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(54) Title of the invention	MESSAGE TRANSMISSION SYSTEM	
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<p>1 Specification</p> <p>1. Title of the Invention</p> <p>2. Claims</p> <p>5 A message transmission system comprising a mobile terminal, a wireless base station, and a control station, using one-way wireless communication lines that transmit data from the control station to the mobile terminal via the wireless base station, wherein the data transmitted from the control station is divided into a plurality of frames, a mobile terminal number, a data number, and a frame number are attached to each frame before being transmitted, and transmitted frames are held by the control station for a fixed amount of time,</p> <p>15 the mobile terminal checks whether or not the frames were able to be received without error, and, if a frame with an error is identified, stores the data number and the frame number thereof, and visibly displays the data number and the frame number in the mobile terminal,</p> <p>20 a mobile terminal owner electrically or acoustically couples the mobile terminal to a general telephone network to transmit to the control station the mobile terminal number, the data number, and the number of the frame where the error occurred,</p> <p>25 the control terminal retransmits only the mobile terminal number, the data number, and the error frame number, and</p>	<p>1 the mobile terminal visibly displays the data of the frames which were initially correctly received and of the retransmitted frame in frame number order.</p> <p>3. Detailed Description of the Invention</p> <p>5 (Industrial Field of Use)</p> <p>The present invention relates to a one-way mobile wireless data communication system such as a display-type beeper, wherein data is retransmitted when received data is incorrect.</p> <p>10 (Prior Art)</p> <p>Conventionally, in one-way mobile wireless data communication systems, advanced error correction functionality has been added to signals or identical signals have been transmitted multiple times to improve signal reliability. However, these methods involve transmitting data that is several times the length of the actually required data length even when there are no problems in the wireless communication line, wasting valuable wireless bandwidth. The waste is particularly egregious when transmitting identical signals multiple times in cases where long pieces of data are transmitted, such as with display-type beepers. Moreover, mobile communication sometimes involves moving to locations with extremely poor wireless communication line transmission quality, such as inside elevators or tunnels, normally necessitating multiple transmissions even when an advanced error correction symbol is used.</p> <p>(Problem to be Solved by the Invention)</p>
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The present invention has as an object to provide a message transmission system that eliminates the waste of retransmission.

5 (Means for Solving the Problem)

A feature of the present invention for attaining this object is a message transmission system comprising a mobile terminal, a wireless base station, and a control station, using one-way wireless communication lines that transmit data from the control station to the mobile terminal via the wireless base station, wherein the data transmitted from the control station is divided into a plurality of frames, a mobile terminal number, a data number, and a frame number are attached to each frame before being transmitted, and transmitted frames are held by the control station for a fixed amount of time, the mobile terminal checks whether or not the frames were able to be received without error, and, if a frame with an error is identified, stores the data number and the frame number thereof, and visibly displays the data number and the frame number in the mobile terminal, a mobile terminal holder electrically or acoustically couples the mobile terminal to a general telephone network to transmit to the control station the mobile terminal number, the data number, and the number of the frame where the error occurred, the control terminal retransmits only the mobile terminal number, the data number, and the error frame number, and the mobile terminal visibly displays the data of the frames which were initially correctly received and of the retransmitted frame in frame number order.

The present invention divides data transmitted to a mobile terminal into a plurality of frames, adds a mobile terminal number, a data number, and a frame number to each frame before transmission, and displays the data number and the frame number of an incorrect frame in the mobile terminal, and a mobile terminal owner transmits the data number and the frame number of this incorrect frame over a general telephone line to a control station. The control station holds downlink data for a fixed amount of time and then retransmits only the data numbers and the frame numbers of the incorrect frames to the mobile terminal. Furthermore, if a configuration is used in which the mobile terminal transmits numbers which must be transmitted to the control station, being a control station access number, the mobile terminal number, the incorrect data number, and the frame number, from the mobile terminal to a general telephone network automatically via acoustic coupling or electromagnetic coupling, transmission of these numbers to the control station becomes very easy.

In this manner, when the wireless communication line quality is good, data is only sent once from the control station, and when retransmitting, only incorrect frames are retransmitted, which is very advantageous in terms of efficient use of wireless frequencies.

