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(54) Title of Invention: System for IP-Camera Control and Monitoring in Private IP Environment and Method thereof

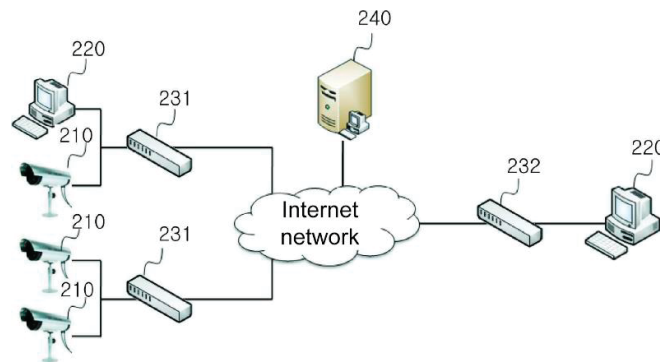
(57) ABSTRACT

The present invention relates to a system and a method for IP-camera control and monitoring in a private internet protocol (IP) environment, more particularly, a system and a method for IP-camera control and monitoring in a private IP environment, in which streaming service skill and packet restoration skill are provided in UDP (User Datagram Protocol) communication environment connected with communication session setup between CCTV management system and IP-camera using UDP hole punching technique.

Accordingly, without port forwarding, a CCTV management system and an IP-camera can be easily connected in a private IP environment.

[Representative Drawing]

FIG. 2



CLAIMS

1. A system for IP-camera control and monitoring in a private IP environment, comprising:

an IP-camera;

a CCTV management system for controlling and monitoring information of the IP-camera;

a first router for transmitting a private IP, a port and a public IP used in the IP-camera to a relay server;

a second router for transmitting a private IP, a port and a public IP used in the CCTV management system to the relay server; and

a relay server that collects the information of the IP-camera and the information of the CCTV management system received from the first router and the second router, respectively, to maintain a UDP connection,

wherein the IP-camera includes: a session maintenance module that attempts to connect with the relay server and maintains a session connection;

a UDP management module for receiving a hole punching request from the CCTV management system;

a hole punching module for connecting a session with the CCTV management system according to the hole punching request; and

a streaming service module that generates and transmits a packet of video image requested from the CCTV management system and transmitted to the UDP after connecting the session.

2. The system according to claim 1, wherein the streaming service module in the IP-camera automatically adjusts a size of the video packet according to a network bandwidth and network conditions.

3. The system according to claim 1, wherein the relay server includes;

an information management module that manages information necessary for session connection from the IP-camera and CCTV management system;

a session maintenance module that maintains a session and generates a keep alive signal for a session connection between the IP camera and the CCTV management system;

a UDP management module that manages a UDP port for hole punching; and

a hole punching management module that issues a hole punching command through the UDP port and manages session information connected after hole punching.

4. The system according to claim 1, wherein the CCTV management system includes:

a streaming receiving module that receives and inspects the video packet transmitted from the IP camera, and then, requests retransmission of a missing and lost packet and reproduces the video image;

a session maintenance module that creates a session when hole punching is required according to a user's selection;

a UDP management module that manages a private IP, a port and a public IP used in the IP-camera for hole punching; and

a hole punching module that connects the session with the IP camera according to the hole punching request.

5. A method for IP-camera control and monitoring in a private IP environment, comprising:

a first step in that a CCTV management system and an IP-camera create a UDP socket for attempting hole punching and transmit session information thereof to a relay server;

a second step in that the IP-camera maintains session connection with the relay server;

a third step in that the CCTV management system requests access information on an IP-camera to be accessed to the relay server;

a fourth step in that the relay server notifies the CCTV management system and the IP-camera of access target information;

a fifth step in that the CCTV management system attempts hole punching on an IP-camera;

a sixth step in that the IP-camera notifies the relay server of a hole punching result when the CCTV management system succeeds in accessing;

a seventh step in that the relay server notifies the CCTV management system of the hole punching result; and

an eighth step in that the CCTV management system controls and monitors a streaming received through the IP-camera.

6. The method according to claim 5, wherein, if the hole punching fails in the fifth step, a UDP communication session is relayed for communication between the IP-camera and the CCTV management system.

7. The method according to claim 5, further comprising: requesting the restoration and retransmission of the packet by the CCTV management system in the eighth step when missing the packet.

