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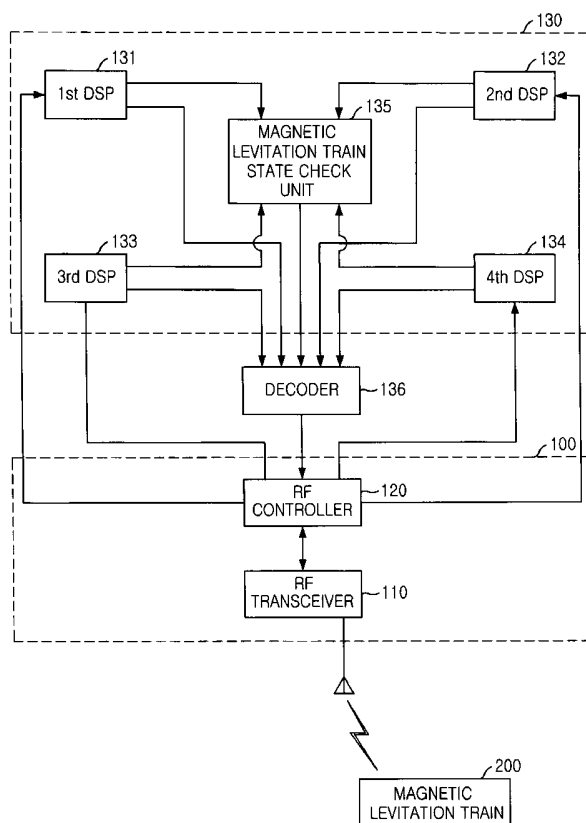
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[Continued on next page]

(54) Title: APPARATUS FOR WIRELESS REMOTE CONTROL MAGNETIC LEVITATION TRAIN AND METHOD THEREOF



(57) Abstract: The present invention provides an Apparatus for wireless Remote control a magnetic levitation train and method thereof, which includes a wireless remote controller communicating with the magnetic levitation train bidirectionally, the wireless remote controller transmitting/receiving data using an RF signal to/from the magnetic levitation train, the wireless remote controller packetizing the transmitted/received data to transmit without an error, a PC transmitting/receiving the packetized data to/from the wireless remote controller mutually and bi-directionally by an RS232 communication system, and a monitor connected to the PC to display the packetized data processed by the PC. Accordingly, the present invention enables the wireless remote control and communication in performing the miniaturized magnetic levitation train simulation test using the wireless remote controller of the magnetic levitation train, thereby being efficiently used for the test having difficulty in performing a short distance work. And, in case of commercializing the magnetic levitation train, the present invention brings about the economic effect to the commercial scale production.



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**Apparatus for Wireless Remote Control Magnetic Levitation
Train and
Method Thereof**

5 TECHNICAL FIELD

The present invention relates to an Apparatus for wireless remote control a magnetic levitation train and method thereof, in which a system necessary for an operation of a miniaturized magnetic levitation train is
10 configured and by which the operation is controlled and miniaturized by wireless.

BACKGROUND ART

15 Generally, several miniatures simply imitating the configuration and structure of a magnetic levitation train have been developed in Korea. Yet, the miniaturized model having the basic principle of the magnetic levitation train applied thereto has never been prepared. And, a wireless
20 remote controller of a magnetic levitation train has never been tried as well.

Currently, a rapid transit railway is opened for traffic to develop a public traffic means with the purpose of supporting the national economy base. A life pattern has
25 been changed as well as a life paradigm. For instance, the National Capital region is expanded. And, in case of using the rapid transit railway, it takes only 30 minutes to travel a distance between Seoul and Cheonan. Thus, a traffic revolution occurs to correct the concept of a
30 locality.

The rapid transit railway, which employs a wheel system, reduces its contact and the like in aspect of operating the wheel system, prepares various systems including a railway, a train, and the like such as a
35 rotation of the train to fit its speed, and operates its control system to fit its high speed. Yet, limitation is

put on the high-speed train using the wheel system and there are various problems caused by the rapid transit service.

