular position is detected in the augmented reality display of the display device using a position sensor.

Figure 1

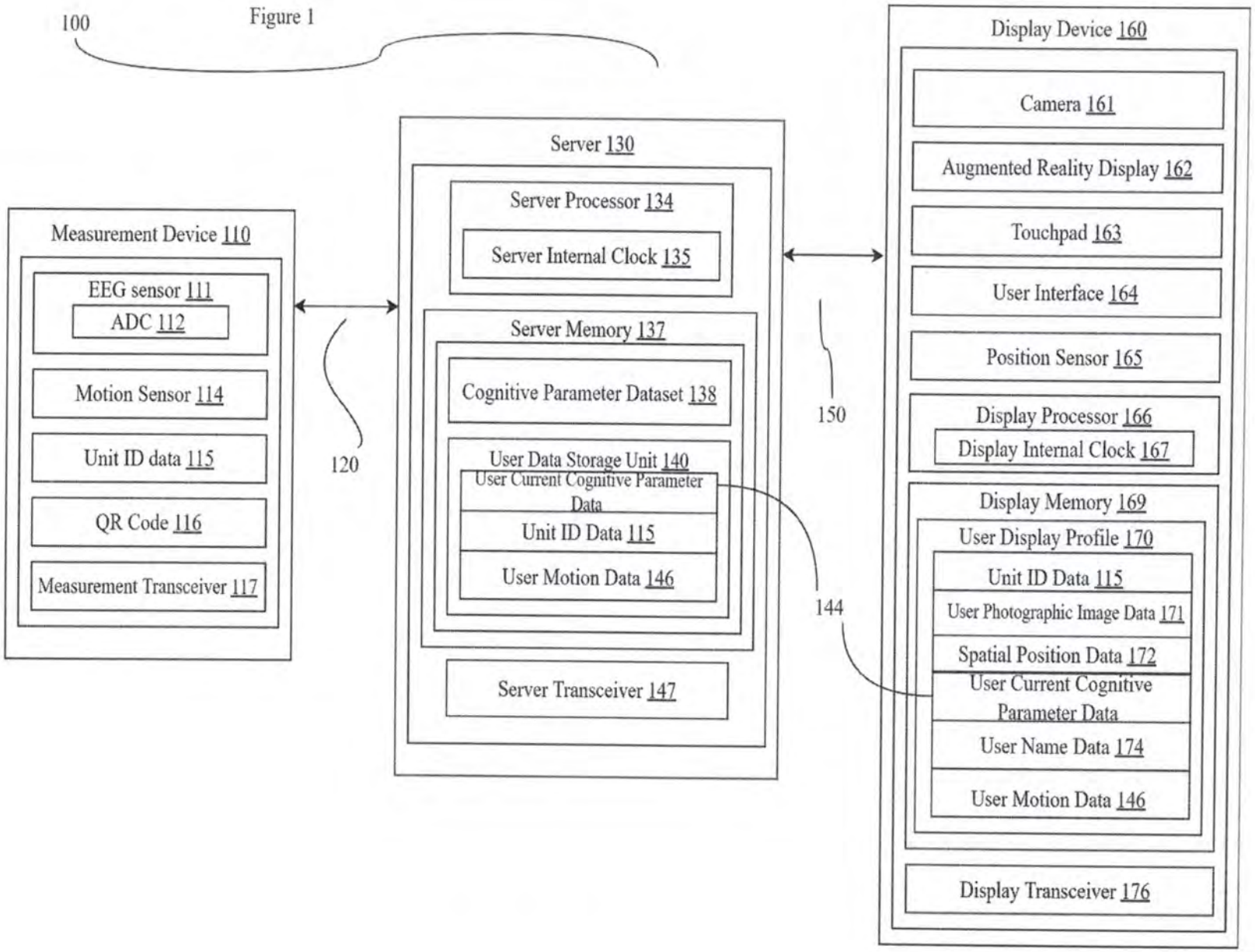

100
Measurement Device 110
EEG sensor 111
ADC 112
Motion Sensor 114
Unit ID data 115
QR Code 116
Measurement Transceiver 117
120
Server 130
Server Processor 134
Server Internal Clock 135
Server Memory 137
Cognitive Parameter Dataset 138
User Data Storage Unit 140
User Current Cognitive Parameter Data
Unit ID Data 115
User Motion Data 146
Server Transceiver 147
150
144
Display Device 160
Camera 161
Augmented Reality Display 162
Touchpad 163
User Interface 164
Position Sensor 165
Display Processor 166
Display Internal Clock 167
Display Memory 169
User Display Profile 170
Unit ID Data 115
User Photographic Image Data 171
Spatial Position Data 172
User Current Cognitive Parameter Data
User Name Data 174
User Motion Data 146
Display Transceiver 176

Figure 2

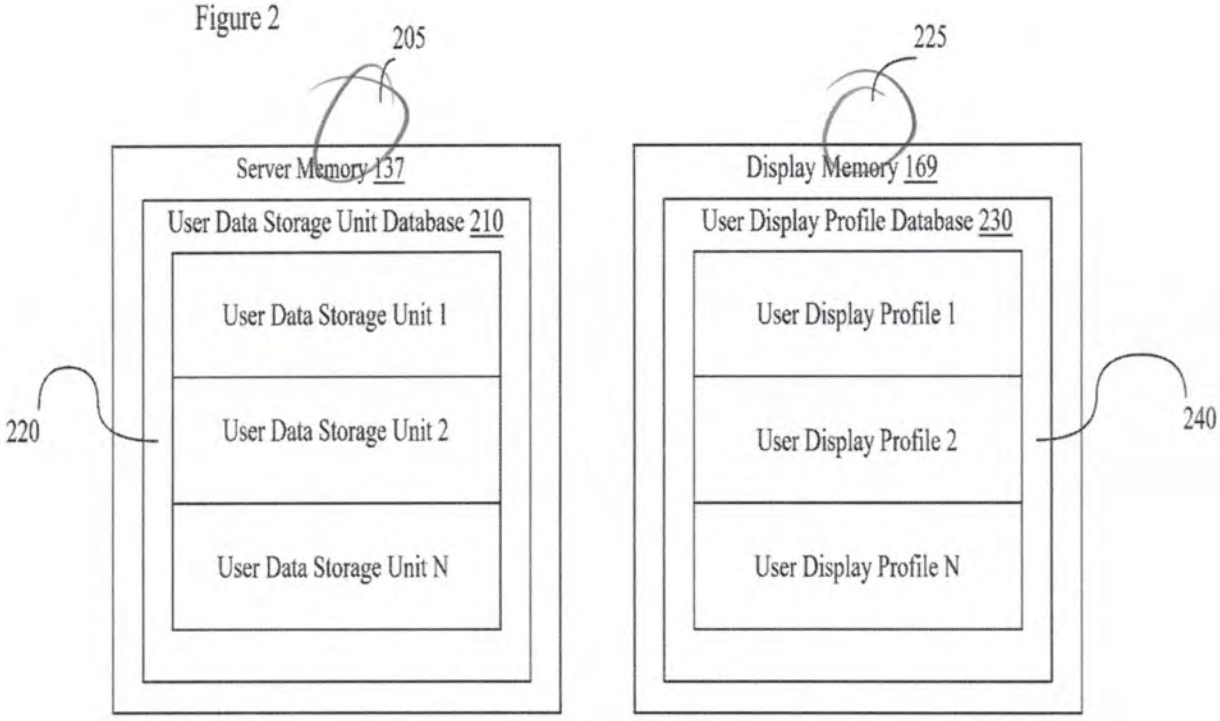

205
225
Server Memory 137
Display Memory 169
User Data Storage Unit Database 210
User Display Profile Database 230
User Data Storage Unit 1
User Data Storage Unit 2
User Data Storage Unit N
User Display Profile 1
User Display Profile 2
User Display Profile N
220
240