8. The method according to claim 5, further comprising: automatically adjusting a size of the video packet by the IP-camera in the eighth step according to a network bandwidth and network conditions thereof to thus transmit and receive images without damaging the same.

DESCRIPTION

Technical Field

[0001] The present invention relates to a system and a method for IP-camera control and monitoring in a private IP environment.

Background of Art

[0002] The first security device using CCTV cameras had to use coaxial cable wiring for security surveillance CCTV cameras installed in various buildings and exteriors, DVRs as a device for monitoring on screens and video-recording the same, and monitoring screens.

[0003] For this reason, the installation cost substantially equal to the purchase price of CCTV camera and DVR is required, and the installation work is also sometimes affected by installation location and environment.

[0004] The technology developed to solve such technical problems is an IP-camera that operates on an IP network instead of a conventional closed-circuit television (CCTV). In the case of the conventional CCTV, unlike NTSC type TV signal transmission through a coaxial cable, IP-cameras transfer images using the existing LAN or wireless Wi-Fi network.

[0005] FIG. 1 illustrates a conventional CCTV monitoring system using a DVR.

[0006] As shown in FIG. 1, the conventional CCTV monitoring system consists of a CCTV camera 110, DVR 120, a monitor unit 140 and a management unit 130.

[0007] The CCTV camera 110 captures images of a specific target using a video camera module.

[0008] The DVR 120 receives and stores images of a specific target photographed by the CCTV camera 110.

[0009] The monitor unit 140 can divide an input image stored in DVR for a plurality of CCTV cameras 110 and then output the same, so as to output the input image through the DVR 120 in which the image captured by the CCTV camera 110 is stored.

[0010] When the management unit 130 is far away from the CCTV camera, it may access the DVR 120 through the Internet to retrieve and manage the image stored in the DVR 120.

[0011] The conventional CCTV may receive streaming service through TCP/IP port forwarding setup if a private IP is present in a router environment, however, in this case, a user cannot receive smooth service when the router occurs malfunctions or is reset, hence causing a problem in that CCTV management cost is increased due to port forwarding request to an expert.

[0012] Further, there is also a problem in that moving or additional installation of CCTVs is cumbersome and can be installed only with the help of a skilled expert.

Detailed Description of Invention

Technical Problem to be Solved

- [0013] Therefore, the technical problem to be solved by the present invention is to transmit and receive images of IP-camera in a router environment provided with a private IP as an external CCTV management system, using UDP hole punching, which is a P2P transmission technique of a large live streaming data between a plurality of users and a plurality of servers in a private IP environment.

Technical Solution

- [0014] A system for IP-camera control and monitoring in a private IP environment according to an aspect of the present invention may include: an IP camera; a CCTV management system for controlling and monitoring information of the IP-camera; a first router for transmitting a private IP, a port and a public IP used in the IP-camera to a relay server; a second router for transmitting a private IP, a port and a public IP used in the CCTV management system to the relay server; and a relay server that collects the information of the IP-camera and the information of the CCTV management system received from the first router and the second router, respectively, to maintain a UDP connection,
- [0015] wherein the IP-camera includes: a session maintenance module that attempts to connect with the relay server and maintains a session connection;
- [0016] a UDP management module for receiving a hole punching request from the CCTV management system;
- [0017] a hole punching module for connecting a session with the CCTV management system according to the hole punching request; and
- [0018] a streaming service module that generates and transmits a packet of video image requested from the CCTV management system and transmitted to the UDP after connecting the session.
- [0019] With regard to the system for IP-camera control and monitoring in a private IP environment according to the above aspect, the relay server may include; an information management module that manages information necessary for session connection from the IP-camera and CCTV management system;
- [0020] a session maintenance module that maintains a session and generates a keep alive signal for a session connection between the IP camera and the CCTV management system;
- [0021] a UDP management module that manages a UDP port for hole punching; and
- [0022] a hole punching management module that issues a hole punching command through the UDP port and manages session information connected after hole punching.
- [0023] With regard to the system for IP-camera control and monitoring in a private IP environment according to the above aspect, the CCTV management system may include: a streaming receiving module that receives and inspects the video packet transmitted from the IP camera, and then, requests retransmission of a missing and lost packet and reproduces the video image;
- [0024] a session maintenance module that creates a session when hole punching is required according to a user's selection;
- [0025] a UDP management module that manages a private IP, a port and a public IP used in the IP-camera for hole punching; and
- [0026] a hole punching module that connects the session with the IP camera according to the hole punching request.
- [0027] A method for IP-camera control and monitoring in a private IP environment according to another aspect of the present invention may include: a first step in that a CCTV management system and an IP-camera create a UDP socket for attempting hole punching and transmit session information thereof to a relay server;
- [0028] a second step in that the IP-camera maintains session connection with the relay server;
- [0029] a third step in that the CCTV management system requests access information on an IP-camera to be accessed to the relay server;
- [0030] a fourth step in that the relay server notifies the CCTV management system and the IP-camera of access target information;
- [0031] a fifth step in that the CCTV management system attempts hole punching on an IP-camera;

