

STORAGE DEVICE FOR ELECTRONIC DEVICES

TECHNICAL FIELD

[0001] The disclosure relates generally to storage devices for one or more electronic devices, such as, but not limited to, wireless electronic devices.

BACKGROUND

[0002] Electronic devices such as cellular telephones, computers, may generate different signals, such as audio signals, during operations and telephone calls. Electronic devices such as ear buds are used to facilitate transmit/receipt of audio signals. Some ear buds have cords that allow the ear buds to be plugged into a host electronic device via an input/output (I/O) port or jack. Recent technological developments include ear buds that are wireless and can communicate with a host device.

[0003] A conventional ear bud storage device, such as an ear bud storage box/case for receiving or accommodating one or more pairs of ear buds, may include charging function. Such storage boxes are provided with charging circuit for interfacing with a power adapter.

[0004] There exists a need to increase the functionality of a conventional storage device.

[0005] It would therefore be desirable to provide an improved storage device for storing electronic devices.

SUMMARY

[0006] Various embodiments concern a storage device for an electronic device. The electronic device may be a pair of wireless ear buds. In some embodiments, the storage device may comprise a casing shaped and dimensioned to receive the electronic device; a charging module arranged to provide electrical power to the electronic device; a broadcast module configured to broadcast audio stream according to a wireless communications protocol for playback by a plurality of remote audio devices; and a controller module configured to receive an activation signal to activate the charging mode and/or the broadcast module. In some embodiments, the device comprises an audio-conferencing module configured to receive audio data from at least one of a plurality of remote devices and send audio data to the other remote devices.

[0007] According to the present disclosure, a storage device for electronic devices as claimed in claim 1 is provided. A wireless ear bud device (in the form of a remote device) as a particular electronic device is defined in claim 14. A method for toggling a storage device for wireless ear buds between a charging mode, a broadcast mode, and an audio-conferencing mode is defined in claim 15.

[0008] The dependent claims define some examples associated with the device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The invention will be better understood with reference to the detailed description when considered in conjunction with the non-limiting examples and the accompanying drawings, in which:

- FIG. 1 illustrates an embodiment of a storage device 100 for storing a pair of wireless ear buds in accordance with various embodiments;
- FIG. 2A to FIG. 2D show schematic of various modules of the storage device 100 in accordance with various embodiments; and
- FIG. 3 shows a flow chart of a method for toggling the storage device 100 between a charging mode, a broadcast mode, and an audio-conferencing mode.

DETAILED DESCRIPTION

[0010] The following detailed description refers to the accompanying drawings that show, by way of illustration, specific details and embodiments in which the disclosure may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the disclosure. Other embodiments may be utilized and structural, and logical changes may be made without departing from the scope of the disclosure. The various embodiments are not necessarily mutually exclusive, as some embodiments can be combined with one or more other embodiments to form new embodiments.

[0011] The disclosure illustratively described herein may suitably be practiced in the absence of any element or elements, limitation or limitations, not specifically disclosed herein. Thus, for example, the terms “comprising”, “including,” “containing”, etc. shall be read expansively and without limitation. The word "comprise" or variations such as "comprises" or "comprising" will accordingly be understood to imply the inclusion of a stated integer or groups of integers but not the exclusion of any other integer or group of integers. Additionally, the

terms and expressions employed herein have been used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the disclosure. Thus, it should be understood that although the present disclosure has been specifically described in exemplary embodiments and optional features, modification and variation of the disclosure embodied herein may be resorted to by those skilled in the art.

[0012] Features that are described in the context of an embodiment may correspondingly be applicable to the same or similar features in the other embodiments. Features that are described in the context of an embodiment may correspondingly be applicable to the other embodiments, even if not explicitly described in these other embodiments. Furthermore, additions and/or combinations and/or alternatives as described for a feature in the context of an embodiment may correspondingly be applicable to the same or similar feature in the other embodiments.

[0013] In the context of various embodiments, the articles “a”, “an” and “the” as used with regard to a feature or element include a reference to one or more of the features or elements.

[0014] As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items.

