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(54) MOBILE VIDEO TELEPHONE SYSTEM

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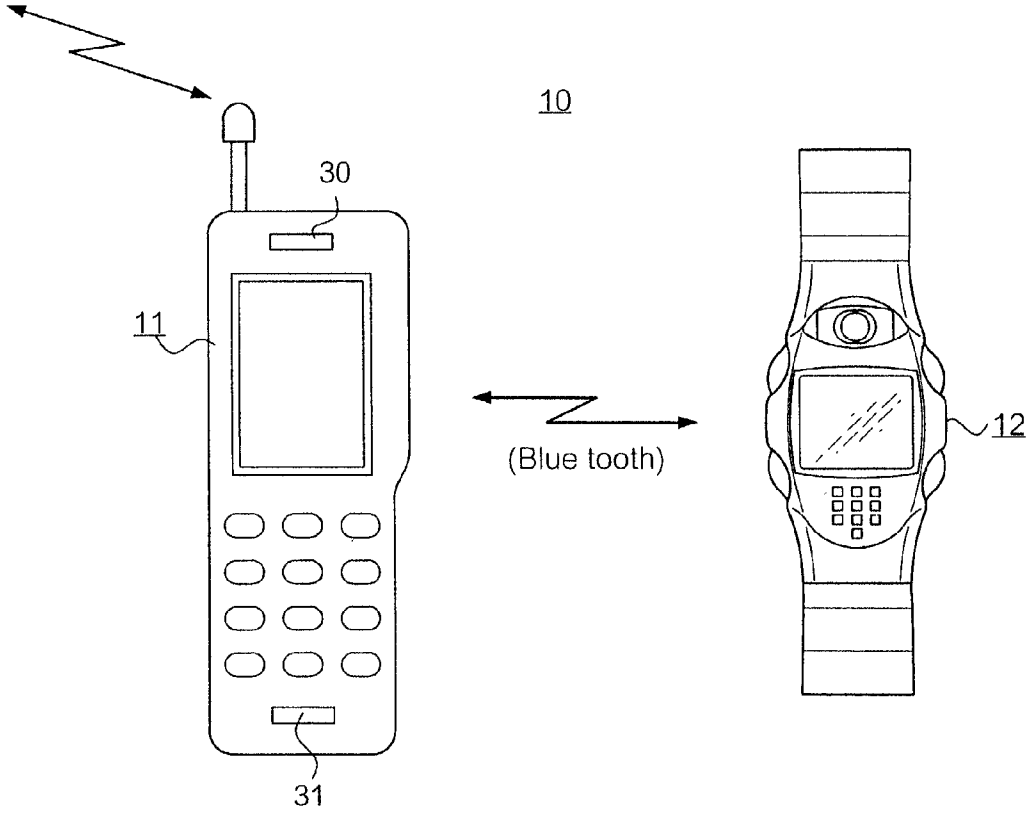
(57) **ABSTRACT**

A mobile telephone device effects the image and voice communication with the other party of communication through a network. The mobile telephone device transmits the voice received from the other party, to a headset having a voice input/output unit by local radio communication, and receives by local radio communication and transmits to the other party the voice received from the headset. Also, the mobile telephone device transmits the image received from the other party to a wearable radio communication device having an imaging unit and a display unit by local radio communication, and receives by local radio communication and transmits to the other party the image from the wearable radio communication device. The wearable radio communication device receives an image from the mobile telephone device by local radio communication and displays it on the display unit, and picks up an image by the imaging unit and transmits it to the mobile telephone device by local radio communication. The headset receives the voice from the mobile telephone device by local radio communication and outputs it from the voice input/output unit while at the same time transmitting the voice input through the voice input/output unit, to the mobile telephone device by local radio communication.



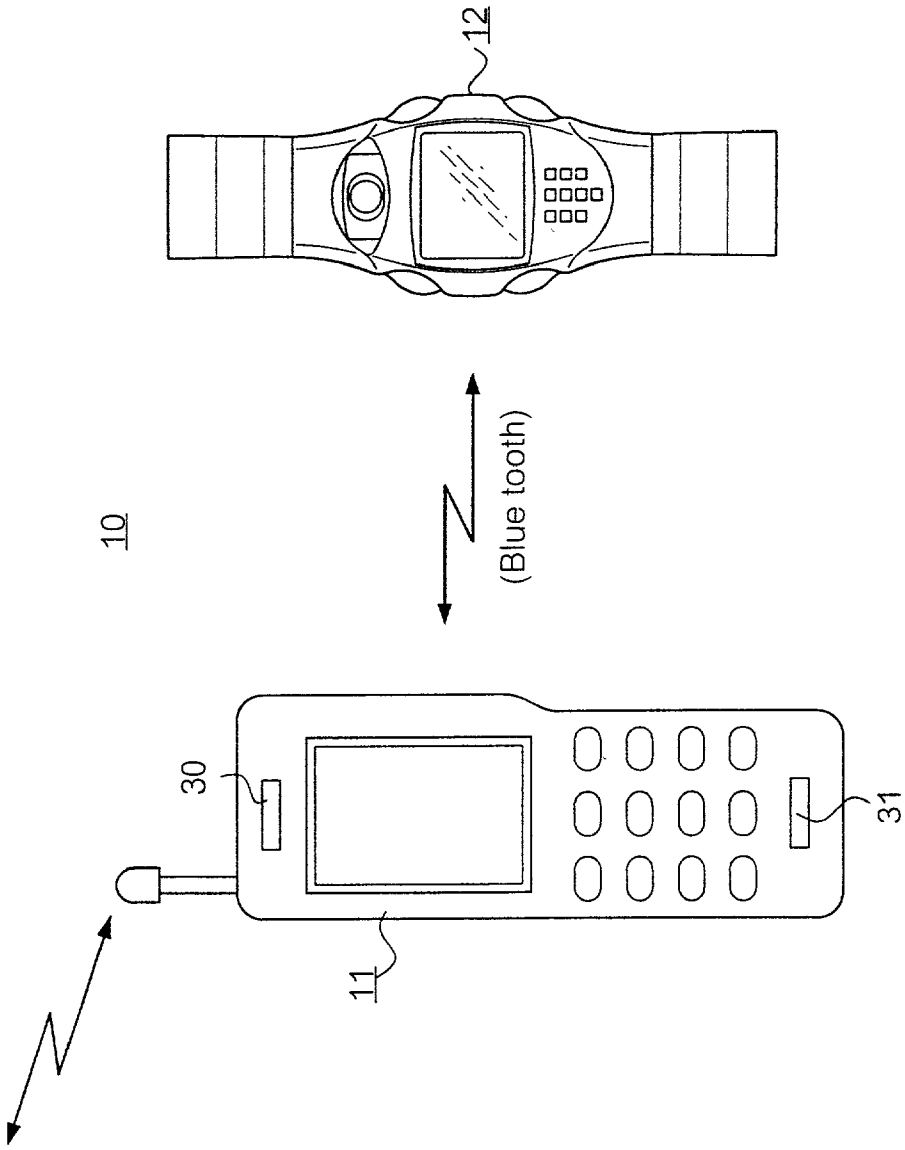


FIG. 1

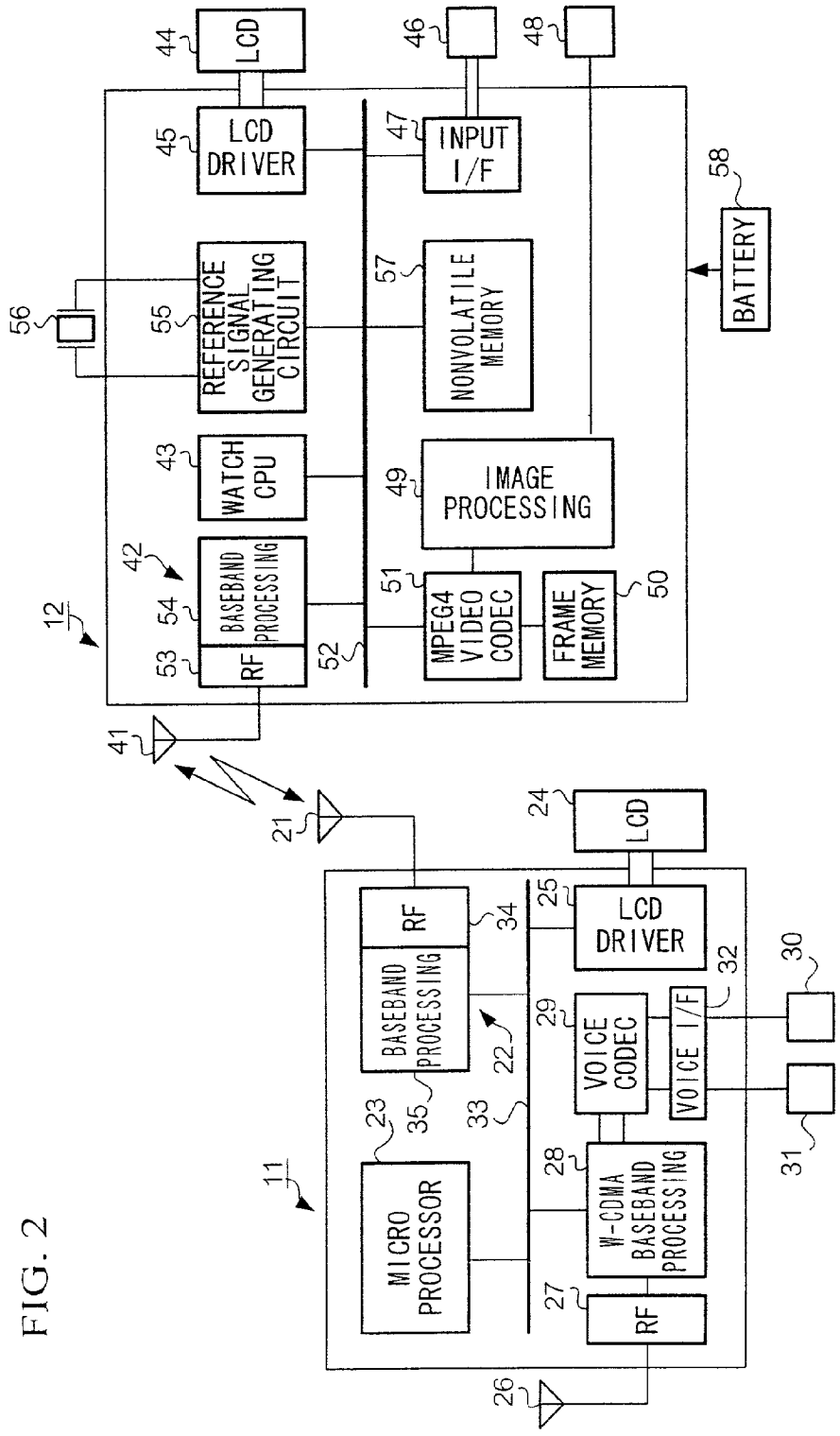

LCD
LCD DRIVER
INPUT I/F
BATTERY
REFERENCE SIGNAL GENERATING CIRCUIT
NONVOLATILE MEMORY
WATCH CPU
IMAGE PROCESSING
BASEBAND PROCESSING
RF
MPEG4 VIDEO CODEC
FRAME MEMORY
LCD
LCD DRIVER
RF
BASEBAND PROCESSING
VOICE CODEC
VOICE I/F
MICRO PROCESSOR
W-CDMA BASEBAND PROCESSING
RF

