United States Patent

Devereaux et al.

Wireless Augmented Reality Communication System

Applicant: Throop, LLC, Los Angeles, CA (US)

Inventors: Ann Devereaux, Tujunga, CA (US); Thomas Jedrey, Pasadena, CA (US); Martin Agan, Pasadena, CA (US)

Assignee: THROOP, LLC, Los Angeles, CA (US)

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Continuation of application No. 14/595,191, filed on Jan. 12, 2015, now Pat. No. 9,479,726, which is a continuation of application No. 14/187,315, filed on Feb. 23, 2014, now Pat. No. 8,933,863, which is a continuation of application No. 10/038,760, filed on Sep. 27, 2013, now Pat. No. 8,736,517, which is a continuation of application No. 13/723,472, filed on Feb. 1, 2013, now abandoned, which is a continuation of application No. 11/410,517, filed on Apr. 24, 2006, now abandoned, which is a continuation of application No. 09/483,315, filed on Jan. 14, 2000, now Pat. No. 7,035,897.

Provisional application No. 60/115,993, filed on Jan. 15, 1999.

Abstract

A portable unit is for video communication to select a user name in a user name network. A transceiver wirelessly accesses a communication network through a wireless connection to a general purpose node coupled to the communication network. A user interface can receive user input to log on to a user name network through the communication network. The user name network has a plurality of user names, at least one of the plurality of user names is associated with a remote portable unit, logged on to the user name network and available for video communication.

20 Claims, 3 Drawing Sheets
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**Welcome to WARP**

Users logged on:
- Vest
- Gordon
- VC1
- GreatHac
- Remote: DrHike
- Nameserver

select one
User puts on the portable access unit with headset and sensor

User logs in and portable access unit associates with local general purpose node

Provide connection list to portable access unit from general purpose nodes

Present connection list of portable access units and media devices logged onto the system

Select entry from the selection list

 Transmit selection to the general purpose node

Set connection between user's portable access unit and the selected portable access unit or media device through the general purpose node

Exchange signals

FIG. 3
WIRELESS AUGMENTED REALITY COMMUNICATION SYSTEM

GOVERNMENT LICENSE RIGHTS

The U.S. Government has certain rights in this invention pursuant to NAST-1407 awarded by NASA.

CROSS-REFERENCE TO RELATED APPLICATIONS

Any and all applications for which a foreign or domestic priority claim is identified in the Application Data Sheet as filed with the present application are hereby incorporated by reference under 37 CFR 1.57.

FIELD OF THE INVENTION

The invention, in general, relates to a wireless augmented reality system (WARS), and more particularly, to a WARS that leverages communications and multimedia information processing microelectronics, along with displays, imaging sensors, biosensors, and voice recognition to provide hands-free, tetherless, real-time access and display of network resources, including video, audio and data.

DESCRIPTION OF RELATED INFORMATION

Online instruction manuals are becoming more prevalent in the industrial and everyday environment. These electronic technical manuals (ETM) may be interactive. Just as with printed manuals, ETMs may become very difficult to use and maintain in these environments where elements of an environment, such as dust, chemical or general harshness may be detrimental to the electronics and storage devices used to display and operate the ETM. Further, it is not always possible for a worker who requires access to an ETM to stop work to consult ETM.

These problems are multiplied in extraterrestrial environments such as a space shuttle or a space station. During intra and extra vehicular activities, it may be virtually impossible to access a traditional keyboard and computer display to access an ETM. For example, during a satellite repair mission, it would not be practical for an astronaut in a bulky extravehicular space suit to type commands on a keyboard to view a display in the extreme environment of outer space where the sun glare may make viewing impossible.

Hands-free portable computers have been implemented in an attempt to solve some of these problems. For example, U.S. Pat. Nos. 5,305,244 and 5,844,824 describe systems in which a head-up display and voice recognition is implemented in a portable computer for displaying ETM. However, these systems, being a single user-to-computer paradigm, do not allow multiple-user access to multiple computers, multimedia devices or nodes on a network for accessing arbitrarily-selected data channels. Further, these previously-described systems are self contained and their data storage needs to be updated periodically to be sure that the latest data is displayed. Further, these systems do not allow two-way communication over local and wide area networks to other multi-media users and devices, and do not provide real-time biomedical information about the physical condition of the user.

