US 20170301259A9

(19) **United States**

(12) **Patent Application Publication**

Song et al.

(10) **Pub. No.: US 2017/0301259 A9**

(48) **Pub. Date: Oct. 19, 2017**

CORRECTED PUBLICATION

(54) **LANGUAGE DELAY TREATMENT SYSTEM AND CONTROL METHOD FOR THE SAME**

(71) Applicant: **KOREA ADVANCED INSTITUTE OF SCIENCE AND TECHNOLOGY**, Daejeon (KR)

(72) Inventors: **June Hwa Song**, Daejeon (KR); **In Seok Hwang**, Daejeon (KR); **Chung Kuk Yoo**, Daejeon (KR); **Chan You Hwang**, Daejeon (KR); **Young Ki Lee**, Daejeon (KR); **John Dong Jun Kim**, Daejeon (KR); **Dong Sun Jennifer Yim**, Seoul (KR); **Chul Hong Min**, Daejeon (KR)

(73) Assignee: **KOREA ADVANCED INSTITUTE OF SCIENCE AND TECHNOLOGY**, Daejeon (KR)

(21) Appl. No.: **14/047,177**

(22) Filed: **Oct. 7, 2013**

Prior Publication Data

(15) Correction of US 2015/0064666 A1 Mar. 5, 2015
See (30) Foreign Application Priority Data.

(65) US 2015/0064666 A1 Mar. 5, 2015

(30) **Foreign Application Priority Data**

Sep. 5, 2013 (KR) 10-2013-0106393

Publication Classification

(51) **Int. Cl.**

G09B 19/04	(2006.01)
G09B 5/04	(2006.01)
G09B 5/14	(2006.01)
G10L 25/78	(2013.01)

(52) **U.S. Cl.**

CPC ***G09B 19/04*** (2013.01); ***G09B 5/14*** (2013.01); ***G09B 5/04*** (2013.01); *G10L 25/78* (2013.01)

(57) **ABSTRACT**

The present disclosures relates to a control terminal, comprising: a data communication unit for receiving a first user voice by data communication with a first audio device and receiving a second user voice by data communication with a second audio device; a turn information generating unit for generating turn information, which is voice unit information, by using the first and second user voices; and a metalanguage processing unit for determining a conversation pattern of the first and second users by using the turn information, and outputting a reminder message corresponding to a reminder event to the first user when the conversation pattern corresponds to a preset reminder event occurrence condition.

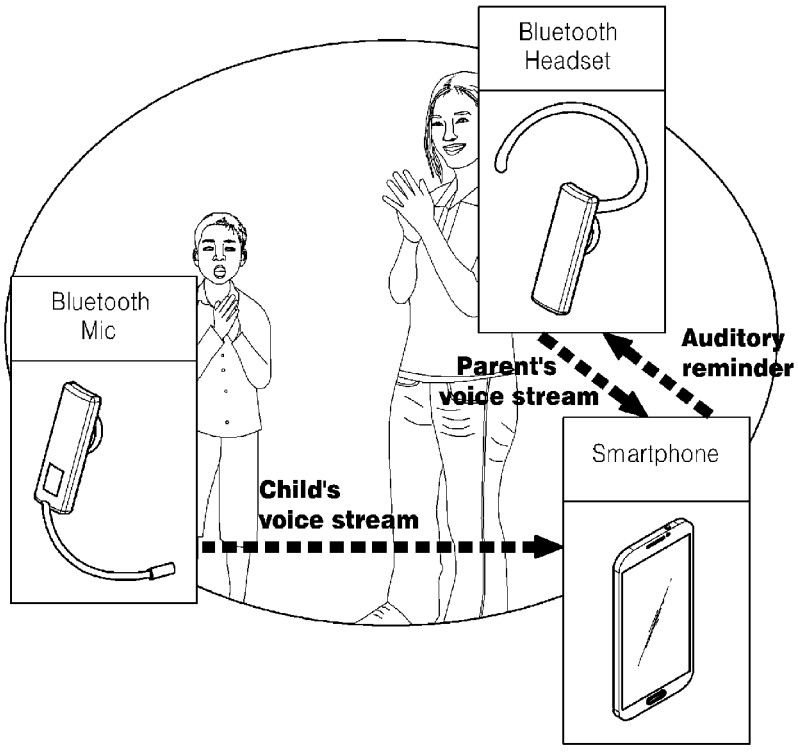


FIG. 1

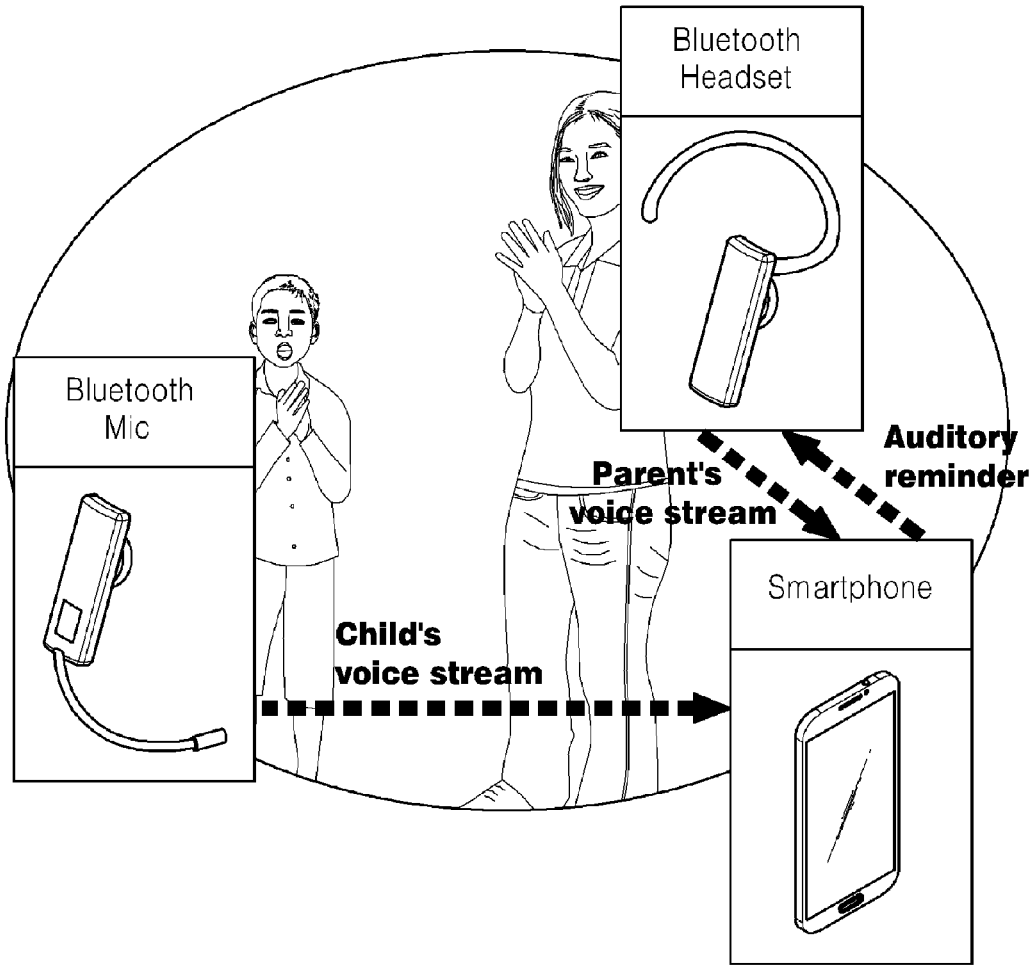

Bluetooth
Headset
Bluetooth
Mic
Auditory
reminder
Parent's
voice stream
Smartphone
Child's
voice stream

