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Schrager

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- (54) **VOICE CONTROLLED MULTIMEDIA AND COMMUNICATIONS DEVICE**
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- See application file for complete search history.

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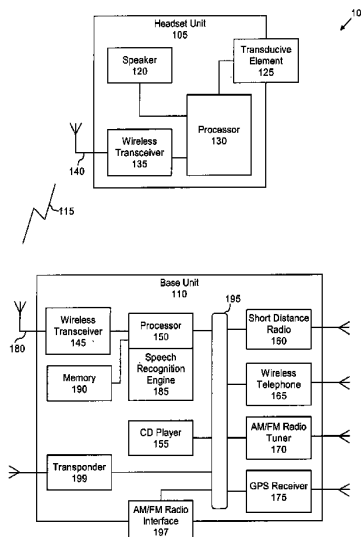
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(57) **ABSTRACT**

A portable multimedia and communications device can include a transductive element for receiving sound. The device also can include a base unit having a plurality of multimedia units and a processor executing a speech recognition engine for recognizing user speech. Each of the plurality of multimedia units can be selectively enabled and operated responsive to user voice commands received via the transductive element and communicated to the base unit via a communication link.

51 Claims, 3 Drawing Sheets



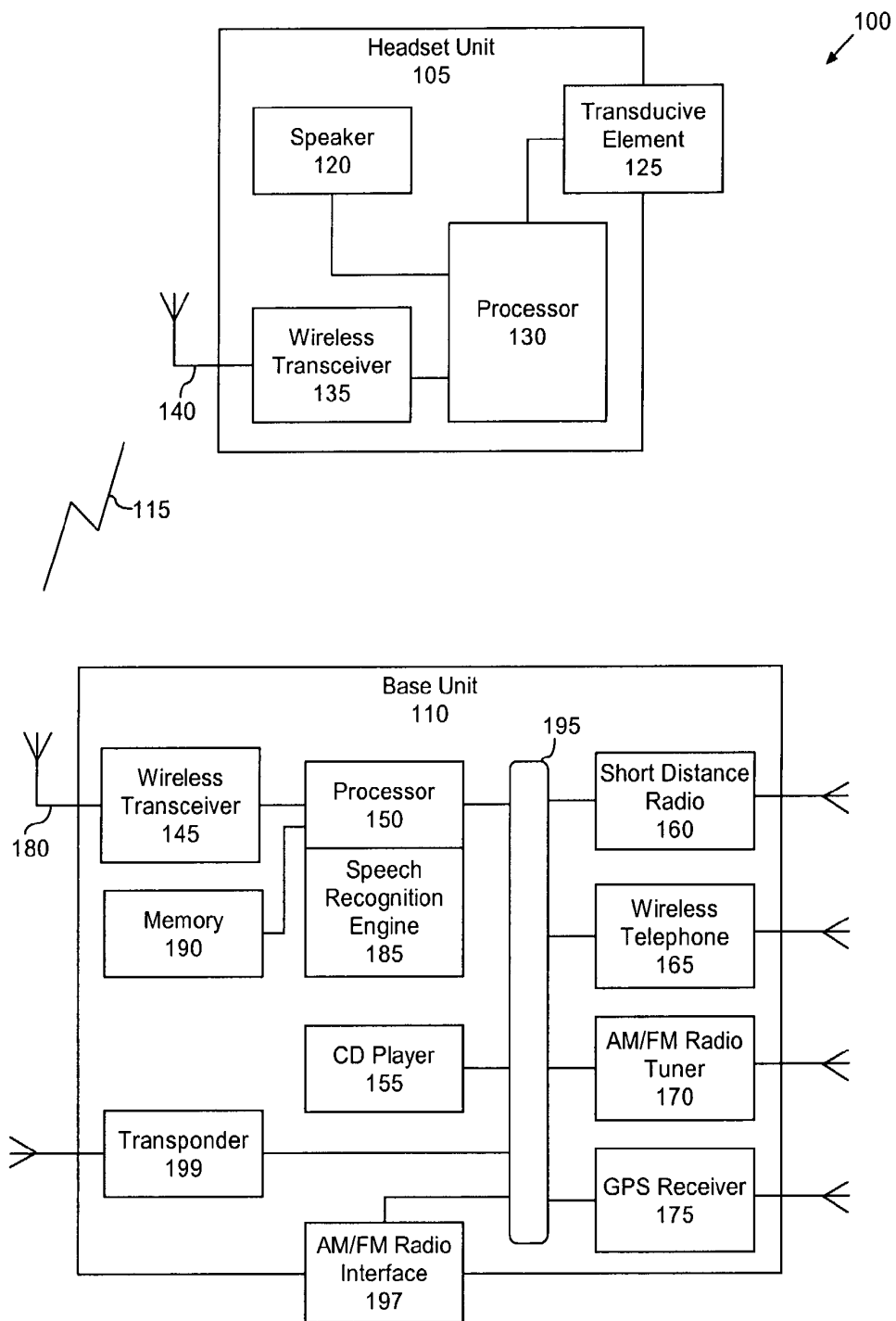
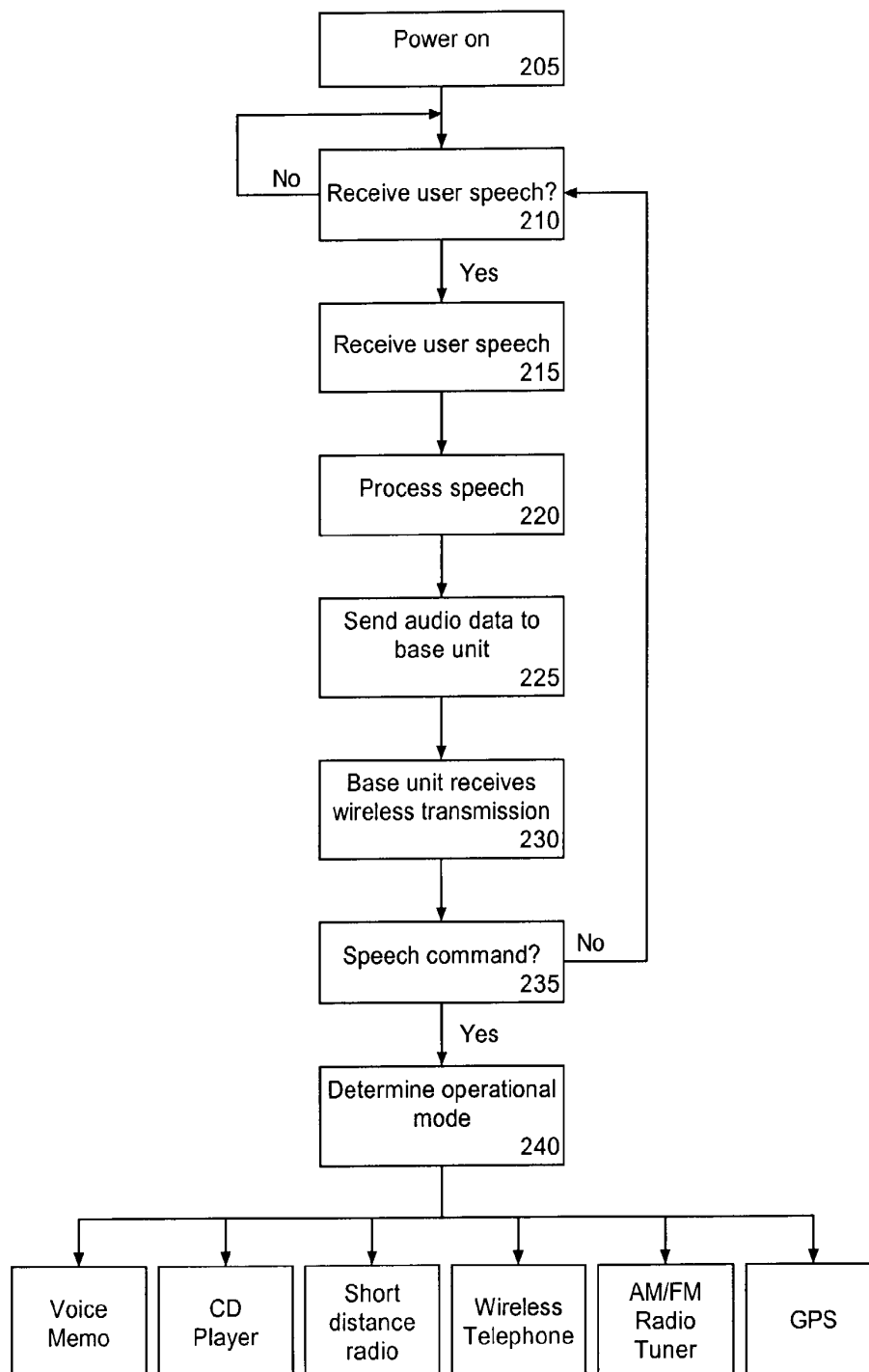
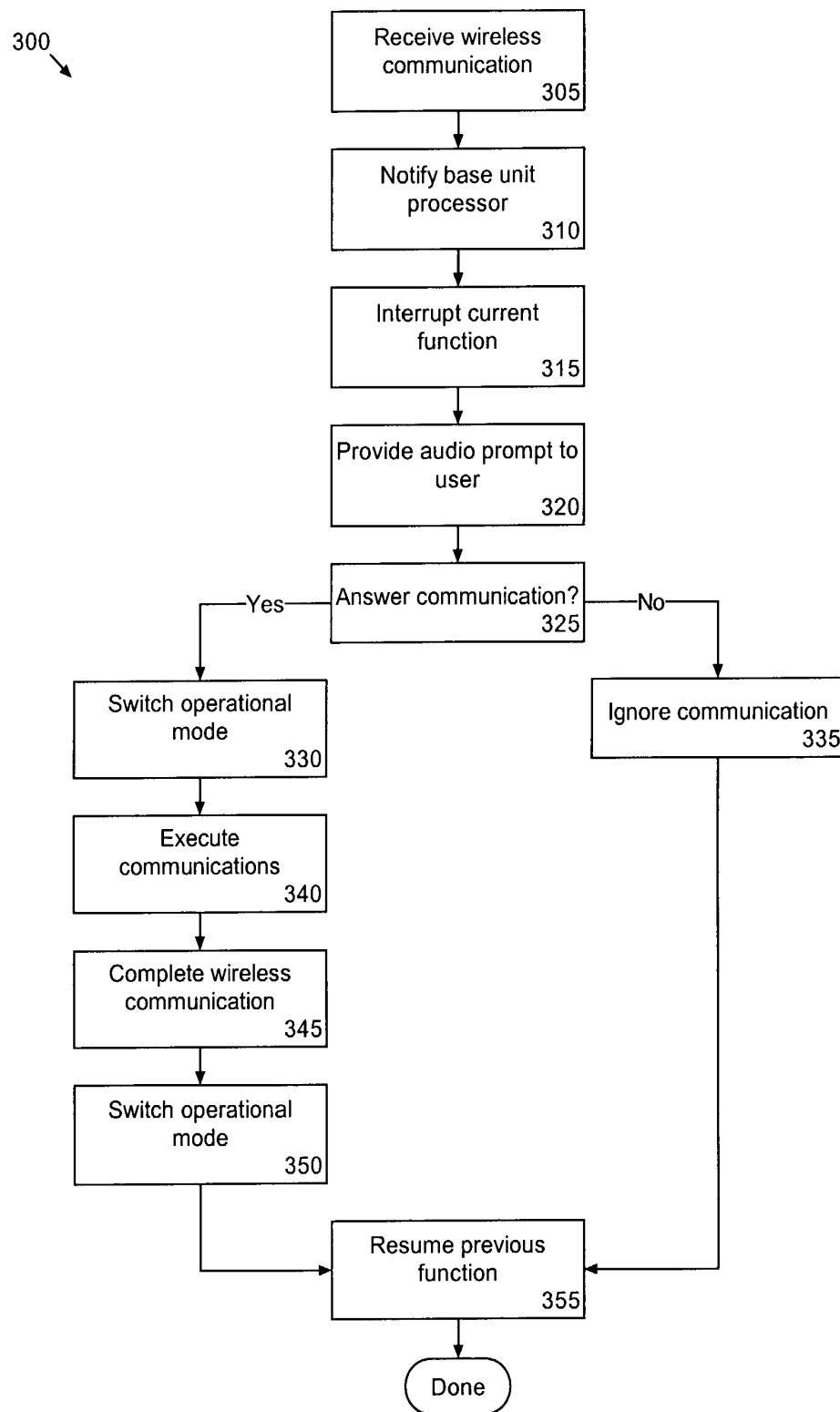


