

【SPECIFICATION】

【TITLE】

METHOD AND SYSTEM FOR SETTING DIFFICULTY LEVEL OF EXERCISE
PROGRAM USING LARGE LANGUAGE MODEL

【TECHNICAL FIELD】

The present disclosure relates to a method and system for setting a difficulty level of an exercise program using a large language model.

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【BACKGROUND】

With the rapid advancement of artificial intelligence (AI) technology in recent years, generative artificial intelligence models (e.g., ChatGPT) capable of natural conversation with humans have emerged.

In particular, a large language model (LLM), unlike conventional rule-based chatbots, provides human-like conversation quality based on diverse contextual understanding and natural language generation capabilities, and is being rapidly adopted in various industrial fields such as healthcare, education, and medical services.

Furthermore, along with the advancement of artificial intelligence technology, the utilization of artificial intelligence (AI) technology in the medical industry is rapidly expanding.

For example, interest is increasing in artificial intelligence technology that uses a large language model to provide non-face-to-face customized rehabilitation to patients requiring continuous management and rehabilitation during the course of treatment.

In this regard, in the medical and healthcare fields, large language models can be effectively utilized for management and rehabilitation of musculoskeletal disorders.

A musculoskeletal disorder refers to pain or damage occurring in the musculoskeletal system, such as muscles, nerves, tendons, ligaments, bones, and surrounding tissues.

As a principle, treatment of musculoskeletal disorders is initiated starting from the least invasive treatment, whereby non-pharmacological conservative treatment (e.g., exercise therapy and education, cognitive therapy, or relaxation therapy) is administered first, followed by pharmacological treatment and surgical treatment, which should be considered sequentially.

Treatment guidelines actively recommend non-pharmacological conservative treatment for musculoskeletal disorders, and research on methods for performing non-pharmacological conservative treatment of musculoskeletal disorders is being actively conducted, particularly in the United States and Europe.

However, in non-pharmacological conservative treatment for musculoskeletal disorders, continuous treatment and rehabilitation are important, and the fact that patients must frequently visit hospitals for treatment poses a significant burden.

Accordingly, interest in services providing non-face-to-face rehabilitation treatment is further increasing.

In non-face-to-face rehabilitation treatment, it is essential to deliver an exercise program accompanied by a rehabilitation exercise difficulty level setting that takes into account the user's age, gender, occupation, level of daily living activities, current primary diagnosis and related disease history, past medical history and surgical history, medication history, current physical functional status (muscle strength, joint range of motion, sense of balance, presence and degree of pain, etc.), cardiopulmonary function, neurological status, mental/psychological status, lifestyle habits (smoking, drinking, dietary habits, exercise experience, etc.), residential environment and exercise environment (use of mobility aids, exercise equipment owned, etc.), special notes (skin condition, surgical site condition, etc.), and the user's goals.

If the exercise difficulty level is set uniformly without taking into account the user's functional level or medical history (e.g., arthritis, rotator cuff injury, surgical records, etc.), the

user's disease, functional level, and age differences may not be considered, resulting in the delivery of exercise at an inappropriate difficulty level, which may increase the risk of cardiopulmonary burden, musculoskeletal damage, and re-injury, potentially leading to worsening of pain or functional decline.

Furthermore, in non-face-to-face rehabilitation treatment, if the difficulty level is not appropriate, a corresponding decrease in rehabilitation effectiveness may occur.

For example, when an exercise program of an easy difficulty level is performed, an appropriate stimulus (exercise threshold) may not be applied to the body, which may result in failure to achieve physical changes, failure to achieve necessary recovery, or may take longer to achieve the goal.

In addition, the exercise may feel boring or meaningless, which may reduce the user's motivation and increase the dropout rate from the exercise program.

On the other hand, in non-face-to-face rehabilitation treatment, if an exercise program including motions at an excessive level relative to the patient's current exercise performance capability is presented, the patient may be unable to properly perform the exercise motions or may avoid exercise due to pain.

Such repeated experiences of failure lead to discontinuation of rehabilitation, and act as a factor that increases the dropout rate from the exercise program and impairs long-term rehabilitation effects.

There exists a need to address such problems of non-face-to-face rehabilitation treatment and to set the difficulty level of an exercise program provided for consistent management and rehabilitation of a specific disease in a user-customized manner.

【BRIEF SUMMARY】

The present disclosure is intended to provide a method and system for setting a difficulty level of an exercise program using a large language model, which is capable of generating an exercise program set to a user-customized difficulty level.

More specifically, the present disclosure is intended to provide a method and system for setting a difficulty level of an exercise program using a large language model, which is capable of evaluating an exercise performance capability by providing different evaluation items according to response data of a user and history information with respect to a questionnaire provided to an electronic device, using a large language model.

Furthermore, the present disclosure is intended to provide a method and system for setting a difficulty level of an exercise program using a large language model, which is capable of setting a difficulty level of an exercise program through a large language model, based on response data of a user and an exercise performance capability evaluation.

Furthermore, the present disclosure is intended to provide a method and system for setting a difficulty level of an exercise program using a large language model, which is capable of generating an exercise program based on the set difficulty level, using a large language model.

In order to solve the problems described above, the present disclosure proposes a method for interacting with a user in a non-face-to-face manner using a large language model, and setting a difficulty level of an exercise program for the indication of the user to a user-customized difficulty level.

A method for setting a difficulty level of an exercise program using a large language model according to the present disclosure may comprise: providing at least one questionnaire related to an indication of a user to an electronic device; receiving, from the electronic device, response data for the questionnaire; setting an evaluation criterion for evaluating an exercise performance capability of the user, based on at least one of the response data and history information of the user; specifying at least one evaluation item among a plurality of evaluation items related to an exercise performance capability evaluation, based on the evaluation criterion; evaluating the exercise performance capability of the user for the at least one evaluation item, by inputting exercise data of the user into a pre-trained motion evaluation model; generating a prompt to be input to a large language model, using the response data and an evaluation result of the exercise performance capability; inputting the prompt to the large language model to obtain an exercise difficulty level related to the indication of the user from the large language model; and generating an exercise program related to the indication of the user, based on the obtained exercise difficulty level.

Furthermore, the evaluation criterion may be set differently based on at least one of the response data for the questionnaire and the history information, and the specifying of the at least one evaluation item may comprise: specifying an evaluation restriction item satisfying an unsuitability condition among a plurality of evaluation items related to the exercise performance capability evaluation, based on the differently set evaluation criterion; and specifying the at least

one evaluation item among the plurality of evaluation items, based on the specified evaluation restriction item.

Furthermore, the evaluation restriction item may be specified based on at least one of a pain level for a pain area of the user and a medical record, included in at least one of the response data for the questionnaire and the history information.

Furthermore, the unsuitability condition may be a condition for specifying the evaluation restriction item to be excluded from the exercise performance capability evaluation of the user, based on a restriction criterion preset in at least one of the pain level and the medical record.

Furthermore, the evaluating of the exercise performance capability of the user may comprise: receiving, from the electronic device, the exercise data of the user corresponding to the specified at least one evaluation item; analyzing at least one of a static posture, a joint range of motion, a balance ability, and a muscle strength of the user, using the pre-trained motion evaluation model or through the response data; and generating an exercise performance capability evaluation result for the at least one evaluation item.

Furthermore, the exercise program may be configured to include a plurality of exercise modules, and each of the plurality of exercise modules may be matched to a different exercise type and include at least one exercise motion content item related to the exercise type matched to each of the exercise modules.

Furthermore, the obtaining of the exercise difficulty level may comprise obtaining a specific exercise difficulty level among a plurality of exercise difficulty levels through the large language model to which the prompt is input, based on a preset difficulty setting criterion.

Furthermore, the at least one exercise motion content item may include motion difficulty level information, and each of the plurality of exercise modules may include at least one specific exercise motion content item satisfying a preset motion difficulty level condition, based on the specific exercise difficulty level.

The preset difficulty setting criterion may include a plurality of different setting criteria, and the specific exercise difficulty level may satisfy all of the plurality of different setting criteria.

Furthermore, the generating of the exercise program may comprise: extracting at least one specific exercise motion content item satisfying the preset motion difficulty level condition, using the specific exercise difficulty level and the prompt; and generating the exercise program

composed of the plurality of exercise modules, based on the exercise type matched to the extracted at least one specific exercise motion content item, through the large language model.

Furthermore, the at least one questionnaire may include at least one of a basic questionnaire including a question related to the indication of the user, and an additional questionnaire provided differently according to a response of the user to the basic questionnaire.

Furthermore, each of the basic questionnaire and the additional questionnaire may include at least one of a selection-type questionnaire composed of at least one query item related to the indication of the user and a plurality of selection items corresponding to each of a plurality of different responses to the query item, and an interactive questionnaire capable of receiving a natural language input from the electronic device in relation to the indication of the user.