FIG. 2

FIG. 3

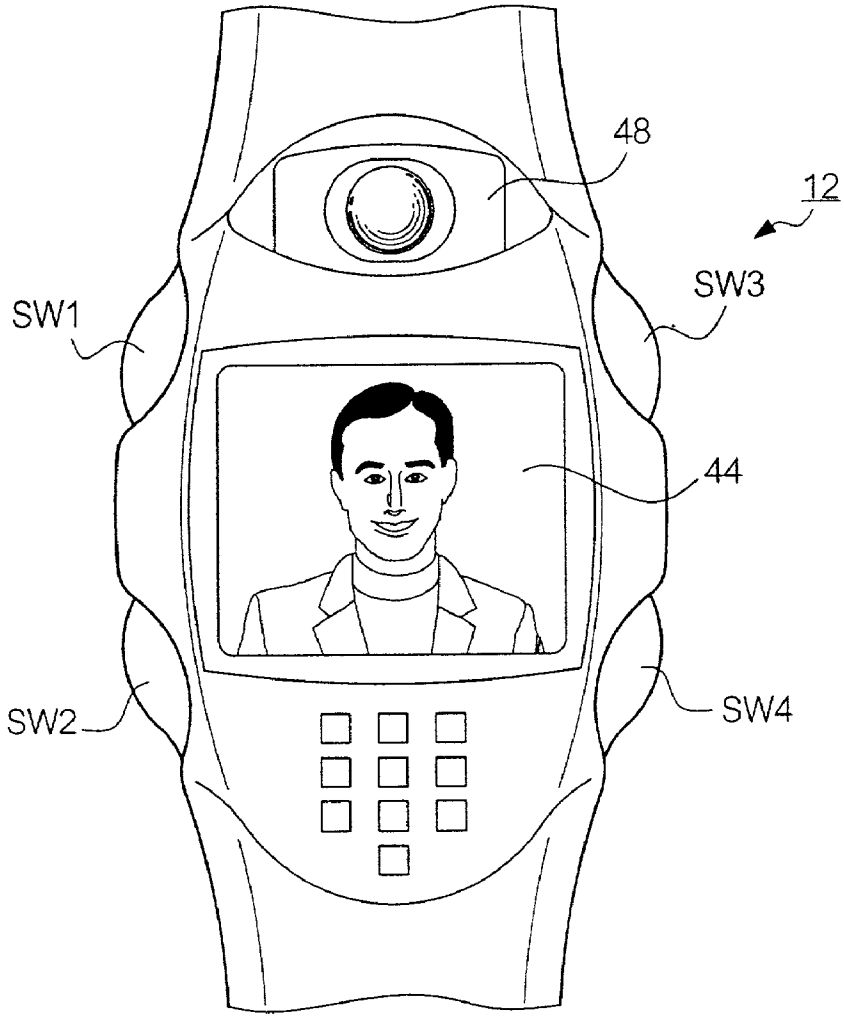


FIG. 4

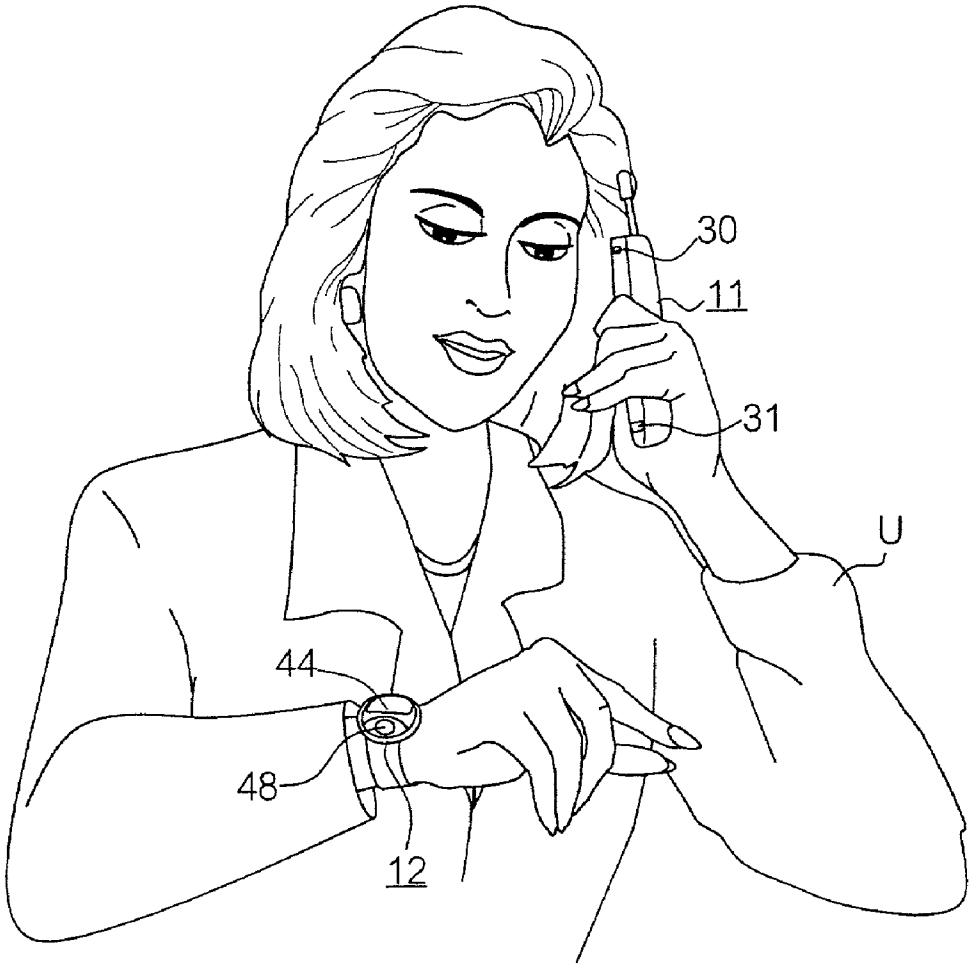
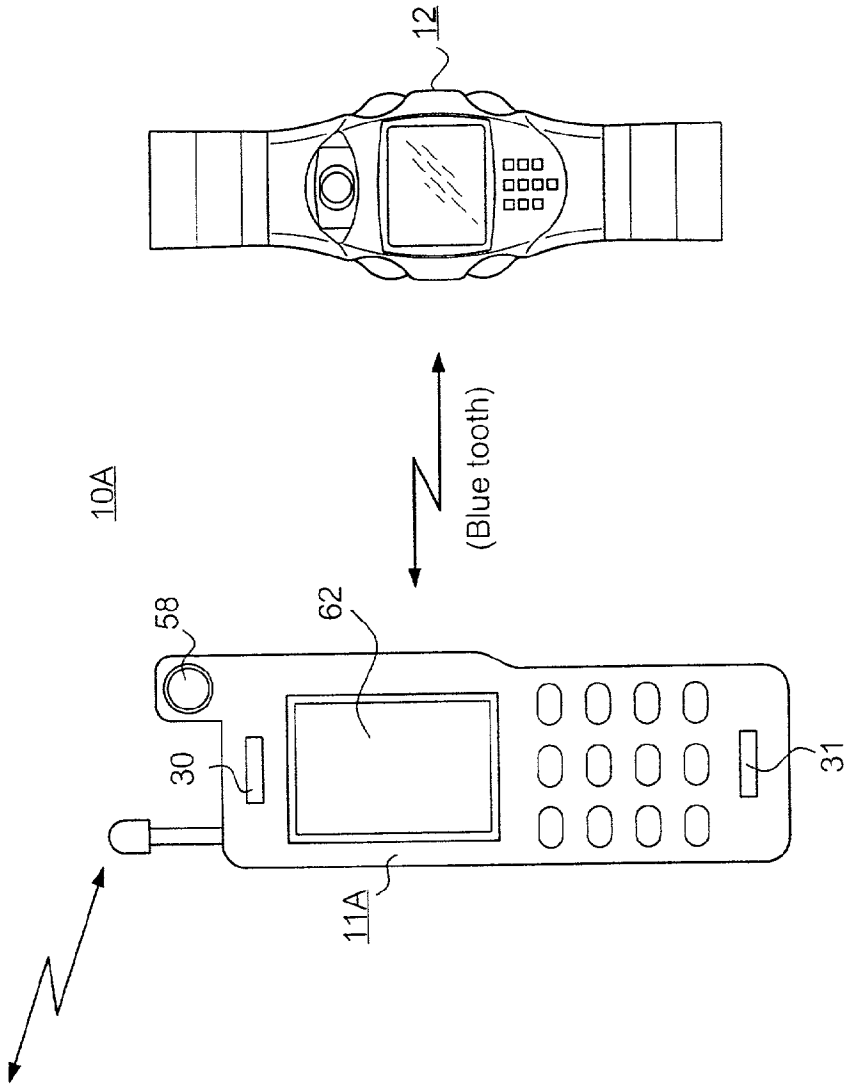


FIG. 5



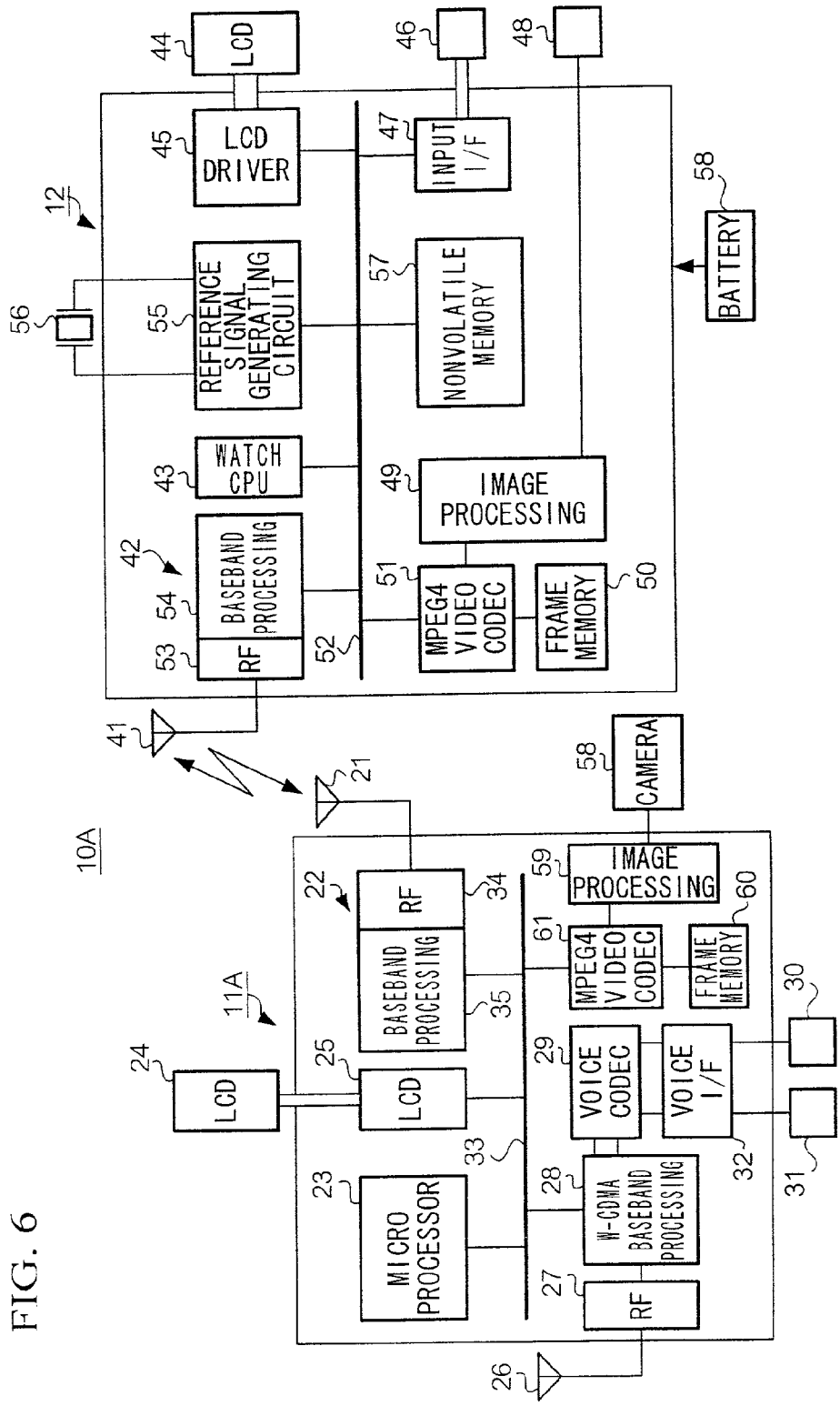

LCD
LCD DRIVER
REFERENCE SIGNAL GENERATING CIRCUIT
WATCH CPU
BASEBAND PROCESSING
RF
INPUT I/F
NONVOLATILE MEMORY
IMAGE PROCESSING
MPEG4 VIDEO CODEC
FRAME MEMORY
BATTERY
12
10A
11A
CAMERA
IMAGE PROCESSING
MPEG4 VIDEO CODEC
FRAME MEMORY
VOICE CODEC
VOICE I/F
W-CDMA BASEBAND PROCESSING
MICRO PROCESSOR
LCD
RF
BASEBAND PROCESSING
RF

FIG. 6

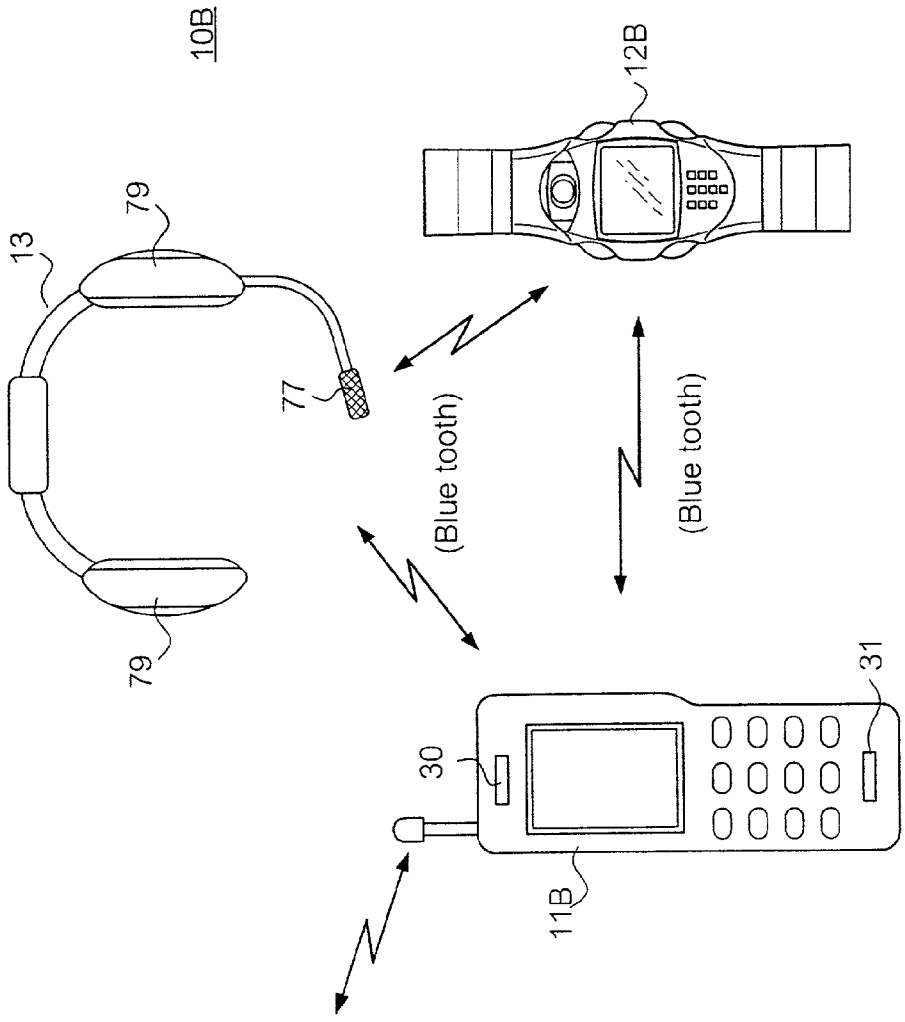
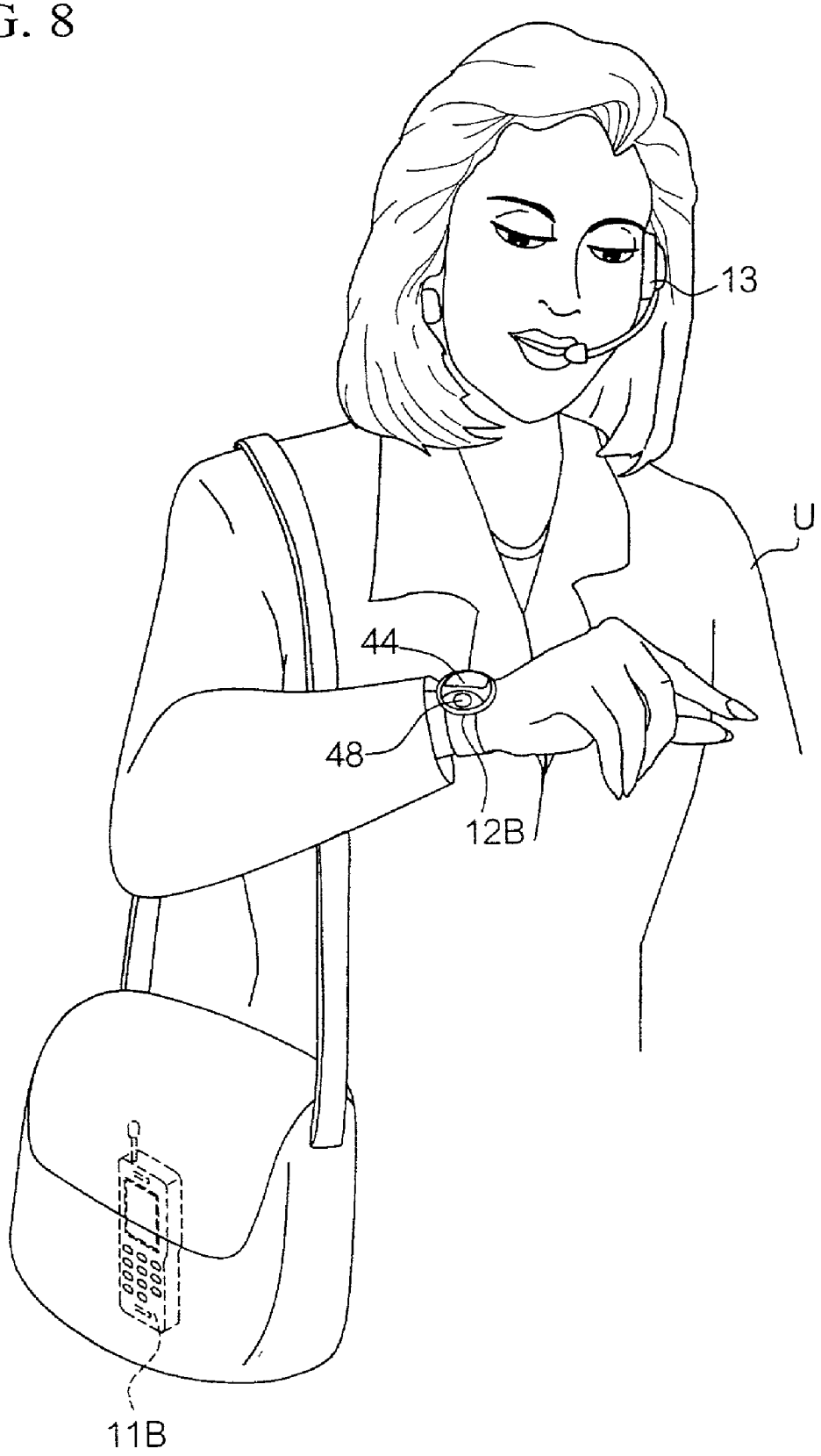


FIG. 7

FIG. 8



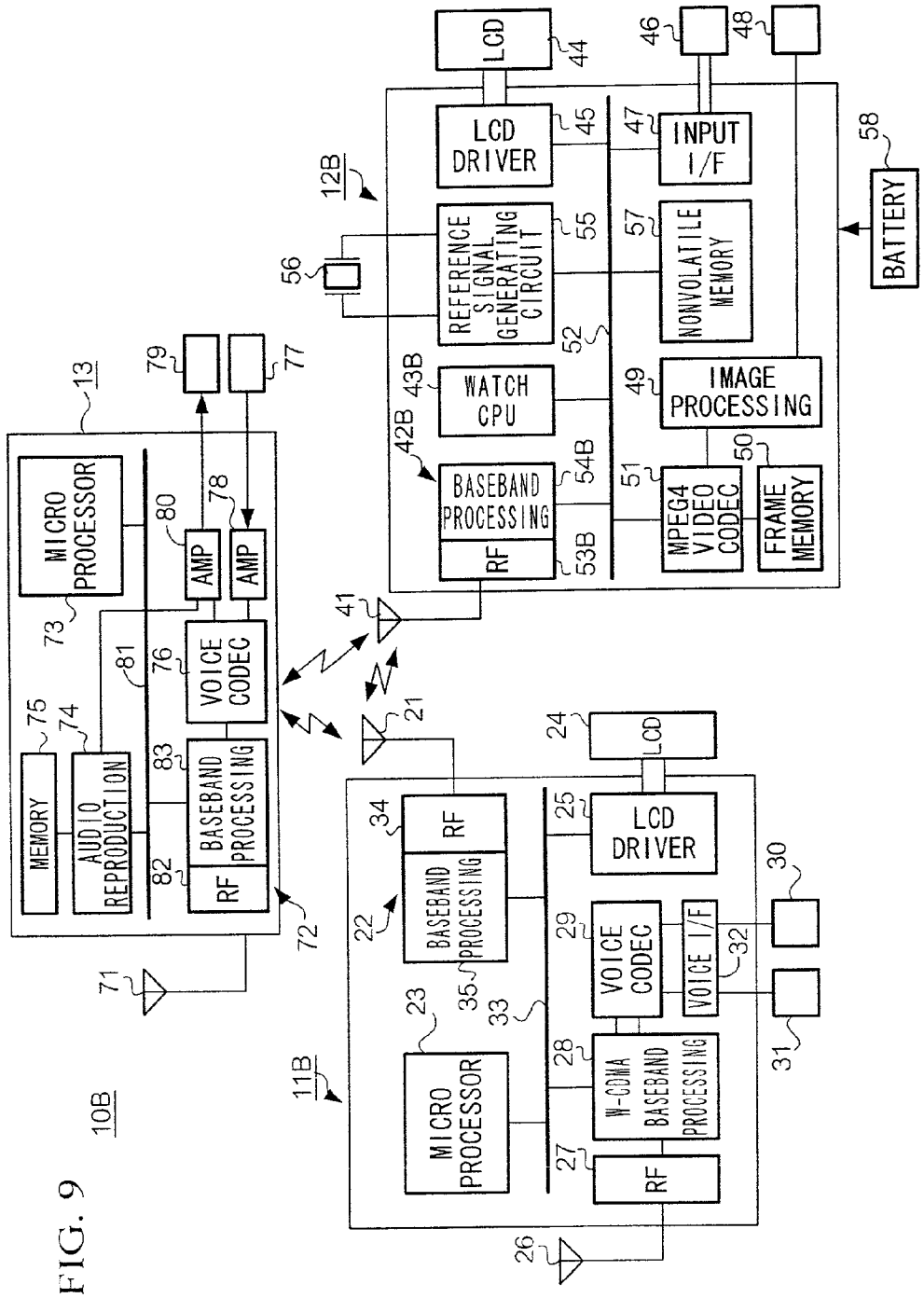

10B
13
MICRO PROCESSOR
73
MEMORY
75
AUDIO REPRODUCTION
74
81
80
AMP
78
AMP
79
77
VOICE CODEC
76
BASEBAND PROCESSING
83
RF
82
72
71
41
21
12B
LCD
44
LCD DRIVER
45
REFERENCE SIGNAL GENERATING CIRCUIT
55
56
WATCH CPU
43B
42B
BASEBAND PROCESSING
54B
RF
53B
52
46
48
INPUT I/F
47
NONVOLATILE MEMORY
57
IMAGE PROCESSING
49
MPEG4 VIDEO CODEC
51
FRAME MEMORY
50
BATTERY
58
11B
24
LCD
25
LCD DRIVER
34
RF
22
BASEBAND PROCESSING
35
33
23
MICRO PROCESSOR
29
VOICE CODEC
VOICE I/F
32
30
31
28
W-CDMA BASEBAND PROCESSING
27
RF
26