FIG. 1

**FIG. 2**

**FIG. 3**

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VOICE CONTROLLED MULTIMEDIA AND COMMUNICATIONS DEVICE

BACKGROUND OF THE INVENTION

1. Technical Field

The present invention relates the field of portable communications devices.

2. Description of the Related Art

As consumers continue to demand mobile access to many computing and communications services, technology continues to evolve to accommodate consumer demand. Ideally, consumers prefer to have access to most, if not all, of the same computing functions presently available at home or the office despite being away from such resources. In response to consumer demand, a wide variety of portable electronic devices have become commercially available. For example, individuals can track and store a variety of personal information using conventional personal digital assistants, communicate with friends, family, and business contacts using cellular telephones, and listen to music through portable radios, compact disc (CD) players, and/or Motion Picture Experts Group-1 Audio Layer 3 (MP3) players. A variety of other portable devices such as portable short distance radios and global positioning system (GPS) receivers are available to consumers as well.

The majority of commercially available portable devices are sold as single function units. That is, the consumer typically must purchase a music player separately from a cellular telephone, or a citizen band radio separately from a GPS receiver. Typically, consumers must carry a plethora of electronic devices should the consumer wish to travel with calendaring, music, communications, and the like. Even in cases where one or more of these devices are available in various combinations within a single unit, frequently, no single combination device is able to meet the consumer's full range of needs.

Although each device may not be burdensome to operate alone, when used in combination with one or more other devices, the consumer can be overwhelmed with connections, wires, cables, and attachments. To better organize the various electronic devices a consumer may carry, several varieties of carry-alls or electronic device organizers are available. Still, as the benefit of using a portable electronic device is the immediacy and ease with which the different functions of the device can be accessed, storing the device in a carry-all may not prove to be convenient. For example, by the time a consumer is able to locate a ringing cellular telephone within a carry-all, the call may be missed. By the time one finds a personal digital assistant within a carry-all, the opportunity to use the sought after information may have passed.

Assuming that a consumer is able to carry each of the various portable electronic devices that the consumer needs or desires, the consumer still must have one or more hands free in order to operate any given device. With respect to travelers, however, this is not often the case. More than likely, travelers use one or both hands to carry luggage, a carry-on bag, or possibly a personal digital assistant. To operate any of the traveler's portable electronic devices, the traveler may have to stop, put down one or more bags, search for the device, and only then proceed to use the desired device.

