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(54) **INFORMATION COMMUNICATION DEVICE, INFORMATION COMMUNICATION SYSTEM, AND COMPUTER PROGRAM PRODUCT FOR TRANSMISSION CONTROL**

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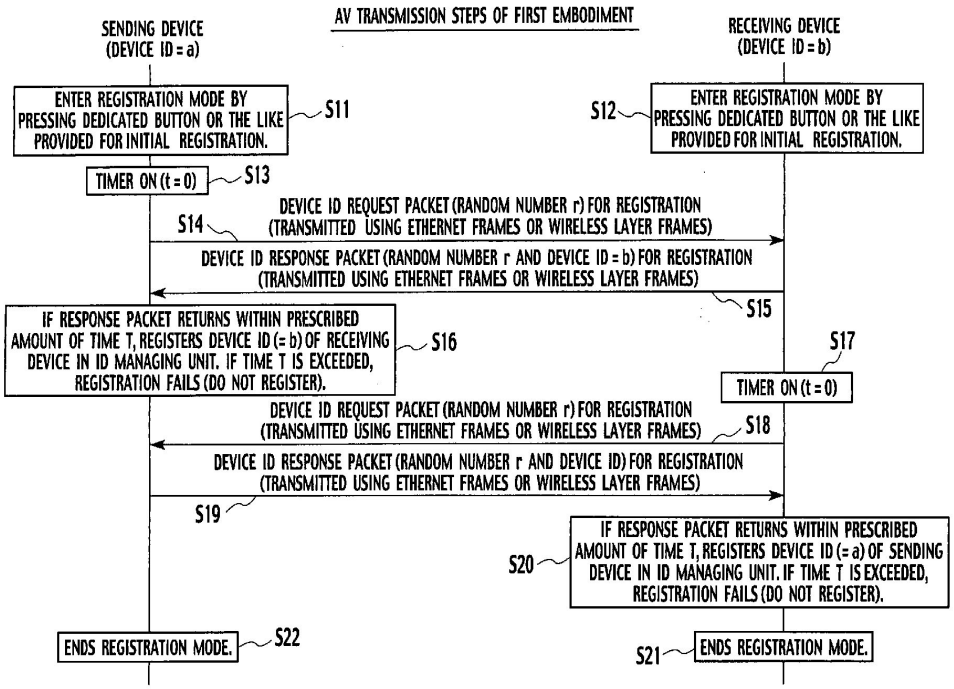
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(52) **U.S. Cl.** **713/168**

(57) **ABSTRACT**

An aspect of the present invention provides an information communication device for transmitting electronic data encrypted for the purpose of copyright protection, the device includes that an identification information managing unit configured to hold device identification information in connection with other information communication devices acquired through a network, an ID registration processing unit configured to register the device identification information of another connection device when the other communication device satisfies a predetermined distance condition or when common identification information that is held by both information communication devices is received from a portable device, and an authentication and key exchange processing unit configured to, for the purpose of copyright protection, complete authentication and key exchange process (AKE process) only when another information communication device whose device identification information is registered in the identification information managing unit.



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FIG.1

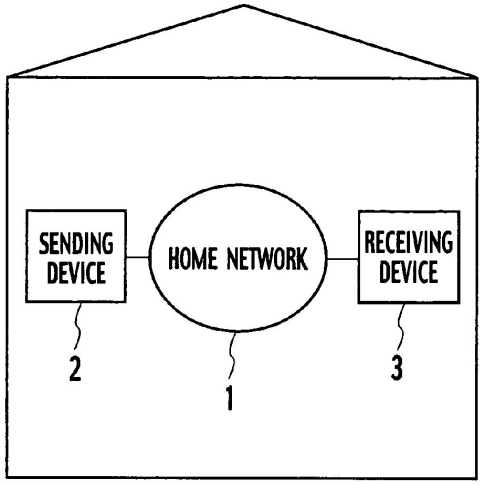

SENDING DEVICE
HOME NETWORK
RECEIVING DEVICE
2
1
3

FIG.2

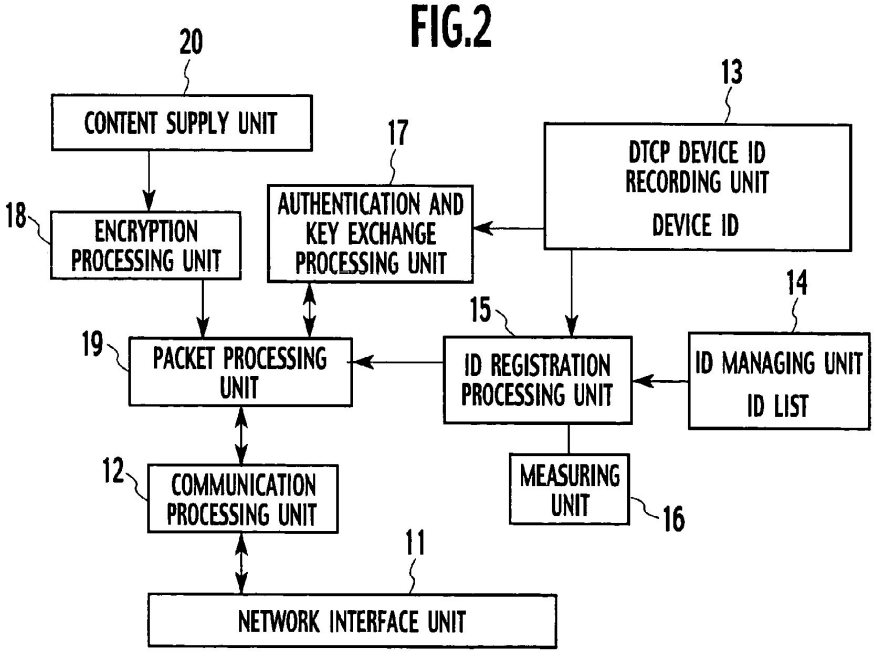

20
CONTENT SUPPLY UNIT
13
DTCP DEVICE ID RECORDING UNIT
DEVICE ID
17
AUTHENTICATION AND KEY EXCHANGE PROCESSING UNIT
18
ENCRYPTION PROCESSING UNIT
14
15
19
PACKET PROCESSING UNIT
ID REGISTRATION PROCESSING UNIT
ID MANAGING UNIT
ID LIST
12
COMMUNICATION PROCESSING UNIT
MEASURING UNIT
16
11
NETWORK INTERFACE UNIT

FIG.3 DEVICE ID LIST OF ID MANAGEMENT UNIT

MANDATORY ITEMS		OPTIONAL ITEMS		
COUNTERPART DEVICE 1		RIT	UNIQUE ID	TIME OF LAST USE
DEVICE ID	AA	○○ms	XXX	△MONTH ×DAY ○HOUR ×MINUTE
COUNTERPART DEVICE 2				
DEVICE ID	AA	△△ms	YYY	×MONTH □DAY △HOUR ○MINUTE
COUNTERPART DEVICE 3				
DEVICE ID	BB	××ms	ZZZ	△MONTH ×DAY ○HOUR □MINUTE

FIG.4

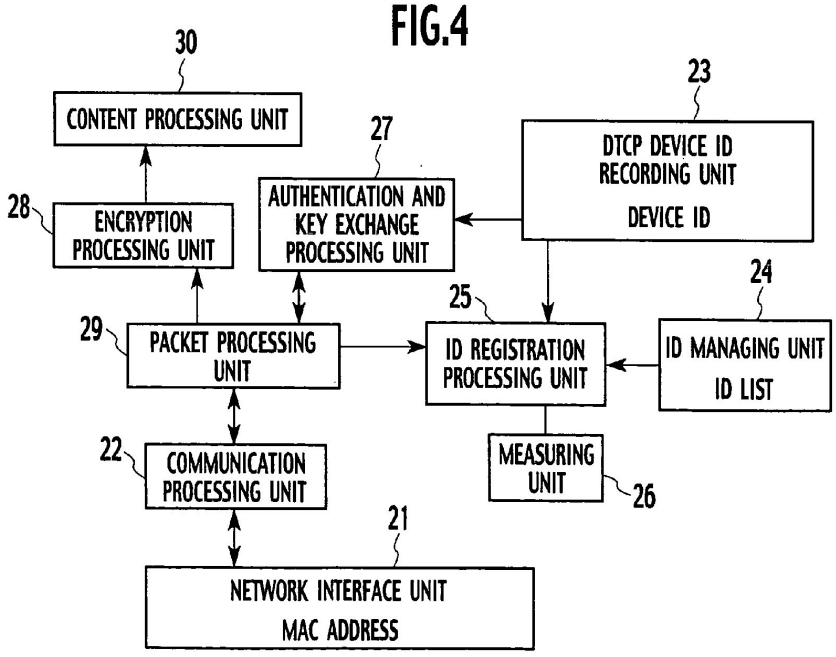


FIG.5

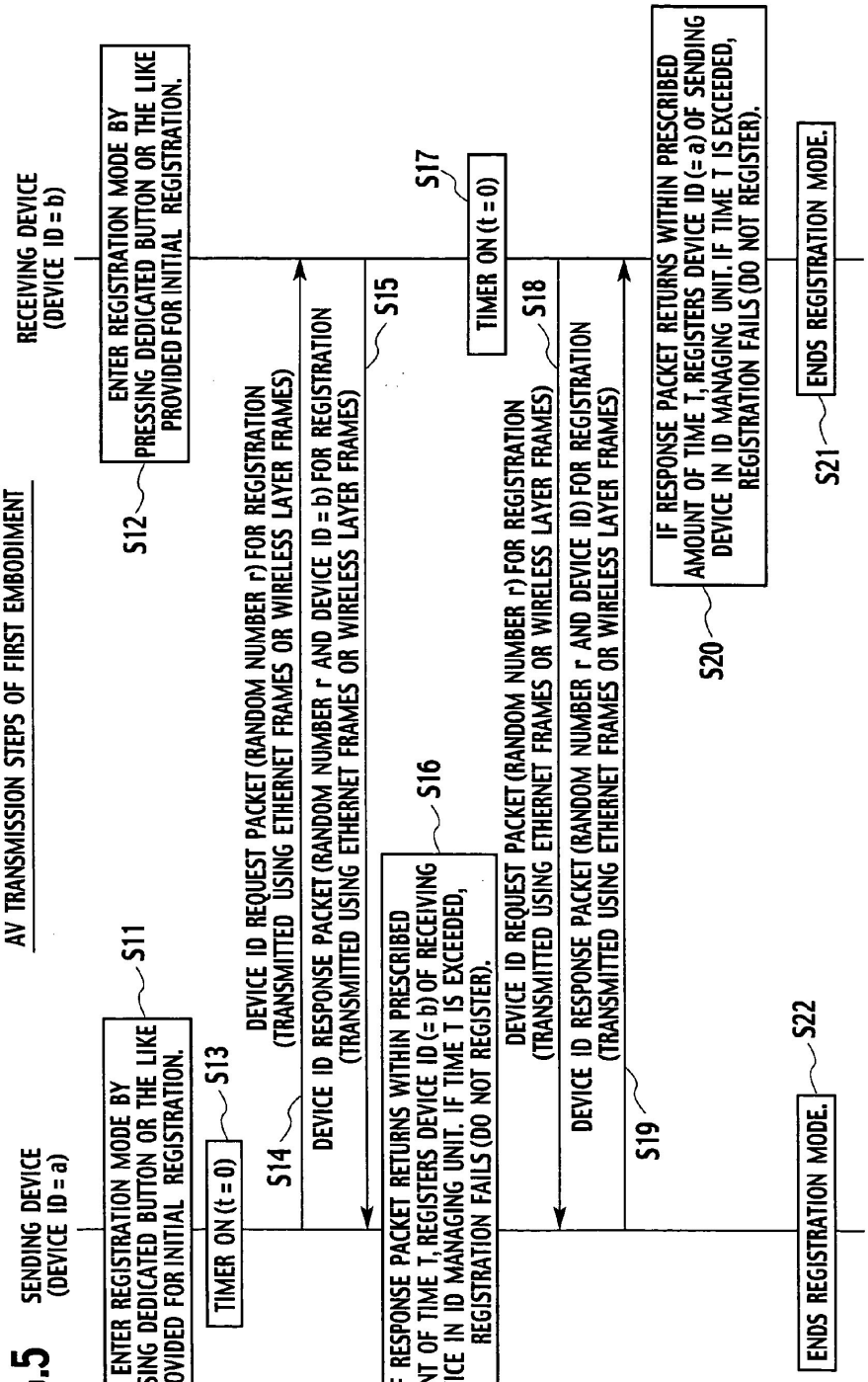

AV TRANSMISSION STEPS OF FIRST EMBODIMENT
SENDING DEVICE (DEVICE ID = a)
RECEIVING DEVICE (DEVICE ID = b)
ENTER REGISTRATION MODE BY PRESSING DEDICATED BUTTON OR THE LIKE PROVIDED FOR INITIAL REGISTRATION.
S11
ENTER REGISTRATION MODE BY PRESSING DEDICATED BUTTON OR THE LIKE PROVIDED FOR INITIAL REGISTRATION.
S12
TIMER ON (t = 0)
S13
DEVICE ID REQUEST PACKET (RANDOM NUMBER r) FOR REGISTRATION (TRANSMITTED USING ETHERNET FRAMES OR WIRELESS LAYER FRAMES)
S14
DEVICE ID RESPONSE PACKET (RANDOM NUMBER r AND DEVICE ID = b) FOR REGISTRATION (TRANSMITTED USING ETHERNET FRAMES OR WIRELESS LAYER FRAMES)
S15
IF RESPONSE PACKET RETURNS WITHIN PRESCRIBED AMOUNT OF TIME T, REGISTERS DEVICE ID (= b) OF RECEIVING DEVICE IN ID MANAGING UNIT. IF TIME T IS EXCEEDED, REGISTRATION FAILS (DO NOT REGISTER).
S16
TIMER ON (t = 0)
S17
DEVICE ID REQUEST PACKET (RANDOM NUMBER r) FOR REGISTRATION (TRANSMITTED USING ETHERNET FRAMES OR WIRELESS LAYER FRAMES)
S18
DEVICE ID RESPONSE PACKET (RANDOM NUMBER r AND DEVICE ID) FOR REGISTRATION (TRANSMITTED USING ETHERNET FRAMES OR WIRELESS LAYER FRAMES)
S19
IF RESPONSE PACKET RETURNS WITHIN PRESCRIBED AMOUNT OF TIME T, REGISTERS DEVICE ID (= a) OF SENDING DEVICE IN ID MANAGING UNIT. IF TIME T IS EXCEEDED, REGISTRATION FAILS (DO NOT REGISTER).
S20
ENDS REGISTRATION MODE.
S21
ENDS REGISTRATION MODE.
S22

FIG.6

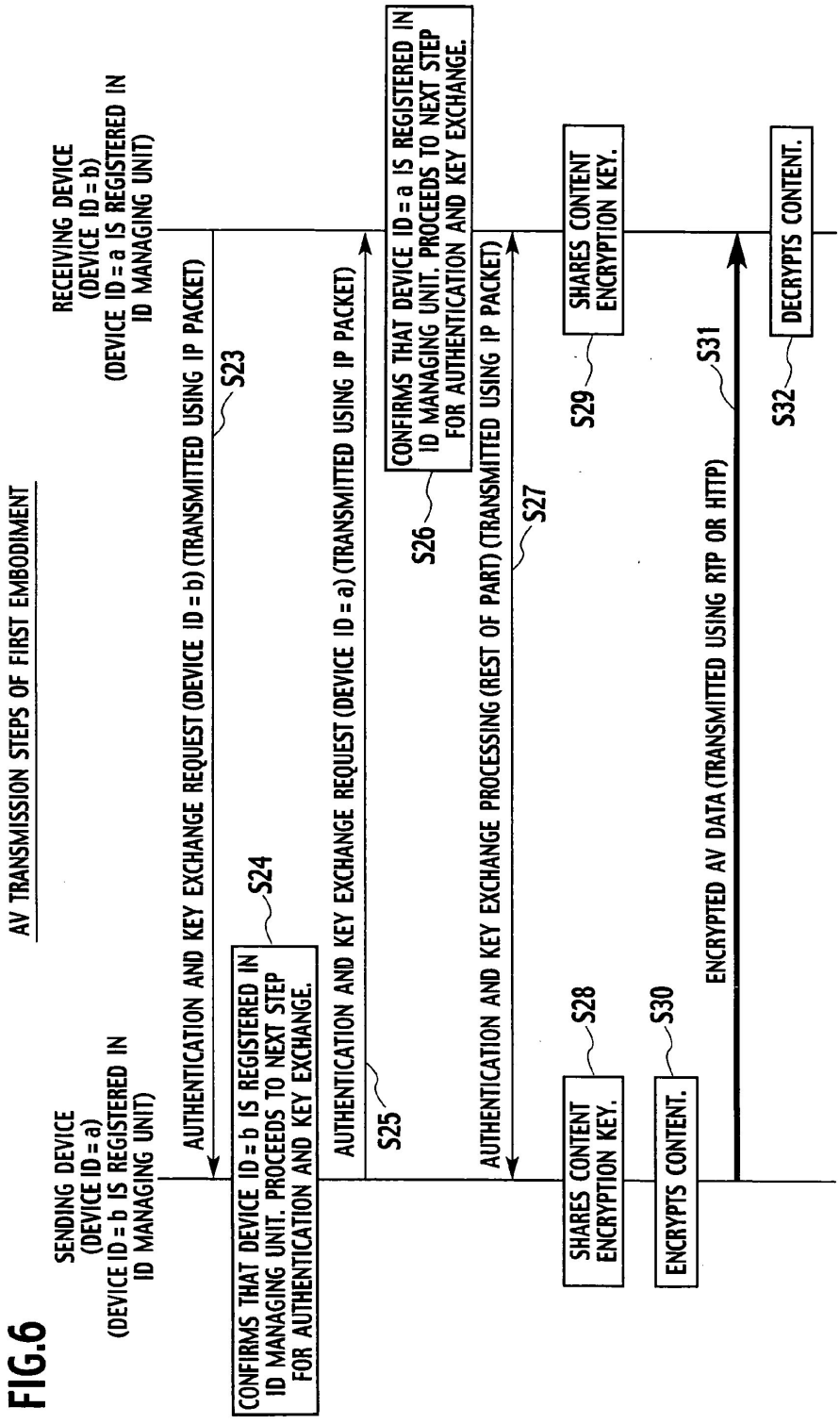

AV TRANSMISSION STEPS OF FIRST EMBODIMENT
SENDING DEVICE (DEVICE ID = a) (DEVICE ID = b IS REGISTERED IN ID MANAGING UNIT)
RECEIVING DEVICE (DEVICE ID = b) (DEVICE ID = a IS REGISTERED IN ID MANAGING UNIT)
AUTHENTICATION AND KEY EXCHANGE REQUEST (DEVICE ID = b) (TRANSMITTED USING IP PACKET)
S23
CONFIRMS THAT DEVICE ID = b IS REGISTERED IN ID MANAGING UNIT. PROCEEDS TO NEXT STEP FOR AUTHENTICATION AND KEY EXCHANGE.
S24
AUTHENTICATION AND KEY EXCHANGE REQUEST (DEVICE ID = a) (TRANSMITTED USING IP PACKET)
S25
CONFIRMS THAT DEVICE ID = a IS REGISTERED IN ID MANAGING UNIT. PROCEEDS TO NEXT STEP FOR AUTHENTICATION AND KEY EXCHANGE.
S26
AUTHENTICATION AND KEY EXCHANGE PROCESSING (REST OF PART) (TRANSMITTED USING IP PACKET)
S27
SHARES CONTENT ENCRYPTION KEY.
S28
SHARES CONTENT ENCRYPTION KEY.
S29
ENCRYPTS CONTENT.
S30
ENCRYPTED AV DATA (TRANSMITTED USING RTP OR HTTP)
S31
DECRYPTS CONTENT.
S32