There is thus a need for a wireless, wearable communications system allowing two-way voice, video and data communication between local users and to remote users and devices over network-nodes, along with tetherless real-time monitoring of the local user's physical condition.

SUMMARY

The needs of the prior art are met by a portable unit, methods of software for video communication to select a user name in a user name network.

In one embodiment, a transceiver wirelessly accesses a communication network through a wireless connection to a general purpose node coupled to the communication network. A user interface can receive user input to log on to a user name network through the communication network. The user name network has a plurality of user names, at least one of the plurality of user names being associated with a remote portable unit, logged on to the user name network and available for video communication. In some embodiments, the user interface comprises a touchpad configured to receive user inputs. A display on the portable unit displays one or more of the plurality of user names.

In an embodiment, the user interface further receives a selection of a user name from the plurality of user names. The display displays video communication received by the portable unit from the remote portable unit. The video communication is associated with the selected user name.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic illustration of the components of the system of the present invention;

FIG. 2 is block diagram illustrating communications components used by the personal access unit and general purpose node of the system of FIG. 1; and

FIG. 3 is a flowchart illustrating a method performed using the system of FIG. 1.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

With reference to FIG. 1, a diagram illustrating components of the system of the present invention is shown. The system may comprise small pager-like devices called portable access units 100. The portable access units 100 are accessorizable for different “multimedia” interfaces for display, camera, audio and sensor operation. Another embodiment of the portable access unit 100 comprises a wearable headset and microphone assembly 102a.

The portable access units 100-100a interface directly through wireless link with a network through a general purpose node 150. The general purpose node 150 allows wireless-to-wire communication with a local network 170. The local area network 170 may be electrically connected to a wide area network or Internet 172 in order to connect to remote area networks 174. Alternatively, the general purpose node 150 may be directly connected to the wide area network 172. The general purpose node 150 may thus act as a router for routing video, display, audio and control data packets between the portable access units 100 and other, or remote, portable access units 100 or remote media devices 125, 180, etc connected to the networks 170-174. The connection with a network 170-174 may occur directly in electrical connection with one of the networks 170-174, or in wireless communication through a remote general purpose node 150a that is electrically connected to the network.

The portable access units 100 may provide communication to and from remote media devices comprising computers 180-182 running specialized client software or certain com-
commercial multimedia Internet software products such as video conferencing products that adhere to the industry standard H.323 for multimedia data transfer.

Each portable access unit 100-100a may dynamically associate with the closest general purpose node 150-150a when it is logged on to the network 170-174 or is connected thereto. Each general purpose node 150-150a records the associations and registers each portable access unit 100-100a on a list of connections associated with the particular general purpose node 150-150a. The list of connections is stored in a random access memory device included in the general purpose node 150-150a. When a portable access unit 100 is logged off or disconnected from the network 170-174, it is disassociated from the particular general purpose node 150-150a that it was associated with, and thus, is removed from the list of connections.

As shown on an example selection list screen 190 that may be presented on a display 102 or headset 102a on any of the portable access units 100-100a, the user can set up a video, audio, or data link with any other portable access unit 100-100a or remote media device 125, 180, etc., that is logged onto a network 170-174. The headset 102a may comprise a heads-up display (120 in FIG. 2) inside a headset embodying a transparent color LCD device. Using control keys or voice commands, a user of the portable access unit 100-100a may select a local or remote portable access unit 100-100a on a selection list 190 of other portable access units 100-100a or media devices 125, 180. The selection list 190 comprises a combination of the lists of connections stored on all of the general purpose nodes 150-150a. Users may further access a nameserver located on the access node 150 for locating remote unfamiliar portable access units 100-100a or remote media devices.

By selecting entries from the selection list 190, users may communicate with portable access units 100-100a or various media devices such as cameras 125, internet phones 104, one or more computers 180-182 located throughout the networks 170-174. A user may further select from the list 190 user names representing users of other portable access units 100 that are logged in and associated with remote general purpose nodes 150a connected to the networks 170-174.