[0015] As used herein, the term “electronic device” refers broadly to any device having electronic circuitry, including wireless circuitry. A wireless wearable electronic device such as a wireless ear bud may communicate with another electronic device such as a mobile phone, a wireless communication enabled storage case, or another wireless ear bud.

[0016] As used herein, the term "mobile device" or "wireless device" or "wireless communication device" is intended to broadly cover different types of devices that can wirelessly receive and/or transmit signals based on a wireless communication protocol. For example, and not for any limitation, a wireless communication device can include any one or a combination of the following: a two-way radio, a cellular telephone, a mobile phone, a smartphone, a two-way pager, a wireless messaging device, a laptop computer, a personal digital assistant, a tablet computing device, a pair of ear buds, chargers, and other similar devices.

[0017] As used herein, the term “module” refers to, or forms part of, or include an Application Specific Integrated Circuit (ASIC); an electronic circuit; a combinational logic circuit; a field programmable gate array (FPGA); a processor (shared, dedicated, or group) that

executes code; other suitable hardware components that provide the described functionality; or a combination of some or all of the above, such as in a system-on-chip. The term module may include memory (shared, dedicated, or group) that stores code executed by the processor.

[0018] As used herein, the term “network” can be any means/system for providing communication between one or more electronic devices and/or content stored remotely. As used herein, a network can be a personal area network, local area network, a storage area network, a system area network, a wide area network, a virtual private network, and an enterprise private network. The network can include one or more gateways or no gateways. The network communication can be conducted via published standard wired or wireless protocols or proprietary protocols.

[0019] As used herein, the term “media stream” broadly refers to the streaming of at least one of the following medium: text, still images (for example, photographs), audio data, video data, animation data (for example, GIFs). Accordingly, the term “media device” broadly refers to any device that is able to receive a media stream and execute broadcast, playout, playback of the media stream.

[0020] In the present application, the plural number means two or more. In addition, it is to be understood that the terms first, second, etc. in the description of the present application are used for distinguishing between similar functional elements within the description and not necessarily for describing a sequential or chronological order.

[0021] A schematic diagram of a device 100 for storing electronic devices, such as a pair ear buds 102, is shown in FIG. 1. The device 100 comprises a casing or housing 104 shaped and dimensioned to receive the ear buds 102. The outer contour of the casing 104 may be a rectangular parallelepiped with rounded corners. The casing 104 may comprise a cover portion 104a and a main body 104b. The inner cavity of the cover portion 104a and main body 104b may define at least one charging base for receiving or accommodating the pair of ear buds 102.

[0022] FIG. 2A to FIG. 2D show various embodiments of the device 100 which include a charging module 106 arranged to provide electrical power to the electronic device, a broadcast module 108 configured to broadcast audio stream according to a wireless communications protocol for playout by a plurality of remote audio devices; and a controller module 110 configured to receive one or more activation requests to perform one or more functions associated with charging the ear buds 102, broadcast audio content, and/or perform an audio conference. The device 100 may also contain an audio-conferencing module 112 configured to

receive audio data and send audio data to a plurality of remote devices. It is appreciable that the modules 106, 108, 110, 112 may be housed completely within the casing 104.

[0023] In various embodiments, the device controller module 110 may include a switch control module 114 to toggle between a broadcast mode, a charging mode, and an audio conference mode. The switch control module 114 may include one or more multiplexer chips to facilitate the switching between the charging mode, the broadcast mode and the audio-conferencing mode. The switch control module 114 may be arranged in data or signal communication with an input/output module to receive activation requests send state related information/data to the controller module 110. In some embodiments, one or more memory device/chip associated with the switch control module 114 may be programmed to have a plurality of interleaved channels, each channel corresponding to one media device for streaming the media content thereto.

[0024] The pair of ear buds 102 may be a pair of wireless ear buds that have small size and cordless form factor. In some embodiments, the wireless ear buds may be what is colloquially referred to as True Wireless Stereo (TWS) ear buds. The wireless ear buds may communicate with other electronic devices, such as mobile smartphones, via a wireless communication protocol. In some embodiments, the wireless communication protocol is a radio frequency based wireless communication protocol. Such wireless communication protocol may include a short-range wireless communication protocol, for example, Bluetooth™ protocol. In some embodiments, one or both of the wireless ear buds may function as hosts. The pair of ear buds 102 may each comprise an in-built battery to be charged by the charging module 106.