FIG.7

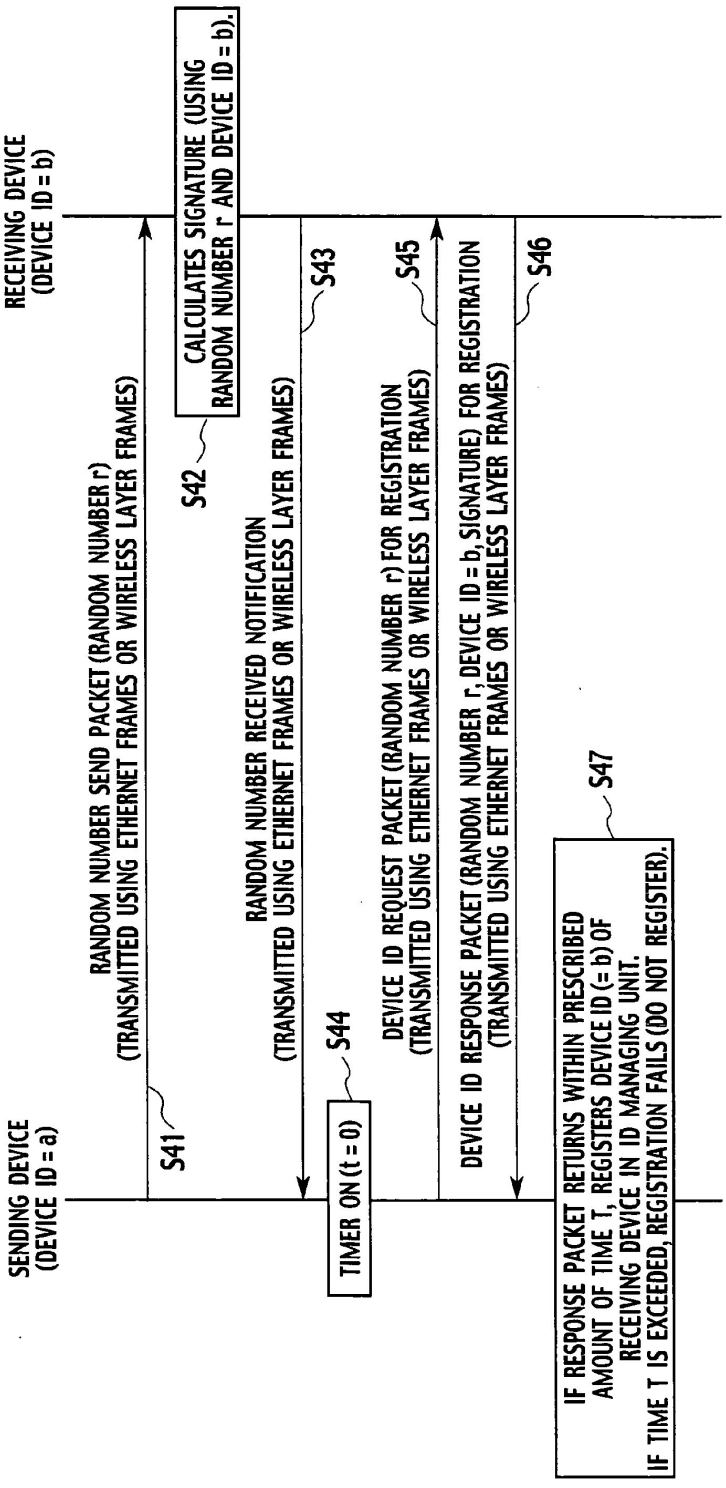

SPOOFING PREVENTION
SENDING DEVICE (DEVICE ID = a)
RECEIVING DEVICE (DEVICE ID = b)
RANDOM NUMBER SEND PACKET (RANDOM NUMBER r) (TRANSMITTED USING ETHERNET FRAMES OR WIRELESS LAYER FRAMES)
S41
CALCULATES SIGNATURE (USING RANDOM NUMBER r AND DEVICE ID = b).
S42
RANDOM NUMBER RECEIVED NOTIFICATION (TRANSMITTED USING ETHERNET FRAMES OR WIRELESS LAYER FRAMES)
S43
TIMER ON (t = 0)
S44
DEVICE ID REQUEST PACKET (RANDOM NUMBER r) FOR REGISTRATION (TRANSMITTED USING ETHERNET FRAMES OR WIRELESS LAYER FRAMES)
S45
DEVICE ID RESPONSE PACKET (RANDOM NUMBER r, DEVICE ID = b, SIGNATURE) FOR REGISTRATION (TRANSMITTED USING ETHERNET FRAMES OR WIRELESS LAYER FRAMES)
S46
IF RESPONSE PACKET RETURNS WITHIN PRESCRIBED AMOUNT OF TIME T, REGISTERS DEVICE ID (= b) OF RECEIVING DEVICE IN ID MANAGING UNIT.
IF TIME T IS EXCEEDED, REGISTRATION FAILS (DO NOT REGISTER).
S47

FIG.8

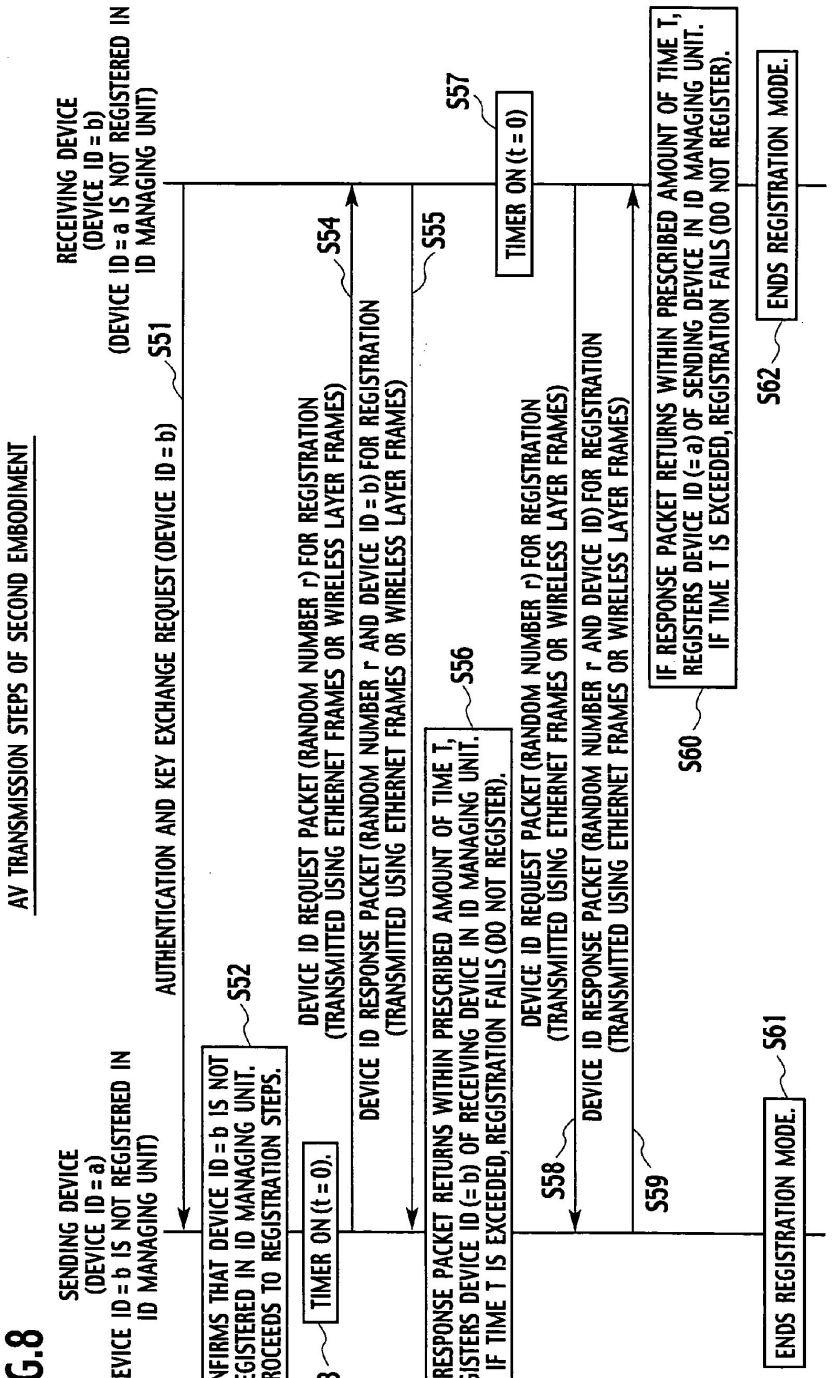

AV TRANSMISSION STEPS OF SECOND EMBODIMENT
SENDING DEVICE (DEVICE ID = a) (DEVICE ID = b IS NOT REGISTERED IN ID MANAGING UNIT)
RECEIVING DEVICE (DEVICE ID = b) (DEVICE ID = a IS NOT REGISTERED IN ID MANAGING UNIT)
S51
AUTHENTICATION AND KEY EXCHANGE REQUEST (DEVICE ID = b)
CONFIRMS THAT DEVICE ID = b IS NOT REGISTERED IN ID MANAGING UNIT. PROCEEDS TO REGISTRATION STEPS.
S52
S53
TIMER ON (t = 0).
DEVICE ID REQUEST PACKET (RANDOM NUMBER r) FOR REGISTRATION (TRANSMITTED USING ETHERNET FRAMES OR WIRELESS LAYER FRAMES)
S54
DEVICE ID RESPONSE PACKET (RANDOM NUMBER r AND DEVICE ID = b) FOR REGISTRATION (TRANSMITTED USING ETHERNET FRAMES OR WIRELESS LAYER FRAMES)
S55
S57
TIMER ON (t = 0)
IF RESPONSE PACKET RETURNS WITHIN PRESCRIBED AMOUNT OF TIME T, REGISTERS DEVICE ID (= b) OF RECEIVING DEVICE IN ID MANAGING UNIT. IF TIME T IS EXCEEDED, REGISTRATION FAILS (DO NOT REGISTER).
S56
S58
DEVICE ID REQUEST PACKET (RANDOM NUMBER r) FOR REGISTRATION (TRANSMITTED USING ETHERNET FRAMES OR WIRELESS LAYER FRAMES)
S59
DEVICE ID RESPONSE PACKET (RANDOM NUMBER r AND DEVICE ID) FOR REGISTRATION (TRANSMITTED USING ETHERNET FRAMES OR WIRELESS LAYER FRAMES)
S60
IF RESPONSE PACKET RETURNS WITHIN PRESCRIBED AMOUNT OF TIME T, REGISTERS DEVICE ID (= a) OF SENDING DEVICE IN ID MANAGING UNIT. IF TIME T IS EXCEEDED, REGISTRATION FAILS (DO NOT REGISTER).
S62
ENDS REGISTRATION MODE.
ENDS REGISTRATION MODE.
S61

FIG.9

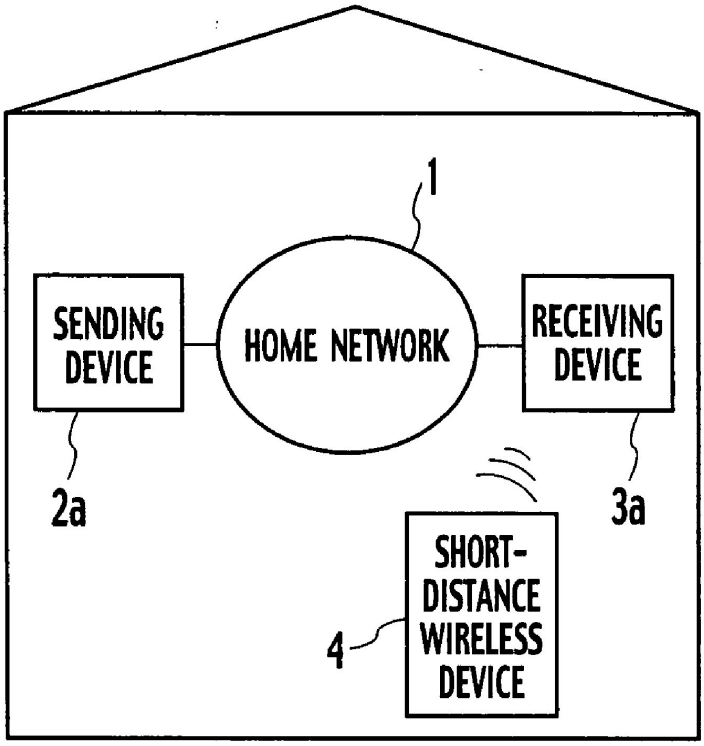

1
SENDING DEVICE
HOME NETWORK
RECEIVING DEVICE
2a
3a
SHORT-DISTANCE WIRELESS DEVICE
4

FIG.10

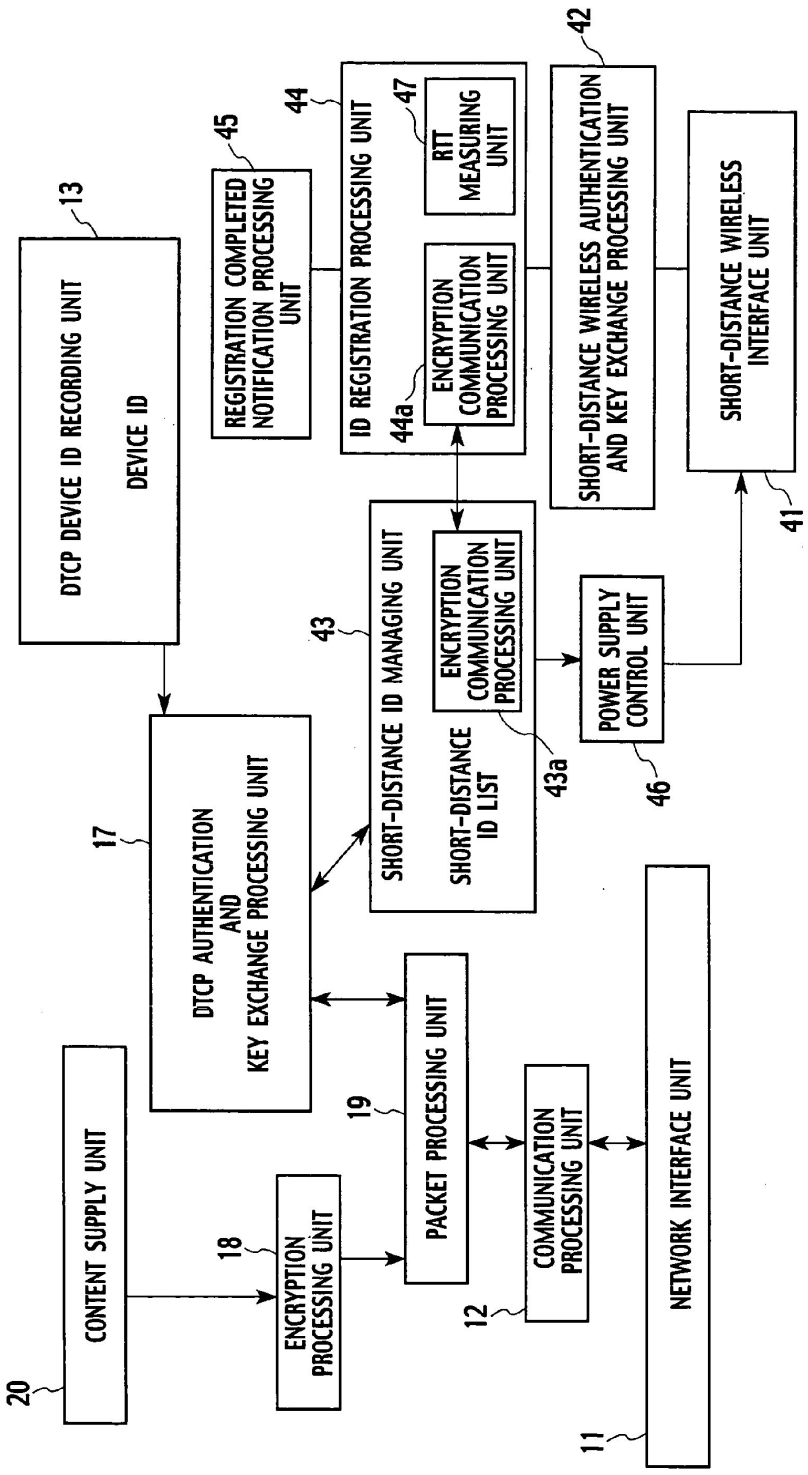

INTERNAL FEATURES OF SENDING DEVICE
DTCP DEVICE ID RECORDING UNIT
DEVICE ID
13
REGISTRATION COMPLETED NOTIFICATION PROCESSING UNIT
45
ID REGISTRATION PROCESSING UNIT
44
RTT MEASURING UNIT
47
ENCRYPTION COMMUNICATION PROCESSING UNIT
44a
SHORT-DISTANCE WIRELESS AUTHENTICATION AND KEY EXCHANGE PROCESSING UNIT
42
SHORT-DISTANCE WIRELESS INTERFACE UNIT
41
SHORT-DISTANCE ID MANAGING UNIT
43
SHORT-DISTANCE ID LIST
ENCRYPTION COMMUNICATION PROCESSING UNIT
43a
POWER SUPPLY CONTROL UNIT
46
DTCP AUTHENTICATION AND KEY EXCHANGE PROCESSING UNIT
17
PACKET PROCESSING UNIT
19
COMMUNICATION PROCESSING UNIT
12
NETWORK INTERFACE UNIT
11
CONTENT SUPPLY UNIT
20
ENCRYPTION PROCESSING UNIT
18

FIG.11

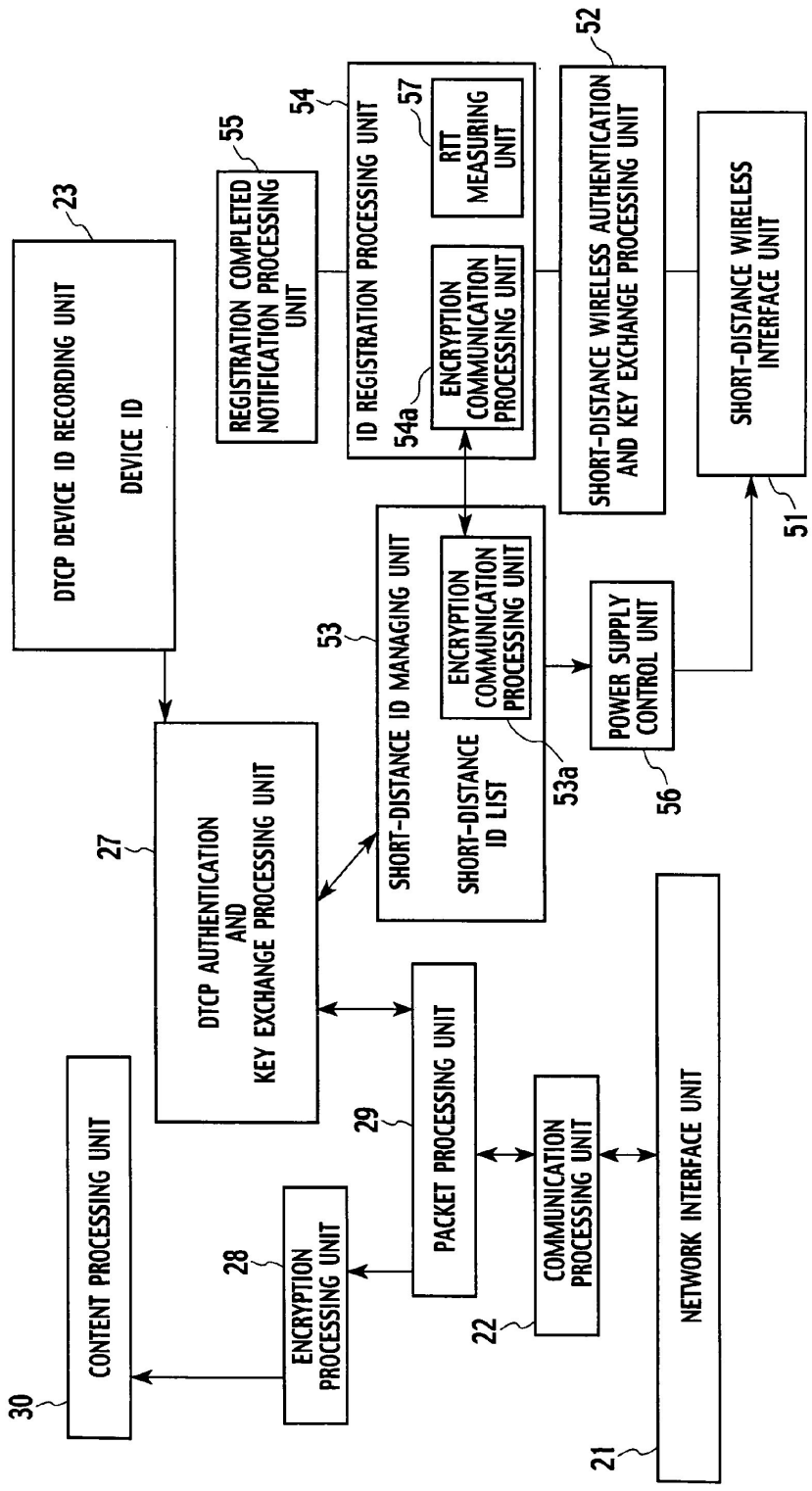

INTERNAL FEATURES OF RECEIVING DEVICE
DTCP DEVICE ID RECORDING UNIT
DEVICE ID
23
REGISTRATION COMPLETED NOTIFICATION PROCESSING UNIT
55
ID REGISTRATION PROCESSING UNIT
54
RTT MEASURING UNIT
57
ENCRYPTION COMMUNICATION PROCESSING UNIT
54a
SHORT-DISTANCE WIRELESS AUTHENTICATION AND KEY EXCHANGE PROCESSING UNIT
52
SHORT-DISTANCE WIRELESS INTERFACE UNIT
51
SHORT-DISTANCE ID MANAGING UNIT
53
ENCRYPTION COMMUNICATION PROCESSING UNIT
SHORT-DISTANCE ID LIST
53a
POWER SUPPLY CONTROL UNIT
56
DTCP AUTHENTICATION AND KEY EXCHANGE PROCESSING UNIT
27
PACKET PROCESSING UNIT
29
COMMUNICATION PROCESSING UNIT
22
NETWORK INTERFACE UNIT
21
ENCRYPTION PROCESSING UNIT
28
CONTENT PROCESSING UNIT
30