(Embodiments)

FIG. 1 is one embodiment of the present invention, in which 101 is a mobile terminal, 102 is a base station, 103 is a control station, 104 and 105 are exchanges in a general telephone network, 106 is memory, 107 is a data terminal, and 108 is a telephone.

FIG. 2 shows a frame format of a signal that the control station 103 transmits to the mobile station 101 from the base station 102. 201 is a synchronization signal, 202 is a mobile terminal number, 203 is a data number, 204 is a frame number, 205 is data, and 206 is an error correction detection code.

FIG. 3 is a clock diagram of the mobile terminal, in which 301 is a wireless section, 302 is a control section, 303 is memory, 304 is a display section, 305 is a PB signal generation section, 306 is a speaker, and 307 is keys.

FIG. 4 is a control flow in the mobile terminal. A user wishing to transmit data to the mobile station 101 first dials an access number to the control station 103 from the data terminal 107 using a general telephone line. The exchange 105 extends a communication line to the exchange 104 and is connected to the control station 103. A reception tone is transmitted to the data terminal 107 from the control station 103, and a mobile terminal number that is to be called and data are transmitted from the data terminal 107. Having received these, the control station 103 looks at the length of the received data and if it is larger than an amount the control station 103 can transmit at one time, the control station 103 divides the received data into a plurality of instances of data and transmits this over a wireless communication line. FIG. 2 shows a transmission frame format. Each frame comprises the synchronization signal 201 for establishing frame synchronization and bit synchronization, the mobile terminal number 202 from which data is to be received, the data number 203 that is to be sent, a frame number 204 of the divided data, the divided data 205, and an error correction detection code 206. The control station outputs these data and stores the data that has been transmitted, the mobile terminal number, the data number, the frame number, and the transmitted data in the memory 106. The transmission data is sent from the base station 102 to the mobile station 101 over the wireless communication line. In the mobile station 101, the wireless section 301 in

1 FIG. 3 performs reception and demodulation (400
 in FIG. 4), and the control section 302 corrects any
 errors

5 using the error correction detection code 206
 (402). If it is found that there are no errors, the data
 number 203, the frame number 204, and the data 205
 are stored in the memory 303 (404). If there are errors,
 a symbol is attached indicating that there is an error,
 and this is similarly stored in the memory 303. Once
 10 all the frames in one data number have been received,
 the control section 302 emits a ring tone (408) as
 needed, and displays the data to the display section
 304 (410). Whether all the frames have been received
 or not can easily be established by including a number
 15 indicating an order of frames and how many frames
 have been transmitted in the frame number. If there
 are any frames that contain errors in the display data,
 the fact that there is an error is also displayed. For the
 error display, several methods are conceivable,
 20 including displaying everything including the
 incorrect data, and causing the frames with incorrect
 data to blink, indicating through writing or the like
 that there are incorrect frames without displaying the
 data, and so on. The mobile terminal owner sees these
 25 displays and if he or she desires to receive correct
 data, he or she goes to a nearby telephone 108 as in
 FIG. 1, and if the telephone is a PB telephone, the
 mobile terminal owner picks up the handset and
 checks for a dial tone, and then places the speaker
 30 section 306 of the mobile terminal 101 against a
 mouthpiece of the telephone and presses a connection
 key of the keys 307 (416). The control section 302
 reads a connection telephone number to the control
 station 103 in FIG. 1 from the memory 303, drives the
 35 PB signal generation section 305, and transmits the
 telephone number as a dial signal through the speaker
 306 (418). The exchange 105 receives this signal, and
 causes the control station 103 to receive it via the
 exchange 104. The control station 103 responds to the
 40 call and transmits a talkie or a second dial tone. Upon
 hearing this, the mobile terminal owner presses the
 data transmission key in the keys 307 (420), upon
 which the control section 302 reads the data number,
 the frame number, and its own mobile terminal
 45 number for the data that is experiencing the error from
 the memory 303, drives the PB signal generation
 section 305, and transmits the data through the speaker
 306 (422). If there are a plurality of frames with
 errors, a plurality of frame numbers are transmitted. If
 50 the frame number(s) could not be received, then
 naturally the missing frame number(s) are transmitted.

