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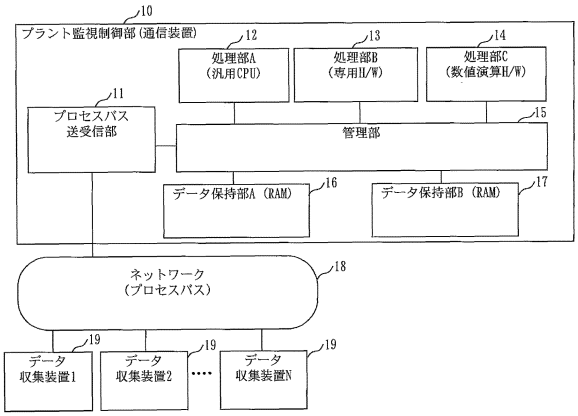
(56) Documents Cited:
JP200557373 A
JP10290207 A

(58) Field of Search:
INT CL **H04L, H04M**

(54) Title of the Invention: **Communication device**
Abstract Title: **Communication device**

(57) In this plant monitoring control device (10) which receives communication packets including data collected at a plurality of data collection devices (19) from a network (process bus) (18), apart from a processing unit (A12) which performs logic computation processing and a processing unit (C14) which performs arithmetic computation processing, a processing unit (B13) which is dedicated hardware for performing data extraction processing for extracting specific data from received communication packets is provided. The processing unit (B13) performs data extraction processing at high speed, and therefore, it is possible to streamline data extraction processing so that packet reception, data extraction, and computation become possible at short time cycles.

[図1]



10 PLANT MONITORING CONTROL UNIT (COMMUNICATION DEVICE)
11 PROCESS BUS TRANSCEIVING UNIT
12 PROCESSING UNIT A (GENERAL-PURPOSE CPU)
13 PROCESSING UNIT B (DEDICATED HARDWARE)
14 PROCESSING UNIT C (ARITHMETIC OPERATION HARDWARE)
15 MANAGEMENT UNIT
16 DATA HOLDING UNIT A (RAM)
17 DATA HOLDING UNIT B (RAM)
18 NETWORK (PROCESS BUS)
19 DATA COLLECTION DEVICE

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Fig. 1

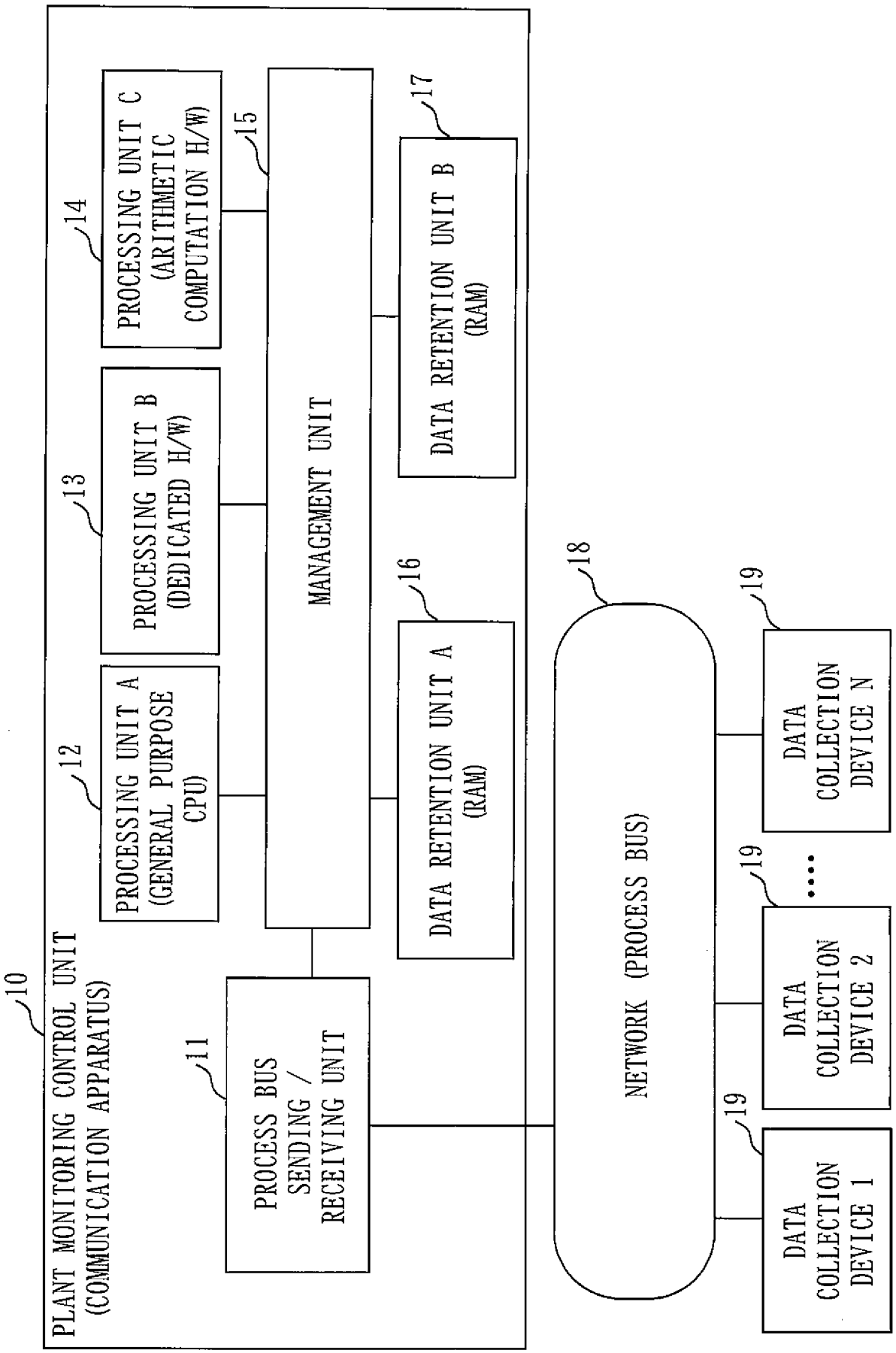

10
PLANT MONITORING CONTROL UNIT
(COMMUNICATION APPARATUS)
11
PROCESS BUS
SENDING /
RECEIVING UNIT
12
PROCESSING UNIT A
(GENERAL PURPOSE
CPU)
13
PROCESSING UNIT B
(DEDICATED H/W)
14
PROCESSING UNIT C
(ARITHMETIC
COMPUTATION H/W)
15
MANAGEMENT UNIT
16
DATA RETENTION UNIT A
(RAM)
17
DATA RETENTION UNIT B
(RAM)
18
NETWORK (PROCESS BUS)
19
DATA
COLLECTION
DEVICE 1
19
DATA
COLLECTION
DEVICE 2
....
19
DATA
COLLECTION
DEVICE N