FIG.12

SHORT-DISTANCE ID LIST OF SHORT-DISTANCE ID MANAGING UNIT

MANDATORY ITEMS	OPTIONAL ITEMS		
	RIT	DCPT DEVICE ID	TIME OF REGISTRATION
(1) SHORT-DISTANCE ID = AA	○○ms	XXX	△MONTH ×DAY ○HOUR ×MINUTE
(2) SHORT-DISTANCE ID = BB	△△ms	YYY	×MONTH □DAY △HOUR ○MINUTE
(3) SHORT-DISTANCE ID = CC	××ms	ZZZ	△MONTH ×DAY ○HOUR □MINUTE

FIG.13

INTERNAL FEATURES OF REMOTE CONTROL DEVICE

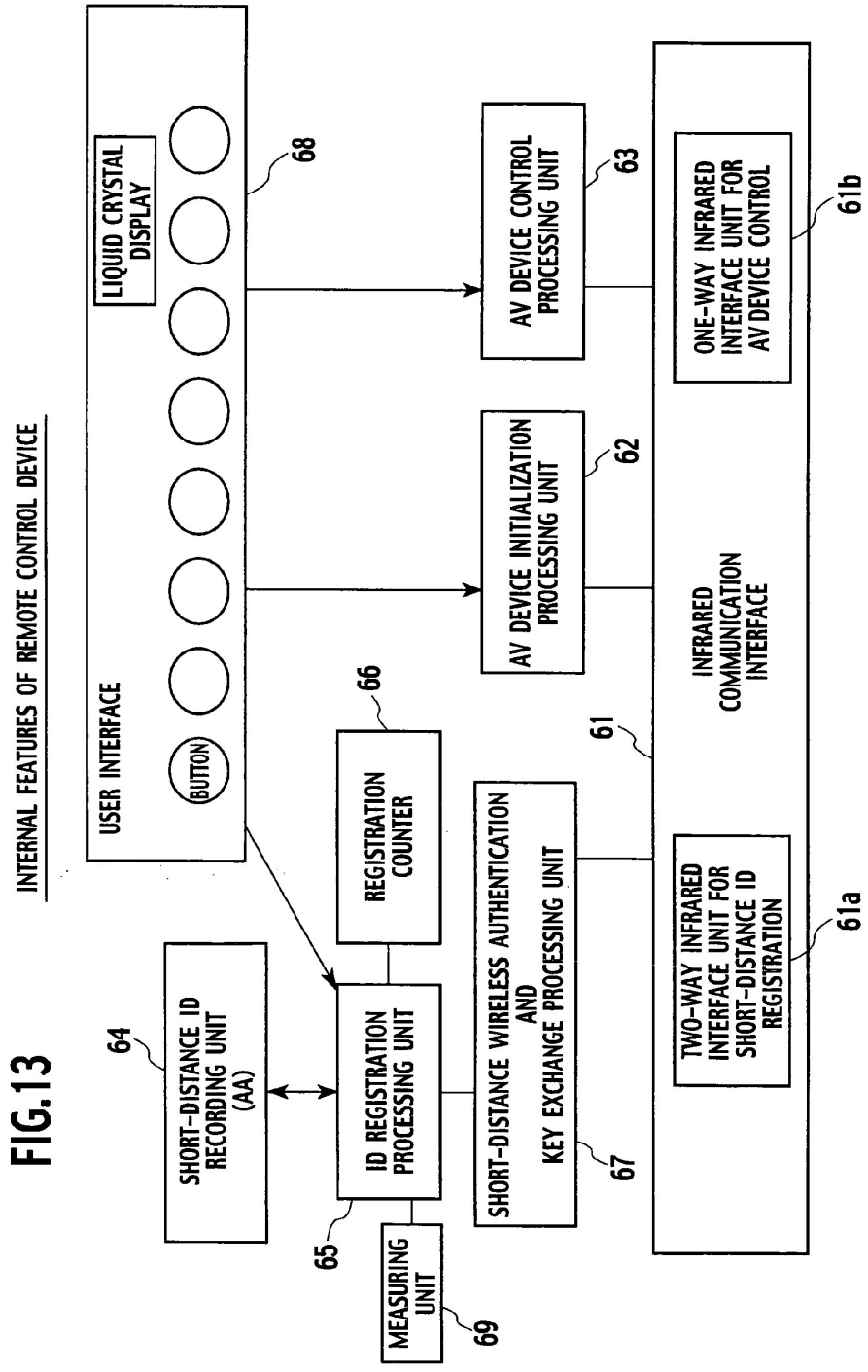
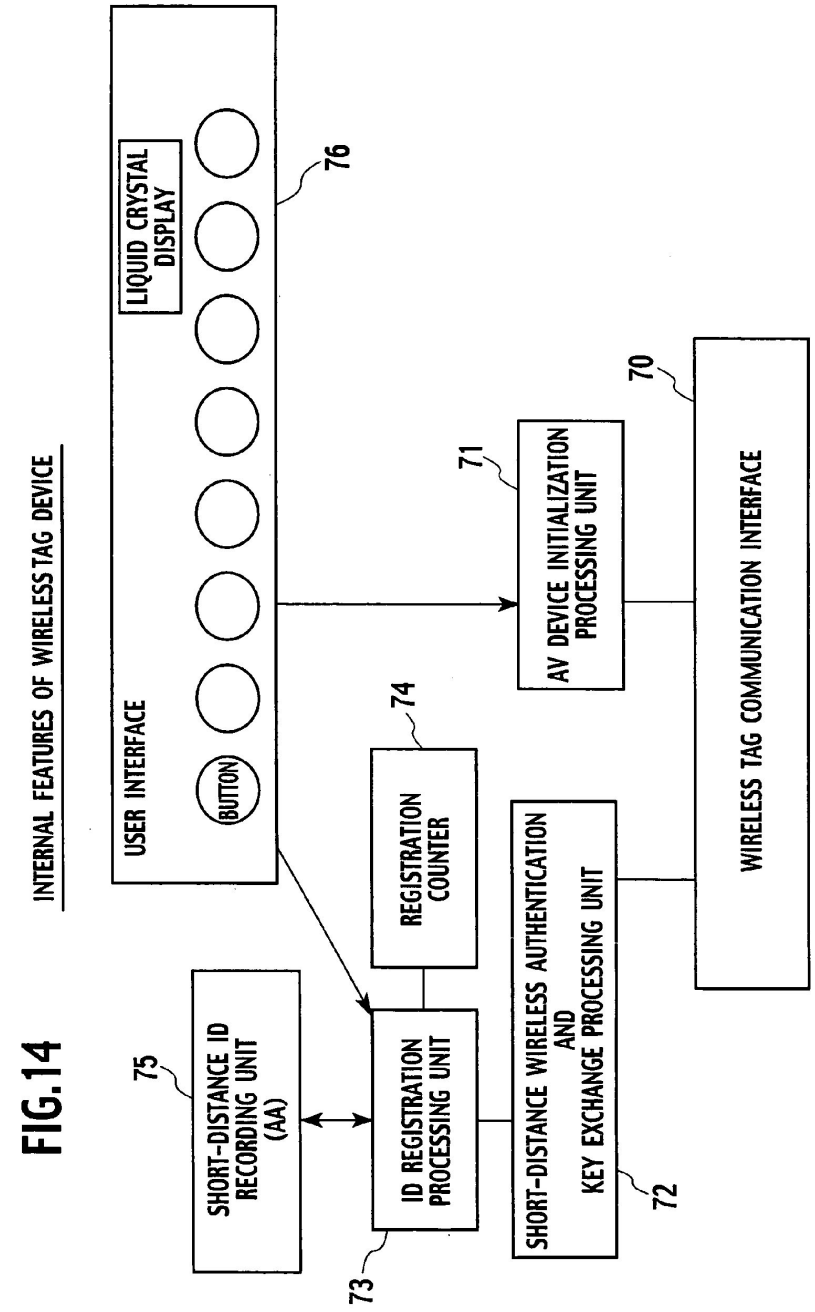


FIG.14


INTERNAL FEATURES OF WIRELESS TAG DEVICE
USER INTERFACE
LIQUID CRYSTAL DISPLAY
BUTTON
76
AV DEVICE INITIALIZATION PROCESSING UNIT
71
WIRELESS TAG COMMUNICATION INTERFACE
70
REGISTRATION COUNTER
74
SHORT-DISTANCE ID RECORDING UNIT (AA)
75
ID REGISTRATION PROCESSING UNIT
73
SHORT-DISTANCE WIRELESS AUTHENTICATION AND KEY EXCHANGE PROCESSING UNIT
72

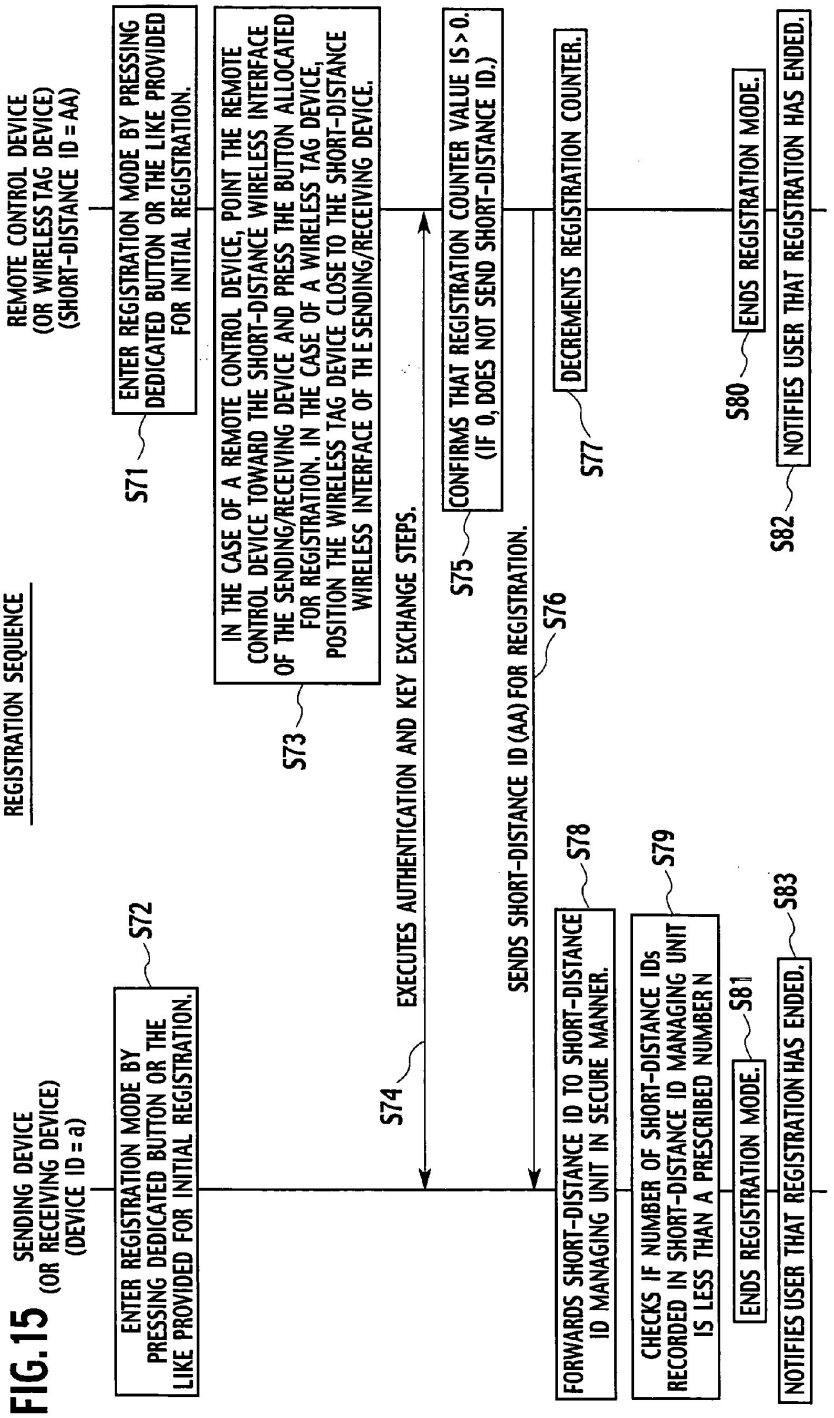

REGISTRATION SEQUENCE
SENDING DEVICE (OR RECEIVING DEVICE) (DEVICE ID = a)
REMOTE CONTROL DEVICE (OR WIRELESS TAG DEVICE) (SHORT-DISTANCE ID = AA)
ENTER REGISTRATION MODE BY PRESSING DEDICATED BUTTON OR THE LIKE PROVIDED FOR INITIAL REGISTRATION.
S71
ENTER REGISTRATION MODE BY PRESSING DEDICATED BUTTON OR THE LIKE PROVIDED FOR INITIAL REGISTRATION.
S72
IN THE CASE OF A REMOTE CONTROL DEVICE, POINT THE REMOTE CONTROL DEVICE TOWARD THE SHORT-DISTANCE WIRELESS INTERFACE OF THE SENDING/RECEIVING DEVICE AND PRESS THE BUTTON ALLOCATED FOR REGISTRATION. IN THE CASE OF A WIRELESS TAG DEVICE, POSITION THE WIRELESS TAG DEVICE CLOSE TO THE SHORT-DISTANCE WIRELESS INTERFACE OF THE SENDING/RECEIVING DEVICE.
S73
EXECUTES AUTHENTICATION AND KEY EXCHANGE STEPS.
S74
CONFIRMS THAT REGISTRATION COUNTER VALUE IS > 0. (IF 0, DOES NOT SEND SHORT-DISTANCE ID.)
S75
SENDS SHORT-DISTANCE ID (AA) FOR REGISTRATION.
S76
DECREMENTS REGISTRATION COUNTER.
S77
FORWARDS SHORT-DISTANCE ID TO SHORT-DISTANCE ID MANAGING UNIT IN SECURE MANNER.
S78
CHECKS IF NUMBER OF SHORT-DISTANCE IDs RECORDED IN SHORT-DISTANCE ID MANAGING UNIT IS LESS THAN A PRESCRIBED NUMBER N
S79
ENDS REGISTRATION MODE.
S81
ENDS REGISTRATION MODE.
S80
NOTIFIES USER THAT REGISTRATION HAS ENDED.
S82
NOTIFIES USER THAT REGISTRATION HAS ENDED.
S83

FIG. 15

FIG.16

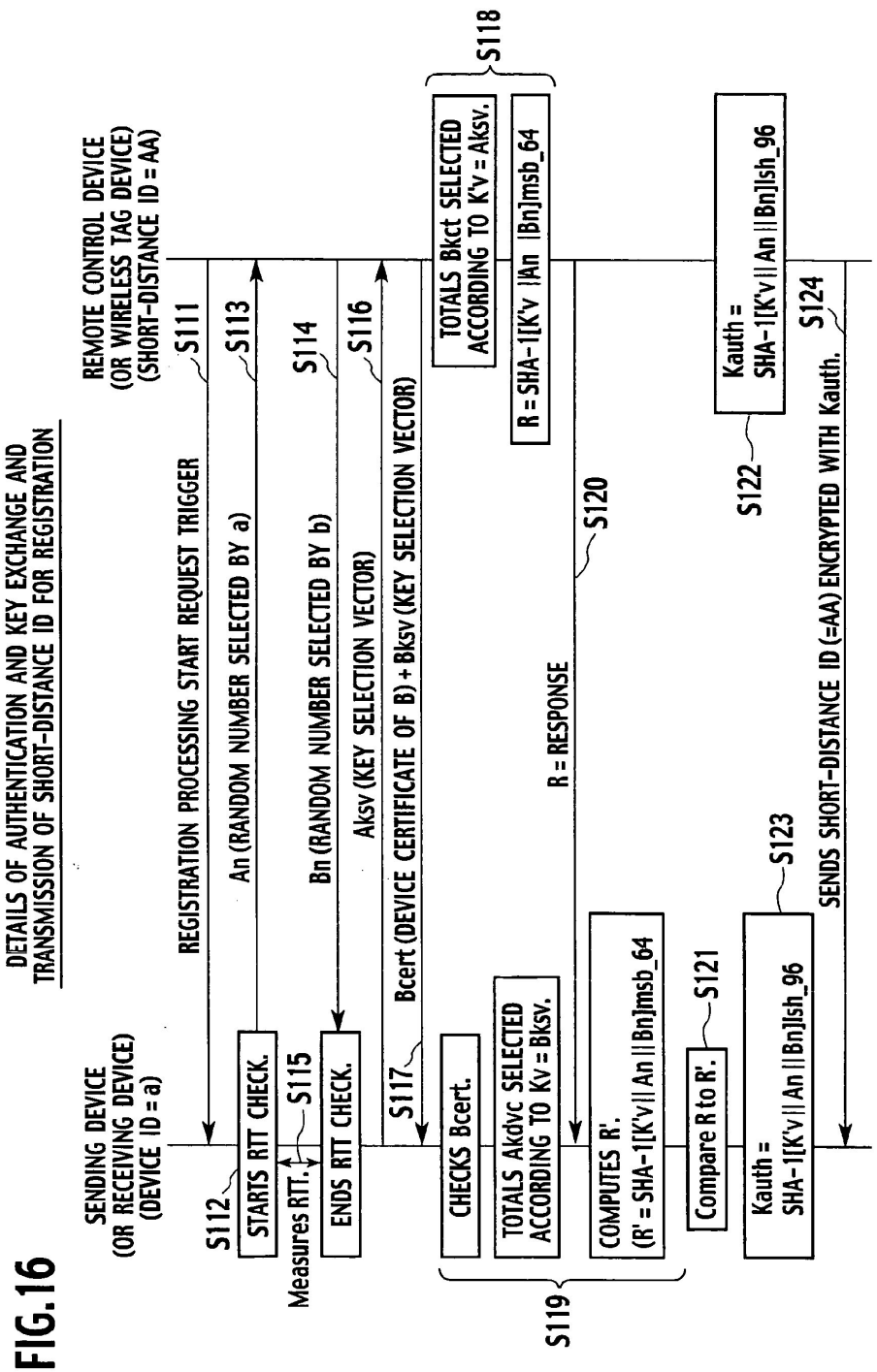

DETAILS OF AUTHENTICATION AND KEY EXCHANGE AND TRANSMISSION OF SHORT-DISTANCE ID FOR REGISTRATION
SENDING DEVICE (OR RECEIVING DEVICE) (DEVICE ID = a)
REMOTE CONTROL DEVICE (OR WIRELESS TAG DEVICE) (SHORT-DISTANCE ID = AA)
REGISTRATION PROCESSING START REQUEST TRIGGER
S111
An (RANDOM NUMBER SELECTED BY a)
S113
Bn (RANDOM NUMBER SELECTED BY b)
S114
Aksv (KEY SELECTION VECTOR)
S116
Bcert (DEVICE CERTIFICATE OF B) + Bksv (KEY SELECTION VECTOR)
S117
R = RESPONSE
S120
R = SHA-1[K'v ||An ||Bn]msb_64
TOTALS Bkct SELECTED ACCORDING TO K'v = Aksv.
S118
Kauth = SHA-1[K'v||An||Bn]lsh_96
S122
SENDS SHORT-DISTANCE ID (=AA) ENCRYPTED WITH Kauth.
S124
S112
STARTS RTT CHECK.
Measures RTT.
S115
ENDS RTT CHECK.
CHECKS Bcert.
TOTALS Akdvc SELECTED ACCORDING TO Kv = Bksv.
COMPUTES R'. (R' = SHA-1[K'v||An||Bn]msb_64
S119
Compare R to R'.
S121
Kauth = SHA-1[K'v||An||Bn]lsh_96
S123