Figure 3A

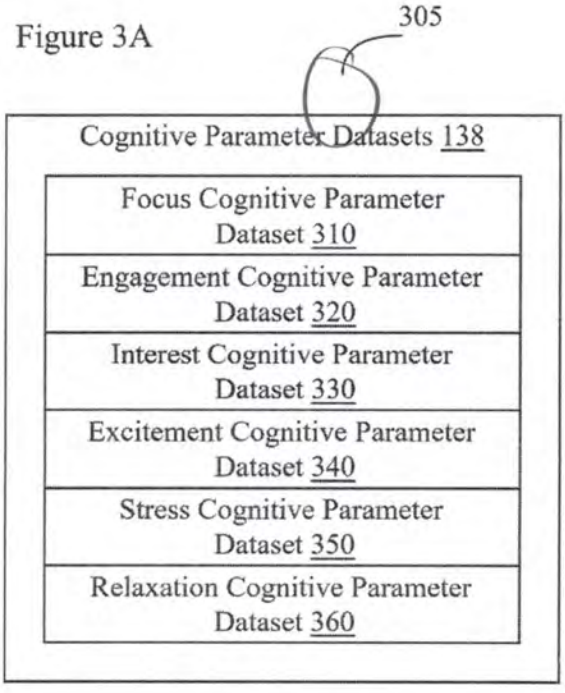


Figure 3B

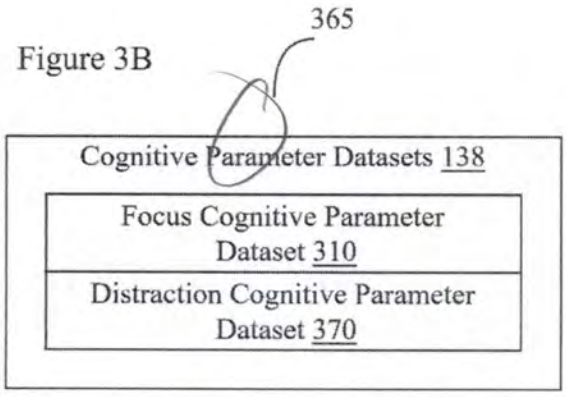
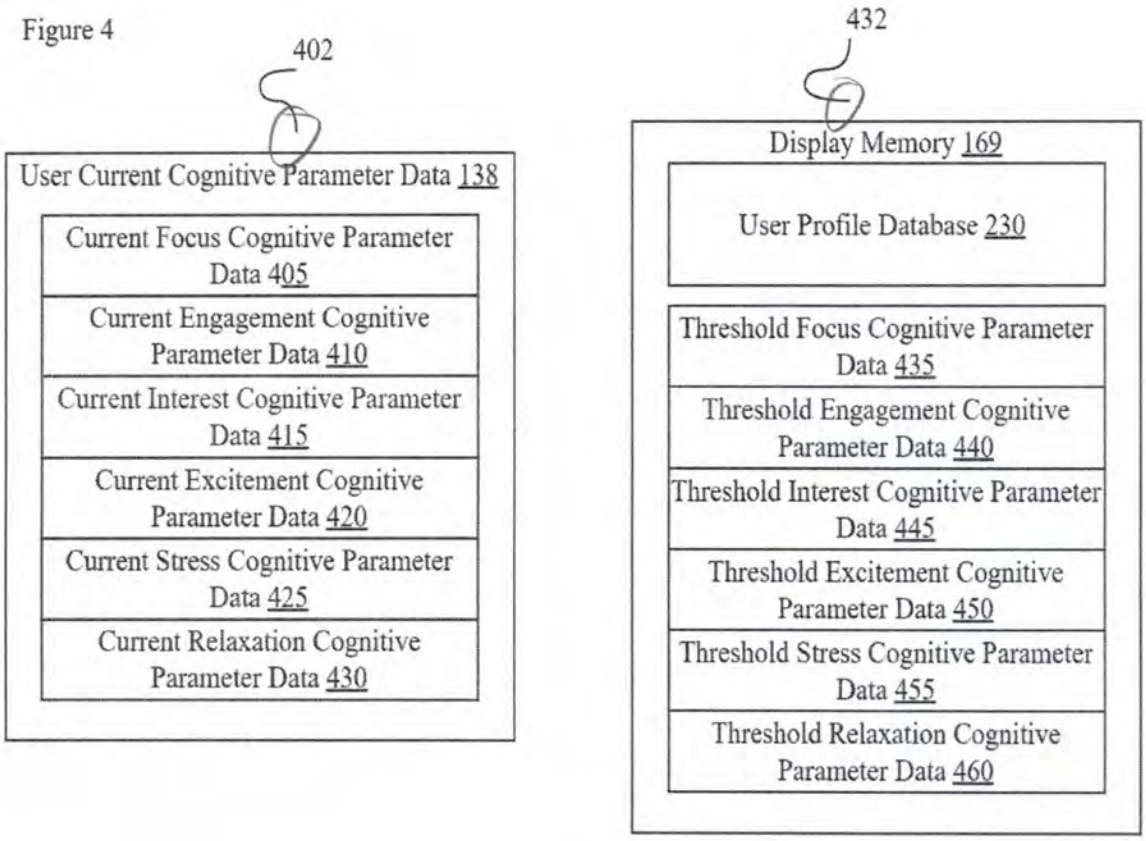


Figure 4


402
User Current Cognitive Parameter Data 138
Current Focus Cognitive Parameter Data 405
Current Engagement Cognitive Parameter Data 410
Current Interest Cognitive Parameter Data 415
Current Excitement Cognitive Parameter Data 420
Current Stress Cognitive Parameter Data 425
Current Relaxation Cognitive Parameter Data 430
432
Display Memory 169
User Profile Database 230
Threshold Focus Cognitive Parameter Data 435
Threshold Engagement Cognitive Parameter Data 440
Threshold Interest Cognitive Parameter Data 445
Threshold Excitement Cognitive Parameter Data 450
Threshold Stress Cognitive Parameter Data 455
Threshold Relaxation Cognitive Parameter Data 460