FIG. 9

FIG. 10

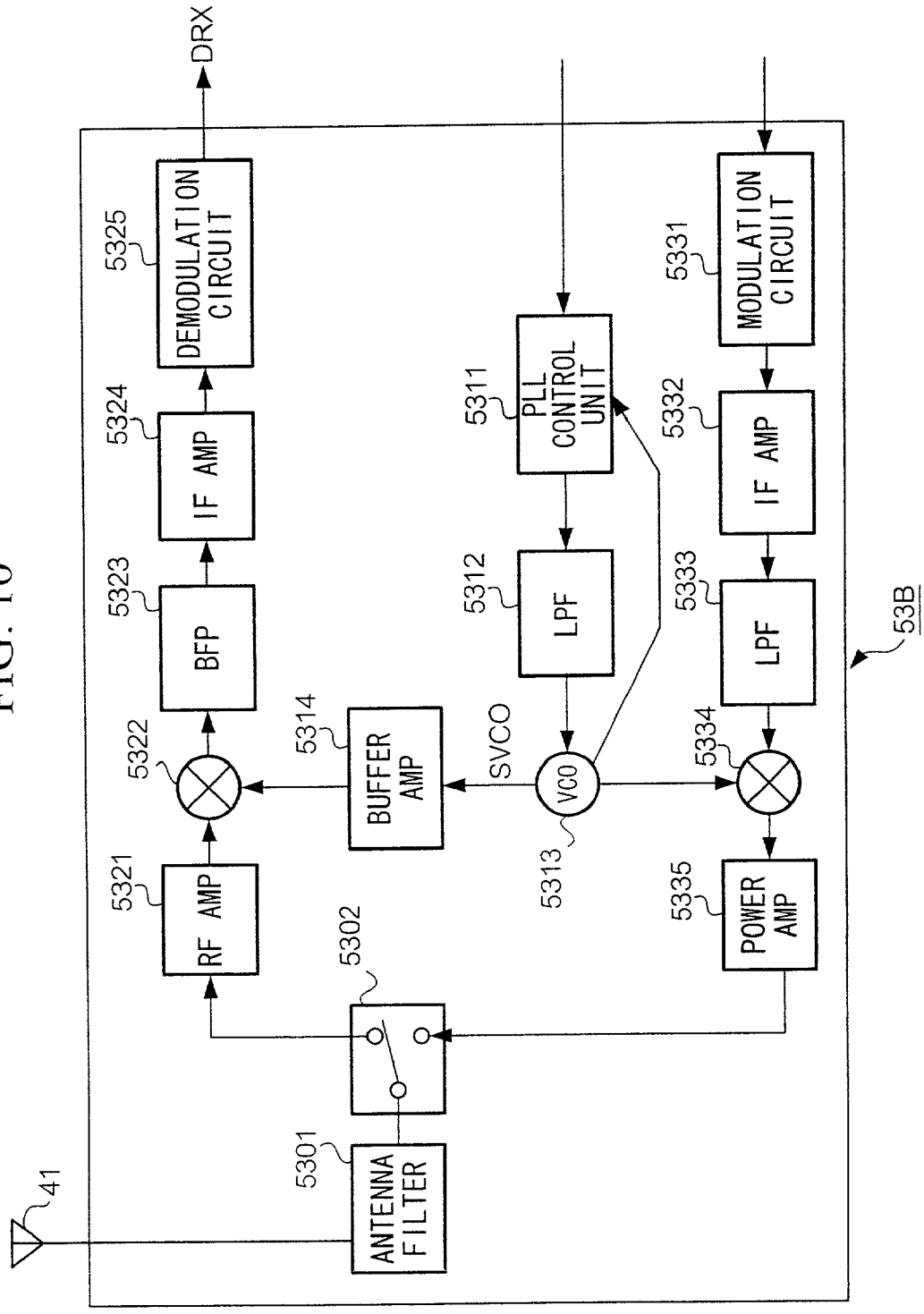
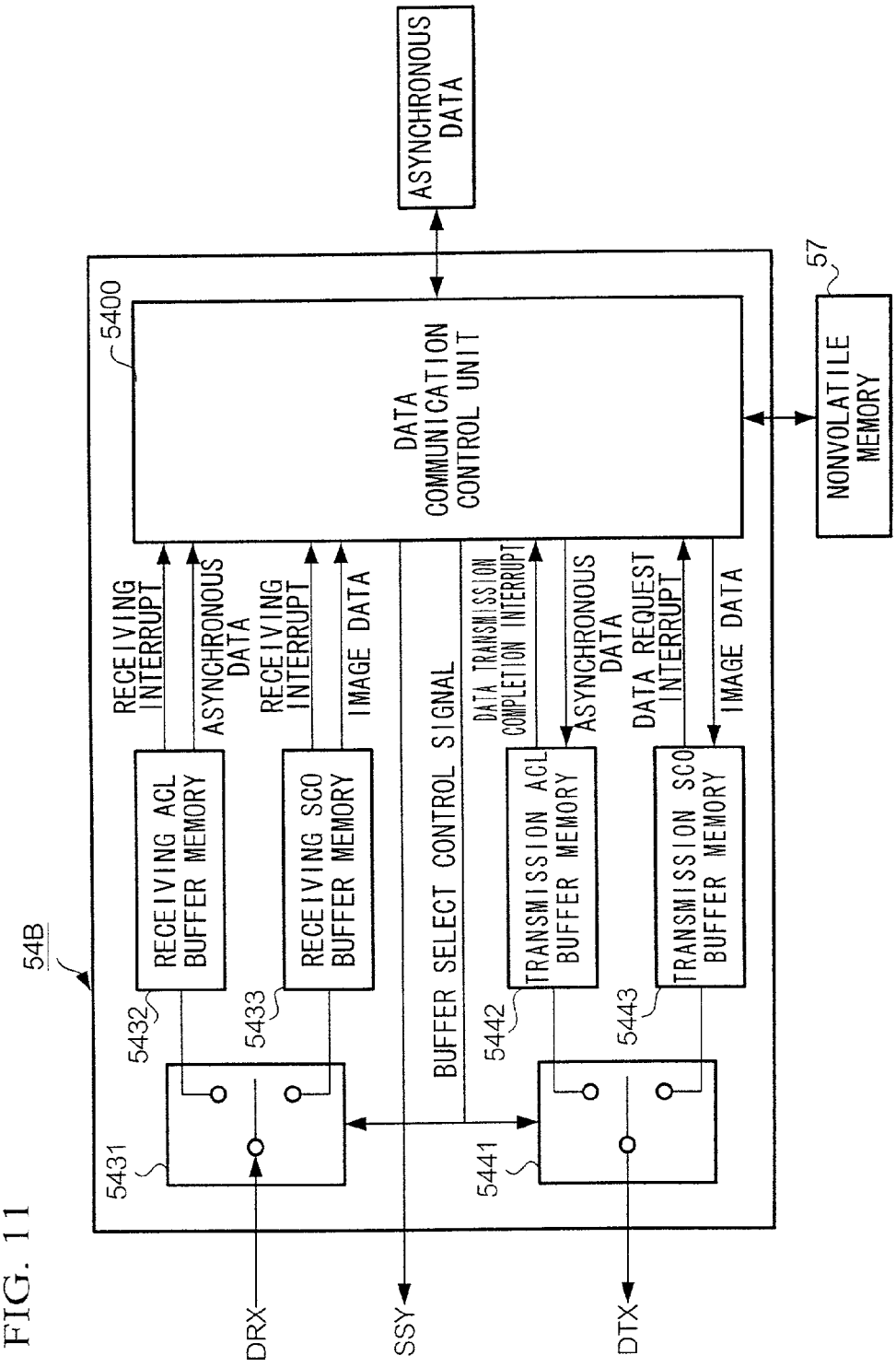

DRX
5325
DEMODULATION CIRCUIT
5324
IF AMP
5323
BFP
5322
5321
RF AMP
5314
BUFFER AMP
SVCO
5311
PLL CONTROL UNIT
5312
LPF
5313
VCO
5331
MODULATION CIRCUIT
5332
IF AMP
5333
LPF
5334
5335
POWER AMP
53B
5302
5301
ANTENNA FILTER
41

FIG. 11


ASYNCHRONOUS DATA
5400
DATA COMMUNICATION CONTROL UNIT
57
NONVOLATILE MEMORY
54B
RECEIVING INTERRUPT
ASYNCHRONOUS DATA
RECEIVING INTERRUPT
IMAGE DATA
DATA TRANSMISSION COMPLETION INTERRUPT
ASYNCHRONOUS DATA
DATA REQUEST INTERRUPT
IMAGE DATA
RECEIVING ACL BUFFER MEMORY
RECEIVING SCO BUFFER MEMORY
BUFFER SELECT CONTROL SIGNAL
TRANSMISSION ACL BUFFER MEMORY
TRANSMISSION SCO BUFFER MEMORY
5432
5433
5442
5443
5431
5441
DRX
SSY
DTX

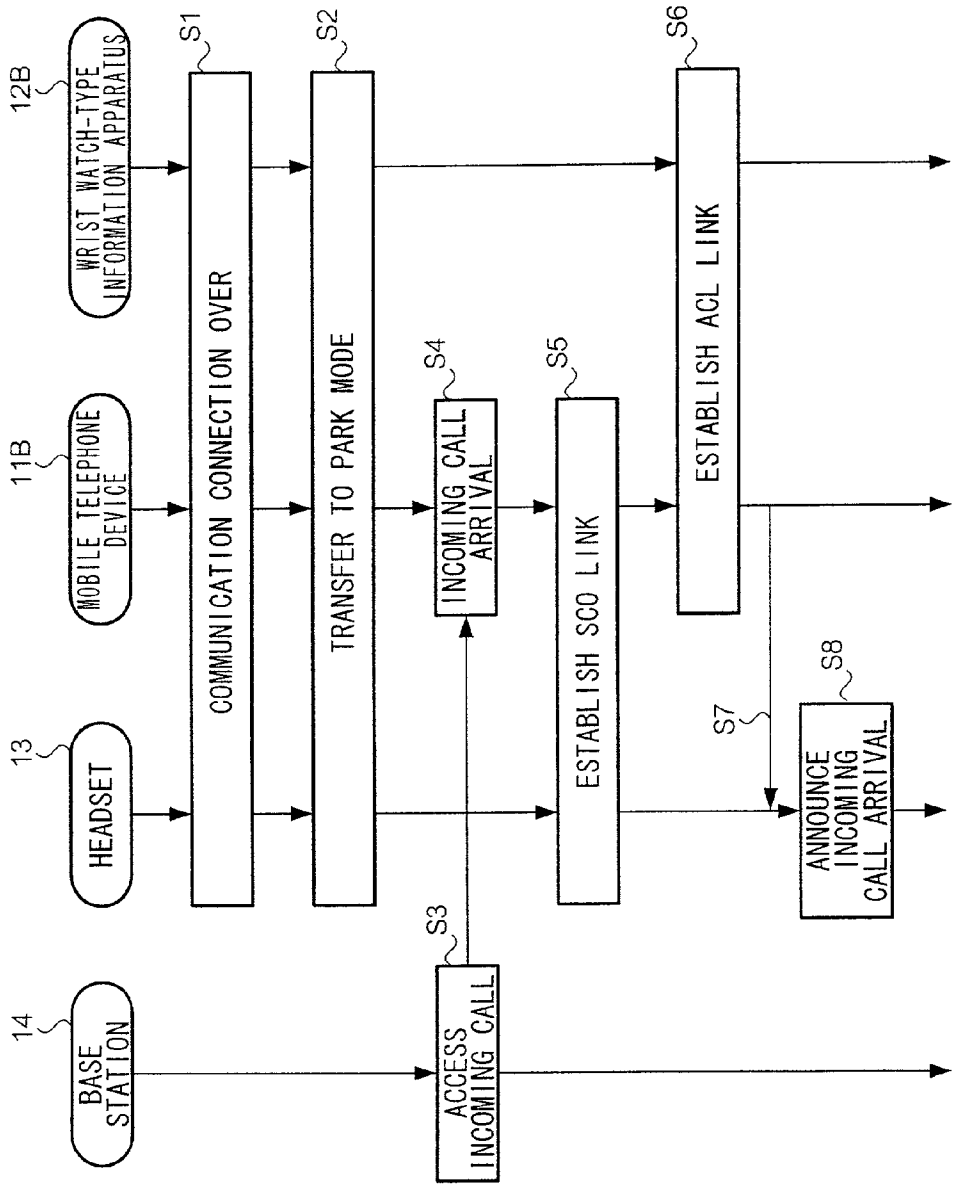

12B
WRIST WATCH-TYPE INFORMATION APPARATUS
11B
MOBILE TELEPHONE DEVICE
13
HEADSET
14
BASE STATION
S1
COMMUNICATION CONNECTION OVER
S2
TRANSFER TO PARK MODE
S3
ACCESS INCOMING CALL
S4
INCOMING CALL ARRIVAL
S5
ESTABLISH SCO LINK
S6
ESTABLISH ACL LINK
S7
S8
ANNOUNCE INCOMING CALL ARRIVAL