FIG. 2

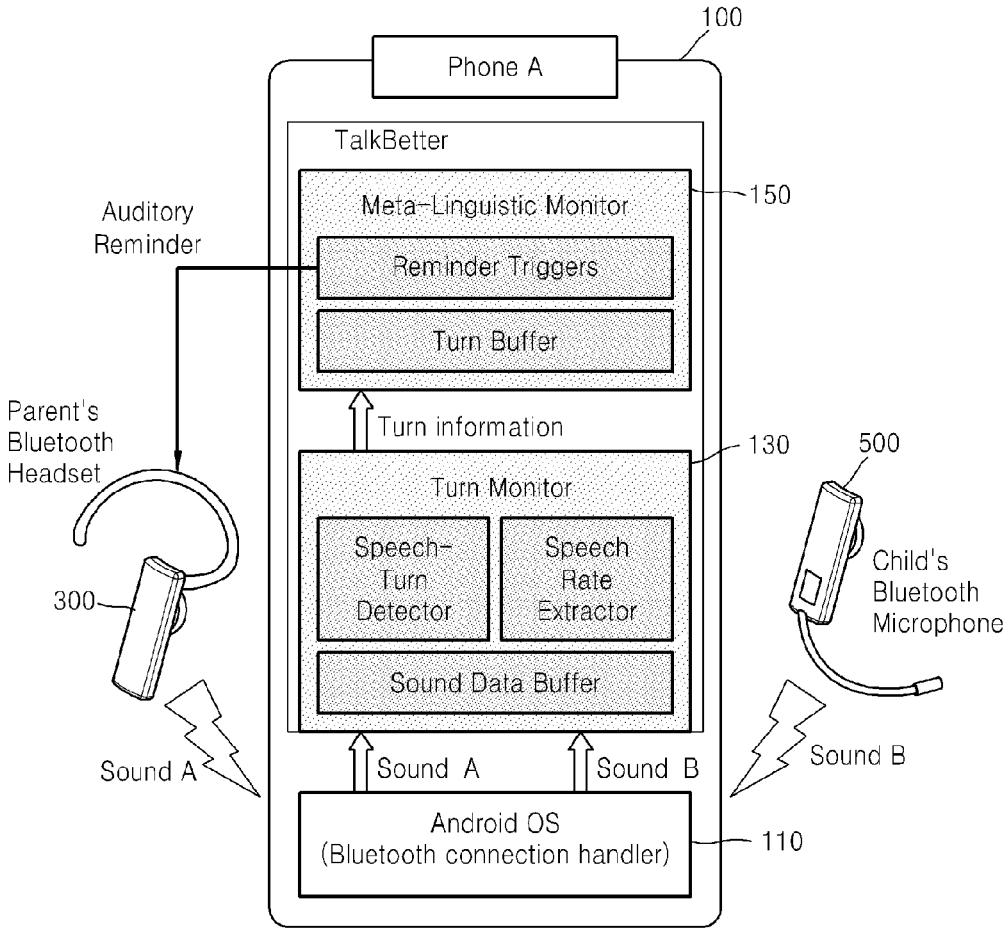

100
Phone A
TalkBetter
Meta-Linguistic Monitor
150
Reminder Triggers
Turn Buffer
Auditory Reminder
Turn information
130
Turn Monitor
Speech-Turn Detector
Speech Rate Extractor
Sound Data Buffer
Parent's Bluetooth Headset
300
500
Child's Bluetooth Microphone
Sound A
Sound A
Sound B
Sound B
Android OS
(Bluetooth connection handler)
110

FIG. 3

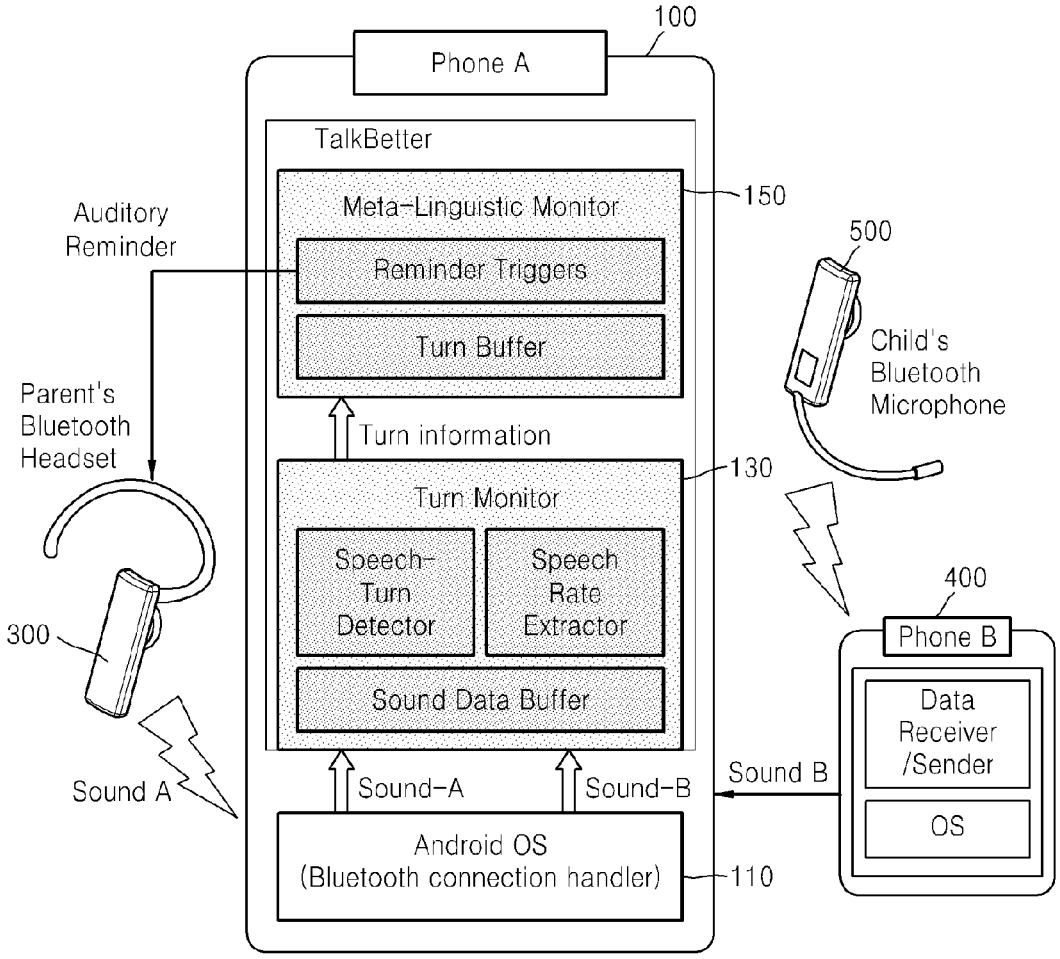

100
Phone A
TalkBetter
Meta-Linguistic Monitor
150
Reminder Triggers
Turn Buffer
Auditory Reminder
Parent's Bluetooth Headset
300
Turn information
Turn Monitor
130
Speech-Turn Detector
Speech Rate Extractor
Sound Data Buffer
Sound A
Sound-A
Sound-B
Android OS
(Bluetooth connection handler)
110
500
Child's Bluetooth Microphone
400
Phone B
Data Receiver /Sender
OS
Sound B