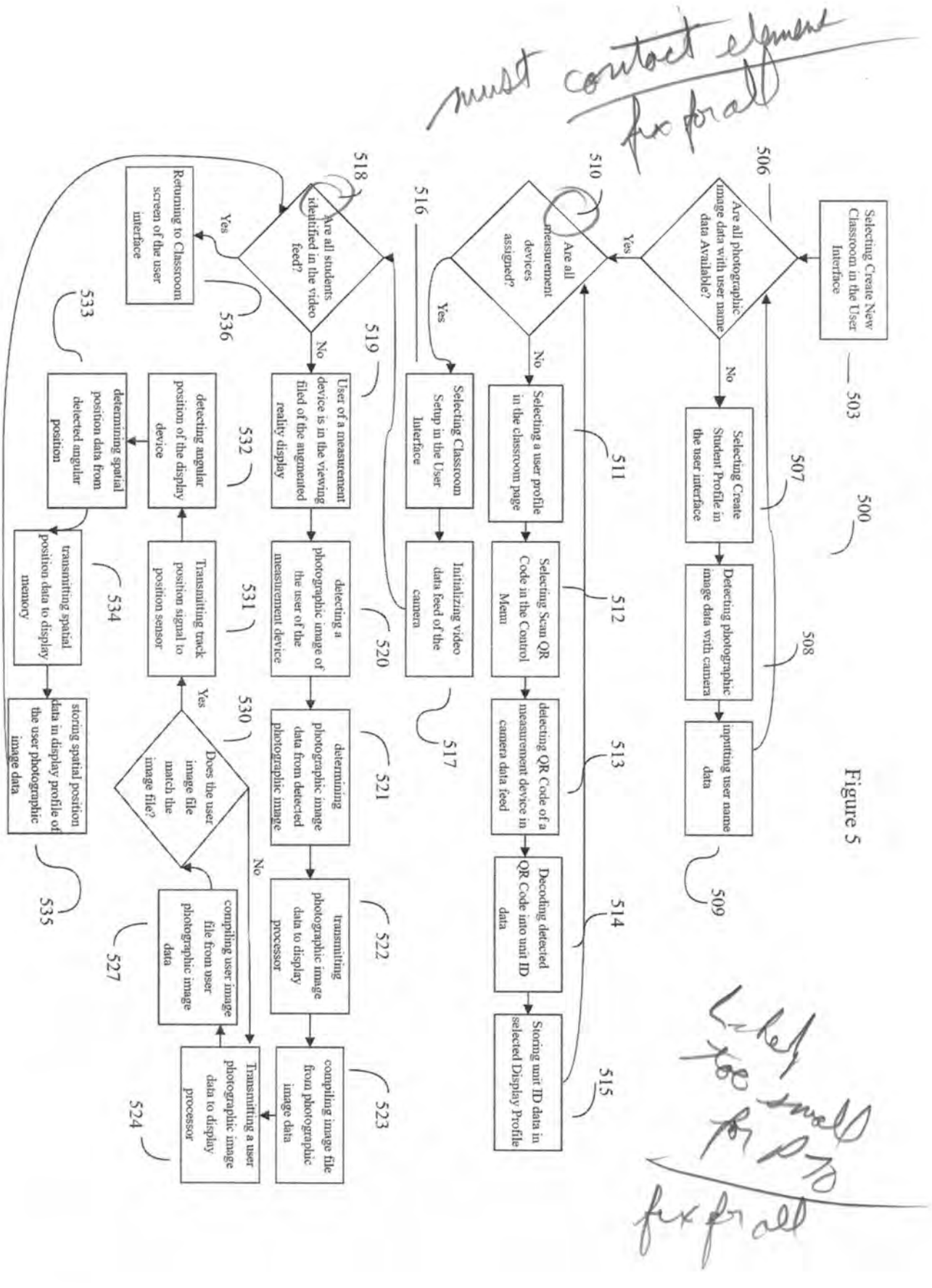

Selecting Create New Classroom in the User Interface
503
500
Are all photographic image data with user name data Available?
506
Yes
No
Selecting Create Student Profile in the user interface
507
Detecting photographic image data with camera
508
inputting user name data
509
Are all measurement devices assigned?
510
Yes
No
Selecting a user profile in the classroom page
511
Selecting Scan QR Code in the Control Menu
512
detecting QR Code of a measurement device in camera data feed
513
Decoding detected QR Code into unit ID data
514
Storing unit ID data in selected Display Profile
515
Selecting Classroom Setup in the User Interface
516
Initializing video data feed of the camera
517
Are all students identified in the video feed?
518
Yes
No
Returning to Classroom screen of the user interface
536
User of a measurement device is in the viewing filed of the augmented reality display
519
detecting a photographic image of the user of the measurement device
520
determining photographic image data from detected photographic image
521
transmitting photographic image data to display processor
522
compiling image file from photographic image data
523
Transmitting a user photographic image data to display processor
524
Does the user image file match the image file?
530
Yes
No
Transmitting track position signal to position sensor
531
detecting angular position of the display device
532
determining spatial position data from detected angular position
533
transmitting spatial position data to display memory
534
storing spatial position data in display profile of the user photographic image data
535
compiling user image file from user photographic image data
527

Figure 5

Figure 6

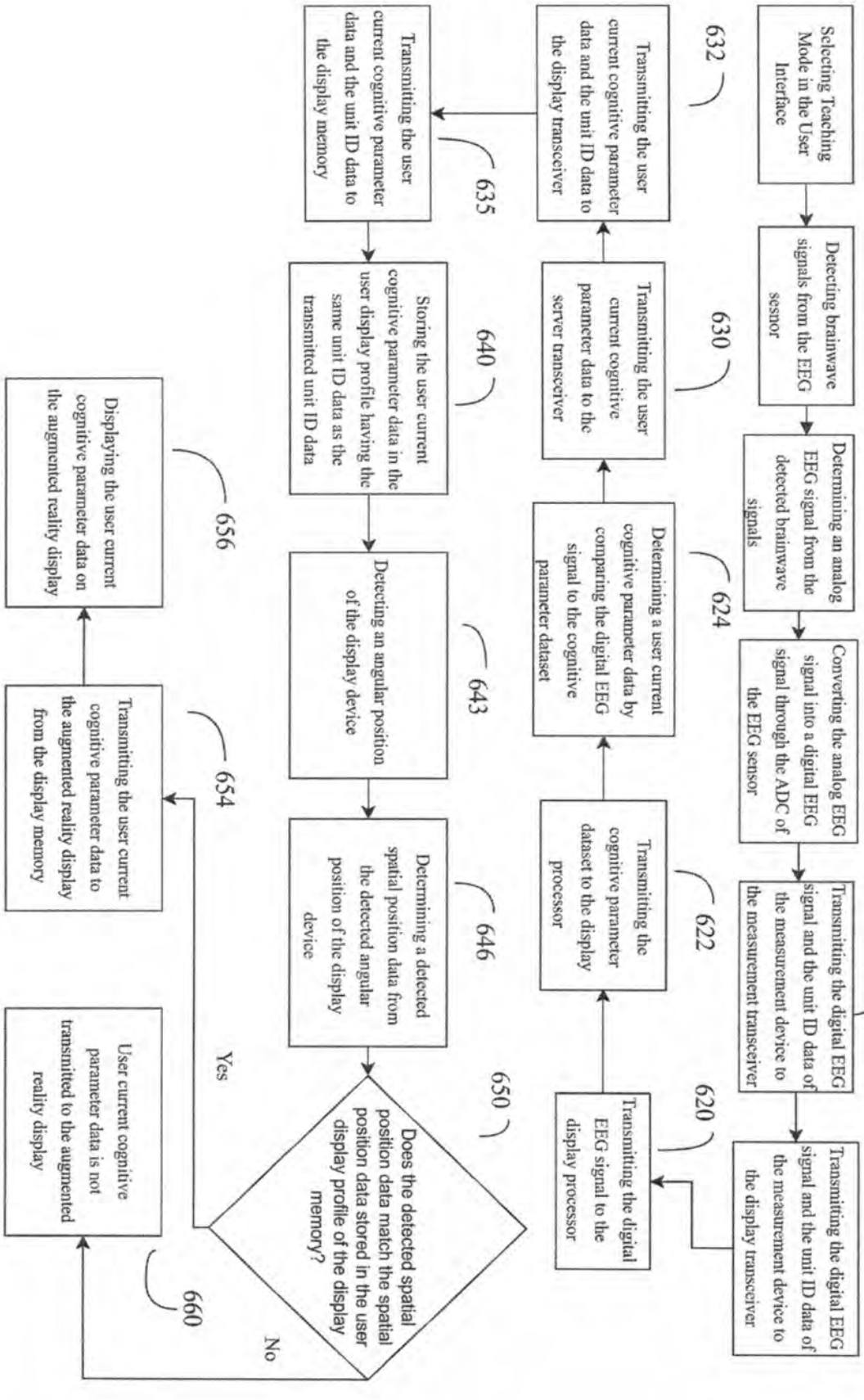

600
603
Selecting Teaching Mode in the User Interface
607
Detecting brainwave signals from the EEG sesnor
608
Determining an analog EEG signal from the detected brainwave signals
609
Converting the analog EEG signal into a digital EEG signal through the ADC of the EEG sensor
615
Transmitting the digital EEG signal and the unit ID data of the measurement device to the measurement transceiver
617
Transmitting the digital EEG signal and the unit ID data of the measurement device to the display transceiver
620
Transmitting the digital EEG signal to the display processor
622
Transmitting the cognitive parameter dataset to the display processor
624
Determining a user current cognitive parameter data by comparing the digital EEG signal to the cognitive parameter dataset
630
Transmitting the user current cognitive parameter data to the server transceiver
632
Transmitting the user current cognitive parameter data and the unit ID data to the display transceiver
635
Transmitting the user current cognitive parameter data and the unit ID data to the display memory
640
Storing the user current cognitive parameter data in the user display profile having the same unit ID data as the transmitted unit ID data
643
Detecting an angular position of the display device
646
Determining a detected spatial position data from the detected angular position of the display device
650
Does the detected spatial position data match the spatial position data stored in the user display profile of the display memory?
Yes
No
654
Transmitting the user current cognitive parameter data to the augmented reality display from the display memory
656
Displaying the user current cognitive parameter data on the augmented reality display
660
User current cognitive parameter data is not transmitted to the augmented reality display

