INTERNET-BASED HOME AUTOMATION SERVER AND CONTROL METHOD THEREOF

User Interface Module

Central Control Module

Detection Sensor Module

Home Automation Module

Central Processor

Flash Memory

SDRAM

Power Supply

Security Control Module

Network Gateway Module

(57) Abstract: The present invention relates to a remote-controlled home automation system, and more particularly to a home automation system capable of controlling household electric appliances and facilities by using a computer connected to the Internet and cellular phone, and generating a fire alarm or a burglar alarm as of abnormality. The home automation server in accordance with the present invention, supports a function of remote-controlling household electric appliances and facilities as well as a function of network gateway which helps household computers to access the Internet while preventing illegal access from outside.
INTERNET-BASED HOME AUTOMATION SERVER AND CONTROL METHOD THEREOF

5 Field of the Invention

The present invention relates to a home automation system, and more particularly, to an internet-based home automation system capable of controlling home appliances and facilities, generating alarm when an invasion, a fire, a gas leakage are detected, to thereby implement a device control, a crime prevention and an accident prevention in a various manner.

15 Description of the Prior Art

Generally, a home automation refers to a technology for automatically controlling home appliances such as electric and electronic devices and facilities by using an electronic technology.

Conventionally, a home automation control device refers to a video door phone via which a host can talk on the line while watching a visitor through the video door phone. In addition to the video door phone function, a security control functions such as sensing undesirable
situations such as gas leakage, occurrence of fire and invasion of an unauthorized person, generating an alarm against those situations and automatically reporting to a guardhouse or a security company are added. Recently, thanks to the development of an information and communication technology, various home appliances and facilities such as lighting apparatus, cooling and heating facilities, various gauges, electric devices are connected to each other via a communication network. Therefore, a new concept of an integrated home automation system that consolidates the home appliances and facilities by using the network and accomplishes a remote control of the home facilities has been highlighted.

From a technological point of view, key factors in implementing the integrated home automation system include home network technology capable of minimizing a wiring as well as an engineering and manufacturing technology for an internet-based home automation controller.

There may be a wired communication method using a power line or a telephone line, or a wireless communication method using a so-called bluetooth or wireless LAN. These well-known communication methods are advantageous since they exclude a necessity of dedicated wiring in implementing the home automation network. Further, those communication methods are readily available with the rapid development of those communication methods. Standards of a variety of
applications of the communications methods, however, are yet to be established.

Meanwhile, the home automation control device connecting various home appliances and facilities should be a server-level computer. Though a personal computer may be used instead of the server-level computer thanks to a drop in price and enhancement in performance, a dedicated imbedded system using the server-level computer is more desirous since it should perform an integrated control of the appliances and facilities while being active for 24 hours. Though the server-level computer can provide various functionalities, it is expensive and large for home applications. Therefore, efforts have been made to implement a compact and versatile home automation control device e.g., in such form of a set-top box for TV set.

Summary of the Invention

An object of the present invention is to provide an internet-based home automation system capable of controlling home appliances and facilities, generating alarm when an invasion, a fire, a gas leakage are detected, to thereby implement a device control, a crime prevention and an accident prevention in a various manner.

According to an aspect of the present invention, there is provided An internet-based home automation system, having
conventional door phone functions such as opening a front
door after confirming a visitor's image through a video
display when a visitor rings a doorbell and automatically
generating an alarming sound and reporting to a guard post
or a security company when detecting a gas leakage, an
occurrence of fire, a break-in of an unauthorized person,
the internet-based home automation server, characterized in
that the internet-based home automation server has functions
of: a PLC (Power Line Communication) interface for
connecting and controlling home appliances and facilities; a
bluetooth interface for facilitating communication via a
mobile terminal, controlling a remote controller and
facilitating an Internet connection by using a portable
computer; a network address expansion, an automatic address
assignment and a network security; an automation capable of
controlling at a remote place or monitoring home appliances
and facilities by using an internet-accessible computer,
mobile terminal or wireless communication terminal; and
manipulating the home appliances and facilities by using a
touch screen or a bluetooth terminal; and a server providing
a network gateway functions for enabling home computers to
connect to the internet and ensuring security from an access
from outside.