FIG. 4

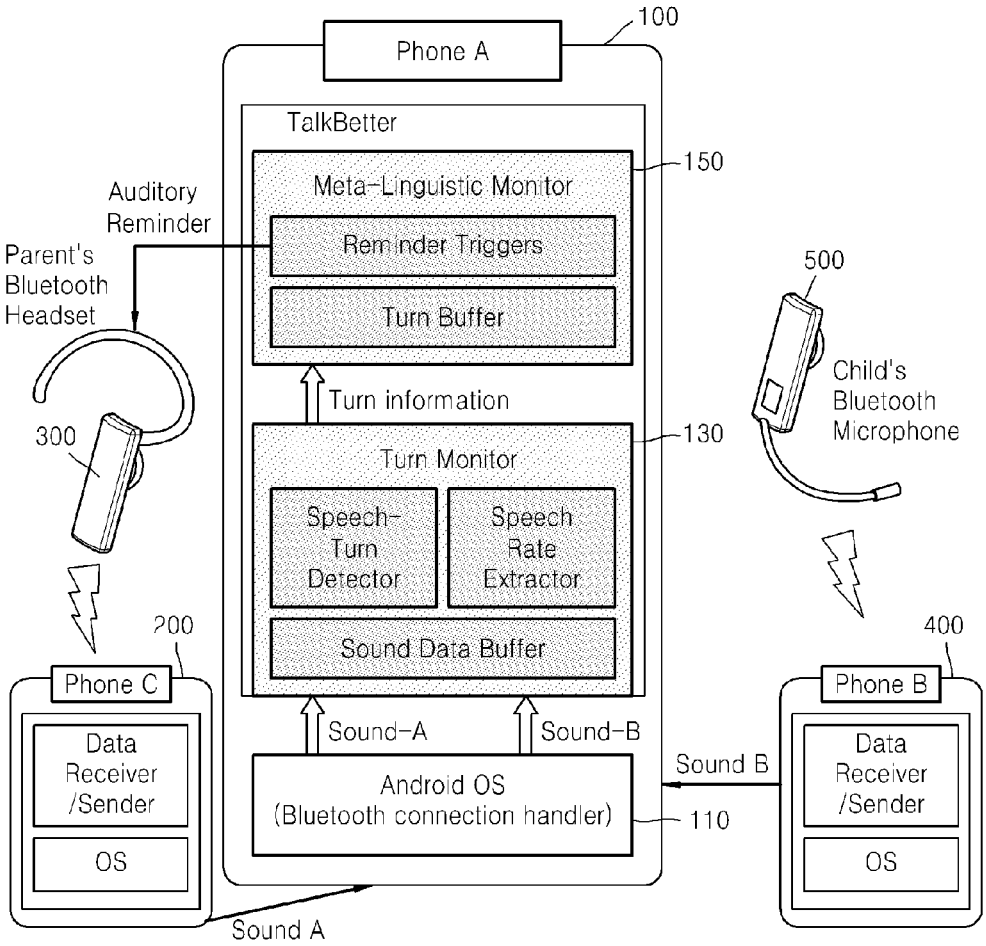
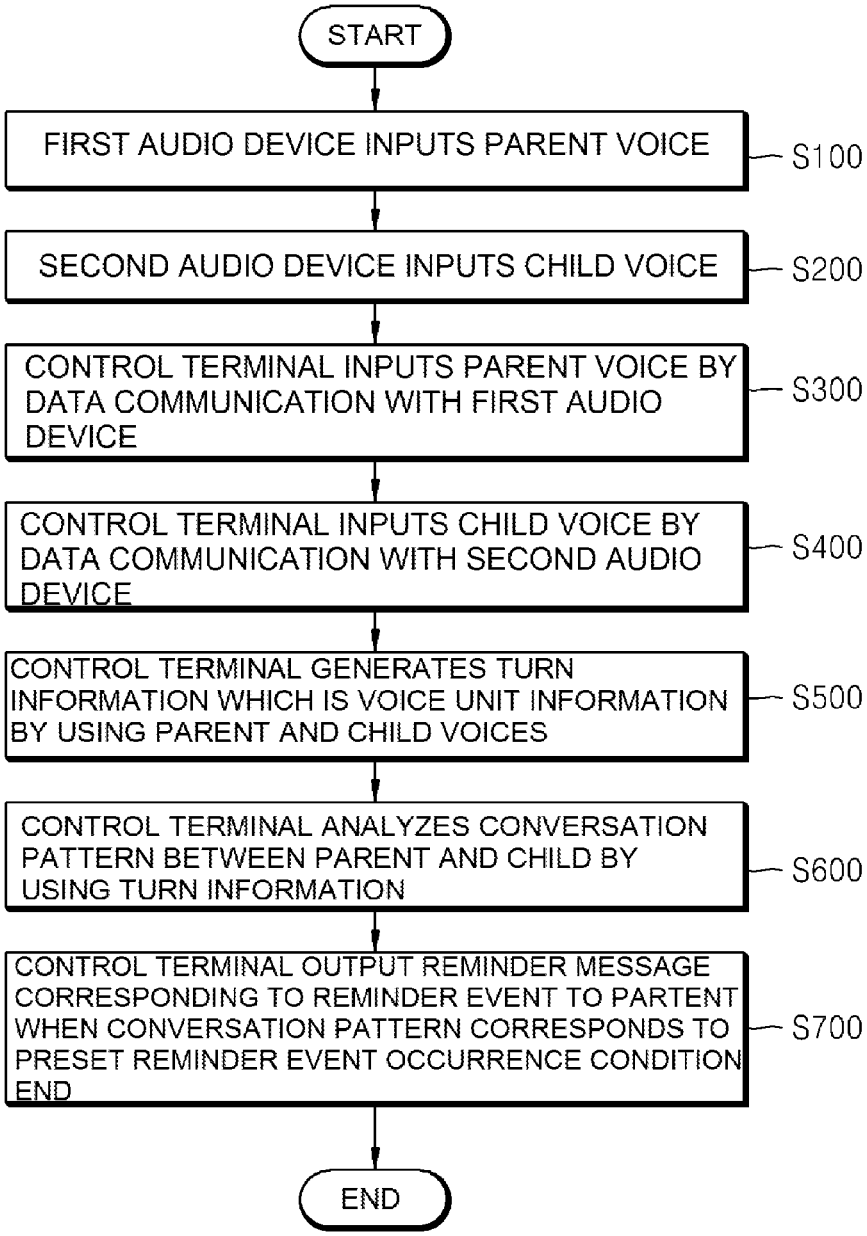

100
Phone A
TalkBetter
150
Meta-Linguistic Monitor
Reminder Triggers
Turn Buffer
Auditory Reminder
Parent's Bluetooth Headset
300
Turn information
130
Turn Monitor
Speech-Turn Detector
Speech Rate Extractor
Sound Data Buffer
500
Child's Bluetooth Microphone
200
Phone C
Data Receiver /Sender
OS
Sound-A
Sound-B
Android OS (Bluetooth connection handler)
110
Sound B
400
Phone B
Data Receiver /Sender
OS
Sound A

FIG. 5


START
FIRST AUDIO DEVICE INPUTS PARENT VOICE
S100
SECOND AUDIO DEVICE INPUTS CHILD VOICE
S200
CONTROL TERMINAL INPUTS PARENT VOICE BY DATA COMMUNICATION WITH FIRST AUDIO DEVICE
S300
CONTROL TERMINAL INPUTS CHILD VOICE BY DATA COMMUNICATION WITH SECOND AUDIO DEVICE
S400
CONTROL TERMINAL GENERATES TURN INFORMATION WHICH IS VOICE UNIT INFORMATION BY USING PARENT AND CHILD VOICES
S500
CONTROL TERMINAL ANALYZES CONVERSATION PATTERN BETWEEN PARENT AND CHILD BY USING TURN INFORMATION
S600
CONTROL TERMINAL OUTPUT REMINDER MESSAGE CORRESPONDING TO REMINDER EVENT TO PARTENT WHEN CONVERSATION PATTERN CORRESPONDS TO PRESET REMINDER EVENT OCCURRENCE CONDITION
END
S700
END

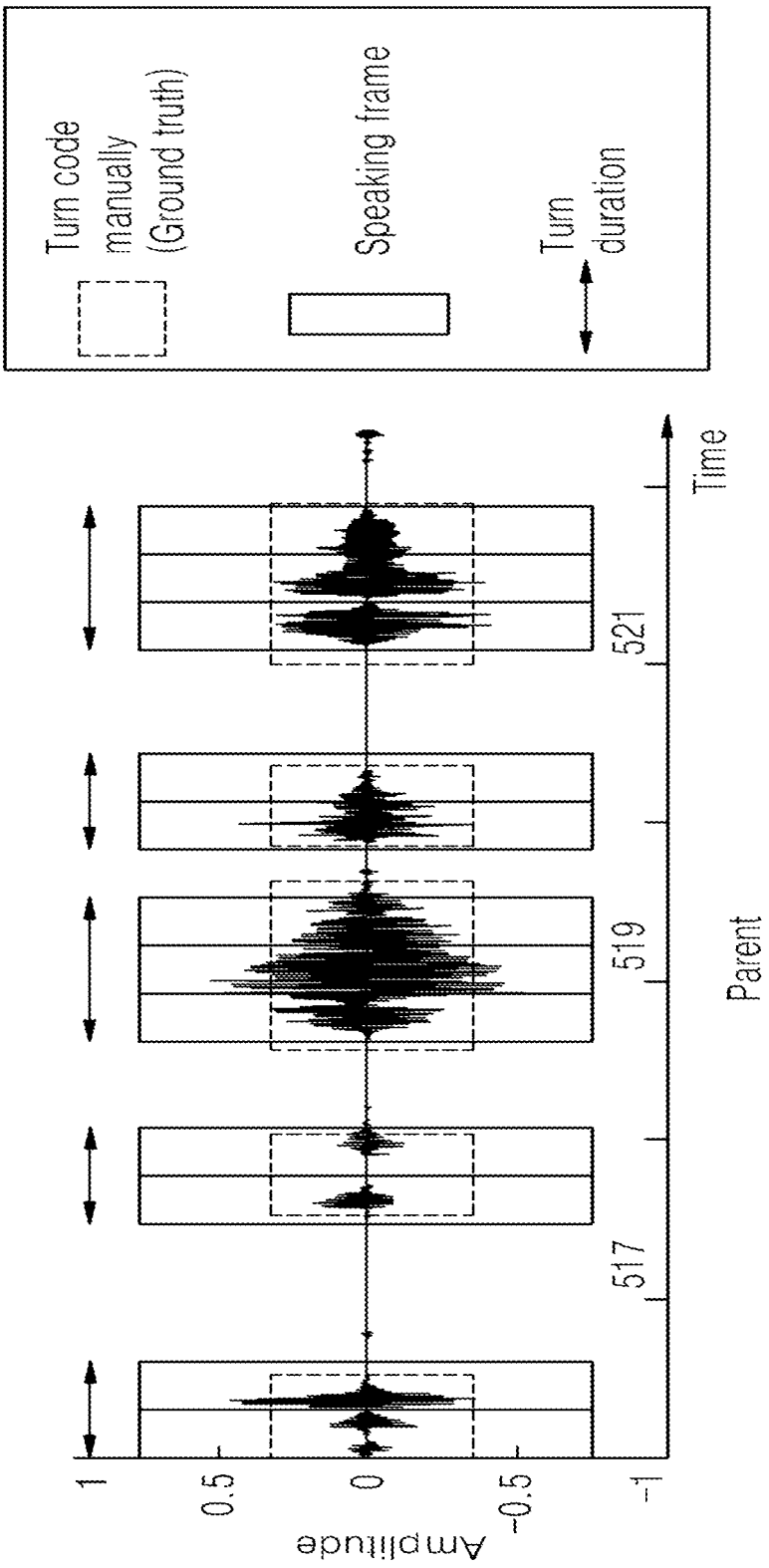

Turn code manually (Ground truth)
Speaking frame
Turn duration
Time
Parent
521
519
517
Amplitude
1
0.5
0
-0.5
-1