Figure 7

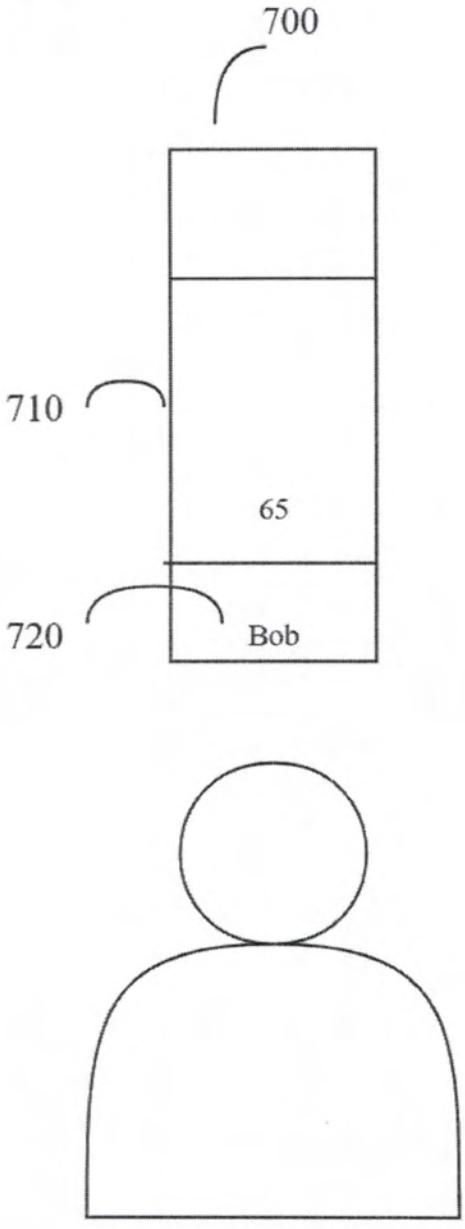


Figure 8

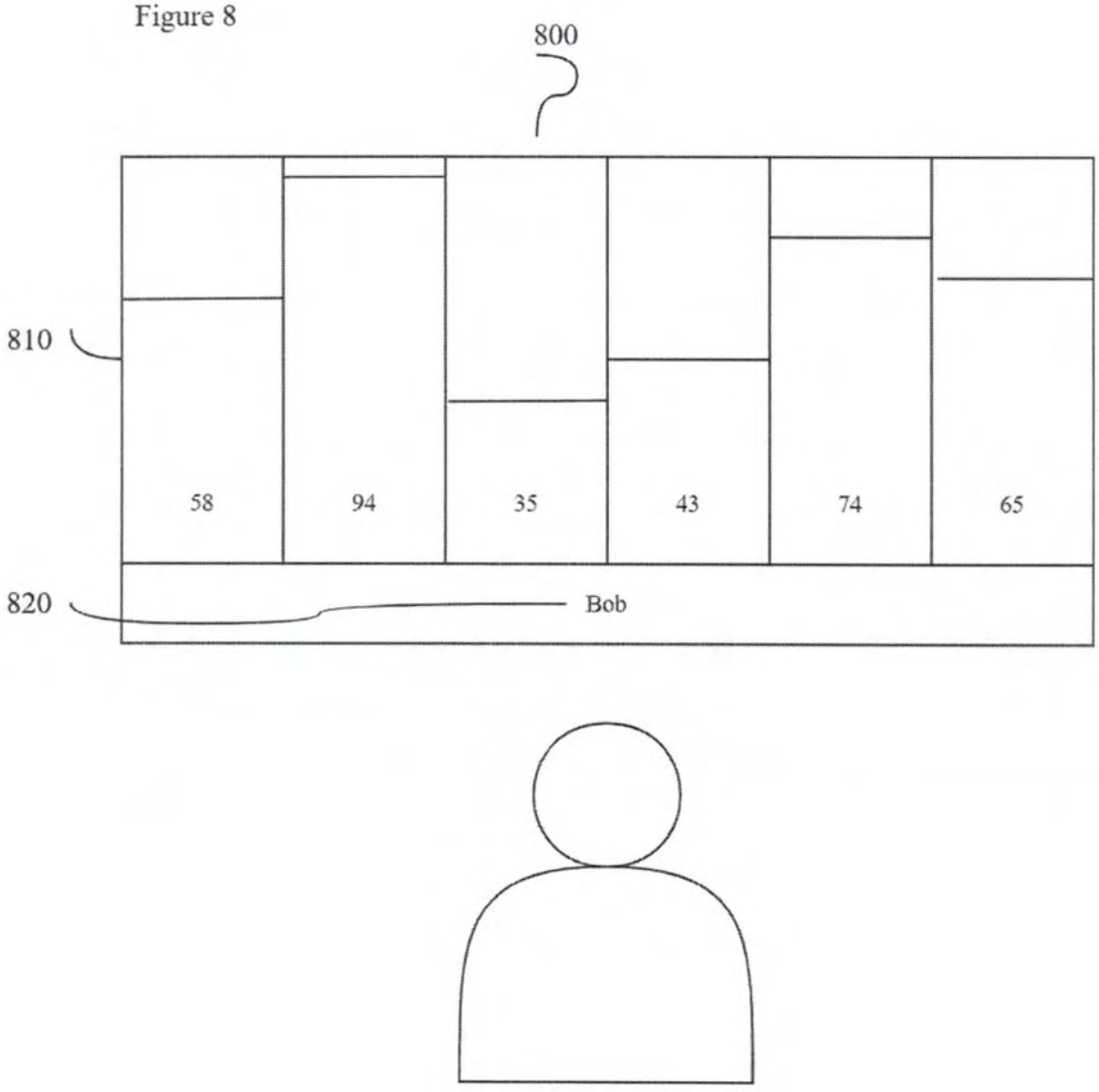


Figure 9

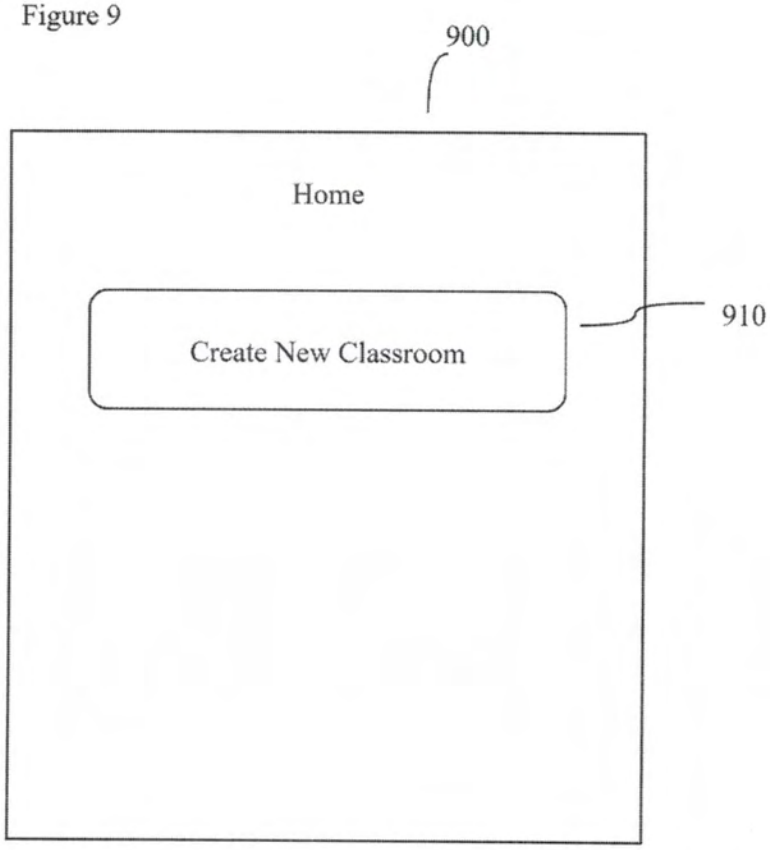


Figure 10

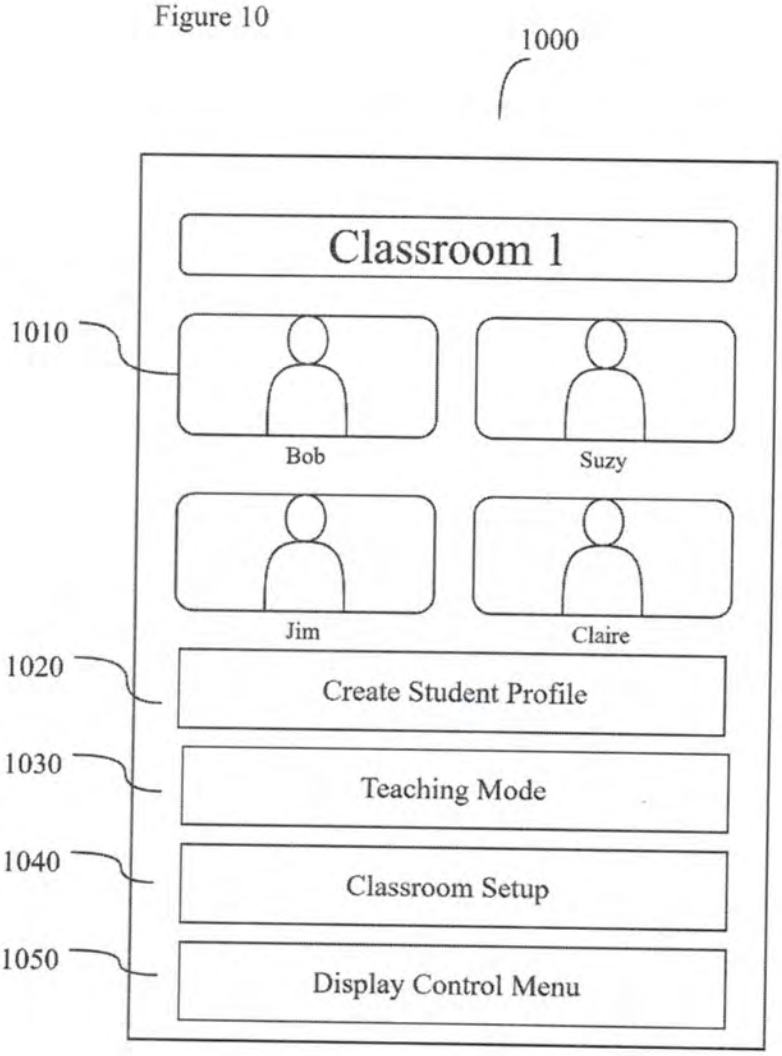

1000