Furthermore, the receiving of the response data for the questionnaire may comprise: receiving, from the electronic device, response data for the selection-type questionnaire including a response matched to an item selected by a user input among the plurality of selection items; and processing the natural language input entered into the electronic device as an input to the large language model, and receiving response data for the interactive questionnaire from the large language model.

Meanwhile, a system for setting a difficulty level of an exercise program using a large language model according to the present disclosure may comprise a controller configured to provide at least one questionnaire related to an indication of a user to an electronic device, and a communication unit configured to receive, from the electronic device, response data for the questionnaire, wherein the controller may set an evaluation criterion for evaluating an exercise performance capability of the user, based on at least one of the response data and history information of the user, specify at least one evaluation item among a plurality of evaluation items related to an exercise performance capability evaluation, based on the evaluation criterion, evaluate the exercise performance capability of the user for the at least one evaluation item by inputting exercise data of the user into a pre-trained motion evaluation model, generate a prompt to be input to a large language model using the response data and an evaluation result of the exercise performance capability, input the prompt to the large language model to obtain an exercise difficulty level related to the indication of the user from the large language model, and generate an exercise program related to the indication of the user, based on the obtained exercise difficulty level.

Meanwhile, a program executed by one or more processors in an electronic device and stored in a computer-readable recording medium may comprise instructions for performing: providing at least one questionnaire related to an indication of a user to an electronic device; receiving, from the electronic device, response data for the questionnaire; setting an evaluation criterion for evaluating an exercise performance capability of the user, based on at least one of the response data and history information of the user; specifying at least one evaluation item among a plurality of evaluation items related to an exercise performance capability evaluation, based on the evaluation criterion; evaluating the exercise performance capability of the user for the at least one evaluation item by inputting exercise data of the user into a pre-trained motion evaluation model; generating a prompt to be input to a large language model, using the response data and an evaluation result of the exercise performance capability; inputting the prompt to the large language model to obtain an exercise difficulty level related to the indication of the user from the large language model; and generating an exercise program related to the indication of the user, based on the obtained exercise difficulty level.

A method and system for setting a difficulty level of an exercise program using a large language model according to the present disclosure may perform a user-customized exercise performance capability evaluation by applying different evaluation items according to a current state of the user, based on response data for a questionnaire and history information of the user.

Through this, the current exercise performance capability of the user may be precisely evaluated, and an exercise program having a difficulty level suitable for rehabilitation of the user may be generated.

Furthermore, the method and system for setting a difficulty level of an exercise program using a large language model according to the present disclosure may adjust exercise performance capability evaluation items based on medical information such as existing medical history and surgical records, by taking into account the medical records (or clinical records) of the user included in the history information, thereby minimizing the risk of injury due to overload and providing a safe evaluation environment that does not impose excessive burden on the user.

Furthermore, the method and system for setting a difficulty level of an exercise program using a large language model according to the present disclosure may generate an exercise program set to a user-customized difficulty level and provide it to the user, thereby minimizing

the risk of pain aggravation and exercise program dropout during exercise performance, securing long-term rehabilitation continuity, and providing an appropriate exercise threshold for the user's body to help improve physical function and assist in functional recovery for return to daily life or work.

【BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS】

FIG. 1 is a conceptual diagram for explaining a system for setting a difficulty level of an exercise program using a large language model according to the present disclosure.

FIG. 2 is a flowchart for generally explaining a method for setting a difficulty level of an exercise program using a large language model according to the present disclosure.

FIGS. 3A to 3C are conceptual diagrams for explaining a questionnaire performing process according to the present disclosure.

FIGS. 4A and 4B are conceptual diagrams for explaining a user-customized exercise performance capability evaluation criterion and exercise performance capability evaluation items according to the present disclosure.

FIGS. 5A and 5B are conceptual diagrams for explaining a user-customized exercise performance capability evaluation process according to the present disclosure.

FIGS. 6A and 6B are conceptual diagrams for explaining a process of obtaining an exercise difficulty level of an exercise program using a large language model according to the present disclosure.

FIG. 7 is a conceptual diagram for explaining a process of generating an exercise program having a user-customized difficulty level according to the present disclosure and providing it to an electronic device.

【DETAILED DESCRIPTION】

Hereinafter, embodiments disclosed in the present specification will be described in detail with reference to the accompanying drawings, wherein the same reference numerals are assigned to the same or similar components regardless of reference numerals, and redundant descriptions thereof will be omitted.

The suffixes "module" and "unit" for components used in the following description are given or used interchangeably in consideration of ease of writing the specification only, and do not themselves have meanings or roles that are distinguished from each other.

In addition, in describing the embodiments disclosed in the present specification, if it is determined that a detailed description of related known technologies may obscure the gist of the embodiments disclosed in the present specification, the detailed description thereof will be omitted.

In addition, the accompanying drawings are only for facilitating understanding of the embodiments disclosed in the present specification, and the technical idea disclosed in the present specification is not limited by the accompanying drawings, and it should be understood that all modifications, equivalents, and substitutes included in the spirit and technical scope of the present disclosure are included.

Terms including ordinal numbers such as first, second, and the like may be used to describe various components, but the components are not limited by the terms.

The terms are used only for the purpose of distinguishing one component from another component.

When a component is referred to as being "connected" or "coupled" to another component, it should be understood that the component may be directly connected or coupled to the other component, but another component may exist in between.

On the other hand, when a component is referred to as being "directly connected" or "directly coupled" to another component, it should be understood that no other component exists in between.

Singular expressions include plural expressions unless the context clearly dictates otherwise.

In the present application, terms such as "comprise" or "have" are intended to designate the existence of features, numbers, steps, operations, components, parts, or combinations thereof

described in the specification, and should be understood as not precluding in advance the possibility of the existence or addition of one or more other features, numbers, steps, operations, components, parts, or combinations thereof.

The present disclosure relates to a method and system for setting a difficulty level (or exercise difficulty level) of an exercise program using a large language model.

More specifically, the present disclosure relates to a method and system capable of performing an exercise performance capability evaluation of a user using different evaluation criteria according to a current state of the user, and setting a difficulty level (or exercise difficulty level) of an exercise program to be provided to the user through a large language model, based on the exercise performance capability evaluation result.

Here, a "large language model" may refer to an artificial intelligence model that learns a vast amount of data and is capable of understanding and generating natural language.

An "exercise program" according to the present disclosure may refer to an exercise plan provided to an electronic device in relation to the indication of a user.

Here, an "indication" may be understood as a symptom or clinical situation requiring a specific treatment or examination, such as a disease or symptom of a user.

For example, in the present disclosure, if a user has an indication related to a specific body part (e.g., the lower back (lumbar spine)), an exercise program for rehabilitation of the indication of the user may be generated.

More specifically, the exercise program according to the present disclosure may be configured to include at least one exercise module.

Here, an "exercise module" may refer to a structural unit of an exercise program including at least one exercise motion content item.

In this case, an "exercise motion content item" may include various types of information such as a name of a specific exercise motion, exercise time information, exercise difficulty level information, exercise type information, exercise area information, and exercise posture information.

In the exercise program according to the present disclosure, different exercise difficulty levels may be set according to a current state (or situation) of each of a plurality of users.

Here, depending on the "exercise difficulty level of the exercise program," the motion difficulty level of exercise motion content items included in the exercise modules constituting the exercise program may differ.

Meanwhile, an "exercise motion" described in the present disclosure refers to a gesture (motion) performed in the course of performing an exercise, and may be used interchangeably with terms such as "movement," "action," and "gesture."

The present disclosure may perform an exercise performance capability evaluation taking into account a current pain state of a user, using response data for a questionnaire provided to an electronic device and history data including medical records (or treatment records) of the user.

Furthermore, the present disclosure may precisely evaluate the exercise performance capability of a user through an exercise performance capability evaluation taking into account the current state of the user, and generate an exercise program set at a user-customized difficulty level to provide to the user.

In the present disclosure, for convenience of description, the description is centered on "indications related to musculoskeletal diseases," but is not necessarily limited thereto.

As an example, the exercise program described in the present disclosure may relate to exercise for users who require rehabilitation treatment for musculoskeletal diseases and for treatment of users with various diseases (e.g., cancer, diabetes, hypertension, etc.).

In addition, the present disclosure may also generate an exercise program necessary for health promotion in daily life, rather than a rehabilitation exercise for therapeutic purposes related to the indication of a user.

For example, the exercise according to the present disclosure is not limited in the purpose of exercise, and may be an exercise performed for various purposes such as rehabilitation exercise, fitness exercise, ball sports exercise, and dance exercise for various purposes such as therapeutic purposes, health promotion purposes, and cosmetic purposes.

Furthermore, the exercise program according to the present disclosure may refer to a collection of exercise modules for various exercises such as rehabilitation exercise, fitness exercise, ball sports exercise, and dance exercise for various purposes such as therapeutic purposes, health promotion purposes, and cosmetic purposes, and may be understood as not being limited to a specific category of exercise.

That is, the type of exercise according to the present disclosure is also not limited, and the location of exercise, such as indoor exercise and outdoor exercise, is also not limited.