To overcome the problems, a magnetic levitation train, which is expected as one of the next generation solutions, needs to solve its own problems for test such as an excessive expense, wide test area occupancy, and the like. Currently, the magnetic levitation train system is operated by such an advanced country as Japan, U.S.A., Germany, China, and the like for test equipments and limited regions only. And, it is still regarded as reckless to commercialize the magnetic levitation train system despite the excessive expense and the risk proportional to a national-wide scale that combines the entire country into a one-day life zone.

Specifically, in order to secure a test system configuring the magnetic levitation train system, many tests for enhancing reliability of controller hardware and software of controlling a magnetic levitation train remotely and controlling the remotely controller magnetic levitation train need to be done previously. However, there are too many risks and danger in testing the real system variously. And, the various tests need vast expenses as well. Hence, it is recommended to perform a test using a reduced or miniaturized system.

DISCLOSURE OF THE INVENTION

TECHNICAL PROBLEM

Even though miniature models imitating the configuration and structure of a magnetic levitation train have been prepared in Korea, a miniaturized model having the basic principle of the magnetic levitation train applied thereto has never been prepared. Hence, it is unable to substantially perform a simulation test of the magnetic levitation train.

Moreover, it is substantially impossible to use a

wire controller for a magnetic levitation train. Namely, in case of installing a control wire at a magnetic levitation train that is moving, it means that a speed or traveling distance of the magnetic levitation train is not taken into consideration. In such a case, wire raveling or cutting of the wiring system raises a failure rate of the magnetic levitation train in testing or commercializing the magnetic levitation train to cause many inconveniences.

10 TECHNICAL SOLUTION

An object of the present invention is to provide an Apparatus for wireless remote control a magnetic levitation train and method thereof, by which a state of the train can be monitored and commanded in a remote distance by wireless in case of using the wireless remote controller for the magnetic levitation train and by which wire cutting or raveling of a wiring system can be avoided.

ADVANTAGEOUS EFFECTS

20 Accordingly, the present invention enables the wireless remote control and communication in performing the miniaturized magnetic levitation train simulation test using the wireless remote controller of the magnetic levitation train, thereby being efficiently used for the test having difficulty in performing a short distance work. And, in case of commercializing the magnetic levitation train, the present invention brings about the economic effect to the commercial scale production.

And, by adopting the packet configuration of the present invention, the present invention is efficient in transmitting/receiving the packet data. And, the present invention raises the value of the corresponding product.

BRIEF DESCRIPTION OF THE DRAWINGS

35 The accompanying drawings, which are included to provide a further understanding of the invention and are

incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

5 In the drawings:

FIG. 1 is a schematic block diagram of a fixed type wireless remote controller, connected to a PC, according to one embodiment of the present invention;

10 FIG. 2 is a detailed block diagram of the fixed type wireless remote controller, connected to a PC, according to one embodiment of the present invention;

FIG. 3 is a schematic block diagram of a mobile wireless remote controller according to one embodiment of the present invention; and

15 FIG. 4 is a flowchart of a wireless remote control method of a magnetic levitation train according to one embodiment of the present invention.

<brief description of principal cord part of figures>

20 fixed type wireless remote controller 100
RF transceiver 110, 151
RF controller 120, 153
PC 130
DSP 131, 132 133, 134
magnetic levitation train state check unit 135
25 decoder 136
Monitor 140
mobile wireless remote controller 150
RS-232C communication unit 152
levitation button 154
30 propulsion button 155
stop button 156
landing button 157
magnetic levitation train 200

35 BEST MODE FOR CARRYING OUT THE INVENTION

To achieve these and other advantages and in

accordance with the purpose of the present invention, as embodied and broadly described, an Apparatus for wireless Remote control a magnetic levitation train according to the present invention includes a wireless remote controller communicating with the magnetic levitation train bi-directionally, the wireless remote controller transmitting/receiving data using an RF signal to/from the magnetic levitation train, the wireless remote controller packetizing the transmitted/received data to transmit without an error, a PC transmitting/receiving the packetized data to/from the wireless remote controller mutually and bi-directionally by an RS232 communication system, and a monitor connected to the PC to display the packetized data processed by the PC.