According to another aspect of the present invention,
there is provided A method for control an internet-based
home automation system, the internet-based home automation
system having conventional door phone functions such as opening a front door after confirming a visitor’s image through a video display when a visitor rings a doorbell and automatically generating an alarming sound and reporting to a guard post or a security company when detecting a gas leakage, an occurrence of fire, a break-in of an unauthorized person, the internet-based home automation server, characterized in that the method comprises the steps of: (a) opening a front door after confirming a visitor’s image on a door phone when the visitor rings a bell; (b) changing modes from a guard mode to a security mode after transmitting an alarming message to a guard post, a security company or a designated mobile phone when a security detection sensor operates in the guard mode; (c) establishing a firewall and automatically assigning network addresses to home computers; (d) operating a web server program after performing a security check and authentication when the home automation system is accessed via a mobile phone or an Internet; (e) receiving a home automation control command from the internet, the mobile phone, a touch screen or a bluetooth terminal; and (f) executing the home automation control command.

25 Brief Description of the Drawings
The above and other objects and features of the present invention will become apparent from the following description of a preferred embodiment given in conjunction with the accompanying drawings, in which:

5 Fig. 1 is a block diagram of a home automation server in accordance with a preferred embodiment of the present invention;

Fig. 2 describes a constitution of the user interface module 110 in accordance with the present invention;

10 Fig. 3 illustrates a constitution of the security control module 120;

Fig. 4 provides a constitution of the network gateway module 130;

Fig. 5 depicts a constitution of the home automation module 140;

Fig. 6 provides a constitution of the detection sensor module 150;

Fig. 7 offers a software structure of the home automation server in accordance with the present invention;

20 and

Fig. 8 is a flow diagram of a control method of the home automation server in accordance with the present invention.
Detailed Description of the Invention

Hereinafter, a preferred embodiment of the present invention will be described in detail with reference to the accompanying drawings.

Fig. 1 is a block diagram of a home automation server in accordance with a preferred embodiment of the present invention.

The home automation server in accordance with the present invention comprises a central control module 100, a user interface module 110, a security control module 120, a network gateway module 130, a home automation module 140 and a detection sensor module 150.

The central control module 100 conducts functions related to dealing with input signal data and output signal data from/to the home automation server according to a prescribed control method. The central control module 100 includes a central processor 102, a non-volatile flash memory 104 for storing programs and data, a SDRAM (Synchronous Dynamic Random Access Memory) 106 for temporarily storing data, and a power supply 108. Conventional home automation systems are not capable of providing various information communication environments. But communication technologies and electronic technologies have been rapidly developed to provide, e.g., a high-speed information network, a wireless Internet and a stable
network. Accordingly, various devices using or connected to those networks can be integrally controlled to finally provide the integrated home automation server employing the central control module 100.

The user interface module 110, having a manipulation panel for allowing the user to hear audio sound or to see video image, transmits audio and video data to the central control module 100. More details relative to the user interface module 110 will be provided with Fig. 2.

The security control module 120 generates an alarming sound or lights an alarming lamp in conformity with a signal from the central control module 100 when an abnormal situation occurs on the system. The abnormal situation refers to a situation when invasion of an unauthorized person, occurrence of fire or gas leakage occurs. The security control module 120 will be explained in detail with Fig. 3.

The network gateway module 130 has functions of automatically assigning network addresses to internet-accessible home computers, controlling network access by bluetooth terminals, providing a firewall and executing an authentication when an outside computer tries access to the home automation system. In accordance with the present invention, various network access devices such as a computer, a mobile telephone, and a bluetooth terminal can access the home network server whenever and wherever
available only through rather a simple security check and authentication process. The network gateway module 130 will be explained in detail with Fig. 4.

The home automation module 140 supervises and controls the home appliances and facilities. The home automation module 140 will be explained in detail with Fig. 5.

The detection sensor module 150 detects such abnormalities as a door open, a window open, a gas leakage and an occurrence of fire, and send a signal indicating the abnormalities to the central control module 100. The detection sensor module 150 will be explained in detail with Fig. 6.

Fig. 2 describes a constitution of the user interface module 110 in accordance with the present invention.