In the foregoing, the method for setting a difficulty level of an exercise program using a large language model according to the present disclosure has been described in general, and this may be implemented by a system for setting a difficulty level of an exercise program using a large language model described below.

Hereinafter, a system for setting a difficulty level of an exercise program using a large language model according to the present disclosure will be described in detail with reference to FIG. 1.

FIG. 1 is a conceptual diagram for explaining a system for setting a difficulty level of an exercise program using a large language model according to the present disclosure.

As shown in FIG. 1, a system for setting a difficulty level of an exercise program using a large language model according to the present disclosure (hereinafter referred to as a "difficulty level setting system," 100) may include at least one of a communication unit 110, a storage unit 120, and a controller 130.

In this case, the difficulty level setting system 100 according to the present disclosure is not limited to the above-described components, and may further include components that perform the same or similar roles as the functions described in the present specification.

Meanwhile, the difficulty level setting system 100 according to the present disclosure may be implemented as an application or software.

The difficulty level setting system 100 implemented as software in this manner may be downloaded through a program (e.g., Play Store) through which an application can be downloaded on the electronic device 10, or may be implemented through an initial installation program on the electronic device 10.

In this case, the communication unit 110, the storage unit 120, and the controller 130 according to the present disclosure may be utilized as components of the electronic device 10.

In the present disclosure, the electronic device 10 may be understood as referring to an application installed on the electronic device 10.

Such an application (or software) may be understood as one component of the difficulty level setting system 100 according to the present disclosure.

In the present disclosure, the electronic device 10 may also be referred to as a "mobile terminal" or "electronic device," and the electronic device 10 described in the present specification may include a mobile phone, a smart phone, a smart TV, a laptop computer, a digital broadcasting terminal, a PDA (personal digital assistants), a PMP (portable multimedia player), a navigation device, a slate PC, a tablet PC, an ultrabook, a wearable device (e.g., a watch-type terminal (smartwatch), a glass-type terminal (smart glass), and an HMD (head mounted display)), and the like.

More specifically, the electronic device 10 according to the present disclosure is not limited to an electronic device on which an application is activated, and may refer to an electronic device connected to an electronic device on which an application is activated.

As an example, based on the electronic device 10 on which the application according to the present disclosure is activated being a smart phone, the electronic device 10 may refer to a smart TV connected to the smart phone.

That is, the electronic device 10 according to the present disclosure may refer to at least one of an electronic device owned by a user (or on which a user account is logged in), an electronic device owned by a medical professional (or on which a medical professional account is logged in), and an electronic device used in common.

Meanwhile, the difficulty level setting system 100 may exist inside a server (hereinafter referred to as a server) constructed for a specific purpose (e.g., setting a difficulty level of an exercise program and generating an exercise program), or may exist as a separate device from the server.

When the difficulty level setting system 100 exists inside a server, the difficulty level setting system 100 according to the present disclosure may set a difficulty level of an exercise program and generate an exercise program corresponding to the set user-customized difficulty level, through at least one component among the communication unit 110, the storage unit 120, and the controller 130 located inside the server, or through a module that performs a function similar to each of the respective components.

In this case, the application may provide an exercise program to the electronic device 10 on which the application is installed, through communication with the server.

Furthermore, the difficulty level setting system 100 according to the present disclosure may provide the exercise program according to the present disclosure to the electronic device 10 by interoperating with a plurality of different external servers.

A user (or patient, U) and a medical professional (or physician) according to the present disclosure may hold an account registered in the difficulty level setting system 100 according to the present disclosure.

In the present specification, for convenience of description, an account of a user (or patient) is referred to as a "user account (or patient account)."

The "account" described above may be created through a page associated with the difficulty level setting system 100.

Alternatively, an "account" may be created in at least one other server (e.g., a medical professional server) associated with the difficulty level setting system 100 according to the present disclosure.

Accordingly, in the present specification, regardless of the server from which an account is issued, all accounts based on the difficulty level setting system 100 according to the present disclosure are referred to as "accounts pre-registered in the difficulty level setting system 100 according to the present disclosure."

Furthermore, a user (U, or patient) according to the present disclosure may receive an exercise program set at a user-customized difficulty level in relation to the indication of the user U, through an application or web page provided by the difficulty level setting system 100 according to the present disclosure.

Meanwhile, a medical professional D may hold a medical professional account pre-registered in the difficulty level setting system 100 according to the present disclosure.

In the present specification, an electronic device logged in with a medical professional account is referred to as an electronic device 10 owned by a medical professional.

Furthermore, a "medical professional" described in the present disclosure refers to a person working in a medical institution (e.g., a hospital), and may include, for example, at least one of a physician, a nurse, and a physical therapist.

In the present disclosure, for convenience of description, a physician and a physical therapist are used as examples of medical professionals.

However, a medical professional is not limited thereto, and any user working in a medical institution to set a difficulty level of a user-customized exercise program and generate an exercise program corresponding to the set difficulty level may qualify as a medical professional according to the present disclosure.

The difficulty level setting system 100 according to the present disclosure may collect sensing information including at least one of voice data and image data, based on a microphone, a camera, and a sensor unit provided in the electronic device 10.

Here, the sensor unit may include at least one of an infrared sensor, a LiDAR sensor, an acceleration sensor, an illuminance sensor, a proximity sensor, a position sensor, a face recognition sensor, an iris scanner, a heart rate sensor, a touch sensor, and a pressure sensor.

The communication unit 110 according to the present disclosure may be connected to the electronic device 10, an LLM server 140, a central server, a device, and at least one network through a wireless or wired network, and may be configured to receive or transmit overall data and information necessary for the operation of the difficulty level setting system 100 according to the present disclosure.

Specifically, the communication unit 110 may transmit at least one questionnaire related to the indication of a user to the electronic device 10.

For example, the communication unit 110 may transmit at least one questionnaire related to the indication of a user to the electronic device 10 on which at least one of a user account and a medical professional account is logged in.

Furthermore, the communication unit 110 may receive response data (or questionnaire response data) for at least one questionnaire provided to the electronic device 10.

Here, "receiving response data" may mean receiving an input signal (or selection signal) corresponding to a user input entered through the electronic device 10.

The communication unit 110 may receive history information from a database 200.

Furthermore, the communication unit 110 may receive exercise motion content items pre-stored in a database (or DB, 200) including an exercise program DB.

In addition, the communication unit 110 may receive exercise data of a user from the electronic device 10.

Here, "exercise data" may refer to at least one of an image and a video of an exercise motion of a user captured (or sensed) by at least one of a camera and a sensor unit provided in the electronic device 10.

The communication unit 110 may include at least one communication module capable of performing wireless communication and wired communication between the difficulty level setting system 100 and a communication target.

In addition, the communication unit 110 may include a communication module that connects the difficulty level setting system 100 to at least one network.

Meanwhile, the communication unit 110 may support various communication methods according to the communication standard of a device with which it communicates.

For example, the communication unit 110 may be configured to perform communication using at least one of WLAN (Wireless LAN), Wi-Fi (Wireless Fidelity), Wi-Fi Direct, DLNA (Digital Living Network Alliance), WiBro (Wireless Broadband), WiMAX (World Interoperability for Microwave Access), HSDPA (High Speed Downlink Packet Access), HSUPA (High Speed Uplink Packet Access), LTE (Long Term Evolution), LTE-A (Long Term Evolution-Advanced), 5G (5th Generation Mobile Telecommunication), Bluetooth™, RFID (Radio Frequency Identification), IrDA (Infrared Data Association), UWB (Ultra-Wideband), ZigBee, NFC (Near Field Communication), and Wireless USB (Wireless Universal Serial Bus) technologies.

Next, the storage unit 120 may be configured to store various information related to the present disclosure.

In the present disclosure, the storage unit 120 may be provided in the difficulty level setting system 100 itself, or alternatively, at least a portion of the storage unit 120 may refer to a database (DB, 200).

The storage unit 120 may include one or more non-transitory computer-readable storage media that can be read and/or accessed by at least one processor.

The one or more computer-readable storage media may include volatile and/or non-volatile storage components such as optical, magnetic, organic or other memory or disk storage devices.

In some examples, the storage unit 120 may be implemented using a single physical device (e.g., one optical, magnetic, organic or other memory or disk storage device), while in other examples, the storage unit 120 may be implemented using a plurality of physical devices.

The storage unit 120 may include computer-readable instructions and additional data.

The storage unit 120 may include storage necessary for performing at least a portion of the methods and techniques described in the present specification and/or at least a portion of the functions of the devices and networks.

That is, it is sufficient for the storage unit 120 to be a space in which information necessary for setting an exercise difficulty level of an exercise program and generating an exercise program corresponding to the set exercise difficulty level according to the present disclosure is stored, and the storage unit 120 may be understood as not being limited in physical space.

The storage unit 120 may store data and instructions necessary for the operation of the difficulty level setting system 100 according to the present disclosure.