FIG.17

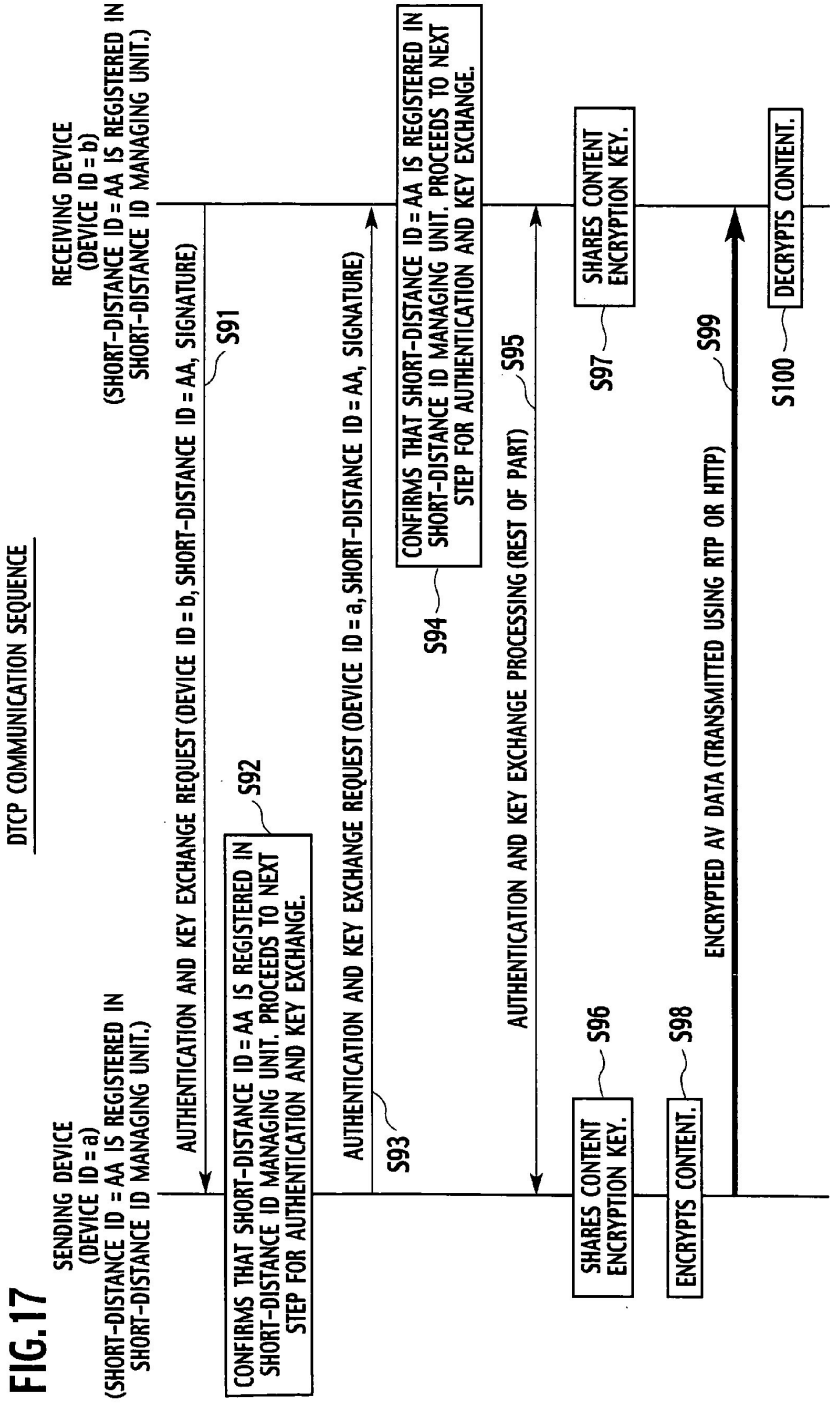

DTCP COMMUNICATION SEQUENCE
SENDING DEVICE (DEVICE ID = a) (SHORT-DISTANCE ID = AA IS REGISTERED IN SHORT-DISTANCE ID MANAGING UNIT.)
RECEIVING DEVICE (DEVICE ID = b) (SHORT-DISTANCE ID = AA IS REGISTERED IN SHORT-DISTANCE ID MANAGING UNIT.)
AUTHENTICATION AND KEY EXCHANGE REQUEST (DEVICE ID = b, SHORT-DISTANCE ID = AA, SIGNATURE)
S91
CONFIRMS THAT SHORT-DISTANCE ID = AA IS REGISTERED IN SHORT-DISTANCE ID MANAGING UNIT. PROCEEDS TO NEXT STEP FOR AUTHENTICATION AND KEY EXCHANGE.
S92
AUTHENTICATION AND KEY EXCHANGE REQUEST (DEVICE ID = a, SHORT-DISTANCE ID = AA, SIGNATURE)
S93
CONFIRMS THAT SHORT-DISTANCE ID = AA IS REGISTERED IN SHORT-DISTANCE ID MANAGING UNIT. PROCEEDS TO NEXT STEP FOR AUTHENTICATION AND KEY EXCHANGE.
S94
AUTHENTICATION AND KEY EXCHANGE PROCESSING (REST OF PART)
S95
SHARES CONTENT ENCRYPTION KEY.
S96
SHARES CONTENT ENCRYPTION KEY.
S97
ENCRYPTS CONTENT.
S98
ENCRYPTED AV DATA (TRANSMITTED USING RTP OR HTTP)
S99
DECRYPTS CONTENT.
S100

FIG.18

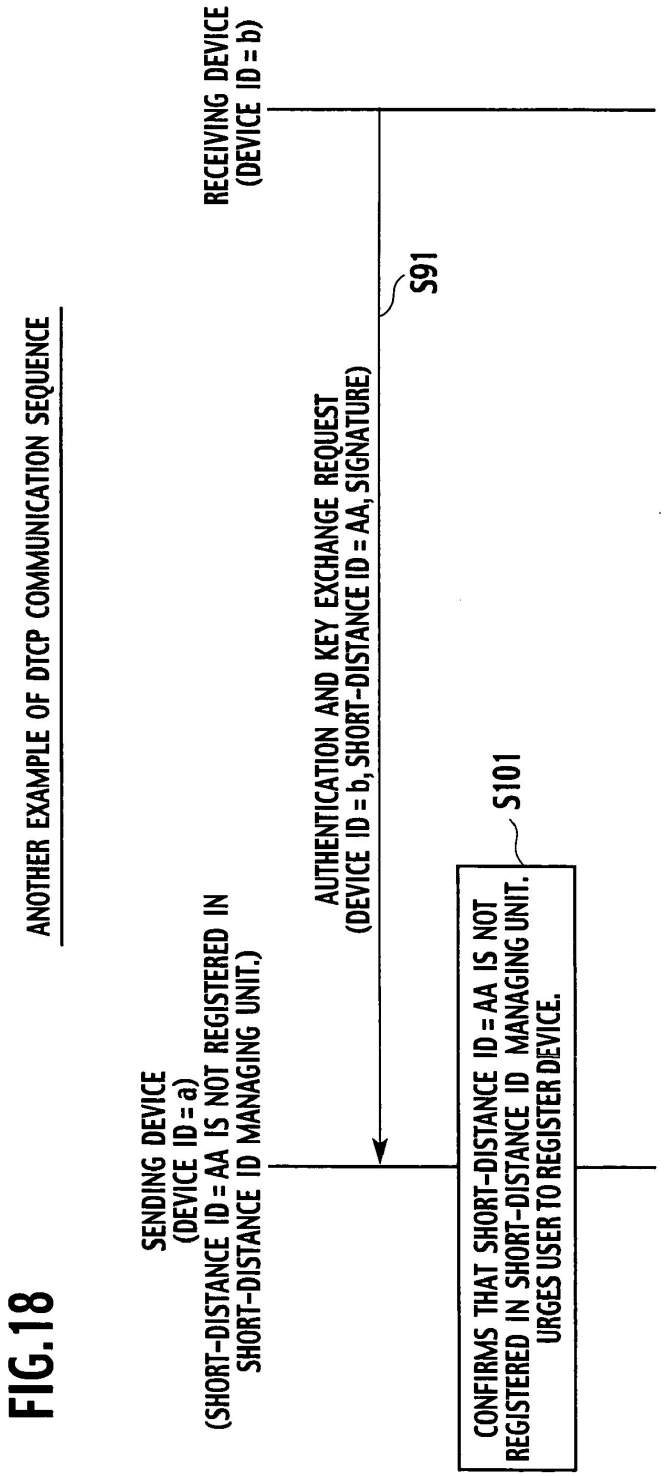

ANOTHER EXAMPLE OF DTCP COMMUNICATION SEQUENCE
SENDING DEVICE
(DEVICE ID = a)
(SHORT-DISTANCE ID = AA IS NOT REGISTERED IN SHORT-DISTANCE ID MANAGING UNIT.)
RECEIVING DEVICE
(DEVICE ID = b)
AUTHENTICATION AND KEY EXCHANGE REQUEST
(DEVICE ID = b, SHORT-DISTANCE ID = AA, SIGNATURE)
S91
S101
CONFIRMS THAT SHORT-DISTANCE ID = AA IS NOT REGISTERED IN SHORT-DISTANCE ID MANAGING UNIT. URGES USER TO REGISTER DEVICE.

FIG.19

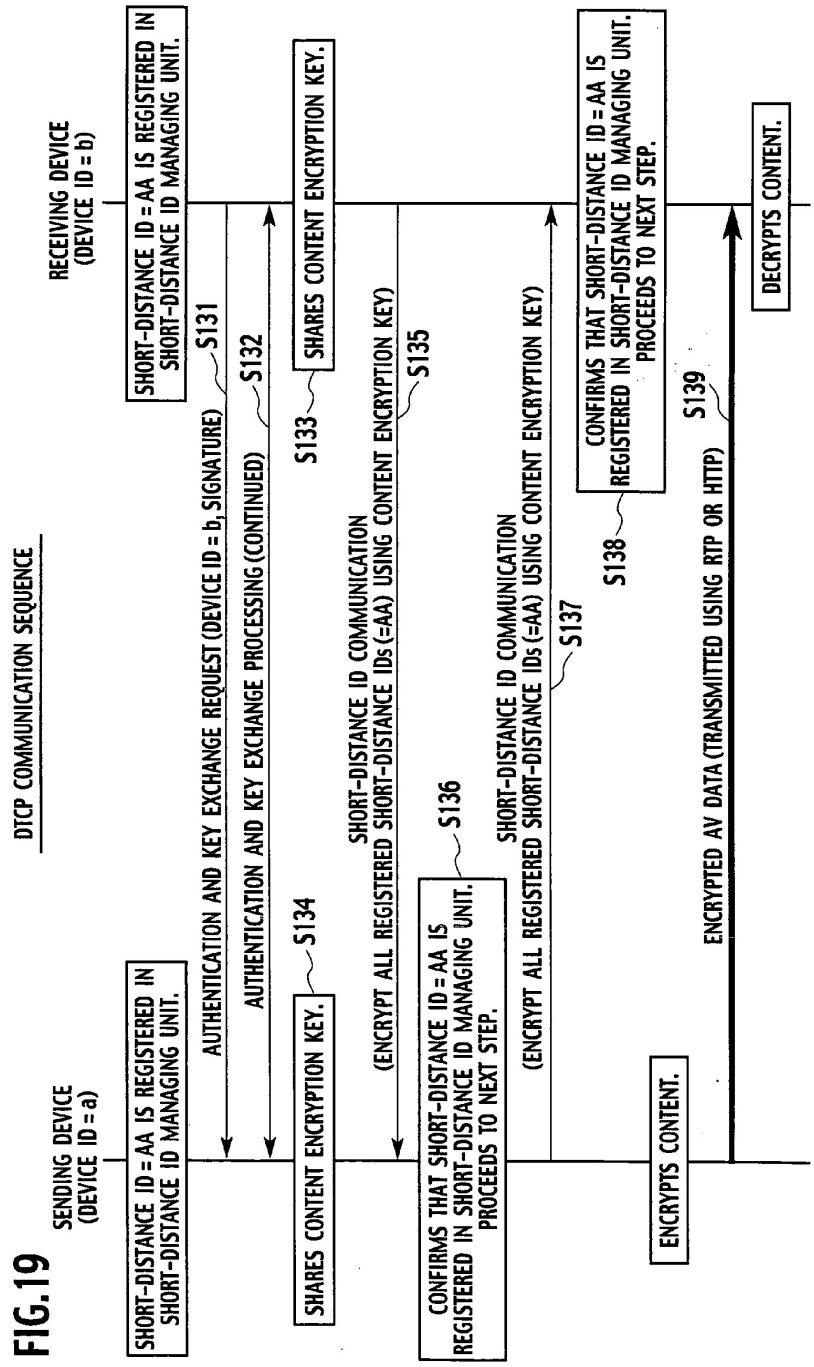

DTCP COMMUNICATION SEQUENCE
SENDING DEVICE (DEVICE ID = a)
RECEIVING DEVICE (DEVICE ID = b)
SHORT-DISTANCE ID = AA IS REGISTERED IN SHORT-DISTANCE ID MANAGING UNIT.
SHORT-DISTANCE ID = AA IS REGISTERED IN SHORT-DISTANCE ID MANAGING UNIT.
S131
AUTHENTICATION AND KEY EXCHANGE REQUEST (DEVICE ID = b, SIGNATURE)
S132
AUTHENTICATION AND KEY EXCHANGE PROCESSING (CONTINUED)
S133
SHARES CONTENT ENCRYPTION KEY.
S134
SHARES CONTENT ENCRYPTION KEY.
SHORT-DISTANCE ID COMMUNICATION
(ENCRYPT ALL REGISTERED SHORT-DISTANCE IDs (=AA) USING CONTENT ENCRYPTION KEY)
S135
CONFIRMS THAT SHORT-DISTANCE ID = AA IS REGISTERED IN SHORT-DISTANCE ID MANAGING UNIT. PROCEEDS TO NEXT STEP.
S136
SHORT-DISTANCE ID COMMUNICATION
(ENCRYPT ALL REGISTERED SHORT-DISTANCE IDs (=AA) USING CONTENT ENCRYPTION KEY)
S137
CONFIRMS THAT SHORT-DISTANCE ID = AA IS REGISTERED IN SHORT-DISTANCE ID MANAGING UNIT. PROCEEDS TO NEXT STEP.
S138
ENCRYPTS CONTENT.
ENCRYPTED AV DATA (TRANSMITTED USING RTP OR HTTP)
S139
DECRYPTS CONTENT.

FIG.20

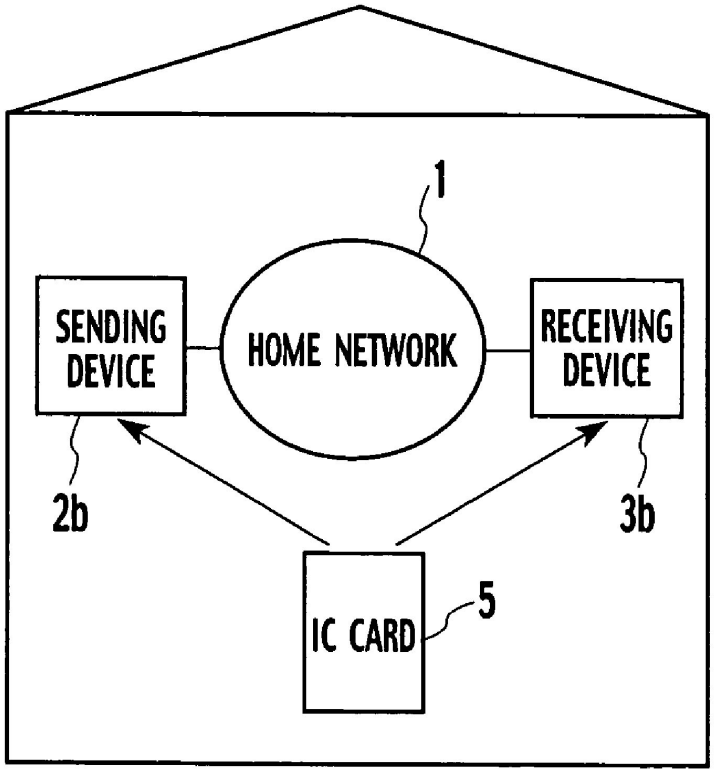

1
SENDING DEVICE
HOME NETWORK
RECEIVING DEVICE
2b
3b
IC CARD
5

FIG.21

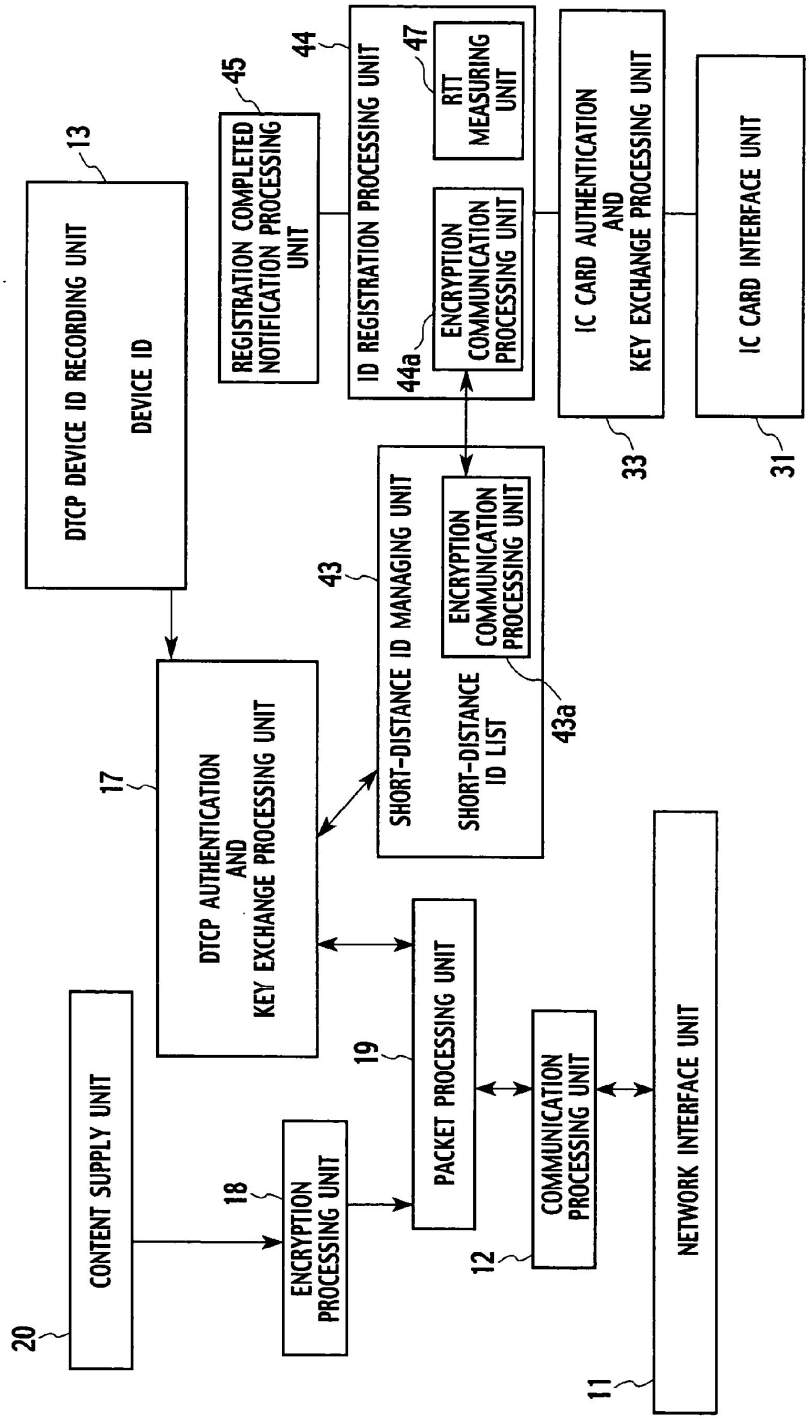

INTERNAL FEATURES OF SENDING DEVICE
DTCP DEVICE ID RECORDING UNIT
DEVICE ID
13
REGISTRATION COMPLETED NOTIFICATION PROCESSING UNIT
45
ID REGISTRATION PROCESSING UNIT
44
RTT MEASURING UNIT
47
ENCRYPTION COMMUNICATION PROCESSING UNIT
44a
IC CARD AUTHENTICATION AND KEY EXCHANGE PROCESSING UNIT
33
IC CARD INTERFACE UNIT
31
SHORT-DISTANCE ID MANAGING UNIT
43
ENCRYPTION COMMUNICATION PROCESSING UNIT
43a
SHORT-DISTANCE ID LIST
DTCP AUTHENTICATION AND KEY EXCHANGE PROCESSING UNIT
17
CONTENT SUPPLY UNIT
20
ENCRYPTION PROCESSING UNIT
18
PACKET PROCESSING UNIT
19
COMMUNICATION PROCESSING UNIT
12
NETWORK INTERFACE UNIT
11