[0025] The charging module 106 may include a charging interface/stand for coupling with a portion of the ear buds 102. The charging module 106 may also include an identification module 132 for identifying whether the pair of ear buds 102 is received within the casing 104 for charging. The identification module 132 may detect if the pair of ear buds 102 is correctly coupled with the charging interface for electrical power to flow from the charging module 106 to the ear buds 102. The charging module 106 may also include electrical voltage/current sensors 134 operable to detect various states of the wireless ear buds 102. Non-limiting examples of states may include a 50% charged state, a 75% charged state, a non-detect state, a no-current flow state. In some embodiments, the charging module 106 may include an alternating current (AC) to direct current (DC) converter 136. In some embodiments, the

charging module 106 may include a built-in battery or capacitor bank 138 to facilitate charging of the wireless ear buds 102 on the move.

[0026] The broadcast module 108 is operable to broadcast audio stream according to a wireless communications protocol for playout by a plurality of remote audio devices. The broadcast module 108 may comprise an input/output interface 142 for receiving audio data from a host device. The host device may be a mobile device, a television set, a computer such as a desktop or laptop computer. The audio data sent to the broadcast module 108 may be processed in various ways as known to a skilled person. The processing may be performed by a processing module 144. Such processing may include noise filtering, bandpass filtering, amplification, etc. The input/output interface 142 may include antennas such as a GPS antenna, a Bluetooth antenna, an LTE antenna, one or more 2G/3G/4G/5G network antennas. In some embodiments, the input/output interface 142 may also include input ports such as a universal serial bus (USB) type-C input port for receiving audio data from a USB device. The broadcast module 108 may also include a streaming module 146 to stream audio content received from a host device to a plurality of remote audio devices. In some embodiments, the broadcast module 108 and/or streaming module 146 may include at least one encoder and/or at least one decoder for encoding and/or decoding media stream, such as an audio and/or video, stream.

[0027] In some embodiments, the plurality of remote audio devices may include multiple pairs of wireless ear buds.

[0028] The controller module 110 may function as a central processor to receive one or more activation requests to perform one or more functions associated with charging the ear buds 102, broadcast audio content, and/or perform an audio conference. In some embodiments, such activation requests may be received via the sending of one or more commands from a computer device within a same network or a different network. Such a computer device may be a mobile smart phone having a dedicated software application installed thereon to interface with the controller module 110. Upon receiving the activation requests, the controller module 110 may operate to send instructions to activate the charging module 106, the broadcast module 108 and/or the audio-conferencing module 110.

[0029] The audio-conferencing module 112 is configured to receive audio data via an audio input interface 152 from an electronic device and/or one of the plurality of remote devices. The received audio data may then be sent to all the plurality of remote devices in data

communication with the device 100. It is appreciable that the modules 106, 108, 110, 112 may be housed within the casing 104.

[0030] In some embodiments, any received audio data may be pre-processed via a pre-processing module 154 before being broadcast to other remote devices. Non-limiting examples of such pre-processing include noise filtering, amplification.

[0031] In some embodiments, the audio-conferencing module 112 may include a real-time module 156. The real-time module 156 may include a real-time operating system installed and configured to handle the audio inputs from respective participants of an audio conference on a real-time basis, so that the audio-conference can proceed smoothly without or with minimal dropped/unprocessed audio data packets.

[0032] In some embodiments, the device 100 may receive audio inputs through a telecommunication network. In some embodiments, the audio-conferencing module 112 may generate an audio output that is a combination of the respective audio inputs from the respective participants of the audio conference. The system transmits the audio output to the respective participants of the audio conference. This transmission can also take place through the telecommunication network.

[0033] In some embodiments, the device 100 may comprises an input port (e.g. a USB type-C port) to receive content data from a portable device, such as a USB drive. The received data may be parsed by the controller module 110 to identify audio data for broadcast by the broadcast module 108. Alternatively, the received data may be parsed by the broadcast module 108.

[0034] In some embodiments, the controller module 110 comprises a user interface positioned on an outer surface of the device 100. The user interface may be in the form of a display screen and/or a touch-screen.