- [0032] a sixth step in that the IP-camera notifies the relay server of a hole punching result when the CCTV management system succeeds in accessing;
- [0033] a seventh step in that the relay server notifies the CCTV management system of the hole punching result; and
- [0034] an eighth step in that the CCTV management system controls and monitors a streaming received through the IP-camera.
- [0035] With regard to the method for IP-camera control and monitoring in a private IP environment according to the above aspect, if the hole punching fails in the sixth step, a UDP communication session may be relayed for communication between the IP-camera and the CCTV management system.
- [0036] With regard to the method for IP-camera control and monitoring in a private IP environment according to the above aspect, the method may further include: requesting the restoration and retransmission of the packet by the CCTV management system in the eighth step when missing the packet.

Effects of Invention

- [0037] According to such aspects of the present invention as described above,
- [0038] when clients exist in a router area having a private IP, the present invention enables communication with one another without setting the router.
- [0039] Further, the present invention does not proceed port forwarding to the router, therefore, can be easily used by a user who does not know communication.
- [0040] Further, the present invention is advantageous in that CCTV is easily installed in any area where the network is available, regardless of user environments, since the CCTV can be managed through ASP service; and CCTV is effectively controlled and managed regardless of the number of CCTVs.
- [0041] In addition, the present invention has effects of reducing the management cost by CCTV operation and management through a control system.

Brief Description of Drawings

- [0042] FIG. 1 is a diagram illustrating a conventional CCTV monitoring system using a DVR.
- FIG. 2 is a diagram illustrating a system for IP-camera control and monitoring in a private IP environment according to the present invention.
- FIG. 3 is a diagram illustrating an IP camera of the system for IP-camera control and monitoring in a private IP environment according to the present invention.
- FIG. 4 is a diagram illustrating a relay server of the system for IP-camera control and monitoring in a private IP environment according to the present invention.
- FIG. 5 is a diagram illustrating a CCTV management system of the system for IP-camera control and monitoring in a private IP environment according to the present invention.
- FIG. 6 is a flowchart illustrating a method for IP-camera control and monitoring in a private IP environment according to the present invention.
- FIG. 7 is a diagram illustrating an internal flow of the relay server in the system for IP-camera control and monitoring in a private IP environment according to the present invention.

Preferred Embodiment for Carrying Out Invention

- [0043] Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings.
- [0044] FIG. 2 is a diagram illustrating a system for IP-camera control and monitoring in a private IP environment according to the present invention; FIG. 3 is a diagram illustrating an IP camera of the system for IP-camera control and monitoring in a private IP environment according to the present invention; FIG. 4 is a diagram illustrating a relay server of the system for IP-camera control and monitoring in a private IP environment according to the present invention; and FIG. 5 is a diagram illustrating a CCTV management system of the system for IP-camera control and monitoring in a private IP environment according to the present invention.