With reference to FIG. 2, the components of the access node 150 and the wearable headset embodiment of the portable access unit 100a is shown. Elements for both the general purpose access node and portable access unit 100a include a communications device 202. Data processing functions are implemented in the form of an audio/video coder/decoder (codec) pair 200, one codec 200 comprising part of the portable access unit 100a and the other codec 200 being part of another portable access node 100b or remote media device for which it is desired to exchange signals. At a portable access node, the codec 200 controls a digital data stream which is fed to the communications device 202, which is implemented as an RF modem transceiver pair with an equivalent communications device 202 located in the general purpose access node. The codecs 200 serve as the interfaces to the external elements (including possibly the user display 102a and the sensor 104) on both sides of the communication continuum comprising the communications device 202 of the general purpose node 150, an internal network interface protocol circuit 152, the external networks 170-174 and the electrical connection or general purpose access node connection to the desired remote portable access node or media device. The internal network interface protocol circuit 152 may comprise an Ethernet chip, memory and a network protocol chip. With this architecture, the system addresses the issues of multiple-access and data channel quality, through the implementation of the communications device 202. Multiple implementations of the communications device 202 in the general purpose node 150 allows for multiple simultaneous communication links with a plurality of portable access units 100-100a for the general purpose node 150.

With the base functionality of the communications device 202 and codec subsystem 200, the architecture provides flexibility in utilization of different external components such as different headset 102a configurations, sensor 104 packages, and network interface 152 capabilities.

The communications device 202 is designed to operate in a high multipath space station or terrestrial indoor environment while being able to support multiple users at high, multimedia-type bandwidths. Thus the communications device’s 202 physical (PHY) and media access (MAC) layers in combination support multiple access, dynamic network association, channel error rates of broadcast video quality (1.times.10e-6), and data rates up to broadcast-quality video bandwidths (on the order of 768 kbps per user (one-way)). Modulation to achieve this performance will be differential phase-shift keying, of binary or higher order (quadrature or high-order quadrature amplitude modulation); the order chosen reflects the necessary user data volume to be supported within fixed, FCC-specified bandwidth allocations. Orthogonal frequency division multiplexing, code division multiple access, and frequency hopping/time division multiple access may be used for achieving multiple access. Spread spectrum, channel equalization, antenna diversity and retransmission techniques may also be used for improving the reliability of the communications link. Through a combination of these technologies, two-way multimedia channel throughputs can be achieved for each of multiple simultaneous users. A variety of RF frequencies may be used, but the determining factor in frequency band selection is the availability in the band of a relatively large amount of spectrum in the space station or FCC terrestrial allocations, allowing the transmission of compressed video. Ranges in the 2.5 to 5.7 band range are preferable due to the FCC bandwidth available, the compactness of RF elements required at these frequencies, and the potentially low amount of interference that will be sustained. The RF front end of both the portable access unit 100-100a and general purpose node 150-150a may be interchangeable with different frequency front ends for system use in different frequency bands.

Low-rate, single user implementations of the communications system may be effected through adapted commercial wireless-LAN type products following the FCC 802.11 standard such as a frequency-hopping 2.4 GHz wireless LAN transceiver by Waveaccess, Inc of Wellesley, Mass., or direct-sequence spread-spectrum 2.4 GHz wireless LAN chipset by Harris Prism of Melbourne, Fla. These radio implementations, as with commercial implementations of the industry-proposed Bluetooth and HomeRF standards, will be limited in user access and overall throughput, however, and therefore unsuitable to real-time video teleconferencing for multiple users. The preferred embodiment for full capability is to implement the communications devices’ physical and media access control layers in custom ASIC circuits allowing for support of all system capabilities within microelectronics architecture for small size and low power draw, providing pager-type form factor of wearable personal access units 100-100a.

The communications device 202 comprises a buffer memory and a radio frequency front end. Data modulation/
demodulation circuits and error detection/correction protocol circuits are further included. Various combinations of these circuits may be obtained from Proxim of Sunnyvale, Calif., Harris of Melbourne, Fla. and Stanford Telecom of Stanford, Calif. Alternatively, all of the various circuitry may be implemented with an application specific integrated circuit (ASIC), or a combination of an ASIC and discrete elements for size and weight efficiency.