Fig. 2

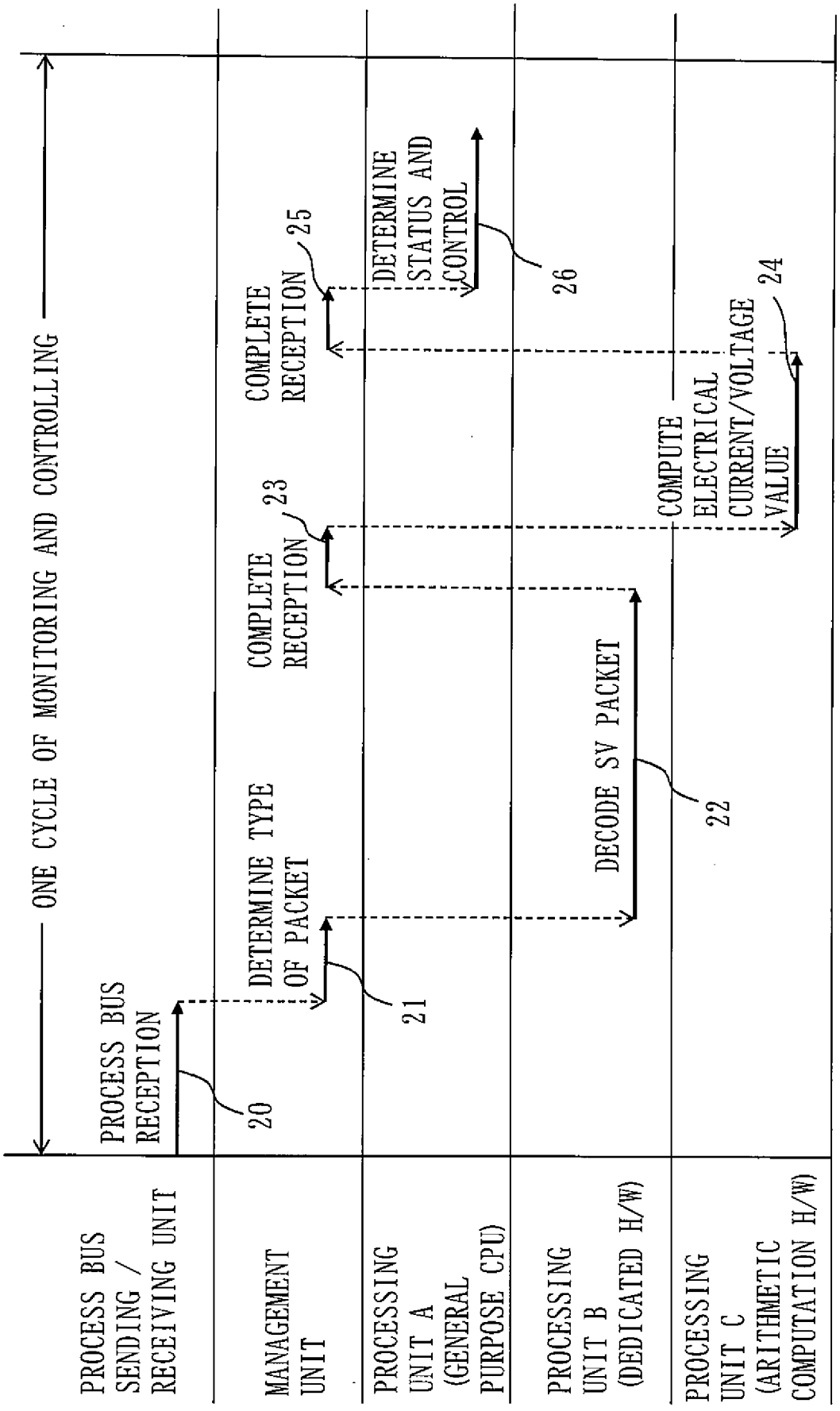

ONE CYCLE OF MONITORING AND CONTROLLING
PROCESS BUS SENDING / RECEIVING UNIT
MANAGEMENT UNIT
PROCESSING UNIT A (GENERAL PURPOSE CPU)
PROCESSING UNIT B (DEDICATED H/W)
PROCESSING UNIT C (ARITHMETIC COMPUTATION H/W)
PROCESS BUS RECEPTION
20
DETERMINE TYPE OF PACKET
21
COMPLETE RECEPTION
23
DECODE SV PACKET
22
COMPUTE ELECTRICAL CURRENT/VOLTAGE VALUE
24
COMPLETE RECEPTION
25
DETERMINE STATUS AND CONTROL
26

