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(54) **METHOD FOR BROADCASTING SPORTS DATA INCLUDING BIO-SIGNAL AND LIVE VIDEO DATA**

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(57) **ABSTRACT**

A method for broadcasting sports includes receiving a first bio-signal output from a first sensor attached to a first sports participant of a sporting event through a first wireless communications module, receiving a second bio-signal output from a second sensor attached to a second sports participant of the sporting event through a second wireless communications module, receiving live video data of the first sports participant and the second sports participant through cameras, and generating sports data including at least one of the first bio-signal and the second bio-signal and the live video data.

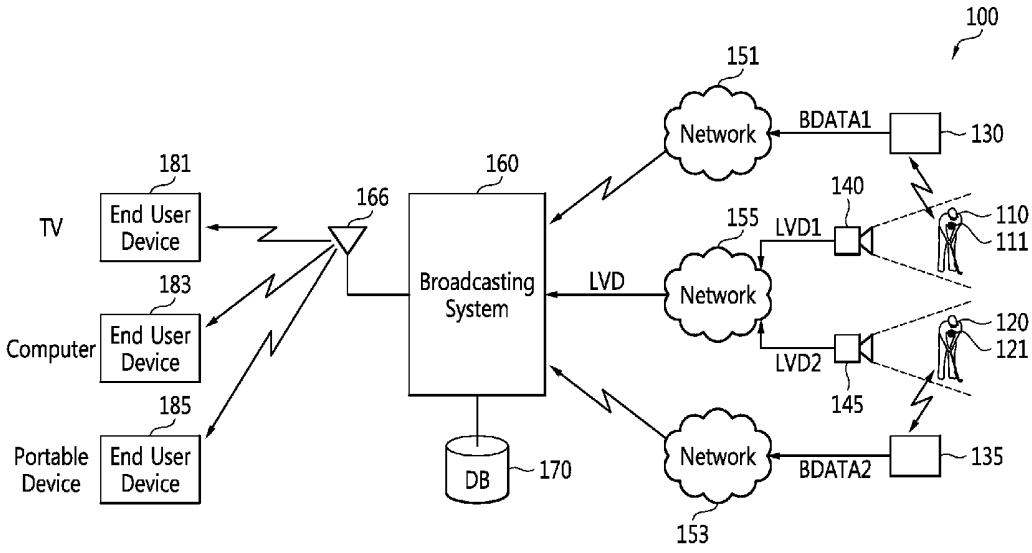


FIG. 1

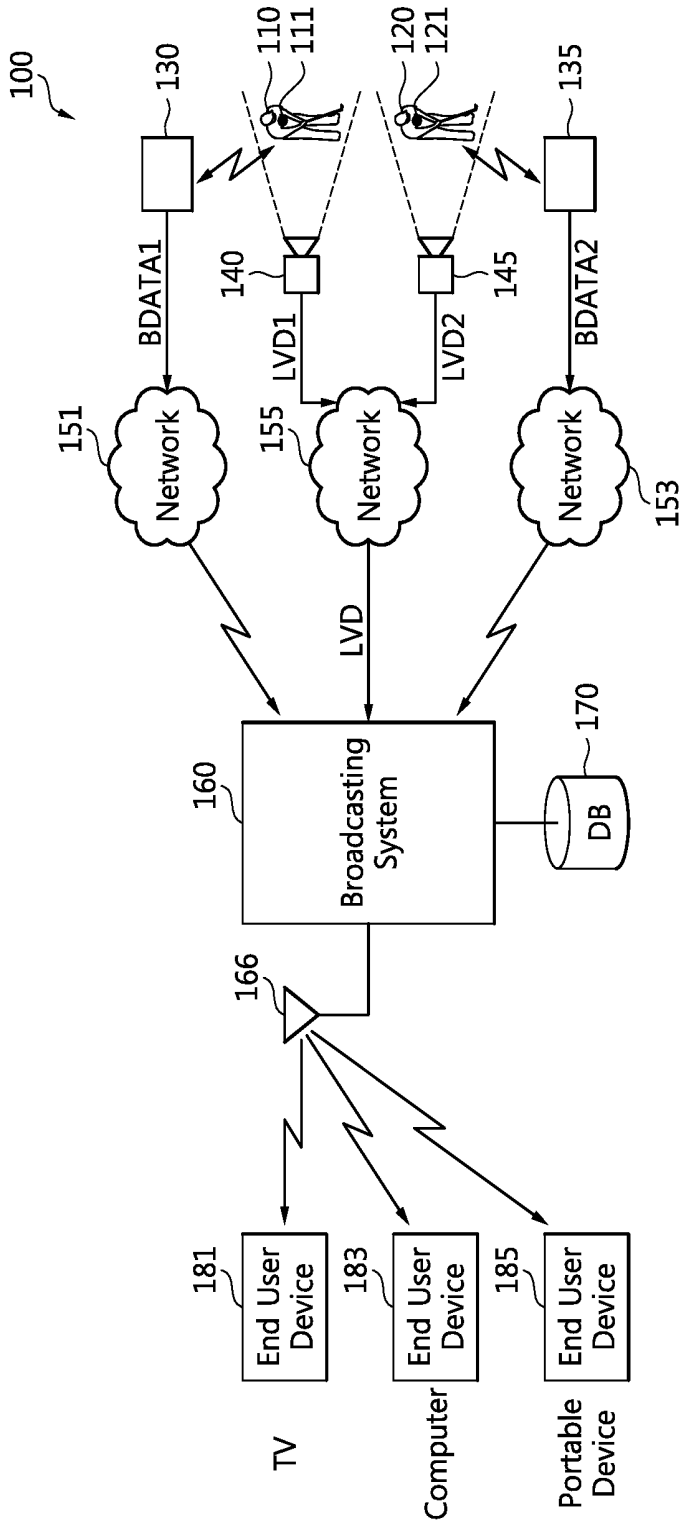

100
130
110
111
120
121
135
BDATA1
140
LVD1
LVD2
145
BDATA2
151
Network
155
Network
Network
153
LVD
160
Broadcasting System
170
DB
166
181
End User Device
183
End User Device
185
End User Device
TV
Computer
Portable Device