FIG. 12A

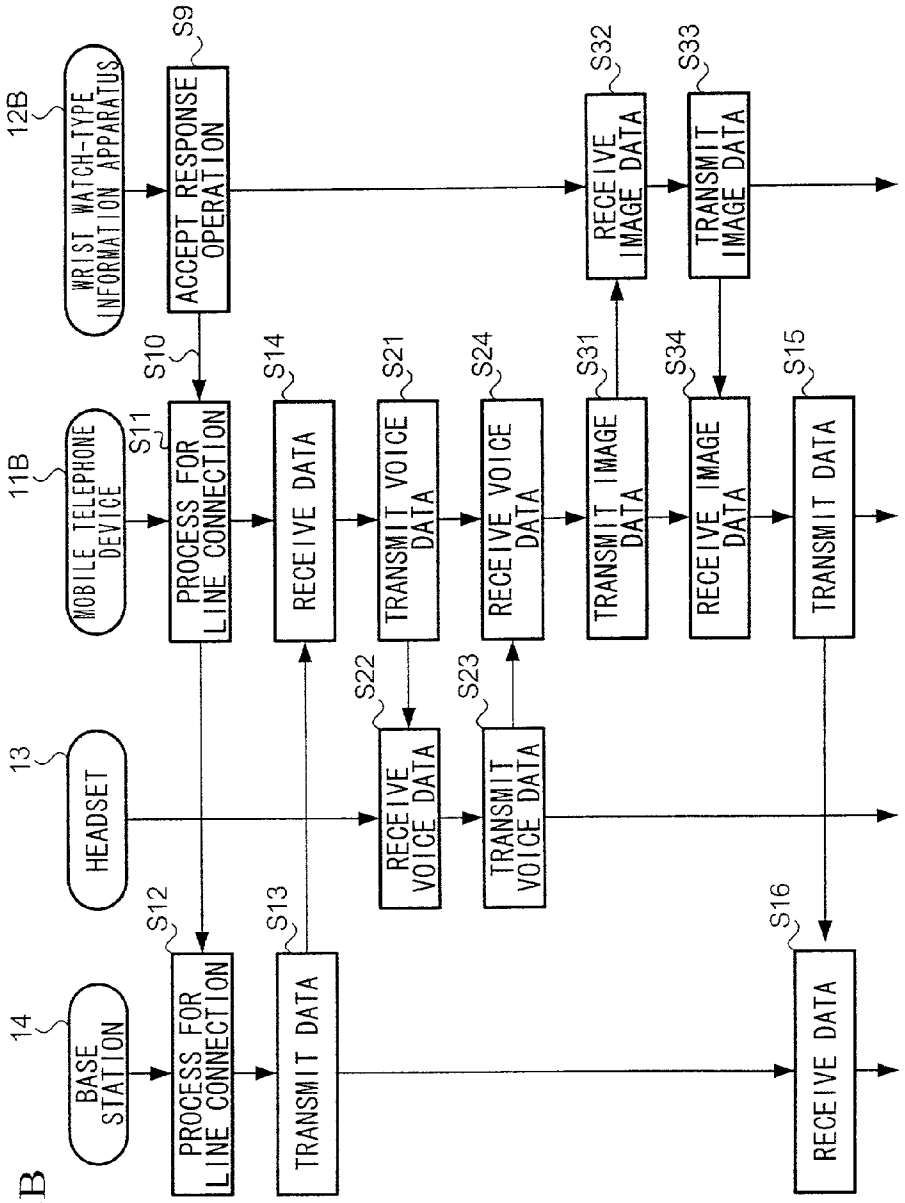

14
BASE STATION
13
HEADSET
11B
MOBILE TELEPHONE DEVICE
12B
WRIST WATCH-TYPE INFORMATION APPARATUS
S12
PROCESS FOR LINE CONNECTION
S13
TRANSMIT DATA
S22
RECEIVE VOICE DATA
S23
TRANSMIT VOICE DATA
S11
PROCESS FOR LINE CONNECTION
S14
RECEIVE DATA
S21
TRANSMIT VOICE DATA
S24
RECEIVE VOICE DATA
S10
S9
ACCEPT RESPONSE OPERATION
S31
TRANSMIT IMAGE DATA
S32
RECEIVE IMAGE DATA
S33
TRANSMIT IMAGE DATA
S34
RECEIVE IMAGE DATA
S15
TRANSMIT DATA
S16
RECEIVE DATA

FIG. 12B

FIG. 13

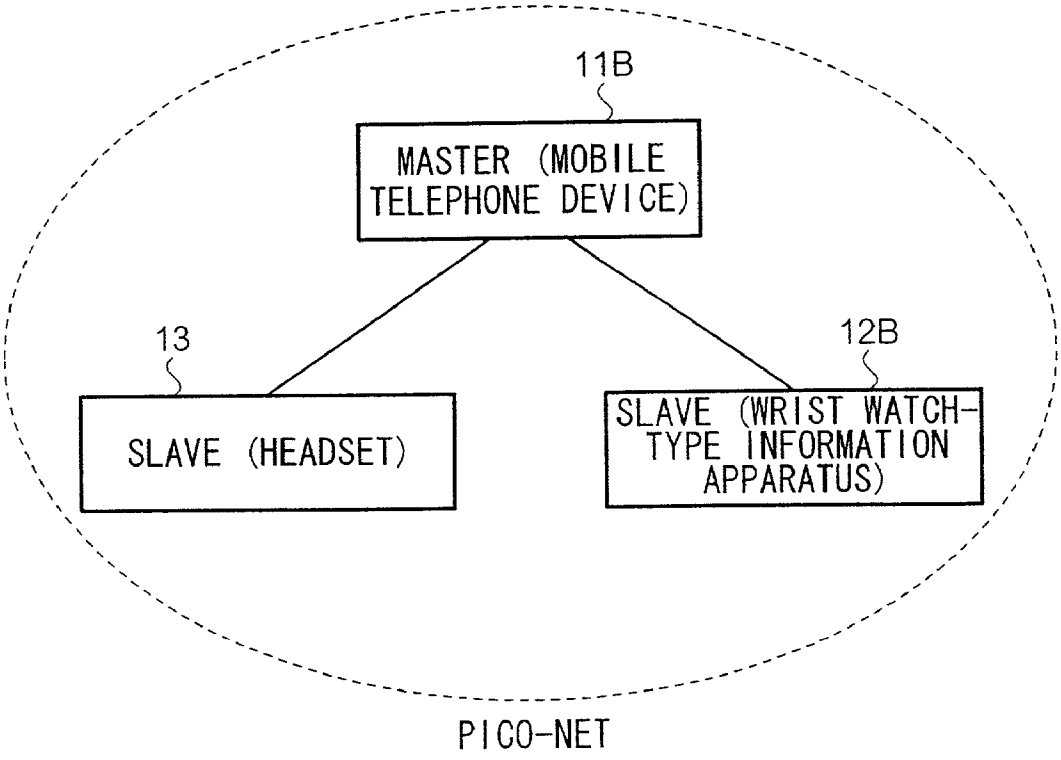

11B
MASTER (MOBILE TELEPHONE DEVICE)
13
SLAVE (HEADSET)
12B
SLAVE (WRIST WATCH-TYPE INFORMATION APPARATUS)
PICO-NET

FIG. 14

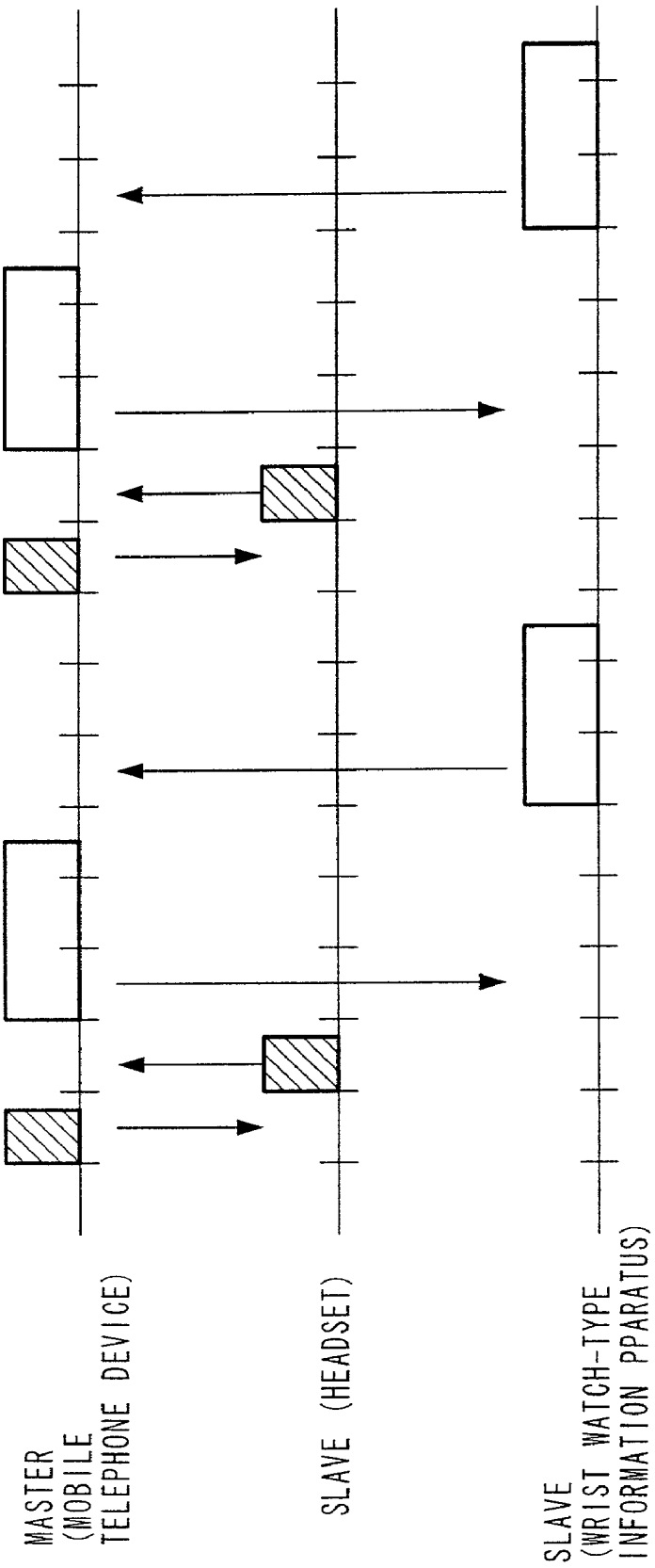
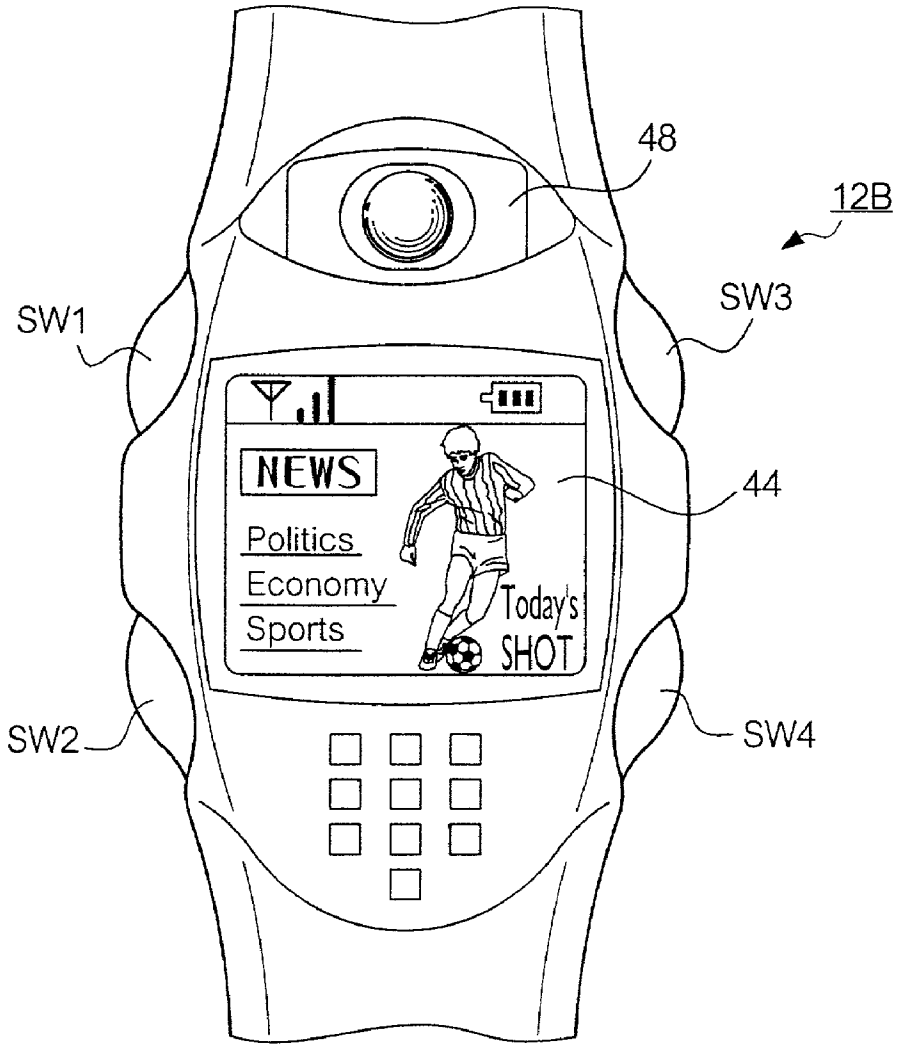

SCO
ACL
SCO
ACL
MASTER (MOBILE TELEPHONE DEVICE)
SLAVE (HEADSET)
SLAVE (WRIST WATCH-TYPE INFORMATION PPARATUS)

FIG. 15


48
12B
SW1
SW3
NEWS
Politics
Economy
Sports
Today's
SHOT
44
SW2
SW4

MOBILE VIDEO TELEPHONE SYSTEM

TECHNICAL FIELD

[0001] The present invention relates to a mobile TV telephone system (hereinafter referred to as the mobile videophone system) comprising a wearable radio communication device portable by being worn on a finger, an arm or the neck of the user and a mobile telephone device, and a mobile videophone system further comprising a headset.

BACKGROUND ART

[0002] With the recent progress of the techniques related to the mobile telephone, the ownership and the use of what is called the mobile videophone is expected to extend in the near future. A simple mobile telephone device capable of transmitting/receiving a still image or an image sequence at the rate of several frames per second is already available.

[0003] The mobile telephone device of this type includes a voice communication unit, an imaging unit and a display unit built in its body. In order to view the image received from the other party displayed on the display unit of the mobile telephone device, therefore, the user of the mobile telephone device is required to place the mobile telephone device at a distance from his head. Also when picking up an image of the surrounding landscape or a person by the imaging unit and sending it to the other party, the user is required to place the mobile telephone device at a distance from his head. In the speech made using a mobile telephone device placed at a distance from his head, the user is required to speak loudly.

[0004] For making speech with an ordinary pitch of the voice, on the contrary, the user is required to attach the mobile telephone device closely to his ear or mouth. In such a case, however, the user cannot view the image of the other party displayed on the display unit of the mobile telephone device nor can he pick up the image of the surrounding scene with the imaging unit of the mobile telephone device.

[0005] As described above, the conventional mobile telephone device has the problem that the image of the other party cannot be checked at the same time as the speech or picking up the image of the surrounding scene.

DISCLOSURE OF THE INVENTION

[0006] The object of the present invention is to provide a mobile videophone system in which the user of a mobile telephone device can check the image of the other party and pick up the image of the surrounding scene while at the same time making speech with the other party, a method of communication using the system, and a wearable radio communication device, a mobile telephone device and a headset making up the system.

[0007] In order to achieve this object, the present invention provides a mobile videophone system comprising a mobile telephone device and a wearable radio communication device, wherein the mobile telephone device includes a communication unit, a voice input/output unit, a first local radio communication unit for effecting local bi-directional radio communication with the wearable radio communication device, and a first control unit for causing the communication unit to effect image and voice communication with the other party through a network, causing the voice received from the other party to be output from the voice input/output unit, causing the voice input through the voice input/output unit to be transmitted to the other party by the communication unit, causing the image received from the other party to be transmitted to the wearable radio communication device by the first local radio communication unit, and causing the image received from the wearable radio communication device to be transmitted to the other party, and wherein the wearable radio communication device includes a second local radio communication unit for effecting local bi-directional radio communication with the mobile telephone device, an imaging unit, a display unit, and a second control unit for causing the image received from the mobile telephone device by the second local radio communication unit to be displayed on the display unit, causing the image obtained by the imaging unit to be transmitted to the mobile telephone device by the second local radio communication unit, and causing an instruction for controlling the mobile telephone device to be transmitted by the second local radio communication unit.

[0008] With this system, the user can effect the bi-directional voice communication with the other party by means of the mobile telephone device and also the bi-directional image communication with the other party by means of the wearable radio communication device, and therefore can enjoy the videophone communication with the other party in a relaxed posture. Another advantage is that the mobile telephone device can be controlled conveniently by sending an instruction signal from the wearable radio communication device.

[0009] The present invention further provides a mobile videophone system comprising a mobile telephone device, a wearable radio communication device and a headset, wherein the mobile telephone device includes a communication unit, a first local radio communication unit for effecting local bi-directional radio communication with the wearable radio communication device and the headset, and a first control unit for causing the communication unit to effect image and voice communication with the other party through a network, causing the voice received from the other party to be transmitted to the headset by the first local radio communication unit, causing the voice received from the headset by the first local radio communication unit to be transmitted to the other party by the communication unit, causing the image received from the other party to be transmitted to the wearable radio communication device by the first local radio communication unit, and causing the image received from the wearable radio communication device by the first local radio communication unit to be transmitted to the other party, and wherein the wearable radio communication device includes a second local radio communication unit for effecting local bi-directional radio communication with the mobile telephone device, an imaging unit, a display unit, and a second control unit for causing the image received from the mobile telephone device by the second local radio communication unit to be displayed on the display unit, and causing the image obtained by the imaging unit to be transmitted to the mobile telephone device by the second local radio communication unit, and wherein the headset includes a third local radio communication unit for effecting bi-directional radio communication with the mobile telephone device, a voice input/output unit, and a third control unit for causing the voice received from the mobile telephone device by the third local radio com-

munication unit to be output by the voice input/output unit, and causing the voice input through the voice input/output unit to be transmitted to the mobile telephone device by the third local radio communication unit.