- [0045] As shown in FIGS. 2 to 5, the system for IP-camera control and monitoring in a private Internet protocol environment according to an embodiment of the present invention may consist of an IP-camera 210, a first router 231, a CCTV management system 220, a second router 232, and a relay server 240.
- [0046] Herein, the IP-camera 210 may include a session maintenance module 211, a UDP management module 212, a hole punching module 213, and a streaming service module 214.
- [0047] In practice, the main function of the IP-camera 210 is to take surrounding images and to transfer the captured images through variation of information such as compression.
- [0048] In an embodiment of the present invention, in order to explain a system and a method for controlling and monitoring an image of an IP-camera in a private IP having captured images from the outside, details of image processing by the IP-camera will be omitted.
- [0049] The session maintenance module 211 of the IP-camera 210 attempts to connect with the relay server to maintain the session connection.
- [0050] The UDP management module 212 of the IP-camera 210 may receive a hole punching request from the CCTV management system.
- [0051] The hole punching module 213 of the IP-camera 210 may connect the session with the CCTV management system according to the reception of the hole punching request of the CCTV management system.
- [0052] The streaming service module 214 of the IP-camera 210 may receive a request from the CCTV management system after connecting the session with the CCTV management system, and then, generate and transmit a packet of video image transmitted by UDP.
- [0053] At this time, the streaming service module 214 of the IP-camera 210 may automatically adjust a size of the video packet according to a network bandwidth and network conditions.
- [0054] Herein, the CCTV management system 220 may consist of a session maintenance module 221, a UDP management module 222, a hole punching module 223, and a streaming receiving module 224.
- [0055] The session maintenance module 221 of the CCTV management system 220 may generate a session at a time when hole punching is required according to a user's selection.
- [0056] The UDP management module 222 of the CCTV management system 220 may manage a private IP, a port and a public IP used in the IP-camera for hole punching.
- [0057] The hole punching module 223 of the CCTV management system 220 may connect the session with the IP-camera according to the hole punching request.
- [0058] The streaming receiving module 224 of the CCTV management system 220 may receive and inspect the video packet transmitted from the IP-camera, and then, request again retransmission of missing and lost packet and reproduce the video image.
- [0059] At this time, the first router 231 and the second router 232 are each address translator of a communication network that converts a private IP address into a public IP address, and the first router 231 and the second router 232 are substantially the same to each other, wherein the first router 231 may transfer a private IP, a port and a public IP used in the IP-camera to the relay server, while the second router 232 may transfer a private IP, a port and a public IP used in the CCTV management system 220 to the relay server.
- [0060] Herein, the relay server 240 may consist of an information management module 244, a session maintenance module 241, a UDP management module 242, and a hole punching management module 243.
- [0061] The information management module 244 of the relay server 240 may manage information necessary for session connection from the IP-camera and CCTV management system.
- [0062] The session maintenance module 241 of the relay server 240 may maintain a session for session connection of the IP-camera and CCTV management system and generate Keep Alive signals.
- [0063] The UDP management module 242 of the relay server 240 may manage the UDP ports of the IP-camera and CCTV management system for hole punching.

- [0064] The hole punching management module 243 of the relay server 240 may issue a hole punching command through the UDP port, and manage session information connected after hole punching.
- [0065] FIG. 6 is a flowchart illustrating a method for IP-camera control and monitoring in a private IP environment according to the present invention; and FIG. 7 is a diagram illustrating an internal flow of the relay server in the system for IP-camera control and monitoring in a private IP environment according to the present invention.
- [0066] As shown in FIG. 6 and FIG. 7, the method for IP-camera control and monitoring in a private IP environment according to an embodiment of the present invention may include, firstly, creating a UDP socket for attempting hole punching by a CCTV management system 220 and an IP-camera 210, and then, transmitting session information thereof to a relay server 240 (S610).
- [0067] In this regard, through the routers (231, 232) that convert the CCTV management system 220 and the IP-camera 210 to the public IP, respectively, the information on the private IP, port and public IP of the CCTV management system 220 and IP-camera 210 may be transferred to the relay server.
- [0068] Next, the IP-camera 210 may maintain the session connection with the relay server 240 (S620).
- [0069] Herein, the IP-camera 210 may be connected to the relay server 240 through the session maintenance module 211, so that the session connection is always maintained.
- [0070] Further, the relay server 240 may periodically generate Keep Alive messages for maintaining session connection, thereby maintaining the session connection with the IP-camera 210.
- [0071] Subsequently, the CCTV management system may request access information on the IP-camera to be accessed to the relay server (S630).
- [0072] At this time, the CCTV management system 220 may request the relay server 240 in order to create a session through the session maintenance module 221 when the hole punching is required according to the user's selection.
- [0073] Following this, the relay server 240 may notify the CCTV management system 220 an the IP-camera 210 of access target information (S640).
- [0074] The operation flow of the relay server is as follows.
- [0075] The session maintenance module 241 of the relay server 240 may allocate a port for hole punching from the IP-camera 210 or the CCTV management system 220 connected to the relay server 240 and then generate periodically Keep alive messages to maintain the same, thereby maintaining the session.
- [0076] The UDP management module 242 may receive a hole punching request from the connected IP-camera 210 or the CCTV management system 220, and then, create a UDP receiving thread and transmit a request in relation to hole punching.
- [0077] The hole punching management module 243 may receive information on the IP-camera 210 or the CCTV management system 220 from the UDP receiving thread, transfer the information to an information management module 244. Then, the information management module 244 may store the information on the IP-camera 210 or the CCTV management system 220 to a database 245 or receive the same through a request of the hole punching management module 243.
- [0078] Subsequently, the CCTV management system 220 may attempt hole punching to the IP-camera 210 (S650).
- [0079] In this case, if the hole punching fails, a UDP communication session is relayed for communication between the IP-camera 210 and the CCTV management system 220.
- [0080] Next, when the CCTV management system 220 succeeds in accessing, the IP-camera 210 may notify the relay server 240 of a hole punching result (S660).
- [0081] Then, the relay server 240 may notify the CCTV management system 220 of the hole punching result (S670).
- [0082] Finally, the CCTV management system 220 may control and monitor a streaming received through the IP-camera (S680).
- [0083] At this time, the CCTV management system 220 may make a request for restoration and retransmission of the packet when the packet is missing.