FIG. 6

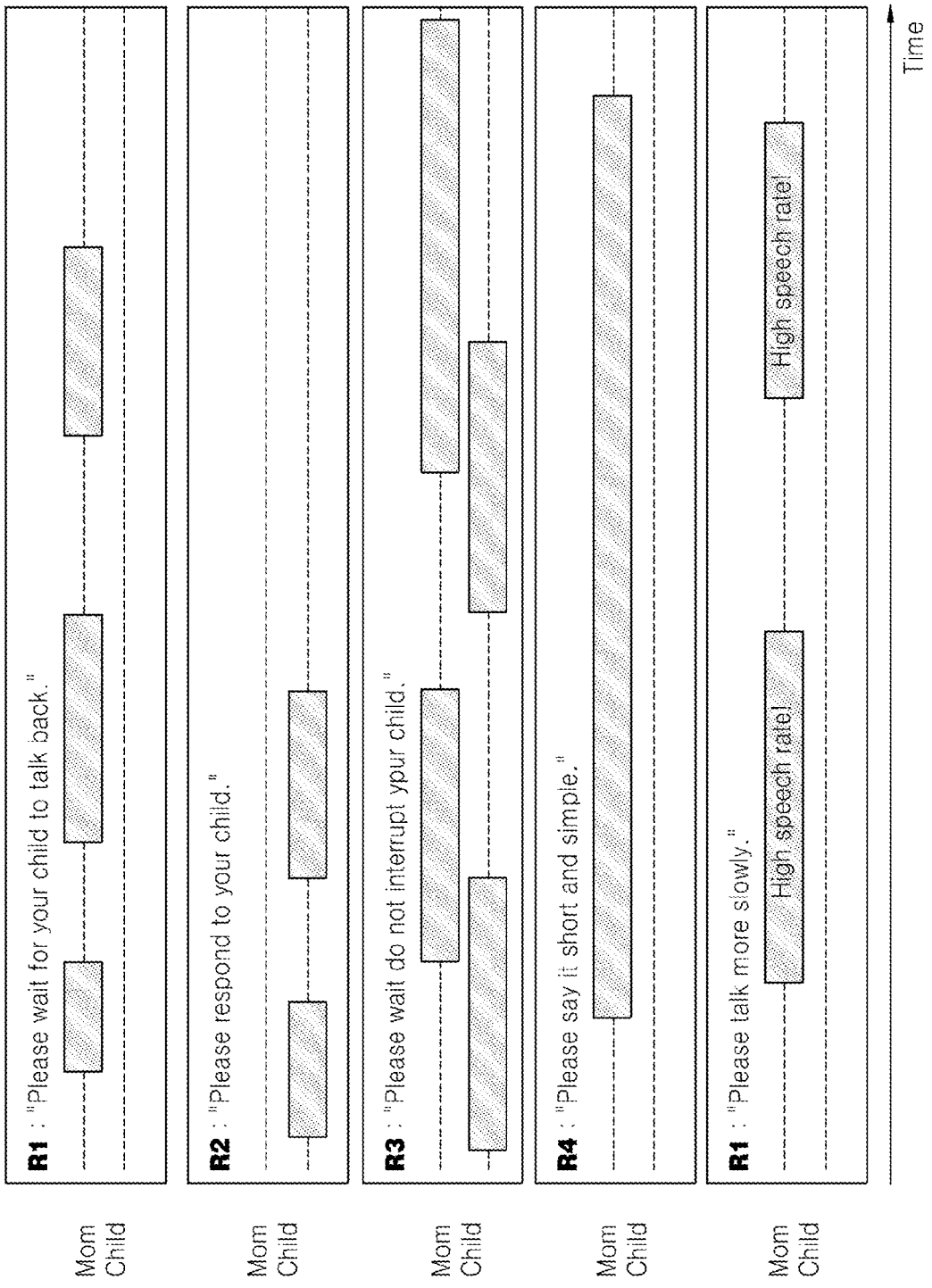

R1 : "Please wait for your child to talk back."
R2 : "Please respond to your child."
R3 : "Please wait do not interrupt ypur child."
R4 : "Please say it short and simple."
R1 : "Please talk more slowly."
High speech rate!
High speech rate!
Mom
Child
Time

FIG. 7

FIG. 8

REMINDER NO	REMINDER CONDITIONS
R1	triggered if a parent's turns repeat Ndominance times in which pauses between adjacent turns are shorter than Twait AND no child's turn appears during these parent turns.
R2	triggered if the following condition repeats Ngrace2 times: Given a child's turn, neither a parent's nor a child's turn follows within time duration $T_{neglect}$.
R3	triggered if a parent's turn begins before the child's turn ends for N_{grace3} times.
R4	triggered if the duration of a parent's turn is longer than T_{long} AND no child turn follows within $T_{response4}$ after the parent's turn ends.
R5	triggered if the estimated syllable rate of a parent's turn is higher than R_{fast} AND no child turn follows within $T_{response5}$ after the parent's turn ends.

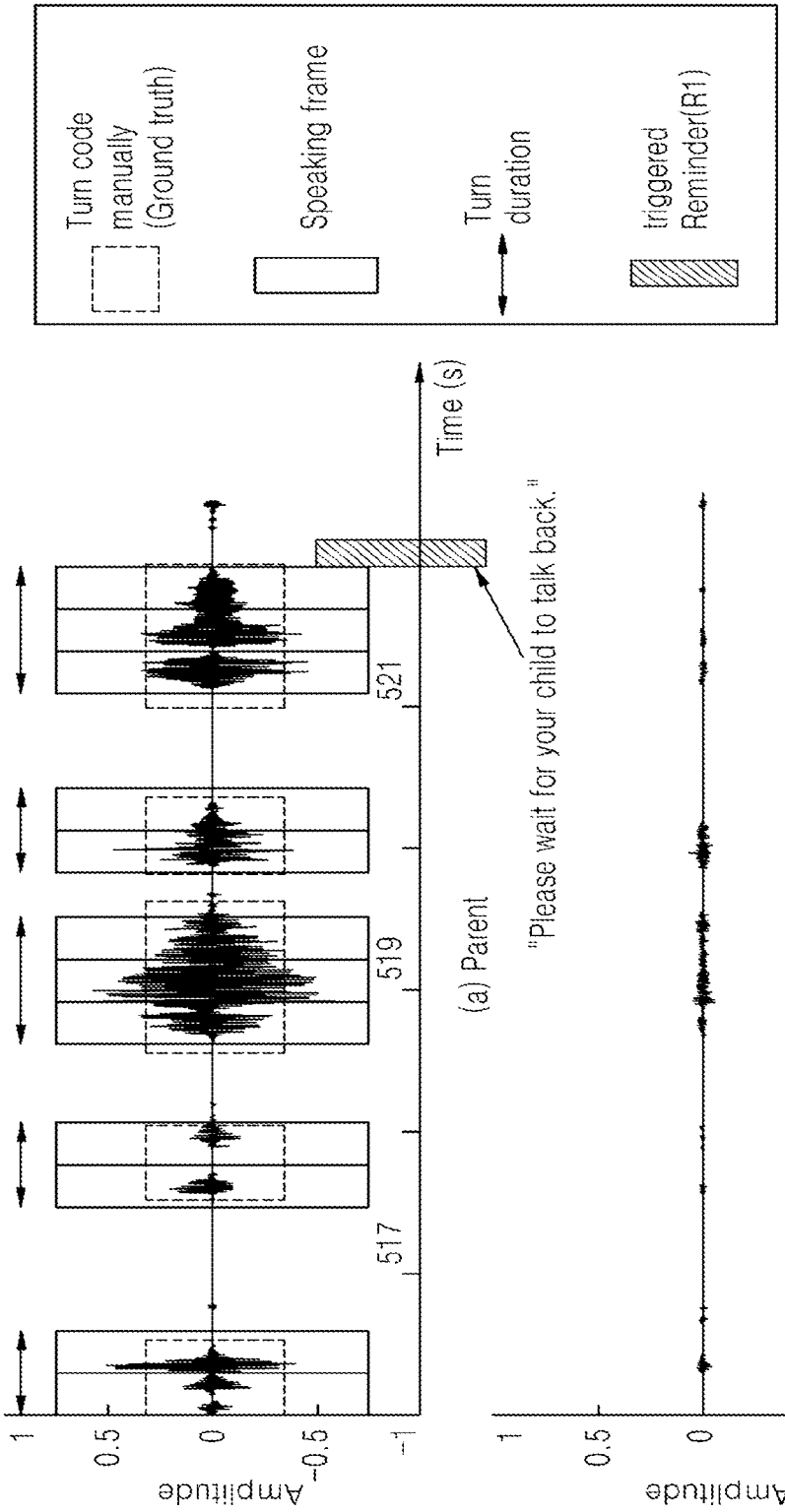

Turn code manually (Ground truth)
Speaking frame
Turn duration
triggered Reminder(R1)
Time (s)
"Please wait for your child to talk back."
(a) Parent
(b) Child
Amplitude
517
519
521
1
0.5
0
−0.5
−1