FIG.22

INTERNAL FEATURES OF RECEIVING DEVICE

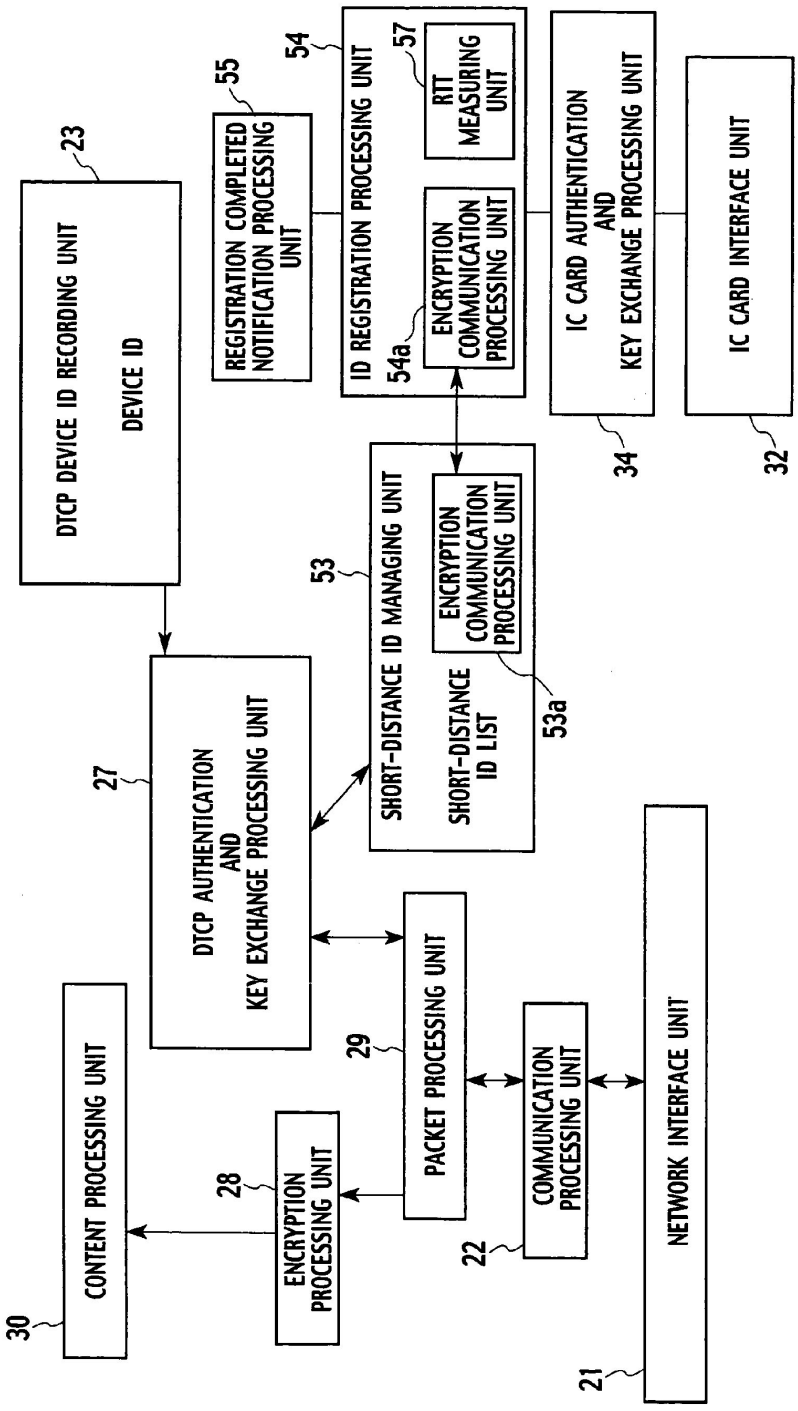


FIG.23 INTERNAL FEATURES OF IC CARD

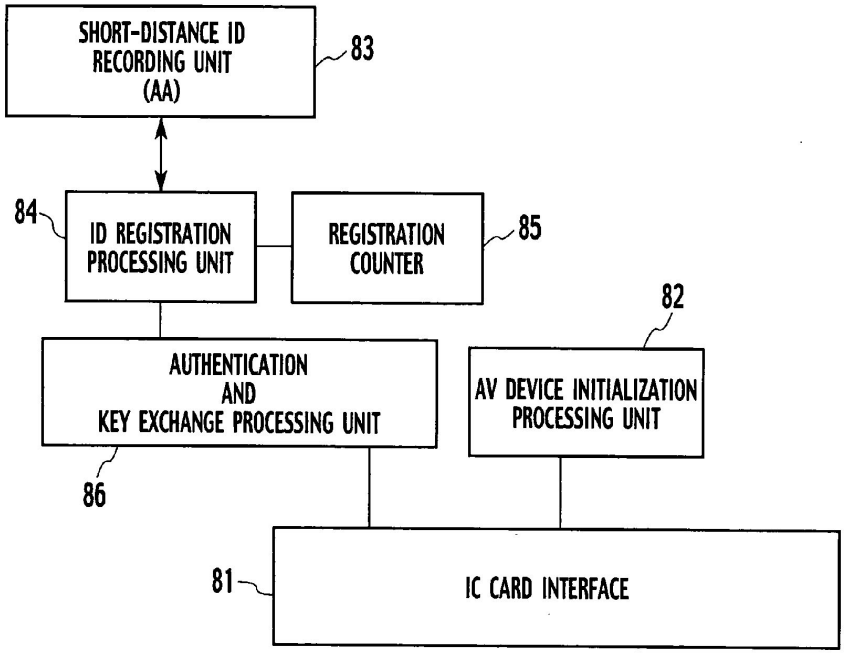


FIG.24

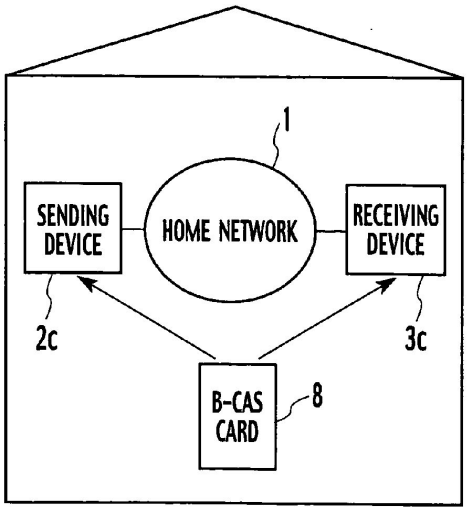


FIG.25

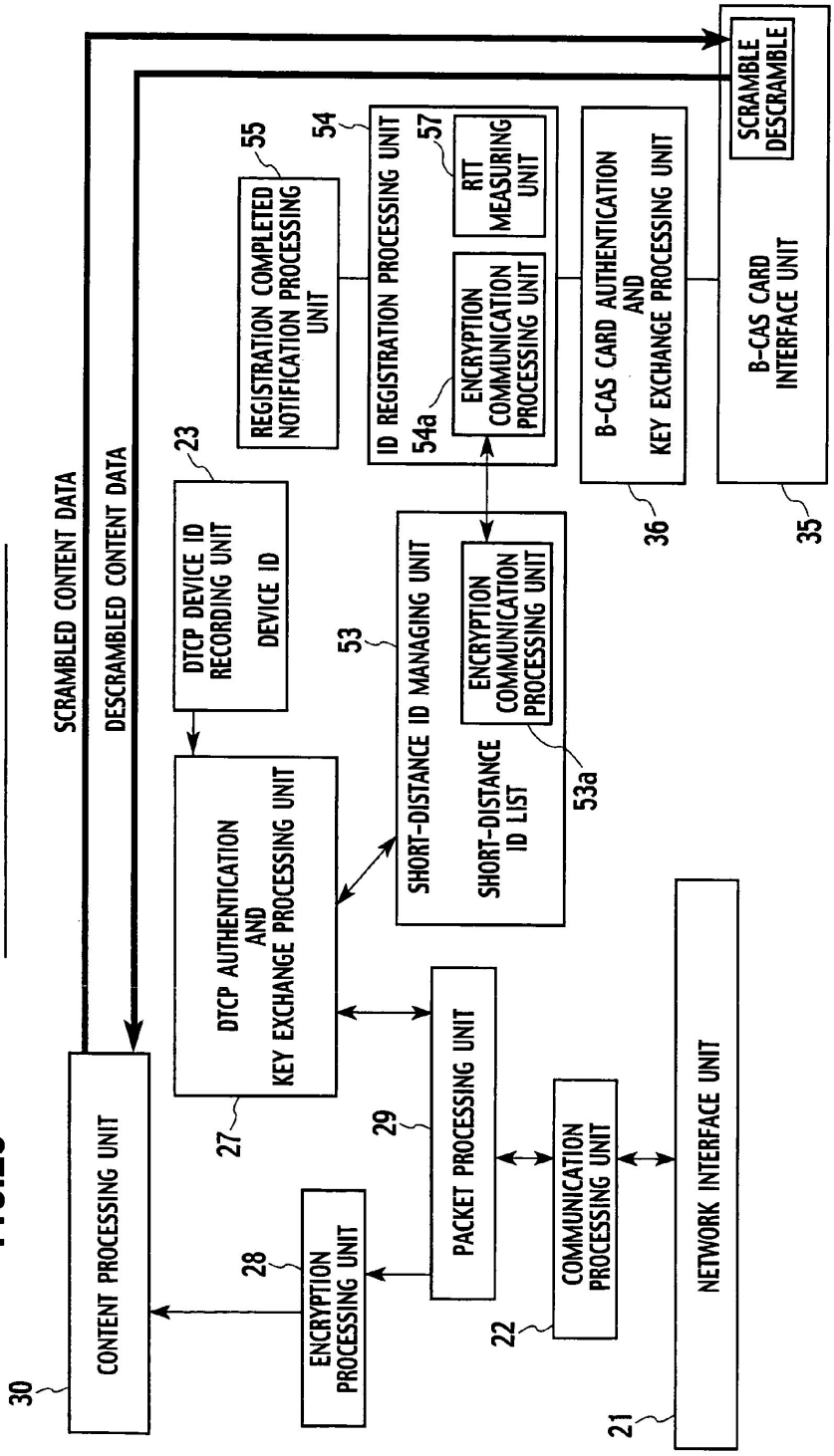
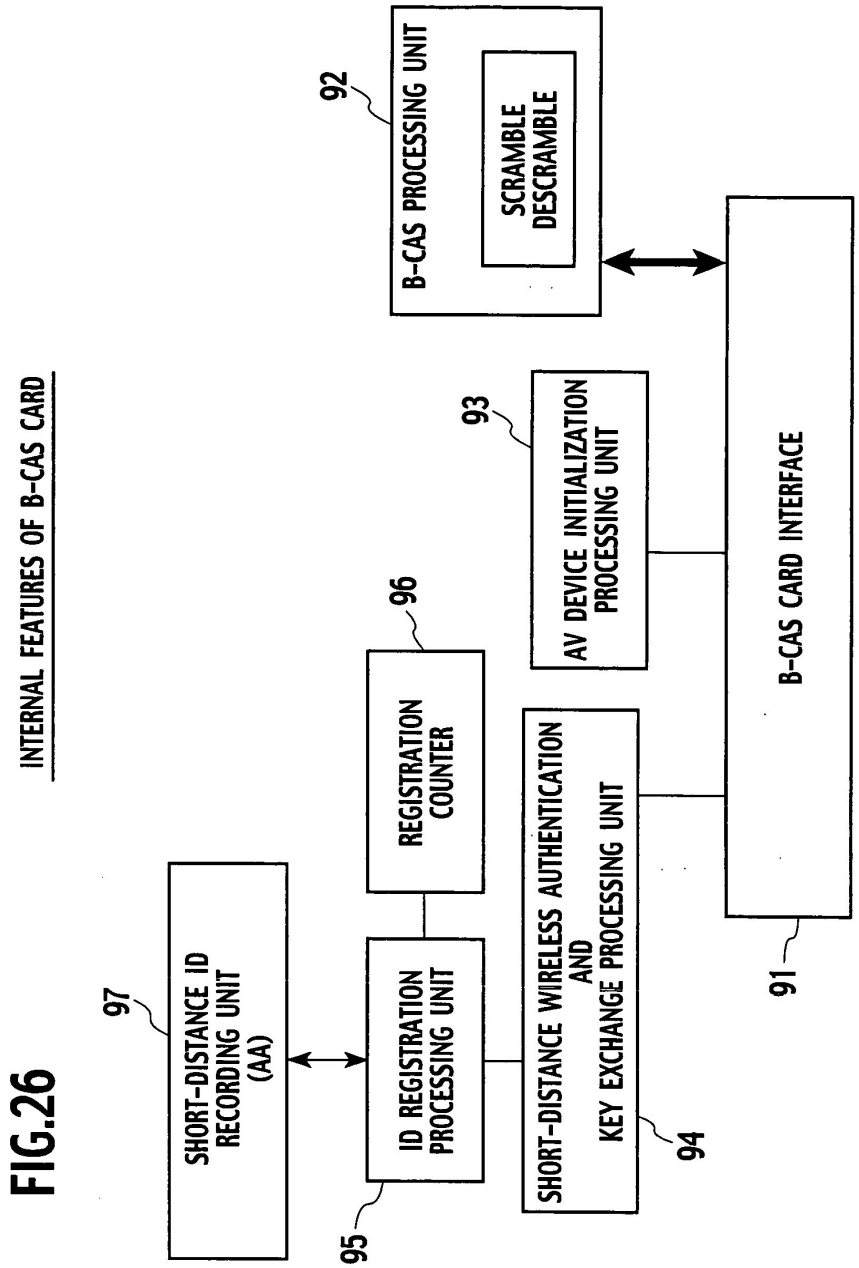

INTERNAL FEATURES OF RECEIVING DEVICE
SCRAMBLED CONTENT DATA
DESCRAMBLED CONTENT DATA
CONTENT PROCESSING UNIT
30
ENCRYPTION PROCESSING UNIT
28
DTCP AUTHENTICATION AND KEY EXCHANGE PROCESSING UNIT
27
DTCP DEVICE ID RECORDING UNIT
DEVICE ID
23
PACKET PROCESSING UNIT
29
COMMUNICATION PROCESSING UNIT
22
NETWORK INTERFACE UNIT
21
SHORT-DISTANCE ID MANAGING UNIT
53
SHORT-DISTANCE ID LIST
ENCRYPTION COMMUNICATION PROCESSING UNIT
53a
REGISTRATION COMPLETED NOTIFICATION PROCESSING UNIT
55
ID REGISTRATION PROCESSING UNIT
54
54a
ENCRYPTION COMMUNICATION PROCESSING UNIT
RTT MEASURING UNIT
57
B-CAS CARD AUTHENTICATION AND KEY EXCHANGE PROCESSING UNIT
36
B-CAS CARD INTERFACE UNIT
35
SCRAMBLE DESCRAMBLE

FIG.26


INTERNAL FEATURES OF B-CAS CARD
B-CAS PROCESSING UNIT
SCRAMBLE DESCRAMBLE
92
AV DEVICE INITIALIZATION PROCESSING UNIT
93
REGISTRATION COUNTER
96
B-CAS CARD INTERFACE
SHORT-DISTANCE ID RECORDING UNIT (AA)
97
ID REGISTRATION PROCESSING UNIT
95
SHORT-DISTANCE WIRELESS AUTHENTICATION AND KEY EXCHANGE PROCESSING UNIT
94
91

INFORMATION COMMUNICATION DEVICE, INFORMATION COMMUNICATION SYSTEM, AND COMPUTER PROGRAM PRODUCT FOR TRANSMISSION CONTROL

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims benefit of priority under 35 USC 119 based on Japanese Patent Applications No. P2003-194491 filed on July 9th, 2003, and No. P2003-406359 filed on December 4th, 2003, the entire contents of which are incorporated by reference herein.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to an information communication device, information communication system, and transmission control program for sending and receiving electronic data that requires copyright protection between a sending device and a receiving device.

[0004] 2. Description of Related Art

[0005] The number of so-called digital information electric products is increasing and the popularity of these products is expected to spread with start of digital broadcasting. These products include such items as televisions compatible with digital broadcasting, digital VTRs, DVD players, hard disk recorders, and various other products that handle digital data and digital content.

[0006] One of the problems that must be addressed as these products became more widespread is the issue of copyright protection for the content. While digital data is advantageous in that it can be copied without degrading in quality, it has the disadvantage of being easy to copy illicitly.

[0007] Consequently, systems compliant with IEEE 1394, i.e., digital networks that connect digital AV (audiovisual) devices together, are provided with functions for authentication, key exchange, and data encryption.

[0008] Consider a hypothetical situation in which AV data requiring copyright protection is to be transmitted form a sending device to a receiving device. In such a situation, it is important for the copyright protection to be contrived in such a manner that an individual (or, in a broader interpretation, a family) can enjoy handling the AV data without being hindered by the copyright protection so long as the handling does not involve exchanging the AV data with other parties or the payment of listening/viewing fees or copyright royalties.

[0009] DTCP (digital transmission content protection) is a known system for providing copyright protection on networks. DTCP has become a de facto standard copyright protection method for use with IEEE 1394 and USB. With DTCP, authentication and key exchange processing is executed between the sending device and the receiving device with respect to the AV data or other content requiring copyright protection and the AV data is transmitted in an encrypted manner (see http://www.dtcp.com).

[0010] Generally, copyright protection in a transmission system involves transmitting AV data using the following processing steps. First, commands for sending and receiving AV data are issued between the sending device and the receiving device. For example, the receiving device issues the playback and (which is one of the AV control commands) to the sending device.

[0011] Next, the AV data is encrypted for copyright protection and transmission of the AV data from the sending device to the receiving device commences. Before or after the transmission, authentication and key exchange processing for the copyright protection is executed between the sending device and the receiving device. If the authentication and key exchange processing is successful, it becomes possible for the AV data encryption key to be shared by the sending device and the receiving device or for the sending device and receiving device to calculate an encryption key and the receiving device decrypts and plays back the received encrypted AV data. If the AV data transmission is conducted using an internet protocol (IP), various web applications can be linked and web browsers and other assets can be utilized so that various network configurations can be accommodated.

[0012] For this reason, an IP (more specifically, IPv4 or IPv6) is often used as the protocol for transmitting AV data that has been compressed using MPEG or the like. Still more specifically, such protocols as RTP (real time transport protocol) and HTTP (hypertext transport protocol) are used.

[0013] However, with an IP, a security problem arises because IP packets can be transmitted regardless of the specific network configuration. Consequently, there are IP technologies, such as VPN (virtual private network), for connecting remote IP networks together logically. When one of these technologies is used, IP packets can be transmitted between a home network of a person X in a district A and a home network of a person Y in a district B (which is physically distant from the district A) over the VPN or the like. In other words, the home network of the person X and the home network of the person Y can be operated as though they are a single home network.

[0014] Regarding copyright protection, copying and the like of AV data are allowed within the realm of individual enjoyment but other parties are not allowed to copy the AV data. However, by using one of the technologies just mentioned (e.g., VPN technology), it is possible to make the networks of different individuals appear logically as a single network (that is, it is possible to configure the networks as a single network) and there is the possibility that devices that violate copyright laws will became available.

SUMMARY OF THE INVENTION

[0015] An aspect of the present invention provides an information communication device for transmitting electronic data encrypted for the purpose of copyright protection, the device includes that an identification information managing unit configured to hold device identification information in connection with other information communication devices acquired through a network, an ID registration processing unit configured to register the device identification information of another communication device when the other communication device satisfies a predetermined distance condition or when common identification information that is held by both information communication devices is received from a portable device, and an authentication and key exchange processing unit configured to, for the purpose

of copyright protection, complete authentication and key exchange process (AKE process) only when another information communication device whose device identification information is registered in the identification information managing unit.

[0016] Another aspect of the present invention provides an information communication system for transmitting electronic data encrypted for the purpose of copyright protection, the system includes that a sending device, and a receiving device configured to receive electronic data encrypted for the purpose of copyright protection and sent from the sending device, wherein at least one of the sending device and the receiving device includes that an identification information managing unit configured to hold device identification information regarding another device acquired through a network, an ID registration processing unit configured to register the device identification information of another device when the other device is recognized to be connected to a network having a prescribed limited range, and an authentication and key exchange processing unit configured to complete AKE process only when another information communication device whose device identification information is registered in the identification information managing unit.