Upon receiving this signal, the control station 103
 searches the content of the memory 106 on the basis of
 the mobile terminal number, the data number, and the

1 frame number that have been received, and then
 5 retransmits the incorrect frame to the mobile terminal
 101 via the base station 102 and the wireless
 communication line. The mobile terminal 101 sees
 from the data number that this data is a retransmission
 of previously received data, and stores the newly
 10 received data in a memory area for already-stored data
 numbers. If there are frames with errors after error
 correction and detection, the display indicates that
 there are errors, as during the first reception, and
 requests retransmission again through the telephone if
 15 needed. If it is seen that all the frames were able to be
 received without errors after error correction, then this
 is displayed to the display section 304 to notify the
 mobile terminal owner.

If the telephone 108 is not a PB telephone, the
 20 mobile terminal 101 is connected to the mouthpiece of
 the telephone 108, then no connection can be
 established with the control station 103 even if the
 connection key of the keys 307 is pressed and the PB
 signal is transmitted through the speaker 306. In this
 25 case, the mobile terminal owner must manually dial
 the connection number for the control station 103 from
 the dial of the telephone 108 and connect to the
 control station 103 using a DP signal. Next, the mobile
 terminal owner hears the talkie or the second dial tone
 30 from the control station and connects the mobile
 terminal 101 to the mouthpiece of the telephone 108
 and presses a data transmission key of the keys 307, at
 which the control section 302 the frame number with
 the error can be extracted from the memory 303 and
 35 transmitted together with the data number, the mobile
 terminal number, and the PB signal through the
 speaker 306. In this manner, the dialing is done
 manually at first, but there is no need to input the data
 number and so on manually, so data entry is extremely
 40 simple. FIG. 4 shows a control flow of the mobile
 terminal.

In the above description, a method was described
 in which a mobile terminal owner acoustically couples
 a mobile terminal to a telephone and automatically
 45 transmits a data number, frame number, and a mobile
 terminal number with an error, but it is also possible to
 provide a special terminal to the telephone and
 transmit the data electromagnetically, instead of using
 acoustic coupling. Moreover, it is also naturally
 50 possible to display the mobile terminal number, the
 data number, and the incorrect frame number to the
 terminal for the mobile terminal owner to enter
 manually through a PB telephone, instead of automatic
 transmission.

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With this system, if the transmission frame is divided into several pieces, all of the frames included in the mobile terminal number, the data number, and the frame number are transmitted several times, and therefore if any of those are received by the mobile terminal the data is transmitted to the mobile terminal, making it possible to know how many frames were not delivered and making it easy to perform a

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retransmission request. However, if the transmission data is a single frame or there are only a few frames, the mobile terminal number and so on are transmitted once or only a few times, and if there are errors therein, it would be impossible even to know that data was transmitted to the mobile terminal, making it impossible to request retransmission. To avoid this, a method is conceivable in which only the mobile terminal number, the data number, and all the frames are transmitted multiple times at first, as with existing beepers. Thus if the wireless communication line is good, waste does arise because of the multiple transmissions, but in general these numbers and digits are shorter than the data that is transmitted, and therefore the usage efficiency of the wireless communication line drops almost not at all, even if transmission is repeated several times.

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(Effects of the Invention)

As discussed above, with the present invention, in a communication system in which there is a one-way wireless communication line, such as with a beeper provided with a display, ordinarily communication can be performed without multiple data transmissions, which is extremely desirable in terms of efficient usage of wireless communication lines. Incorrect frame numbers are transmitted over a telephone line, but retransmitted data from a control station uses wireless communication lines, meaning no new receiver is needed for the mobile terminal, allowing economical retransmission. Moreover, when a frame number that has an error is transmitted to the control station using a general telephone line, the mobile terminal is coupled with a telephone using acoustic coupling or the like, allowing transmission of incorrect frame numbers and the like using a PB signal

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1 simply by operating keys on the mobile terminal. This provides the effect of making it possible to make a retransmission request using an extremely simple operation. Moreover, by transmitting only the mobile terminal number and all the frames, the reliability of the system can be improved even more.

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1. Brief Description of the Drawings

FIG. 1 is one embodiment of the present invention.

FIG. 2 is a frame format of a signal that is transmitted to a mobile terminal 101 from a base station 102 by a control station 103.

FIG. 3 is a block diagram of a mobile terminal.

FIG. 4 is a control flow of the mobile terminal describing operation of the present invention.