FIG. 9

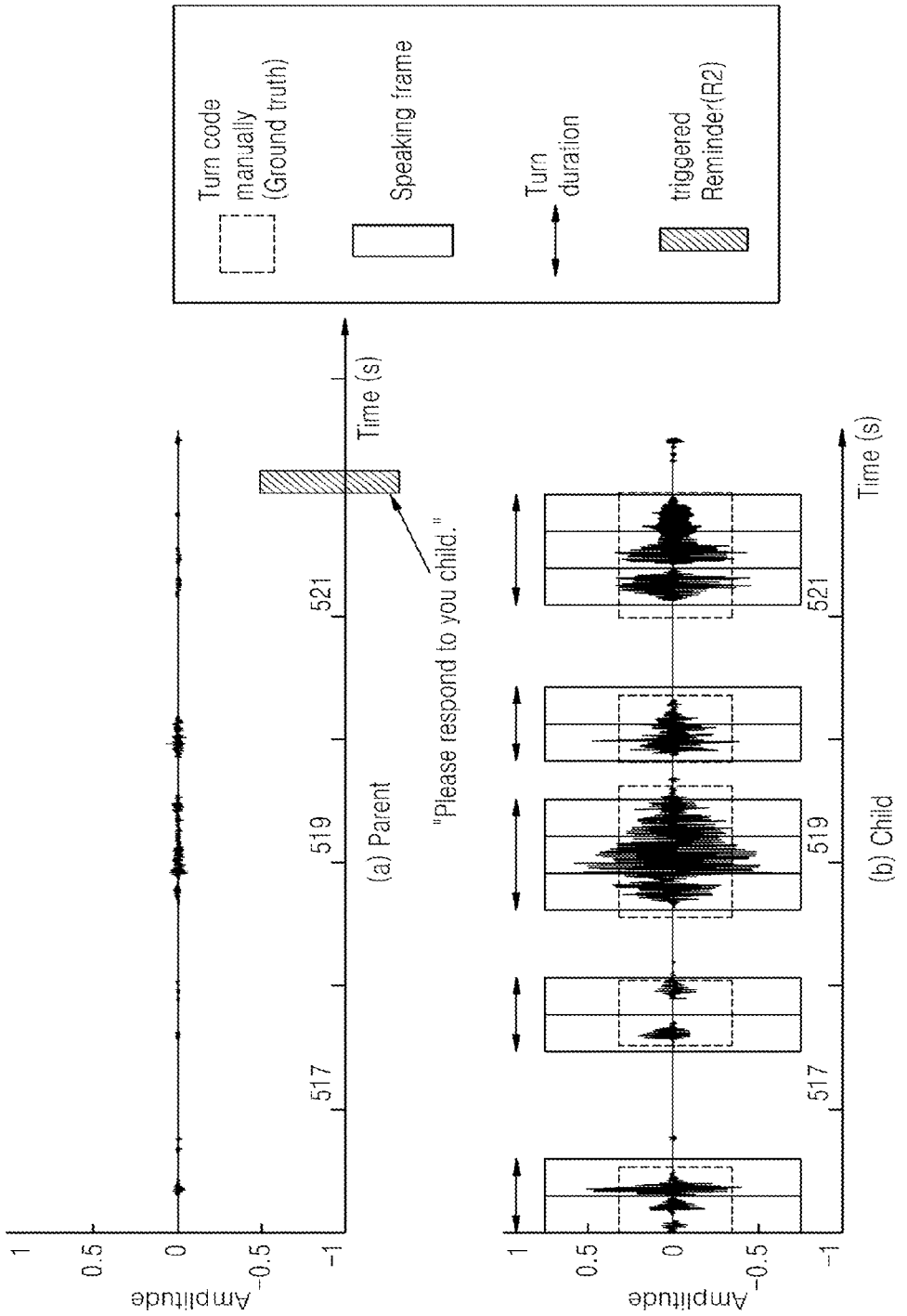

Turn code manually (Ground truth)
Speaking frame
Turn duration
triggered Reminder(R2)
Time (s)
"Please respond to you child."
(a) Parent
(b) Child
Amplitude
1
0.5
0
-0.5
-1
517
519
521

FIG. 10

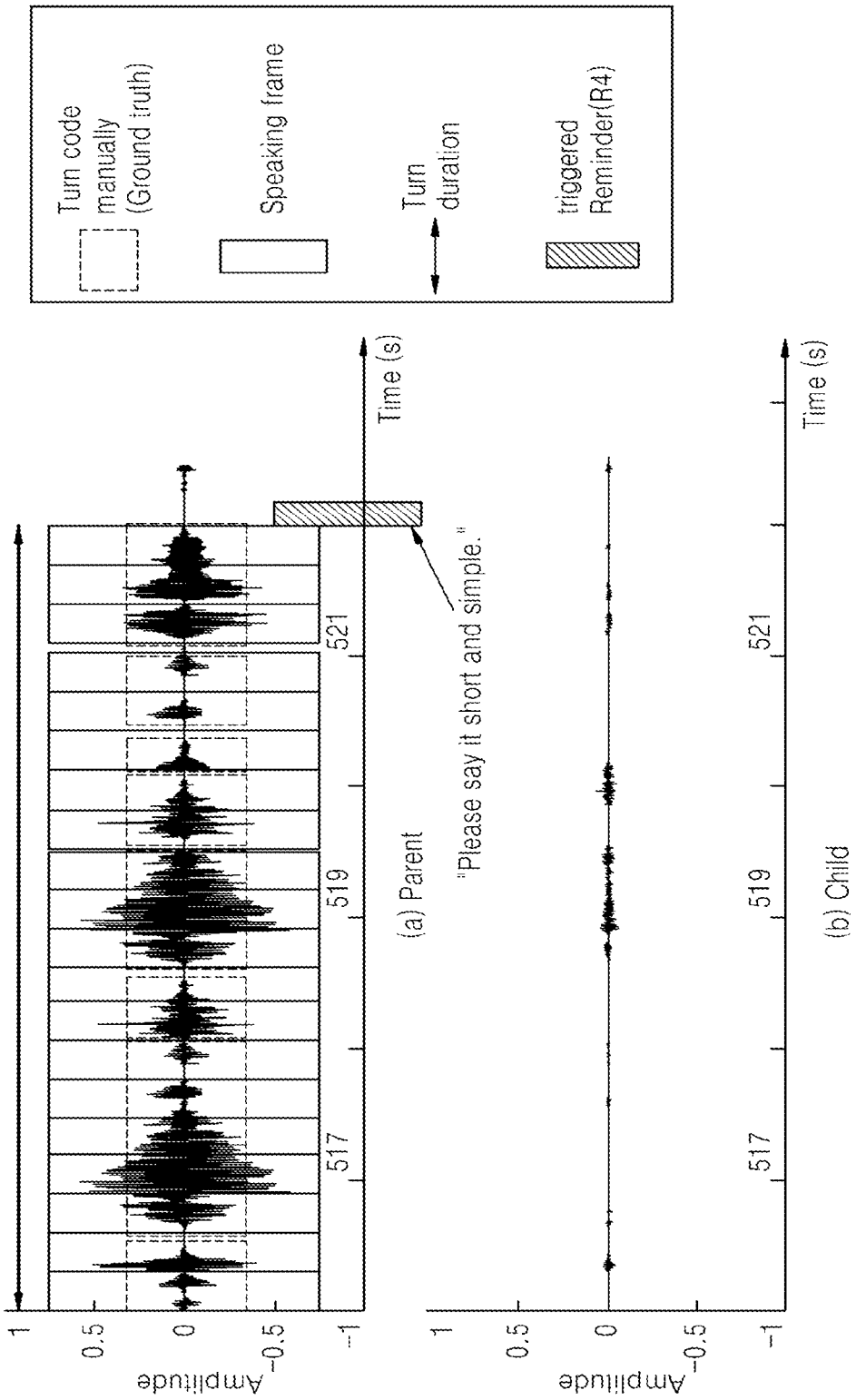

Turn code manually (Ground truth)
Speaking frame
Turn duration
triggered Reminder(R4)
Time (s)
(a) Parent
"Please say it short and simple."
(b) Child
Amplitude
1
0.5
0
−0.5
−1
517
519
521

FIG. 11

FIG. 12

REMINDER NO	REMINDER MESSAGE
R1	"Please wait for your child to talk back."
R2	"Please respond to your child."
R3	"Please do not interrupt your child."
R4	"Please say it short and simple."
R5	"Please talk more slowly."

LANGUAGE DELAY TREATMENT SYSTEM AND CONTROL METHOD FOR THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority of Korean Patent Application No. 10-2013-0106393, filed on Sep. 5, 2013, in the KIPO (Korean Intellectual Property Office), the disclosure of which is incorporated herein entirely by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present disclosure relates to a language delay treatment system and a control method for the same, and more particularly, to a language delay treatment system configured to analyze a conversation pattern between a parent and a child and correct a conversation habit of the parent, and a control method for the same.

[0004] 2. Description of the Related Art

[0005] Language delay means a state in which verbal development of an infant is relatively delayed in comparison to physical development.