[0084] Further, the IP-camera 210 may automatically adjust a size of a video packet according to a network bandwidth and network conditions so as to transmit and receive images without damaging the same.

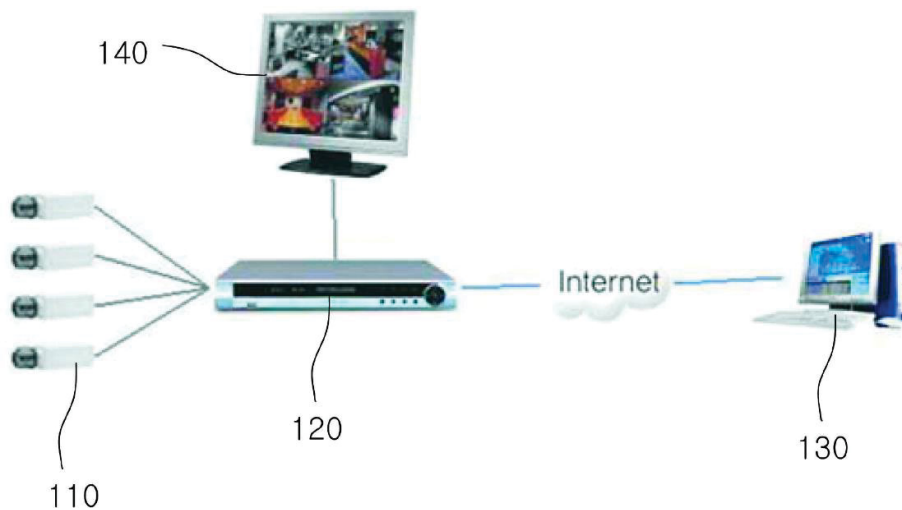
[0085] As described above, the preferred embodiments of the present invention have been described in the detailed description of the invention. However, it is of course to be understood by those skilled in the art, in which the present invention pertains, that various modifications are possible without departing from the scope of the present invention. Accordingly, the scope of the present invention is not limited to the disclosed exemplary embodiments, instead, should be defined by equivalents as well as the claims to be described later.

Description of Reference Numerals

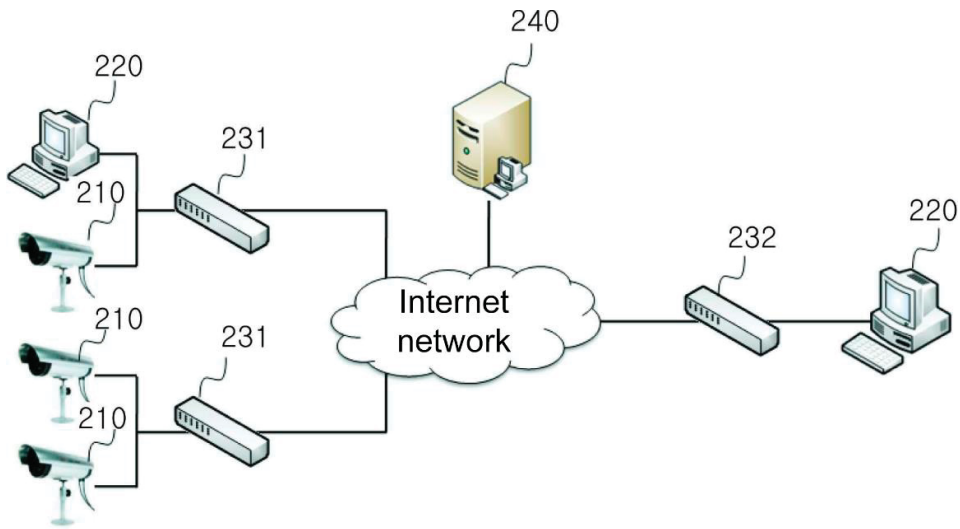
[0086]	210: IP-camera	211, 221, 241: Session maintenance module
	212, 222, 242: UDP management module	213, 223: Hole punching module
	214: Streaming service module	220: CCTV management system
	224: Streaming receiving module	231: First router
	232: Second router	240: Relay server
	243: Hole punching management module	244: Information management module
	245: Database	