Classroom 1
1010
Bob
Suzy
Jim
Claire
1020
Create Student Profile
1030
Teaching Mode
1040
Classroom Setup
1050
Display Control Menu

Figure 11

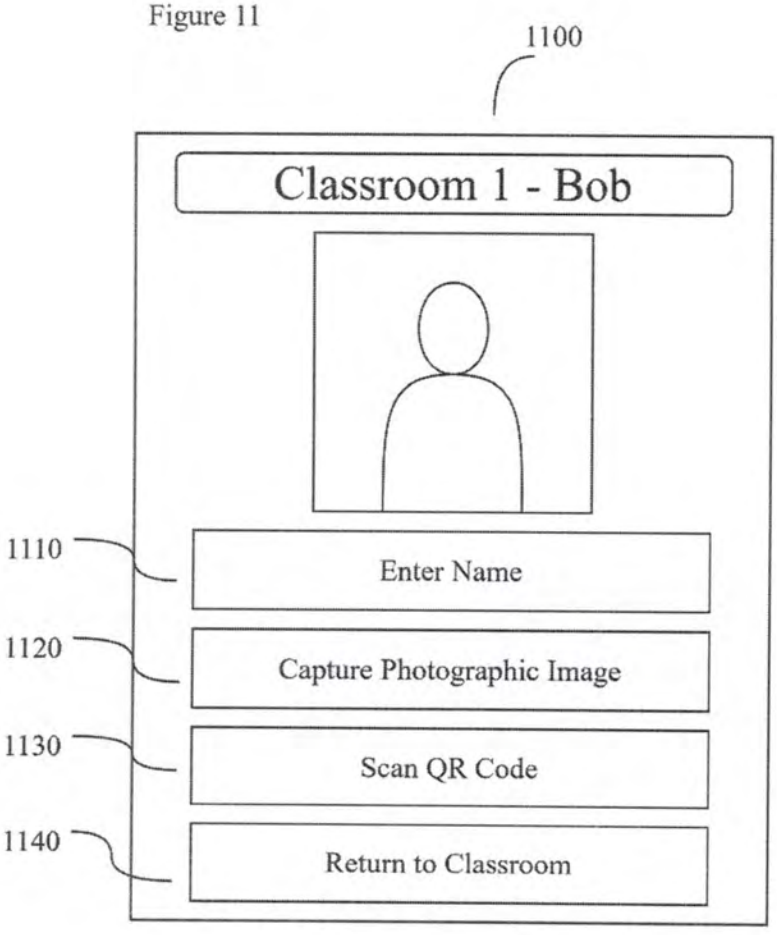
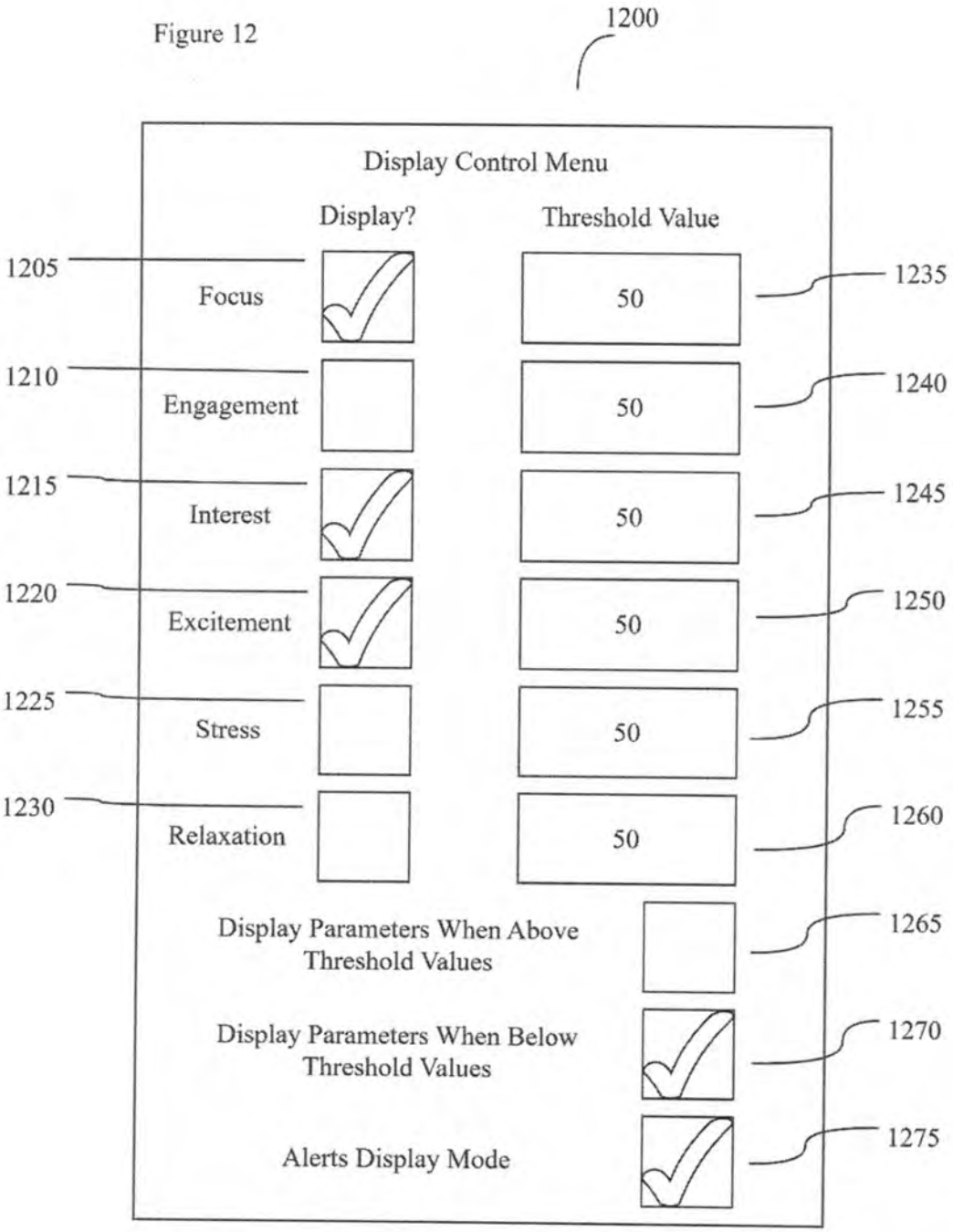