A display unit 200 provides images of a menu table for use in manipulating the system or exhibits a visitor’s image shot at a front door. The user can monitor all the events occurring at the system through the display unit 200, and accordingly, may take appropriate measures against the events.

A password unit 210 compares a currently input password with a previously stored password that the user has set, and releases a guard mode when the two passwords match to each other, provided the user wants to release the guard mode.
A dialing unit 220, in response to a control signal from the central control module 100, performs dialing to a receiving telephone corresponding to a stored telephone number, and transmits a message via the network gateway module 130.

An audio input/output unit 230 apprises the user, when there is a visit, of the visit of a visitor and allows the user to talk on the line with the visitor, or outputs a voice message of the user stored in the flash memory 104 of the central control module 100 to the visitor when the user is not home.

A video input unit 240 converts an image about the visitor or about a specific area into video signal, transmits the video signal to the central control module 100. Consequently, the user can recognize the visitor through the display module 200 prior to opening a front door, and moreover, monitor real-time image or stored image from a remote place by using a computer or a mobile phone.

A touch screen unit 250 is attached on top of the display unit 200 for use in receiving commands from the user. The coordinate values corresponding to the point where the user touched a finger on the touch screen unit 250 are transferred to and temporarily stored in a memory buffer of the central control module 100, and accordingly, the central control module 100 controls the operation of the system by translating a control command corresponding
to the coordinate values.

A telephone unit 260 has a function similar to a general telephone, but herein, puts a speaker phone (not shown) or a bluetooth phone (not shown) through a PSTN (Public Switched Telephone Network) or an Internet telephone network.

Fig. 3 illustrates a constitution of the security control module 120.

An image signal transmitting unit 300 receives an image signal shot at the video input unit 240 from the central control module 100 and transmits the image signal to a guard post 360, a security company 370 or the user's mobile phone through the dialing unit 220.

A command output unit 310, according to a command from a detection signal processing unit 610 to be described later, receives command signals from the central control module 100 and transmits the command signals to security devices connected to the command signal output unit 310. The security devices includes an alarming sound output unit 320, an automatic door control unit 330, a voice output unit 340, an alarming lamp lighting unit 350, and the like. The automatic door control unit 330 is designed so that the user can directly control open/close of a door from indoor and the user can remotely control the open/close of the door from outdoor as well by accessing the home automation server via the Internet or the mobile phone. If a security
sensor at the detection sensor module 150 is in active operation, the guard post 360 and the security company 370 receive an emergency signal having an audio or video format transmitted from the home automation server that connects itself to systems of the guard post 360 or the security company 370. Upon receiving the emergency signal, the guard post 360 or the security company 370 controls the home automation server on a remote basis or directly dispatch persons, to cope with the emergency situation.

Fig. 4 provides a constitution of the network gateway module 130.

A hub A 400 allows the user to access the central control module 100 with, e.g., a computer and control the system on a remote basis when the user is out of the house. The present invention provides a firewall for the situation in order to ensure a system security when the user tries to access the system from outside the house. The firewall, one of network elements to protect an inside network, refers to hardware or software or both for the purpose of breaking inflow of harmful information from outside of a network and protecting inner information property from illegal intrusion from outside of the network. The firewall cuts off illegal access from outside by analyzing an IP (Internet Protocol) address and a port number of a system that tries to gain access to a system for each service such as FTP and Telnet, or analyzing a header included in a
packet.

A hub B 410 connects the central control module 100 and a number of home computers 430, 440. The hub B 410 allows each home computer 430, 440 to be assigned a network address. The central control module 100 can accommodate a maximum of 256 number of computers by exploiting software such as a DHCP (Dynamic Host Configuration Protocol, "DHCP" hereinafter) and a NAT (network Access Translation, "NAT" hereinafter). The central control module 100 can accommodate a wireless LAN terminal such as a PDA (Personal Digital Assistant) or a web pad by employing an AP (Access Point, "AP" hereinafter).