MODE FOR CARRYING OUT THE INVENTION

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

FIG. 1 is a schematic block diagram of a fixed type wireless remote controller, connected to a PC, according to one embodiment of the present invention.

Referring to FIG. 1, a fixed type wireless remote controller 100 bi-directionally communicates with a magnetic levitation train 200. The fixed type wireless remote controller 100 includes an RF transceiver 110 transmitting/receiving data such as a gap value, an acceleration value, and the like to/from the magnetic levitation train 200 using an RF signal and an RF controller 120 converting the data to a packet format to transmit without error.

The fixed type wireless remote controller 100 controlling the magnetic levitation train 200 is configured as shown in FIG. 1. The fixed type wireless remote controller 100, which is fabricated to have a box shape apart from a PC 130, transmits/receives the packetized data

to/from the PC 130 by the RS232 communication system mutually and bi-directionally.

The RF controller 120 receives levitation, landing, propulsion, stop, and auto-run commands given by the PC 130.

5 In performing the received commands, the magnetic levitation train automatically levitates, runs for a predetermined time, stops, and lands on the ground in turn.

FIG. 2 is a detailed block diagram of the fixed type wireless remote controller, connected to a PC, according to
10 one embodiment of the present invention.

Referring to FIG. 2, as mentioned in the above description, the fixed type wireless remote controller 100 receives levitation, landing, propulsion, stop, and auto-run commands from the PC 130. When the magnetic levitation
15 train 200 is levitated, landed, propelled, and auto-run by operating buttons for the commands via the PC 130, real-time information including the gap value, acceleration value, and the like is inputted to the fixed type wireless remote controller 100 via the RF transceiver 110 from the
20 magnetic levitation train 200 by wireless.

Thus, the RF transceiver 110 receives to transfer the information of the gap value, the acceleration value, and the like to the RF controller 120. In doing so, it is necessary that RS232 and software of the PC 130, e.g.,
25 video for Windows (VFW) be previously initialized.

The RF controller 120 packetizes the received information and then transfers to distribute the packetized information to a plurality of DSPs 131 to 134, respectively. And, the distributed information is processed by the DSPs
30 131 to 134.

Each of the DSPs 131 to 134 within the PC 130 performs digital signal processing on the packet data including the gap value, the acceleration value, and the like and then transfers the digitalized data to a state
35 check unit 135.

The state check unit 135 having received the packet

data examines a checksum. If an error occurs, the state check unit 135 displays an error message on a monitor 140 and requests retransmission of the information including the gap value, the acceleration value, and the like to the magnetic levitation train 200 via a decoder 136, the RF controller 120, and the RF transceiver 110.

If no error occurs through the checksum examination, the magnetic levitation train state check unit 135 stores the packet data and then converts the stored packet to readable decimal numerals to display the information including the gap value, the acceleration value, and the like on the monitor 140. Hence, the state check unit 135 enables a user to check a real-time operational state of the magnetic levitation train 200.

The command inputted via the PC 130 is decoded by the decoder 136 to be transmitted to the magnetic levitation train 200 via the RF controller 120 and the RF transceiver 110. As mentioned in the above description, the command corresponds to the levitation, landing, propulsion, stop or auto-run command.

FIG. 3 is a schematic block diagram of a mobile wireless remote controller according to one embodiment of the present invention.

Referring to FIG. 3, a mobile wireless remote controller according to one embodiment of the present invention is configured to be capable of controlling the levitation, landing, propulsion, and stop commands that can be controlled by the PC 130.

First of all, once a button such as a levitation button 154, a propulsion button 155, a stop button 156, a landing button 157, and the like is pressed, a corresponding command is transmitted to a magnetic levitation train 200 via an RF controller 153, an RS 232C communication unit 152, and an RF transceiver 151. If a gap value and an acceleration value are outputted from the magnetic levitation train 200, the outputted values are

transmitted to an external mobile device, e.g., PDA or the like via the RS 232C communication unit 152 or to the PC 130 connected to the fixed type wireless remote controller 100.

5 FIG. 4 is a flowchart of a wireless remote control method of a magnetic levitation train according to one embodiment of the present invention.