More specifically, the storage unit 120 may store data and instructions necessary for the operation of the motion evaluation model 132.

Here, the motion evaluation model 132 may refer to an artificial intelligence model that analyzes an exercise motion of a user performed according to a user-customized exercise performance capability evaluation item and performs an evaluation of the exercise motion.

For example, the motion evaluation model 132 of the present disclosure may be a posture estimation model trained using a training data set including positional information on joint points, and may estimate an exercise posture of a user U from a video of an exercise motion of the user received from the electronic device 10.

Here, "joint point" may refer to a plurality of joints of the user U (or a part of the body of the user U including the joints).

And, "keypoint" may refer to a region corresponding to each of a plurality of joint points of the user U in an exercise motion video.

The storage unit 120 may store user authentication information included in user account information.

Here, "user authentication information" may refer to information used in a user authentication process performed to log in to a user account on an electronic device.

As an example, user authentication information may vary, including i) an ID, ii) a password, iii) a password pattern, iv) fingerprint authentication information of the user, v) face authentication information, vi) voice authentication information, vii) iris authentication information, and viii) vein authentication information set by the user.

In addition, the storage unit 120 may store at least one of an exercise video and an exercise description corresponding to each exercise motion.

Meanwhile, the database (DB, 200) may be configured to store various information related to providing a user-customized exercise program.

Specifically, the database 200 may store exercise motion content items (e.g., exercise name, number of exercise repetitions, exercise timing, exercise difficulty level, etc.) corresponding to each of a plurality of pain areas related to an indication (e.g., shoulder, elbow, wrist & hand, hip joint & pelvis, knee, ankle & foot, neck, back, lower back, abdomen, etc.).

Furthermore, the database 200 may store at least one of an exercise video and an exercise description corresponding to each exercise motion content item.

In addition, the database 200 may store history information of each of a plurality of different users.

For example, the database 200 may store history information including at least one of i) the user's name, ii) date of birth, iii) type of indication of the user, iv) exercise history, v) medical record, vi) surgical record, vii) past medical history, viii) prescription information, ix) past response data, and x) exercise rehabilitation.

In the present disclosure, the storage unit 120 is described as existing separately from the database 200, but is not limited thereto, and the storage unit 120 may include the database 200.

Next, the controller 130 may be configured to control the overall operation of the difficulty level setting system 100 related to the present disclosure.

The controller 130 may include at least one of a prompt generation unit 131 and a motion evaluation model 132.

Furthermore, the controller 130 may process signals, data, information, and the like that are input or output through the components described above, or may provide or process appropriate information and functions for a user.

The controller 130 may control a service page for setting a difficulty level of an exercise program to be output through a display unit (or touchscreen) provided in the electronic device 10.

Such a service page may be output on the electronic device 10 through an application installed in the electronic device 10 or a web page.

The service page is a page associated with the difficulty level setting system 100 according to the present disclosure, and may be configured to be controlled by the difficulty level setting system 100 according to the present disclosure.

Furthermore, when the service page is provided in the form of an application, the service page may be controlled by a CPU (Central Processing Unit) of the electronic device 10 in which the application is installed.

In this case, the CPU of the electronic device 10 may set a difficulty level of an exercise program and generate an exercise program corresponding to the set difficulty level, based on information provided by the difficulty level setting system 100 according to the present disclosure.

Meanwhile, the controller 130 may provide at least one questionnaire related to the indication of a user on the service page provided to the electronic device 10.

Furthermore, the controller 130 may set an evaluation criterion for evaluating the exercise performance capability of a user, using response data for at least one questionnaire received through the electronic device 10 and history information.

In this case, "evaluation criterion" may refer to a criterion for specifying at least one evaluation item among a plurality of evaluation items related to an exercise performance capability evaluation, according to the current state of the user based on the response data and the history information.

Furthermore, the controller 130 may evaluate the exercise performance capability of a user according to the specified at least one evaluation item, using the pre-trained motion evaluation model 132.

More specifically, the controller 130 may input exercise data of a user captured (or sensed) using at least one of a camera and a sensor unit provided in the electronic device 10 into the motion evaluation model, and generate an exercise performance capability evaluation result.

The controller 130 may generate a prompt to be input to the LLM server 140, using at least one of response data for at least one questionnaire provided to the electronic device 10 and an exercise performance capability evaluation result.

In this case, the LLM server 140 according to the present disclosure may include at least one large language model.

For example, the LLM server 140 may include at least one large language model based on at least one of GPT (Generative Pre-trained Transformer), T5 (Text-to-Text Transfer Transformer), Vision-Language Models (e.g., CLIP, Flamingo), Multimodal Generative Models (GPT-4 Multimodal, PaLM-E), BERT (Bidirectional Encoder Representations from Transformers), and LaMDA (Language Model for Dialogue Applications).

In the present disclosure, the LLM server 140 is described as existing separately from the difficulty level setting system 100, but is not limited thereto, and the difficulty level setting system 100 may be configured to include the LLM server 140.

That is, the difficulty level setting system 100 and the LLM server 140 according to the present disclosure may exist separately, or the LLM server 140 may be included in the difficulty level setting system 100.

In the following description, for convenience of explanation, the LLM server 140 and the large language model are used interchangeably, and the controller 130 using the large language model may be understood as using at least one large language model included in the LLM server 140.

In addition, in the present disclosure, the controller 130 is described as including the prompt generation unit 131, but is not limited thereto, and the controller 130 and the prompt generation unit 131 may exist separately.

In this case, the controller 130 may generate a prompt in conjunction with the prompt generation unit 131.

The controller 130 according to the present disclosure may obtain a user-customized exercise difficulty level corresponding to the prompt through the large language model 140.

More specifically, the controller 130 may obtain an exercise difficulty level of an exercise program according to a preset difficulty setting criterion in conjunction with the large language model 140, and generate an exercise program corresponding to the obtained exercise difficulty level.

In the present disclosure, the controller 130 is described as obtaining an exercise difficulty level and generating an exercise program in conjunction with the large language model 140, but is not limited thereto, and the controller 130 itself may include the functions of the large language model 140 or perform the same functions, thereby specifying an exercise difficulty level and generating an exercise program.

Accordingly, in the present specification, the controller 130 obtaining an exercise difficulty level and generating an exercise program, and the large language model 140 generating an exercise difficulty level and generating an exercise program may be used interchangeably.

Meanwhile, the difficulty level setting system 100 may include one or more processors, and such processors may include one or more general-purpose processors and/or one or more special-purpose processors (e.g., a digital signal processor, a tensor processing unit (TPU), a graphics processing unit (GPU), a neural network processing unit (NPU), an application-specific integrated circuit, an application-specific semiconductor (ASIC), etc.).

The one or more processors may be configured to execute instructions stored (or included) in the storage unit 120, computer-readable instructions, and/or other instructions described in the present specification.

The difficulty level setting system 100 may perform data processing described below through cooperation between a memory and at least one processor.

The processor may perform a series of operations and data processing using data and information stored in the memory.

Here, "memory" may be a component of the storage unit 120, and "processor" may be used interchangeably with the controller 130.

In the foregoing, the difficulty level setting system 100 of the present disclosure has been described, and this may be implemented based on the method for setting a difficulty level of an exercise program using a large language model described below.

In the following, with reference to FIG. 2 together with FIGS. 3A to 3C, FIGS. 4A and 4B, FIGS. 5A and 5B, FIGS. 6A and 6B, and FIG. 7, the method for setting a difficulty level of an exercise program using a large language model according to the present disclosure will be described in more detail.

FIG. 2 is a flowchart for generally describing the method for setting a difficulty level of an exercise program using a large language model according to the present disclosure, and FIGS.

3A to 3C are conceptual diagrams for describing a questionnaire process according to the present disclosure.

FIGS. 4A and 4B are conceptual diagrams for describing a user-customized exercise performance capability evaluation criterion and exercise performance capability evaluation items according to the present disclosure, and FIGS. 5A and 5B are conceptual diagrams for describing a user-customized exercise performance capability evaluation process according to the present disclosure.

FIGS. 6A and 6B are conceptual diagrams for describing a process of obtaining a difficulty level of an exercise program using a large language model according to the present disclosure, and FIG. 7 is a conceptual diagram for describing a process of generating an exercise program having a user-customized difficulty level according to the present disclosure and providing the exercise program to an electronic device.

In the present disclosure, a process of providing at least one questionnaire related to an indication of a user to an electronic device may be performed (S210, see FIG. 2).

As shown in FIG. 3A(a), the controller 130 may provide a basic questionnaire 300 on the service page 1000 provided to the electronic device 10 in relation to the indication of the user.

Here, "basic questionnaire" may refer to a questionnaire related to at least one of personal information of the user, a pain area related to the indication of the user, and a pain level (or pain degree).

Specifically, the controller 130 may receive user information 310 including at least one of a gender, age, occupation, and underlying disease (or diagnosed disease) of the user through the basic questionnaire 300 provided on the service page 1000.