Three classes of headsets 102a may be used: hi-resolution military systems which are CRT based and may be provided by Honeywell of Morristown, N.J., or Hughes Network Systems of San Diego, Calif.; medium resolution industrial systems which are CRT or LED based scanners and may be provided by Intervision of Santa Clara, Calif.; or low to medium resolution entertainment systems which are color viewfinder LCD based systems that may be supplied by Virtual Vision of Redmond, Wash. (the V-CAP and E-GLASS), Sony Europe of Hampshire, United Kingdom (GLASSTRON VISOR) or Olympus of San Jose, Calif.

Typical headset display 120 specifications for the portable access unit 100a include the following:

**RESOLUTION:** Comparable at least to VGA (640x480) or better to 1280x1024 w/off-the-shelf display & I/O configuration

**DISPLAY:** >10 FL/day, Display Bright.Ratio: >2, Brightness range: 2 OOM_max

**FOV:** 40-60 deg, Gray scale: >12

**EyeRelief:** 20-26 mm TSP, 14/10 mm (on/off-axis) exit pupil

**Unif:** 2:1 across ½ FOV, GLARE: <2.5% image content, PixelContrast: 25

**FOCUS:** Hands off, Obs: % look-around, Diopter range: +4.2,

**Mag:** x:±95%, Cont: >95%, motion sensor 10° cone, Inter. Eye: adj: 52-72 mm

**Image Enhancer & IFF:** Weapsight, motion sensor and computer interface

The audio/video codec 200 in a portable access unit 100-100a or other client device is based around a single chip, standards-based codec that accepts analog or digital audio and video (i.e. NTSC or VGA) compresses this input, and multiplexes the compressed data with an external data stream. The preferred industry standards are: ITU H.263 based video, ITU G.722 based audio, and ITU H.221 based multiplexing. The audio video codec 200 in the portable access unit 100-100a can establish a link with a similar audio/video codec 200 associated with another portable access unit 100-100a or a remote media device 104, 125, 180 or 182. The signals from the codec 200 in the portable access unit 100a outputs the received and decompressed remote signals from the device for which the link was established. The interface between the codec 200 and communication device 202 as well as between the communication devices 202 of the general purpose node 150-150a and portable access unit 100-100a operate two-way with a high bandwidth suitable for transmitting video. Of this bandwidth, the audio portion utilizes up to 64 kbps and the data from the sensor 104 utilizes the required amount for the type of sensor 104, with the remainder allocated to compressed video. The quality of the video at these data rates in excess of 128 kbps is at least equivalent to video teleconferencing quality video.

The audio/video codec 200 portion of the portable access unit 100-100a may further comprise video input and output ports, audio input and output ports, data input and output ports, and a the above-mentioned multimedia processor chip for packaging signals for data compression and decompression for transmission. Exemplary multimedia processors include the VCPEX chip by 8.times.8, Inc. of Santa Clara, Calif. or digital signal processing chips by Texas Instruments and others. The audio/video codec 200 further comprises a field processor gate array, electrically programmable read-only memory and random access memory for processing and packaging signals for compression and decompression.

The sensor 104 may comprise a commercially available pulse oximeter sensor or other type of bio-sensor. A pulse-oximeter sensor allows the measurement of pulse rate and oxygen saturation of the blood. Data from the sensor 104 is transmitted to the general purpose node 150-150a, and transmitted to any remote media device connected to any of the networks 170-172. The sensor 104 may comprise an “on body” wireless human performance and fatigue monitoring system that communicates with a belt-mounted transceiver/ control module. The remote media device may comprise a processor 180-182 for display or logging of the real-time sensor signals.

The headset 102a comprises a heads-up display 120 comprising a transparent color LCD device for video signals received and processed by the codec 200. The headset 102a may further comprise, or have attached thereto, an integrated microphone 122 for receiving voice commands from the user of the portable access unit 100a or for communicating voice signals to a remote portable access unit 100 or remote media device. The headset may further comprise a speaker 124 or earpiece unit for presenting audio signals to the user. The portable access unit 100a may further comprise a digital camera 106 that may either be attached on the user’s person, or to the headset 102a for providing video signals to other portable access units 100-100a or media devices.