1100
Classroom 1 - Bob
1110
Enter Name
1120
Capture Photographic Image
1130
Scan QR Code
1140
Return to Classroom

Figure 12


1200
Display Control Menu
Display?
Threshold Value
1205
Focus
50
1235
1210
Engagement
50
1240
1215
Interest
50
1245
1220
Excitement
50
1250
1225
Stress
50
1255
1230
Relaxation
50
1260
Display Parameters When Above Threshold Values
1265
Display Parameters When Below Threshold Values
1270
Alerts Display Mode
1275

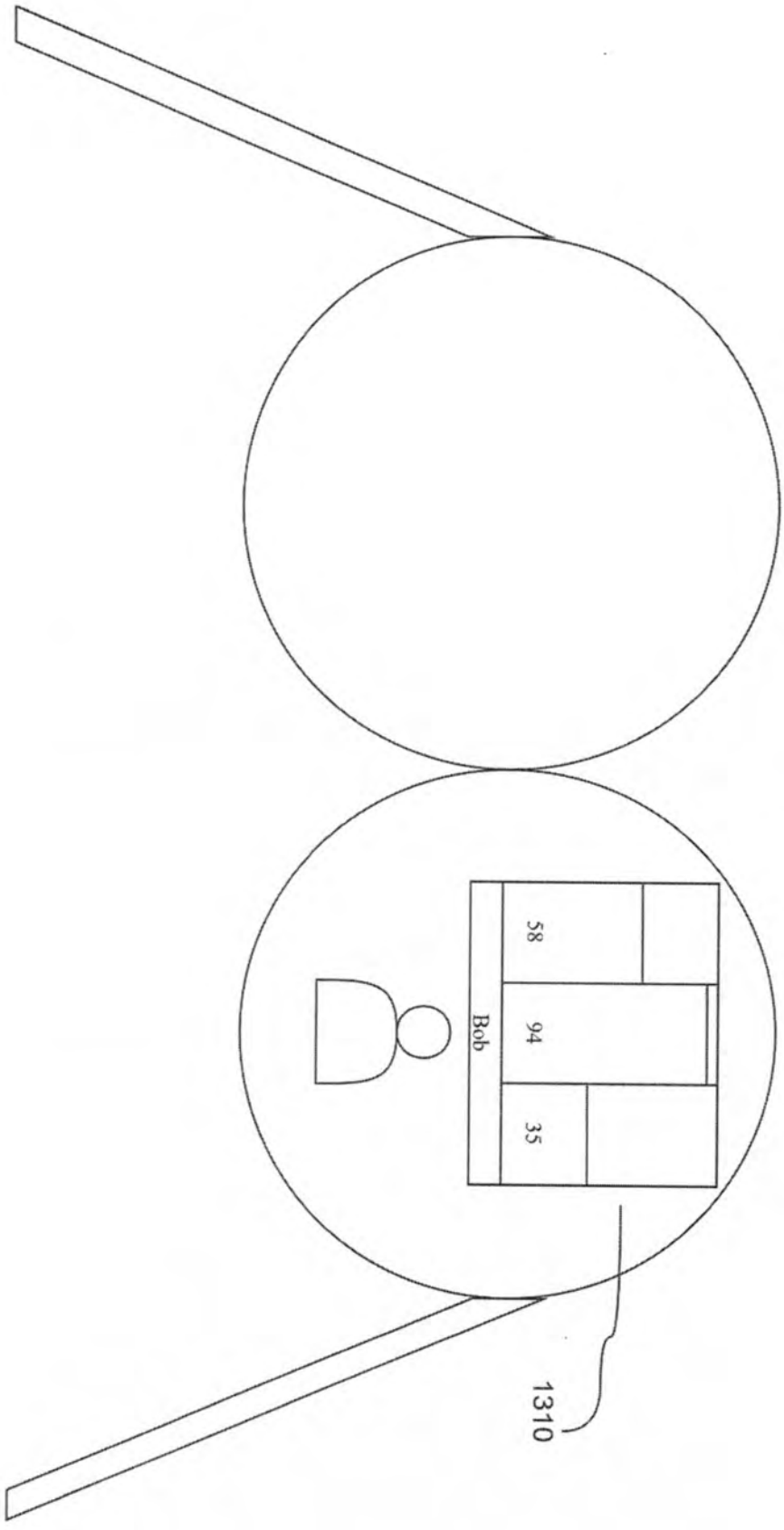


Figure 13