[0006] Unless suitable treatment is timely provided to the language delay symptom, the language delay may act as various latent risk factors over the entirely life of the corresponding infant. For example, learning disability or social skill deficiency in an adolescent period, or even economic hardship or long-term unemployment in an adult age has been reported.

[0007] Through studies for more ten years, speech pathologists have proved that very important effects can be provided to infants who are suffering from language delay, when formal treatment provided to the infants under a dedicated therapeutic environment is accompanied with active participation and endeavors of a parent under various conversation situations in daily life.

[0008] However, at the conversation in daily life between a parent and a child, the participation of the parent may be more effective when conversation habits of the parent, which have been during the lifetime of the parent, are corrected suitably for the purpose of the treatment. In the speech pathology, correcting conversation habits of a parent as described above is called as 'parent training'.

[0009] In order to intentionally change natural conversation habits of a person, it is demanded to concentrate efforts for a long time and always pay attention at every instant in daily life. This is never simple to a parent who has not been studied specialized language treatment.

[0010] Therefore, in order to correct conversation habits of parent suitably for the treatment of language delay of a child, there is demanded a system for monitoring conversations in daily life between the parent and the child and guiding the parent to rapidly correct the conversation habits based on the monitoring results.

SUMMARY OF THE INVENTION

[0011] The present disclosure is directed to providing a language delay treatment system configured to analyze a conversation pattern between a parent and a child and guides the parent to correct a conversation habit, and a control method for the same.

[0012] By using the above configuration, the language delay treatment system and the control method for the same according to the present disclosure may actively expand the language treatment effects for an infant, who is suffering from language delay, over the entire daily life.

[0013] In addition, by monitoring a conversation pattern between the parent and the child, a conversation habit which should be corrected may be rapidly recognized.

[0014] Moreover, by sending a correction guide message for the conversation habit which should be corrected, it is possible to support the parent to be efficiently trained against the language delay.

[0015] Further, it is possible to give a motive for preventing or early treating a language delay problem.

[0016] According to an aspect of the present disclosure, there is provided a control terminal, comprising: a data communication unit for receiving a first user voice by data communication with a first audio device and receiving a second user voice by data communication with a second audio device; a turn information generating unit for generating turn information, which is voice unit information, by using the first and second user voices; and a metalanguage processing unit for determining a conversation pattern of the first and second users by using the turn information, and outputting a reminder message corresponding to a reminder event to the first user when the conversation pattern corresponds to a preset reminder event occurrence condition.

[0017] The control terminal may further comprise a preprocessing unit for optionally processing the first and second user voices with respect to a voice range.

[0018] The turn information in the control terminal may include at least one of speaker identification information, time, accent, loudness and speed of a unit voice.

[0019] The turn information generating unit in the control terminal may determine speaker identification information of the turn information according to a ratio of the first user voice and the second user voice.

[0020] The turn information generating unit generating unit in the control terminal may generate the turn information when the first user voice or the second user voice is equal to or greater than a preset loudness.

[0021] The reminder event occurrence condition may include at least one of a case in which only a turn of the first user occurs during a preset time, a case in which only a turn of the second user occurs during a preset time, a case in which the turn of the first user occurs over a preset number before the turn of the second user ends, a case in which the turn of the first user continues over a preset time, and a case in which the turn of the first user is equal to or greater than a preset speed.

[0022] According to still another aspect of the present disclosure, there is provided a control method for a language delay treatment system, which includes a first audio device for receiving a voice of a first user, a second audio device for receiving a voice of a second user, and a control terminal, the control method comprising: receiving, by the control terminal, the first user voice by data communication with the first audio device; receiving, by the control terminal, the second user voice by data communication with the second audio device; generating, by the control terminal, turn information which is voice unit information by using the first and second user voices; determining, by the control terminal, a conversation pattern of the first and second users by using the turn information; and outputting, by the control terminal, a reminder message corresponding to a reminder event to the

first user when the conversation pattern corresponds to a preset reminder event occurrence condition.

[0023] The control method for a language delay treatment system may further comprise: preprocessing for optionally processing the first and second user voices with respect to a voice range.

[0024] The turn information may include at least one of speaker identification information, time, accent, loudness and speed of a unit voice.

[0025] The generating of turn information may determine speaker identification information of the turn information according to a ratio of the first user voice and the second user voice.

[0026] The generating of turn information generates the turn information when the first user voice or the second user voice is equal to or greater than a preset loudness.

[0027] The reminder event occurrence condition includes at least one of a case in which only a turn of the first user occurs during a preset time, a case in which only a turn of the second user occurs during a preset time, a case in which the turn of the first user occurs over a preset number before the turn of the second user ends, a case in which the turn of the first user continues over a preset time, and a case in which the turn of the first user is equal to or greater than a preset speed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The above and other features and advantages will become more apparent to those of ordinary skill in the art by describing in detail exemplary embodiments with reference to the attached drawings, in which:

[0029] FIG. **1** shows a service environment of a language delay treatment system according to an embodiment of the present disclosure;

[0030] FIGS. **2** to **4** are diagrams showing the language delay treatment system according to an embodiment of the present disclosure;

[0031] FIG. **5** is a flowchart illustrating a control method for the language delay treatment system according to an embodiment of the present disclosure;

[0032] FIG. **6** describes relations of the user voice stream and turn, and the turn information;

[0033] FIG. **7** is a diagram showing a reminder event occurrence condition of turn information according to an embodiment of the present disclosure;

[0034] FIG. **8** is a diagram showing a reminder event occurrence condition according to an embodiment of the present disclosure;

[0035] FIG. **9** is a diagram showing turn information of the first reminder event occurrence condition according to an embodiment of the present disclosure, in which only a turn of the parent occurs during a preset time;

[0036] FIG. **10** is a diagram showing turn information of the second reminder event occurrence condition according to an embodiment of the present disclosure, in which only a turn of the child occurs during a preset time;

[0037] FIG. **11** is a diagram showing turn information of the fourth reminder event occurrence condition according to an embodiment of the present disclosure, in which the turn of the parent continues over a preset time; and

[0038] FIG. **12** is a diagram showing a reminder message according to an embodiment of the present disclosure.

[0039] In the following description, the same or similar elements are labeled with the same or similar reference numbers.

DETAILED DESCRIPTION

[0040] The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

[0041] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "includes", "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. In addition, a term such as a "unit", a "module", a "block" or like, when used in the specification, represents a unit that processes at least one function or operation, and the unit or the like may be implemented by hardware or software or a combination of hardware and software.

[0042] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0043] Preferred embodiments will now be described more fully hereinafter with reference to the accompanying drawings. However, they may be embodied in different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the disclosure to those skilled in the art.

[0044] FIG. **1** shows a service environment of a language delay treatment system according to an embodiment of the present disclosure.

[0045] The language delay treatment system provides a conversation habit correction guide service to parent in real time.

[0046] The language delay treatment system receives a voice of a user (a parent or a child) through an audio device such as a Bluetooth headset or a microphone and sends the voice to a control terminal such as a smart phone. In addition, the control terminal operates the conversation habit correction guide service as a background service to continuously monitor conversations between the parent and the child without intentional intervention of the parent.

[0047] In addition, the language delay treatment system analyzes a time-based pattern of the conversations between

the parent and the child in real time, and if a pattern not in accordance with recommended patterns treated by a speech therapist is found, the language delay treatment system automatically reminds the parent of it through voice guidance or the like.

[0048] FIGS. **2** to **4** are diagrams showing the language delay treatment system according to an embodiment of the present disclosure.

[0049] First, FIG. **2** is a diagram showing a language delay treatment system according to a first embodiment of the present disclosure, and the language delay treatment system includes a control terminal **100**, a first audio device **300** and a second audio device **500**.

[0050] The first audio device **300** is configured to receive a voice of the parent, and for example, the first audio device **300** may be a Bluetooth headset. The parent wears the first audio device **300** and input their voice thereto.

[0051] The second audio device **500** is configured to receive a voice of the child, and for example, the second audio device **500** may be a Bluetooth microphone. The child wears the second audio device **500** and inputs a voice thereto.

[0052] The control terminal **100** includes a data communication unit **110**, a turn information generating unit **130** and a metalanguage processing unit **150**, and for example, the control terminal **100** may be a mobile terminal such as a smart phone, a tablet or a notebook.

[0053] The data communication unit **110** is configured to receive a parent voice by data communication with the first audio device **300**, and to receive a child voice by data communication with the second audio device **500**.

[0054] Even though it is depicted that the data communication unit **110** and the first and second audio devices **300**, **500** make Bluetooth communication, the present disclosure is not limited thereto and may receive a user voice by means of various kinds of data communication such as IR communication, NFC, wire communication or the like.

[0055] The turn information generating unit **130** is configured to generate turn information, which is voice unit information, by using the input parent and child voices.

[0056] First, the turn represents a vocalization unit extracted from a successive voice stream of the parent and the child. In addition, the turn information includes speaker identification information, start time, duration time, voice accent, voice loudness, voice speed or the like of each turn.