Fig. 3

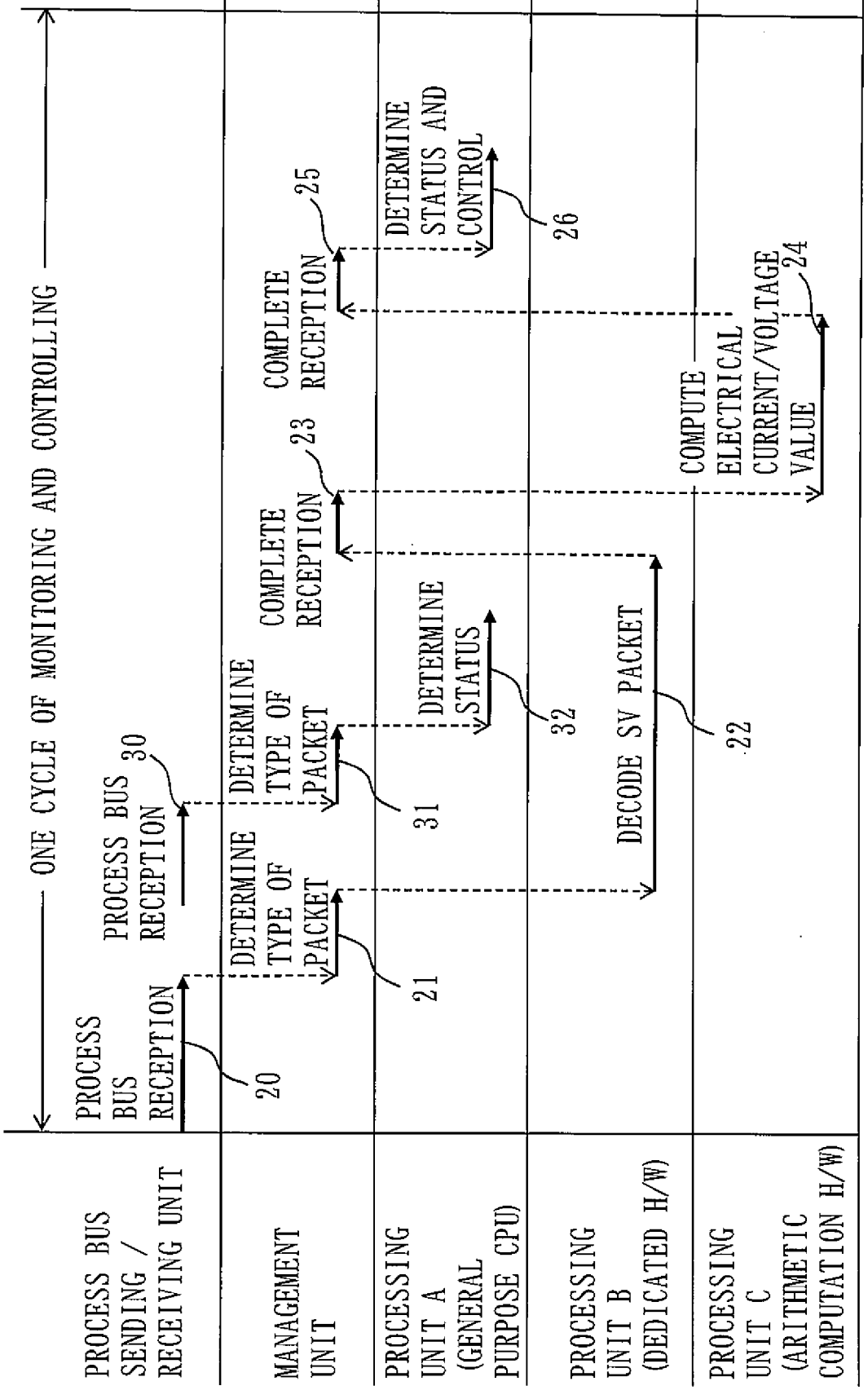

ONE CYCLE OF MONITORING AND CONTROLLING
PROCESS BUS SENDING / RECEIVING UNIT
MANAGEMENT UNIT
PROCESSING UNIT A (GENERAL PURPOSE CPU)
PROCESSING UNIT B (DEDICATED H/W)
PROCESSING UNIT C (ARITHMETIC COMPUTATION H/W)
PROCESS BUS RECEPTION
20
PROCESS BUS RECEPTION
30
DETERMINE TYPE OF PACKET
DETERMINE TYPE OF PACKET
21
COMPLETE RECEPTION
23
DETERMINE STATUS
31
STATUS
32
DECODE SV PACKET
22
COMPUTE ELECTRICAL CURRENT/VOLTAGE VALUE
24
COMPLETE RECEPTION
25
DETERMINE STATUS AND CONTROL
26