FIG. 2

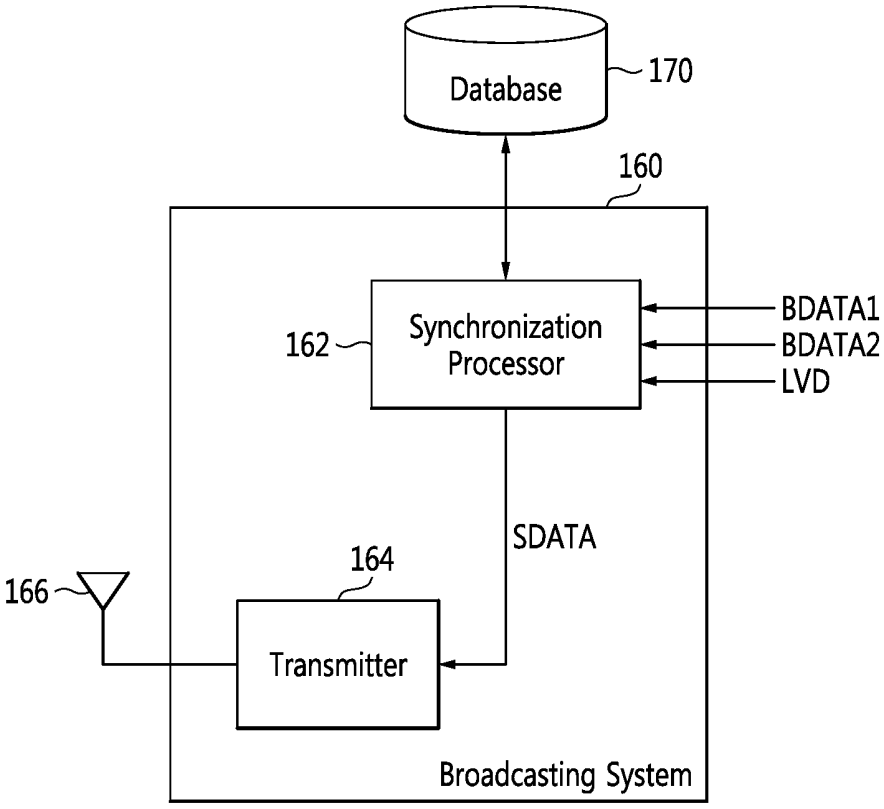
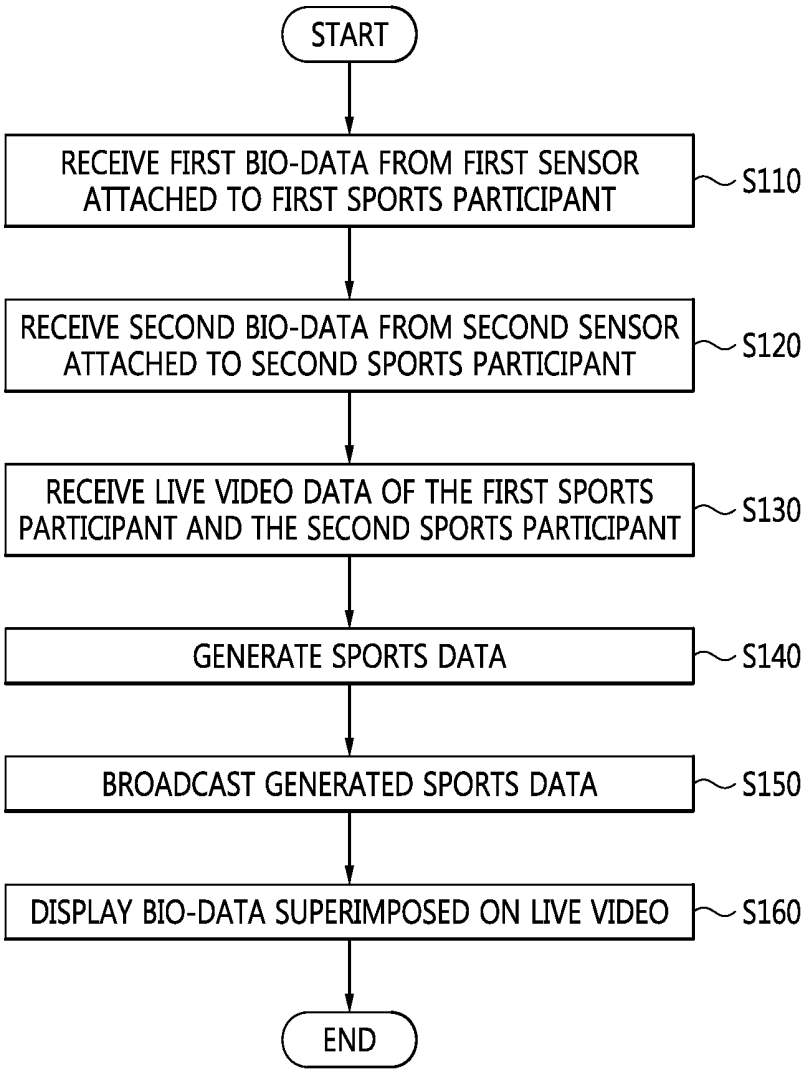

Database
170
160
Synchronization Processor
162
BDATA1
BDATA2
LVD
SDATA
164
166
Transmitter
Broadcasting System

FIG. 3


START
RECEIVE FIRST BIO-DATA FROM FIRST SENSOR ATTACHED TO FIRST SPORTS PARTICIPANT
S110
RECEIVE SECOND BIO-DATA FROM SECOND SENSOR ATTACHED TO SECOND SPORTS PARTICIPANT
S120
RECEIVE LIVE VIDEO DATA OF THE FIRST SPORTS PARTICIPANT AND THE SECOND SPORTS PARTICIPANT
S130
GENERATE SPORTS DATA
S140
BROADCAST GENERATED SPORTS DATA
S150
DISPLAY BIO-DATA SUPERIMPOSED ON LIVE VIDEO
S160
END