Other users, for example individuals who enjoy walking, jogging, hiking, bicycling, motorcycling, boating, or other activities, also rely upon portable electronic devices such as GPS units, music players, cellular telephones, voice memo

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pads, and the like when engaged in sports or other outdoor activities. Such individuals, however, not only must have one or more free hands to operate a given device, but also must be able to divert their attention away from an ongoing activity to operate the device. For example, the user typically must watch a dial or display as a radio is tuned, as a volume is adjusted, and the like. The use of one's eyes and hands, however, can cause a break in rhythm and concentration and may even cause an accident.

SUMMARY OF THE INVENTION

The present invention provides a solution for persons requiring access to a variety of multimedia, communications, and computing functions from a single electronic device. In particular, the present invention provides a portable electronic device which can include one or more of an AM/FM radio, a music player, a short distance radio, a voice memo pad, a cellular telephone, a global positioning system (GPS) receiver, an AM/FM radio interface, and a transponder (hereafter collectively referred to as "multimedia units"). Importantly, each of the various multimedia units not only can be included within a single, portable device, but also can be operated in a hands-free manner through the use of voice commands and speech recognition technology. Although the device can be embodied in a variety of forms, according to one inventive arrangement, the device can be modular, wearable, and weather resistant.

One aspect of the present invention can include a portable multimedia and communications device. The device can include a transductive element for receiving sound. According to one arrangement, the transductive element can be disposed in a first headset unit which can include a sound generation source and a short range wireless transceiver. The device also can include a base unit having a plurality of multimedia units and a processor executing a speech recognition engine for recognizing user speech. Notably, the speech recognition engine can be switched between a speaker-independent operational mode and a speaker-dependent operational mode responsive to a control signal, for example a user spoken utterance.

The device can be voice enabled such that each of the multimedia units can be selectively enabled and operated responsive to user voice commands received via the transductive element and communicated to the base unit via a communication link. Notably, the base unit can include a second short range wireless transceiver for communicating with the short range wireless transceiver of the headset unit. Accordingly, the communication link can be a wireless communication link. Still, the transductive element, or the headset unit depending upon the particular embodiment of the present invention, can be connected to the base unit via a wired connection.

According to one aspect of the present invention, responsive to activating one of the plurality of multimedia units, the processor can disable another active one of the plurality of multimedia units by lowering an audio volume of the other active multimedia unit or pausing operation of the other active multimedia unit. Responsive to terminating use of the activated multimedia unit, the processor can re-enable the other active one of the plurality of multimedia units.

For example, one of the multimedia units can be a wireless telephone. Thus, responsive to the wireless telephone receiving a telephone call, the processor can disable an active one of the multimedia units. For instance, the processor can disable an active multimedia unit by lowering an audio volume of the active multimedia unit or by pausing

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operation of the active multimedia unit. Responsive to termination of the telephone call, the processor can re-enable the active multimedia unit.

Taking another example, a second one of the multimedia units can be a short distance radio. In that case, responsive to the short distance radio receiving a wireless communication, the processor can disable an active one of the multimedia units. The processor can disable an active multimedia unit by lowering an audio volume of the active multimedia unit or by pausing operation of the active multimedia unit. Responsive to termination of the wireless communication, the processor can re-enable the active multimedia unit.

Still, the present invention can include additional multimedia units. For example, the present invention can include, but is not limited to, multimedia units such as a GPS receiver, an AM/FM radio tuner, an audio player, a compact disc player, a digital software-based media player, a cassette player, a voice recorder memo pad, an AM/FM radio interface, and a transponder.

Another embodiment of the present invention can include at least a second headset unit configured similarly to the first headset unit. The first headset unit and the second headset unit can communicate with one another through the base unit via wireless communication links.

Another aspect of the present invention can include a method of operating a voice activated, portable multimedia and communications device. The method can include receiving a user spoken utterance in a transductive element. The transductive element can be included within a headset unit. The user spoken utterance can be transmitted to a base unit via a wired connection or a short distance wireless communication link. The user spoken utterance can be speech recognized as a valid voice command. Accordingly, one of the multimedia units disposed in the base unit can be selectively enabled responsive to identifying the user spoken utterance as a valid voice command. Notably, the method can include switching between a speaker-independent operational mode and a speaker-dependent operational mode responsive to a control signal such as a voice command.

The method can include activating one of the plurality of multimedia units, and responsive to the activating step, disabling another active one of the plurality of multimedia units. For example, the disabling step can include lowering an audio volume of the other active multimedia unit or pausing operation of the other active multimedia unit. Responsive to terminating use of the activated one of the plurality of multimedia units, the other active one of the plurality of multimedia units can be re-enabled.

According to one embodiment of the present invention, the voice command can activate an intercom operational mode. In that case, the method can include receiving a subsequent user spoken utterance in the base unit from the headset unit via a wireless communication link. The user spoken utterance can be forwarded to a second headset unit via a second wireless communication link.

Still, one of the multimedia units can be a wireless telephone. Accordingly, the method can include receiving a telephone call in the wireless telephone and playing an audio notification through the headset unit indicating that the call has been received. For example, the audio notification can play a name associated with the received telephone call or a calling telephone number of the received call. Notably, the audio notification can query the user whether to answer the received telephone call. If another one of the multimedia units is active when the telephone call is received, the method further can include, responsive to receiving the telephone call, disabling the active multimedia unit. The

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active multimedia unit can be disabled by lowering an audio volume of the active multimedia unit or by pausing operation of the active multimedia unit. Responsive to terminating the telephone call, the active multimedia unit can be re-enabled. The method also can include determining that a calling number for the received telephone call is not included in a contact list and querying a user whether to save the received call information.

According to another embodiment of the present invention, one of the multimedia units can be a short distance radio. In that case the method can include receiving a short distance radio communication in the short distance radio and providing an audio notification to the headset unit indicating that the short distance radio communication has been received. For example, the user can be queried as to whether the received short distance radio communication should be answered. If another one of the multimedia units is active when the short distance radio communication is received, the method also can include, responsive to receiving the short distance radio communication, disabling the active multimedia unit. For example, the active multimedia unit can be disabled by lowering an audio volume of the active multimedia unit or by pausing operation of the active multimedia unit. Responsive to terminating the short distance radio communication, the active multimedia unit can be re-enabled. Notably, if one of the plurality of multimedia units is a wireless telephone and another one of the plurality of multimedia units is a short distance radio, the method can include exchanging audio between the wireless telephone and the short distance radio.

BRIEF DESCRIPTION OF THE DRAWINGS

There are shown in the drawings embodiments which are presently preferred, it being understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown.

FIG. 1 is a schematic diagram illustrating a voice-controlled multimedia and communications device in accordance with the inventive arrangements disclosed herein.

FIG. 2 is a flow chart illustrating a method of communicating between the headset unit and the base unit of the voice-controlled multimedia and communications device of FIG. 1.

FIG. 3 is a flow chart illustrating a method of receiving and processing wireless communications in accordance with the present invention.

DESCRIPTION OF THE INVENTION

The present invention provides a solution for persons requiring hands-free control over a variety of multimedia, communications, and computing functions contained within a single electronic device. In particular, the present invention provides a portable electronic device which can include one or more of an AM/FM radio, a music player, a short distance radio, a voice memo pad, a cellular telephone, a global positioning system (GPS) receiver, an AM/FM radio interface, and a transponder (hereafter collectively referred to as "multimedia units"). Importantly, each of the various multimedia units can be operated in a hands-free manner through the use of voice commands. Although the device can be embodied in a variety of forms, according to one inventive arrangement, the device can be modular, wearable, and weather resistant.