A bluetooth AP 420 provides functions of connecting a bluetooth terminal 450 to the central control module 100 so that the central control module 100 can control by using the bluetooth terminal 450. Currently, in order to connect to the Internet by using a wireless mobile terminal, there are needed a terminal having a data communication function, a notebook computer and a cable for connecting these two. On the other hand, the bluetooth technology has removed such necessity of employing the cable. The bluetooth technology enables various electronic devices to transmit and receive data with very high speed but without any cable connecting them. The bluetooth uses frequency band of ISM (Industrial Scientific Medical) or 2.4 gigahertz worldwide, and therefore, the quality of data transmission exhibits
high in spite of some obstacles. Developments in bluetooth Technologies is still under progress and it is highlighted as one of standard technologies regarding a next generation near distance wireless networking. The bluetooth exploited in the present invention is the class 1, which has a safe data transmission range of about 100 meters and has around 1 mbps.

Meanwhile, the bluetooth technology employed in the present invention is applicable to the notebook computer or the web pad mentioned above as well as the bluetooth terminal. That is, the internet is accessible by using the bluetooth AP 420 without an additional LAN card since a bluetooth dongle that is about 10 cm length for being inserted into a USB (Universal Serial Port) connector, has been developed.

Fig. 5 depicts a constitution of the home automation module 140.

A PLC (Power Line Communication, “PLC” hereinafter) based on a CEBus (Consumer Electronics Bus) is exploited for the control of the home appliances and facilities in accordance with a preferred embodiment of the present invention. Herein, the PLC is a method for data communication through power line cables simply by connecting to a utility outlet at home. The CEBus is a communications standard for in home networks developed by the Electronics Industry Association (EIA) and the Consumer
Electronics Manufacturers Association. The CEBus has advantages that it is strong for noises since a multiple bandwidths are used at the same time. According to the CEBus, a transmitter modulates utility signal of 50 to 60 Hz with high frequency signals of 100 to 400 kHz based on a spread spectrum method and sends the modulated signal and a receiver separates the modulated signal into low and high frequency components by using a filter. The home automation server is connected to a PLC master unit 510 via a UART (Universal Asynchronous Receiver Transmitter) interface unit 500 and in turn connected to a 220 V AC power line through a PLC interface unit 520. Parts that directly controls a device under control such as a remote metering unit 530, a gas blocking unit 540, a light control unit 550, a ventilation control unit 560, a white home appliance unit 570 and an electric-powered curtain unit 580 are connected to the home automation server through the PLC interface 520 for interchange data with the home automation server and performs in conformity with home automation control commands.

Fig. 6 provides a constitution of the detection sensor module 150.

A detection signal handling unit 610 receives detection signals from a gas leakage sensor 630, fire monitoring sensor unit 640, crime prevention zone 1, 2, 3, 4 650 to 680 via a signal input unit 610 and transmits the
detection signals to the central control module 100 via a host interface unit 600. Sensors employed in the detection sensor module 150 are not limited to the sensors mentioned above but may include more various sensors.

Fig. 7 offers a software structure of the home automation server in accordance with the present invention.

The software of the home automation server in accordance with the present invention basically utilizes a method that multiple processes and threads share data through a shared memory 740. It also has a modified network kernel program to facilitate a network gateway functions. A web server process 700 exchanges data through the shared memory 740 with other processes, by inter-working with a CGI (Common gateway Interface) program 710 and a Java Applet server program 720. A user interface process 730 offers functions of converting the coordinate values of the touch screen unit 250 into the control data or displaying operational status of the home automation server on the display unit 200. A central control process 750 performing most important functions in the home automation server includes a home automation thread 752 responsible for individual control of the home appliances and facilities by using the PLC, a detection sensor thread 756 which is security function software for the security control module 120, a detection sensor thread 756 for performing input of each detection sensor, and a bluetooth thread 758 used for
control command transmission of each terminal, video monitoring and telephone functions. The network kernel program 760 includes therein a firewall 762 and NAT program 768 for security and expansion of the network, respectively. The network kernel program operates in conjunction with a DHCP server process 770 for automatically assigning network address of the home computers.

Fig. 8 is a flow diagram of a control method of the home automation server in accordance with the present invention.