Fig. 4

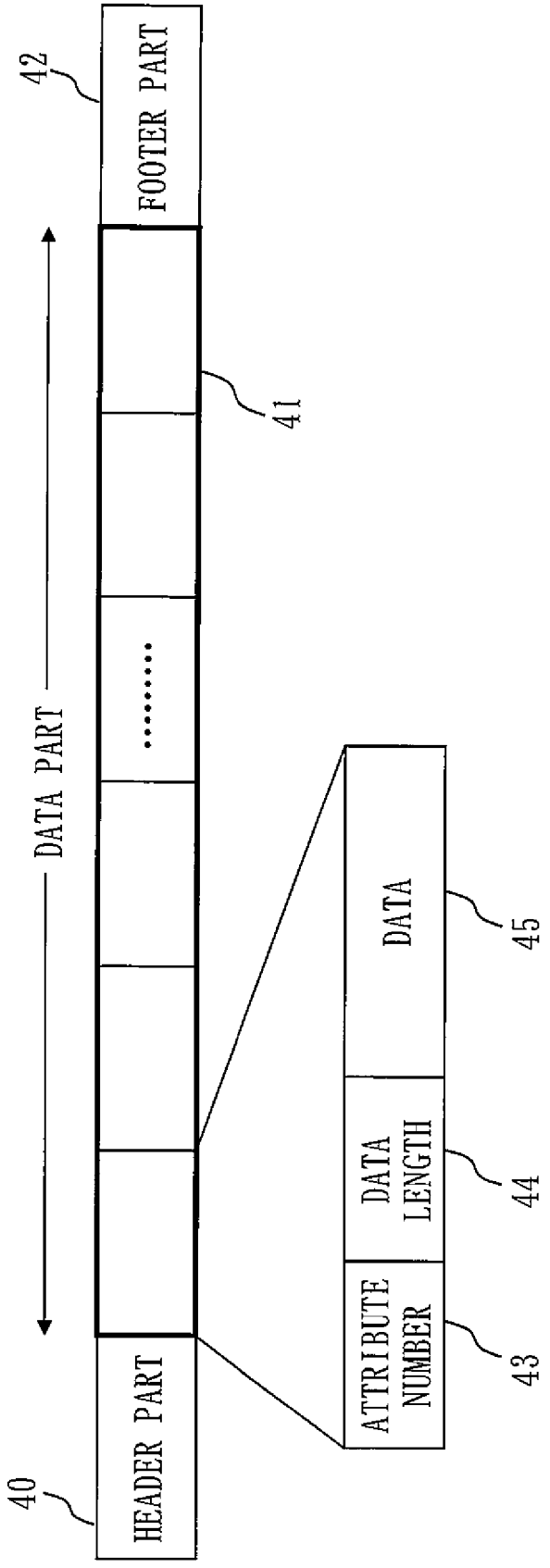

40
HEADER PART
DATA PART
41
42
FOOTER PART
.....
ATTRIBUTE NUMBER
43
DATA LENGTH
44
DATA
45

Fig. 5

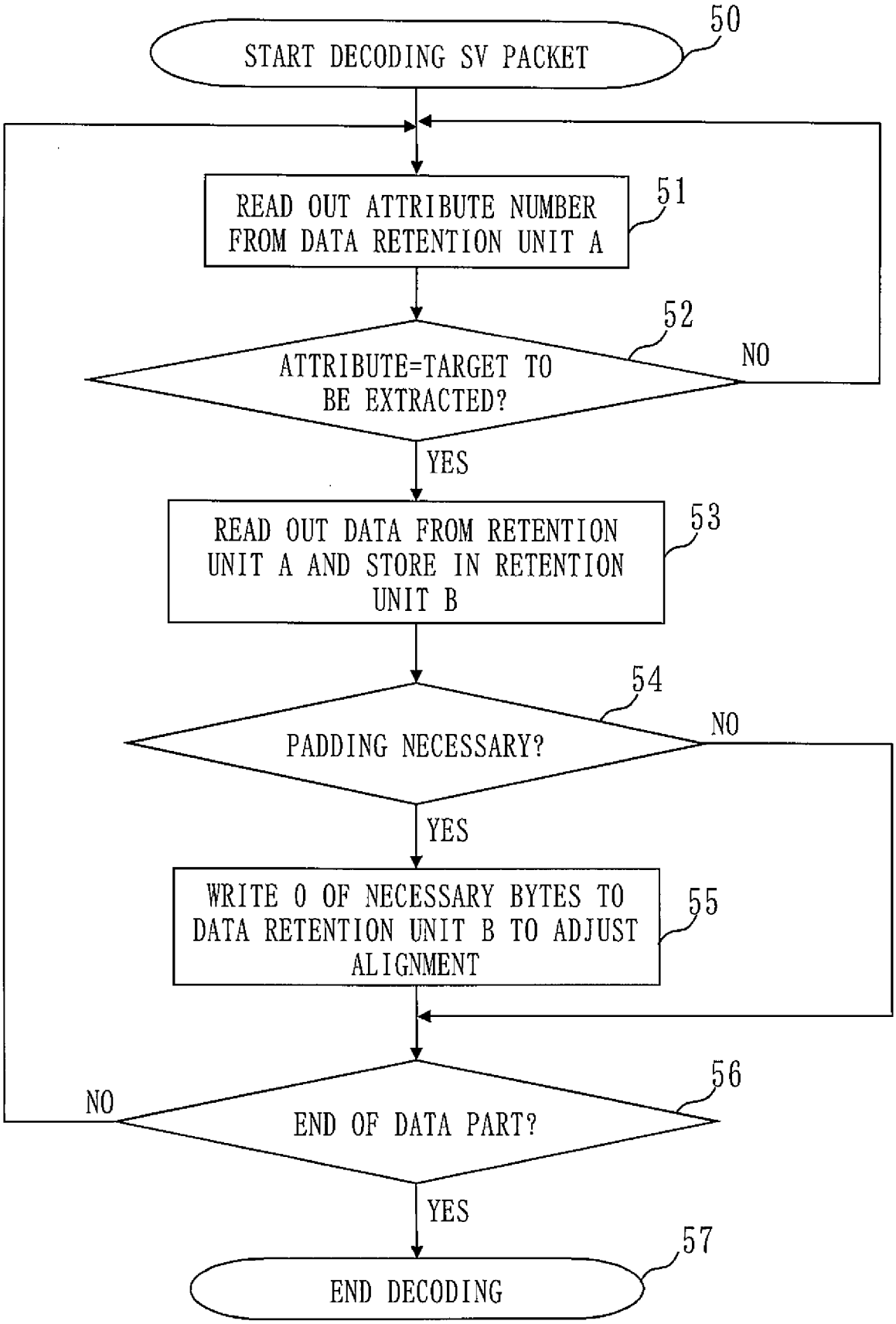

START DECODING SV PACKET
50
READ OUT ATTRIBUTE NUMBER FROM DATA RETENTION UNIT A
51
ATTRIBUTE=TARGET TO BE EXTRACTED?
52
NO
YES
READ OUT DATA FROM RETENTION UNIT A AND STORE IN RETENTION UNIT B
53
PADDING NECESSARY?
54
NO
YES
WRITE 0 OF NECESSARY BYTES TO DATA RETENTION UNIT B TO ADJUST ALIGNMENT
55
END OF DATA PART?
56
NO
YES
END DECODING
57

Fig. 6

58

DECODE PROGRAMMING REGISTER	
ATTRIBUTE NUMBER	NUMBER OF PADDING
80	2
82	0
87	0

Fig. 7

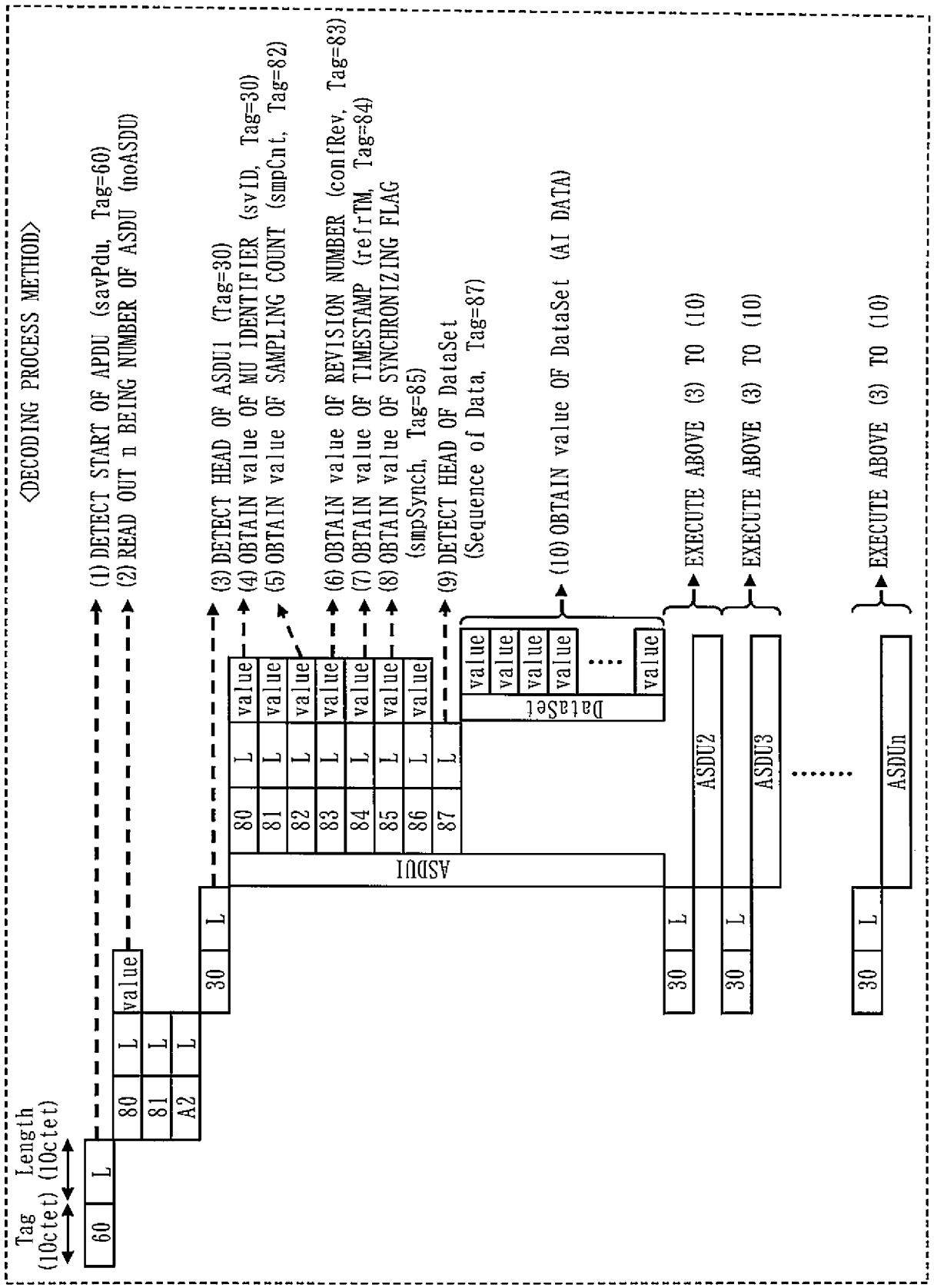
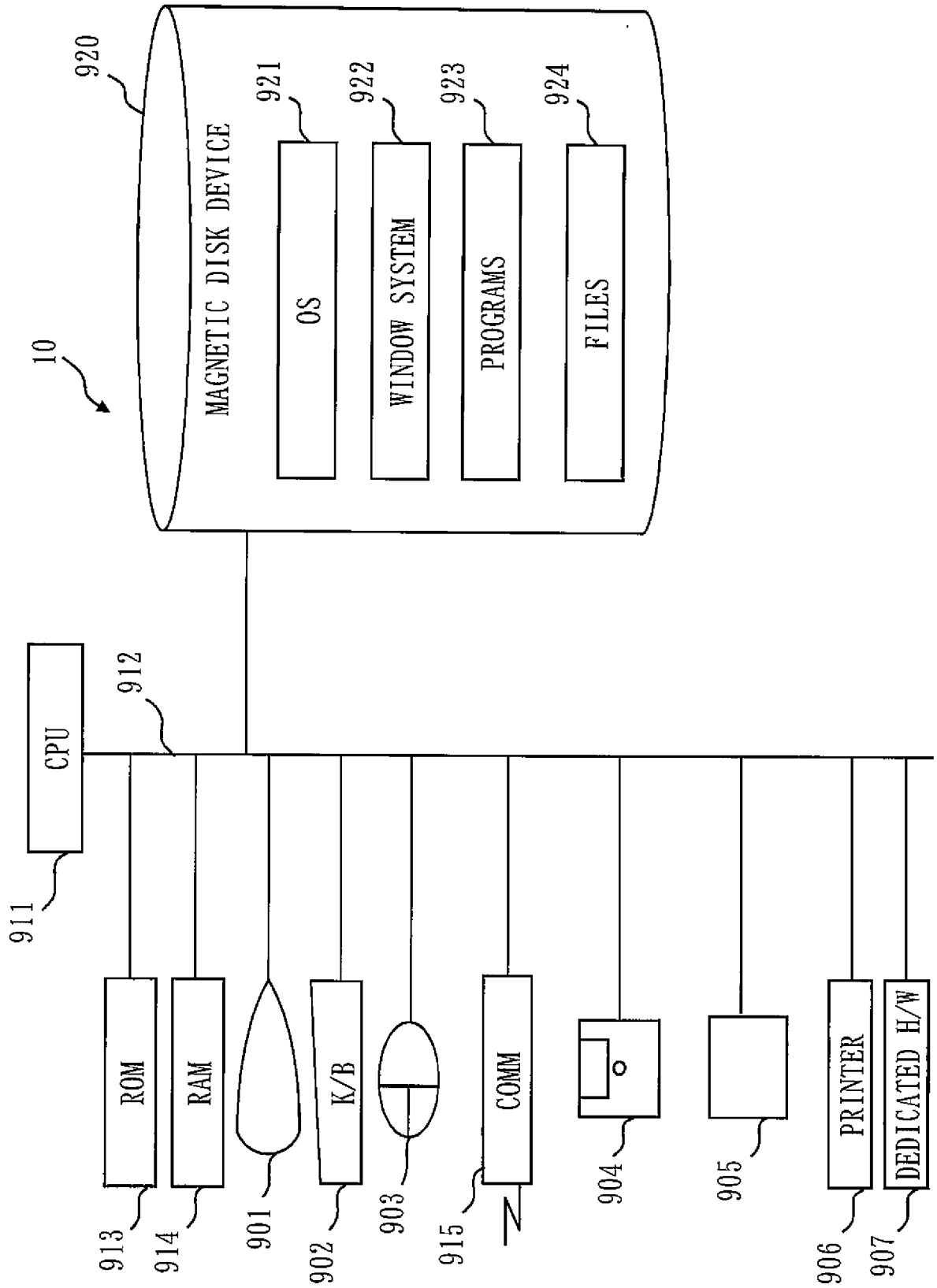