Referring to FIG. 4, a method of the flowchart indicates a process for representing the aforesaid state of the magnetic levitation train 200 using a bar graph and is
10 carried out during about 200ms. The PC 130 preferentially initializes variables (step 402).

A communication channel of the RS232 of the PC 130 is opened and the VFW of Windows used as an operational system
15 of the PC (step 404). Namely, it can be said that the steps of initializing the variables, opening the communication channel, and initializing the VFW are to initialize the PC 130.

The PC 130 receives the packet data from the mobile
20 wireless remote controller 150 via the channel established as a physical channel by an RS232 cable (S406).

The PC 130 examines the checksum among the received packet data to decide whether the received data are non-defective data via a non-defect test of the data (Step 408).

25 If it is decided as defective as a result of the step 408, an error message is displayed on the monitor 140 and retransmission is requested to the magnetic levitation train 200 (step 410).

If the PC 130 decides that the received packet data
30 are non-defective in the step 408, the corresponding data are stored in a memory of the PC 130 (S412).

The PC 130 converts the packet data, which were received according to base conversion of 16, to ASCII-coded packet data (step 414).

35 The PC 130 converts the ASCII-coded packet data to decimal numerals (step 416).

The PC 130 represents the decimal-coded packet data by a graph to display the graph on the monitor 140 of the PC 130, whereby it can be checked whether the magnetic levitation train 200 smoothly operates via a GUI environment (S418).

It is then requested to transmit the packet data to the mobile wireless remote controller 150 (step 420), and the procedure goes back to the step 406.

As explained in the foregoing description, the mobile wireless remote controller 150 has the same configuration shown in FIG. 3 and its configuration is similar to the hardware configuration of the fixed type wireless remote controller 100 using the PC 130. And, the mobile wireless remote controller 150 has a configuration of a controller having simple buttons for levitation, landing, propulsion, and stop commands instead of the PC 130.

The data packet configurations of the two kinds of the wireless controllers are shown in Table 1.

[Table 1]

STX	'R'	Code1	LRC10	LRC0	ETX	PC → PC RF
STX	'w'	Code1	Code2	AD0~AD7 voltage (16byte)		
LRC10	LRC0	ETX	PC RF → PC			
STX	'R'	Code3	LRC10	LRC0	ETX	PC RF → Local RF
STX	'w'	Code3	Code4	AD0~AD7 voltage (16byte)		
LRC10	LRC0	ETX	Local RF → PC RF			

There are total 23-bytes which include 2-bytes for identifying a beginning and an end, checksum 2-bytes for checking a presence or non-presence of erroneous data, 1-byte for confirming transmission or reception, and 16-bytes for storing a current flowing in an electromagnet and gap data between a rail and a train body.

INDUSTRIAL APPLICABILITY

Accordingly, the present invention enables the wireless remote control and communication in performing the miniaturized magnetic levitation train simulation test using the wireless remote controller of the magnetic

levitation train, thereby being efficiently applied for the test having difficulty in performing a short distance work.

WHAT IS CLAIMED IS:

1. Apparatus for wireless Remote control a magnetic levitation train, comprising:

a wireless remote controller 100 communicating with the magnetic levitation train 200 bi-directionally, the wireless remote controller 100 transmitting/receiving data using an RF signal to/from the magnetic levitation train 200, the wireless remote controller 100 packetizing the transmitted/received data to transmit without an error;

a PC 130 transmitting/receiving the packetized data to/from the wireless remote controller mutually and bi-directionally by an RS232 communication system; and

a monitor 140 connected to the PC 130 to display the packetized data processed by the PC.

2. The apparatus of claim 1, the wireless remote controller 100 comprising:

an RF transceiver unit 110 receiving levitation, landing, propulsion, stop, and auto-run commands from the PC 130 to levitate, land, propel, stop, and auto-run the magnetic levitation train 200, respectively, and the RF transceiver unit 110 receiving information of a gap value, an acceleration value, and the like from the magnetic levitation train 200; and

an RF controller 120 packet-processing the received information and transferring the packet-processed information to the PC 130 wherein the transferred information is distributed to the PC 130 to be processed therein.