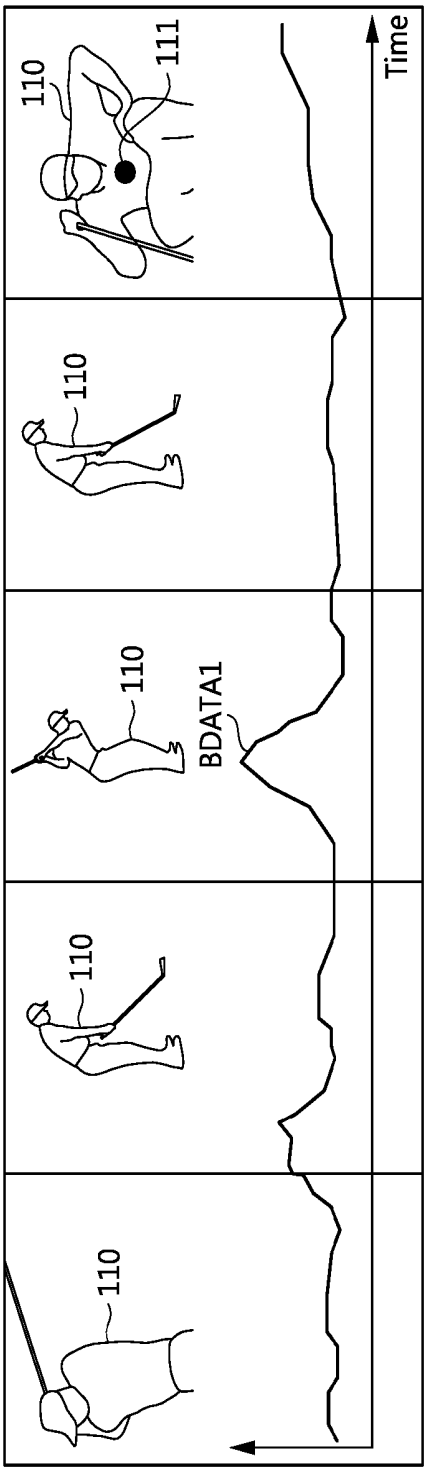


FIG. 4A

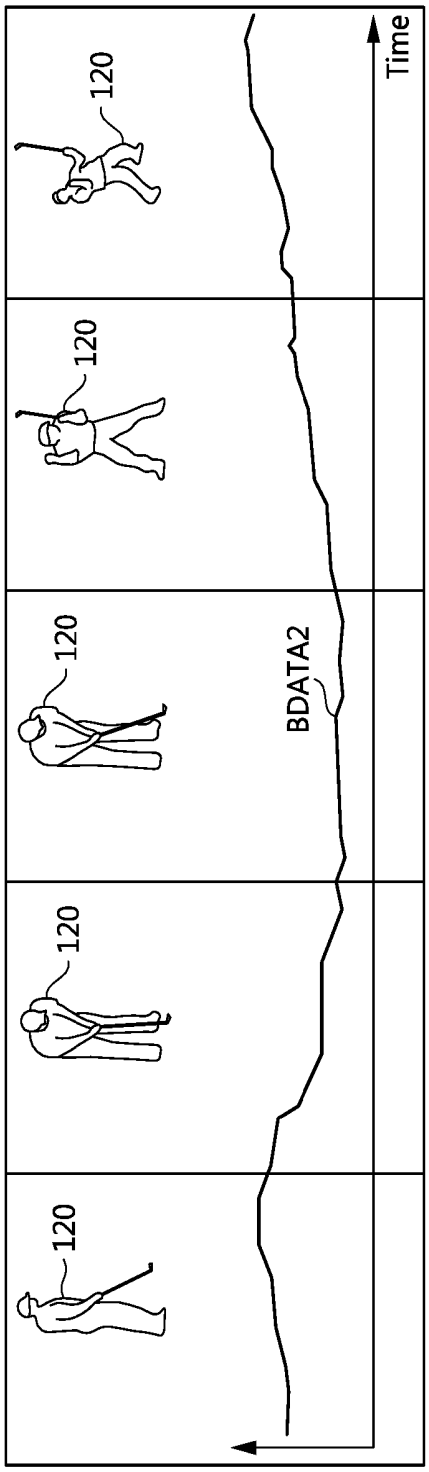


FIG. 4B

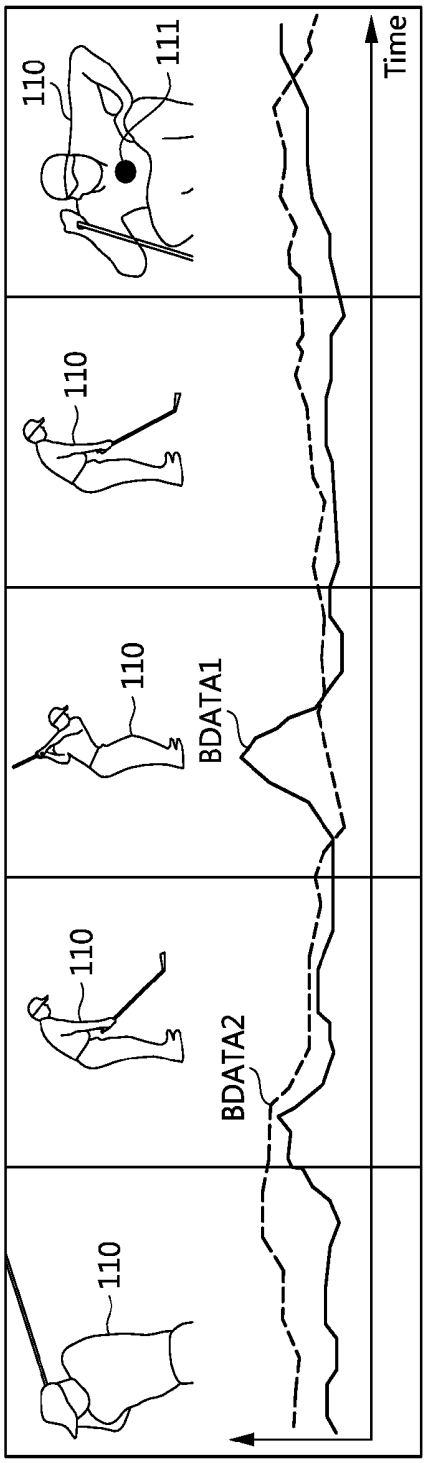

110
110
110
110
111
BDATA2
BDATA1
Time

FIG. 5A

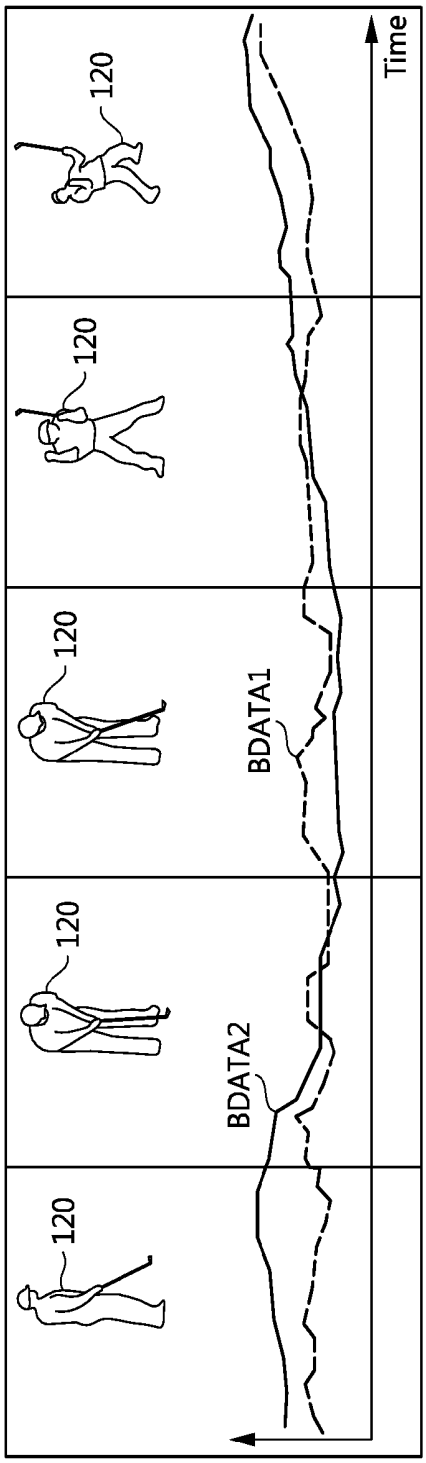

120
120
120
120
BDATA2
BDATA1
Time

FIG. 5B

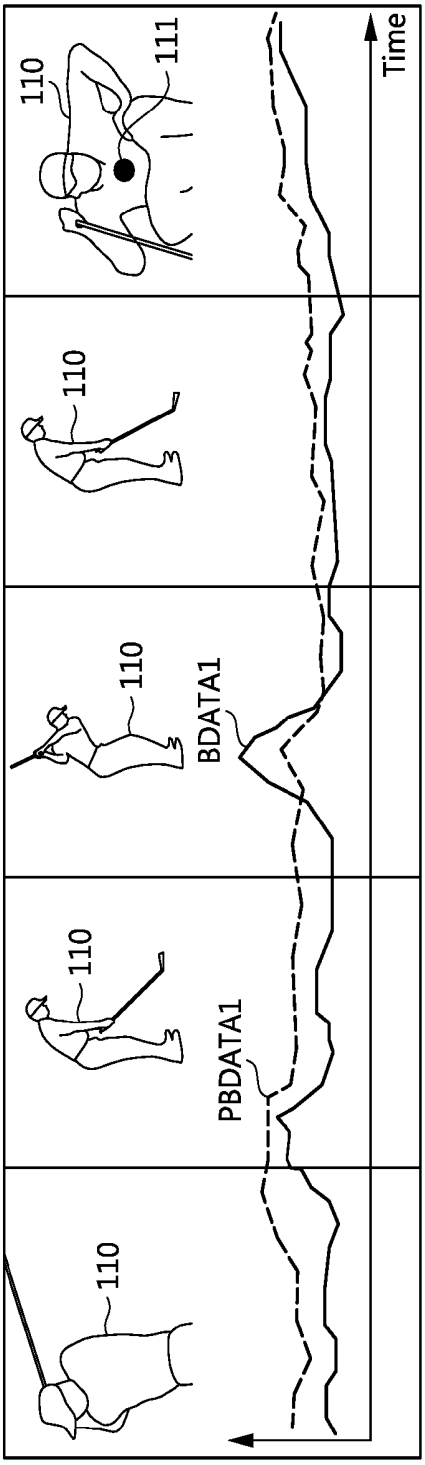

110
110
110
110
111
PBDATA1
BDATA1
Time

FIG. 6A

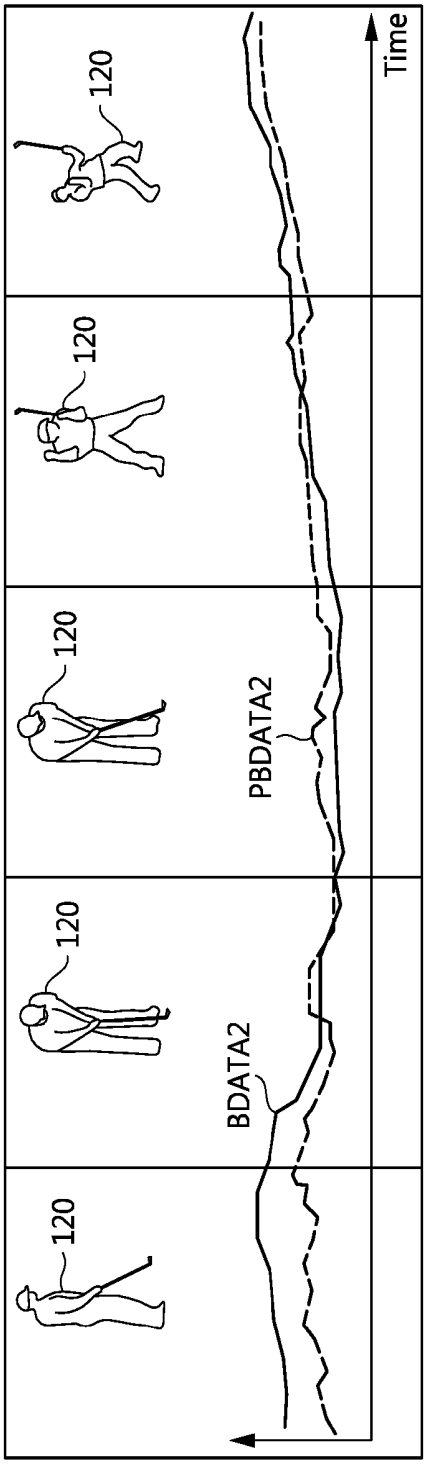
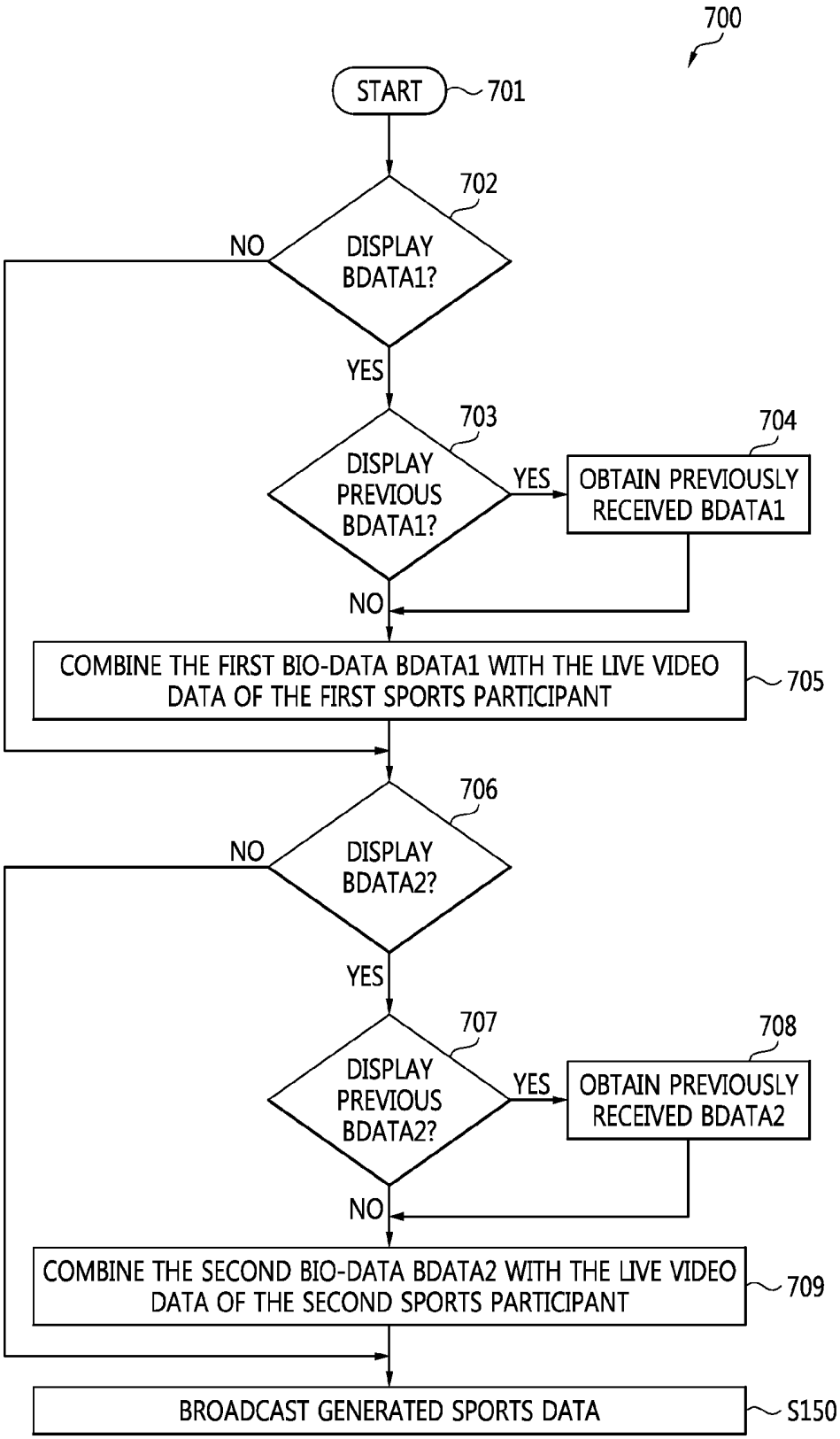