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101 ... mobile terminal, 102 ... base station, 103 ... control station, 104, 105 ... exchanges in a general telephone network,

106 ... memory, 107 ... data terminal,

108 ... telephone, 201 ... synchronization signal,

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202 ... mobile terminal number, 203 ... data signal,

204 ... frame number, 205 ... data

206 ... error correction detection code, 303 ... memory,

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304 ... display section, 305 ... PB signal generation section,

306 ... speaker, 307 ... key.

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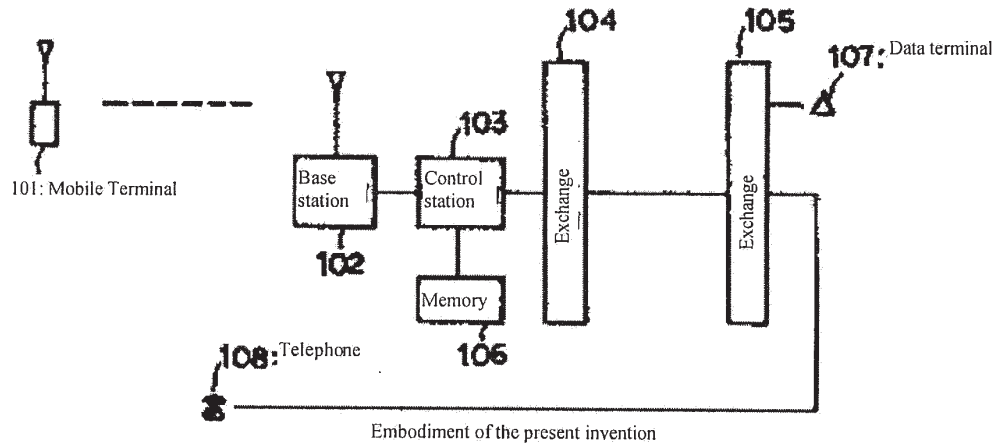


FIG. 1

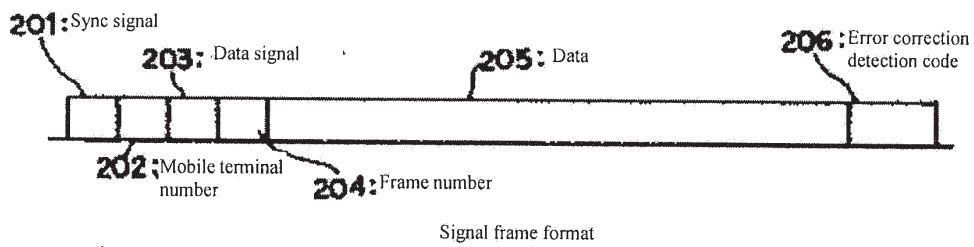


FIG. 2

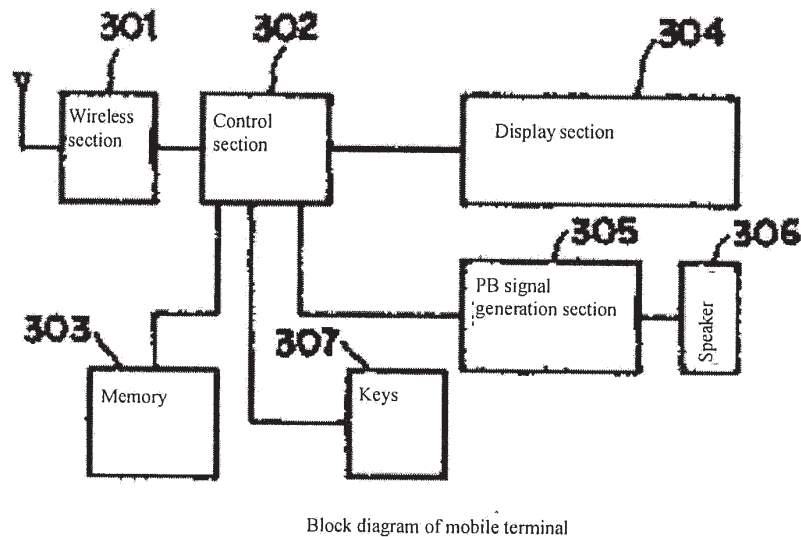


FIG. 3

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