A visitor rings a bell at the front door phone 270 and the image of the visitor appears on the display 200 or the mobile phone, and then, the host opens the door after talking with the visitor (S800). If the guard mode is set and a security detection sensor of the detection sensor module 150 operates, the system issues the alarming message to a designated mobile terminal, the guard post 360 and the security company 370, and then, enters into a security mode (S810). The home automation server automatically assigns network addresses to the home computers where the home computers are used, and operates the firewall 762 and an invasion protection program 764 (S820). If the user attempts access to the home automation server from a remote place, the user is allowed to operate the web server program after passing the security and authentication process (S830). The home automation control commands are
transmitted from the user interface module 110 of such as the internet, the mobile terminal, the touch screen or the bluetooth terminal, the home automation server receives the home automation control commands (S840), and finally executes the home automation control commands with regard to the remote metering, the gas blocking, the light control, the ventilation control, the home appliance control and the remote image monitoring (S850).
Consequently, the user can monitor current status of the home appliances or facilities by using various control terminals and control the home appliances and facilities, as he wants without regard to whether he is at home or outside.

As described above, the present invention has the advantages that installation and control of the home automation system are easily implemented by integrating detecting devices detecting an illegal intrusion an unauthorized person, occurrence of fire, gas leakage and control devices controlling the home appliances and facilities.

In addition, in terms of control methods, not only a direct control by using the touch screen on the monitor at home and the bluetooth terminal, but also a remote control via the Internet or the mobile terminal are applicable for controlling the home appliances and facilities.

Meanwhile, the home automation system also functions as a home gateway having security means such as the
firewall and invasion prevention by assigning network addresses to the home computers equipped with the LAN card or the bluetooth dongle.

Consequently, a more evolved home automation system can be achieved since, in accordance with the present invention, control over the home appliances and facilities is possible without regard to place and time, and the home computers can be simply and safely connected to each other.

While the invention has been shown and described with respect to the preferred embodiments, it will be understood by the skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the invention as defined in the following claims.
What is claimed is:

1. An internet-based home automation system, having conventional door phone functions such as opening a front door after confirming a visitor's image through a video display when a visitor rings a doorbell and automatically generating an alarming sound and reporting to a guard post or a security company when detecting a gas leakage, an occurrence of fire, a break-in of an unauthorized person, the internet-based home automation server, characterized in that the internet-based home automation server has functions of:

   a PLC (Power Line Communication) interface for connecting and controlling home appliances and facilities;

   a bluetooth interface for facilitating communication via a mobile terminal, controlling a remote controller and facilitating an Internet connection by using a portable computer;

   a network address expansion, an automatic address assignment and a network security;

   an automation capable of controlling at a remote place or monitoring home appliances and facilities by using an internet-accessible computer, mobile terminal or wireless communication terminal; and manipulating the home appliances and facilities by using a touch screen or a bluetooth terminal; and
a server providing a network gateway functions for enabling home computers to connect to the internet and ensuring security from an access from outside.

2. The internet-based home automation system of claim 1, wherein the server includes:

- a central control module for controlling input/output signals to and from the server and for storing a program and data for use in operation of the server;
- a user interface module, equipped with a control panel for use in control of the server, for displaying audio signal and video signal received from the central control module;
- a security control module for activating a security function when an abnormal status is detected;
- a network gateway module for connecting a broadband Ethernet to a home Ethernet or bluetooth wireless network;
- a home automation module, connected to the central control module, for controlling operations of the home appliances and facilities; and
- a detection sensor module for detecting security status including a gas leakage, a fire occurrence, an illegal intrusion and detecting operation status of the home appliances and facilities.

3. The internet-based home automation system of claim 2, wherein the user interface module includes:
a display unit for displaying a menu table for use in manipulating the home appliances and facilities and for displaying image data generated in the internet home automation system;

a password unit for comparing a currently input password with a past password that the user has set in order to determine whether to open a lock or not;

a dialing unit performing dialing to a receiving telephone corresponding to a stored telephone number according to a control signal from the central control module;

an audio input/output unit provides communication between a host and a visitor via a door phone;

a touch screen unit, attached on top of the display unit for receiving commands from the user; and

a telephone unit putting a speakerphone or a bluetooth phone through a PSTN (Public Switched Telephone Network) or an Internet telephone network.