Drawings

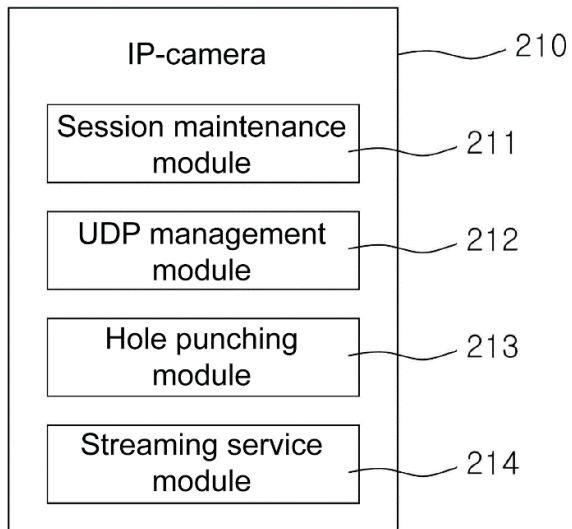
[FIG. 1]



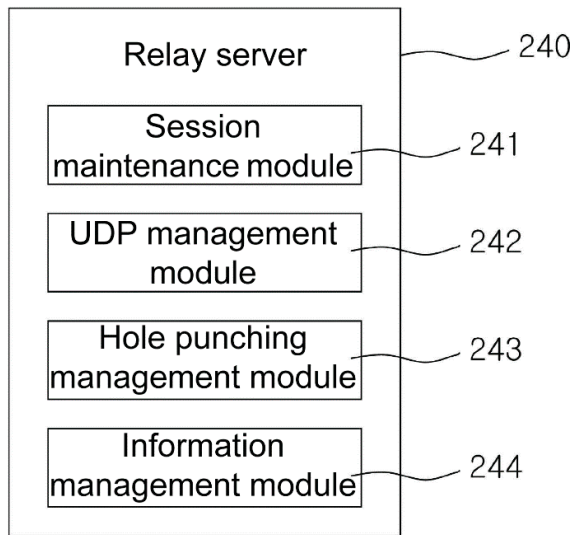
[FIG. 2]



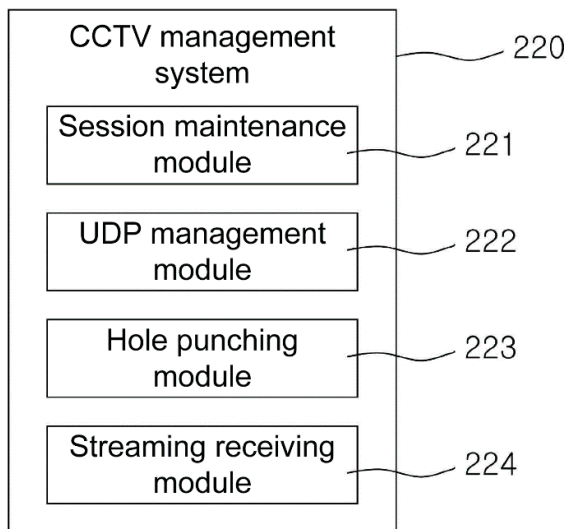
[FIG. 3]