[0017] Furthermore, another aspect of the present invention provides a computer program product comprising a computer useable medium having computer program logic recorded thereon for enabling a processor to control transmission of electronic data encrypted for the purpose of copyright protection, the computer program product includes that a sending procedure that enables the processor to send a request packet to another information communication device with which communication is to be conducted, a receiving procedure that enables the processor to receive a response packet from another information communication device, a determining procedure that enables the processor to determine if another information communication device is connected to a network having a prescribed limited range based on the received device ID response packet, a registration procedure that enables the processor to register the device identification information of another information communication device when it is determined that the other information communication device is connected to a network having a prescribed limited range, and an authentication and key exchange procedure that enables the processor to, for the purpose of copyright protection, complete AKE process only when another information communication device whose device identification information is registered in the identification information managing unit.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] **FIG. 1** is a block diagram showing a receiving device according to an embodiment of the present invention.

[0019] **FIG. 2** is a block diagram an embodiment of the sending device **2**.

[0020] **FIG. 3** shows an example of an ID list.

[0021] **FIG. 4** is a block diagram showing the internal features of a receiving device **3** in accordance with the embodiment.

[0022] **FIGS. 5 and 6** are sequence diagrams showing the processing steps for transmitting AV data between the sending device **2** and the receiving device **3** in accordance with the first embodiment.

[0023] **FIG. 7** is a sequence diagram showing the processing steps for spoofing prevention in accordance with the first embodiment.

[0024] **FIG. 8** is a sequence diagram showing the processing steps for transmitting AV data in the second embodiment.

[0025] **FIG. 9** is a block diagram showing an information communication system in accordance with the third embodiment of the present invention.

[0026] **FIG. 10** is a block diagram showing an example of the sending device **2***a* shown in **FIG. 9**.

[0027] **FIG. 11** is a block diagram showing an example of the receiving device **3***a*.

[0028] **FIG. 12** shows the data structure of the short-distance ID managing units **43**, **53** inside the sending device **2***a* and receiving device **3***a*.

[0029] **FIG. 13** is a block diagram showing an example of the internal features of the short-distance wireless device **4** when the short-distance wireless device **4** is an infrared remote control device.

[0030] **FIG. 14** is a block diagram showing an example of the internal features of the short-distance wireless device **4** when the short-distance wireless device **4** is a wireless tag device.

[0031] **FIG. 15** is a sequence diagram showing the processing steps for registering a short-distance ID to the sending device **2***a* and the receiving device **3***a*.

[0032] **FIG. 16** is a sequence diagram of the authentication and key exchange processing and the send processing for registration of the short-distance ID.

[0033] **FIG. 17** is a sequence diagram showing the processing steps for transmitting AV data between the sending device **2***a* and the receiving device **3***a*.

[0034] **FIG. 18** is a sequence diagram showing the processing steps for a case in which the short-distance ID (=AA) sent from the receiving device **3***a* in the previously described step **S91** is not registered in the short-distance ID managing unit **43** of the sending device **2***a*.

[0035] **FIG. 19** is a sequence diagram showing another example of the processing steps for transmitting AV data between the sending device **2***a* and the receiving device **3***a*.

[0036] **FIG. 20** is a block diagram showing an information communication system in accordance with the fourth embodiment of the present invention.

[0037] **FIG. 21** is a block diagram showing an example of the internal features of the sending device **2***b* indicated in **FIG. 20**.

[0038] **FIG. 22** is a block diagram showing an example of the internal features of the receiving device **3***b* shown in **FIG. 20**.

[0039] **FIG. 23** is a block diagram showing an example of the internal features of an IC card.

[0040] **FIG. 24** is a block diagram showing an information communication system in accordance with the fifth embodiment of the present invention.

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[0041] **FIG. 25** is a block diagram showing an example of the internal features of the receiving device **3***c* indicated in **FIG. 24**.

[0042] **FIG. 26** is a block diagram showing an example of the internal features of a B-CAS card **6**.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0043] Various embodiments of the present invention will be described with reference to the accompanying drawings. It is to be noted that the same or similar reference numerals are applied to the same or similar parts and elements throughout the drawings, and the description of the same or similar parts and elements will be omitted or simplified.

[0044] **FIG. 1** is a block diagram of an information communication system in accordance with a first embodiment of the present invention. The information communication system shown in **FIG. 1** is intended for sending and receiving chiefly AV data within the residence of an individual and is provided with a sending device **2** and a receiving device **3** connected to a home network **1**.

[0045] The home network **1** can be any of a variety of network configurations, such as a wireless LAN compliant with IEEE 802.11, an Ethernet (registered trademark), or an IEEE 1394 network. It is acceptable for other devices to be connected to the home network **1** in addition to the sending device **2** and the receiving device **3**, but such devices are omitted here for the purpose of simplification. When an internet protocol (IP) is used on the home network **1**, either IPv4 or IPv6 is acceptable.

[0046] The AV data exchanged between the sending device **2** and receiving device **3** requires copyright protection and is transmitted in a state in which appropriate copyright protection has been applied. In this embodiment, it will be assumed that DTCP is used as the method of achieving copyright protection on the network, but it also acceptable to use a copyright protection arrangement other than DTCP. See http://www.dtcp.com for more information regarding DTCP.

[0047] In this embodiment, a registration procedure is established in advance between the sending device **2** and the receiving device **3** whereby the sending device **2** and receiving device **3** are both registered to each other or only one is registered to the other. Devices that have not completed the registration procedure are not allowed to transmit AV data to each other, decrypt encrypted AV data, or complete the authentication and key exchange processing.

[0048] More specifically, the transmission time is generally longer when packets are transmitted between different home networks **1** and a router network (public internet) is typically used when different home networks **1** are connected together. In this embodiment, the information communication device takes advantage of these characteristics and ends the registration if the exchange of the registration packets is not completed within a prescribed amount of time. The packets used for registration can be data link layer frames and physical layer frames. These frames include, for example, Ethernet (registered trademark) packets and wireless layer packets. Since these frames are not routed by the router, the exchange of these frames can be limited to devices that can communicate within a prescribed LAN.

[0049] **FIG. 2** is a block diagram an embodiment of the sending device **2**. The sending device **2** shown in **FIG. 2** is provided with the following: a network interface unit **11**; a communication processing unit **12** configured to execute communication processing; a DTCP device ID recording unit **13** configured to record the DTCP device ID of the sending device **2**; an ID managing unit **14** configured to register the device IDs of other communication devices inside the same residence acquired through the network; an ID registration processing unit **15** configured to control the registration of device IDs in the ID management unit **14**; a measuring unit **16** configured to measure the time required for the device ID's to be reported from the other communication devices; an authentication and key exchange processing unit **17** configured to execute DTCP authentication and key exchange processing in order to accomplish copyright protection, an encryption processing unit **18** configured to encrypt data that will be sent; a packet processing unit **19** configured to convert the AV data and the DTCP management data to be sent to the receiving device **3** into communication packets; and a content supply unit **20** configured to store AV data. After the ID registration processing unit **15** requests another communication device inside the residence to send its device ID, the measuring unit **16** measures the time until there is a response providing the device ID. It is also acceptable that the measuring unit **17** measures time of other packet communications than that of device ID between the sending device **2** and the other communication device. If the response occurs within a prescribed amount of time, the ID registration processing unit **15** registers the device ID in the ID managing unit **14**. The ID managing unit **14** holds a list of registered device IDs (hereinafter called the "ID list") and, when the ID registration processing unit **15** issues a request to register a device ID, the ID managing unit **14** adds the device ID to the ID list so long as the device ID has not already been registered to the ID list.

[0050] In this embodiment, the measuring device **16** measures the distance between the sending device **2** and the other communication device within the network by measuring time. However, the invention is not limited to this method and it is also acceptable to measure the physical distance using a GPS or the like. In the case of a wireless arrangement, it is also acceptable to measure the distance based on the strength of the wireless signal. When an optical communication medium is used, it is acceptable to measure the distance based on the intensity of the light.

[0051] **FIG. 3** shows an example of an ID list. The ID list registers the DTCP device ID of each of the other communication devices as a mandatory item and registers such optional items as the following: the RTT (round trip time), a unique ID (e.g., MAC address), and date and time of last use (data and time of the last communication with the other communication device).

[0052] Up to N (where N is a prescribed integer) device IDs can be registered in the ID list. When there is a request to register a new device ID and N device IDs have already been registered, it is acceptable to handle the request by either denying the registration of the new device ID or deleting a previously registered device ID so that the new device ID can be registered. In the latter case, any of the following arrangements is acceptable: delete the device ID of the registered communication device with which communication has not been conducted for the longest period of

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time; delete the device ID that was registered the longest ago, as in the case of the FIFO format; or allow the user to delete an arbitrary device ID by means of some kind of user interface. In this way, the number of device ID entries in the ID list can be limited as mentioned-above.

[0053] In this embodiment, the DTCP device ID is an identification number for the DTCP device. It is preferable that every DTCP device in the entire world have a unique ID. It is also acceptable for the DTCP device ID to be an ID embedded in a certificate (called a "device certificate") that proves the device is a properly licensed device. The device certificate includes digital signatures and the like that can be verified to confirm that the device certificate is correct.

[0054] **FIG. 4** is a block diagram showing the internal features of a receiving device **3** in accordance with this embodiment. The receiving device **3** shown in **FIG. 4** is provided with the following: a network interface unit **21**; a communication processing unit **22** configured to execute communication processing; a DTCP device ID recording unit **23** configured to record the DTCP device ID of the receiving device **3**; an ID managing unit **24** configured to register the device IDs of other communication devices inside the same residence acquired through the network; an ID registration processing unit **25** configured to control the registration of device IDs in the ID management unit **24**; a measuring unit **26** configured to measure the time required for the device ID's to be reported form the other communication devices; an authentication and key exchange processing unit **27** configured to execute DTCP authentication and key exchange processing in order to accomplish copyright protection, an encryption processing unit **28** configured to decrypt data that has been received; a packet processing unit **29** configured to convert the received signal into AV data; and a content supply unit **30** configured to store AV data.

[0055] **FIGS. 5 and 6** are sequence diagrams showing the processing steps for transmitting AV data between the sending device **2** and the receiving device **3** in the first embodiment. The sequence diagrams shown in **FIGS. 5 and 6** start when the users of the sending device **2** and the receiving device **3** press a register button or click a register icon (steps S**11** and S**12**).

[0056] It is also acceptable to start the processing of **FIG. 5** when a starting action is performed at only one or the other of the sending device **2** and the receiving device **3**. Still another option is to set the sending device **2** and the receiving device **3** to registration mode and start the processing of **FIG. 5** automatically when the power to said devices is turned on.

[0057] In any case, registration processing is executed between two devices each of whose registration button was pressed or between a communication device whose registration button was pressed and another communication device (normally a communication device whose power is on).

[0058] It is also acceptable to configure the system such that registration processing starts without obtaining an instruction to start registration form a user.

[0059] Although **FIG. 5** illustrates a case in which registration is performed between two devices, i.e., the sending device **2** and the receiving device **3**, it is also acceptable register three or more devices simultaneously.

[0060] When the registration processing starts, the sending device **2** starts measuring time (timer ON) using the measuring unit (step S**13**) and sends a device ID send request packet to the receiving device **3** for the purpose of registering the device ID in the ID list (step S**14**). The packet can be sent using Ethernet (registered trademark) frames or wireless layer frames (data link layer frames or physical layer frames). The device ID send request packet includes a time stamp and a random number selected by the sending device **2**. It is acceptable for the sending device **2** to broadcast the device ID send request packet over the network. In such a case, the Ethernet (registered trademark) broadcast address is used as the destination Ethernet (registered trademark) address.

[0061] The receiving device **3** receives the device ID send request packet and sends a device ID response packet to the sending device **2** (step S**15**). The device ID response packet, too, is sent using Ethernet (registered trademark) frames or wireless layer frames. It is acceptable for the receiving device **3** to include in the device ID response packet the same random number and time stamp as was included in the device ID send request packet from the sending device **2**. In this way, the sending device **2** can know which request packet the response corresponds to and it is easier for the measuring unit **16** to measure the time.

[0062] It is also acceptable to configure the system such that the receiving device **3** sends a device ID send request packet to the sending device **2** and, after receiving the packet, the sending device **2** sends a device ID response packet to the receiving device **3**. In this case, the time required for the packet response is measured by the receiving device **3**. In case that the receiving device **3** measures the packet response, it is acceptable that the receiving device **3** sends a result of the measured time of the packet response to the sending device **2**.

[0063] If the device ID response packet is received within a prescribed amount of time T, the ID registration processing unit **15** inside the sending device **2** registers the device ID of the receiving device **3** in the ID managing unit **24**. If the device ID response packet is not received within the prescribed amount of time T, the registration is determined to have failed and the device ID is not registered in the ID managing unit **24** (step S**16**).

[0064] It is acceptable that the time measurement is conducted only once, and it is also acceptable that the time is measurement is retried for prescribed times until the device ID response packet is received within a prescribed amount of time.

[0065] If the device ID registration fails, it is necessary to inform the user that it is necessary to perform the device ID registration over an identical link network but with a shorter distance between devices. Therefore the user is urged to try such actions as the following: perform the registration with the sending device **2** and the receiving device **3** plugged into the same Ethernet (registered trademark) switch; perform the registration with the sending device **2** and the receiving device **3** connected directly to the Ethernet (registered trademark) cable; temporarily reduce the traffic on the network (by, for example, stopping transmissions of AV data

between other communication devices); stop other applications running on the sending device **2** or receiving device **3** in order to reduce the processing load.

[**0066**] After the processing of step **S16** is completed, the receiving device **3** starts measuring time with the measuring unit **26** (step **S17**) and sends a device ID send request packet to the sending device **2** (step **S18**). The sending device **2** receives the request and sends a device ID response packet (step **S19**).

[**0067**] If the receiving device **3** receives the device ID response packet from the sending device **2** within a prescribed amount of time T, the receiving device **3** registers the device ID of the sending device **2** in the ID managing unit. If the device ID response packet is not received within the prescribed amount of time T, the device ID of the sending device **2** is not registered (step **S20**).

[**0068**] It is acceptable that the time measurement is conducted only once, and it is also acceptable that the time measurement is retried for prescribed times until the device ID response packet is received within a prescribed amount of time.

[**0069**] It is also acceptable to accomplish this time measurement using packets other than the device ID registration request and response packets. It is also acceptable to accomplish the time measurement using IP packets. But not limited to this, other packets can be used in this embodiment.

[**0070**] After completing the procedure just described, the sending device **2** and the receiving device **3** end registration mode (steps **S21** and **S22**) and execute authentication and key exchange processing (steps **S23** to **S29** of **FIG. 6**).

[**0071**] First, the receiving device **3** uses an IP packet to send a request for authentication and key exchange to the sending device **2** (step **S23**). The receiving device **3** includes its own device ID in the IP packet.

[**0072**] The sending device **2** receives the IP packet from the receiving device **3** and checks if the device ID of the receiving device **3** is registered in the ID managing unit **14** (step **S24**). If the device ID is registered, the sending device **2** uses an IP packet to send a request for authentication and key exchange to the receiving device **3** (step **S25**). The sending device **2** includes its own device ID in the IP packet. For example, the measurement can be achieved using key exchange or random number request and response packets. Another example is that the measurement can be done using Ethernet Frames instead of IP packets.

[**0073**] The receiving device **3** receives the IP packet from the sending device **2** and checks if the device ID of the sending device **2** is registered in the ID managing unit **24** (step **S26**). If the device ID is registered, authentication and key exchange is executed between the sending device **2** and the receiving device **3** (step **S27**).

[**0074**] If the authentication and key exchange succeeds, the sending device **2** and the receiving device **3** will share a content encryption key (steps **S28** and **S29**) and the sending device will encrypt the content (step **S30**).

[**0075**] In this embodiment, the RTT measurement is carried out at the beginning part of the processing AKE (authentication and key exchange) protocol. It is also acceptable such that the RTT measurement is carried out before the processing of AKE protocol, during the processing of the AKE protocol, or at the ending part of the processing AKE protocol.

[**0076**] Next, the sending device **2** transmits the encrypted AV data using RTP or HTTP (step **S31**). The receiving device **3** receives the AV data and decrypts the content (step **S32**).

[**0077**] When either one of the devices, i.e., the sending device **2** or the receiving device **3**, has already completed the device ID registration procedure, the steps **S13** to **S16** or the steps **S17** to **S20** of **FIG. 5** can be omitted.

[**0078**] It is also acceptable to conduct the request for device ID registration and the response thereto at the authentication and key exchange processing stage of step **S25**.

[**0079**] It is also acceptable to provide a procedure for protecting against spoofing (man in the middle attack) when the device ID registration request and registration response are executed. In such a case, processing such as that shown in **FIG. 7** is executed instead of the steps **S14** to **S16** of **FIG. 5**.

[**0080**] First, the sending device **2** sends a random number send packet to the receiving device **3** using Ethernet (registered trademark) frames or wireless layer frames (step **S41**). The random number send packet contains a random number r generated by the sending device **2**.

[**0081**] The receiving device **3** receives the random number send packet and calculates a signature using the random number and its own device ID (step **S42**). The receiving device **3** sends a random number received notification to the sending device **2** using Ethernet (registered trademark) frames or wireless layer frames (step **S43**).

[**0082**] After receiving the notification, the sending device **2** starts measuring time using the measuring unit (step **S44**) and sends a device ID request packet to the receiving device **3** using Ethernet (registered trademark) frames or wireless layer frames (step **S45**). This packet contains the aforementioned random number r.

[**0083**] After receiving the packet, the receiving device **3** sends a device ID response packet containing the random number r and its own device ID and signature to the sending device **2** (step **S46**).

[**0084**] The sending device **2** determines if the amount of time from when it sent the device ID request packet until when it received the device ID response packet is within a prescribed amount of time T. If the time is within the prescribed amount of time T, the device ID=b of the receiving device **3** is registered in the ID managing unit. If response is not received within the prescribed amount of time T, the device ID is not registered to the ID managing unit (step **S47**).

[**0085**] Thus, in the first embodiment, the other communication device (receiving device **3** or sending device **2**) is only registered if the response is received within a prescribed amount of time after the device ID registration request is issued. As a result, it is possible to restrict the transmission of AV data to communication devices that are within a limited area and the AV data can be copyright-protected using simple processing.

[0086] (Second Embodiment)

[0087] The second embodiment is configured such that after the receiving device **3** has issued a request for authentication and key exchange to the sending device **2**, the sending device **2** sends a device ID request packet to the receiving device **3**.

[0088] The constituent features of the sending device **2** and the receiving device **3** of the second embodiment are the same as those shown in **FIG. 2** and **FIG. 4** and descriptions thereof are therefore omitted.

[0089] **FIG. 8** is a sequence diagram showing the processing steps for transmitting AV data in the second embodiment. First, the receiving device **3** issues a request for authentication and key exchange to the sending device **2** (step S**51**). The sending device **2** confirms that the receiving device **3** from which the request for authentication and key exchange was issued is not already registered in the ID managing unit (step S**52**), starts measuring time with the measuring unit (step S**53**), and sends a device ID request packet to the receiving unit **3** using Ethernet (registered trademark) frames or wireless layer frames (step S**54**).

[0090] The receiving device **3** responds to the packet by sending a device ID response packet to the sending device **2** using Ethernet (registered trademark) frames or wireless layer frames (step S**55**).

[0091] Next, if the amount of time from when the sending device **2** sent the device ID request packet until it received the device ID response packet is within a prescribed amount of time T, the sending device **2** registers the device ID (=b) of the receiving device **3** to the ID managing unit **14**. If response is not received within the prescribed amount of time T, the device ID is not registered (step S**56**).

[0092] Next, the receiving device **3** uses the same steps to execute registration processing with respect to the device ID of the sending device **2** (steps S**57** to S**60**). Thereafter, the processing steps are the same as steps S**21** to S**32** of **FIG. 6**.

[0093] When either one of the devices, i.e., the sending device **2** or the receiving device **3**, has already completed the device ID registration procedure, the steps S**52** to S**56** or the steps S**57** to S**60** of **FIG. 8** can be omitted.

[0094] Thus, the second embodiment eliminates unnecessary requests and responses for device IDs because the device ID requests are issued after the request for authentication and key exchange. As a result, communication traffic can be reduced.

[0095] (Third Embodiment)

[0096] The third embodiment is different from the first and second embodiments in that it is configured such that AV data can only be transmitted between a sending device and a receiving device in which an ID sent from the same short-distance wireless device is registered.