Furthermore, the controller 130 may receive information on a body part with pain (or discomfort) related to the indication of the user through the basic questionnaire 300 provided on the service page 1000.

Specifically, the controller 130 may provide a pain area questionnaire for inputting a body part (or musculoskeletal part) with pain.

The controller 130 may provide, to the electronic device 10, a questionnaire including a selection-type questionnaire for selecting a body part with pain (or a pain area) in relation to the indication of the user.

For example, the controller 130 may provide, to the electronic device 10, a plurality of body icons corresponding to each body part in a body schematic diagram 320.

Furthermore, the controller 130 may provide guidance information (e.g., "Please select the area where you feel pain or discomfort") that prompts the user to select at least one body part.

As an example, the controller 130 may display a plurality of body icons corresponding to each of a plurality of body parts (e.g., "neck (cervical spine)", "shoulder", "back (thoracic spine)", "lower back (lumbar spine)", "elbow", "wrist", "knee", "ankle", etc.) in the body schematic diagram 320 provided to the electronic device 10.

The user U may specify at least one body part with pain through a selection-type questionnaire for selecting a pain area.

Specifically, the controller 130 may specify a body part (e.g., lower back (lumbar spine)) corresponding to a specific icon as the pain area of the user, based on a user input 322 being applied to a specific icon 321 among the plurality of body icons provided to the electronic device 10 by the user U.

In this case, the controller 130 may specify a plurality of pain areas through the plurality of body icons, and in this case, may provide a pain area questionnaire for additionally inputting the pain area with the most severe pain among the plurality of pain areas.

As shown in FIG. 3A(c), when a pain area (or the area with the most severe pain) is specified, the controller 130 may provide a basic questionnaire 300 including a pain level questionnaire for inputting a pain level (or pain degree, pain score) on the service page 1000 provided to the electronic device 10.

In this case, the pain level questionnaire may include a selection-type questionnaire for inputting the pain level of the user for the specified pain area.

Specifically, the controller 130 may provide a selection item 324 through which the pain level of the user U for the pain area specified in the electronic device 10 can be input through the pain area questionnaire.

Here, "pain level" may refer to a score corresponding to a pain value subjectively felt by the user U.

For example, the pain level may refer to at least one of a Numerical Rating Scale (NRS) and a Visual Analogue Scale (VAS), and may be composed of numbers from 0 to 10.

Specifically, the controller 130 may provide a selection-type questionnaire including a selection item 324 for expressing the degree of pain felt by the user U as a number.

The controller 130 may provide a questionnaire related to the indication of the user in response to a user input 325 for a pain level being applied to the selection item 324 through which the user U can input the pain level.

As shown in FIG. 3B(a), the controller 130 may provide at least one of at least one selection-type questionnaire (or selection-type questionnaire item, 330) configured for the user U to directly make a selection regarding the health condition of the user U, an interactive questionnaire 340, and an additional questionnaire 350 related to the specified pain area, based on a pain level for the specified pain area being input.

Here, a "selection-type questionnaire" may be composed of a question related to the indication of the user and a plurality of selection items corresponding to each of a plurality of different responses to the question.

The storage unit 120 stores selection-type questionnaires for confirming symptoms of the user for each of a plurality of pain areas.

Such selection-type questionnaires may be configured differently depending on the pain area specified by the user.

The controller 130 may refer to the storage unit 120 and provide a selection-type questionnaire 330 for a specified pain area among a plurality of body parts to the electronic device 10, thereby identifying the indication state of the user for the specific pain area.

As shown in FIG. 3B(b), the controller 130 may provide, to the electronic device 10, a plurality of selection-type questionnaires 331, 332, 333, 334 and selection items corresponding to each of a plurality of different responses to each query item related to the indication of the user included in the plurality of selection-type questionnaires, so that the questionnaire regarding the indication of the user may be conducted from multiple angles.

For example, the controller 130 may conduct a questionnaire related to the indication of the user using a selection-type questionnaire including a query item related to symptoms of the pain area 331, a query item related to the timing of pain 332, a query item related to exercise habits 333, a query item related to risk factors (or RED FLAG) 334, a query item related to medications being taken, a query item related to the place of exercise performance, and a query item related to exercise equipment in possession.

Furthermore, the controller 130 may conduct an artificial intelligence-based interactive questionnaire.

Here, "interactive questionnaire" may refer to a questionnaire capable of receiving a natural language input from the electronic device in relation to the indication of the user.

In this case, the interactive questionnaire may be conducted using at least one of at least one large language model 140 and a chatbot.

Here, the at least one large language model 140 may refer to a large language model 140 based on at least one of GPT (Generative Pre-trained Transformer), T5 (Text-to-Text Transfer Transformer), Vision-Language Models (e.g., CLIP, Flamingo), Multimodal Generative Models (GPT-4 Multimodal, PaLM-E), BERT (Bidirectional Encoder Representations from Transformers), and LaMDA (Language Model for Dialogue Applications).

In addition, the "chatbot" according to the present disclosure may be implemented to receive input of information that is difficult to obtain from selection-type questions in relation to the indication of the user.

For example, the "chatbot" according to the present disclosure may include at least one of a rule-based chatbot, an artificial intelligence chatbot, a natural language processing chatbot, and a hybrid chatbot.

As shown in FIG. 3B(c), the controller 130 may conduct an interactive questionnaire 340 regarding the indication of the user.

More specifically, the controller 130 may conduct the interactive questionnaire 340 in order to collect information related to the indication that is difficult to confirm in detail through the selection-type questionnaire.

For example, the controller 130 may generate and provide an interactive questionnaire item 341 related to the indication of the user on the service page 1000 provided to the electronic device 10.

In this case, the controller 130 may provide the interactive questionnaire 340 through at least one of the large language model 140 and a chatbot so that the user can freely respond to the interactive questionnaire item 341.

Furthermore, the controller 130 may receive a response 342 of the user to the interactive questionnaire item 341 through the service page 1000.

Furthermore, the controller 130 may provide an additional questionnaire 350 related to the pain area specified by the user in the basic questionnaire 300.

Specifically, the controller 130 may provide an additional questionnaire including at least one question related to the specified pain area to the electronic device.

As shown in FIGS. 3C(a) and 3C(b), the controller 130 may provide an additional questionnaire 350 related to a pain area specified based on a user input for the pain area questionnaire included in the basic questionnaire to the electronic device 10.

For example, when a first body part (e.g., "lower back (lumbar spine)") is selected as the pain area in the basic questionnaire by the user, the controller 130 may provide a first additional questionnaire 351 including at least one query item 353 to 355 related to the first body part to the electronic device 10.

Alternatively, when a second body part (e.g., "shoulder") is selected as the pain area in the basic questionnaire by the user, the controller 130 may provide a second additional questionnaire 352 including at least one query item 356 to 358 related to the second body part to the electronic device 10.

More specifically, the controller 130 may provide the additional questionnaire 350 to the user to receive response data related to the indication of the user that was not obtained in the basic questionnaire 300.

For example, the controller 130 may provide, to the electronic device 10, an additional questionnaire including at least one query item related to the specified pain area, such as a pain-triggering motion query item 353, symptom-related query items 354, 355, 358, and lifestyle-related query items 357, and a plurality of selection items corresponding to each of a plurality of different responses to the query items.

That is, in the present disclosure, the at least one questionnaire provided to the electronic device 10 in relation to the indication of the user may include at least one of a basic questionnaire including a question related to the indication of the user, and an additional questionnaire provided differently according to a response of the user to the basic questionnaire.

Furthermore, each of the basic questionnaire and the additional questionnaire may include at least one of a selection-type questionnaire composed of at least one query item related to the indication of the user and a plurality of selection items corresponding to each of a plurality

of different responses to the query item, and an interactive questionnaire capable of receiving a natural language input from the electronic device in relation to the indication of the user.

Meanwhile, each of the basic questionnaire 300 and the additional questionnaire 350 according to the present disclosure is not limited to the examples of questionnaires (or questions) described above, and may include at least one of a selection-type questionnaire and an interactive questionnaire, and the at least one questionnaire may include various questionnaires (or questions) related to the indication of the user.

In the present disclosure, a process of receiving response data for the questionnaire from the electronic device may be performed (S220, see FIG. 2).

The controller 130 may receive response data for a selection-type questionnaire (or selection-type questionnaire response data) including a response matched to an item selected by a user input among a plurality of selection items from the electronic device 10.

As shown in FIG. 3B(b), the controller 130 may receive, as selection-type response data, a response matched to a selection item selected by a user input among a plurality of selection items for a question related to the indication of the user included in the selection-type questionnaire 330 (e.g., "Please select all symptoms of the current pain area").

As shown in FIG. 3B(c), the controller 130 may process a natural language input entered into the electronic device 10 as an input to the large language model 140, and receive response data for the interactive questionnaire (or interactive questionnaire response data) from the large language model 140.