120
120
120
120
BDATA2
PBDATA2
Time

FIG. 6B

FIG. 7


700
START
701
702
DISPLAY BDATA1?
NO
YES
703
DISPLAY PREVIOUS BDATA1?
YES
704
OBTAIN PREVIOUSLY RECEIVED BDATA1
NO
COMBINE THE FIRST BIO-DATA BDATA1 WITH THE LIVE VIDEO DATA OF THE FIRST SPORTS PARTICIPANT
705
706
DISPLAY BDATA2?
NO
YES
707
DISPLAY PREVIOUS BDATA2?
YES
708
OBTAIN PREVIOUSLY RECEIVED BDATA2
NO
COMBINE THE SECOND BIO-DATA BDATA2 WITH THE LIVE VIDEO DATA OF THE SECOND SPORTS PARTICIPANT
709
BROADCAST GENERATED SPORTS DATA
S150

METHOD FOR BROADCASTING SPORTS DATA INCLUDING BIO-SIGNAL AND LIVE VIDEO DATA

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority under 35 U.S.C. §119(a) from Korean Patent Application No. 10-2015-0110873 filed on Aug. 6, 2015, the disclosure of which is hereby incorporated by reference in its entirety.

BACKGROUND

[0002] Embodiments of the present inventive concept relate to a method for broadcasting sports data, and more particularly, to a method for collecting a bio-signal of a sports participant in real time or substantially real time and broadcasting sports data including the collected bio-signal and a live video data of a sporting event performed by the sport participant.

[0003] A broadcasting system may record images of players participating in a sporting event using cameras, and broadcast the recorded images to TV sets. The broadcasting system may insert captions or advertising subtitles on the recorded images that are to be broadcast to the TV sets.

[0004] Viewers may view a sporting event through images of the event and a commentary by a commentator displayed on TV sets. However, the commentator does not know a physical condition, a mental condition, and/or a psychological condition of each of the players and the commentator may not correctly provide the viewers with current conditions of each of the players. That is, a broadcasting system of the related art may not automatically collect and provide a physical condition, a mental condition, and/or a psychological condition of each of the players participating in a sporting event.

SUMMARY

[0005] An example embodiment of the present inventive concepts is directed to a method for broadcasting sports data, including receiving a first bio-signal output from a first sensor attached to a first sports participant through a first wireless communications module, receiving a second bio-signal output from a second sensor attached to a second sports participant through a second wireless communications module, receiving live video data of the first sports participant and the second sports participant through cameras, and generating sports data including at least one of the first bio-signal and the second bio-signal and the live video data.

[0006] Generating the sports data may generate the sports data so that the at least one of the first bio-signal and the second bio-signal is superimposed on a live video related to the live video data.

[0007] Receiving the first bio-signal, the second bio-signal and the live video data may be performed in real time or substantially real time during a sporting event.

[0008] The method for broadcasting sports data further includes broadcasting the sports data to at least one end user device, in which the at least one end user device may include a TV, a computer, or a mobile device. The broadcasting may be performed in real time or substantially real time during the sporting event. The sporting event may be a static-type sporting event or a dynamic-type sporting event. Each of the first bio-signal and the second bio-signal may be data related to electrocardiography (ECG) or data related to photoplethysmography (PPG).

[0009] When the live video data include a first video data of the first sports participant or the second sports participant, the broadcasting may broadcast the sports data including the first live video data, the first bio-signal, and the second bio-signal in real time or substantially real time during a sporting event.

[0010] The generating sports data may include reading a first previously received bio-signal of the first sports participant and a second previously received bio-signal of the second sports participant from a database, and generating the sports data including the first previously received bio-signal, the first bio-signal, the second previously received bio-signal, the second bio-signal, and the live video data.

[0011] The method for broadcasting sports data may further include broadcasting the sports data to at least one end user device through a wireless communications link in which the wireless communications link may be based on an ATSC communications standard, an ATSC-M/H communications standard, a terrestrial-digital multimedia broadcasting (T-DMB) communications standard, or a satellite-digital multimedia broadcasting (S-DMB) communications standard.

[0012] The broadcasting broadcasts the sports data to the at least one end user device through the wireless communications link in real time or substantially real time during a sporting event. The first bio-signal and the second bio-signal may be data respectively related to a heart rate of the first sports participant and the second sports participant.

[0013] An example embodiment of the present inventive concepts is directed to a method for broadcasting sports data, including receiving a first bio-signal output from a first sensor attached to a first sports participant through a first wireless communications module in real time or substantially real time, receiving a second bio-signal output from a second sensor attached to a second sports participant through a second wireless communications module in real time or substantially real time, receiving a first live video data of the first sports participant through at least one first camera recording a sporting event, processing the first bio-signal and the second bio-signal so that the first bio-signal and the second bio-signal are combined with the first live video data to generate a first sports data, and broadcasting the first sports data to at least one end user device through a wireless communications link to display the first sports data on the at least one end user device.

[0014] The method for broadcasting sports data further includes receiving a second live video data of the second sports participant through at least one second camera recording the sporting event, processing the first bio-signal and the second bio-signal so that the first bio-signal and the second bio-signal are combined with the second live video data to generate a second sports data, and broadcasting the first sports data and the second sports data to the at least one end user device through the wireless communications link to display the first sports data and the second sport data on the at least one end user device.

[0015] The first bio-signal and the second bio-signal may be data respectively related to a heart rate of the first sports participant and the second sports participant.

[0016] At least one of the first bio-signal and the second bio-signal may be superimposed on the first live video data

to generate the first sports data. At least one of the first bio-signal and the second bio-signal may be superimposed on the second live video data to generate the second sports data.