[0035] In some embodiments, the broadcast module 108 comprises a database operable to store at least one identifier, the at least one identifier associated with a broadcast source.

[0036] The device of any one of the preceding claims, further comprising an audio-conferencing module adapted to receive audio data from at least one of the plurality of remote audio devices, the audio-conferencing module further arranged in data communication with the broadcast module to broadcast the received audio data according to the wireless communications protocol for playout by others of the plurality of remote audio devices.

[0037] In some embodiments, the audio-conferencing module comprises at least one of a multiplexer and a power amplifier.

[0038] In some embodiments (not shown), the device 100 may include a card slot to receive a mobile phone SIM card and/or an external memory card connected to the controller module 110.

[0039] In some embodiments (not shown), an intelligent voice module is also provided on the main control circuit. The intelligent voice module includes a core circuit board, a built-in memory, and a main control chip mainly composed of an embedded speech synthesis chip.

[0040] The modules 106, 108, 110, 112, 114 are described for the purpose of clarity and for ease of understanding. It is contemplated that one or more of the aforementioned modules may be combined. It is further contemplated that all the modules may be combined.

[0041] In the aforementioned embodiments the broadcast module 108 and the audio-conferencing module 112 are described with specific reference to streaming of audio content. It is contemplated that the modules 108, 112 may be adapted for other media streams, for example, video streaming. It is further contemplated that the modules 108, 112 may be adapted for multimedia streaming, which may include augmented reality/virtual reality related data.

[0042] According with another aspect, there is a remote device in the form of a pair of wireless ear buds. Each wireless ear bud may comprise a control circuit operable to obtain or calculate a first signal measurement with respect to the other wireless ear bud device and a second signal measurement with respect to an electronic device. The wireless ear bud may have a first indicator device arranged to receive a first control signal from the control circuit to provide an indication of a first state relating to the other wireless ear bud device or the electronic device; and a second indicator device arranged to receive a second control signal from the control circuit to provide an indication of the first state relating to the remote device.

[0043] In some embodiments, the first indicator may be in the form of a speaker, the second indicator may be in the form of a light module, such as a light-emitting diode (LED) ring or LED strip. The ear bud device 102 may include a microphone and an accelerometer. The microphone may gather audio input data such as the voice of a user who is making a telephone call. The accelerometer may detect movement associated with the ear buds 102, for example, when an ear bud 102 is dropped onto the ground or floor. The accelerometer may also detect a force applied on the ear bud 102 by a user (e.g. a tap or double tap) which may be associated

with some operations of the ear bud device 102. In some embodiments, the output of the accelerometer may be in the form of pulses.

[0044] One or more processors within the modules 106, 108, 110, 112 may contain software codes stored within one or more computer-readable media (including a non-transitory computer readable medium) such that, when executed, performs a method 200 as illustrated in FIG. 3.

[0045] FIG. 3 shows a flow-chart of a method for toggling the storage device 100 between a charging mode, a broadcast mode, and an audio-conferencing mode, wherein the electronic device is a pair of wireless ear buds, comprising the steps of: (a.) receiving an activation request to charge, broadcast or commence an audio conference (step S202); (b.) detecting if a pair of compatible wireless ear buds is present in the casing if the activation request is associated with charging the pair of ear buds (step S204); (c.) detecting if a broadcast host is present if the activation request is associated with broadcasting audio content to a plurality of remote devices (step S206); and (d.) detecting if at least one audio input is received from the plurality of remote devices or a host (step S208); wherein upon the steps of detecting any one of (b.), (c.) or (d.), the device activates the charging mode, the broadcast mode, and/or the audio-conferencing mode (step S210).

[0046] According to various embodiments, a circuit may include analog circuits or components, digital circuits or components, or hybrid circuits or components. Any other kind of implementation of the respective functions which will be described in more detail below may also be understood as a "circuit" in accordance with an alternative embodiment. A digital circuit may be understood as any kind of a logic implementing entity, which may be special purpose circuitry or a processor executing software stored in a memory, firmware, or any combination thereof. Thus, in various embodiments, a "circuit" may be a digital circuit, e.g. a hard-wired logic circuit or a programmable logic circuit such as a programmable processor, e.g. a microprocessor (e.g. a Complex Instruction Set Computer (CISC) processor or a Reduced Instruction Set Computer (RISC) processor). A "circuit" may also include a processor executing software, e.g. any kind of computer program, e.g. a computer program using a virtual machine code such as e.g. Java.