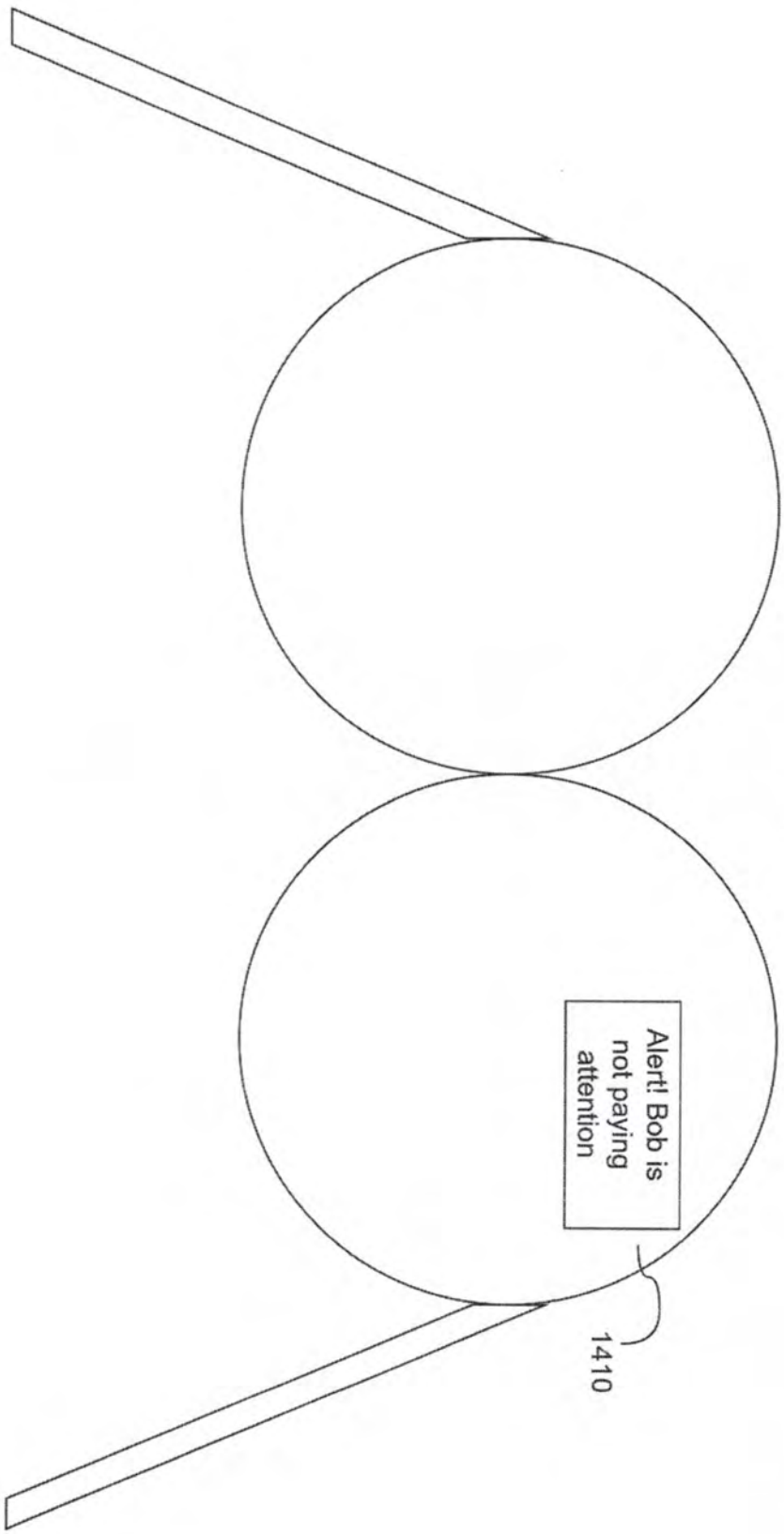


Figure 14

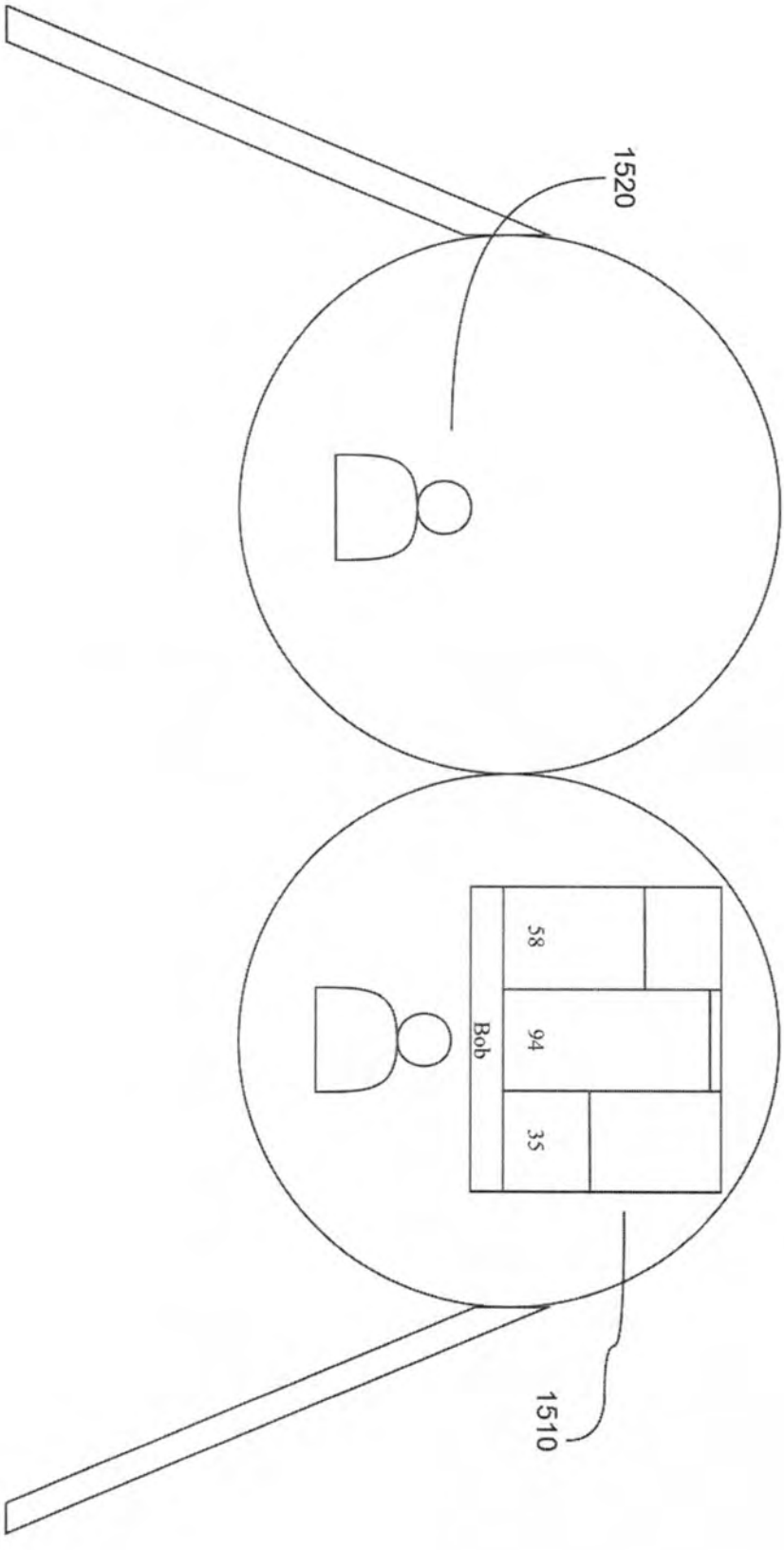


Figure 15

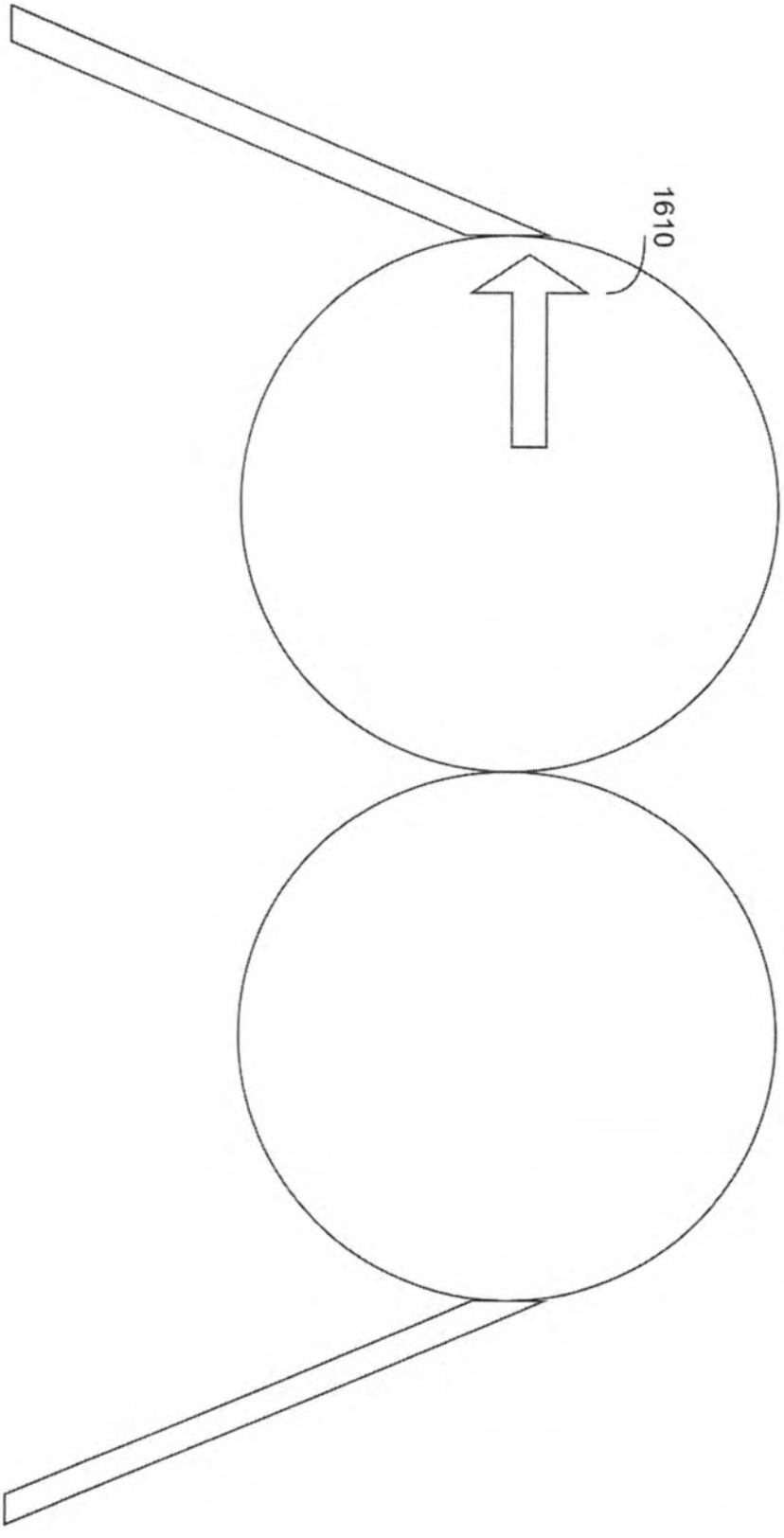


Figure 16

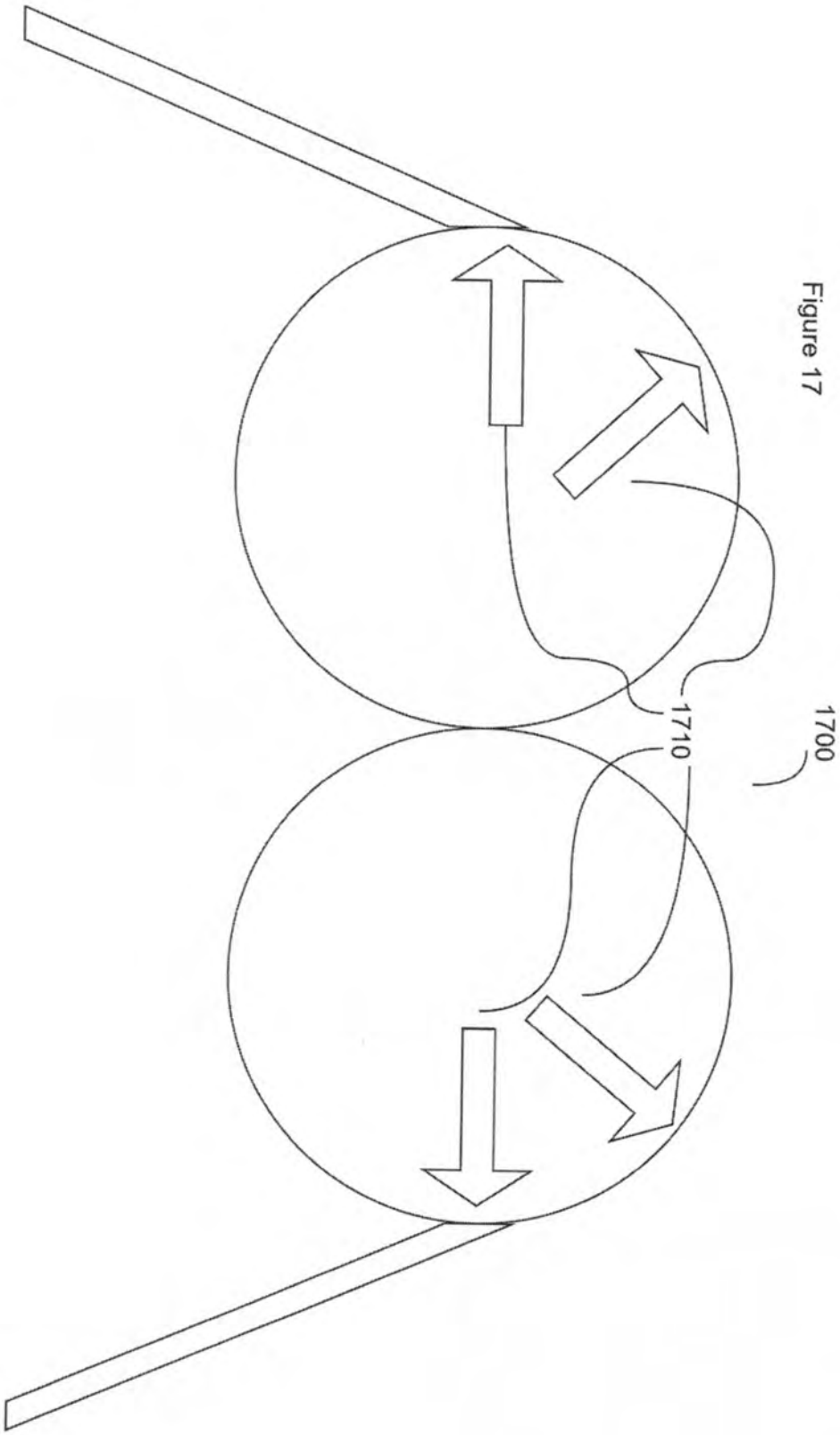


Figure 17

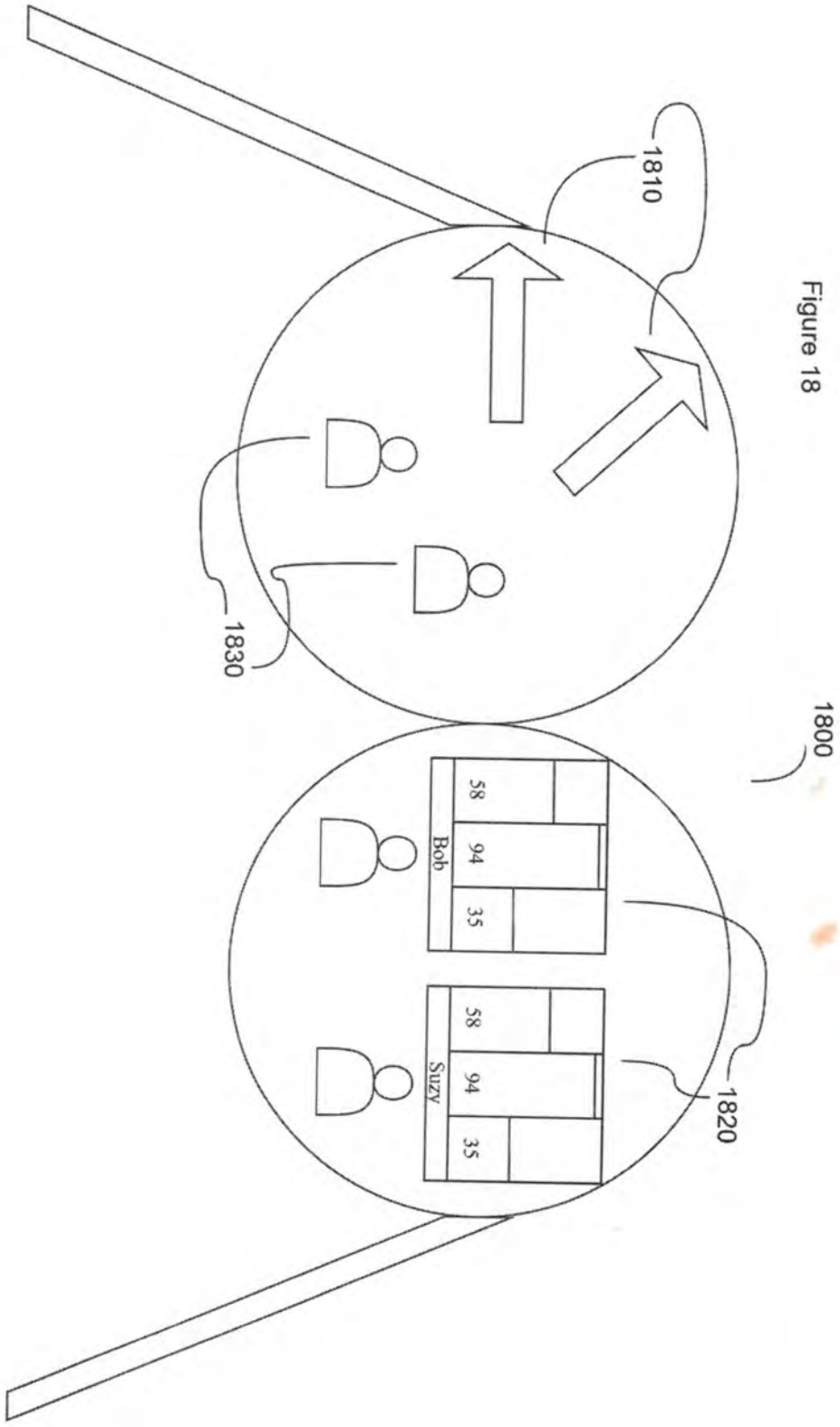


Figure 18