[0097] **FIG. 9** is a block diagram showing an information communication system in accordance with the third embodiment of the present invention. In addition to the features shown in **FIG. 1**, the information communication system shown in **FIG. 9** is provided with a short-distance wireless device **4** that includes an infrared remote controller (hereinafter called "remote control") and a wireless tag.

[0098] The sending device **2***a* and the receiving device **3***a* of this embodiment both communicate wirelessly with the short-distance wireless device **4** and register the globally unique ID (hereinafter called "short-distance ID") sent from the short-distance wireless device **4**. AV data (or its copyright protection key exchange) is only allowed to be transmitted between a sending device **2***a* and a receiving device **3***a* that have this short-distance ID registered therein. More specifically, if the ID is not registered in the sending device **2***a* and receiving device **3***a*, authentication and key exchange (or exchange of content) will not succeed between the sending device **2***a* and receiving device **3***a*.

[0099] The short-distance wireless device **4** holds the short-distance ID and sends the ID to both the sending device **2***a* and the receiving device **3***a* using short-distance wireless communication only. The "short-distance" mentioned here is, for example, the range (e.g., several meters) that can be reached by the infrared rays in the case of an infrared device or the range (e.g., several centimeters) that can be reached by the radio waves in the case of a wireless tag device.

[0100] **FIG. 10** is a block diagram showing an example of the sending device **2***a* shown in **FIG. 9**. Components in **FIG. 10** that are the same as in **FIG. 2** are indicated with identical reference symbols and only the differences will be discussed below.

[0101] Similarly to **FIG. 2**, the sending device **2***a* of **FIG. 10** is provided with a network interface unit **11**, a communication processing unit **12**, a DTCP device ID recording unit **13**, an ID managing unit **14**, a DTCP authentication and key exchange processing unit **17**, an encryption processing unit **18**, a packet processing unit **19**, and a content supplying unit **20**. Additionally, the sending device **2***a* of **FIG. 10**, is provided with the following: a short-distance wireless interface unit **41** for short-distance wireless c cation; a short-distance authentication and key exchange processing unit **42** configured to execute authentication and key exchange between the sending device **2***a* and the short-distance wireless device **4**; a short-distance ID managing unit **43** configured to register the short-distance ID acquired by means of short-distance wireless communication; an ID registration processing unit **44** configured to control the registration of the short-distance ID to the short-distance ID managing unit **43**; a registration completed notification processing unit **45** configured to notify the user that the registration of a short-distance ID has been completed; and a power supply control unit **46** configured to supply a power supply voltage to the short-distance wireless interface unit **41** and peripheral units thereof only during registration of a short-distance ID.

[0102] For security reason, it is also acceptable to provide the short-distance ID managing unit **43** and the ID registration processing unit **44**, respectively, with encryption communication processing units **43***a*, **44***a* configured to encrypt the short-distance ID. This arrangement eliminates the risk of the short-distance ID being illicitly acquired form the data bus between the short-distance ID managing unit **43** and the ID registration processing unit **44**. More specifically, the data transfer between the ID registration processing unit **44** and the short-distance ID managing unit **43** takes place through a general-purpose data bus in a case in which all of the following conditions exist: the short-distance wireless

interface unit **41**, the short-distance wireless authentication and key exchange processing unit **42**, and the ID registration processing unit **44** are modularized into, for example, infrared modules or wireless tag modules; the modules are connected to a PCI bus or other general-purpose data bus; and the short-distance ID managing unit **43** and the DTCP authentication and key exchange processing unit **17** operate using software located in an MPU. Consequently, if the short-distance ID is not encrypted, it can be intercepted illicitly on the general-purpose data bus and used for such purposes as to make illegal copies.

[**0103**] Therefore, it is preferred to provide encryption communication processing units **43***a* and **44***a* in the short-distance ID managing unit **43** and the ID registration processing unit **44**, respectively, and encrypt, such as the short-distance ID before transmitting it. The encryption communication processing units **43***a*, **44***a* can be constituted with hardware or they can configured to accomplish the encryption of the IDs using software by preparing an API for encrypting with software.

[**0104**] It is also acceptable to provide the encryption communication processing units **43***a*, **44***a* with internal functions for measuring if the communications between the encryption communication processing units **43***a*, **44***a* are taking place within a prescribed amount of tire. This function is provided in order to check if the physical distance between the short-distance ID managing unit **43** and the ID registration processing unit **44** is within a prescribed distance (e.g., if the physical distance between the short-distance ID managing unit **43** and the ID registration processing unit **44** within the same case is within a prescribed distance or if the physical distance between the short-distance ID managing unit **43** and an externally attached part, such as a USB dongle, constituting the short-distance wireless processing unit is within a prescribed distance).

[**0105**] The externally attached part mentioned here includes, for example, the short-distance wireless interface unit **41**, the short-distance authentication and key exchange processing unit **42**, and the ID registration processing unit **44**. Without this time measuring (distance measuring) function, it is feasible that someone could attack the system by arranging an externally attached part in a remote location, connecting the short-distance ID managing unit **43** and the externally attached part together through the internet or other public network (wide area network), and registering a device remotely. Said function has the effect of preventing such an attack.

[**0106**] It is possible that the functions related to short-distance wireless communication (e.g., the short-distance wireless interface unit **41**, the short-distance authentication and key exchange processing unit **42**, and the ID registration processing unit **44**) will be functions that are not used except when registering a short-distance ID. Therefore, electric power can be conserved by configuring the system such that power is not supplied to these functions except when a short-distance ID is being registered. This control of the power supply is executed by the power supply control unit **46**. The power supply control unit **46** detects when a user presses the short-distance ID registration button and controls the power supply accordingly.

[**0107**] The short-distance wireless ID is an identification number for the short-distance wireless device **4** and it is acceptable for it to be an identification number that is issued by the same licensing institution as the DTCP or DTLA (the license organization of DTCP) and assigned a value that is unique throughout the world. Similarly to the DTCP device ID, it is also acceptable for the short-distance wireless ID to be an ID embedded in a certificate (called a "device certificate") that proves the device is a properly licensed device. The device certificate includes digital signatures and the like that can be verified to confirm that the device certificate is the correct certificate.

[**0108**] **FIG. 11** is a block diagram showing an example of the receiving device **3***a*. Components in **FIG. 11** that are the same as in **FIG. 4** are indicated with identical reference symbols and only the differences will be discussed below.

[**0109**] Similarly to **FIG. 4**, the receiving device **3***a* of **FIG. 11** is provided with a network interface unit **21**, a communication processing unit **22**, a DTCP device ID recording unit **23**, an ID managing unit **14**, a DTCP authentication and key exchange processing unit **27**, an encryption processing unit **28**, a packet processing unit **29**, and a content supplying unit **30**. Additionally, the receiving device **23***a* of **FIG. 11**, is provided with the following: a short-distance wireless interface unit **51** for short-distance wireless communication; a short-distance authentication and key exchange processing unit **52** configured to execute authentication and key exchange between the receiving device **3***a* and the short-distance wireless device **4**; a short-distance ID managing unit **53** configured to register the short-distance ID acquired by means of short-distance wireless communication; an ID registration processing unit **54** configured to control the registration of the short-distance ID to the short-distance ID managing unit **53**; a registration completed notification processing unit **55** configured to notify the user that the registration of a short-distance ID has been completed; and a power supply control unit **56** configured to operate (i.e., turn on the power to) the short-distance wireless interface unit and peripheral units thereof only during registration of a short-distance ID.

[**0110**] **FIG. 12** shows the data structure of the short-distance ID managing units **43**, **53** inside the sending device **2***a* and receiving device **3***a*. The values of the short-distance IDs are registered in the short-distance ID managing unit **43**, **53** as mandatory items. Other values, such as the RTT (round trip time), the DTCP device ID, and the date and time of registration corresponding to each short-distance ID are recorded as optional items.

[**0111**] **FIG. 13** is a block diagram showing an example of the internal features of the short-distance wireless device **4** when the short-distance wireless device **4** is an infrared remote control device. The infrared remote control device of **FIG. 13** is provided with the following: an infrared communication interface unit **61**; an AV device initialization processing unit **62** for initializing the AV device; an AV device control processing unit **63** for controlling the AV device; a short-distance ID recording unit **64** configured to record the short-distance ID of the infrared device; an ID registration processing unit **65** configured to control registration of the ID to the short-distance ID recording unit **64**; a registration counter **66** configured to measure the number of times recording of the short-distance ID to the short-distance ID recording unit **64** takes place; short-distance wireless authentication and key exchange processing unit **67**

configured to execute authentication and key exchange between the short-distance wireless device **4** and the sending device **2***a*, or, between the short-distance wireless device **4** and the receiving device **3***a*; and a user interface unit **68**.

[**0112**] It is acceptable for the infrared communication interface unit **61** to be provided with a two-way infrared interface unit for short-distance ID registration **61***a* and a one-way infrared interface unit for AV device control. While the infrared remote control interface for controlling an AV device is generally a one-way interface, the infrared interface for registering the short-distance ID of this embodiment is a two-way interface, as described later. In order to accomplish these two functions, it is necessary to provide the infrared communication interface unit **61** with two infrared interfaces **61***a*, **61***b*. These two infrared interfaces can be constituted with two or more separate components or sealed inside one individual component. The two-way infrared interface **61***a* for short-distance ID registration is connected to the short-distance wireless authentication and key exchange processing unit **67** and the AV device initialization processing unit **62**. Meanwhile, the one-way infrared interface **61***b* for AV device control is connected to the AV device control processing unit **63**. It is acceptable for these two infrared interfaces **61***a*, **61***b* to use different infrared frequencies, command systems, and packet formats.

[**0113**] Meanwhile, **FIG. 14** is a block diagram showing an example of the internal features of the short-distance wireless device **4** when the short-distance wireless device **4** is a wireless tag device. The wireless tag device of **FIG. 14** is provided with the following: a wireless tag communication interface unit **70**; an AV device initialization processing unit **71**; a short-distance wireless authentication and key exchange processing unit **72**; an ID registration processing unit **73**; a registration counter **74**; a short-distance ID recording unit **75**; and a user interface unit **76**.

[**0114**] The wireless tag device does not require a battery, and is therefore economical, because it sends its wireless signal using electric power generated from received radio waves. Although omitted in **FIG. 14**, a capacitor for storing electric power generated from received radio waves is provided inside the wireless tag device.

[**0115**] **FIG. 15** is a sequence diagram showing the processing steps for registering a short-distance ID to the sending device **2***a* and the receiving device **3***a*. The processing steps for registering a short-distance ID will now be described based on **FIG. 15**. In order to send the short-distance ID from the short-distance wireless device **4** to the sending device **2***a* (or the receiving device **3***a*), the user depresses the button **68***a* of the short-distance wireless device **4** shown in **FIG. 13** to put the short-distance wireless device **4** into registration mode (step **S71**). Then the user depresses the button of the sending device (or receiving device **3***a*) to which the short-distance ID is to be sent and points the short-distance wireless device **4** toward the sending device **2***a* (or receiving device **3***a*). This procedure puts the sending device **2***a* (or receiving device **3***a*) into registration mode (step **S72**).

[**0116**] It is acceptable for the sending device **2***a* (or receiving device **3***a*) to be configured such that, when the device enters registration mode, the power supply control unit **46** (or **56**) delivers electric power to the short-distance wireless interface unit **41** (or **51**) and the peripheral units thereof.

[**0117**] Thus, with this embodiment, the possibility of sending AV data over the internet or the like from a sending device **2***a* to a receiving device **3***a* in a distant location is eliminated because it is necessary for the user to depress buttons on both the sending device **2***a* and the receiving device **3***a* and then register the short-distance ID using the same short-distance wireless device **4**.

[**0118**] Next, the user points the short-distance wireless device **4** at the sending device **2***a* (or receiving device **3***a*) or brings the short-distance wireless device **4** close to the sending device **2***a* (or receiving device **3***a*) and depresses the short-distance ID registration button (step **S73**). This action causes authentication and key exchange to take place between the short-distance wireless device **4** and the sending device **2***a* (or receiving device **3***a*) and each device confirms that the other is a device that has been recognized by a proper licensing institution (step **S74**). If necessary, public keys or other keys are exchanged. The key exchange procedure is discussed later.

[**0119**] Next, the short-distance wireless device **4** determines if the value of the registration counter, which measures the number of times the short-distance ID has been sent to a sending device **2***a* (or receiving device **3***a*) and registered, is larger than zero (step **S75**). If the value of the registration counter is larger than zero, the number of previous registrations is smaller than a prescribed number and the short-distance ID is sent to the sending device **2***a* (or receiving device **3***a*) (step **S76**). If the value of the registration counter is zero, the prescribed number of registrations has already been performed and transmission of the short-distance ID is stopped.

[**0120**] It is acceptable that the short-distance ID is sent from the same wireless device **4** to the same sending device **2***a* or receiving device **3***a*) for more than two times.

[**0121**] After the short-distance wireless device **4** sends the short-distance ID to the sending device **2***a* (or receiving device **3***a*), it decrements the registration counter by 1 (step **S77**).

[**0122**] The sending device **2***a* (or receiving device **3***a*) receives the short-distance ID and transmits the short-distance ID to the short-distance ID managing unit **43**, **53** (step **S78**). As described previously, in order to prevent unlawful acquisition of the short-distance ID during transmission, the short-distance ID can be, for example, encrypted or provided with a signature so that it can be determined if the short-distance ID has been altered. It is also acceptable to measure if the transmission to the short-distance ID managing unit **43**, **53** is accomplished within a prescribed amount of time.

[**0123**] Next, it is determined if the number of short-distance IDs registered in the short-distance ID managing unit **43**, **53** is below a prescribed number N (step **S79**). If the number of short-distance IDs is below the prescribed number, the short-distance ID is registered. If the number of short-distance IDs is already the prescribed number N, it is acceptable to register the new short-distance ID after deleting the short-distance ID that was registered the longest ago or another short-distance ID as described previously.

[**0124**] After the completing the steps just described, registration mode ends for the short-distance wireless device **4** and the sending device **2***a* (or receiving device **3***a*) and the

user is notified that registration mode has ended by a beep sound or an indication presented on a display (steps **S80** to **S83**).

[**0125**] The sending device **2***a* and the receiving device **3***a* register the short-distance ID in their respective short-distance ID managing units **43**, **53**. A predetermined number N of IDs can be registered in the short-distance ID managing units **43**, **53**. The value of N can be selected to be 1 or some other value, such as 2, 4, 8, or 16. Although it is feasible to configure the system such that when there is a request to register a new short-distance ID and the maxi number N of short-distance IDs has already been registered, the new short-distance ID is registered after taking such a measure as deleting the short-distance ID that was registered the longest ago, the basic idea is to deny any registrations of new IDs beyond the prescribed number N.

[**0126**] The registration processing of the short-distance ID managing units **43**, **53** is executed separately by the sending device **2***a* and the receiving device **3***a*, respectively. In other words, the sending device **2***a* and the receiving device **3***a* each execute the short-distance ID registration using the same short-distance wireless device **4**. It is preferable that it be possible to confirm that the sending device **2***a* and the receiving device **3***a* are close to each other when the registrations are performed. Otherwise, it will be possible for the short-distance ID to registered using the same short-distance wireless device **4** at different times and locations with respect to the sending device **2***a* and the receiving device **3***a*, respectively (for example, the ID could be registered to the sending device **2***a* in Tokyo and to the receiving device **3***a* in Osaka). As a result, it would be possible to accomplish remote communication between arbitrary remote locations.

[**0127**] Thus, it is acceptable to provide a measuring unit **69** inside the short-distance wireless device **4** as shown in **FIG. 13** so that the registration tasks executed by the sending device **2***a* and the receiving device **3***a* are disallowed if they are not executed in succession and completed within several minutes.

[**0128**] Another option is to provide a GPS (global positioning system) inside the short-distance wireless device **4** and disallow registration of the short-distance ID when it can be estimated that the distance between the sending device **2***a* and the receiving device **3***a* is greater than a prescribed distance.

[**0129**] Still another option is to provide RTT measuring units **47**, **57** for measuring the RTT (round trip time) in the ID registration processing units **44**, **54** of the sending device **2***a* and the receiving device **3***a* as shown in **FIGS. 10 and 11**, use said measuring units **47**, **57** to measure if the time required (RTT) for the data transaction with the remote control device or the wireless tag device is less than a prescribed amount of time, and disallow registration of the short-distance ID if the RTT is not less than the prescribed amount of time. The RTT measuring units **47**, **57** are configured to, for example, send a prescribed packet to the short-distance wireless device **4** and measure the round trip time required for a response packet to come back. The distance to the short-distance wireless device **4** can be estimated based on the RTT measurement result.

[**0130**] Still another option is to provide measuring units in of the ID registration processing units **44**, **54** of the sending device **2***a* and the receiving device **3***a*, respectively, and check if the data transaction with the remote control device or the wireless tag device is completed within a prescribed amount of time (RTT). If not, registration of the short-distance ID is disallowed.

[**0131**] **FIG. 16** is a sequence diagram of the authentication and key exchange processing and the send processing for registration of the short-distance ID. First, the short-distance wireless device **4** sends a trigger to the sending device **2***a* (or receiving device **3***a*) requesting that registration processing start (step **S111**). Then, the ID registration processing unit **44** (or **54**) of the sending device **2***a* (or receiving device **3***a*) starts a timer inside the RTT measuring unit **47** (or **57**) (step **S112**) and sends a command for measuring the round trip time (RTT) to the short-distance wireless device **4** (step **S113**). It is acceptable for a random value An selected by the short-distance wireless device **4** to be transmitted along with the command. Upon receiving the command, the short-distance wireless device **4** immediately sends a reply to the sending device **2***a* (or receiving device **3***a*) (step **S114**). It is acceptable for a random value Bn selected by the sending device **2***a* (or remote control device (short-distance wireless device **4**)) to be transmitted along with the reply.

[**0132**] Upon receiving the reply, the sending device **2***a* (or receiving device **3***a*) uses the timer inside the RTT measuring unit **47** (or **57**) to measure the RTT (step **S115**). If the measured value is less than a predetermined value (e.g., several milliseconds), the distance between the short-distance wireless device **4** and the sending device **2***a* (or receiving device **3***a*) is recognized to be smaller than a prescribed distance and the subsequent authentication and key exchange processing calculating or sharing content key to encrypt the AV data is allowed. If the RTT is equal to or greater than the predetermined time value, the distance between the short-distance wireless device **4** and the sending device **2***a* (or receiving device **3***a*) is recognized to be equal to or larger than the prescribed distance (i.e., there is the possibility that the devices are arranged remotely from each other and are communicating through a public network) and the subsequent authentication and key exchange processing calculating or sharing content key to encrypt the AV data is disallowed. The measurement of the RTT is accomplished using a sequence in which encryption computations and hashing computations do not occur. Consequently, the measurement is advantageous in that an RTT value close to the true value can be measured without taking into consideration the time required for encryption and hashing computations.

[**0133**] Although in this embodiment the sending device **2***a* (or receiving device **3***a*) conducts the RTT measurement, it is also acceptable to reverse the direction of the sequence so that the short-distance wireless device **4** measures the RTT. It is also feasible to use a sequence in which both the sending device **2***a* (or receiving device **3***a*) and the short-distance wireless device **4** measure the RTT.

[**0134**] Next, the short-distance wireless device **4** and the sending device **2***a* (or receiving device **3***a*) begin the authentication and key exchange processing. In this embodiment, the processing is accomplished using extended (enhanced) restricted authentication, which has already been standardized in DTCP standards. More specifically, the sending device **2***a* (or receiving device **3***a*) sends a key selection

vector Aksv to the short-distance wireless device **4** (step S**116**) and the short-distance wireless device **4** sends its device certificate (Bcert) and a key selection vector (Bksv) to the sending device **2***a* (or receiving device **3***a*) (step S**117**). Then the two devices calculate the value of R and R' by following predetermined computational operations (steps S**118** and S**119**).

[**0135**] In the computations, SHA-1 is a predetermined hash function. The value of R computed by the short-distance wireless device **4** is sent to the sending device **2***a* (or receiving device **3***a*) (step S**120**).

[**0136**] The sending device **2***a* (or receiving device **3***a*) cares the value of R' that it calculated to the value of R that was sent from the short-distance wireless device **4** (step S**121**). If the values match, the authentication and key exchange is deemed a success and the authentication key Kauth is computed (steps S**122** and S**123**). Since the sending device **2***a* (or receiving device **3***a*) can hold the same authentication key value Kauth, the short distance wireless device **4** sends the short-distance ID value (AA) to the sending device **2***a* (or receiving device **3***a*) using that value Kauth as a key (step S**124**). Feasible methods include, for example, using the XOR of the short-distance ID and the value of Kauth and sending the result of an encryption computation that uses the value of Kauth as a key.