FIG. 1 is a schematic diagram illustrating a voice-controlled multimedia and communications device (VCMCD)

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100 in accordance with the inventive arrangements disclosed herein. As shown, the VCMCD 100 can include two primary components, a headset unit 105 and a base unit 110. The headset unit 105 and the base unit 110 can communicate with one another via a wireless communication link 115. The headset unit 105 can include a speaker 120 or other sound generator, a transductive element 125, a processor 130, a wireless transceiver 135, and an antenna 140. The speaker 120 can be disposed in an earpiece portion of the headset unit 105 to provide audio output when the headset 105 is worn by a user. Although not shown in FIG. 1, the headset unit 105 can include additional speakers so as to provide stereo sound. Accordingly, the headset can include two earpiece portions, each having a speaker disposed therein.

The transductive element 125, for example a microphone, can be attached to the headset unit 105. For example, according to one embodiment of the present invention, the transductive element 125 can be located on an arm which is rotatably attached to the earpiece so as to swing up and away from a user's face when not in use. Still, the transductive element 125 can be attached to the headset in any of a variety of different forms. For instance, the transductive element can be disposed within a clip-on apparatus which can clip onto a user's clothing. In that case, the transductive element 125 can be communicatively linked to the headset unit 105 via a wired connection. In the event the transductive element 125 is located as a separate component from the headset unit 105, the transductive element 125 can be communicatively linked to the base unit 110 via a wireless or wired connection.

Continuing with FIG. 1, the speaker 120 and the transductive element 125 can be communicatively linked to the processor 130. The processor 130 can perform a variety of audio processing and routing functions, as well as serve as an interface between the speaker 120, the transductive element 125, and the wireless transceiver 135. In particular, the processor 130 can perform analog-to-digital (A/D) conversions of audio signals received from the transductive element 125 and perform digital-to-analog (D/A) conversions of audio so as to provide a suitable audio signal to the speaker 120.

As mentioned, the processor 130 further can route signals among the various components of the headset unit 105. In particular, the processor 130 can receive audio signals, control signals, and other data originating from the base unit 110 through the wireless transceiver 135. The processor 130 can separate audio signals from the various control signals, D/A convert the audio, and provide the audio to the speaker 120. Similarly, the processor 130 can A/D convert audio signals received from the transductive element 125, and provide the converted audio in addition to any control signals and data to the wireless transceiver 135 for transmission to the base unit 110.

It should be appreciated that the processor 130, although depicted as a single general purpose processor, can be embodied as one or more processors, including control processors and audio processors such as digital signal processing (DSP) units. The speaker 120 and the transductive element 125 can be communicatively linked to the processor 130 via suitable circuitry. The processor 130 and the wireless transceiver 135 also can be communicatively linked via circuitry, for example a communications bus capable of supporting two way communications.

The wireless transceiver 135 can serve as an interface to the base unit 110. Specifically, the wireless transceiver 135 can receive signals from the processor 130 and convert the signals for use with a suitable wireless communications

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protocol for transmission. Similarly, the wireless transceiver 135 can receive signals from the base unit 110 and decode the signals using an appropriate wireless communications protocol prior to forwarding the signals to the processor 130.

The wireless transceiver 135 can be embodied in a variety of forms. For example, the wireless transceiver 135 can be configured to communicate with the base unit 110 using sound waves or infrared light. According to one embodiment of the invention, however, radio waves, that is radio frequency (RF) communication can be used. Thus, the wireless transceiver 135 can provide a signal to antenna 140 for transmission to the base unit 110. The wireless transceiver 135 can be configured to communicate with the base unit 110 using any of a variety of short range wireless technologies and/or protocols. For example, the wireless transceiver 135 can utilize BLUETOOTH technology, another technology of the 802.11 family of wireless communication specifications, as well as other proprietary technologies.

It should be appreciated, however, that the audio signal received from the transductive element 125 can be provided to the wireless transceiver 135 and transmitted in analog form. Accordingly, after the audio signal is received by the base unit 110, the processor 150, to be described in greater detail, can A/D convert the signal. In such an embodiment, audio and control signals transmitted from the base unit 110 to the headset unit 105 can be transmitted in analog form as well. In that case, the headset 105 can include additional analog processing circuitry, including analog audio processing circuitry.

According to another embodiment of the present invention, the speaker 120, the transductive element 125, and the processor 130 can be communicatively linked to the base unit 110 (to be described herein in greater detail) via a suitable wired connection which can facilitate two way communications among the headset unit 105 and the base unit 110.

On the exterior of the headset unit 105, one or more control buttons and/or switches can be included. The controls can be hardwired to perform one or more predetermined functions, or can be programmed through the base unit 110 to perform one or more of a variety of different functions. Alternatively, a software application executing on another computer system can be used to configure the VCMCD 100 using a charging cradle or other data link which communicatively links the headset unit 105, the base unit 110, and the separate computer system. Regardless, the controls can be assigned to perform functions such as interrupting the processor 130 so as to give precedence to audio input received from the transductive element 125, dialing 911, sending an emergency signal over the short distance radio, sending a transponder signal, or awakening the VCMCD 100 from a power save or sleep mode. For example, activating a control can notify the VCMCD 100 that speech to follow specifies a name for voice dialing or is to be recorded as a voice memo. Still, one or more controls, whether permanently configured or software configurable, can be included for accessing any of the various functions to be described herein with reference to the base unit 110. For example, one or more control buttons can be dynamically assigned a function according to the operating state of the VCMCD 100.

The base unit 110 of the VCMCD 100 can include a wireless transceiver 145, a processor 150, a compact disc (CD) player 155 or other music source, a short distance radio 160, a wireless telephone 165, an AM/FM radio tuner 170, a GPS receiver 175, an AM/FM radio interface, as well as a transponder 199. The wireless transceiver 145 can be

matched to the wireless transceiver **135** of the headset unit **105** so as to support two-way wireless communications via antenna **180** as previously discussed. The transceiver **145** can be communicatively linked to the processor **150** via suitable interface circuitry. Thus, the transceiver **140** can receive data from the processor **150**, format data using the appropriate communications protocol, and send data to the headset unit **105** via the wireless communication link **115**. Similarly, data received from the headset unit **105** over the wireless communication link **115** can be decoded and provided to the processor **150**.

The processor **150** can be communicatively linked to the CD player **155**, the short distance radio **160**, the wireless telephone **165**, the AM/FM radio tuner **170**, the GPS receiver **175**, the AM/FM radio interface **197**, and the transponder **199** via suitable circuitry such as a communications bus **195**. The communications bus **195** can support two way communication among each of the respective components, thereby enabling the exchange of control signals as well as audio data.

The processor **150**, similar to the processor **130** of the headset unit **105**, can include one or more general purpose processors and/or DSP units. The processor **150**, however, can include a speech recognition engine **185**. For example, the speech recognition engine **185** can be included in the memory of processor **150** or can be included within an additional memory **190** which is accessible by the processor **150**. In any case, the speech recognition engine **185** can receive digitized speech from the headset unit **105** and convert the received speech to text. The speech recognized text can be processed to determine one or more voice commands which can be executed by the processor **150**.

Still, as discussed, the based unit **110** can receive analog signals from the headset unit **105** which can be decoded by the wireless transceiver **145**. In that case, the analog signals can be A/D converted by the processor **150** for further processing such as speech recognition.

The CD player **155** can be communicatively linked to the processor **150** via the communications bus **195**. Notably, additional audio sources such as tape players and other digital medial players including, but not limited to, minidisk players, Motion Picture Experts Group-1 Audio Layer 3 (MP3) players, and the like can be included in place of, or in addition to, the CD player **155**. According to one embodiment of the present invention, one or more software-based audio players can be included within the base unit **110**.