4. The internet-based home automation system of claim 2, wherein the security control module includes:

an image signal transmission unit for receiving an image signal from the central control module and transmitting the image signal to a guard post, a security company; and

a command signal output unit 310, receiving command
signals from the central control module and transmitting the command signals to security devices, wherein the security devices include an alarming sound output unit, automatic door control unit, voice output unit and alarming lamp lighting unit.

5. The internet-based home automation system of claim 2, wherein the network gateway module includes:
   a first hub, responsible for network security function, for connecting a computer outside of home and the central control module;
   a second hub for automatically assigning network addresses to home computers; and
   a bluetooth access point for enabling communications between the central control module and bluetooth terminals.

6. The internet-based home automation system of claim 2, wherein the home automation module includes:
   a UART(Universal Asynchronous Receiver Transmitter) interface unit, a PLC master unit and a PLC interface unit, for receiving control signal from the central control module, the control signal corresponding to data generated from the home appliances and facilities and a user and transmitting the control signal to the home appliances and facilities by using a power line communication based on a CEBus(consumer Electronic Bus).
7. The internet-based home automation system of claim 2, wherein the detection sensor module includes:
   a signal input unit, a detection signal handling unit and a host interface unit, for receiving detection signal from a gas leakage sensor, a fire sensor and a intrusion sensor and transmitting the detection signal to the central control module.

8. The internet-based home automation system of claim 2, wherein the Internet home automation system includes software that multiple processes and threads shares data through a shared memory, wherein the software includes:
   a web server process for inter-working with a CGI program and a Java applet to perform connection to a mobile phone and the Internet;
   a user interface process, having functions of a video display, a touch screen and a telephone, for exchanging data with the web server process through the shared memory;
   a central control process, having a home automation thread, a security control thread, a detection sensor thread and a bluetooth thread, for exchanging data with the web server program;
   a network kernel program, having functions of a firewall, an invasion prevention and network address
conversion, for exchanging data with the web server process; and

a DHCP (Dynamic Host Configuration Protocol) for exchanging data with the network kernel program and automatically assigning network addresses to home computers and terminals.

9. A method for control an internet-based home automation system, the internet-based home automation system having conventional door phone functions such as opening a front door after confirming a visitor's image through a video display when a visitor rings a doorbell and automatically generating an alarming sound and reporting to a guard post or a security company when detecting a gas leakage, an occurrence of fire, a break-in of an unauthorized person, the internet-based home automation server, characterized in that the method comprises the steps of:

(a) opening a front door after confirming a visitor's image on a door phone when the visitor rings a bell;

(b) changing modes from a guard mode to a security mode after transmitting an alarming message to a guard post, a security company or a designated mobile phone when a security detection sensor operates in the guard mode;

(c) establishing a firewall and automatically assigning network addresses to home computers;

(d) operating a web server program after performing a
security check and authentication when the home automation
system is accessed via a mobile phone or an Internet;
(e) receiving a home automation control command from
the internet, the mobile phone, a touch screen or a
bluetooth terminal; and
(f) executing the home automation control command.
FIG. 3

- Security Control Module 300
  - Video Signal Transmitting Unit 320
  - Alarming Sound Output Unit 330
  - Automatic Door Control Unit 330
  - Command Output Unit 310
  - Alarming Lamp Lighting Unit 340
  - Voice Output Unit 340

- Central Control Module 100
- Guard Post 360
- Security Company 370
Start

Open Door after talking with a visitor when doorbell rings

Enter into security mode after sending alarming signal to mobile phone and guard post when detection sensor operates in guard mode

Establish firewall and automatically assign network addresses to home computers

Operate web server program upon security check and authentication when there is an access from outside

Receive home automation control commands from internet, mobile phone, touch screen, bluetooth terminal

Perform home automation control command in connection with remote metering, gas leakage blocking, light control, ventilation control, appliance control, remote video monitoring

End

FIG. 8
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

**IPC7** H04L 12/28

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04L, H04M, G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Patents and Applications for Inventions since 1975

Korean Utility Models and Applications for Utility Models since 1975

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

IEL (IEEE/IEE Electronic Library)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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<td>Y</td>
<td>JP8-32707 (Japan Telecom Technology Corp.) 2. February 1996: abstract, claims, figures</td>
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Further documents are listed in the continuation of Box C.

[X] See patent family annex.

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

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"P" document published prior to the International filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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