3. The apparatus of claim 1, the PC 130 comprising:

a plurality of DSPs 131 to 134 splitting the packet data to perform digital signal processing thereon;

a magnetic levitation train state check unit 135 examining a checksum of receiving the packet data from the

DSPs 131 to 134, the magnetic levitation train state check unit 135 requesting a retransmission in case of a presence of error occurrence, the magnetic levitation train state check unit 135 storing the packet data in case of a non-
5 presence of the error occurrence to display the packet data on the monitor 140 by converting the stored packet to readable decimal numerals; and

a decoder 136 decoding the commands inputted via the PC 130 to transfer the commands to the magnetic levitation
10 train 200 via the RF controller 120 and the RF transceiver unit 110.

4. Apparatus for wireless Remote control a magnetic levitation train, comprising a plurality of
15 buttons including a levitation button 154, a propulsion button 155, a stop button 156, a landing button 157, and the like,

wherein a corresponding command is transmitted to the magnetic levitation train 200 via an RF controller 153, an
20 RS 232C communication unit 152, and an RF transceiver 151 and

wherein if a gap value and an acceleration value are outputted from the magnetic levitation train 200, the outputted values are transmitted to an external mobile
25 device via the RS 232C communication unit 152.

5. A wireless remote control method of a magnetic levitation train, comprising:

a first step of initializing a plurality of
30 variables;

a second step of opening a communication channel of an RS232 and initializing an operational system of a PC 130 controlling the magnetic levitation train;

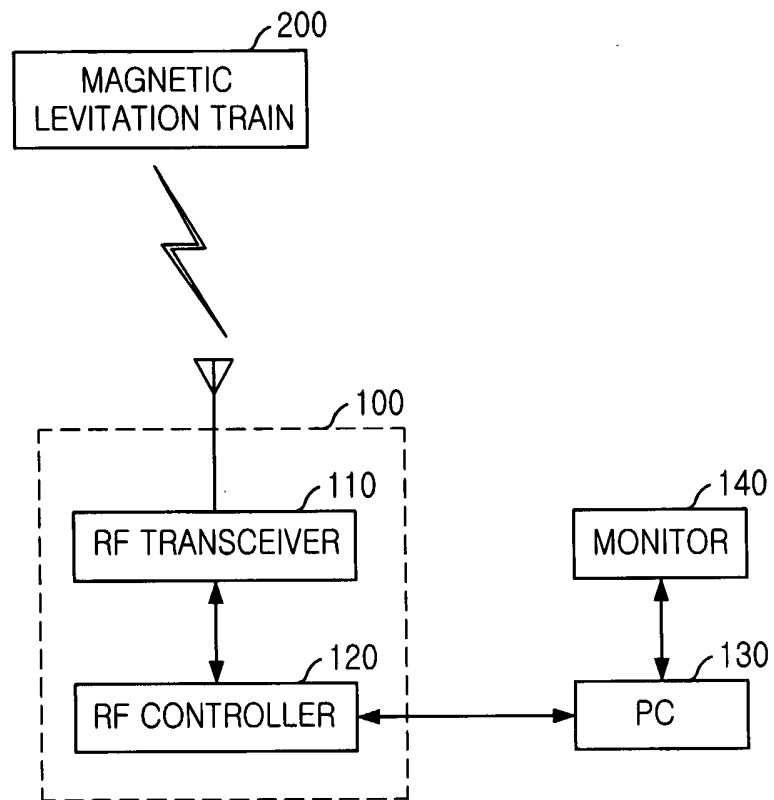
a third step of receiving packet data from a mobile
35 wireless remote controller 150 via a channel established by an RS232 cable;