Specifically, the controller 130 may provide at least one interactive questionnaire item 341 on the service page 1000 to the electronic device 10, and receive a natural language input 342 of the user for the interactive questionnaire item 341 in a manner of conversing with the user.

Furthermore, the controller 130 may process the natural language input 342 received from the electronic device 10 as an input to at least one of the large language model 140 and a chatbot.

For example, the controller 130 may process the natural language input 342 entered in the interactive questionnaire 340 as an input to the large language model 140, and receive interactive questionnaire response data from the large language model 140.

As another example, the controller 130 may process the natural language input 342 entered in the interactive questionnaire 340 as an input to a chatbot, and receive interactive questionnaire response data from the chatbot.

Furthermore, the controller 130 may provide a preset number of interactive questionnaire items to the electronic device 10, and receive interactive questionnaire response data of the user for each of the interactive questionnaire items.

In this case, the controller 130 may provide a sample answer for the interactive questionnaire item 341 together with the interactive questionnaire item 341, so that important information for the interactive questionnaire item 341 can be input.

In the present disclosure, a process of setting an evaluation criterion for evaluating the exercise performance capability of the user, based on at least one of the response data and the history information of the user, may be performed (S230, see FIG. 2).

The controller 130 may evaluate the exercise performance capability of the user using the evaluation criterion that takes into account the current indication state of the user.

Here, "evaluation criterion" may refer to a criterion for specifying at least one evaluation item among a plurality of evaluation items related to the exercise performance capability evaluation, according to the current indication state of the user based on the response data and the history information.

In this case, the history information may include at least one of a medical record related to the indication of the user and past response data for the questionnaire, and the medical record may include at least one of a medical treatment record and a rehabilitation record of the user.

Specifically, "exercise performance capability" according to the present disclosure is a key indicator reflecting the current physical function state of the user, and may be evaluated by synthesizing evaluation results for at least one evaluation item performed in the exercise performance capability evaluation process.

In addition, an "evaluation item" according to the present disclosure may include at least one exercise motion matched to different evaluation types (e.g., a static posture, a joint range of motion, a balance (or coordination) ability, and a muscle strength (or muscular endurance) of the user) in order to evaluate the exercise performance capability of the user.

As shown in FIG. 4A, the controller 130 may evaluate the exercise performance capability of the user taking into account the current indication state of the user, using

questionnaire response data 410 for at least one of the basic questionnaire and the additional questionnaire, and the history information 420 of the user pre-stored in the database 200.

Specifically, the controller 130 may set an evaluation criterion 400 for specifying an exercise performance capability evaluation item 450 taking into account the current indication state of the user, using at least one of the questionnaire response data 410 and the history information 420.

As described above, each of the basic questionnaire and the additional questionnaire according to the present disclosure may include at least one of a selection-type questionnaire and an interactive questionnaire.

The controller 130 may set the evaluation criterion 400 using selection-type questionnaire response data 411 and interactive questionnaire response data 412 received based on responses (or user inputs) of the user to the basic questionnaire and the additional questionnaire.

In addition, the controller 130 may set the evaluation criterion 400 using the history information 420 of the user collected from the database 200.

Here, the history information 420 may include information related to at least one of the user's i) name, ii) date of birth, iii) type of indication of the user, iv) exercise history, v) medical treatment record, vi) surgical record, vii) past medical history, viii) prescription information, ix) past response data, and x) exercise rehabilitation.

The controller 130 may set the evaluation criterion using evaluation information extracted from at least one of the questionnaire response data 410 and the history information 420 of a specific user.

Here, the "evaluation criterion" according to the present disclosure may be set differently based on at least one of the response data for the questionnaire and the history information.

In addition, "evaluation information" according to the present disclosure may include at least one of information related to the user's name, pain area and symptoms, pain duration, pain level (or pain degree), diagnosed disease (or underlying disease), risk factors, medical record, and exercise environment (e.g., exercise location), extracted from at least one of the questionnaire response data and the history information.

For example, the controller 130 may set, as a first evaluation criterion 438, a criterion for specifying an exercise performance capability evaluation item of the first user, using first

evaluation information 430 including at least one of questionnaire response data of the first user and history information of the first user.

Alternatively, the controller 130 may set, as a second evaluation criterion 448, a criterion for specifying an exercise performance capability evaluation item of the second user, using second evaluation information 440 including at least one of questionnaire response data of the second user and history information of the second user.

In the present disclosure, a process of specifying at least one evaluation item among a plurality of evaluation items related to the exercise performance capability evaluation, based on the evaluation criterion, may be performed (S240, see FIG. 2).

The controller 130 may specify an evaluation restriction item satisfying an unsuitability condition among a plurality of evaluation items related to the exercise performance capability evaluation, based on the evaluation criterion set differently according to at least one of the response data and the history information.

Here, the "evaluation restriction item" may be specified based on at least one of a pain level for a pain area of the user and a medical record, included in at least one of the response data for the questionnaire and the history information.

In addition, the unsuitability condition may refer to a condition for specifying an evaluation restriction item to be excluded from the exercise performance capability evaluation of the user, based on a restriction criterion preset in at least one of the pain level and the medical record.

In this case, the "preset restriction criterion" according to the present disclosure is a criterion for determining whether a specific evaluation item is subject to performance restriction based on the evaluation information, and may be preset and exist by at least one of the electronic device 10 to which a medical professional account is logged in and the difficulty level setting system 100.

Specifically, the preset restriction criterion may include a restriction criterion corresponding to information related to at least one of a pain area and symptoms, a pain duration, a pain level (or pain degree), a diagnosed disease (or underlying disease), risk factors, a medical record, and an exercise location, included in the evaluation information.

For example, the controller 130 may compare a pain level for a specific pain area with a specific threshold value (e.g., 5 points) based on the restriction criterion for the pain level, and specify an evaluation item satisfying the unsuitability condition as an evaluation restriction item.

As shown in FIGS. 4B(a) and 4B(b), as an example, the controller 130 may specify, as an evaluation restriction item, a first evaluation item 461 related to the first pain area when a first user feels a first pain level (e.g., 7 points) for a first pain area (e.g., lower back), based on the first evaluation information 430.

On the other hand, the controller 130 may specify, as an evaluation restriction item, a fourth evaluation item 464 related to the second pain area when a second user feels a second pain level (e.g., 5 points) for a second pain area (e.g., shoulder), based on the second evaluation information 440.

In addition, the controller 130 may specify an evaluation item satisfying the unsuitability condition as an evaluation restriction item, based on the restriction criterion for risk factors.

Specifically, the controller 130 may specify, as an evaluation restriction item, an evaluation item related to a specific risk factor matched to a specific evaluation item, based on the restriction criterion for risk factors.

For example, when the first evaluation information 430 includes a first risk factor (e.g., hypertension), the controller 130 may specify a third evaluation item 463 related to the first risk factor as an evaluation restriction item.

As another example, when the second evaluation information 440 includes a second risk factor (e.g., pregnancy), the controller 130 may specify a second evaluation item 462 related to the second risk factor as an evaluation restriction item.

Furthermore, the controller 130 may specify an evaluation item satisfying the unsuitability condition as an evaluation restriction item, based on the restriction criterion for the exercise environment.

Specifically, the controller 130 may specify an evaluation restriction item according to exercise environment information matched to a specific evaluation item.

For example, when the second evaluation information 440 includes a second exercise environment (e.g., a company), the controller 130 may specify a fifth evaluation item 465 not matched to the second exercise environment as an evaluation restriction item.

Meanwhile, the controller 130 may specify an evaluation restriction item based on the medical record of the user (e.g., surgical record, medical treatment record, etc.) included in the history information.

For example, based on the existence of a surgical record for a second body part (e.g., shoulder) among the body parts of the user, the controller 130 may specify an evaluation item related to the second body part as an evaluation restriction item to be excluded from performance within a preset period from the time of surgery.

As such, the preset restriction criterion in the present disclosure may be set by at least one of the electronic device 10 to which a medical professional account is logged in and the difficulty level setting system, so that exercise performance capability evaluation items suitable for the condition of each user can be selected.

Furthermore, the controller 130 may specify at least one evaluation item among a plurality of evaluation items, based on the specified evaluation restriction item.

Specifically, the controller 130 may specify an evaluation restriction item satisfying the unsuitability condition among a plurality of evaluation items performed according to the exercise performance capability evaluation, and specify at least one evaluation item to be performed in the exercise performance capability evaluation by excluding the specified evaluation restriction item from the plurality of evaluation items.

In the present disclosure, a process of evaluating the exercise performance capability of the user for at least one evaluation item by inputting exercise data of the user into a pre-trained motion evaluation model may be performed (S250, see FIG. 2).

The controller 130 may evaluate the exercise performance capability of the user based on different evaluation types (e.g., a static posture, a joint range of motion, a balance (or coordination) ability, and a muscle strength (or muscular endurance) of the user), using the pre-trained motion evaluation model 132.