[**0137**] Since the extended restricted authentication of DTCP is provided with a mechanism to revoke a device, it is possible for the sending device **2***a* (or receiving device **3***a*) to deny (revoke) transactions from a particular short-distance wireless device **4**.

[**0138**] See the DTCP standards listed at http://www.dtcp-.com for details regarding the extended restricted authentication procedure of DTCP.

[**0139**] **FIG. 17** is a sequence diagram showing the processing steps for transmitting AV data between the sending device **2***a* and the receiving device **3***a*. In this embodiment, it is assumed that the same short-distance ID (=AA) is registered in the short-distance ID managing units **43**, **53** of both the sending device **2***a* (which is assumed to have device ID=a) and the receiving device **3***a* (which is assumed to have device ID=b), respectively.

[**0140**] The receiving device **3***a* requests the sending device **2***a* for authentication and key exchange by sending notification of its own device ID (=b) and the short-distance ID (=AA) (step S**91**).

[**0141**] Upon receiving the request, the sending device **2***a* confirms that the short-distance ID AA is registered in its short-distance ID managing unit (step S**92**) and requests the receiving device **3***a* for authentication and key exchange by sending notification of its own device ID (=a) and the short-distance ID (=AA) (step S**93**).

[**0142**] Upon receiving this request, the receiving device **3***a* confirms that the short-di-stance ID AA is registered in its short-distance ID managing unit (step S**94**), and authentication and key exchange is executed between the sending device **2***a* and the receiving device **3***a*.

[**0143**] If the authentication and key exchange succeeds, the sending device **2***a* and receiving device **3***a* will share a common content encryption key (steps S**96** and S**97**). The sending device **2***a* uses this key to encrypt the AV data (step S**98**) and sends the encrypted AV data to the receiving device **3***a* (step S**99**). The receiving device **3***a* uses the content encryption key to decrypt the received AV data (step S**100**).

[**0144**] It is also feasible to use a method in which the short-distance ID is used as an input to the computation of the content encryption key.

[**0145**] **FIG. 18** is a sequence diagram showing the processing steps for a case in which the short-distance ID (=AA) sent from the receiving device **3***a* in the previously described step S**91** is not registered in the short-distance ID managing unit **43** of the sending device **2***a*. The sending device **2***a* confirms that the short distance ID (=AA) is not registered in the short-distance ID managing unit **43** and urges the user to registered the short-distance ID using a beep sound or the like (step S**101**).

[**0146**] **FIG. 19** is a sequence diagram showing another example of the processing steps for transmitting AV data between the sending device **2***a* and the receiving device **3***a*. In this example, the processing up to the step where the content encryption key is shared by the sending device **2***a* and the receiving device **3***a* (steps S**131** to S**134**) is the same as the DTCP authentication and key exchange processing shown in **FIG. 17**. Then, one or both of the devices confirms the value of the short-distance ID. Since there are no changes to the DTCP authentication and key exchange procedure, this arrangement has the merit that the conventional commands can be used as is by merely preparing additional commands for executing the short-distance ID transactions.

[**0147**] In this embodiment, the short-distance ID confirmation is carried out at the beginning part of the processing AKE (authentication and key exchange) protocol. It is also acceptable such that the short-distance ID confirmation is carried out before the processing of AKE protocol, during the processing of the AKE protocol, or at the ending part of the processing AKE protocol.

[**0148**] (Fourth Embodiment)

[**0149**] In the third embodiment, the ID registration was accomplished using a short-distance wireless device. In the fourth embodiment, instead of a short-distance wireless device, an IC card (contact-type IC card), memory card, or other detachable storage device is used to accompli the ID registration. In this explanation, an IC card refers to, for example, a plastic card having a built-in IC and the size of a credit card or a stamp. A memory card refers to, for example, a PCMCIA memory card or such a memory card of the type represented by SD cards and memory sticks. The memory card is not limited to having a card-like shape and can be any memory device capable of being attached and detached, such as a USB key.

[**0150**] **FIG. 20** is a block diagram showing an information communication system in accordance with the fourth embodiment of the present invention. **FIG. 21** is a block diagram showing an example of the internal features of the sending device **2***b* indicated in **FIG. 20** and **FIG. 22** is a block diagram showing an example of the internal features of the receiving device **3***b* shown in **FIG. 20**. The difference with respect to the third embodiment is that instead of registering the ID using a short-distance wireless device, such as an infrared remote control or a wireless tag, the ID

is registered using an IC card or a memory card (hereinafter referred to collectively as "IC card") **5**.

[**0151**] The sending device **2***b* and receiving device **3***b* of this embodiment are different from the sending device **2***a* and receiving device **3***a* of the third embodiment in that they are each provided with an IC card interface unit **31**, **32** and an IC card authentication and key exchange processing unit **33**, **34** (**FIGS. 21 and 22**) instead of a short-distance wireless interface and a short-distance wireless authentication and key exchange processing unit.

[**0152**] The sending device **2***b* and the receiving device **3***b* each communicate with the IC card **5** through their respective IC card interface units **31**, **32** and register the globally unique ID (short-distance ID) transmitted from the IC card **5**. The feature that AV data can only be transmitted between a sending device **2***b* and a receiving device **3***b* in which the same short-distance ID has been registered is the same as the third embodiment.

[**0153**] Each IC card has a short-distance ID. The IC card is set into an IC card throttle (IC card interface unit) of the sending device **2***b* or receiving device **3***b* and the short-distance ID is transmitted. Since the ID transmission cannot take place unless the IC card physically exists in the interface unit, remote registration is believed to be impossible.

[**0154**] **FIG. 23** is a block diagram showing an example of the internal features of an IC card. The IC card shown in **FIG. 23** is provided with the following: an IC card interface unit **81**, an AV device initialization processing unit **82** for initializing the AV device; a short-distance ID recording unit **83** configured to record the short-distance ID of the IC card; an ID registration processing unit **84** configured to control the registration of IDs to the short-distance ID recording unit **83**; a registration counter **85** configured to measure the number times recording of the short-distance ID to the short-distance ID recording unit **83** takes place; a short-distance wireless authentication and key exchange processing unit **86** configured to execute authentication and key exchange between the sending device **2***b* and the receiving device **3***b*.

[**0155**] It is acceptable such that the short-distance ID confirmation is carried out before the processing of AKE protocol, during the processing of the AKE protocol, or at the ending part of the processing AKE protocol.

[**0156**] It is acceptable for the IC card shown in **FIG. 23** to include other functions, such as a memory card function. In such a case, the IC card will be provided with a memory unit and functions for executing other functions.

[**0157**] The short-distance ID registration processing steps, registration sequence, and internal operations of the fourth embodiment are the same as in the third embodiment and the operational effects achieved are the same as with the third embodiment.

[**0158**] (Fifth Embodiment)

[**0159**] In the fourth embodiment, the registration of the IDs is accomplished using an ID card or a memory card. Some digital AV devices are provided with an ID card interface unit and configured such that they cannot be used as an AV device unless the ID card is inserted. One example of such a device is the B-CAS card widely used in Japan for digital broadcasting. The card is provided with a functions for receiving scrambled content from a digital broadcast and descrambling and outputting the content and a function for using an internal ID number (different from the short-distance ID) to confirm the receiver.

[**0160**] Since all digital broadcast devices are provided with such an IC card interface unit, it would be a convenient arrangement to use the IC card interface both for the aforementioned ID card and for an IC card configured to write a short-distance ID in accordance with the embodiment of the present invention. This embodiment is contrived to realize such an arrangement.

[**0161**] **FIG. 24** is a block diagram showing an information communication system in accordance with the fifth embodiment of the present invention. **FIG. 25** is a block diagram showing an example of the internal features of the receiving device **3***c* indicated in **FIG. 24**. The information communication system shown in **FIG. 24** is generally the same as the information communication system shown in **FIG. 20** except that instead of using an ID card (or memory card), the information communication system shown in **FIG. 24** uses a B-CAS card.

[**0162**] The information communication system shown in **FIG. 24** is provided with a sending device **2***c*, a receiving device **3***c*, and a B-CAS card **6** that can be inserted into the sending device **2***c* and the receiving device **3***c*.

[**0163**] In this embodiment, the receiving device **3***c* is a device (e.g., a display) equipped with a digital broadcast receiving function.

[**0164**] As shown in **FIG. 25**, the receiving device **3***c* has a B-CAS card interface unit **35** and a B-CAS card authentication/key exchange processing unit **36**. It is also acceptable for the sending device **2***c* to have a B-CAS card interface unit and a B-CAS card authentication/key exchange processing unit.

[**0165**] The B-CAS card interface unit **35** has the distance required for registering the short-distance ID and is provided with the characteristic functions of B-CAS cards described previously (e.g., scramble processing and receiver confirmation functions).

[**0166**] **FIG. 26** is a block diagram showing an example of the internal features of a B-CAS card **6**. The B-CAS card shown in **FIG. 26** is provided with a B-CAS card interface unit **91**, a B-CAS processing unit **92**, an AV device initialization processing unit **93**, a short-distance wireless authentication and key exchange processing unit **94**, an ID registration processing unit **95**, a registration counter **96**, and a short-distance ID recording unit **97**.

[**0167**] The B-CAS card **6** differs from the ID card described in the fourth embodiment in that it is provided with a B-CAS card interface **91** and a B-CAS processing unit **92** for realizing the characteristic functions of B-CAS cards (e.g., scramble processing and receiver confirmation functions).

[**0168**] The short-distance ID registration processing steps, registration sequence, and internal operations of the fifth embodiment are the same as in the third and fourth embodiments.

[**0169**] In the third to fifth embodiments, AV data can be sent form the sending device **2** to the receiving device **3** only

when the same short-distance wireless device **4** has registered the short-distance ID to both the sending device **2** and the receiving device **3**. Thus, an arrangement can be achieved in which AV data is allowed to be transmitted only to specific sending devices **2** and receiving devices **3** and the copyrights of the AV data can be reliably protected.

[**0170**] By restricting the number of times the short-distance ID can be registered from the short-distance wireless device **4** to the sending device **2** (or receiving device **3**), the illicit acquisition of AV data by means of the illicit use of the short-distance wireless device **4** can be prevented.

[**0171**] Additionally, by setting the time interval during which the short-distance ID must be registered to the sending device **2** and the receiving device **3** to a prescribed amount of time, registration of the short-distance ID to a sending device **2** or receiving device **3** positioned in a remote location can be prevented.

[**0172**] Since the short-distance ID cannot be registered unless the user is close to the sending device **2** (or receiving device **3**) and performs such tasks as operating a button when sending the short-distance ID from the short-distance wireless device **4** to the sending device **2** (or receiving device **3**), an arrangement can be achieved in which the short-distance ID can be registered only to sending devices (or receiving devices **3**) that are close to the user.

[**0173**] Although all of the previously described embodiments concern the transmission of AV data that requires copyright protection, the present invention can also be applied to the transmission of various other types of content (electronic data) that require copyright protection.

[**0174**] The internal features of the sending devices **2**, **2***a*, **2***b*, **2***c* and receiving devices **3**, **3***a*, **3***b*, **3***c* described in **FIG. 2** and other figures are merely examples. It is also accepted for the previously described sending devices to be provided with the functions of a receiving device and/or for the receiving device to be provided with the functions of a sending device.

[**0175**] A transmission control program in accordance with the embodiment of the present invention is a computer program created to achieve the previously described processing and stored in a memory device provided in an information communication device or an information communication system. A processing unit provided in the information communication device or information communication system can read the computer program from the memory device and execute it to accomplish the previously described information communication processing.

[**0176**] As described in detail heretofore, an information communication device in accordance with the present invention does not register the device identification information of another communication device unless the other communication device is connected to a network having a limited range. Consequently, it is possible to limit the transmission destinations to which electronic data can be sent and to provide reliable copyright protection for the electronic data.

[**0177**] The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed is:

1. An information communication device for transmitting electronic data encrypted for the purpose of copyright protection, the device comprising:

an identification information managing unit configured to hold device identification information in connection with other information communication devices acquired through a network;

an ID registration processing unit configured to register the device identification information of another communication device when the other communication device satisfies a predetermined distance condition or when common identification information that is held by both information communication devices is received form a portable device; and an authentication and key exchange processing unit configured to, for the purpose of copyright protection, complete authentication and key exchange process (AKE process) only when another information communication device whose device identification information is registered in the identification information managing unit.

2. The information communication device as claimed in claim 1, further comprising a measuring unit configured to measure if another information communication device satisfies a predetermined distance condition,

wherein the ID registration processing unit is configured to register the device identification information of another information communication device when the measurement result of the measuring unit indicates that the other information communication device satisfies the predetermined distance condition.

3. The information communication device as claimed in claim 2,

wherein the measuring unit is configured to determine if the time duration from when a request for sending information is sent to another information communication device until when the information is received from the other information communication device is within a predetermined amount of time; and

the ID registration processing unit is configured to register the device identification information of another information communication device when the measuring unit determines that said time duration is within the predetermined amount of time.

4. The information communication device as clad in claim 1,

wherein the ID registration processing unit is configured to issue a registration request to another information communication device and register the device identification information of the other information communication device to the identification information managing unit when the other information is recognized to be connected to a network having a prescribed limited range.

5. The information communication device as claimed in claim 4, further comprising an interface unit connected to a local network,

wherein the ID registration processing unit is configured to register the device identification information of the other information communication device to the identification information managing unit when the other information communication device is connected directly to the local network.

6. The information communication device as claimed in claim 4, wherein the ID registration processing unit is configured such that, when the number of device identification information entries registered in the identification information managing unit reaches a predetermined upper limit, further registration of device identification information is denied or a new device identification information entry is registered after deleting the device identification information that was registered the longest ago and/or the device identification information of the registered information communication device with which communication has not been conducted for the longest period of time.

7. The information communication device as claimed in claim 4, further comprising an authentication and key exchange request receiving unit configured to receive authentication and key exchange requests from other information communication devices, wherein the ID registration processing unit is configured to register the device identification information of another information communication device to the identification information managing unit after the authentication and key exchange request receiving unit has received a request for authentication and key exchange.

8. The information communication device as claimed in claim 4, wherein when the device identification information of another information communication device is registered to the identification information managing unit, the communication, for AKE process and/or RTT measuring process, with the other information communication device is accomplished using data link layer frames or physical layer frames.

9. The information communication device as claimed in claim 8, the authentication and key exchange executed by the authentication and key exchange processing unit is accomplished using IP (internet protocol) packets.

10. An information communication system for transmitting electronic data encrypted for the purpose of copyright protection, the system comprising:

a sending device; and

a receiving device configured to receive electronic data encrypted for the purpose of copyright protection and sent from the sending device,

wherein at least one of the sending device and the receiving device comprises:

an identification information managing unit configured to hold device identification information regarding another device acquired through a network;

an ID registration processing unit configured to register the device identification information of another device when the other device is recognized to be connected to a network having a prescribed limited range; and

an authentication and key exchange processing unit configured to complete AE process only when another information communication device whose device identification information is registered in the identification information managing unit.

11. A computer program product comprising a computer useable medium having computer program logic recorded thereon for enabling a processor to control transmission of electronic data encrypted for the purpose of copyright protection, the computer program product comprising:

a sending procedure that enables the processor to send a request packet to another device with which communication is to be conducted;

a receiving procedure that enables the processor to receive a response packet from another device;

a determining procedure that enables the processor to determine if another information communication device is connected to a network having a prescribed limited range based on the received device ID response packet;

a registration procedure that enables the processor to register the device identification information of another information communication device when it is determined that the other information communication device is connected to a network having a prescribed limited range; and

an authentication and key exchange procedure that enables the processor to, for the purpose of copyright protection, complete AKE process only when another information communication device whose device identification information is registered in the registration procedure.

12. An information communication device for transmitting electronic data encrypted for the purpose of copyright protection to another information communication device through a network, the device comprising:

a first interface unit that is connected to the network;

a second interface unit configured to receive unique identification information sent from an identification information sending device that is capable of communicating with the information communication device;

an identification information managing unit configured to hold said unique identification information after it is received;

an identification information registration processing unit configured to register said unique identification information to the identification information managing unit and determine if the unique identification information is registered in another device; and

a first authentication and key exchange processing unit configured to complete authentication of and key exchange with another information communication device for the purpose of copyright protection when it is determined that the unique identification information is registered in the other information communication device.

13. The information communication device as claimed in claim 12, wherein the second interface unit receives electronic data transmitted through the second interface unit include encrypted data.

14. The information communication device as claimed in claim 12, further comprising:

a registration start directive issuing unit configured to issue a directive for starting registration of the unique identification information,

the identification information registration processing unit being configured to execute registration processing when the directive has been issued from registration start directive issuing unit.

15. The information communication device as claimed in claim 12, further comprising a power supply control unit configured to deliver power supply voltage to the second interface unit when the identification information registration processing unit is executing registration processing.

16. The information communication device as claimed in claim 12, further comprising:

a second authentication and key exchange processing unit configured to execute authentication and key exchange with respect to the identification information sending device through the second interface unit,

the identification information registration processing unit configured to execute registration processing with respect to the identification information sending device when the second authentication and key exchange processing unit has successfully completed its authentication and key exchange with respect to the identification information sending device.

17. The information communication device as claimed in claim 16, further comprising:

a measuring unit configured to measure the round trip time between sending a specific packet to the identification information sending device and receiving a corresponding response packet from the identification information sending device,

the second authentication and key exchange processing unit being configured to complete authentication and exchange processing when the round trip time measured by the measuring device is less than a prescribed amount of time.

18. The information communication device as claimed in claim 17, wherein the identification information registration processing unit starts registration processing after the measuring unit has completed measuring the round trip time.

19. The information communication device as claimed in claim 12, further comprising a registration notifying unit configured to notify a user that the identification information registration processing unit has registered the unique identification information.

20. The information communication device as claimed in claim 12, wherein the identification information registration processing unit further comprises an encryption communication processing unit configured to encrypt the unique identification information received form the second interface unit to register the encrypted unique identification information; and

wherein the identification information managing unit further comprises a decryption communication processing unit configured to decrypt the encrypted unique identification information sent from the encryption communication processing unit.

21. The information communication device as claimed in clam **12**, wherein the unique identification information is unique to each identification information sending device.

22. The information communication device as claimed in claim 12, wherein the identification information registration processing unit limits the number of different unique identification information entries that can be registered to a predetermined number.

23. An information communication device for sending identification information to first and second information communication devices configured to transmit electronic data encrypted for copyright protection over a network, the information communication device comprising:

an identification information holding unit configured to hold unique identification information that is required in order for the first and second information communication devices to transmit the electronic data which are required for copyright protection to complete authentication and key exchange process (AKE process); and

a communication unit configured to send the unique identification information to the first and second communication devices.

24. The information communication device as claimed in claim 23, wherein the identification information holding unit limits the number of identification information entries that can be held to a prescribed number.

25. The information communication device as claimed in claim 23, wherein the communication unit is configured to perform wireless communication between the first and second communication devices using infrared rays.

26. The information communication device as claimed in claim 25, further comprising:

a one-way infrared communication unit configured to perform one-way infrared communication,

wherein the aforementioned communication unit is a two-way infrared communication unit.

27. The information communication device as claimed in claim 23, wherein the communication unit is configured to perform wireless communication between the first and second communication devices using electric power generated from received radio waves.

28. The information communication device as claimed in claim 25, wherein the communication device is configured to perform communication between the using a detachable memory device.

29. A data transmission system, comprising:

a sending device connected to a network;

a receiving device configured to receive electronic data sent from the sending device through the network, the electronic data having been encrypted for the purpose of copyright protection;

wherein at least one of the sending device and the receiving device comprises:

a communication unit configured to communicate with an identification information sending device through an interface that is separate from the network and receive unique identification information sent from the identification information sending device;

an identification information registering unit configured to register the received unique identification information;

an identification information registration determining unit configured to determine if the unique identification information is registered in another communication device; and

an authentication and key exchange processing unit configured to complete authentication of and key exchange with another communication device for the purpose of copyright protection only when it is determined that the unique identification information is registered in the other communication device.

30. A computer program product comprising a computer useable medium having a computer program logic recorded thereon for enabling a processor to control the transmission of electronic data between a sending device connected to a network and a receiving device configured to receive electronic data encrypted for the purpose of copyright protection and sent from the sending device through the network, the computer program product comprising:

a receiving procedure that enables the processor to communicate with an identification information sending device through an interface that is separate from the network and receive unique identification information sent from the identification information sending device;

a registration procedure that enables the processor to register the received unique identification information;

a determining procedure that enables the processor to determine if the unique identification information is registered in another communication device; and

an authentication and key exchange procedure that enables the processor to complete authentication of and key exchange with another communication device for the purpose of copyright protection only when it is determined that the unique identification information is registered in the other communication device.

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