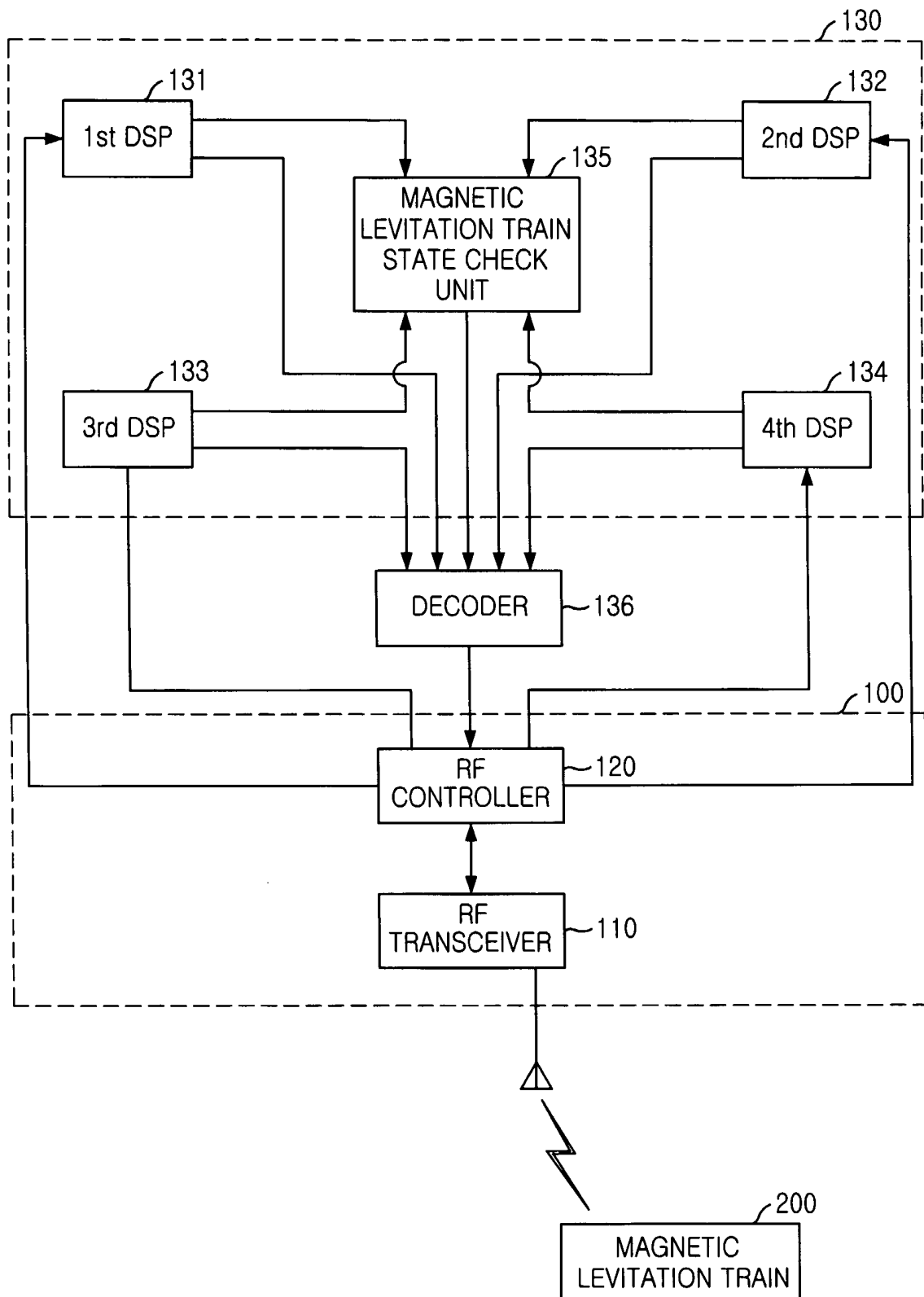
a fourth step of deciding whether the packet data among the received packet data are non-defective data;

a fifth step of if the received data are decided as the non-defective data in the fourth step, storing the data
5 in a memory of the PC 130;

a sixth step of converting the packet data received according to base conversion of 16 to recognizable decimal numerals; and