Specifically, the controller 130 may specify at least one evaluation item among a plurality of evaluation items including exercise motions matched to each of the different evaluation types, and perform an exercise performance capability evaluation for the different evaluation types based on the specified at least one evaluation item.

In this case, the controller 130 may perform an exercise performance capability evaluation for different evaluation types according to an evaluation item related to the pain area of the user included in the evaluation information of the user.

As shown in FIG. 5A, the controller 130 may perform an exercise performance capability evaluation 510 related to the first pain area (e.g., lower back) when the pain area of the first user is the first pain area (e.g., lower back), based on the first evaluation information 430.

For example, the controller 130 may perform a motion analysis evaluation of the first user based on a motion analysis evaluation item list 511 composed of evaluation items related to the first pain area (e.g., lower back).

Here, "motion analysis evaluation" may refer to an exercise performance capability evaluation related to at least one of the static posture and the joint range of motion of the user.

As another example, the controller 130 may perform a balance (or coordination) ability evaluation of the first user based on a balance (or coordination) ability evaluation list 512 composed of evaluation items related to the first pain area (e.g., lower back).

In addition, the controller 130 may perform a muscle strength (or muscular endurance) evaluation of the first user based on a muscle strength (or muscular endurance) ability evaluation list 513 composed of evaluation items related to the first pain area (e.g., lower back).

On the other hand, the controller 130 may perform an exercise performance capability evaluation 520 related to the second pain area when the pain area of the second user is the second pain area (e.g., shoulder), based on the second evaluation information 440.

For example, the controller 130 may perform a motion analysis evaluation of the second user based on a motion analysis evaluation item list 521 composed of evaluation items related to the second pain area (e.g., shoulder).

In addition, the controller 130 may perform a balance (or coordination) ability evaluation of the second user based on a balance (or coordination) ability evaluation list 522 composed of evaluation items related to the second pain area (e.g., shoulder).

Likewise, the controller 130 may perform a muscle strength (or muscular endurance) evaluation of the second user based on a muscle strength (or muscular endurance) evaluation list 523 composed of evaluation items related to the second pain area (e.g., shoulder).

Based on FIG. 5B, the controller 130 may receive, from the electronic device, the exercise data of the user corresponding to the specified at least one evaluation item.

Specifically, the controller 130 may collect exercise data 530 of the user using at least one of a camera and a sensor unit provided in the electronic device 10, and evaluate the current exercise performance capability of the user based on the specified at least one evaluation item 450.

Here, "exercise data" may include at least one of an image and a video of a motion of the user performed for the exercise performance capability evaluation provided to the electronic device.

For example, the controller 130 may receive exercise data for a specific posture of the user captured by a camera provided in the electronic device 10.

Specifically, the controller 130 may activate at least one sensor provided in the electronic device 10 in order to evaluate the exercise performance capability of the user.

For example, when the exercise performance capability evaluation is executed from the electronic device 10, the controller 130 may activate a sensor unit including a microphone, a camera, and a plurality of different sensors provided in the electronic device 10.

Furthermore, the controller 130 may receive sensing information based on activation of at least one of a microphone, a camera, and a sensor unit provided in the electronic device 10.

For example, the controller 130 may receive exercise data 530 including at least one of an exercise motion image and an exercise motion video of the user from the camera, based on activation of at least one of the camera and the microphone.

In this case, a video received through the camera may be output in real time on a display unit of the electronic device 10.

Furthermore, the controller 130 may analyze at least one of a static posture, a joint range of motion, a balance (or coordination) ability, and a muscle strength (or muscular endurance) of the user, using the pre-trained motion evaluation model 132.

Here, the motion evaluation model 132 is a pose estimation model trained using a training data set including position information for joint points, and may refer to an artificial intelligence model trained to estimate an exercise motion of the user U from exercise data.

Here, a "joint point" may refer to a plurality of joints of the user U (or a part of the body of the user U including a joint).

And, a "keypoint" may refer to a region corresponding to each of a plurality of joint points of the user U in at least one of an image and a video including an exercise motion of the user.

The controller 130 may extract a keypoint corresponding to a joint point of the user from exercise data of the user using the pre-trained motion evaluation model 132, and evaluate an exercise motion of the user U based on an analysis of a positional relationship between the extracted keypoints.

In the present disclosure, a series of processes of evaluating the exercise performance capability of the user from exercise data using keypoints extracted through the motion evaluation model 132 may be referred to as an "exercise performance capability evaluation process."

In the present disclosure, the exercise performance capability evaluation process may be described as being performed in the difficulty level setting system 100, without separately distinguishing the physical space and the subject in which the exercise performance capability evaluation process takes place.

The exercise performance capability evaluation process may be performed using keypoints extracted from the motion evaluation model 132.

More specifically, the controller 130 may analyze the exercise data 530 received from the camera on a frame-by-frame basis, and extract a keypoint corresponding to a joint point corresponding to an exercise motion of the user.

For example, the motion evaluation model 132 may include various object detection algorithms.

For example, the motion evaluation model 132 may include an algorithm (Weighted Box Fusion, WBF) that ensembles a plurality of bounding boxes.

However, it is natural that the controller 130 is not limited to the object detection algorithm described above, and may use various object detection algorithms capable of detecting an object corresponding to the user U from an image or video included in the exercise data 530.

In the present disclosure, training data on which the motion evaluation model 132 performs training may be stored in a database 200, and a part of the database 200 may also be referred to as a "training data DB."

Details of the training data will be described later.

Furthermore, the controller 130 may perform training for the motion evaluation model 132 based on a training data set existing in the training data DB.

As described above, the training data set may include position information of joint points matched to joint points of the user.

The controller 130 may train the motion evaluation model 132 to extract a keypoint corresponding to a joint point of the user from exercise data 530, using the training data set.

As shown in FIG. 5A, the controller 130 may perform a motion analysis evaluation 511, 521 for the user.

Here, "motion analysis evaluation 511, 521" may include at least one of a static posture evaluation (or body shape analysis) and a joint range of motion evaluation.

Specifically, the controller 130 may perform a motion analysis evaluation 511, 521 for each of a plurality of different body parts in order to evaluate the exercise performance capability of the user in the electronic device 10.

For example, the controller 130 may analyze the body shape of the user from an image (or video) of the static posture of the user captured from the electronic device 10, using the pre-trained motion evaluation model 132.

For example, the controller 130 may analyze an alignment state of body parts of the user (e.g., head, neck, shoulder, pelvis, knee, etc.) from the image (or video) of the static posture, using the pre-trained motion evaluation model 132.

Furthermore, the controller 130 may perform a joint range of motion evaluation for each of a plurality of different body parts in order to evaluate the exercise performance capability of the user in the electronic device 10.

Specifically, the controller 130 may perform an analysis of at least one of a range of motion of a joint, a movement speed (or acceleration) of a joint, a body balance of the user included in an exercise video to be analyzed, a body equilibrium, and a body alignment state (e.g., an axial alignment state of a leg, a spinal alignment state, etc.), using the pre-trained motion evaluation model 132.

For example, the controller 130 may capture an exercise motion of the user based on a plurality of shooting topics for a joint range of motion evaluation, using a camera provided in the electronic device 10.

In this case, among a plurality of shooting topics (first through fourth shooting topics), a first shooting topic may be related to "static posture," a second shooting topic may be related to "joint range of motion (shoulder)," a third shooting topic may be related to "joint range of motion (elbow)," and a fourth shooting topic may be related to "joint range of motion (torso)."

Meanwhile, for each of a plurality of shooting items respectively corresponding to a plurality of shooting topics, at least one of a shooting target scene (or scene), a shooting method, and a shooting order may be matched and present.

The controller 130 may receive user exercise data according to a shooting method and a shooting order matched to a shooting topic selected in the electronic device 10, and perform a motion analysis evaluation 511, 521 of the user from the exercise data.

Furthermore, the controller 130 may perform a balance (or coordination) ability evaluation 512, 522 and a muscle strength (or muscular endurance) evaluation 513, 523 of the user, using the pre-trained motion evaluation model 132.

Specifically, the controller 130 may evaluate at least one of a balance (or coordination) ability and a muscle strength (or muscular endurance) of the user from exercise data of the user performing a preset exercise motion (e.g., a single-leg standing motion, a dead bug motion, a plank motion, etc.).

In this case, the controller 130 may provide a sample video of a preset exercise motion to the electronic device 10, and induce the user to perform the preset exercise motion according to the provided sample video.

The controller 130 may measure a time during which the user performs and maintains a preset exercise motion (e.g., a single-leg standing posture, a plank posture) in a correct posture, and perform at least one of a balance (or coordination) ability evaluation 512, 522 and a muscle strength (or muscular endurance) evaluation 513, 523 of the user based on the maintenance time.

For example, the controller 130 may evaluate the measured maintenance time according to a preset time interval, and perform a balance (or coordination) ability evaluation and a muscle strength (or muscular endurance) evaluation of the user.

Here, a "preset time interval" may include a plurality of different time intervals.