[0017] An example embodiment of the present inventive concept is directed to a method to generate sports data, including receiving at a synchronization processor first current bio-signal data for a first sports participant for a current sporting event; determining at the synchronization processor whether previously received first bio-signal data for the first sports participant for a previous sporting event in which the first sports participant participated is to be displayed with the first current bio-signal data; receiving at the synchronization processor first live video data of the first sports participant participating in the current sporting event; combining the first current bio-signal data and the previously received first bio-signal data with the first live video data if it is determined that the previously received first bio-signal data is to be displayed with the first current bio-signal data; and combining the first current bio-signal data with the first live video data if it is determined that the previously received first bio-signal data is not to be displayed with the first current bio-signal data.

[0018] Combining the first current bio-signal data and the previously received first bio-signal data with the first live video data may include superimposing the first current bio-signal data and the previously received first bio-signal data on the first live video data. Similarly, combining the first current bio-signal data with the first live video data may include superimposing the first current bio-signal data on the first live video data.

[0019] In one embodiment, the previously received first bio-signal data may be an average of a plurality of previously received first bio-signal data.

[0020] The method to generate sports data may further include receiving at a synchronization processor second current bio-signal data for a second sports participant for a current sporting event; determining at the synchronization processor whether previously received second bio-signal data for the second sports participant for a previous sporting event in which the second sports participant participated is to be displayed with the second current bio-signal data; receiving at the synchronization processor second live video data of the second sports participant participating in the current sporting event; combining the second current bio-signal data and the previously received second bio-signal data with the second live video data if it is determined that the previously received second bio-signal data is to be displayed with the second current bio-signal data; and combining the second current bio-signal data with the second live video data if it is determined that the previously received second bio-signal data is not to be displayed with the second current bio-signal data.

[0021] Combining the second current bio-signal data and the previously received second bio-signal data with the second live video data may include superimposing the first current bio-signal data and the previously received first bio-signal data on the second live video data. Similarly, combining the first current bio-signal data with the second live video data comprises superimposing the first current bio-signal data on the second live video data.

[0022] In one embodiment, the previously received first bio-signal data may be an average of a plurality of previously received first bio-signal data.

[0023] In one embodiment, the first bio-signal data and the second bio-signal data may be data respectively related to a heart rate of the first sports participant and the second sports participant.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] These and/or other aspects and advantages of the present inventive concepts will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

[0025] FIG. **1** is a block diagram that shows a communications network system according to an exemplary embodiment of the present inventive concepts;

[0026] FIG. **2** is a block diagram of a broadcasting system portion of the communications network system shown in FIG. **1**;

[0027] FIG. **3** is a flowchart that depicting processes of broadcasting sports data using the communications network system shown in FIG. **1**;

[0028] FIGS. **4**A and **4**B are drawings that depict a process of generating sports data including bio-signals and live video data and a process of displaying the sports data on a display device according to embodiments of the present inventive concepts;

[0029] FIGS. **5**A and **5**B are drawings that depict the process of generating sports data including bio-signals and live video data and the process of displaying the sports data in a display device according to embodiments of the present inventive concepts;

[0030] FIGS. **6**A and **6**B are drawings that depict the process of generating sports data including bio-signals and live video data and the process of displaying the sports data in a display device according to embodiments of the present inventive concepts;

[0031] FIG. **7** is a flowchart that describes a process of generating sports data according to an embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0032] The present inventive concepts now will be described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, the size and relative sizes of layers and regions may be exaggerated for clarity. Like numbers refer to like elements throughout.

[0033] It will be understood that when an element is referred to as being "connected" or "coupled" to another element, it can be directly connected or coupled to the other element or intervening elements may be present. In contrast, when an element is referred to as being "directly connected" or "directly coupled" to another element, there are no intervening elements present. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items and may be abbreviated as "/."

[0034] It will be understood that, although the terms first, second, etc. may be used herein to describe various ele-

ments, these elements should not be limited by these terms. These terms are only used to distinguish one element from another. For example, a first signal could be termed a second signal, and, similarly, a second signal could be termed a first signal without departing from the teachings of the disclosure.

[0035] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a," "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," or "includes" and/or "including" when used in this specification, specify the presence of stated features, regions, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, regions, integers, steps, operations, elements, components, and/or groups thereof.

[0036] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and/or the present application, and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0037] FIG. **1** is a block diagram that shows a communications network system **100** according to some embodiments of the present inventive concepts. Referring to FIG. **1**, a communications network system **100** may include a first sensor **111** attached to a first sports participant **110**, a second sensor **121** attached to a second sports participant **120**, a first wireless communications module **130**, a second wireless communications module **135**, a first camera **140**, a second camera **145**, networks **151**, **153**, and **155**, a broadcasting system **160**, and a plurality of end user devices **181**, **183**, and **185**. The communications network system **100** may further include an antenna **166** that can broadcast sports data generated by the broadcasting system **160** and a database **170** that may store the sports data.

[0038] Each of the sports participants **110** and **120** may be a participant or a player in a static-type sporting event or a dynamic-type sporting event. A static-type sporting event may be static sports match (or game) and includes golf games, archery games, chess, and the like; however, it is not limited thereto. That is, a static-type sporting event may be a sporting event in which the participants are relatively physically inactive. A dynamic-type sporting event may be a dynamic sports match (or game), and includes American Football games, baseball games, basketball games, volleyball games, ice hockey games, and the like; however, it is not limited thereto. That is, a dynamic-type sporting event may be a sporting event in which the participants are relatively physically active.

[0039] The first sensor **111** may be one or more sensors that may sense a first bio-signal (a first biological-signal, or a first bio-data) of the first sports participant **110**. For example, the first sensor **111** may be a sensor that can sense electrocardiography (ECG) or photoplethysmography (PPG) of the first sports participant **110**; however, it is not limited thereto. When the first sensor **111** generates a signal related to a heart rate as a bio-signal, the first sensor **111** may be attached to the first sports participant **110** at a position (for example, around a heart or a wrist; however, it is not limited thereto) that is capable of sensing a heart rate of the first sports participant **110**.

[0040] The second sensor **121** may be one or more sensors that can sense a second bio-signal (a second biological-signal or a second bio-data) of the second sports participant **120**. For example, the second sensor **121** may be a sensor that can sense ECG or PPG of the second sports participant **120**; however, it is not limited thereto. When the second sensor **121** generates a signal related to a heart rate as bio-signal, the second sensor **121** may be attached to the second sports participant **120** at a position (for example, around a heart or a wrist; however, it is not limited thereto) that is capable of sensing a heart rate of the second sports participant **120**.

[0041] Each of the sensors **111** and **121** may perform a function of sensing one or more bio-signals of each of the sports participants **110** and **120** and a function of respectively transmitting the one or more sensed bio-signals to the respective wireless communications modules **130** and **135** through a wireless communications link. If each of the sensors **111** and **121** is an ECG sensor or a PPG sensor, each of the sensors **111** and **121** may further analyze an ECG waveform or a PPG waveform of each of the sports participants **110** and **120**, predict cardiac arrhythmia of each of the sports participants **110** and **120** according to a result of the analysis, and output a result of the prediction through an output device (for example, a speaker) included in each of the sensors **111** and **121** and/or output the result of the prediction to each respective wireless communications modules **130** and **135**.

[0042] Each of the sensors **111** and **121** may be embodied as an Internet of Things (IoT) device or an Internet of Everything (IoE) device. According to some exemplary embodiments, a wireless communications link may be established using Bluetooth, Bluetooth low energy (BLE), near-field communication (NFC), Zigbee, and/or radio frequency identification (RFID); however, it is not limited thereto.

[0043] The first wireless communications module **130** may receive a first bio-signal (BDATA**1**) of the first sports participant **110** that has been output from the first sensor **111** and transmit the first bio-signal BDATA**1** to a first network **151**. The first wireless communications module **130**, which can perform wireless communications with the first sensor **111**, may be a smart phone, an IoT device, an IoE device, and/or a wearable device; however, it is not limited thereto.

[0044] The second wireless communications module **135** may receive a second bio-signal BDATA**2** of the second sports participant **120** that has been output from the second sensor **121**, and transmit the second bio-signal BDATA**2** to a second network **153**. The second wireless communications module **135**, which can perform wireless communications with the second sensor **121**, may be a smart phone, an IoT device, an IoE device, and/or a wearable device; however, it is not limited thereto.

[0045] The first camera **140** that records a sporting event may generate a first live video data LVD**1** of the first sports participant **110** and transmit the first live video data LVD**1** to a third network **155**. The second camera **145** that records the sporting event may generate a second live video data LVD**2** of the second sports participant **120** and transmit the second live video data LVD**2** to the third network **155**. Each of the cameras **140** and **145** may be embodied as an

automatic video camera that can automatically track each of the sports participants **110** and **120**; however, it is not limited thereto.