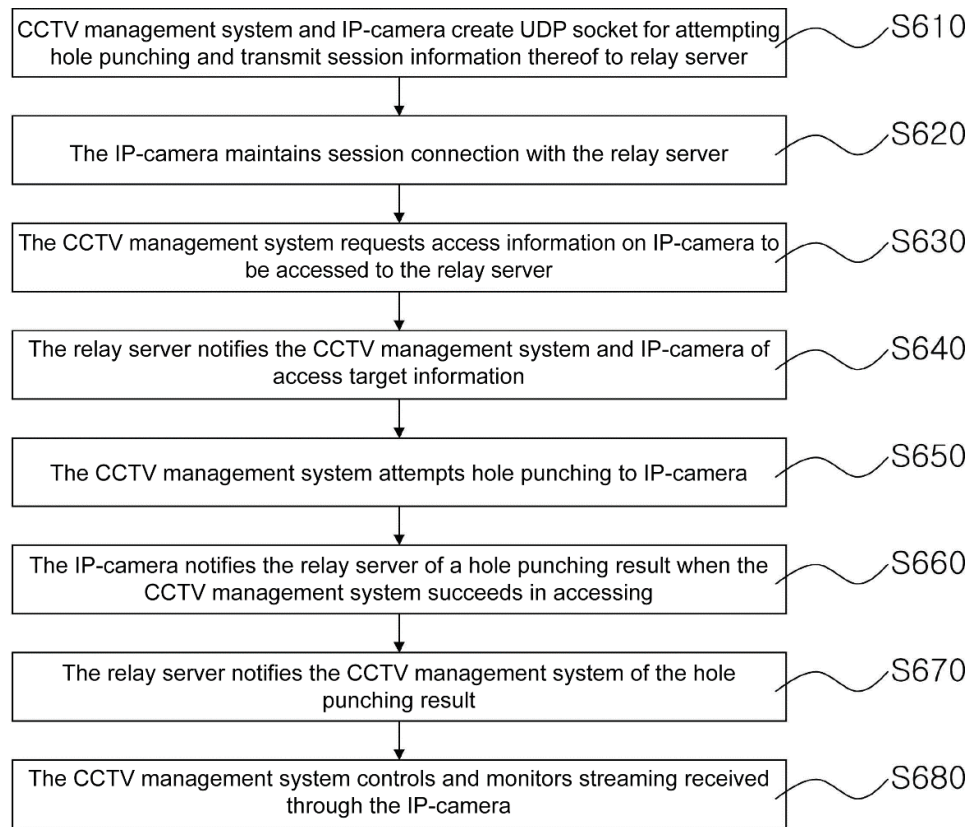
[FIG. 4]



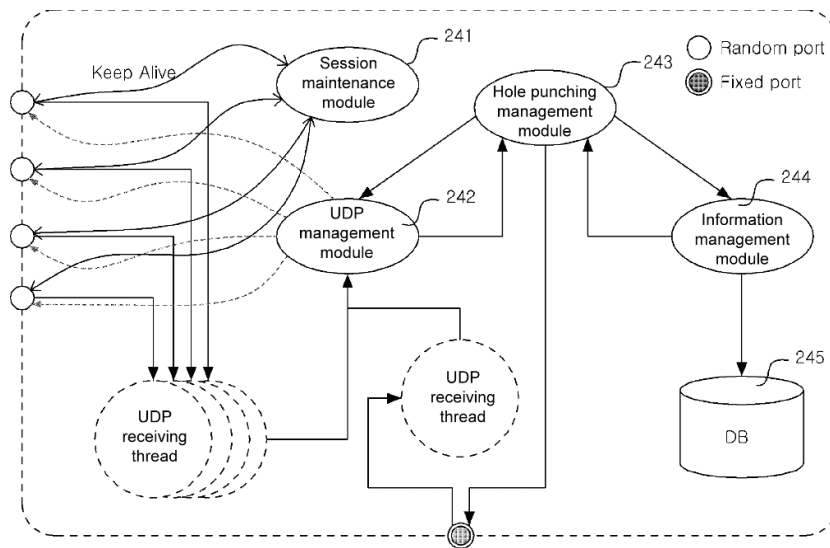
[FIG. 5]



[FIG. 6]



[FIG. 7]





TRANSLATOR'S CERTIFICATE OF TRANSLATION

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Questel Project Number: FRPC2340039UT-LZ_Q
Date: January 8, 2024

To whom it may concern:

I, [OH, Kyung-Ah], a translator fluent in the Korean and English languages, on behalf of Questel, do solemnly and sincerely declare that the following is, to the best of my knowledge and belief, a true and correct translation of the document(s) listed below in a form that best reflects the intention and meaning of the original text.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

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Signed this 8th day of January, 2024

[translator signature]

Signature

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