<DECODING PROCESS METHOD>
Tag
Length (10ctet) (10ctet)
60 L
80 L value
81 L
A2 L
30 L
(1) DETECT START OF APDU (savPdu, Tag=60)
(2) READ OUT n BEING NUMBER OF ASDU (noASDU)
(3) DETECT HEAD OF ASDU1 (Tag=30)
(4) OBTAIN value OF MU IDENTIFIER (svID, Tag=30)
(5) OBTAIN value OF SAMPLING COUNT (smpCnt, Tag=82)
(6) OBTAIN value OF REVISION NUMBER (confRev, Tag=83)
(7) OBTAIN value OF TIMESTAMP (refrTM, Tag=84)
(8) OBTAIN value OF SYNCHRONIZING FLAG (smpSynch, Tag=85)
(9) DETECT HEAD OF DataSet (Sequence of Data, Tag=87)
(10) OBTAIN value OF DataSet (AI DATA)
ASDU1
80 L value
81 L value
82 L value
83 L value
84 L value
85 L value
86 L value
87 L
DataSet
value value value value ..... value
30 L ASDU2
30 L ASDU3
30 L ASDUn
EXECUTE ABOVE (3) TO (10)
EXECUTE ABOVE (3) TO (10)
EXECUTE ABOVE (3) TO (10)

Fig. 8


10
920
MAGNETIC DISK DEVICE
921
OS
922
WINDOW SYSTEM
923
PROGRAMS
924
FILES
911
CPU
912
913
ROM
914
RAM
901
902
K/B
903
915
COMM
904
905
906
PRINTER
907
DEDICATED H/W

Description

Title of Invention: A Communication Apparatus

Technical Field

[0001] The present invention relates to a technology which improves efficiency in a process of extracting data from a communication packet received.

Background Art

[0002] For example, in monitoring and controlling of an electrical substation, a monitoring control device (a protection relay device) collects and computes an electrical amount (electrical current, voltage) of a power transmission line or a busbar. When an abnormality is detected, the monitoring control device controls a GIS (Gas Insulated Switch-Gear, a gas insulation switchgear device) to block flowing-in of an abnormal electrical current. Thereby, spreading of an accident to a power system is prevented.

The monitoring control device includes a CPU (Central Processing Unit), a RAM (Random Access Memory), a ROM (Read Only Memory), a communication interface, etc. The CPU executes the processing of the electrical amount and abnormality detection.

Further, in recent years, a scheme in which a data collection device (a merging unit) collects the electrical amount (electrical current, voltage) of the power transmission line or the busbar and sends the electrical amount to the monitoring control device (the protection relay device) by a network (a process bus) communication is being standardized.

As a technology related to the present invention, there is a technology described in Patent Literature 1.

Citation List

Patent Literature

[0003] Patent Literature 1: JP 11-341706

Summary of Invention

Technical Problem

[0004] An interval at which a monitoring control device receives and computes data is short, such as a cycle of several tens of microseconds to a several hundreds of microseconds. When a plurality of data collection devices are arranged on a process bus, and when a single data processing means receives and computes data in the monitoring control device, a processing load of the data processing means becomes large. Therefore, there is a problem that it is difficult to execute a process of receiving and computing data in a short cycle.