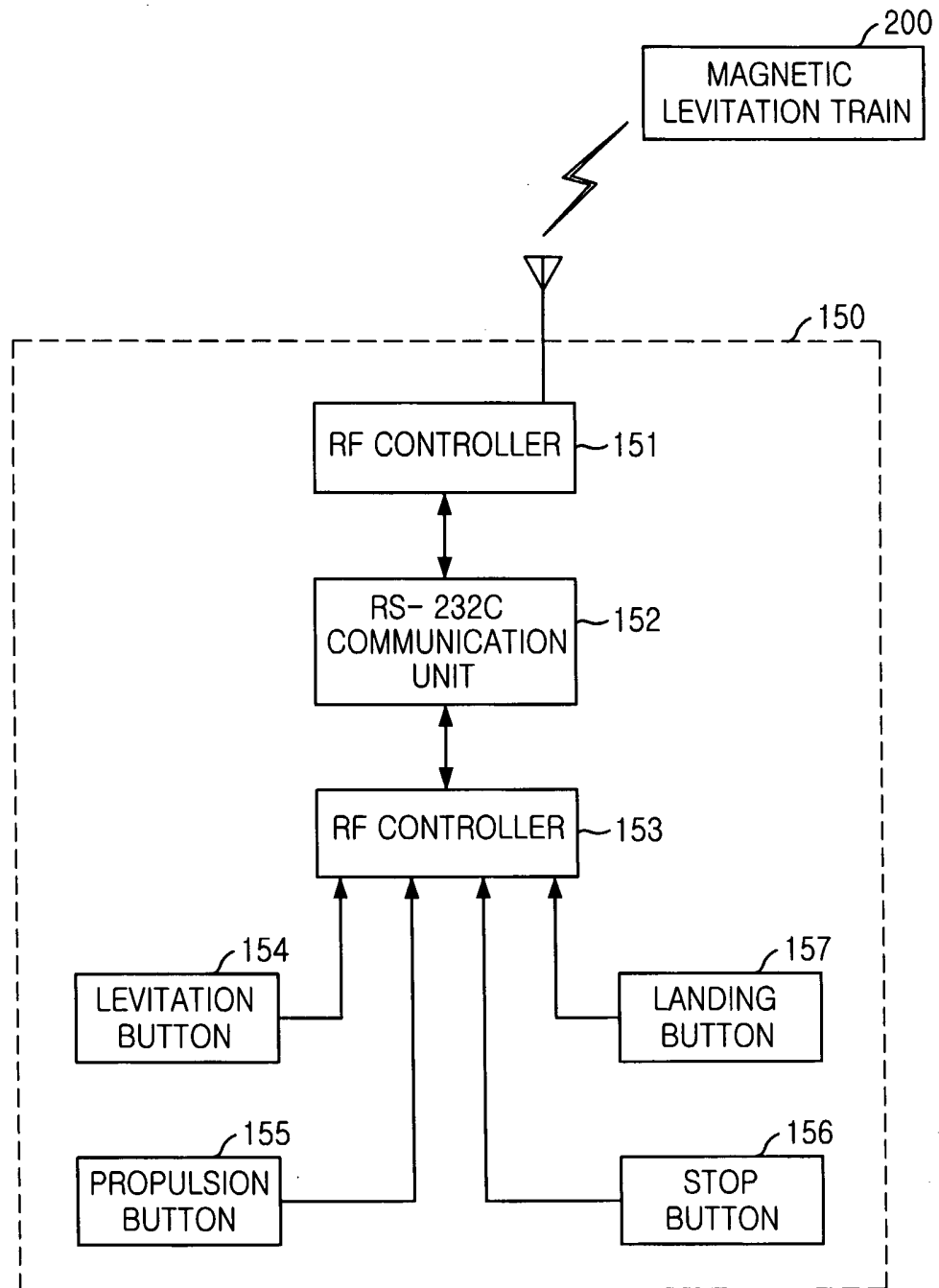
representing the packet data converted to the decimal
10 numerals using a graph to display on a monitor 140 of the PC 130.