With reference to FIG. 3, a flow diagram illustrating the method performed by the system of FIG. 1 is shown. A user puts on the headset 102a, portable access unit 100a, step 400. The user may log into the local general purpose node 150 wherein the portable access unit associates with the general purpose node 150 such that the user is added to a connection list stored in a random access memory device residing in the general purpose node 150, step 401. Data is provided from the general purpose node 150 to the portable access unit through the communication devices 202, step 402. The user is presented with a selection list 190 of portable access units 100-100a and media devices logged onto the system on the display 120, step 404. The user selects one of the entries from the selection list, step 406. The selection is transmitted to the general purpose node 150, step 408. The general purpose node 150 sets up a connection over the networks 170-174 for channelling data between the portable access unit 100a and the selected network device, step 410. The selected network device may comprise the processor 180 or other network client 182 for running a software application, a camera 125 for providing remote viewing operations to the user on the display 120, the Internet phone 104 for providing voice communications with the a remote user, or another portable access unit 100-100a over a remote general purpose node 150a. By providing control commands to the microphone 122 or other input system, such as a keyboard or handheld mouse, the user may conduct operations by transmitting commands between the portable access unit 100a and the general purpose node 150 which routes the control commands to the device that the user selected, step 412.

It will thus be seen that changes may be made in carrying out the above system and method and in the construction set forth without departing from the spirit and scope of the
invention, it is intended that any and all matter contained in
the above description and shown in the accompanying
drawings shall be interpreted as illustrative and not in a
limiting sense.
What is claimed is:
1. A system for communication between remote devices, the system comprising:
a network device connected to a communication network;
and
a memory associated with the network device and con-
figured to maintain and update a connection list of wireless communication devices that are currently con-
ected to the communication network and ready for two-way communication with another networked
device such that the connection list is updated to add a new device when the new device is logged on to the
communication network and that the connection list is updated to remove an existing device when the existing
device is logged off from the communication network,
wherein, in response to logon to the communication network by a first wireless device associated with a first
user name, the network device is configured to com-
municate with the first wireless device to cause to
display, on an integrated display of the first wireless device, user names to select from for two-way com-
munication via the communication network and further
to cause the user names to be updated based on the
connection list such that when a second wireless device corresponding to a second one of the displayed user
names is logged off from the communication network, the second user name is no longer displayed on the
integrated display of the first wireless device, wherein, in response to selection of a third user name from the
displayed user names, the network device is configured to coordinate establishing a wireless communication
channel for video communication between the first wireless device and a third wireless device corresponding to the third user name.
2. The system of claim 1, wherein, in response to con-
nection to the communication network by the first wireless device comprising an integrated camera, the integrated
display and an integrated touch input device, the network device is configured to cause the memory to add the first
wireless device to the connection list.
3. The system of claim 1, wherein, in response to discon-
nexion from the communication network by the first wire-
less device comprising an integrated camera, the integrated
display and an integrated touch input device, the network
device is configured to cause the memory to remove the first
wireless device from the connection list.
4. The system of claim 1, wherein the first wireless device comprises an integrated microphone configured to capture audio signals to be transmitted to the third wireless device, and the third wireless device comprises an integrated speaker configured to receive audio signals transmitted from the first wireless device, such that upon the establishment of the wireless communication channel, the first wireless device is configured to provide real-time access to the audio signals captured by the integrated microphone of the third wireless device to the first user via the integrated speaker of the first wireless device.
5. The system of claim 1, wherein the first wireless device comprises an integrated speaker configured to present audio signals received from the third wireless device, and the third wireless device comprises an integrated microphone configured to capture audio signals to be transmitted to the first wireless device, such that upon the establishment of the wireless communication channel, the first wireless device is configured to provide real-time access to the audio signals captured by the integrated microphone of the third wireless device to the first user via the integrated speaker of the first wireless device.
6. The system of claim 1, wherein in response to selection of the third user name from the displayed user names, the first wireless device is configured to transmit the selection to the network device.
7. The system of claim 1, wherein the third wireless
device comprises a processor configured to execute a video communication software application configured to provide real-time access to video signals captured by the third wireless device to the first wireless device.
8. The system of claim 1, wherein the third wireless
device comprises an integrated camera configured to capture video signals to be transmitted to the first wireless device such that upon the establishment of the wireless communication channel, the first wireless device is configured to provide real-time access to the video signals captured by the integrated camera of the third wireless device to the first user via the integrated display of the first wireless device.
9. The system of claim 1, wherein the first wireless device comprises an integrated camera configured to capture video signals to be transmitted to the third wireless device, and the third wireless device comprises an integrated display configured to display video signals received from the first wireless device, such that upon the establishment of the wireless communication channel, the first wireless device is configured to provide real-time access to the video signals captured by the integrated camera of the third wireless device to the third user via the integrated display of the third wireless device.
10. The system of claim 1, wherein the first wireless device comprises an integrated input device configured to receive control commands such that upon the establishment of the wireless communication channel, the first wireless device is configured to transmit the control commands received by the integrated input device to the third wireless device to control at least one operation of the third wireless device based on the control commands.
11. The system of claim 1, wherein the first wireless device comprises a codec configured to encode and decode video data transmitted between the first wireless device and the third wireless device.
12. A system for communication between remote devices, the system comprising:
a network device connected to a communication network;
and
a memory associated with the network device and con-
figured to maintain and update a connection list of wireless communication devices that are currently con-
ected to the communication network and ready for two-way communication with another networked
device such that the connection list is updated to add a new device when the new device is logged on to the
communication network and that the connection list is updated to remove an existing device when the existing
device is logged off from the communication network,
wherein, in response to logon to the communication network by a first wireless device associated with a first
user name, the network device is configured to com-
municate with the first wireless device to cause to
display, on an integrated display of the first wireless device, user names to select from for two-way com-
munication via the communication network,
wherein, in response to selection of a second user name from the displayed user names, the network device is configured to coordinate establishing a wireless communication channel for video communication between the first wireless device and a second wireless device corresponding to the second user name.