[0005] One of the main objectives of the present invention is to solve such a problem as described above. The present invention mainly aims to enhance an efficiency in a process of extracting data from a communication packet received, and to make possible packet reception, data extraction, and computation in a short cycle.

Solution to Problem

[0006] A communication apparatus according to the present invention is a communication apparatus which receives a packet that includes a plurality of data. The communication apparatus includes:

a dedicated hardware for a data extraction process in which data that satisfies a specific condition is extracted from the plurality of data in the packet received.

Advantageous Effects of Invention

[0007] According to the present invention, as a dedicated hardware for a data extraction process is provided, it is possible to enhance an efficiency in a process of extracting data that satisfies a specific condition from a communication packet received. Therefore, packet reception, data extraction, and computation in a short cycle are possible.

Brief Description of Drawings

[0008] [Fig. 1] a diagram showing an example of a configuration of a plant monitoring control device according to a first embodiment;

[Fig. 2] a diagram showing an example of an operation of the plant monitoring control device according to the first embodiment;

[Fig. 3] a diagram showing an example of an operation of the plant monitoring control device according to the first embodiment;

[Fig. 4] a diagram showing an example of a configuration of an SV packet according to a second embodiment;

[Fig. 5] a flowchart showing an example of an operation of the plant monitoring control device according to the second embodiment;

[Fig. 6] a diagram showing contents stored in a decode programming register according to the second embodiment;

[Fig. 7] a diagram showing a layered structure of a packet of an IEC61850-9-2 standard; and

[Fig. 8] a diagram showing an example of a hardware configuration of the plant monitoring control device according to the first and the second embodiments.

Description of Embodiments

[0009] Embodiment 1.

The present embodiment explains, a plant monitoring control device having a plurality of processing units and a management unit which allocates a process to each processing unit, which divides processes and executes processes in parallel, thereby improves processing performance, and is capable of a reception process and a computing process in a short cycle.

[0010] Fig.1 is a diagram showing an example of a configuration of the plant monitoring control device according to the present embodiment.

[0011] In Fig. 1, the plant monitoring control device 10 performs plant monitoring and controlling.

The plant monitoring control device 10 is, for example, a protection relay device.

The plant monitoring control device 10 is connected to a plurality of data collection devices 19 via a network (a process bus) 18.

The data collection device 19 collects an electrical amount value (electrical current value, voltage value) of a predetermined target, and transmits a communication packet which notifies of the collected electrical amount value to the network (the process bus) 18.

The plant monitoring control device 10 receives the communication packet from the plurality of plurality of data collection devices 19 in a short cycle (in a cycle of several tens of microseconds to a several hundreds of microseconds) and extracts the targeted electrical amount value from the communication packet received.

The plant monitoring control device 10 is an example of a communication

apparatus.

[0012] In the plant monitoring control device 10, a process bus sending / receiving unit 11 sends and receives the communication packet between the network (the process bus) 18.

A processing unit A 12 performs a logical computation process such as data determination and communication packet generation.

A processing unit B 13 performs a data extraction process (hereinafter a data extraction process is also referred to as a decoding process) at high speed in which specific data is extracted from a specific communication packet.

A processing unit C 14 performs an arithmetic computation process of analog input data such as the electrical current value and the voltage value.

A management unit 15 allocates processes to the processing unit A 12 to the processing unit C 14.

A data retention unit A 16 stores the communication packet that the process bus sending / receiving unit 11 received from the network (the process bus) 18.

A data retention unit B 17 stores data that the processing unit B 13 extracted.

[0013] For example, the processing unit A 12 is a general purpose CPU, the processing unit B 13 is a dedicated hardware specialized for the data extraction process, and the processing unit C 14 is a CPU for the arithmetic computation.

Furthermore, the processing unit A 12 and the processing unit C 14 may not necessarily be separate parts. For example, by using a processor part which includes the general purpose CPU and an FPU (Floating Point number processing Unit), it is possible to implement the processing unit A 12 and the processing unit C 14 in a single LSI (Large Scale Integration).

[0014] Next, an operation will be described using Fig. 2 and Fig. 3.

Fig. 2 shows an operation carried out when a received packet from the network (the process bus) 18 is to be a processed by the processing unit B 13.

[0015] The process bus sending / receiving unit 11 stores the received packet from the network (a process bus) 18 in the data retention unit A 16 (Step 20).

[0016] The management unit 15 determines type of the received packet in the data retention unit A 16 and determines which of the processing unit A 12 and the processing unit B 13 should process the received packet (Step 21).

As previously described, assume that the processing unit B 13 is the dedicated hardware which performs the decoding process of an SV (Sampled Value) packet which is a communication packet for sending and receiving the analog input data.

[0017] When the management unit 15 determines that the type of the received packet is the SV packet, the management unit 15 instructs the processing unit B 13 to execute the decoding process of the SV packet, and the processing unit B 13 executes the decoding process of the SV packet (Step 22).

An SV packet decoding process is a process in which a structure of the SV packet is analyzed and data to be required in electrical current / voltage value computation performed by the processing unit C 14 is extracted.

In the SV packet decoding process, the processing unit B 13 decodes the received packet in the data retention unit A 16, extracts the necessary data and stores the data in the data retention unit B 17.

[0018] When detecting completion of the SV packet decoding process, the management unit 15 starts the electrical current / voltage value computation (Step 23) of the processing unit C 14.

[0019] The processing unit C 14 reads out electrical current / voltage data (data extracted by the processing unit B 13 and stored in the data retention unit B 17) in the

data retention unit B 17, and carries out computation required for a status determination of a target for monitoring and controlling (Step 24).

[0020] When detecting completion of an electrical current / voltage value computation process, the management unit 15 starts a status determination process of the processing unit A 12 (Step 25).

[0021] The processing unit A 12, based on a result of Step 24, determines presence or absence of an abnormality in a target for monitoring and controlling.

Then, the processing unit A 12, according to a determination result, executes a necessary plant control process (Step 26).

[0022] Fig. 3 shows an operation carried out when the received packet from the network (the process bus) 18 is both a processing target (the SV packet) and a non-processing target of the processing unit B 13.

Since a process at the time of the SV packet reception is the same as the above mentioned Step 20 to Step 26, the description will be omitted here.

[0023] The management unit 15 determines the type of the received packet in the data retention unit A 16 and determines which of the processing unit A 12 and the processing unit B 13 should process the received packet.

In the present example, assuming that the communication packet that should be executed by the processing unit A 12, for example, an operation status data of a data collection device 19, has been obtained, the management unit 15 determines that the communication packet should be processed by the processing unit A 12 (Step 31).

The processing unit A 12 executes a status determination of the data collection device 19 (Step 32).

[0024] Embodiment 2.

In Embodiment 2, details of the decoding process of the SV (Sampled Value) packet executed by the processing unit B 13 as shown in the Embodiment 1 will be described.