[0010] With this system, even in the case where the mobile telephone device is put in a bag, for example, the user can make bi-directional speech with the other party by means of the headset and also can establish bi-directional image communication with the other party by means of the wearable radio communication device.

[0011] The present invention further provides a communication method wherein the mobile telephone device is such that the image and voice communication is effected with the other party through a network, the voice received from the other party is output from a voice input/output unit, the voice input through the voice input/output unit is transmitted to the other party, the image received from the other party is transmitted to a wearable radio communication unit having an imaging unit and a display unit by local radio communication, and the image is received by local radio communication from the wearable radio communication device and transmitted to the other party, and wherein the wearable radio communication device is such that an image is received from the mobile telephone device by local radio communication and displayed on the display unit, the image is picked up by the imaging unit and transmitted to the mobile telephone device by local radio communication, and an instruction signal for controlling the mobile telephone device is transmitted by local radio communication.

[0012] The present invention further provides a communication method wherein the mobile telephone device is such that the image and voice communication is effected with the other party through a network, the voice received from the other party is transmitted to a headset having a voice input/output unit by local radio communication, the voice is received from the headset by local radio communication and transmitted to the other party, the image received from the other party is transmitted to a wearable radio communication unit having an imaging unit and a display unit by local radio communication, and the image is received by local radio communication from the wearable radio communication device and transmitted to the other party, wherein the wearable radio communication device is such that an image is received from the mobile telephone device by local radio communication and displayed on the display unit, and an image is picked up by the imaging unit and transmitted to the mobile telephone device by local radio communication, and wherein the headset is such that a voice is received from the mobile telephone device by local radio communication and output from the voice input/output unit, and the voice input through the voice input/output unit is transmitted to the mobile telephone device by local radio communication.

[0013] In a preferred form, the mobile telephone device, with the arrival of an incoming call, establishes a first communication link for effecting local radio communication with the wearable radio communication device and a second communication link for effecting local radio communication with the headset, transmits an incoming call arrival announcing signal to the headset through the second communication link, and performs the processing for line connection with the other party upon receipt of an incoming call response instruction through the first communication link through the wearable radio communication device.

[0014] The present invention further provides a mobile telephone device comprising a communication unit, a voice input/output unit, a local radio communication unit for effecting local bi-directional radio communication including the image data communication with a wearable radio communication device having an imaging unit and a display unit, and a control unit for causing the communication unit to effect image and voice communication with the other party through a network, causing the voice received from the other party to be output from the voice input/output unit, causing the voice input through the voice input/output unit to be transmitted to the other party by the communication unit, causing the image received from the other party to be transmitted to the wearable radio communication device by the local radio communication unit, causing the image received from the wearable radio communication device to be transmitted to the other party by the communication unit, and causing a control operation to be performed by the local radio communication unit as instructed according to an instruction signal received from the wearable radio communication device.

[0015] The present invention further provides a mobile telephone device comprising a communication unit, a local radio communication unit for effecting local bi-directional radio communication with the wearable radio communication device having an imaging unit and a display unit and a headset having a voice input/output unit, and a control unit for causing the communication unit to effect image and voice communication with the other party through a network, causing the voice received from the other party to be transmitted to the headset by the local radio communication unit, causing the voice received from the headset by the local communication unit to be transmitted to the other party by the communication unit, causing the image received from the other party to be transmitted to the wearable radio communication device by the local radio communication unit, and causing the image received from the wearable radio communication device by the local radio communication unit to be transmitted to the other party by the communication unit.

[0016] In a preferred form, the control unit, with the arrival of an incoming call, establishes, by the local radio communication unit, a first communication link for effecting local radio communication with the wearable radio communication device and a second communication link for effecting local radio communication with the headset, sends an incoming call arrival announcing signal to the headset through the second communication link and, upon receipt of an incoming call response instruction through the first communication link from the wearable radio communication device, performs the processing for line connection with the other party.

[0017] The present invention further provides a wearable radio communication device comprising an imaging unit, a display unit, a local radio communication unit for effecting local bi-directional radio communication with a mobile telephone device, and a control unit for causing the image received from the mobile telephone device by the local radio communication unit to be displayed on the display unit, causing the image obtained by the imaging unit to be

transmitted to the mobile telephone device by the local radio communication unit, and causing an instruction signal for controlling the mobile telephone device to be transmitted by the local radio communication unit.

[0018] In a preferred form, the wearable radio communication device further comprises a voice input/output unit, and the control unit outputs from the voice input/output unit the voice received from the mobile telephone device by means of the local radio communication unit and transmits the voice input through the voice input/output unit, to the mobile telephone device by means of the local radio communication unit.

[0019] In another preferred form, the wearable radio communication device comprises an operating unit and the control unit generates the instruction signal in accordance with the operation of the operating unit.

[0020] In this case, the control unit transmits the instruction signal for giving an instruction for access to the site in the network, to the mobile telephone device in accordance with the operation of the operating unit, and receives and displays on the display unit the response from the site through the mobile telephone device.

[0021] In still another preferred form, the control unit receives the information displayed on the display unit of the mobile telephone device from the mobile telephone device and displays it on the display unit of the wearable radio communication unit.

[0022] In yet another preferred form, the mobile telephone device can establish a first communication link for effecting local bi-directional radio communication with the wearable radio communication device and a second communication link for effecting local bi-directional radio communication with the headset having a voice input/output unit, and also can effect the bi-directional local radio communication including the voice data communication through the second communication link.

[0023] In this preferred form, for example, the mobile telephone device has the first repeating function for transmitting the information received from the wearable radio communication device through the first communication link, to the headset through the second communication link, and the control unit transmits to the headset an instruction signal for controlling the headset, through the first and second communication links utilizing the first repeating function.

[0024] In another preferred form, the headset comprises a memory for storing the voice data and an audio reproduction unit for reading the voice data from the memory and performing the audio reproduction processing for outputting the voice data as a sound from the voice input/output unit, and the control unit transmits the instruction signal in the form of a signal for instructing the headset to perform the audio reproduction processing.

[0025] Further, the mobile telephone device may have the second repeating function for transmitting the information received from the headset through the second communication link, to the wearable radio communication device through the first communication link, in which case the control unit receives the information from the headset through the second and first links utilizing the second repeating function.

[0026] In this preferred form, the headset preferably comprises a memory for storing the voice data, an audio reproduction unit for reading the voice data from the memory and performing the audio reproduction processing for outputting the voice data as a sound from the voice input/output unit, and a device for outputting a list of the information stored in the memory. Also, the wearable radio communication device further comprise an operating unit and the control unit receives from the headset the list of the information stored in the memory and displays it on the display unit, and transmits to the headset an instruction to perform the audio reproduction processing for the voice data as instructed by the operation of the operating unit.

[0027] The wearable radio communication device of various forms described above is preferably a radio communication device of wrist watch type wearable on the wrist of the user.

[0028] In still another preferred form, the wearable radio communication device has the function as a wrist watch, and displays the present time when the image or the information obtained by data communication is not displayed on the display unit.

[0029] The present invention further provides a headset comprising a memory for storing music information, an audio reproduction unit for reproducing the music information stored in the memory and outputting the music information as a sound, a local radio communication unit for effecting the local bi-directional radio communication with a mobile telephone device capable of effecting the local bi-directional radio communication with a wearable radio communication device, and a control unit for causing the local radio communication unit to receive the music information from the mobile telephone device and instructing the audio reproduction unit to reproduce the music information stored in the memory, in accordance with the instruction signal received from the wearable radio communication device through the mobile telephone device.

[0030] The memory included in the headset may be a semiconductor memory removable from the headset.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] **FIG. 1** is a diagram showing a configuration of a mobile videophone system according to a first embodiment of the invention.

[0032] **FIG. 2** is a block diagram showing a configuration of a mobile telephone device and a wrist watch-type information apparatus according to the same embodiment.

[0033] **FIG. 3** is a diagram showing an example of display of the wrist watch-type information apparatus according to the same embodiment.

[0034] **FIG. 4** is a diagram showing the manner in which the mobile telephone device and the wrist watch-type information apparatus are used according to the same embodiment.

[0035] **FIG. 5** is a diagram showing a configuration of a mobile videophone system according to a second embodiment of the invention.

[0036] **FIG. 6** is a block diagram showing a configuration of a mobile telephone device and a wrist watch-type information apparatus according to the same embodiment.

[0037] **FIG. 7** is a diagram showing a configuration of a mobile videophone system according to a third embodiment of the invention.

[0038] **FIG. 8** is a diagram showing the manner in which the mobile telephone device, the wrist watch-type information apparatus and the headset are used according to the same embodiment.

[0039] **FIG. 9** is a block diagram showing a configuration of the mobile telephone device, the wrist watch-type information apparatus and the headset according to the same embodiment.

[0040] **FIG. 10** is a block diagram showing a configuration of the RF unit of the wrist watch-type information apparatus according to the same embodiment.

[0041] **FIG. 11** is a block diagram showing a configuration of the baseband processing unit of the wrist watch-type information apparatus according to the same embodiment.

[0042] **FIGS. 12A and 12B** are sequence diagrams showing the operation according to the same embodiment.

[0043] **FIG. 13** is a diagram showing a pico-net configured according to the same embodiment.

[0044] **FIG. 14** is a time chart showing the manner in which packets are transferred according to the same embodiment.

[0045] **FIG. 15** is a diagram showing an example of display on the wrist watch-type information apparatus according to the same embodiment.

BEST MODE FOR CARRYING OUT THE INVENTION

[0046] Preferred embodiments of the present invention will be explained with reference to the drawings.

[0047] [1] First Embodiment

[0048] [1.1] Configuration of First Embodiment

[0049] **FIG. 1** is a diagram showing a configuration of a mobile videophone system **10** according to a first embodiment of the invention. As shown in **FIG. 1**, the mobile videophone system **10** comprises a mobile telephone device **11** and a wrist watch-type information apparatus **12** as main component elements. The mobile telephone device **11** is capable of processing an image sequence such a MPEG4 (Moving Picture Experts Group phase 4), and voice communication and data communication with the other party through a mobile communication network and/or a fixed communication network. The wrist watch-type information apparatus **12** has the functions of local bi-directional radio communication (short distance radio communication) with the mobile telephone device by bluetooth or the like in addition to the functions similar to an ordinary wrist watch. The wrist watch-type information apparatus **12**, by this function of bi-directional communication, can receive the image sequence data and text information from the mobile telephone device **11** and display it, while at the same time picking up an image and transmitting image data to the mobile telephone device **11**.

[0050] **FIG. 2** is a block diagram showing a configuration of the mobile telephone device **11** and the wrist watch-type information apparatus **12**. **FIG. 3** shows an outer appearance of the wrist watch-type information apparatus **12**. First, with reference to **FIG. 2**, the configuration of the mobile telephone device **11** will be explained. A bluetooth module **22** includes an RF unit **34** for carrying out operations corresponding to the RF (radio frequency) layer in the bluetooth communication and a baseband processing unit **35** for carrying out operations corresponding to the baseband layer overriding the RF layer. A microprocessor **23** includes memories (not shown) such a ROM and a RAM for storing various data. The microprocessor **23** uses these memories to control the communication and applications, and control the whole of the mobile telephone device **11** on the other hand. A LCD driver **25** is for driving a LCD (liquid crystal display) **24** under the control of the microprocessor **23**. The RF unit **27** performs bi-directional radio communication with the mobile communication network by generating a signal modulated by the baseband signal to be transmitted, and transmitting the modulated signal from a mobile telephone antenna **26**, and by demodulating the received signal of the mobile telephone antenna **26** to generate the baseband signal. A W-CDMA baseband processing unit **28** is a device for carrying out the baseband processing according to the W-CDMA (wide-band code division multiple access) method. The W-CDMA baseband processing unit **28** is connected with a voice CODEC **29**, which in turn is connected with a speaker **30** and a microphone **31** through a voice interface unit **32**. The voice CODEC **29** decodes the output signal of the W-CDMA baseband processing unit **28** and outputs voice data. The voice interface unit **32** carries out digital/analog conversion on the voice data to generate an analog voice signal which is output as a sound from the speaker **30**. The voice interface unit **32** also generates voice data by analog/digital conversion of the analog signal input through the microphone **31**. The voice CODEC **29** encodes the voice data and outputs the encoded voice data to the W-CDMA baseband processing unit **28**. The bluetooth module **22**, the microprocessor **23**, the W-CDMA baseband processing unit **28** and the LCD driver **25** are interconnected through a bus **33**.

[0051] Now, a configuration of the wrist watch-type information apparatus **12** will be explained with reference to **FIGS. 2 and 3**. A reference signal generating circuit **55** is a device which generates an oscillation signal by an external crystal oscillator **56** and generates a signal for controlling the timing of operation of various internal parts of the wrist watch-type information apparatus **12** based on the oscillation signal. A nonvolatile memory **57** is for storing information such as ID for communication. The bluetooth module **42** includes a RF unit **53** for carrying out operations corresponding to the RF layer of the bluetooth communication and a baseband processing unit **54** for carrying out operations corresponding to the baseband layer. A watch CPU **43** controls the timepiece operation while at the same time controlling the whole operation of the wrist watch-type information apparatus **12**. The LCD driver **45** is a device for driving the LCD **44** under the control of the watch CPU **43**. As long as the wrist watch-type information apparatus **12** is not making speech nor the data is not on display on the LCD **44**, the LCD **44** displays the current time under the control of the watch CPU **43**. The operating switch unit **46** includes operating switches SW1 to SW4 (**FIG. 3**) for allowing the user to perform various operations. The input interface unit **47** is a device for transmitting the operation event generated in the operating switch unit **46** to the watch CPU **43**. A

CMOS image sensor **48** is a device functioning as a camera for picking up an image and outputting an image signal. An image processing unit **49** is a device for analog/digital conversion and image synchronous processing of the image signal output from the CMOS image sensor **48** and outputting original image data. A MPEG4 video CODEC **51** includes a frame memory **50** for storing the image data. The MPEG4 video CODEC **51** generates a coded image data from the original image data in accordance with the coding method based on MPEG4 using the frame memory **50**. The MPEG4 video CODEC **51** receives the coded image data from the mobile telephone device **11** through the bluetooth module **42**. The MPEG4 video CODEC **51** decodes the coded image data to generate the display image data in accordance with the decoding method based on MPEG4 using the frame memory **50**. The reference signal generating circuit **55**, the nonvolatile memory **57**, the bluetooth module **42**, the watch CPU **43**, the LCD driver **45**, the input interface unit **47** and the MPEG4 video CODEC **51** are interconnected through a bus **52**. The reference signal generating circuit **55**, the nonvolatile memory **57**, the bluetooth module **42**, the watch CPU **43**, the LCD driver **45**, the input interface unit **47**, the MPEG4 video CODEC **51** and the frame memory **50** are supplied with power from a battery **58**. Even if power from the battery **58** stops, the information stored in the nonvolatile memory **57** is not lost.

[**0052**] [1,2] Operation of First Embodiment

[**0053**] With the arrival of an incoming call from a telephone set of a given calling party to the mobile telephone device **11**, the RF unit **27** of the mobile telephone device **11** demodulates the received signal of the antenna **26** to generate the baseband signal. The W-CDMA baseband processing unit **28** extracts the coded image data and the coded audio data independently of each other from the baseband signal.

[**0054**] The bluetooth module **22** processes the coded image data for the baseband layer and the RF layer under the control of the microprocessor **23**, and generates a signal modulated by the coded image data. This signal is transmitted to the wrist watch-type information apparatus **12** through a bluetooth antenna **21**. In parallel with this, the voice CODEC **29** decodes the coded voice data to generate the voice data. The voice interface unit **32** outputs the voice data as an analog voice signal from the speaker **30**. As a result, the voice of the calling party is produced from the speaker **30**.

[**0055**] The wrist watch-type information apparatus **12** receives the signal from the mobile telephone device **11** through the bluetooth antenna **41**. The bluetooth module **42** processes the received signal for the RF layer and the baseband layer, and demodulates the received signal to generate the coded image data as a baseband signal. The MPEG4 video CODEC **51** decodes the coded image data to generate the image data using the frame memory **50** under the control of the watch CPU **43**, and outputs the image data to the LCD driver **45**. The LCD driver **45** displays the image corresponding to the image data on the display screen of the LCD **44**. **FIG. 3** illustrates an image of the calling party thus displayed on the display screen of the LCD **44**. The user U of the mobile videophone system **10** can effect communication with the calling party in a relaxed position on the videophone as shown in **FIG. 4** using the mobile telephone device **11** and the wrist watch-type information apparatus **12**. Specifically, the user U can make speech with the calling party by holding the mobile telephone device **11** with the speaker **30** located near his ear and the microphone **31** located near his mouth. At the same time, the user U can face the LCD **44** and the CMOS image sensor **48** of the wrist watch-type information apparatus **12** at an appropriate distance, and while checking the received image of the calling party displayed on the LCD **44**, can cause the CCD image sensor **48** to pick up his image. In the process, the mobile telephone device **11** and the wrist watch-type information apparatus **12** operate as follows.