[0046] Each of the networks **151**, **153**, and **155** may be a network that uses the same communications method or, alternatively, a different communications method. According to embodiments, each of the networks **151**, **153**, and **155** may be a local area network (LAN), a wireless local area network (WLAN), such as wireless fidelity (Wi-Fi), a wireless personal area network (WPAN), a wireless universal serial bus (USB), a 3rd generation (3G) mobile communications network, a 4^{th} generation (4G) mobile communications network, a long term evolution (LTE™) mobile communications network, the Internet, or the wireless Internet; however, it is not limited thereto.

[0047] FIG. **2** is a block diagram of a broadcasting system portion of the communications system network shown in FIG. **1**, and FIG. **3** is a flowchart that describes processes of broadcasting sports data using the communications network system shown in FIG. **1**.

[0048] Referring to FIGS. **1** to **3**, the broadcasting system **160** may receive the first bio-signal BDATA**1** of the first sports participant **110** through the first network **151** (S**110**). For example, a synchronization processor **162** of the broadcasting system **160** may receive the first bio-signal BDATA**1** output from the first sensor **111** attached to the first sports participant **110** through the first wireless communication module **130** and the first network **151** (S**110**).

[0049] The broadcasting system **160** may receive a second bio-signal BDATA**2** of the second sports participant **120** through the second network **153** (S**120**). For example, the synchronization processor **162** of the broadcasting system **160** may receive the second bio-signal BDATA**2** output from the second sensor **121** attached to the second sports participant **120** through the second wireless communication module **135** and the second network **152** (S**120**).

[0050] Even though it is shown in FIG. **3** that a process (S**110**) of receiving the first bio-signal BDATA**1** is performed prior to a process (S**120**) of receiving the second bio-signal BDATA**2**, the process (S**110**) of receiving the first bio-signal BDATA**1** and the process (S**120**) of receiving the second bio-signal BDATA**2** may be performed simultaneously or substantially simultaneously, in a parallel manner, may be overlapped in time with respect to each other, or the process (S**110**) of receiving the first bio-signal BDATA**1** may be performed later than the process (S**120**) of receiving the second bio-signal BDATA**2**.

[0051] The broadcasting system **160** may receive at least one of the first live video data LVD**1** of the first sports participant **110** and the second live video data LVD**2** of the second sports participant **120** through the third network **155** (S**130**). Live video data LVD may include at least one of the first live video data LVD**1** and the second live video data LVD**2**. For example, each of the live video data LVD**1** and LVD**2** output from each of the cameras **140** and **145** may be transmitted to the synchronization processor **162** of the broadcasting system **160** through the third network **155** (S**130**).

[0052] The broadcasting system **160** may generate sports data including at least one of the first bio-signal BDATA**1** and the second bio-signal BDATA**2** and at least one of the first live video data LVD**1** and the second live video data LVD**2** (S**140**).

[0053] For example, the synchronization processor **162** of the broadcasting system **160** may process at least one of the first bio-signal BDATA**1** and the second bio-signal BDATA**2** so that at least one of the first bio-signal BDATA**1** and the second bio-signal BDATA**2** is superimposed on or onto a video (or a live video) corresponding to at least one of the first live video data LVD**1** and the second live video data LVD**2**, and generate sports data SDATA corresponding to a result of the processing (S**140**).

[0054] The synchronization processor **162** of the broadcasting system **160** may store the first bio-signal (or data) BDATA**1**, the second bio-signal (or data) BDATA**2**, the first live video data LVD**1**, the second live video data LVD**2**, and/or the sports data SDATA in a database **170**. The database **170** may store a previously received bio-signal of the first sports participant **110**, a previously received live video data of the first sports participant **110**, a previously received bio-signal of the second sports participant **120**, and/or a previously received live video data of the second sports participant **120**.

[0055] A transmitter **164** of the broadcasting system **160** may broadcast the sports data SDATA to a plurality of end user devices **181**, **183**, and **185** through the antenna **166** under the control of the synchronization processor **162** (S**150**).

[0056] According to some exemplary embodiments, the broadcasting system **160** may generate sports data SDATA based on an advanced television system committee (ATSC) standard and/or an ATSC-mobile/handheld (ATSC-M/H) standard, and broadcast the sports data SDATA. According to some exemplary embodiments, the broadcasting system **160** may generate sports data SDATA based on a digital video broadcasting-cable (DVB-C) standard, a digital video broadcasting-terrestrial (DVB-T) standard, a DVB-satellite (DVB-S) standard, a DVB-satellite services to handhelds (DVB-SH) standard, and/or broadcast the sports data SDATA.

[0057] According to some exemplary embodiments, the broadcasting system **160** may generate sports data SDATA based on a China Digital Multimedia Broadcast-Terrestrial/Handheld (CDMB-T/H) standard and/or a China Mobile Multimedia Broadcasting (CMMB) standard and broadcast the sports data SDATA.

[0058] According to some exemplary embodiments, the broadcasting system **160** may generate sports data SDATA based on an Integrated Services Digital Broadcasting (ISDB) standard, an ISDB-satellite (ISDB-S) standard, an ISDB-terrestrial (ISDB-T) standard, an ISDB-cable (ISDB-C) standard, a 1 seg standard, an international system for digital broadcast, terrestrial, and/or Brazilian version (ISDB-Tb) standard, and broadcast the sports data SDATA.

[0059] According to some exemplary embodiments, the broadcasting system **160** may generate sports data SDATA based on a national television system committee (NTSC) standard, a phase alternating line (PAL) standard, and/or a sequential color with memory (SECAM) standard, and broadcast the sports data SDATA. According to exemplary embodiments, the broadcasting system **160** may generate sports data SDATA based on a terrestrial-digital multimedia broadcasting (T-DMB) standard and/or a satellite-digital multimedia broadcasting (S-DMB) standard, and broadcast the sports data SDATA.

[0060] Each of the user end devices **181**, **183**, and **185** may receive sports data SDATA and display live video including

at least one of the bio-signal BDATA1 and BDATA2 on a display device of each of the end user devices **181**, **183**, and **185** (S**160**). For example, a first end user device **181** may be a TV (or a digital TV), a second end user device **183** may be a computer, and a third end user device **185** may be a portable device; however, these are not limited thereto. The portable device may be a laptop computer, a mobile phone, a smart phone, a tablet PC, a personal digital assistant (PDA), an enterprise digital assistant (EDA), a portable multimedia player (PMP), a mobile internet device (MID), a wearable computer, an IoT device, or an IoE device; however, it is not limited thereto.

[0061] FIG. **7** is a flowchart that describes a process of generating sports data **700** according to an embodiment. In particular, FIG. **7** provides details regarding generating sports data S**140** shown in FIG. **3**. The process **700** begins at operation **701**. At operation **702**, it is determined whether the synchronization processor **162** is to generate sports data that includes the first bio-signal data BDATA**1** for the first sports participant. If, at operation **701**, the synchronization processor **162** is to generate sports data that includes the first bio-signal data BDATA**1**, flow continues to operation **703**, wherein it is determined whether the synchronization processor **162** is to obtain and display previously received first bio-signal data BDATA**1** for the first sports participant. If so, flow continues to operation **704**, where the synchronization processor **162** accesses the database **170** to obtain previously received first bio-signal data BDATA**1**, and flow continues to operation **705**. If, at operation **703**, the synchronization processor **162** is not to obtain and display previously received first bio-signal data BDATA**1** for the first sports participant, flow continues to operation **705**. At operation **705**, the synchronization processor **162** combines the first bio-signal data BDATA**1** into the live video data for the first sports participant. In one embodiment, the first bio-signal data BDATA**1** is superimposed on the live video data for the first sports participant. Flow continues to operation **706**.

[0062] At operation **706**, it is determined whether the synchronization processor **162** is to generate sports data that includes the second bio-signal data BDATA**2** for the second sports participant. If, at operation **706**, the synchronization processor **162** is to generate sports data that includes the second bio-signal data BDATA**2**, flow continues to operation **707**, wherein it is determined whether the synchronization processor **162** is to obtain and display previously received second bio-signal data BDATA**2** for the second sports participant. If so, flow continues to operation **708**, where the synchronization processor **162** accesses the database **170** to obtain previously received second bio-signal data BDATA**2**, and flow continues to operation **709**. If, at operation **707**, the synchronization processor **162** is not to obtain and display previously received second bio-signal data BDATA**2** for the second sports participant, flow continues to operation **709**. At operation **709**, the synchronization processor **162** combines the second bio-signal data BDATA**2** into the live video data for the second sports participant. In one embodiment, the second bio-signal data BDATA**2** is superimposed on the live video data for the second sports participant. Flow continues to operation S**150**, wherein the generated sports data is broadcast.