13. The system of claim 12, wherein the first wireless device comprises an integrated microphone configured to capture audio signals to be transmitted to the second wireless device, and the second wireless device comprises an integrated speaker configured to receive audio signals transmitted from the first wireless device, such that upon the establishment of the wireless communication channel, the first wireless device is configured to provide real-time access to the audio signals captured by the integrated microphone of the first wireless device to the second user via the integrated speaker of the second wireless device.

14. The system of claim 12, wherein the first wireless device comprises an integrated microphone configured to capture audio signals to be transmitted to the second wireless device, and the second wireless device comprises an integrated speaker configured to receive audio signals transmitted from the first wireless device, such that upon the establishment of the wireless communication channel, the first wireless device is configured to provide real-time access to the audio signals captured by the integrated microphone of the first wireless device to the second user.

15. The system of claim 12, wherein in response to selection of the second user name from the displayed user names, the first wireless device is configured to transmit the selection to the network device.

16. The system of claim 12, wherein the second wireless device comprises a processor configured to execute a video communication software application configured to provide real-time access to video signals captured by the second wireless device to the first wireless device.

17. The system of claim 12, wherein the second wireless device comprises an integrated camera configured to capture video signals to be transmitted to the first wireless device such that upon the establishment of the wireless communication channel, the first wireless device is configured to provide real-time access to the video signals captured by the integrated camera of the second wireless device to the first user via the integrated display of the second wireless device.

18. The system of claim 12, wherein the first wireless device comprises an integrated camera configured to capture video signals to be transmitted to the second wireless device, and the second wireless device comprises an integrated display configured to display video signals received from the first wireless device, such that upon the establishment of the wireless communication channel, the first wireless device is configured to provide real-time access to the video signals captured by the integrated camera of the first wireless device to the second user via the integrated display of the second wireless device.

19. The system of claim 12, wherein the first wireless device comprises an integrated input device configured to receive control commands such that upon the establishment of the wireless communication channel, the first wireless device is configured to transmit the control commands received by the integrated input device to the second wireless device to control at least one operation of the second wireless device based on the control commands.

20. The system of claim 12, wherein the first wireless device comprises a codec configured to encode and decode video data transmitted between the first wireless device and the second wireless device.