[0047] Examples of the pre-defined wireless communication protocols include: global system for mobile communication (GSM), enhanced data GSM environment (EDGE), wideband code division multiple access (WCDMA), code division multiple access (CDMA), time division multiple access (TDMA), wireless fidelity (Wi-Fi), voice over Internet protocol

(VoIP), worldwide interoperability for microwave access (Wi-MAX), Wi-Fi direct (WFD), an ultra-wideband (UWB), infrared data association (IrDA), BluetoothTM (e.g. Bluetooth 5.2, ZigBee, SigFox, LPWan, LoRaWan, GPRS, 3G, 4G, LTE, and 5G communication systems.

[0048] While the disclosure has been particularly shown and described with reference to specific embodiments, it should be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention as defined by the appended claims. The scope of the invention is thus indicated by the appended claims and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced.

CLAIMS

1. A device for storing an electronic device comprising
a casing shaped and dimensioned to receive the electronic device;
a charging module arranged to provide electrical power to the electronic device;
a broadcast module configured to broadcast a media stream according to a wireless communications protocol for playout by a plurality of remote media devices; and
a controller module configured to receive an activation signal to activate the charging mode and/or the broadcast module.
2. The device of claim 1, wherein the electronic device is a pair of wireless ear buds.
3. The device of claim 1 or 2, wherein the wireless communications protocol is a radio frequency-based communication protocol.
4. The device of any one of claims 1 to 3, further comprises an input port to receive content data from a portable device.
5. The device of claim 4, wherein the input port is a universal serial bus (USB) port.
6. The device of any one of claims 1 to 5, wherein the plurality of remote media devices include at least one pair of True Wireless Stereo (TWS) type ear buds.
7. The device of any one of claims 1 to 6, wherein the controller module comprises a user interface.
8. The device of claim 7, wherein the user interface comprises a touch-screen.
9. The device of any one of claims 1 to 8, wherein the broadcast module is configured to receive an audio stream from a broadcast source.

10. The device of claim 9, wherein the broadcast source is one of a mobile phone, a television, a personal computer, and a laptop.

11. The device of any one of the preceding claims, wherein the broadcast module comprises a database operable to store at least one identifier, the at least one identifier associated with the broadcast source.

12. The device of any one of the preceding claims, further comprising an audio-conferencing module adapted to receive audio data from at least one of the plurality of remote audio devices, the audio-conferencing module further arranged in data communication with the broadcast module to broadcast the received audio data according to the wireless communications protocol for playout by others of the plurality of remote audio devices.

13. The device of claim 12, wherein the audio-conferencing module comprises at least one of a multiplexer, a memory module having a plurality of interleaved channels, and a power amplifier.

14. A remote device of claim 1 in the form of a wireless ear bud device comprising
a control circuit operable to obtain or calculate a first signal measurement with respect to another wireless ear bud device and a second signal measurement with respect to an electronic device;

a first indicator device arranged to receive a first control signal from the control circuit to provide an indication of a first state relating to the another wireless ear bud device or the electronic device; and

a second indicator device arranged to receive a second control signal from the control circuit to provide an indication of the first state relating to the remote device.

15. A method for toggling a storage device of any one of claims 1 to 13 between a charging mode, a broadcast mode, and a conferencing mode, wherein the electronic device is a pair of wireless ear buds, comprising the steps of:

(a.) receiving an activation request to charge, broadcast or commence a media conference;

(b.) detecting if a pair of compatible wireless ear buds is present in the casing if the activation request is associated with charging the pair of ear buds;

(c.) detecting if a broadcast host is present if the activation request is associated with broadcasting content to a plurality of remote devices; and

(d.) detecting if at least one media input is received from the plurality of remote devices or a host;

wherein upon the steps of detecting any one of (b.), (c.) or (d.), the device activates the charging mode, the broadcast mode, and/or the conferencing mode.