[0025] Fig. 4 shows a structure of the communication packet that the plant monitoring control device 10 sends and receives on the network (the process bus) 18.

A numeral 40 denotes a header part of the communication packet, a numeral 41 denotes a data part, and a numeral 42 denotes a footer part.

Furthermore, a numeral 43 denotes an attribute number of data, a numeral 44 denotes a data length, and a numeral 45 denotes data. In the data part 41, a plurality of data 43 to 45 are stored.

The attribute number 43 is an identifier of data 45.

Furthermore, in the data 45, an identification number and status data of the data collection device 19 and the electrical amount value (electrical current value, voltage value), etc. collected by the data collection device 19 are shown.

[0026] In the present embodiment, the decoding process is a process in which the attribute number 43 and the data length 44 are analyzed, the necessary data 45 is extracted, and further, dummy data is added so as to conform to a process of the processing unit C 14.

For example, when the processing unit C 14 is a 32 bit CPU, data is processed most efficiently when the data is stored in units of 4 bytes. However, data length of data extracted is not always in multiples of 4 bytes. Therefore, the processing unit B 13 adds the dummy data (Padding) so as not to be out of an alignment of 4 bytes.

[0027] Data that is to be extracted from the SV packet is set in a decode programming register 58 beforehand.

Data to be extracted is the data 45 which is subsequent to the attribute number

43, being identical to the attribute number described in the decode programming register 58.

The decode programming register 58, for example, is arranged in the processing unit B 13.

In the decode programming register 58, the number of Padding is defined for the attribute number as shown in Fig. 6.

The number of Padding is the number of the dummy data that will be added to the data extracted.

Since the structure of the communication packet does not change dynamically during operation, the setting of the number of Padding in the decode programming register 58 may be done only once at power on, for example.

[0028] Next, a decoding process of the processing unit B 13 will be described using Fig. 5.

[0029] First, the processing unit B 13 reads out the attribute number 43 from the communication packet stored in the data retention unit A 16 (Step 51).

[0030] Next, the processing unit B 13 compares the read out attribute number 43 with the decode programming register 58 and determines whether or not the data subsequent to the read out attribute number 43 is data to be extracted (Step 52).

In other words, if the read out attribute number 43 matches the attribute number described in the decode programming register 58, the processing unit B 13 determines that the data subsequent to the read out attribute number 43 is to be extracted.

[0031] When the data is to be extracted (YES at Step 52), the processing unit B 13 reads out the data to be extracted from the data retention unit A 16, and stores the data in the data retention unit B 17 (Step 53).

[0032] Next, the processing unit B 13 determines whether or not the data stored in the

data retention unit B 17 requires a Padding process (a process to store a dummy value so as to obtain a 32 bit array) by referring to the decode programming register 58 (Step 54).

In other words, the processing unit B 13 determines that Padding is required if, in the decode programming register 58, the number of Padding other than "0" is defined with respect to the attribute number 43 which has been read out in Step 51.

[0033] When Padding is required, the processing unit B 13 stores dummy data of the required bytes in the data retention unit B 17. For example, when the number of Padding is 2, the processing unit B 13 writes dummy data (for example, value "0") of 2 bytes in the data retention unit B 17 (Step 55).

[0034] Then, the processing unit B 13 executes the above Step 51 to Step 55 for all of the data part 41 (Step 56), and when the processes for all of the data part 41 are completed, the processing unit B 13 ends the decoding process (Step 57).

[0035] The data part 41 of the communication packet shown in Fig. 4 is based on the structure description in ASN.1 (Abstract Syntax Notation 1) and has a layered structure basically formed of Tag (attribute number) + Length (data length) + Value (data).

Specifically, the data part 41 has a layered structure shown in Fig. 7 (Fig. 7 is cited from the IEC61850-9-2 Standard).

The Tag (a part where 60, 80-87, A2, and 30 are shown in Fig. 7) of Fig. 7 corresponds to the attribute number 43 of Fig. 4.

Further, the Length (a part where L is shown in Fig. 7) of Fig. 7 corresponds to the data length 44.

Further, the Value of Fig. 7 corresponds to the data 45 of Fig. 4.

For example, the data 45 subordinated to the Tag and the Length (60 and L) on the first layer is all the data on the second layer (80, L, and Value) and below.

Further, the data 45 subordinated to the Tag and the Length (A2 and L) on the fourth layer is all the data on the fifth layer (30 and L) and below.

The data 45 subordinated to the Tag and the Length (30 and L) on the fifth layer is data in areas that an ASDU (Application Service Data Unit) 1 covers.

Further, an interior configuration of an ASDU 2, an ASDU 3, and an ASDUn of Fig. 7 is the same as that of the ASDU 1.

The processing unit B 13, as the decoding process, extracts Value necessary for the process of the processing unit C 14 from the layered structure of Fig. 7.

A method of the decoding process for the layered structure of Fig. 7 is show in (1) to (10) on the right portion of Fig. 7.

As shown in Fig. 7, the processing unit B 13 analyzes the layered structure of the SV packet received and extracts data included in the ASDU 1 to the ASDUn.

The data included in the ASDU 1 to the ASDUn shows the electrical amount value, etc. collected by a plant to be monitored.

In addition, the processing unit C 14 performs computation with the electrical amount value, etc. shown in the data extracted by the processing unit B 13.

[0036] According to the Embodiment 1 and 2 above, a process of extracting specific data from the received packet (the decoding process) is executed by the dedicated hardware separately from a CPU for logical computation and a CPU for arithmetic computation. Therefore, enhancing an efficiency in the decoding process is possible, and packet reception, data extraction, and computation in a short cycle are possible.

Especially, with respect to the protection relay device compliant with the IEC61850-9-2 (a process bus standard), enhancing an efficiency in the decoding process of the SV packet is possible. Therefore, packet reception, data extraction, and computation in a short cycle are possible.

[0037] In the Embodiment 1 and 2, the plant monitoring control device including the following has been described.

(a) a process bus sending / receiving unit which receives a collected electrical current / voltage value in a communication packet;

(b) a processing unit which performs logical computation for data determination and communication packet generation, etc.;

(c) a processing unit which performs a decoding process on a specific communication packet at high speed;

(d) a processing unit which performs arithmetic computation process of the electrical current / voltage value;

(e) a management unit which allocates processes to the processing units;

(f) a data retention unit which stores the communication packet received from a process bus; and

(g) a data retention unit which stores a decoding result of the communication packet.

[0038] And, in the Embodiment 1 and 2, a communication packet decoding process unit including the following has been described.

(a) a processing unit which extracts only an attribute data necessary for a process;

(b) a processing unit which programs an attribute that should be extracted; and

(c) a processing unit which executes an alignment adjustment process of an address.

[0039] Finally, an example of a hardware configuration of the plant monitoring control device 10 shown in the Embodiment 1 and 2 will be described.

Fig. 8 is a diagram showing an example of hardware resources of the plant

monitoring control device 10 shown in the Embodiment 1 and 2.