The short distance radio **160** can be any of a variety of personal two-way short distance radio communications devices which can operate over distances of less than one mile and up to distances of tens of miles. For example, the short distance radio **160** can be configured to operate over one of the Citizen's Band Radio Services, such as Citizen's Band (CB) or Family Radio Service (FRS). Alternatively, the short distance radio **160** can be configured to operate over General Mobile Radio Service (GMRS), or some other short distance radio communications format.

The wireless telephone **165**, for example a cellular telephone, the AM/FM radio tuner **170**, and the GPS receiver **175** are commercially available components. Notably, the AM/FM radio tuner **170** can be programmed with one or more preset stations for both AM and FM bands. Each of the various preset stations can be accessed via a suitable voice command such as "preset 1", "preset 2", "next preset up", or "next preset down". Each of the respective components can be communicatively linked to the processor **150** via the communications bus **195**. The transponder **199** can provide wireless communications for monitoring incoming signals

or sending outgoing signals such as a "beacon" signal which can be tracked by third parties for purposes of safety. Although the transponder **199** can include active components so that the transponder can receive and send signals which can be detected over long ranges, the transponder **199** also can include passive components enabling the transponder **199** to be detected by sensors within ranges of several feet. Notably, the transponder **199** can be configured to transmit coordinates as determined by the GPS receiver **175** in cases of emergency or periodically depending upon the VCMCD **100** configuration.

The AM/FM radio interface **197** allows the base unit **110** to be connected to a car radio, for example, via an antenna input or other standard connector available on conventional car radios. Responsive to connecting the base unit **110** to a car radio via the AM/FM radio interface **197**, the processor **150** can direct audio output through the communications bus **195** to the AM/FM radio interface **197**. The AM/FM radio interface **198** enables a user to listen to audio received and generated by the VCMCD **100** through a high quality car audio system rather than the headset unit **105**.

According to another embodiment of the present invention, the headset unit **105** can be configured, or a separate and additional transductive element can be configured, without the speaker **120**. As the audio originating from the base unit **110** can be played through the car audio system when the AM/FM radio interface **197** is engaged, no speaker need be included in the headset unit **105**. For example, a wearable microphone such as a lapel microphone can be used. Such a microphone can be wirelessly connected to the base unit **110** as described. Alternatively, the microphone can be connected to the base unit **110** via a wired connection to a suitable audio jack disposed in the base unit **110** which can be connected to the processor **150** via suitable interface circuitry.

The processor **150** can receive speech recognized text from the speech recognition engine **185** to compare against a grammar or vocabulary of recognizable words and/or voice commands. If a match exists, the processor **150** can determine an appropriate action. In particular, responsive to voice commands, the processor **150** can selectively enable and disable the CD player **155** or other audio source, the short distance radio **160**, the wireless telephone **165**, the AM/FM radio tuner **170**, and the GPS receiver **175**. Moreover, the processor **150** can control software driven processes such as recording voice memos and the like responsive to voice commands. Notably, not only can a user select a particular device through voice commands, but the user also can access the various operational parameters of each of the respective devices via voice commands. An exemplary listing of voice commands is included in the Appendix.

As shown in FIG. 1, the short distance radio **160**, the wireless telephone **165**, the AM/FM radio tuner **170**, the GPS receiver **175**, and the transponder **199** each can be configured to include a separate antenna for sending and receiving wireless signals. It should be appreciated by those skilled in the art, however, that one or more of these components can be configured to share a common antenna. For example, the wireless telephone **165** can be configured to share a general purpose antenna with the short distance radio **160**, or with the wireless transceiver **145**. Regardless of the particular antenna configuration used, the examples disclosed herein are not intended as a limitation of the present invention.

A power source (not shown) can be included in the headset unit **105** and the base unit **110**. The power source can be one or more disposable batteries or rechargeable batter-

ies. For example, a rechargeable power source can be recharged in a charging cradle similar to the cradle commonly used with conventional personal digital assistants. Notably, both the headset **105** and the base unit **110** can be configured to charge within such as cradle. Still, other charging mechanisms can be used to charge the power source of the VCMCD **100** such as wearable, flexible photovoltaic devices, regenerative braking charging units, or chargers which connect to an electrical connection such as a cigarette lighter receptacle commonly used in motor vehicles. Accordingly, the base unit **110** can draw power to operate as well as recharge a rechargeable power source via such an electrical connection.

FIG. **2** is a flow chart illustrating a method **200** of communicating between the headset unit and the base unit of FIG. **1**. In step **205**, the VCMCD can be powered on. The VCMCD can include a power switch on the headset unit as well as the base unit. Accordingly, the headset unit and the base unit can be powered on independently of one another. In an alternative embodiment of the invention, the VCMCD can be powered on by a voice command. For example, the unit can remain in a low power consumption sleep mode such that a received voice command such as "power on" can activate or awaken the VCMCD.

In any case, once the VCMCD is powered on, the VCMCD can be configured to begin operation in either a speaker independent mode or a speaker dependent mode. In speaker independent mode, a generalized speaker model can be used for purposes of speech recognition. That is, the speaker model is not tailored for use with any particular user. In speaker dependent mode, a speaker-specific voice model can be used which emphasizes perceptually important speaker characteristics. Although the VCMCD can determine a speaker dependent model, the speaker dependent model also can be derived from a counterpart application and transferred to the base unit via a data link. The VCMCD can be configured to power on in either speaker independent or speaker dependent mode through various controls on the base unit, or using a software application configured to communicate with the VCMCD via a charging cradle, a universal serial bus port, or other wired or wireless connection.

In step **210**, the VCMCD can enter a power save mode awaiting user speech. If user speech is received, the method can continue to step **215**. If not, however, the method can continue to loop until user speech is received. If user speech is received, the method can continue to step **220**. According to one embodiment of the invention, the processor can implement one or more noise filters and frequency filters so as to emphasize sounds within the frequency range of human speech. Thus, if a signal is received having a particular strength and within a particular frequency range, the signal can be considered a speech signal. Notably, the transductive element can be suited for use with the frequency range of human speech as well as be equipped with a wind guard. Accordingly, user speech can be detected automatically and distinguished from background and environmental noise.

In an alternative embodiment of the invention, either the headset unit, the base unit, or both can be equipped with a control which awakens the VCMCD or serves as an indication that the user will speak. The user can activate such a control prior to speaking. In any event, user speech can be received through the transductive element and converted to an analog audio signal to be provided to the headset processor.

Continuing with step **220**, the analog speech signal can be processed for transmission to the base unit. In particular, the

analog speech signal can be A/D converted by the headset processor and provided to the headset transceiver. The headset transceiver **220** can prepare the digitized speech signal according to a wireless communication protocol for transmission to the base unit. Accordingly, in step **225**, the headset unit can transmit the speech signal to the base unit through the wireless communication link.

In step **230**, the base unit can receive the audio data from the headset via the wireless communication link and the base unit wireless transceiver. The base unit wireless transceiver can decode the signal and provide the digitized audio signal to the base unit processor. In step **235**, the processor can perform speech recognition on the received audio and determine whether the received audio is a valid voice command. In particular, the speech recognition engine can compare the recognized text to one or more possible commands specified in a command grammar or list. If the speech is not a valid command, the method can continue to step **210** and repeat as necessary. If the speech is a valid command, the method can continue to step **240** to determine the operating state corresponding to the received voice command.

In particular, the user can select any of a variety of operating modes including, but not limited to a voice memo mode, a CD player mode, a short distance radio mode, a wireless telephone mode, an AM/FM tuner mode, and a GPS mode. Each of the various operating modes can be associated with a predefined command vocabulary. Exemplary voice commands for each of the modes are illustrated in the Appendix. For example, the user can utter "radio on", "CD on", "communicator on", "memo on", or "locator on", and once received, the VCMCD will enter the appropriate operating state. Accordingly, if the command "CD on" is received, the command grammar associated with operation of the CD player can be activated. The command grammar for the CD player can include commands for skipping tracks, fast forwarding, rewinding, playing, pausing, stopping, as well as voice commands for various modes of continuous and random play.