[0063] FIGS. **4**A and **4**B are drawings that depict a process of generating sports data including bio-signals and live video data and a process of displaying the sports data on a display device according to some exemplary embodiments of the present inventive concepts. It is shown that each of the sports participants **110** and **120** is a golfer as an exemplary embodiment in FIGS. **4**A to **6**B; however, a technical concept of the present inventive concepts may be applied to participants of various sporting events (or sports games).

[0064] Referring to FIGS. **1** to **4**B, the synchronization processor **162** may receive the first bio-signal BDATA**1** and the first live video data LVD**1** in real time or substantially real time, and generate sports data SDATA including the first bio-signal BDATA**1** and the first live video data LVD**1** in real time or substantially real time.

[0065] The synchronization processor **162** may receive the second bio-signal VDATA**2** and the second live video data LVD**2** in real time or substantially real time and generate sports data SDATA including the second bio-signal BDATA**2** and the second live video data LVD**2** in real time or substantially real time.

[0066] The synchronization processor **162** may receive the first bio-signal BDATA**1**, the second bio-signal VDATA**2**, and the first live video data LVD**1** in real time or substantially real time, and generate sports data SDATA including the first bio-signal BDATA**1**, the second bio-signal BDATA**2**, and the first live video data LVD**1** in real time or substantially real time.

[0067] The synchronization processor **162** may receive the first bio-signal BDATA**1**, the second bio-signal BDATA**2**, and the second video data LVD**2** in real time or substantially real time, and generate sports data SDATA including the first bio-signal BDATA**1**, the second bio-signal BDATA**2**, and the second video data LVD**2** in real time or substantially real time.

[0068] The synchronization processor **162** may receive the first bio-signal BDATA**1**, the second bio-signal BDATA**2**, the first live video data LVD**1**, and the second video data LVD**2** in real time or substantially real time, and generate sports data SDATA including the first bio-signal BDATA**1**, the second bio-signal BDATA**2**, the first live video data LVD**1**, and the second video data LVD**2** in real time or substantially real time.

[0069] The synchronization processor **162** of FIG. **4**A may generate sports data SDATA including the first bio-signal BDATA**1** of the first sports participant **110** and the first live video data LVD**1** of the first sports participant **110** in real time or substantially real time, and broadcast the sports data SDATA to each of the end user devices **181**, **183**, and **185**. Each of the end user devices **181**, **183**, and **185** may display live video including the first bio-signal BDATA**1** on a display device. Here, the live video may be a video corresponding to the first live video data LVD**1**. The first bio-signal BDATA**1** may be displayed in different sizes at different positions in the live video under selectable control of the synchronization processor **162**.

[0070] The synchronization processor **162** of FIG. **4**B may generate sports data SDATA including the second bio-signal BDATA**2** of the second sports participant **120** and the second live video data LVD**2** of the second sports participant **120** in real time or substantially real time, and broadcast the sports data SDATA to each of the end user devices **181**, **183**, and **185**. Each of the end user devices **181**, **183**, and **185** may display live video including the second bio-signal BDATA**2** on a display device. Here, the live video may be a video corresponding to the second live video data LVD**2**. The second bio-signal BDATA**2** may be displayed in different

sizes at different positions in the live video under selectable control of the synchronization processor **162**.

[0071] Even though it is shown in FIGS. **4**A and **4**B that each of the bio-signal BDATA**1** and BDATA**2** itself is displayed on a display of each of the end user devices **181**, **183**, and **185**; however, it is only exemplification, and each of the bio-signal BDATA**1** and BDATA**2** displayed on the display may be understood as a concept including a graphics user interface GUI and/or an icon for displaying each of the bio-signal BDATA**1** and BDATA**2**.

[0072] FIGS. **5**A and **5**B are drawings that depict the process of generating sports data including bio-signals and live video data and the process of displaying the sports data in a display device according to some exemplary embodiments of the present inventive concepts.

[0073] As shown in FIG. **5**A, the synchronization processor **162** may generate sports data SDATA including the first bio-signal BDATA**1** of the first sports participant **110**, the second bio-signal BDATA**2** of the second sports participant **120**, and the first live video data LVD**1** of the first sports participant **110** in real time or substantially real time, and broadcast the sports data SDATA to each of end user devices **181**, **183**, and **185**.

[0074] Each of the end user devices **181**, **183**, and **185** may display a live video including the first bio-signal BDATA**1** and the second bio-signal BDATA**2** on a display device. Here, the live video may be a video corresponding to the first live video data LVD**1**. The first bio-signal BDATA**1** and the second bio-signal BDATA**2** may be displayed in different sizes at different positions in the live video under selectable control of the synchronization processor **162** and/or the user of the end user device **181**, **183** and **185**.

[0075] As shown in FIG. **5**A, when the first sports participant **110** continues with a current play, the second sports participant **120** may not be continuing with the current play. The first bio-signal BDATA**1** may be data (or signal) related to a heart rate of the first sports participant **110** continuing with the current play, and the second bio-signal BDATA**2** may be data (or signal) related to a heart rate of the second sports participant **120** that is not continuing with the current play. Accordingly, a viewer can view not only the heart rate of the first sports participant **110**, but also the heart rate of the second sports participant **120** while viewing a video corresponding to the first live video data LVD**1**.

[0076] As shown in FIG. **5**B, the synchronization processor **162** may generate sports data SDATA including the first bio-signal BDATA**1** of the first sports participant **110**, the second bio-signal BDATA**2** of the second sports participant **120**, and the second live video data LVD**2** of the second sports participant **120** in real time or substantially real time, and broadcast the sports data SDATA to each of the end user devices **181**, **183**, and **185**.

[0077] Each of the end user devices **181**, **183**, **185** may display a live video including the first bio-signal BDATA**1** and the second bio-signal BDATA**2** on a display device. Here, the live video may be a video corresponding to the second live video data LVD**2**. The first bio-signal BDATA**1** and the second bio-signal BDATA**2** may be displayed in different sizes at different positions in the live video under selectable control of the synchronization processor **162** and/or the user of the end user device **181**, **183** and **185**.

[0078] As shown in FIG. **5**B, when the second sports participant **120** continues with a current play, the first sports participant **110** may not be continuing with the current play. The second bio-signal BDATA**2** may be data related to a heart rate of the second sports participant **120** continuing with the current play, and the first bio-signal BDATA**1** may be data related to a heart rate of the first sports participant **110** not that is continuing with the current play. Accordingly, a viewer can view not only the heart rate of the first sports participant **110**, but also the heart rate of the second sports participant **120** while viewing a video corresponding to the second live video data LVD**2**.

[0079] Each of the bio-signals BDATA**1** and BDATA**2** displayed on a display of each of the end user devices **181**, **183**, and **185** may be understood as a concept including a graphics user interface (GUI) and/or an icon for displaying each of the bio-signals BDATA**1** and BDATA**2**.

[0080] FIGS. **6**A and **6**B are drawings that depict the process of generating sports data including bio-signals and live video data and the process of displaying the sports data in a display device according to some exemplary embodiments of the present inventive concepts.

[0081] As shown in FIG. **6**A, the synchronization processor **162** may generate sports data SDATA including the first bio-signal BDATA**1** of the first sports participant **110**, a previously received bio-signal PBDATA**1** of the first sports participant **110**, and a first live video data LVD**1** of the first sports participant **110** in real time or substantially real time, and broadcast the sports data SDATA to each of end user devices **181**, **183**, and **185**. The previously received bio-signal PBDATA**1** may be bio-signal collected by the first sensor **111** from one or more sporting events in which the first sports participant **110** previously participated. The previous bio-signal PBDATA**1** may be an average value of a number of previously received bio-signals PBDATA**1**; however, it is not limited thereto.

[0082] Each of the end user devices **181**, **183**, and **185** may display live video including the first bio-signal BDATA**1** and the previously received bio-signal PBDATA**1** on a display device. Here, the live video may be a video corresponding to the first live video data LVD**1**. The first bio-signal BDATA**1** and the previous bio-signal PBDATA**1** may be displayed in different sizes at different positions in the live video under selectable control of the synchronization processor **162** and/or the user of the end user device **181**, **183** and **185**.

[0083] As shown in FIG. **6**A, the first bio-signal BDATA**1** may be data related to a change in a heart rate of the first sports participant **110** continuing with a current play, and the previous bio-signal PBDATA**1** may be data related to a change in a heart rate of the first sports participant **110** as the first sports participant **110** participated in a previous sporting event. Accordingly, a viewer can view not only the change in the heart rate of the first sports participant **110** proceeding with the current sports, but also the change in the heart rate of the first sports participant **110** who performed in a previous sporting event while viewing a video corresponding to the first live video data LVD**1**.