The configuration of Fig. 8 is only an example of the hardware configuration of the plant monitoring control device 10, and the configuration of the plant monitoring control device 10 may be in another configuration, not limiting to the configuration described in Fig. 8.

[0040] In Fig. 8, the plant monitoring control device 10 includes a CPU 911 (Central Processing Unit, also called a processing device, a computation device, a microprocessor, a microcomputer, or a processor) which executes programs.

The CPU 911 is connected, via a bus 912, for example, to a ROM (Read Only Memory) 913, a RAM (Random Access Memory) 914, a communication board 915, a display device 901, a keyboard 902, a mouse 903, and a magnetic disk device 920, and controls these hardware devices.

The CPU 911, for example, corresponds to the processing unit A 12 and processing unit C 14 shown in Fig. 1.

[0041] Further, the CPU 911 may be connected to an FDD 904 (Flexible Disk Drive), a compact disc device 905 (CDD), or a printer device 906. The magnetic disk device 920 may be replaced with another memory device such as an SSD (Solid State Drive), an optical disc drive, or a memory card (registered trademark) read/write device.

The RAM 914 is an example of a volatile memory. The ROM 913, the FDD 904, the CDD 905, and a memory medium of the magnetic disk device 920 are examples of a non-volatile memory. These are examples of a memory device.

The data retention unit A 16 and the data retention unit B 17 shown in Fig. 1 are, for example, implemented by the RAM 914.

The process bus sending / receiving unit 11 shown in Fig. 1 is, for example, implemented by the communication board 915.

The communication board 915, the keyboard 902, and the mouse 903, etc. are examples of an input device.

Further, the communication board 915, the display device 901, and the printer device 906, etc. are examples of an output device.

[0042] The communication board 915 is, as shown in Fig. 1, connected to the network (the process bus) 18.

For example, the communication board 915 may be connected to a LAN (Local Area Network), the Internet, a WAN (Wide Area Network), a SAN (Storage Area Network), etc.

[0043] A dedicated hardware 907 corresponds to the processing unit B 13 shown in Fig. 1.

The dedicated hardware 907 may be a CPU that executes a program that implements the decoding process shown in Fig. 5 or a combination of logic circuits.

If the dedicated hardware 907 is a CPU, the program for implementing the decoding process shown in Fig. 5, for example, is included in programs 923 of the magnetic disk device 920.

[0044] The magnetic disk device 920 stores an operating system 921 (OS), a window system 922, programs 923, and files 924.

Each program of the programs 923 is executed by the CPU 911 while using the operating system 921 and a window system 922.

The programs 923, for example, includes programs that implement a process of the processing unit A 12 and the processing unit C 14, and a program that implements the process of the management unit 15.

Further, the programs 923, as previously described, includes a program that implements the decoding process shown in Fig. 5 when the dedicated hardware 907 is

the CPU.

[0045] And, in the RAM 914, at least parts of the program of the operating system 921 and application programs that the CPU 911 executes are temporarily stored.

And, in the RAM 914, various kinds of data necessary for a process of the CPU 911 are stored.

And, in the RAM 914, the SV packet received from the network (the process bus) 18 and the data extracted by the processing unit B 13 are stored.

[0046] And, in the ROM 913, a BIOS (Basic Input Output System) program is stored, and in the magnetic disk device 920, a boot program is stored.

At the startup of the plant monitoring control device 10, the BIOS program of the ROM 913 and the boot program of the magnetic disk device 920 are executed and by the BIOS program and the boot program, the operating system 921 is started.

[0047] In the files 924, information, data, signal values, variable values, or parameters that show results of processes that are explained as "evaluation of...", "determination of...", "extraction of...", "analysis of...", "comparison of...", "updating of...", "setting of...", "registering of...", "selection of...", etc. in the explanation of the Embodiment 1 and 2 are stored as each item of "... file" or "... database".

Further, an arrow part in flowcharts used for the explanation of the Embodiment 1 and 2 mainly shows an input/output of data or signals.

The data or the signal values may be stored in a storage medium, besides the RAM 914, such as in a flexible disk of the FDD 904, in a compact disc of the CDD 905, in a magnetic disk of the magnetic disk 920, or in another such as in an optical disc, in a mini disc, or in a DVD.

Further, the data or the signals are transmitted online by the bus 912, signal lines, cables, or another transmission medium.

[0048] Further, by the steps, procedures, and processes described in the Embodiment 1 and 2, the process of the plant monitoring control device 10 may be regarded as a data processing method.

Reference Signs List

[0049] 10: plant monitoring control device

11: process bus sending / receiving unit

12: processing unit A

13: processing unit B

14: processing unit C

15: management unit

16: data retention unit

17: data retention unit

18: network (process bus)

19: data collection device

Claims

[Claim 1] A communication apparatus which receives a packet that includes a plurality of data comprising:

a dedicated hardware for a data extraction process in which data that satisfies a specific condition is extracted from the plurality of data in the packet received.

[Claim 2] The communication apparatus according to claim 1, wherein

the communication apparatus receives the packet in a layered structure that includes a plurality of data being related with data identifiers, and

the dedicated hardware, in the data extraction process, analyzes the layered structure of the packet received, and extracts data that is related with a specific data identifier from the plurality of data in the packet received.

[Claim 3] The communication apparatus according to claim 1, wherein

the dedicated hardware, in the data extraction process, adds dummy data to the data extracted.

[Claim 4] The communication apparatus according to claim 1, wherein

the communication apparatus receives a packet that includes, among the plurality of data, data that notifies of an electrical amount measured, and

the dedicated hardware, in the data extraction process, extracts the data that notifies of the electrical amount, from the plurality of data in the package received,

the communication apparatus further comprising another hardware than the dedicated hardware, which performs computation with the electrical amount notified by the data extracted by the dedicated hardware.

[Claim 5] The communication apparatus according to claim 4, wherein

the communication apparatus receives, as the packet that includes the data that notifies of the electrical amount measured, a packet that complies with the IEC

(International Electrotechnical Commission) 61850-9-2 standard, and

the dedicated hardware, in the data extraction process, extracts data which is included in an ASDU (Application Service Data Unit), as the data that notifies of the electrical amount.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/062396

A. CLASSIFICATION OF SUBJECT MATTER
H04L12/28(2006.01)i, *H04M11/00*(2006.01)i

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)
H04L12/28, H04M11/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2011
Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2005-57373 A (NTT Docomo Inc.), 03 March 2005 (03.03.2005), paragraph [0035]; fig. 2, 3 & US 2005/0030965 A1 & EP 1505775 A2 & TW 242946 B & KR 10-2005-0016173 A & CN 1581854 A	1-5
Y	JP 10-290207 A (Hitachi, Ltd.), 27 October 1998 (27.10.1998), paragraphs [0008] to [0015]; fig. 5 to 7 (Family: none)	1-5

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"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 another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 July, 2011 (12.07.11)	19 July, 2011 (19.07.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.