It should be appreciated, however, that particular commands, for example volume commands, operating state commands, and power commands, can remain active no matter which state the VCMCD is operating. This enables a user to change operating states during operation of any of the multimedia units disclosed herein. For example, while dictating a voice memo, the user can say "phone", which can be a reserved voice command which initiates the wireless telephone mode. Accordingly, once the VCMCD enters the wireless telephone mode, the user can access voice dialing or other telephone related functions using voice commands.

Other voice commands which can remain in the active vocabulary can include specialized communications functions. For example, emergency or "911" access can be accessible no matter which mode the VCMCD is operating. Thus, the user can say "emergency 911" which can cause the VCMCD to initiate a cellular telephone call to 911 or another predetermined number, for example one corresponding to an emergency service. Voice dialing can remain active at all times such that the user can say "voice dial" and a contact name no matter which mode the VCMCD is operating. Notably, the VCMCD can be configured to transmit coordinates with an emergency call. Similar functionality can be available using the short distance radio and transponder. For example, responsive to a voice command such as "emergency communication", the VCMCD can transmit a call for help over one or more specified channels or continuously over one or more specified channels using the short distance radio. The user's coordinates as deter-

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mined by the GPS receiver also can be transmitted through the short distance radio. Notably, the user's location can be specified either by sending data or by playing a text-to-speech rendition of the GPS receiver determined coordinates.

FIG. 3 is a flow chart illustrating a method 300 of receiving wireless communications in accordance with the present invention. The method can begin in a state wherein the user is engaged in an activity such as listening to a CD or audio file played by the audio source in the base unit or is dictating a voice memo. Accordingly, in step 305, a wireless communication can be received. For example, a telephone call can be detected by the wireless telephone in the base unit or an incoming communication can be received by the short distance radio in the base unit. Accordingly, in step 310, the particular multimedia unit having received the incoming wireless communication can send a notification to the base unit processor.

In step 315, the processor can instruct the current function to pause or otherwise stop. For example, the processor can pause the recording of a voice memo, stop the audio feed from the CD player or AM/FM radio tuner, or lower the volume of the multimedia unit currently playing. Similarly, if a telephone call is received during a short distance radio communication, or a short distance radio communication is received during an ongoing telephone call, the audio of the current active function can be lowered so that an audio prompt provided by the VCMCD can be heard by the user.

In step 320, the base unit processor can cause an audio notification to be played to the user. For example, a tone can be played from a tone generator (not shown) to indicate that an incoming communication has been received. Distinctive tones can be used to signify whether the received communication is a short distance radio communication or a received wireless telephone call. Alternatively, the processor can simply play an audio prompt which explicitly states that a telephone call or a short distance radio communication has been received. For example, a recorded voice prompt can be played or text-to-speech (TTS) technology can be used to play prompts to the user. Still, the base unit processor can send a control signal to the processor of the headset to play an audio prompt stored in the headset unit.

According to one embodiment of the invention, the audio prompt can inform the user of the identity of the calling party. For example, the calling number can be played to the user. Additionally, if the calling number, or source identifier in the case of a short distance radio communication, is specified within a contact list stored within the VCMCD, then the contact name can be played. Notably, the contact name can be played using TTS technology or, as the VCMCD can perform voice dialing, the recorded user sample of the contact's name can be played to indicate the identity of the calling party or source of the incoming wireless communication.

In step 325, a determination can be made as to whether the user wishes to respond to the received wireless communication. In particular, the user can say "yes" or "no" to indicate whether the user wishes to respond to the incoming wireless communication. Notably, as mentioned, one or more "hot keys", or keys the function of which changes according to the operational state of the VCMCD can be provided. For example, controls can be provided allowing the user to answer the incoming wireless communication or send the wireless communication directly to voice mail. Still, another control can be used to ignore the incoming wireless communication and return directly to the previous function without having to wait a predetermined amount of

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time and hear several audio prompts before the wireless communication is sent to voice mail. Accordingly, a user can select such a key to respond to a wireless communication or simply ignore any audio prompts allowing the predetermined response time to expire such that the incoming wireless communication is ignored. Thus, if the user indicates that the incoming wireless communication is to be answered, the method can continue to step 330. If, however, the user indicates that the incoming wireless communication is to be ignored, the method can proceed to step 335. Notably, in the case where the wireless communication is not to be answered, the VCMCD can notify the user whether a message has been left. In any case, it should be appreciated that any function which can be controlled via a hardware control can be accessed also by a voice command.

Continuing with step 330, the VCMCD can switch operational modes from current mode of the VCMCD to either the short distance radio mode or the wireless telephone mode depending upon the particular wireless communication received in step 305. Accordingly, in step 340, the VCMCD can perform the functions necessary for the user to engage in short distance radio communications or a telephone call. Thus, audio received from the wireless communication can be provided to the headset unit and speech received from the user can be transmitted to the caller or individual sending short distance radio communication. In step 345, after the user has finished participating in the telephone call or the short distance radio communications, the communication session can be terminated. For example, the user can say "end call", "end communication", or can activate a control on the headset or the base unit. Notably, in the case of a wireless telephone call, the wireless telephone can automatically detect the termination of a call by the other participant. According to another embodiment of the present invention, the VCMCD can terminate an ongoing wireless communication after a predetermined time period has elapsed without any audio being received from the participant or generated by the user.

In step 350, responsive to termination of the communication session, the VCMCD can switch operational modes back to the particular mode in which the VCMCD was engaged prior to receiving the wireless communication. Accordingly, the user can resume any paused and/or discontinued activity. It should be appreciated that the method 300 illustrated in FIG. 3 is for purposes of example only. Thus, if a wireless communication is received when the VCMCD is not engaged in another function or the unit is in a sleep mode, the VCMCD still can query the user as to whether the received wireless communication is to be answered.

The VCMCD, as mentioned, can include a contact list and/or database. According to one embodiment of the present invention, the VCMCD can determine that a calling telephone number of a received call does not exist in the user's contact list. Thus, the VCMCD can prompt the user whether to store the calling number. If the user wishes to store the number, the VCMCD can query the user for the name of the contact corresponding to the calling number. The name can be specified by dictating the spelling of the name letter by letter so that the letters can be speech recognized or by dictating the entire name such that the name can be recorded or speech recognized and stored for use in voice dialing the number in the future. Notably, the recorded speech or recognized text as provided to a TTS system can be used in audio prompts for notifying the user of an incoming call from the newly stored name.

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The present invention can provide a variety of different functions, each of which can be accessed in a hands-free manner through one or more voice commands, or through one or more controls and operational state-dependent function controls. Accordingly, although many of the functions of the VCMCD have been described in detail, the VCMCD can provide a variety of additional functions. For example, according to one embodiment of the present invention, the VCMCD can function as an intercom. In that case, the VCMCD can be configured to operate with two or more headset units which can communicate with one another via a single base unit. Thus, the present invention can be used by motorcyclists or other active persons engaged in activities wherein the environment complicates communication between participants. Notably, the headset units can be incorporated into helmets or other varieties of protective head gear.

The intercom function of the VCMCD further can make the various functions of the VCMCD available to all users of a communicatively linked headset. For example, the VCMCD can be placed in speaker independent mode to receive voice commands from either user or can be placed in speaker dependent mode to receive voice commands from one user. Regardless, audio from the CD player and/or audio source, the AM/FM radio tuner, the short distance radio, and the wireless telephone can be made available to one or more headsets selectively. Notably, using the headsets, one or more users having access to a headset can participate in a given telephone call.