[**0056**] First, when the user U utters a voice, the voice signal is output from the microphone **31**. This voice signal is converted into a digital audio data by the voice interface unit **32**. The voice CODEC **29** generates coded voice data from the voice data. The W-CDMA baseband processing unit **28** outputs the coded voice data as a baseband signal to the RF unit **27**. The RF unit **27** generates a signal modulated by the baseband signal, and transmits it from the mobile telephone antenna **26**. As a result, the voice of the user U is output on the calling party side.

[**0057**] On the other hand, the image of the user U picked up by the CMOS image sensor **48** is output as an image signal to the image processing unit **49**. The image processing unit **49** processes the image signal by analog/digital conversion and image synchronization and outputs the original image data to the MPEG4 video CODEC **51**. The MPEG4 video CODEC **51** generates the coded image data from the original image data under the control of the watch CPU **43**, and transfers it to the bluetooth module **42**. The bluetooth module **42** processes the coded image data for the baseband layer and the RF layer, and generating the signal modulated by the coded image data, transmits it from the bluetooth antenna **41**. This signal is received by the bluetooth antenna **21** of the mobile telephone device **11**. Then, the bluetooth module **22** processes the received signal for the baseband layer and the RF layer and thus generates the coded image data from the received signal. The W-CDMA baseband processing unit **28** outputs the coded image data as a baseband signal to the RF unit **27**. The RF unit **27** generates a signal modulated by the baseband signal, and transmits it from the mobile telephone antenna **26**. This signal is sent to the calling party through a mobile communication network. As a result, the image of the user U is displayed on the calling party side.

[**0058**] [1.3] Effects of First Embodiment

[**0059**] As described above, according to this embodiment, the user can make speech with the other party by the mobile telephone device in a relaxed position, while at the same time causing the received image of the other party to be displayed on the display unit of the wrist watch-type information apparatus on the one hand and picking up the image transmitted to the other party on the other hand.

[**0060**] [1.4] Modifications of First Embodiment

[**0061**] [1.4.1] First Modification

[**0062**] In this modification, the telephone numbers and the names of the desired other parties or such information as names or nicknames of the other parties can be stored by the user in the nonvolatile memory **57** of the wrist watch-type information apparatus **12**. With the arrival of an incoming

call at the mobile telephone device **11**, the incoming call arrival announcing signal including the telephone number of the calling party is sent to the wrist watch-type information apparatus **12**. In the wrist watch-type information apparatus **12**, the telephone number included in the incoming call arrival announcing signal is displayed on the LCD **44**. At the same time, the name or nickname of the other party associated with the telephone number is read from the nonvolatile memory **57** and displayed on the LCD **44**. According to this modification, the user can check the calling party by the information displayed on the LCD **44** of the wrist watch-type information apparatus **12**. In the case where the mobile telephone device **11** has the voice response function in this modification, the wrist watch-type information apparatus **12** may be provided with the function of transmitting an instruction signal for performing the voice response function. Specifically, with the arrival of an incoming call, the operating switches SW1 to SW4 of the operating switch unit **46** of the wrist watch-type information apparatus **12** are operated to input an incoming call response instruction. Then, the wrist watch-type information apparatus **12** transfers the instruction to the mobile telephone device **11**. The mobile telephone device **11**, in response to this incoming call response instruction, perform the processing for response to the incoming call. As an example of the processing for the incoming call response, a wait request voice message is transmitted for requesting the calling party to keep off hook or a recall request voice message is transmitted for requesting the other party to call again later or a message storage processing is performed for recording the message as a function of an automatic answering machine.

[**0063**] [1.4.2] Second Modification

[**0064**] In this modification, with the arrival of an electronic mail at the mobile telephone device **11**, the title, etc. of the electronic mail is sent to the wrist watch-type information apparatus **12**. The wrist watch-type information apparatus **12** displays this title. Under this condition, assume that the operating switches SW1 to SW4 of the operating switch unit **46** are operated in a predetermined way. Then, the wrist watch-type information apparatus **12** requests the mobile telephone device **11** to download the electronic mail and transfer it to the wrist watch-type information apparatus **12**. The wrist watch-type information apparatus **12** receives the electronic mail from the mobile telephone device **11** and displays the contents thereof on the LCD **44**.

[**0065**] [1.4.3] Third Modification

[**0066**] In this modification, the wrist watch-type information apparatus **12** includes, like the mobile telephone device **11**, a microphone, a speaker, a voice input/output interface unit, a voice CODEC and the like devices for voice communication. The mobile telephone device **11** connects the line with the calling party and sends the voice from the calling party to the wrist watch-type information apparatus **12**, while the voice which may be sent from the wrist watch-type information apparatus **12** is sent to the calling party. According to this modification, even in the case where the mobile telephone device **11** is placed in a bag or the like, the user can make speech using the wrist watch-type information apparatus **12**. In this case, the voice data communication function of the wrist watch-type information apparatus **12** can be set arbitrarily by the user in either an operative mode or an inoperative mode.

[**0067**] [2] Second Embodiment

[**0068**] **FIG. 5** is a diagram showing a configuration of a mobile videophone system **10**A according to a second embodiment of the invention. **FIG. 6** is a block diagram showing a configuration of the mobile telephone device **11**A and the wrist watch-type information apparatus **12** making up the main component elements of the system **10**A.

[**0069**] The mobile telephone device **11**A, as compared with the mobile telephone device **11** of the first embodiment, additionally includes a camera **58**, an image processing unit **59**, a MPEG4 video CODEC **61** and a frame memory **60**. The camera **58** picks up an image and outputs an image signal. The image processing unit **59** processes the image signal output from the camera **58** by analog/digital conversion and the image synchronization and outputs the original image data. The MPEG4 video CODEC **61** generates the coded image data from the original image data output from the image processing unit **59**, by the MPEG4 coding method using the frame memory **60**. The MPEG4 video CODEC **61** can receive the coded image data from the other party through the mobile telephone antenna **26**, the RF unit **27** and the W-CDMA baseband processing unit **28**, or can receive the coded image data from the wrist watch-type information apparatus **12** through the bluetooth module **22**. The MPEG4 video CODEC **61** decodes each coded image data to generate the image data by the MPEG4 decoding method using the frame memory **60**. The other component elements are similar to those of the mobile telephone device **11** and will not be described. Also, the wrist watch-type information apparatus **12** according to this embodiment is similar to that of the first embodiment and will not be described.

[**0070**] According to this embodiment, like the first embodiment, the image including the image sequence can be displayed on the wrist watch-type information apparatus **12**, and the voice and image sequence can be transmitted and received to and from the other party with the mobile telephone device **11**A alone. The operation of transmitting and receiving the image sequence will be explained below. The operation for transmitting/receiving the voice is identical to that for an ordinary mobile telephone device and therefore will not be described.

[**0071**] First, with the arrival of an incoming all at the mobile telephone device **11**A, the RF unit **27** demodulates the baseband signal from the signal received through the antenna **26**, and the W-CDMA baseband processing unit **28** extracts the coded image data and the coded voice data independently of each other from the baseband signal. The coded image data is the image of the face of the calling party and the coded voice data is the voice of the calling party, for example. The coded voice data is output from the speaker **30** as a voice through the voice CODEC **29** and the voice interface **32**.

[**0072**] The MPEG4 video CODEC **6** decodes the coded image data to generate the image data under the control of the microprocessor **23** and outputs the image data to the LCD driver **25**. The LCD driver **25** drives the LCD **24** by the image data. As a result, the image of the face of the calling party, for example, is displayed on the LCD **24**.

[**0073**] An image is also picked up by the camera **58**, and the image signal is output from the camera **58** to the image processing unit **59**. The image processing unit **59** generates

the original image data by processing the image signal by analog/digital conversion and the image synchronization. The MPEG4 video CODEC **61** generates the coded image data from the original image data according to the MPEG4 coding method under the control of the microprocessor **23**. The W-CDMA baseband processing unit **28** uses the coded image data as a baseband signal, and the RF unit **27** generates a signal modulated by the baseband signal and transmits it from the mobile telephone antenna **26**. This signal is transmitted to the calling party through a mobile communication network. As a result, the calling party can display the image of the user U (**FIG. 4**) of the mobile telephone device **11**A.

[**0074**] As described above, this embodiment, in addition to the effects of the first embodiment, permits the image data including the image sequence to be transmitted or received only with the mobile telephone device and can thus produce the effect of an improved operating convenience.

[**0075**] In the embodiment described above, the image is transmitted to or received from the other party only by the mobile telephone device **11**A or the wrist watch-type information apparatus **12**. As an alternative, the mobile telephone device **11**A may produce an image displayable on a single screen (such as an image P**3**) by synthesizing the image (such as an image P**1**) picked up by the mobile telephone device **11**A and the image (such as an image P**2**) picked up by the wrist watch-type information apparatus **12**, and may send the synthesized image to the other party. In this case, the images of a plurality of persons can be sent. A specific method of synthesis will be explained. First, the images P**1** and P**2** are temporarily stored in the frame memory **60**. Then, the number of horizontal scanning lines of the images P**1** and P**2** is reduced to about one half or two thirds. After reducing the number of scanning lines this way, the two images are synthesized to produce a new image. According to this method, the image data of an image P**3** is produced in which, for example, a part of the image P**1** is included in the upper half portion of the screen and a part of the image P**2** is included in the lower half of the screen.

[**0076**] [3] Third Embodiment

[**0077**] [3.1] Configuration of Embodiment

[**0078**] **FIG. 7** is a diagram showing a configuration of a mobile videophone system **10**B according to a third embodiment of the invention. As shown in **FIG. 7**, the mobile videophone system **10**B comprises a mobile telephone device **11**B, a wrist watch-type information apparatus **12**B and a headset **13** as main component parts. **FIG. 8** is a diagram showing the manner in which the mobile telephone device **11**B, the wrist watch-type information apparatus **12**B and the headset **13** are used. In the example shown in **FIG. 8**, the user U places the mobile telephone device **11**B in his bag, and wears the wrist watch-type information apparatus **12**B on his wrist and the headset **13** on his head.

[**0079**] The mobile telephone device **11**B can process the image sequence by such as MPEG4 , and can establish communication with a telephone set connected to a fixed telephone network or another mobile telephone set accommodated in a mobile communication network. The wrist watch-type information apparatus **12**B has the function of an ordinary wrist watch and at the same time the function of effecting the local bi-directional radio communication (short-distance radio communication) with the mobile telephone device **11**B and the headset **13**. The wrist watch-type information apparatus **12**B receives the information representing the image sequence and text from the mobile telephone device **11** by bi-directional communication and displays them, while at the same time picking up an image and transmitting the image data to the mobile telephone device **11**. The wrist watch-type information apparatus **12**B also has the function of transmitting an instruction to the headset **13** to send music data. The headset **13** establishes the local bi-directional radio communication (short-distance radio communication) with the mobile telephone device **11**B and the wrist watch-type information apparatus **12**B. By this bi-directional radio communication, the headset **13** can receive the music data from the mobile telephone device **11**B and reproduce stereo music.

[**0080**] **FIG. 9** is a block diagram showing a configuration of the mobile telephone device **11**, the wrist watch-type information apparatus **12** and the headset **13**. With reference to **FIG. 9**, the headset **13** will be explained. In **FIG. 9, a** bluetooth module **72** is a device for establishing the bluetooth communication, which is a kind of local bi-directional radio communication, with the mobile telephone device **11**B through a bluetooth antenna **71**. The bluetooth module **72** includes a RF unit **82** for processing the RF layer and a baseband processing unit **83** for processing the baseband layer in the bluetooth communication. The microprocessor **73** includes a memory **75** such as a ROM or a RAM for storing various data. The microprocessor **73** controls the communication and applications using this memory while at the same time controlling the whole operation of the headset **13**. The memory **75** is provided for storing the audio data of MP3 (MPEG Audio layer3) type. An example of data stored in the memory **75** includes the music contents acquired by the mobile telephone device **11**B or what is called the audio data of incoming melodies. The memory **75** is preferably a nonvolatile semiconductor memory replaceably mounted on the headset **13**. The audio reproduction unit **74** reproduces the stereo music of the audio data of MP3 type under the control of the microprocessor **73**. The bluetooth module **72** is connected with a voice CODEC **74**. The voice CODEC **74** is connected to a headphone **79** through an amplifier **80** on the one hand and to a microphone **77** through an amplifier **78** on the other. The voice CODEC **74** decodes the coded voice data input through the bluetooth module **72** to generate an analog voice signal and outputs it. The amplifier **80** can amplify the analog music signal and can output it as a voice from the headphone **79**. The amplifier **78** amplifies the voice signal input through the microphone **77**, and outputs it to the voice CODEC **76**. The voice CODEC **76** generates the coded voice data from the voice signal, and outputs it to the bluetooth module **72**. The bluetooth module **72**, the microprocessor **73** and the audio reproduction unit **74** are connected to each other through a bus **81**.

[**0081**] Now, the mobile telephone device **11**B will be explained. In the mobile telephone device **11**B according to this embodiment, a microprocessor **23**B is used instead of the microprocessor **23** (**FIG. 2**) of the first embodiment. The microprocessor **23** according to the first embodiment establishes a communication link with the wrist watch-type information apparatus **10** by the bluetooth module **35**, and exchanges information with the wrist watch-type information apparatus **10** through this communication link. With the microprocessor **23**B according to this embodiment, on the

other hand, the communication link is established with each of the the wrist watch-type information apparatus **12**B and the headset **13** through the bluetooth module **35**, and using these communication links, the microprocessor **23**B transmits and receives information to and from the wrist watch-type information apparatus **12**B and the headset **13**. The other points are similar to the corresponding ones of the mobile telephone device **11** of the first embodiment.

[**0082**] Now, the wrist watch-type information apparatus **12**B will be explained. The wrist watch-type information apparatus **12**B according to this embodiment comprises a bluetooth module **42**B and a watch CPU **43**B in place of the bluetooth module **42** and the watch CPU **43** (**FIG. 2**), respectively, of the first embodiment.

[**0083**] The bluetooth module **42**B is a device for effecting the bluetooth communication, which is a kind of local bi-directional radio communication, with the mobile telephone device **11**B. The bluetooth communication effected in this embodiment is what is called the half-duplex bi-directional radio communication. The bluetooth module **42**B is configured of a RF unit **53**B for processing the RF layer and a baseband processing unit **54**B for processing the baseband layer in the bluetooth communication. More specifically, the baseband processing unit **54**B is a device for transmitting and receiving the baseband signal to and from the called parties of the wrist watch-type information apparatus **12**B under the control of the watch CPU **43**B. The RF unit **53**B performs the spectrum spreading modulation of the frequency hopping (FH) type using the baseband signal addressed to the mobile telephone device **11**B, and outputs the resulting transmission signal from the antenna **41**. Also, the RF unit **53**B carries out the spectrum spreading modulation of FH type for the received signal of the antenna **41** and demodulates the baseband signal addressed to the wrist watch-type information apparatus **12**B.

[**0084**] The configuration of the RF unit **53**B will be explained with reference to **FIG. 10**. As shown in **FIG. 10**, the antenna **41** is connected through an antenna filter **5301** to a switch circuit **5302** for switching transmission and receiving for half-duplex bi-directional communication. When the wrist watch-type information apparatus **12**B transmits a signal, the switch circuit **5302** connects the antenna filter **5301** to the output terminal of the power amplifier **5335**, and when receiving a signal, connects the antenna filter **5301** to the input terminal of the RF amplifier **5321**.

[**0085**] A PLL control unit **5311**, a low-pass filter **5312** and a voltage controlled oscillator (VCO) **5313** make up a PLL (phase locked loop) for generating an oscillation signal SVCO. The PLL control circuit **5311** is supplied with a synthesizer control signal SSY from the baseband processing unit **54**B. The frequency of the oscillation signal SVCO is determined by the synthesizer control signal SSY. In order to change the frequency of the oscillation signal SVCO with time in accordance with a predetermined PH pattern, the baseband processing unit **54**B changes the synthesizer control signal SSY as required. A buffer amplifier **5314** amplifies the oscillation signal SVCO and supplies it to a mixer **5322**.