[0057] Relations of the user voice stream and turn, and the turn information will be described later in detail with reference to FIG. **6**.

[0058] In addition, the turn information generating unit **130** may determine speaker identification information of the turn information by comparing loudness of the input parent voice with loudness of the input child voice and finding relative voice loudness in comparison to surrounding noise loudness.

[0059] For example, if a ratio of parent voice loudness and child voice loudness in one turn is 8:2, the turn information generating unit **130** may determine that the corresponding turn belongs to a parent voice, namely, the speaker identification information of the turn is the parent.

[0060] In addition, the turn information generating unit **130** may extract acoustic meta information such as voice accent, voice loudness and voice speed by applying various acoustic signal processing logics.

[0061] Moreover, the turn information generating unit **130** may be configured to generate the corresponding turn information only when the parent voice or the child voice is equal to or greater than a preset loudness. This prevents turn information from being generated by surrounding noise.

[0062] The metalanguage processing unit **150** analyzes a conversation pattern between the parent and the child by using the turn information.

[0063] If the conversation pattern between the parent and the child corresponds to a preset reminder event occurrence condition, the metalanguage processing unit **150** outputs a reminder message corresponding to the reminder event to the parent.

[0064] In the present disclosure, the reminder event occurrence condition may include five cases as follows.

[0065] (R1) a case in which only a turn of the parent occurs during a preset time

[0066] (R2) a case in which only a turn of the child occurs during a preset time

[0067] (R3) a case in which the turn of the parent occurs over a preset number before the turn of the child ends

[0068] (R4) a case in which the turn of the parent continues over a preset time

[0069] (R5) a case in which the turn of the parent is equal to or greater than a preset speed

[0070] The reminder event occurrence condition will be described later in detail with reference to FIGS. **7** and **8**.

[0071] In addition, the metalanguage processing unit **150** may output the reminder message through the control terminal **100**, and may send the reminder message to the first audio device **300** so that the first audio device **300** outputs the reminder message to the parent.

[0072] Even though it is depicted that the reminder message is output to the parent as a voice, the present disclosure may also output the reminder message on a screen by using a display of the control terminal **100** or the first audio device **300**.

[0073] The reminder message will be described in detail later with reference to FIG. **12**.

[0074] The control terminal **100** may further include a preprocessing unit (not shown) for optionally processing a voice of the parent and the child with respect to a voice range.

[0075] The sound input from the first audio device **300** and the second audio device **500** may include not only a user voice but also various surrounding noise. Therefore, a preprocessing technique for enhancing selectivity for a human voice range from the input sound is required.

[0076] The preprocessing unit (not shown) may perform the preprocessing work by using a band-pass filter turned suitable for a human voice spectrum band or a voice activity detection (VAD) technique.

[0077] In addition, as shown in the figures, the data communication unit **110** and the preprocessing unit (not shown) may operate on an operating system (OS) of the control terminal **100**.

[0078] FIG. **3** is a diagram showing a language delay treatment system according to a second embodiment of the present disclosure, and FIG. **4** is a diagram showing a language delay treatment system according to a third embodiment of the present disclosure.

[0079] The language delay treatment system according to the second embodiment of the present disclosure further includes a second mobile terminal **400**. The second mobile

terminal **400** receives a child voice from the second audio device **500** and transmits the child voice to the control terminal **100**.

[0080] The language delay treatment system according to the third embodiment of the present disclosure further includes a first mobile terminal **200** and a second mobile terminal **400**. The first mobile terminal **200** receives a parent voice from the first audio device **300** and transmits the parent voice to the control terminal **100**, and the second mobile terminal **400** receives a child voice from the second audio device **500** and transmits the child voice to the control terminal **100**.

[0081] In addition, the first mobile terminal **400** and the second mobile terminal **400** may preprocess a voice of the parent or the child and transmit the preprocessed voice to the control terminal **100**. By doing so, the workloads of the control terminal **100** may be reduced.

[0082] FIG. **5** is a flowchart illustrating a control method for the language delay treatment system according to an embodiment of the present disclosure.

[0083] As shown in FIG. **5**, the control method for the language delay treatment system includes receiving, by the first audio device **300**, a parent voice (S**100**), receiving, by the second audio device **500**, a child voice (S**200**), receiving, by the control terminal **100**, the parent voice by data communication with the first audio device **300** (S**300**), receiving, by the control terminal **100**, the child voice by data communication with the second audio device **500** (S**400**), generating, by the control terminal **100**, turn information which is voice unit information by using the parent and child voice (S**500**), analyzing, by the control terminal **100**, a conversation pattern between the parent and the child by using the turn information (S**600**), and outputting, by the control terminal **100**, a reminder message corresponding to a reminder event to the parent when the conversation pattern corresponds to a preset reminder event occurrence condition (S**700**).

[0084] First, the first audio device **300** receives a parent voice (S**100**), and the second audio device **500** receives a child voice (S**200**). As described above, the first audio device **300** and the second audio device **500** are configured with a Bluetooth headset or a Bluetooth microphone to receive a voice of a user.

[0085] In addition, the data communication unit **110** of the control terminal **100** receives a parent voice by data communication with the first audio device **300** (S**300**), and receives a child voice by data communication with the second audio device **500** (S**400**).

[0086] Even though it is described in the specification that the data communication unit **110** and the first and second audio devices **300**, **500** perform Bluetooth communication, the present disclosure is not limited thereto but may receive a user voice by means of various kinds of data communication such as IR communication, NFC, wire communication or the like.

[0087] In addition, the turn information generating unit **130** of the control terminal **100** generates turn information, which is voice unit information, by using the parent voice and the child voice (S**500**).

[0088] As described above, the turn represents a vocalization unit extracted from a successive voice stream of the parent and the child. In addition, the turn information includes speaker identification information, start time, duration time, voice accent, voice loudness, voice speed or the like of each turn.

[0089] Moreover, the turn information generating unit **130** may determine speaker identification information of the turn information by comparing loudness of the input parent voice with loudness of the input child voice and finding relative voice loudness in comparison to surrounding noise loudness.

[0090] In addition, the turn information generating unit **130** may extract acoustic meta information such as voice accent, voice loudness and voice speed by applying various acoustic signal processing logics.

[0091] Moreover, the turn information generating unit **130** may be configured to generate the corresponding turn information only when the parent voice or the child voice is equal to or greater than a preset loudness. This prevents turn information from being generated by surrounding noise.

[0092] In addition, the metalanguage processing unit **150** of the control terminal **100** analyzes a conversation pattern between the parent and the child by using the turn information (S**600**). Moreover, if the conversation pattern corresponds to a preset reminder event occurrence condition, the metalanguage processing unit **150** outputs a reminder message corresponding to the reminder event to the parent (S**700**).

[0093] The metalanguage processing unit **150** may output the reminder message through the control terminal **100**, and may send the reminder message to the first audio device **300** so that the first audio device **300** outputs the reminder message to the parent.

[0094] In addition, even though it is described in the specification that the reminder message is output to the parent as a voice, the present disclosure may also output the reminder message on a screen by using a display of the control terminal **100** or the first audio device **300**.

[0095] Moreover, the control method for the language delay treatment system may further include optionally processing a voice of the parent and the child with respect to a voice range, by means of a preprocessing unit (not shown) of the control terminal **100**.

[0096] As described above, the sound input from the first audio device **300** and the second audio device **500** may include not only a user voice but also various surrounding noise. Therefore, a preprocessing technique for enhancing selectivity for a human voice range from the input sound is required.

[0097] The preprocessing unit (not shown) may perform the preprocessing work by using a band-pass filter turned suitable for a human voice spectrum band or a voice activity detection (VAD) technique.

[0098] FIG. **6** is a diagram showing user voice information and turn information according to an embodiment of the present disclosure.

[0099] FIG. **6** shows a voice stream of the parent and turn information of the corresponding voice stream.

[0100] First, the turn is obtained by extracting a vocalization region from a voice stream as a unit, and in FIG. **6**, a turn is generated by extracting a vocalization region from the voice stream of the parent.

[0101] In addition, the turn information is voice stream information of the generated turn, and the turn information speaker identification information, start time, duration time, voice accent, voice loudness, voice speed or the like of the voice stream to which the corresponding turn belongs.

[0102] Therefore, the turn information generating unit **130** extracts a turn of a voice stream by using the corresponding voice stream and generates turn information which is voice stream information of the corresponding turn.

[0103] FIG. **7** is a diagram showing a reminder event occurrence condition of turn information according to an embodiment of the present disclosure, and FIG. **8** is a diagram showing a reminder event occurrence condition according to an embodiment of the present disclosure.

[0104] As described above, the reminder event occurrence condition may include five cases.

[0105] First, there is a first reminder event (R1) occurrence condition in which only a turn of the parent occurs during a preset time. This condition means that the parent talks alone regardless of an answer of the child.

[0106] The first reminder event (R1) occurrence condition has a formula "R1 is triggered if a parent's turns repeat $N_{dominance}$ times in which pauses between adjacent turns are shorter than T_{wait} AND no child's turn appears during these parent turns." Here, $N_{dominance}$ represents a repetition number of the preset parent turns, and T_{wait} represents an interval time of the preset parent turns.