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FIG. 1

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FIG. 2

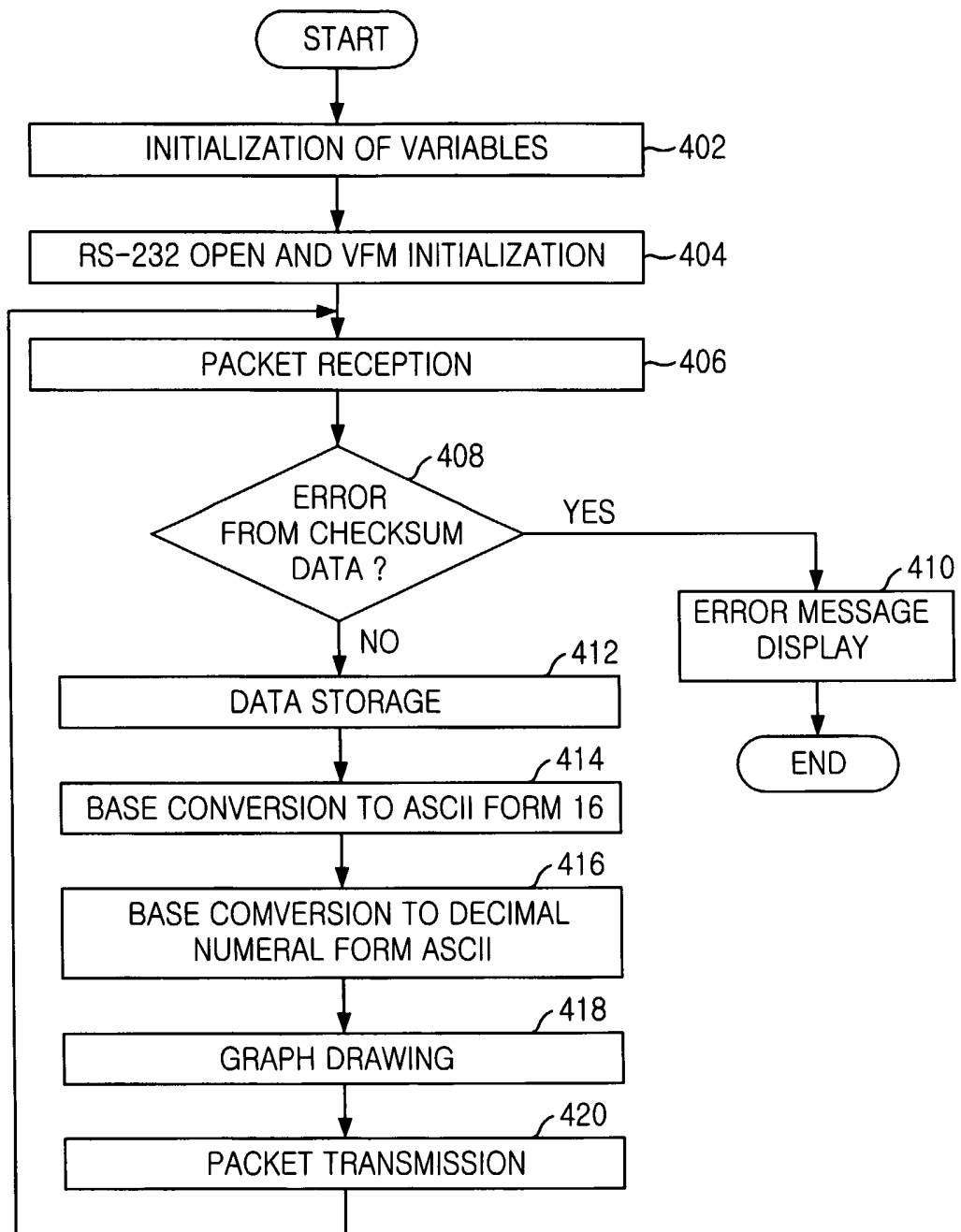
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FIG. 3



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FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER**IPC7 B60L 13/06**

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 B60L

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

Japanese Utility models and application for Utility models since 1975

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	CA 02263031 A(KASTEN CHASE RESEARCH LIMITED) 26 Feb 1999 (See the abstract and Claim 1)	1, 2, 4, 5
A	JP 10-203369 A(Toshiba Ltd) 4 Aug 1998 (See the whole document)	1 ~ 5
A	WO 2004/036526(Johnson Controls Technology Company) 29 Apr 2004 (See the whole document)	1 ~ 5



Further documents are listed in the continuation of Box C.



See patent family annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP10203369	04.08.1998	JP10203369A2	04.08.1998
		JP10203369	04.08.1998