[**0086**] The RF amplifier **5321**, the mixer **5322**, the band-pass filter **5323**, the IF amplifier **5324** and the demodulation circuit **5325** receive the received signal of the antenna **41** through the antenna filter **5301** and the switch circuit **5302**, and make up a receiving circuit for demodulating the received data DRX from the received signal. More specifically, in receive mode, the antenna filter **5302** removes the unnecessary components from the received signal of the antenna **41** and outputs only the required components through the switch circuit **5302** to the RF amplifier **5321**. The RF amplifier **5321** amplifies the received signal and sends it to the mixer **5322**. The mixer **5322** is supplied with the oscillation signal SVCO having a frequency changing with time in accordance with the FH pattern. The mixer **5322** mixes the oscillation signal SVCO with the received signal from the RF amplifier **5321** thereby to subject the received signal to the inverse spectrum spreading. The band-pass filter **5323** selects the IF (intermediate frequency) signal of the intermediate frequency band out of the output signals of the mixer **5322**, and outputs the selected signal to the IF amplifier **5324**. The IF amplifier **5324** amplifies the IF signal and outputs the amplified signal to the demodulation circuit **5325**. The demodulation circuit **5325**, in turn, demodulates the received data DRX providing a baseband signal from the IF signal, and outputs it to the baseband processing unit **54**B.

[**0087**] The modulation circuit **5331**, the IF amplifier **5322**, the low-pass filter **5323**, the mixer **5334** and the power amplifier **5335** make up a transmission circuit for generating a transmission signal to be supplied to the switch circuit **302**. More specifically, in transmission mode, the modulation circuit **5331** modulates the carrier by the transmission data DTX supplied from the baseband processing unit **54**B, and outputs an IF signal. This IF signal is supplied to the mixer **5334** through the IF amplifier **5322** and the low-pass filter **5333**. This mixer **5334** is supplied with the oscillation signal SVCO having a frequency changing with time in accordance with the FH pattern. The mixer **5334** mixes the oscillation signal SVCO with the IF signal, and subjecting it to the spectrum spreading of FH type, outputs a transmission signal of a high frequency. The power amplifier **5335** amplifies the high-frequency signal, and outputs the amplified signal to the switch circuit **5302**. The antenna filter **5301** receives the output signal of the power amplifier **5335** through the switch circuit **5302**, and removing the unnecessary components, outputs only the required components to the antenna **41**.

[**0088**] Now, the configuration of the baseband processing unit **54**B will be explained with reference to **FIG. 11**. In **FIG. 11, a** data communication control unit **5400** is a device for controlling various parts in the baseband processing unit **54**B. The synthesizer control signal SSY described above is generated by the data communication control unit **5400**. In this embodiment, the baseband processing unit **4**B, as a circuit underlying the data communication control unit **5400**, includes a circuit for effecting the data communication by the ACL (Asynchronous ConnectionLess) link and a circuit for effecting the data communication by the SCO (Synchronous Connection Oriented) link.

[**0089**] The ACL link is an asynchronous communication link according to the bluetooth technical specification. In a pico-net comprised of one master and a plurality of slaves, the master establishes data communication with each slave by using the ACL link. In this case, the effective signaling rate of the ACL link changes with the data amount transmitted and received and the number of slaves in the pico-net. This is by reason of the fact that the master polls the slaves in accordance with the empty state of the communication

slots, and effects the data communication with the slaves using an empty communication slot. As a result, normally, the ACL link is used for the communication which has a lesser need of real time processing.

[**0090**] The wrist watch-type information apparatus **12**B according to this embodiment also transmits and receives the asynchronous data requiring no real time processing to and from the mobile telephone device **11**B using the ACL link. The asynchronous data include the control data used for various instructions and control operations between, for example, the wrist watch-type information apparatus **12**B and the mobile telephone device **11**B.

[**0091**] In effecting the communication by the ACL link, the data communication control unit **5400** sends a buffer select control signal to the switch circuits **5431** and **5441** thereby to switch the switch circuit **5431** to the receiving ACL buffer memory **5432** and the switch circuit **5441** to the transmission ACL buffer memory **5442**. Under this condition, the received data DRX output from the demodulation circuit **5325** is written in the receiving ACL buffer memory **5432** through the switch circuit **5431**. After a packet of asynchronous data has been written, a receiving interrupt signal is sent out to the data communication control unit **5400** from a memory controller not shown. In response to this receiving interrupt signal, the data communication control unit **5400** sequentially reads the asynchronous data stored in the receiving ACL buffer memory **5432**. The asynchronous data generated by the data communication control unit **5400**, on the other hand, is written in the transmission ACL buffer memory **5442**. After that, the asynchronous data is read from the transmission ACL buffer memory **5442** and output to the modulation circuit **5331** as transmission data DTX through the switch circuit **5441**. Once a packet of the control data has been sent out and the transmission ACL buffer memory **5442** becomes empty, a data transmission over signal is sent to the data communication control unit **5400** from a memory controller not shown. In response to the data transmission over signal, the data communication control unit **5400** sequentially writes the asynchronous data next to be transmitted, in the transmission ACL buffer memory **5442**.

[**0092**] The configuration for effecting the communication using the ACL link according to this embodiment was described in detail above.

[**0093**] Now, an explanation will be given of the SCO link which is a communication link of synchronous type used for the bluetooth communication. The communication with the SCO link is effected in one-to-one relation between the master and slaves. In the communication using the SCO link, a communication slot is given at predetermined regular time intervals for communication between one slave and the master. Thus, the slave can secure a predetermined signaling rate (**64** kbps in the case under consideration). The SCO link is normally used for the communication requiring the real time processing.

[**0094**] The wrist watch-type information apparatus **12**B according to this embodiment also transmits and receives the coded image data requiring the real time processing by use of the SCO link to and from the mobile telephone device **11**.

[**0095**] In effecting the communication by the SCO link, the data communication control unit **5400** sends a buffer select control signal to the switch circuits **5431** and **5441**, thereby switching the switch circuit **5431** to the receiving SCO buffer memory **5433** and the switch circuit **5441** to the transmission SCO buffer memory **5443**. Under this condition, the coded image data constituting the received data DRX output from the demodulation circuit **5325** is sequentially written in the receiving SCO buffer memory **5433** through the switch circuit **5431**. Once a packet of the coded image data has been written in the receiving SCO buffer memory **5433**, a receiving interrupt signal is sent out to the data communication control unit **5400** from a memory controller not shown. In accordance with the receiving interrupt signal, the data communication control unit **5400** reads the coded image data stored in the receiving SCO buffer memory **5433**, and supplies it to the MPEG4 video CODEC **51**. On the other hand, the transmission operation is performed in the following manner. First, the coded image data to be sent to the other party, when output from the MPEG4 video CODEC **51**, are written in the transmission SCO buffer memory **5443** by the data communication control unit **5400**. After that, the coded image data is read from the transmission SCO buffer memory **5433**, and through the switch circuit **5441**, output to the modulation circuit **5331** as the transmission data DTX. Subsequently, when a packet of the coded image data is sent out and the transmission SCO buffer memory **5443** becomes empty, a data request interrupt signal is sent out to the data communication control unit **5400** from a memory controller not shown. In response to this data request interrupt signal, the data communication control unit **5400** acquires the coded image data to be next sent, from the MPEG4 video CODEC **51**, and writes them sequentially in the transmission SCO buffer memory **5443**.

[**0096**] The configuration for communication using the SCO link according to this embodiment was described above in detail.

[**0097**] In **FIG. 9**, the watch CPU **43**B transmits and receives information to and from the mobile telephone device **11**B by the bluetooth module **42**B. The other points are similar to the corresponding points of the first embodiment and will not be explained.

[**0098**] [3.2] Operation of Embodiment

[**0099**] [3.2.1] Basic Operation Sequence

[**0100**] **FIGS. 12A and 12B** are sequence diagrams showing the operation of the mobile videophone system according to this embodiment. With reference to these sequence diagrams, the operation of this embodiment will be explained.

[**0101**] The wrist watch-type information apparatus **12**B executes the synchronization phase and the communication connection phase determined in the bluetooth technical specification and forms a communication network called the pico-net with the mobile telephone device **11**B and the headset **13** (step S1). In the bluetooth technique, any of the bluetooth terminals making up the pico-net can be freely determined as a master. According to this embodiment, the mobile telephone device **11**B is determined as a master and the wrist watch-type information apparatus **12**A and the headset **13** as slaves to configure the pico-net shown in **FIG. 13**. Once the pico-net is formed, the operation mode of the mobile telephone device **11**B, the wrist watch-type information apparatus **12**B and the headset **13** transfers to a low

power consumption mode called the park mode (step S2). In this mode transfer, the process is executed while identifying the other party using the bluetooth address and the link key between the master and slaves. This is a well-known technique and will not be described in detail.

[0102] In the low power consumption mode, assume that other telephone users have input the telephone number of the mobile telephone device 11B and carried out the call operation. In response, the mobile communication network transmits an incoming call signal through a base station 14 (step S3). This incoming call signal includes the telephone number of the mobile telephone device 11B. Further, the incoming call signal includes the telephone number of the telephone set of the calling party.

[0103] The mobile telephone device 11B located in the radio zone of the base station 14, on the other hand, upon receipt of the incoming call signal (step S4), instructs the headset 13, a slave, to transfer to the communication connection phase by the SCO link from the park mode. In response, the operation of the mobile telephone device 11B and the headset 13 transfers to the communication connection phase by the SCO link (step S5). Then, the mobile telephone device 11B instructs the wrist watch-type information apparatus 12B, a slave, to transfer to the communication connection phase by the ACL link from the park mode. In response, the operation of the mobile telephone device 11B and the wrist watch-type information apparatus 12B transfers to the communication connection phase by the ACL link (step S6).

[0104] Once the SCO link with the headset 13 and the ACL link with the wrist watch-type information apparatus 12B are established, the mobile telephone device 11B, the master, as shown in FIG. 14, can transmit and receive SCO packets to and from the headset 13, a slave, while at the same time transmitting and receiving ACL packets to and from the wrist watch-type information apparatus 12B, another slave.

[0105] In the bluetooth communication, the master can establish the SCO link with a maximum of three slaves at a time. Thus, the SCO link may be established between the mobile telephone device 11B and the wrist watch-type information apparatus 12B as well as between the mobile telephone device 11B and the headset 13.

[0106] After the SCO link and the ACL link are established, the mobile telephone device 11A sends the incoming call announcing signal to the bluetooth module 22. The bluetooth module 22 transmits the SCO packet including the incoming call announcing signal to the headset 13 (step S7).

[0107] The bluetooth module 72 of the headset 13, upon receipt of the SCO packet, retrieves the incoming call announcing signal from the particular packet, and sends it to the microprocessor 73. In response, the microprocessor 73 instructs the audio reproduction unit 74 to reproduce the incoming call melody. As a result, the incoming call melody is reproduced by the audio reproduction unit 74 and output through the amplifier 80 and the speaker 79 (step S8).

[0108] The user U wearing the headset 13 (FIG. 8), taking note of the incoming call melody, operates the operating unit 46 of the wrist watch-type information apparatus 12A and inputs an instruction to respond to the incoming call. The watch CPU 43B, upon receipt of this instruction through the operating unit 46 (step S9), sends the incoming call response command to the bluetooth module 42B. The bluetooth module 42B generates an ACL packet including the incoming call response command and transmits it to the mobile telephone device 11B (step S10).

[0109] The bluetooth module 42B of the mobile telephone device 11B, upon receipt of the ACL packet, retrieves the incoming call response command from it, and sends it to the microprocessor 23B. The microprocessor 23B, upon receipt of the incoming call response command, transmits the incoming call response signal to the W-CDMA baseband processing unit and the RF unit 27 (step S11). This incoming call response signal is sent to the telephone set of the calling party through the base station 14 of the mobile communication network (step S12). As a result, the line connection is completed between the telephone set of the calling party and the mobile telephone device 11B. After that, the bi-directional data communication is carried out between the two telephone sets (steps S13, S14, S15 and S16). In FIG. 12B, steps S13 and S14 represent all the data transmission from the calling party to the mobile telephone device 11B in the bi-directional data communication, while steps S15 and S16 represent all the data transmission from the mobile telephone device 11B to the calling party.

[0110] In this bi-directional data communication, upon receipt of the voice data from the calling party, the microprocessor 23B of the mobile telephone device 11B sends to the bluetooth module 22 an instruction to transmit packets to the headset 13. Then, a series of voice data received from the calling party are sent to the bluetooth module 22. The bluetooth module 22 places on the SCO packets the voice data received from the calling party, and transmits them to the headset 13 (step S21).

[0111] The bluetooth module 72 of the headset 13, upon receipt of the SCO packet from the mobile telephone device 11B, retrieves the voice data from the SCO packet and sends it to the voice CODEC 76. The voice CODEC 76 generates an analog voice signal from the voice data, and sends it to the speaker 79 through the amplifier 80. As a result, the voice of the calling party is output from the speaker 79 (step S22).

[0112] The user U wearing the headset 13 as shown in FIG. 8 can hear the voice of the calling party produced from the speaker 79. When the user utters a voice, the voice data corresponding to the particular voice is output from the voice CODEC 76. This voice data is sent to the bluetooth module 76 under the control of the microprocessor 73. The SCO packet including the voice data is transmitted to the mobile telephone device 11B by the bluetooth module 72 (step S23).

[0113] The bluetooth module 22 of the mobile telephone device 11B, upon receipt of the SCO packet, retrieves the voice data from the SCO packet (step S24). This voice data is transmitted through the W-CDMA baseband processing unit 28 and the RF unit 27 under the control of the microprocessor 23B, and sent to the calling party through the base station 14 and the mobile communication network (steps S15 and S16).

[0114] Upon receipt of the coded image data from the calling party in the bi-directional data communication (steps S13 and S14), on the other hand, the microprocessor 23B of the mobile telephone device 11B sends to the bluetooth

module **22** an instruction to transmit the packet to the wrist watch-type information apparatus **12**B, and then sends the coded image data received from the calling party, to the bluetooth module **22**. The bluetooth module **22** places the coded image data from the calling party on the ACL packet and transmits it to the wrist watch-type information apparatus **12**B (step S**31**).

[**0115**] The bluetooth module **42**B of the wrist watch-type information apparatus **12**B, on the other hand, upon receipt of the ACL packet from the mobile telephone device **11**B, retrieves the coded image data from the ACL packet. Under the control of the watch CPU **43**B, the MPEG video CODEC **51** decodes the coded image data to generate the image data. The LCD driver **45** drives the LCD **44** using this image data. As a result, the image sent from the calling party is displayed on the LCD **44** (step S**32**).

[**0116**] The user U, watching the display screen of the wrist watch-type information apparatus **11**B in a posture as shown in **FIG. 8**, can check the image sent from the calling party.

[**0117**] The user U desirous of sending the image of his face to the calling party, as shown in **FIG. 8**, places his face in opposed relation to the imaging surface of the CMOS image sensor **48** of the wrist watch-type information apparatus **12**B. As a result, the face of the user U is output as an image signal from the CMOS image sensor **48**. The coded image data is generated from this image signal by the image processing unit **49** and the MPEG video CODEC **51**. This coded image data is sent to the bluetooth module **42**B under the control of the watch CPU **43**B, and placed on the ACL packet, sent to the mobile telephone device **11**B (step S**33**).

[**0118**] The bluetooth module **22** of the mobile telephone device **11**B, on the other hand, upon receipt of the ACL packet, retrieves the coded image data from the ACL packet (step S**34**). This coded image data is transmitted through the W-CDMA baseband processing unit **28** and the RF unit **27** under the control of the microprocessor **23**B, and sent to the calling party through the base station **14** and the mobile network (steps S**15** and S**16**).

[**0119**] [3.2.2] Music Reproduction Operation

[**0120**] According to this embodiment, the user U can send the music information acquired by the mobile telephone device **11**B to the headset **13** and can enjoy the music through the headset **13**. This operation will be explained below.

[**0121**] First, the user U calls the desired contents server by the mobile telephone device **11**B. When the mobile telephone device **11**B and the contents server are connected to each other in response to this call, the user U requests the contents server for the audio data on the desired music through the mobile telephone device **11**B. As a result, the contents including the audio data of MP3 format and the title of the music are transmitted from the contents server to the mobile telephone device **11**B. This transmission data, upon receipt by the RF unit **27** of the mobile telephone device **11**B, is sent through the W-CDMA baseband processing unit **28** to the bluetooth module **22** under the control of the microprocessor **23**B, and placed on a plurality of SCO packets, transmitted to the headset **13**.

[**0122**] The bluetooth module **72** of the headset **13**, upon receipt of the SCO packets, retrieves the data from the SCO packets making up the contents under the control of the microprocessor **73**. The microprocessor **73** assigns the music numbers to the contents. Thus, the numbers and the titles of the music are set in correspondence with the contents, and written in the memory **75** through the audio reproduction unit **74**. Also, the microprocessor **73** sends the prevailing information on the list of the contents (specifically, the list of the titles and the numbers of the music in the contents) in the memory **75** to the bluetooth module **72** each time new contents are written in the memory **75** or part of the contents in the memory **75** is erased. The bluetooth module **72** places the list information on SCO packets and transmits them to the mobile telephone device **11**B. The mobile telephone device **11**B, placing the list information on the ACL packets, transfers them to the wrist watch-type information apparatus **12**B. The watch CPU **43**B of the wrist watch-type information apparatus **12**B, upon receipt of the list information by the bluetooth module **42**B, stores the list information in the nonvolatile memory **57**.