[0107] In addition, there is a second reminder event (R2) occurrence condition in which only a turn of the child occurs during a preset time. This condition means that the parent does not answer to the child's talk.

[0108] The second reminder event (R2) occurrence condition has a formula "R2 is triggered if the following condition repeats N_{grace2} times: Given a child's turn, neither a parent's nor a child's turn follows within time duration $T_{neglect}$." Here, N_{grace2} represents a repetition number of the preset child turns, and $T_{neglect}$ represents an interval time of the preset child turns.

[0109] In addition, there is a third reminder event (R3) occurrence condition in which the turn of the parent occurs over a preset number before the turn of the child ends. This condition means that the parent does not answer to the child's talk.

[0110] The third reminder event (R3) occurrence condition has a formula "R3 is triggered if a parent's turn begins before the child's turn ends for N_{grace3} times." Here, N_{grace3} represents a preset number of the parent's turns which have occurred before the child's turn ends.

[0111] In addition, there is a fourth reminder event (R4) occurrence condition in which the turn of the parent continues over a preset time. This condition means that the parent talks too long sentence to be understood by the child.

[0112] The fourth reminder event (R4) occurrence condition has a formula "R4 is triggered if the duration of a parent's turn is longer than T_{long} AND no child turn follows within $T_{response4}$ after the parent's turn ends." Here, T_{long} represents a duration time of the preset parent's turn, and $T_{response4}$ represents a generation time of the preset child's turn.

[0113] Finally, there is a fifth reminder event (R5) occurrence condition in which the turn of the parent is equal to or greater than a preset speed. This condition means that the parent talks too fast to be understood by the child.

[0114] The fifth reminder event (R5) occurrence condition has a formula "R5 is triggered if the estimated syllable rate of a parent's turn is higher than R_{fast} AND no child turn follows within $T_{response5}$ after the parent's turn ends." Here, R_{fast} represents a preset voice speed, and $T_{response5}$ represents a generation time of the preset child's turn.

[0115] Therefore, the metalanguage processing unit **150** determines by using the turn information whether the conversation pattern between the parent and the child corresponds to the reminder event occurrence condition mentioned above.

[0116] In addition, even though 5 reminder event occurrence conditions have been described in the specification, the present disclosure may also include various reminder event occurrence conditions which may be applied to treat language delay of a child.

[0117] FIGS. **9** to **11** show cases in which turn information of a parent and a child corresponds to the above reminder event occurrence conditions and therefore corresponding reminder events occur.

[0118] FIG. **9** is a diagram showing turn information of the first reminder event occurrence condition according to an embodiment of the present disclosure, in which only a turn of the parent occurs during a preset time.

[0119] FIG. **10** is a diagram showing turn information of the second reminder event occurrence condition according to an embodiment of the present disclosure, in which only a turn of the child occurs during a preset time.

[0120] FIG. **11** is a diagram showing turn information of the fourth reminder event occurrence condition according to an embodiment of the present disclosure, in which the turn of the parent continues over a preset time.

[0121] FIG. **12** is a diagram showing a reminder message according to an embodiment of the present disclosure.

[0122] As shown in FIG. **12**, the first reminder (R1) may have a message "Please wait for your child to talk back.", the second reminder (R2) may have a message "Please respond to your child.", the third reminder (R3) may have a message "Please do not interrupt your child.", the fourth reminder (R4) may have a message "Please say it short and simple.", and the fifth reminder (R5) may have a message "Please talk more slowly."

[0123] Therefore, if a reminder event occurs, the metalanguage processing unit **150** may output the corresponding reminder message through the control terminal **100**, or may send the reminder message to the first audio device **300** so that the first audio device **300** outputs it to the parent.

[0124] In addition, the metalanguage processing unit **150** may output the reminder message on a screen through a display of the control terminal **100** or the first audio device **300**.

[0125] While the present disclosure has been described with reference to the embodiments illustrated in the figures, the embodiments are merely examples, and it will be understood by those skilled in the art that various changes in form and other embodiments equivalent thereto can be performed. Therefore, the technical scope of the disclosure is defined by the technical idea of the appended claims The drawings and the forgoing description gave examples of the present invention. The scope of the present invention, however, is by no means limited by these specific examples. Numerous variations, whether explicitly given in the specification or not, such as differences in structure, dimension, and use of material, are possible. The scope of the invention is at least as broad as given by the following claims.

What is claimed is:

1. A control terminal comprising:

a data communication unit for receiving a first user voice by data communication with a first audio device and

receiving a second user voice by data communication with a second audio device;

a turn information generating unit for generating turn information, which is voice unit information, by using the first and second user voices; and

a metalanguage processing unit for determining a conversation pattern of the first and second users by using the turn information, and outputting a reminder message corresponding to a reminder event to the first user when the conversation pattern corresponds to a preset reminder event occurrence condition.

2. The control terminal of claim **1**, further comprising a preprocessing unit for optionally processing the first and second user voices with respect to a voice range.

3. The control terminal of claim **1**, wherein the turn information includes at least one of speaker identification information, time, accent, loudness and speed of a unit voice.

4. The control terminal of claim **3**, wherein the turn information generating unit determines speaker identification information of the turn information according to a ratio of the first user voice and the second user voice.

5. The control terminal of claim **1**, wherein the turn information generating unit generates the turn information when the first user voice or the second user voice is equal to or greater than a preset loudness.

6. The control terminal of claim **1**, wherein the reminder event occurrence condition includes at least one of a case in which only a turn of the first user occurs during a preset time, a case in which only a turn of the second user occurs during a preset time, a case in which the turn of the first user occurs over a preset number before the turn of the second user ends, a case in which the turn of the first user continues over a preset time, and a case in which the turn of the first user is equal to or greater than a preset speed.

7. The control terminal of claim **2**, wherein the turn information includes at least one of speaker identification information, time, accent, loudness and speed of a unit voice.

8. The control terminal of claim **7**, wherein the turn information generating unit determines speaker identification information of the turn information according to a ratio of the first user voice and the second user voice.

9. The control terminal of claim **2**, wherein the turn information generating unit generates the turn information when the first user voice or the second user voice is equal to or greater than a preset loudness.

10. The control terminal of claim **2**, wherein the reminder event occurrence condition includes at least one of a case in which only a turn of the first user occurs during a preset time, a case in which only a turn of the second user occurs during a preset time, a case in which the turn of the first user occurs over a preset number before the turn of the second user ends, a case in which the turn of the first user continues over a preset time, and a case in which the turn of the first user is equal to or greater than a preset speed.

11. A control method for a language delay treatment system, which includes a first audio device for receiving a voice of a first user, a second audio device for receiving a voice of a second user, and a control terminal, the control method comprising:

receiving, by the control terminal, the first user voice by data communication with the first audio device;

receiving, by the control terminal, the second user voice by data communication with the second audio device;

generating, by the control terminal, turn information which is voice unit information by using the first and second user voices;

determining, by the control terminal, a conversation pattern of the first and second users by using the turn information; and

outputting, by the control terminal, a reminder message corresponding to a reminder event to the first user when the conversation pattern corresponds to a preset reminder event occurrence condition.

12. The control method for a language delay treatment system of claim **11**, further comprising:

preprocessing for optionally processing the first and second user voices with respect to a voice range.

13. The control method for a language delay treatment system of claim **11**, wherein the turn information includes at least one of speaker identification information, time, accent, loudness and speed of a unit voice.

14. The control method for a language delay treatment system of claim **13**, wherein the generating of turn information determines speaker identification information of the turn information according to a ratio of the first user voice and the second user voice.

15. The control method for a language delay treatment system of claim **11**, wherein the generating of turn information generates the turn information when the first user voice or the second user voice is equal to or greater than a preset loudness.

16. The control method for a language delay treatment system of claim **11**, wherein the reminder event occurrence condition includes at least one of a case in which only a turn of the first user occurs during a preset time, a case in which only a turn of the second user occurs during a preset time, a case in which the turn of the first user occurs over a preset number before the turn of the second user ends, a case in which the turn of the first user continues over a preset time, and a case in which the turn of the first user is equal to or greater than a preset speed.

17. The control method for a language delay treatment system of claim **12**, wherein the turn information includes at least one of speaker identification information, time, accent, loudness and speed of a unit voice.

18. The control method for a language delay treatment system of claim **17**, wherein the generating of turn information determines speaker identification information of the turn information according to a ratio of the first user voice and the second user voice.

19. The control method for a language delay treatment system of claim **12**, wherein the generating of turn information generates the turn information when the first user voice or the second user voice is equal to or greater than a preset loudness.

20. The control method for a language delay treatment system of claim **12**, wherein the reminder event occurrence condition includes at least one of a case in which only a turn of the first user occurs during a preset time, a case in which only a turn of the second user occurs during a preset time, a case in which the turn of the first user occurs over a preset number before the turn of the second user ends, a case in which the turn of the first user continues over a preset time, and a case in which the turn of the first user is equal to or greater than a preset speed.

* * * * *