[0084] As shown in FIG. **6**B, the synchronization processor **162** may generate sports data SDATA including the second bio-signal BDATA**2** of the second sports participant **120**, a previously received bio-signal PBDATA**2** of the second sports participant **120**, and the second live video data LVD**2** of the second sports participant **120** in real time or substantially real time, and broadcast the sports data SDATA to each of the end user devices **181**, **183**, and **185**. The previously received bio-signal PBDATA**2** may be bio-signal

collected by the second sensor **121** from one or more sporting events in which the second sports participant **120** previously participated. The previous bio-signal PBDATA**2** may be an average value of a number of previously received bio-signals PBDATA**2**; however, it is not limited thereto.

[0085] Each of the end user devices **181**, **183**, and **185** may display a live video including the second bio-signal BDATA**2** and the previously received bio-signal PBDATA**2** on a display device. Here, the live video may be a video corresponding to the second live video data LVD**2**. The second bio-signal BDATA**2** and the previously received bio-signal PBDATA**2** may be displayed in different sizes at different positions in the live video under selectable control of the synchronization processor **162** and/or the user of the end user device **181**, **183** and **185**.

[0086] As shown in FIG. **6**B, the second bio-signal BDATA**2** may be data related to a change in a heart rate of the second sports participant **120** continuing with a current play, and the previously received bio-signal PBDATA**2** may be data related to a change in a heart rate of the second sports participant **120** as the second sports participant **120** participated in a previous sporting event. Accordingly, a viewer can view not only a change in the heart rate of the second sports participant **120** proceeding with the current sporting event, but also a change in the heart rate of the second sports participant **120** who performed in a previous sporting event while viewing a video corresponding to the second live video data LVD**2**.

[0087] A method for broadcasting sports data according to some embodiments of the present inventive concepts may collect bio-signal, e.g., a heart rate, of a sports participant, in real time or substantially real time, and broadcast the sports data including collected bio-signal and live video data of a sporting event.

[0088] According to the method for broadcasting sports data, a broadcasting company can broadcast tension and/or a psychological state of a sports participant to a viewer in real time or substantially real time using a change in bio-signal, e.g., a heart rate, of the sports participant. Moreover, according to the method for broadcasting sports data, a viewer can observe how a sports participant overcomes tension or a psychological state. The sports data broadcast by a broadcasting company can stimulate curiosity of a viewer on how a sports participant overcomes tension or a psychological state and intensify the broadcast of a sporting event.

[0089] Although a few embodiments of the present general inventive concept have been shown and described, it will be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the general inventive concept, the scope of which is defined in the appended claims and their equivalents.

1. A method for broadcasting sports data, the method comprising:

receiving a first bio-signal output from a first sensor attached to a first sports participant through a first wireless communications module;

receiving a second bio-signal output from a second sensor attached to a second sports participant through a second wireless communications module;

receiving live video data of the first sports participant and the second sports participant through cameras, and

generating sports data so that at least one of the first bio-signal and the second bio-signal is superimposed on a live video related to the live video data,

wherein receiving the first bio-signal, the second bio-signal and the live video data are performed in real time or substantially real time during a sporting event.

2. The method of claim **1**, further comprising broadcasting the sports data to at least one end user device,

wherein the at least one end user device includes a TV, a computer, or a mobile device.

3. The method of claim **2**, wherein the broadcasting is performed in real time or substantially real time during the sporting event.

4. The method of claim **3**, wherein the sporting event is a static-type sporting event or a dynamic-type sporting event.

5. The method of claim **2**, wherein each of the first bio-signal and the second bio-signal may be data related to electrocardiography (ECG) or data related to photoplethysmography (PPG).

6. The method of claim **5**, wherein if the live video data includes a first live video data of the first sports participant or the second sports participant,

the broadcasting broadcasts the sports data including the first live video data, the first bio-signal, and the second bio-signal in real time or substantially real time during a sporting event.

7. The method of claim **1**, wherein the generating sports data includes:

reading a first previously received bio-signal of the first sports participant and a second previously received bio-signal of the second sports participant from a database, and

generating the sports data including the first previously received bio-signal, the first bio-signal, the second previously received bio-signal, and the second bio-signal, and the live video data.

8. The method of claim **7**, further comprising broadcasting the sports data to a at least one end user device through a wireless communications link,

wherein the wireless communications link is based on an ATSC communications standard, an ATSC-M/H communications standard, a terrestrial-digital multimedia broadcasting (T-DMB) communications standard, or a satellite-digital multimedia broadcasting (S-DMB) communications standard.

9. The method of claim **8**, wherein the broadcasting broadcasts the sports data to the plurality of end user devices through the wireless communications link in real time or substantially real time during a sporting event.

10. The method of claim **1**, wherein the first bio-signal and the second bio-signal is data respectively related to a heart rate of the first sports participant and the second sports participant.

11. A method for broadcasting sports data, the method comprising:

receiving a first bio-signal output from a first sensor attached to a first sports participant of a sporting event through a first wireless communications module in real time or substantially real time;

receiving a second bio-signal output from a second sensor attached to a second sports participant of a sporting event through a second wireless communications module in real time or substantially real time;

receiving a first live video data of the first sports participant through at least one first camera recording the sporting event;

processing the first bio-signal and the second bio-signal so that the first bio-signal and the second bio-signal are combined with the first live video data to generate a first sports data, and

broadcasting the first sports data to at least one end user device through a wireless communications link to display the first sports data on the at least one end user device.

12. The method of claim **11**, further comprising:

receiving a second live video data of the second sports participant through at least one second camera recording the sporting event;

processing the first bio-signal and the second bio-signal so that the first bio-signal and the second bio-signal are combined with the second live video data to generate a second sports data, and

broadcasting the first sports data and the second sports data to the at least one end user device through the wireless communications link to display the first sports data and the second sports data on the at least one end user device.

13. The method of claim **11**, wherein the first bio-signal and the second bio-signal is data respectively related to a heart rate of the first sports participant and the second sports participant.

14. The method of claim **11**, wherein each of the first bio-signal and the second bio-signal is data related to electrocardiography (ECG) or data related to photoplethysmography (PPG).

15. The method of claim **11**, wherein the wireless communications link is based on an ATSC communications standard, an ATSC-M/H communications standard, a terrestrial-digital multimedia broadcasting (T-DMB) communications standard, or a satellite-digital multimedia broadcasting (S-DMB) communications standard.

16-18. (canceled)

19. A method to generate sports data, the method comprising:

receiving at a synchronization processor first current bio-signal data for a first sports participant for a current sporting event;

determining at the synchronization processor whether previously received first bio-signal data for the first sports participant for a previous sporting event in which the first sports participant participated is to be displayed with the first current bio-signal data;

receiving at the synchronization processor first live video data of the first sports participant participating in the current sporting event;

combining the first current bio-signal data and the previously received first bio-signal data with the first live video data if it is determined that the previously received first bio-signal data is to be displayed with the first current bio-signal data; and

combining the first current bio-signal data with the first live video data if it is determined that the previously received first bio-signal data is not to be displayed with the first current bio-signal data.

20. The method of claim **19**, wherein combining the first current bio-signal data and the previously received first bio-signal data with the first live video data comprises superimposing the first current bio-signal data and the previously received first bio-signal data on the first live video data.

21. The method of claim **19**, wherein combining the first current bio-signal data with the first live video data comprises superimposing the first current bio-signal data on the first live video data.

22. The method of claim **19**, wherein the previously received first bio-signal data is an average of a plurality of previously received first bio-signal data.

23. The method of claim **19**, further comprising:

receiving at a synchronization processor second current bio-signal data for a second sports participant for a current sporting event;

determining at the synchronization processor whether previously received second bio-signal data for the second sports participant for a previous sporting event in which the second sports participant participated is to be displayed with the second current bio-signal data;

receiving at the synchronization processor second live video data of the second sports participant participating in the current sporting event;

combining the second current bio-signal data and the previously received second bio-signal data with the second live video data if it is determined that the previously received second bio-signal data is to be displayed with the second current bio-signal data; and

combining the second current bio-signal data with the second live video data if it is determined that the previously received second bio-signal data is not to be displayed with the second current bio-signal data.

24-27. (canceled)

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专利名称(译)	用于广播包括生物信号和直播视频数据的体育数据的方法		
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[标]申请(专利权)人(译)	三星电子株式会社		
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摘要(译)

一种用于广播体育的方法包括：通过第一无线通信模块接收从附接到体育赛事的第一体育参与者的第一传感器输出的第一生物信号，从附接到第二体育的第二传感器接收第二生物信号输出体育赛事的参与者通过第二无线通信模块，通过摄像头接收第一体育参与者和第二体育参与者的现场视频数据，并生成包括第一生物信号和第二生物信号中的至少一个的体育数据，实时视频数据。