[**0123**] After that, the user U operates the operating switch unit **4** of the wrist watch-type information apparatus **12**B and gives an instruction to reproduce music. Then, the watch CPU **43**B sends the list information in the nonvolatile memory **57** to the LCD driver **45**. As a result, the titles and the number of the music in the respective contents stored in the memory **75** of the headset **13** are displayed on the LCD **44**. When the user U selects the music number of the desired contents by operating the operating switch unit **46**, the input interface unit **47** generates an instruction data for music reproduction and sends it to the watch CPU **43**B. The instruction data includes the music number selected by the user U. The watch CPU **43**B instructs the bluetooth module **42** to transmit the instruction data to the mobile telephone device **11**B. In accordance with this instruction, the bluetooth module **42**B transmits the ACL packet including the instruction data to the mobile telephone device **11**B.

[**0124**] The bluetooth module **22** of the mobile telephone device **11**B, upon receipt of the ACL packet, retrieves the instruction data from the ACL packet and sends it to the microprocessor **23**B. The microprocessor **23**B, checking that the instruction data is the one for music reproduction, instructs the the bluetooth module **22** to transfer the instruction data to the headset **13**. The bluetooth module **22** transmits the SCO packet including the instruction data to the headset **13**.

[**0125**] This SCO packet is received by the bluetooth module **72** of the headset **13**. The bluetooth module **72** retrieves the instruction data from the SCO packet and sends it to the microprocessor **73**. The microprocessor **73**, checking that the instruction data is for music reproduction, instructs the audio reproduction unit **74** to reproduce the music of the contents corresponding to the music number included in the instruction data. In response to the instruction, the audio reproduction unit **74** reads the corresponding contents from the memory **75**, demodulates the music signal from the audio data of the contents, and outputs the music signal to the amplifier **80**. The amplifier **80** amplifies and outputs the music signal from the speaker **79**.

[**0126**] In parallel with the music reproduction, the audio reproduction unit **74** outputs to the bluetooth module **72** the reproduction condition data indicating the title and the number of the music, the time elapsed by the music, the

reproduction time for all the music to be reproduced, and the remaining reproduction time for all the music to be reproduced. The bluetooth module **72** transmits the SCO packets including the reproduction condition data to the mobile telephone device **11**B.

[**0127**] The reproduction condition data are transferred to the wrist watch-type information apparatus **12**B by the mobile telephone device **11**. In the wrist watch-type information apparatus **12**B, the reproduction condition data are sent to the LCD driver **45**, and the information including the title and the number of the music in reproduction, the time elapsed by the music, the reproduction time for all the music to be reproduced, and the remaining reproduction time for all the music to be reproduced are displayed on the LCD **44**.

[**0128**] [3.2.3] Access to WWW Server Through Mobile Telephone Device

[**0129**] According to this embodiment, the user U, when not making speech, can cause the mobile telephone device **11**B to access the WWW (world wide web) server by operating the wrist watch-type information apparatus **12**B. This operation will be explained below.

[**0130**] When the user U gives an instruction for access to the desired WWW server by operating the operating switch **46** of the wrist watch-type information apparatus **12**B, the watch CPU **43**B transmits the access instruction to the mobile telephone device **11**B by the bluetooth module **42**. The mobile telephone device **11**B, in response to the access instruction, connects the WWW server desired by the user U. With the arrival of the HTML (HiperText Markup Language) data of the home page from the WWW server, the mobile telephone device **11**B transmits the HTML data to the wrist watch-type information apparatus **12**B by the bluetooth module **22**. Also, in the case where there occurs any change in the information including the receiving level of the RF unit **27**, the remaining battery capacity, etc. displayed on the LCD **24** of the mobile telephone device **11**B, the microprocessor **23**B of the mobile telephone device **11**B transmits the information displayed after the change to the wrist watch-type information apparatus **12**B by the bluetooth module **22**. The information displayed includes the receiving level of the RF unit **27**, the remaining battery capacity and the currently set mode. The watch CPU **43**B of the wrist watch-type information apparatus **12**B synthesizes the display data from the displayed information of the wrist watch-type information apparatus **11**B and the HTML data of the home page sent this way, and sends the synthesized data to the LCD driver **45**. As a result, as shown in **FIG. 15**, the same information as the one displayed on the LCD **24** of the mobile telephone device **11**B accessing the WWW server is displayed on the LCD **44** of the wrist watch-type information apparatus **12**B. Thus, the user can access the desired site by remote control operation of the mobile telephone device **11**B by the wrist watch-type information apparatus **12**B. At the same time, the user U can check the receiving level and remaining battery capacity of the mobile telephone device **11**B by the display on the LCD **44** of the wrist watch-type information apparatus **12**B.

[**0131**] [3.3] Effects of Third Embodiment

[**0132**] As described above, according to the third embodiment, the user can establish the videophone communication with a third party using the headset as a means for voice conversation and the wrist watch-type information apparatus as a means for image communication while keeping the mobile telephone device in the bag.

[**0133**] [3.4] Modifications of Third Embodiment

[**0134**] [3.4.1] First Modification

[**0135**] According to the embodiment described above, the instruction for incoming call response is given by operating the operating switch unit of the wrist watch-type information apparatus. It is possible, however, to provide the headset or the mobile telephone device with a voice recognition circuit for recognizing the voice input from the microphone of the headset so that a response is made to an incoming call when a given voice is recognized. According to this modification, the hand-free communication can be realized while displaying various information on the wrist watch-type information apparatus.

[**0136**] [3.4.2] Second Modification

[**0137**] This modification assumes the case in which the mobile telephone device has the functions of receiving electric mails and displaying a home page. In this modification, the mobile telephone device transfers the electric mail data or the home page to the wrist watch-type information apparatus at the time of arrival of an electric mail or at the time of setting the home page in automatic cycles. The wrist watch-type information apparatus displays the transfer data. According to this modification, the electric mail can be read or the home page can be accessed without taking out the mobile telephone device from the bag. Also, the mobile telephone device may be provided with a voice synthesis circuit for converting the text data in the received electric mail to the voice data so that the voice data obtained from the voice synthesis circuit may be transferred to the headset. This modification make it possible for the user to hear the contents of the electric mail by way of the headset.

[**0138**] [4] Common Modification of Embodiments

[**0139**] [4.1] First Modification

[**0140**] Each of the embodiments described above employs the bluetooth communication as a local bi-directional radio communication, to which the invention is not limited. Instead, various radio communication using the radio wave can be used.

[**0141**] [4.2] Second Modification

[**0142**] In each of the embodiments described above, the wrist watch-type information apparatus is used as a wearable radio communication device. Nevertheless, those skilled in the art can modify the embodiments to configure various wearable radio communication devices such as a finger ring type, a ring type, necklace type or pendant type which can be worn by the user.

[**0143**] [4.3] Third Modification

[**0144**] The foregoing description refers to the reproduction of the music data as digital recording data. The invention, however, is not limited to the sing and music performance, but can be configured to reproduce various audio data including natural and synthesized sounds as well as the conversation for learning a language, chirping of birds or murmuring of little streams.

[0145] The data can be digitally recorded in such formats as ATRAC3, SoundVQ or other various formats for music data compression or MIDI as well as MP3 format described in the embodiments above.

1. A mobile videophone system comprising a mobile telephone device and a wearable radio communication device:

wherein said mobile telephone device includes;

a communication unit;

a voice input/output unit;

a first local radio communication unit for effecting local bi-directional radio communication with said wearable radio communication device; and

a first control unit for causing said communication unit to effect image and voice communication with the other party through a network, causing the voice received from the other party to be output from said voice input/output unit, causing the voice input through said voice input/output unit to be transmitted to the other party by said communication unit, causing the image received from the other party to be transmitted to said wearable radio communication device by said first local radio communication unit, and causing the image received from said wearable radio communication device to be transmitted to the other party; and

wherein said wearable radio communication device includes;

a second local radio communication unit for effecting local bi-directional radio communication with said mobile telephone device,

an imaging unit,

a display unit, and

a second control unit for causing the image received from said mobile telephone device by said second local radio communication unit to be displayed on said display unit, causing the image obtained by said imaging unit to be transmitted to said mobile telephone device by said second local radio communication unit, and causing an instruction for controlling said mobile telephone device to be transmitted by said second local radio communication unit.

2. A mobile videophone system comprising a mobile telephone device, a wearable radio communication device and a headset:

wherein said mobile telephone device includes;

a communication unit;

a first local radio communication unit for effecting local bi-directional radio communication with said wearable radio communication device and said headset; and

a first control unit for causing said communication unit to effect image and voice communication with the other party through a network, causing the voice received from the other party to be transmitted to said headset by said first local radio communication unit, causing the voice received from said headset by said first local radio communication unit to be transmitted to the other party by said communication unit, causing the image received from the other party to be transmitted to said wearable radio communication device by said first local radio communication unit, and causing the image received from said wearable radio communication device by said first local radio communication unit to be transmitted to the other party; and

wherein said wearable radio communication device includes;

a second local radio communication unit for effecting local bi-directional radio communication with said mobile telephone device,

an imaging unit,

a display unit, and

a second control unit for causing the image received from said mobile telephone device by said second local radio communication unit to be displayed on said display unit, and causing the image obtained by said imaging unit to be transmitted to said mobile telephone device by said second local radio communication unit; and

wherein said headset includes;

a third local radio communication unit for effecting bi-directional radio communication with said mobile telephone device,

a voice input/output unit, and

a third control unit for causing the voice received from said mobile telephone device by said third local radio communication unit to be output by said voice input/output unit, and causing the voice input through said voice input/output unit to be transmitted to said mobile telephone device by said third local radio communication unit.

3. A communication method:

wherein said mobile telephone device is such that the image and voice communication is effected with the other party through a network, the voice received from the other party is output from a voice input/output unit, the voice input through said voice input/output unit is transmitted to the other party, the image received from the other party is transmitted to a wearable radio communication unit having an imaging unit and a display unit by local radio communication, and the image is received by local radio communication from said wearable radio communication device and transmitted to the other party; and

wherein said wearable radio communication device is such that an image is received from said mobile telephone device by local radio communication and displayed on said display unit, the image is picked up by said imaging unit and transmitted to said mobile telephone device by local radio communication, and an instruction signal for controlling said mobile telephone device is transmitted by local radio communication.

4. A communication method:

wherein said mobile telephone device is such that the image and voice communication is effected with the other party through a network, the voice received from the other party is transmitted to a headset having a voice input/output unit by local radio communication,

the voice is received from said headset by local radio communication and transmitted to the other party, the image received from the other party is transmitted to a wearable radio communication unit having an imaging unit and a display unit by local radio communication, and the image is received by local radio communication from said wearable radio communication device and transmitted to the other party;

wherein said wearable radio communication device is such that an image is received from said mobile telephone device by local radio communication and displayed on said display unit, and an image is picked up by said imaging unit and transmitted to said mobile telephone device by local radio communication; and

wherein said headset is such that a voice is received from said mobile telephone device by local radio communication and output from said voice input/output unit, and the voice input through said voice input/output unit is transmitted to said mobile telephone device by local radio communication.

5. A communication method according to claim 4, wherein with the arrival of an incoming call, said mobile telephone device establishes a first communication link for effecting local radio communication with said wearable radio communication device and a second communication link for effecting local radio communication with said headset, an incoming call arrival announcing signal is sent to said headset through said second communication link, and the line with the other party is connected upon receipt of an incoming call response instruction through said first communication link from said wearable radio communication device.

6. A mobile telephone device comprising:

a communication unit;

a voice input/output unit;

a local radio communication unit for effecting local bi-directional radio communication including the image data communication with a wearable radio communication device having an imaging unit and a display unit; and

a control unit for causing said communication unit to effect image and voice communication with the other party through a network, causing the voice received from the other party to be output from said voice input/output unit, causing the voice input through said voice input/output unit to be transmitted to the other party by said communication unit, causing the image received from the other party to be transmitted to said wearable radio communication device by said local radio communication unit, causing the image received from said wearable radio communication device to be transmitted to the other party by said communication unit, and causing a control operation to be performed by said local radio communication unit as instructed according to an instruction signal received from said wearable radio communication device.

7. A mobile telephone device comprising:

a communication unit,

a local radio communication unit for effecting local bi-directional radio communication with said wearable radio communication device having an imaging unit and a display unit and a headset having a voice input/output unit, and

a control unit for causing said communication unit to effect image and voice communication with the other party through a network, causing the voice received from the other party to be transmitted to said headset by said local radio communication unit, causing the voice received from said headset by said local communication unit to be transmitted to the other party by said communication unit, causing the image received from the other party to be transmitted to said wearable radio communication device by said local radio communication unit, and causing the image received from said wearable radio communication device by said local radio communication unit to be transmitted to the other party by said communication unit.

8. A mobile telephone device according to claim 7, wherein with the arrival of an incoming call, said control unit causes said local radio communication unit to establish a first communication link for effecting local radio communication with said wearable radio communication device and a second communication link for effecting local radio communication with said headset, sends an incoming call arrival announcing signal to said headset through said second communication link, and performs the processing for connecting the line with the other party upon receipt of an incoming call response instruction through said first communication link from said wearable radio communication device.

9. A wearable radio communication device comprising:

an imaging unit,

a display unit,

a local radio communication unit for effecting local bi-directional radio communication with a mobile telephone device, and

a control unit for causing the image received from said mobile telephone device by said local radio communication unit to be displayed on said display unit, causing the image obtained by said imaging unit to be transmitted to said mobile telephone device by said local radio communication unit, and causing an instruction signal for controlling said mobile telephone device to be transmitted by said local radio communication unit.

10. A wearable radio communication device according to claim 9, further comprising a voice input/output unit, wherein said control unit causes the voice received from said mobile telephone device by said local radio communication unit to be output by said voice input/output unit, and causes the voice input through said voice input/output unit to be transmitted to said mobile telephone device by said local radio communication unit.

11. A wearable radio communication device according to claim 9, further comprising an operating unit, wherein said control unit generates said instruction signal in accordance with the operation of said operating unit.

12. A wearable radio communication device according to claim 11, wherein said control unit transmits an instruction signal for giving an instruction to access a site in a network, to said mobile telephone device in accordance with the operation of said operating unit, and receives the response

from said site through said mobile telephone device and displays said response on said display unit.

13. A wearable radio communication device according to claim 9, wherein said control unit receives from said mobile telephone device the information displayed on the display unit of said mobile telephone device and displays said information on the display unit of said wearable radio communication device.

14. A wearable radio communication device according to claim 9, wherein said mobile telephone device can establish a first communication link for local bi-directional radio communication with said wearable radio communication device and a second communication link for local bi-directional radio communication with a headset having a voice input/output unit, and can effect the local bi-directional radio communication including the voice data communication through said second communication link.

15. A wearable radio communication device according to claim 14, wherein said mobile telephone device has the first repeating function whereby the information received from said wearable radio communication device through said first communication link is transmitted to said headset through said second communication link, and said control unit transmits an instruction signal for controlling said headset, to said headset through said first communication link and said second communication link utilizing said first repeating function.

16. A wearable radio communication device according to claim 15, wherein said headset includes a memory for storing the voice data and an audio reproduction unit for performing the audio reproduction processing by reading said voice data from said memory and outputting said voice data as a sound from said voice input/output unit, and said control unit transmits to said headset an instruction signal giving an instruction to execute said audio reproduction processing.

17. A wearable radio communication device according to claim 15, wherein said mobile telephone device has the second repeating function whereby the information received from said headset through said second communication link is transmitted to said wearable radio communication device through said first communication link, and said control unit receives the information through said second communication link and said first communication link from said headset utilizing said second repeating function.

18. A wearable radio communication device according to claim 17, wherein said headset includes a memory for storing the voice data, an audio reproduction unit for performing the audio reproduction processing by reading said voice data from said memory and outputting said voice data as a sound from said voice input/output unit, and a device for outputting a list of the information stored in said memory, said wearable radio communication device further comprising an operating unit, said control unit being such that the list of the information stored in said memory is received from said headset and displayed on said display unit and the instruction signal for giving an instruction given by the operation of said operating unit for performing the audio reproduction processing for the voice data is transmitted to said headset.

19. A wearable radio communication device according to claim 9, which is in the shape of a wrist watch wearable on the wrist of the user, has the clocking function, and when the information obtained by communication is not displayed on said display unit, displays the present time on said display unit.

20. A headset comprising:

a memory for storing music information;

an audio reproduction unit for reproducing the music information stored in said memory and outputting said music information as a sound;

a local radio communication unit for effecting the local bi-directional radio communication with a mobile telephone device capable of effecting the local bi-directional radio communication with a wearable radio communication device; and

a control unit for causing said local radio communication unit to receive the music information from said mobile telephone device and instructing said audio reproduction unit to reproduce the music information stored in said memory, in accordance with the instruction signal received from said wearable radio communication device through said mobile telephone device.

21. A headset according to claim **20**, wherein said memory is a semiconductor memory removable from said headset.

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