Another aspect of the present invention can include the ability to communicatively link the wireless telephone and the short distance radio such that audio received via the wireless telephone can be routed to the short distance radio and visa versa. This enables the free exchange of communications between short distance radio participants, one or more users of the VCMCD having headsets, and wireless telephone participants.

Notably, as the VCMCD includes a wireless telephone, standard telephony functions such as conference calling also can be made available. Conference call functions can be accessed via one or more voice commands. For example, responsive to a voice command such as "conference caller 1", the VCMCD can place an existing call on hold, initiate a call to a contact "caller 1", and conference caller 1 into the existing call. It should be appreciated that the particular method of establishing the conference call can vary, and that the number of conference callers to be joined to an existing call need only be limited by the telephony service. For example, responsive to a voice command such as "conference caller 1 and caller 2", the VCMCD can initiate a call to caller 1, establish the call with caller 1, place caller 1 on hold, and initiate a call to caller 2 to eventually conference caller 2 into the existing call with caller 1.

Another aspect of the present invention can provide directional services to users. In particular, as the GPS receiver can continually determine coordinates specifying the location of a user, those coordinates can be provided to the base unit processor. According to one embodiment of the present invention, the processor can provide the coordinates to a service which can be accessed via the wireless telephone. Directions to a user specified location then can be provided back to the base unit and played to the user. Alternatively, the base unit can store one or more different maps in memory allowing the base unit processor to determine a route to the user specified location and provide audible instructions as to how to follow the route.

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Those skilled in the art will recognize that the invention disclosed herein can be embodied in a variety of different physical arrangements. Accordingly, depending upon the size of the various multimedia units to be included within the present invention, the base unit can be combined with the headset unit. In particular, if larger multimedia units are excluded in favor of more compact multimedia units, for example where the CD player is excluded in favor of an MP3 player, the VCMCD can be embodied as a single headset device capable of performing the various functions disclosed herein.

The present invention can be realized in a combination of hardware and software. Any kind of computer system or other apparatus adapted for carrying out the methods described herein is suited. Aspects of the present invention also can be embedded in a computer program product, which comprises all the features enabling the implementation of the methods described herein, and which when loaded in a computer system is able to carry out these methods. Computer program in the present context means any expression, in any language, code or notation, of a set of instructions intended to cause a system having an information processing capability to perform a particular function either directly or after either or both of the following: a) conversion to another language, code or notation; b) reproduction in a different material form.

This invention can be embodied in other forms without departing from the spirit or essential attributes thereof. Accordingly, reference should be made to the following claims, rather than to the foregoing specification, as indicating the scope of the invention.

APPENDIX

Exemplary voice commands for controlling various operational parameters of the voice controlled multimedia and communication device (VCMCD) as disclosed herein are illustrated below. Notably, the various voice commands listed herein can be amended to include a code, that if said in combination with the listed voice command, can cause the VCMCD to process the received speech using a speaker independent recognition model rather than a user specific speech recognition model, and vice versa.

1. VCMCD (General).
 - a. DEVICE (ON/OFF). Turns entire VCMCD on or off.
 - b. DEVICE ON (code). Turns entire device on in a universal voice mode if user programmed code is specified in combination with DEVICE ON command.
 - c. VOLUME (UP/DOWN). Raises or lowers volume of presently enabled multimedia unit.
 - d. STANDBY. The designated feature or the feature currently operating can be placed on standby.
2. AM/FM Radio Tuner.
 - a. RADIO (ON/OFF). Enables or disables AM/FM radio tuner.
 - b. GO TO (AM/FM). Causes AM/FM radio tuner to switch to specified band.
 - c. GO TO X PLAY. Causes AM/FM radio tuner to change specified frequency on current band and play audio from the AM/FM radio tuner.
 - d. SCROLL (UP/DOWN). Causes AM/FM radio tuner to search for a next higher or lower frequency which is clearly received.
 - e. SCAN (UP/DOWN). Causes AM/FM radio tuner to scan frequencies up or down until stopped by user.

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- f. STOP. Causes AM/FM radio tuner to stop scanning frequencies and play the station to which the AM/FM radio tuner is presently tuned.
- 3. Compact Disc (CD) Player.
 - a. CD (ON/OFF). Enables or disables CD player.
 - b. PLAY. Play disc in CD player beginning at first track.
 - c. PLAY TRAC X. Plays specified track of CD in CD player.
 - d. REPEAT DISC. Plays CD continuously until stopped by user.
 - e. REPEAT TRACK. Plays current track until stopped by user.
 - f. STOP. Stops playing current track.
- 4. Short Distance Radio.
 - a. COMMUNICATOR (ON/OFF). Enables or disables short distance radio.
 - b. GO TO CHANNEL X. Switches short distance radio to designated channel.
 - c. SCROLL (UP/DOWN). Causes short distance radio to scroll up or down a single channel.
 - d. SCAN (UP/DOWN). Causes short distance radio to scan channels up or down until stopped by user.
 - e. STOP. If received during SCAN operation, causes short distance radio to stop scanning.
- 5. Memo Pad.
 - a. MEMO (ON/OFF). Enables or disables the memo pad function.
 - b. (START/STOP). Begins or terminates recording when in memo pad function.
 - c. SEND TO X. Causes voice memo to be speech recognized and text to be sent to designated contact or causes audio recording to be played after connecting with another party over a wireless communication link.
- 6. Wireless Telephone.
 - a. PHONE (ON/OFF). Enable or disable wireless telephone.
 - b. SAVE CONTACT. Saves current number, i.e. of received call, in address list along with recorded name of contact or text name as determined by speech recognition engine through character recognition.
- 7. GPS Receiver/Finder.
 - a. LOCATOR (ON/OFF). Enable or disable GPS receiver.
 - b. DIRECTIONS TO X. Causes GPS receiver to note current position and initiate audio directions to user specified location.
 - c. SOS. Sends wireless communication, i.e. wireless telephone call to specified destination, short distance radio communication, or transponder signal. Can specify GPS determined coordinates.

What is claimed is:

1. A portable multimedia and communications device comprising:
 - a transductive element for receiving sound; and
 - a base unit comprising a plurality of multimedia units and a processor executing a speech recognition engine for recognizing user speech, wherein each of said plurality of multimedia units can be selectively enabled and operated responsive to user voice commands received via said transductive element and communicated to said base unit via a communication link, wherein the base unit is a portable electronic device, wherein said plurality of multimedia units comprise at least one multimedia unit selected from the group consisting of an AM/FM radio, a cassette player, a compact disk player,

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- and a digital software-based media player, and wherein said speech recognition engine is switched between a speaker-independent operational mode and a speaker-dependent operational mode responsive to a user spoken utterance.
- 2. The device of claim 1, wherein said transductive element is disposed in a first headset, said first headset unit further comprising a sound generation source and a short range wireless transceiver, said base unit comprising a second short range wireless transceiver for communicating with said short range wireless transceiver of said headset unit, and wherein said communication link is a wireless communication link.
- 3. The device of claim 1, wherein said device is voice activated, and wherein said plurality of multimedia units comprise a voice memo pad.
- 4. The device of claim 1, wherein responsive to activating one of said plurality of multimedia units, said processor disables another active one of said plurality of multimedia units.
- 5. The device of claim 4, wherein said processor disables said another active one of said plurality of multimedia units by lowering an audio volume of said another active multimedia unit.
- 6. The device of claim 4, wherein said processor disables said another active one of said plurality of multimedia units by pausing operation of said another active multimedia unit.
- 7. The device of claim 4, wherein responsive to terminating use of said activated multimedia unit, said processor re-enables said another active one of said plurality of multimedia units.
- 8. The device of claim 1, wherein one of said multimedia units is a wireless telephone.
- 9. The device of claim 8, wherein responsive to said wireless telephone receiving a telephone call, said processor disables an active one of said plurality of multimedia units.
- 10. The device of claim 9, wherein said processor disables an active one of said plurality of multimedia units by lowering an audio volume of said active multimedia unit.
- 11. The device of claim 9, wherein said processor disables an active one of said plurality of multimedia units by pausing operation of said active multimedia unit.
- 12. The device of claim 9, wherein responsive to terminating said telephone call, said processor re-enables said active one of said plurality of multimedia units.
- 13. The device of claim 1, wherein a second one of said multimedia units is a short distance radio, and wherein plurality of multimedia units comprise an AM/FM radio interface.
- 14. The device of claim 13, wherein responsive to said short distance radio receiving a wireless communication, said processor disables an active one of said plurality of multimedia units.
- 15. The device of claim 14, wherein said processor disables an active one of said plurality of multimedia units by lowering an audio volume of said active multimedia unit.
- 16. The device of claim 14, wherein said processor disables an active one of said plurality of multimedia units by pausing operation of said active multimedia unit.
- 17. The device of claim 14, wherein responsive to terminating said wireless communication, said processor re-enables said active one of said plurality of multimedia units.
- 18. The device of claim 8, wherein a second one of said multimedia units is a global positioning (GPS) receiver.

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19. The device of claim 8, wherein a second one of said multimedia units is an AM/FM radio tuner, and wherein a third one of said multimedia units is a digital software based media player.

20. The device of claim 8, wherein a second one of said multimedia units is an audio player.

21. The device of claim 20, wherein said audio player is selected from the group consisting of a compact disc player, a digital software-based media player, and a cassette player.

22. The device of claim 8, wherein a second one of said multimedia units is a voice recorder memo pad.

23. The device of claim 2, further comprising:

at least a second headset unit configured similarly to said first headset unit, wherein said first headset unit and said second headset unit communicate with one another through said base unit via wireless communication links.

24. The device of claim 1, said base unit further comprising:

an AM/FM radio interface for providing audio from said base unit to a radio.

25. The device of claim 1, said base unit further comprising:

a transponder for locating said device.

26. A method of operating a voice activated, portable multimedia and communications device comprising:

receiving a user spoken utterance in a transductive element;

transmitting said user spoken utterance to a base unit via a communication link;

speech recognizing said user spoken utterance as a valid voice command;

selectively enabling one of a plurality of multimedia units disposed in said base unit responsive to identifying said user spoken utterance as said valid voice command, wherein the base unit is a portable electronic device, and wherein said plurality of multimedia units comprise at least one multimedia units selected from the group consisting of an AM/FM radio, a cassette player, a compact disk player, and a digital software-based media player; and

switching a selectively-enabled multimedia unit between a speaker-independent operational mode and a speaker-dependent operational mode in response to a user spoken utterance identified as a valid voice command.

27. The method of claim 26, wherein said transductive element is disposed in a headset unit.

28. The method of claim 26, wherein said user spoken utterance is transmitted to a base unit via a short distance wireless communications link.

29. The method of claim 26, further comprising:

activating one of said plurality of multimedia units; responsive to said activating steps disabling another active one of said plurality of multimedia units.

30. The method of claim 29, said disabling step comprising:

lowering an audio volume of said another active multimedia unit.

31. The method of claim 29, said disabling step comprising:

pausing operation of said another active multimedia unit.

32. The method of claim 29, further comprising:

responsive to terminating use of said activated one of said plurality of multimedia units, re-enabling said another active one of said plurality of multimedia units.

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33. The method of claim 26, wherein said voice command activates an intercom operational mode, said method further comprising:

receiving a subsequent user spoken utterance in said base unit from said headset unit via a wireless communication link; and

forwarding said user spoken utterance to a second headset unit via a second wireless communication link.

34. The method of claim 26, wherein one of said plurality of multimedia units is a wireless telephone, said method further comprising:

receiving a telephone call in said wireless telephone; and playing an audio notification through said headset unit indicating that said call has been received.

35. The method of claim 34, wherein said audio notification plays a name associated with said received telephone call.

36. The method of claim 34, wherein said audio notification plays a calling telephone number of said received call.

37. The method of claim 26, wherein another one of said plurality of multimedia units is active when said telephone call is received, said method further comprising:

responsive to receiving said telephone call, disabling said active one of said plurality of multimedia units.

38. The method of claim 37, said disabling step comprising:

lowering an audio volume of said active multimedia unit.

39. The method of claim 37, said disabling step comprising:

pausing operation of said active multimedia unit.

40. The method of claim 37, further comprising:

responsive to terminating said telephone call, re-enabling said active one of said plurality of multimedia units.

41. The method of claim 34, wherein said audio notification queries a user whether to answer said received telephone call.

42. The method of claim 34, further comprising:

determining that a calling number for said received telephone call is not included in a contact list; and querying a user whether to save said received call information.

43. The method of claim 26, wherein one of said plurality of multimedia units is a short distance radio, said method further comprising:

receiving a short distance radio communication in said short distance radio; and

providing an audio notification to said headset unit indicating that said short distance radio communication has been received.

44. The method of claim 43, wherein another one of said plurality of multimedia units is active when said short distance radio communication is received, said method further comprising:

responsive to receiving said short distance radio communication, disabling said active one of said plurality of multimedia units.

45. The method of claim 44, said disabling step comprising:

lowering an audio volume of said active multimedia unit.

46. The method of claim 44, said disabling step comprising:

pausing operation of said active multimedia unit.

47. The method of claim 44, further comprising:

responsive to terminating said short distance radio communication, re-enabling said active one of said plurality of multimedia units.

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48. The method of claim 43, wherein said audio notification queries a user whether to answer said received short distance radio communication.

49. The method of claim 26, wherein one of said plurality of multimedia units is a wireless telephone and another one of said plurality of multimedia units is a short distance radio, said method further comprising:

exchanging audio between said wireless telephone and said short distance radio.

50. A portable multimedia and communications device comprising:

a transductive element for receiving sound; and

a base unit comprising a plurality of multimedia units and a processor executing a speech recognition engine for recognizing user speech, wherein each of said plurality of multimedia units can be selectively enabled and operated responsive to user voice commands received via said transductive element and communicated to said base unit via a communication link, wherein the base unit is a portable electronic device, wherein said plurality of multimedia units comprise at least one multimedia unit selected from the group consisting of an AM/FM radio, a cassette player, a compact disk player, and a digital software-based media player, and wherein each multimedia unit operates in a speaker-dependent operational mode until being switched to a speaker-independent operational mode in response to a user spoken utterance.

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51. A method of operating a voice activated, portable multimedia and communications device comprising:

receiving a user spoken utterance in a transductive element;

transmitting said user spoken utterance to a base unit via a communication link;

speech recognizing said user spoken utterance as a valid voice command;

selectively enabling one of a plurality of multimedia units disposed in said base unit responsive to identifying said user spoken utterance as said valid voice command, wherein the base unit is a portable electronic device, and wherein said plurality of multimedia units comprise at least one multimedia units selected from the group consisting of an AM/FM radio, a cassette player, a compact disk player, and a digital software-based media player; and

operating a selectively-enabled multimedia unit in a speaker-dependent operational mode until causing the selectively-enable multimedia unit to operate in a speaker-independent mode in response to a user spoken utterance identified as a valid voice command.

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