The controller 130 may evaluate at least one of the balance (or coordination) ability and the muscle strength (or muscular endurance) of the user as "insufficient (or low)" based on the measured maintenance time falling within a first time interval (e.g., less than 1 minute) among a

plurality of different intervals, "average (or intermediate)" based on falling within a second time interval (e.g., 1 minute to 3 minutes), and "good (or high)" based on falling within a third time interval (e.g., more than 3 minutes).

In this case, the preset time intervals according to the present disclosure are not limited to the examples described, and may be variously set by the difficulty level setting system 100.

As another example, the controller 130 may measure the number of times the user performs a preset exercise motion (e.g., a dead bug motion) in a correct posture for a preset time (e.g., 30 seconds), and perform at least one of a balance (or coordination) ability evaluation 512, 522 and a muscle strength (or muscular endurance) evaluation 513, 523 of the user based on the number of performances.

For example, the controller 130 may evaluate the measured number of performances according to a preset count interval, and perform a balance (or coordination) ability evaluation and a muscle strength (or muscular endurance) evaluation of the user.

Here, a "preset count interval" may include a plurality of different count intervals.

The controller 130 may evaluate at least one of the balance (or coordination) ability and the muscle strength (or muscular endurance) of the user as "insufficient (or low)" based on the measured number of performances falling within a first count interval (e.g., less than 10) among a plurality of different intervals, "average (or intermediate)" based on falling within a second count interval (e.g., 10 to 20), and "good (or high)" based on falling within a third count interval (e.g., more than 20).

In this case, the preset count intervals according to the present disclosure are not limited to the examples described, and may be variously set by the difficulty level setting system 100.

As shown in FIG. 5B, the controller 130 may generate an exercise performance capability evaluation result for at least one evaluation item.

Specifically, the controller 130 may receive exercise data 530 using at least one of a camera and a sensor unit provided in the electronic device 10.

Furthermore, the controller 130 may process the exercise data 530 as an input to the pre-trained motion evaluation model 132 to generate an exercise performance capability evaluation result 500 of the user.

Specifically, the exercise performance capability evaluation result 500 may include at least one of a motion analysis evaluation result 540, a balance (or coordination) ability

evaluation result 550, and a muscle strength (or muscular endurance) evaluation result 560 of the user.

Furthermore, the controller 130 may comprehensively evaluate the exercise performance capability of the user based on the motion analysis evaluation result 540, the balance (or coordination) ability evaluation result 550, and the muscle strength (or muscular endurance) evaluation result 560 of the user, based on a preset evaluation criterion.

Here, a "preset evaluation criterion" may refer to a criterion by which a medical professional evaluates the exercise performance capability of the user according to the evaluation of the static posture, joint range of motion, balance (or coordination) ability, and muscle strength (or muscular endurance) of the user.

The controller 130 may generate an exercise performance capability evaluation result 500 that further includes a comprehensive evaluation result 570 for the comprehensive evaluation.

In the present disclosure, a process of generating a prompt to be input to a large language model may be performed using the response data and the evaluation result of the exercise performance capability (S260, see FIG. 2).

As shown in FIG. 6A, the controller 130 may generate a prompt 600 to be input to the large language model 140 from questionnaire response data 410 including selection-type questionnaire response data 411 and interactive questionnaire response data 412, and the exercise performance capability evaluation result 500, using a prompt generator 131.

Specifically, the prompt generator 131 may generate the prompt 600 to include a response matched to an item selected by a user input among the plurality of selection items for a question related to the indication of the user included in the selection-type questionnaire.

For example, the prompt generator 131 may generate the prompt 600 to include information on at least one of a pain area, a pain level, an underlying disease, a medical record, a risk factor, and exercise equipment owned by the user, specified in relation to the indication of the user included in the selection-type questionnaire response data 411.

Furthermore, the prompt generator 131 may generate the prompt 600 to include a natural language input of the user included in the interactive questionnaire response data 412 and an answer of the large language model 140 to the natural language input.

In addition, the prompt generator 131 may generate the prompt 600 to include a motion analysis evaluation result 540 of the user included in the exercise performance capability evaluation result 500 of the user.

The controller 130 may generate a prompt 600 including a balance (or coordination) ability evaluation result 550 and a muscle strength (or muscular endurance) evaluation result 560.

Furthermore, the controller 130 may generate a prompt 600 including a comprehensive evaluation result 570 of the exercise performance capability of the user.

In the present disclosure, a process of inputting the prompt to the large language model to obtain an exercise difficulty level related to the indication of the user from the large language model may be performed (S270, see FIG. 2).

The exercise difficulty level according to the present disclosure may be determined based on a preset difficulty setting criterion.

Here, the preset difficulty setting criterion may include a plurality of different setting criteria.

For example, the preset difficulty setting criterion may refer to a criterion for setting the exercise difficulty level of the exercise program according to at least one of the response data, the history information, and the exercise performance capability evaluation included in the prompt.

Here, an "exercise program" is configured to include a plurality of exercise modules, and each of the plurality of exercise modules is matched to a different exercise type and may include at least one exercise motion content item related to the exercise type matched to each of the exercise modules.

In this case, the different exercise types may refer to at least one of a first exercise type (or a main exercise type), a second exercise type (e.g., a warm-up exercise type), and a third exercise type (or a cool-down exercise type).

Specifically, the controller 130 may obtain a specific exercise difficulty level among a plurality of exercise difficulty levels through the large language model to which the prompt is input, based on a preset difficulty setting criterion.

In this case, the at least one exercise motion content item includes motion difficulty level information, and each of the plurality of exercise modules may include at least one specific exercise motion content item based on the specific exercise difficulty level.

In the present disclosure, the controller 130 is described as obtaining the exercise difficulty level in conjunction with the large language model 140; however, the present disclosure is not limited thereto, and the controller 130 itself may specify (or generate) the exercise difficulty level by including the functions of the large language model 140 or performing the same functions.

Accordingly, in the present specification, the obtaining of the exercise difficulty level by the controller 130 and the generating or specifying of the exercise difficulty level by the large language model 140 may be used interchangeably.

As shown in FIG. 6B, the large language model 140 may specify an exercise difficulty level 610 of the exercise program based on at least one of the response data, the history information, and the exercise performance capability evaluation result included in the prompt, according to a difficulty setting criterion 630.

Here, the "difficulty setting criterion 630" may include a plurality of difficulty setting criteria based on at least one of the response data, the history information, and the exercise performance capability evaluation result included in the prompt.

For example, a first setting criterion 631 among the plurality of difficulty setting criteria may refer to a difficulty setting criterion based on information related to at least one of a pain level (or pain score), a pain-inducing motion, and a pain duration in relation to the pain of the user.

Specifically, the first setting criterion 631 may include a difficulty restriction criterion for each piece of information related to at least one of the pain level (or pain score), the pain-inducing motion, and the pain duration.

As one example, when the pain score for the pain area of the user is a first score (e.g., 5 points), the large language model 140 may specify an exercise difficulty level at or below a specific difficulty level (e.g., a third difficulty level), based on a difficulty restriction criterion matched to the first score.

As another example, the large language model 140 may specify the exercise difficulty level based on a difficulty restriction criterion matched to the pain duration for the pain area of the user.

Specifically, the large language model 140 may specify the pain of the user as a first state (e.g., acute) based on the pain duration being a first period (e.g., one week), and specify the exercise difficulty level at or below a specific difficulty level (e.g., a third difficulty level), based on a second difficulty restriction criterion matched to the first state.

In contrast, the large language model 140 may specify the pain of the user as a second state (e.g., chronic) based on the pain duration being a second period (e.g., 6 months), and specify the exercise difficulty level at or below a specific difficulty level (e.g., a fifth difficulty level), based on a difficulty restriction criterion matched to the second state.

In addition, a second setting criterion 632 among the plurality of difficulty setting criteria may refer to a difficulty setting criterion based on at least one of a static posture, a joint range of motion, a balance (or coordination) ability, and a muscle strength (or muscular endurance), based on the exercise performance capability evaluation result included in the prompt.

Specifically, the second setting criterion 632 may include a difficulty restriction criterion for each evaluation result for at least one of a static posture, a joint range of motion, a balance (or coordination) ability, and a muscle strength (or muscular endurance).

As one example, when the balance (or coordination) ability is a first grade (e.g., an average grade) in the exercise performance capability evaluation result of the user, the large language model 140 may specify an exercise difficulty level at or below a specific difficulty level (e.g., a third difficulty level), based on a difficulty restriction criterion matched to the first grade.

In addition, a third setting criterion 633 among the plurality of difficulty setting criteria may refer to a difficulty setting criterion based on at least one of a medical record (e.g., surgical record, diagnostic record) and underlying disease information included in the response data and history information included in the prompt.

Specifically, the third setting criterion 633 may include a difficulty restriction criterion for each of a medical record (e.g., surgical record, diagnostic record) and underlying disease information.

As one example, when the user has a specific underlying disease (e.g., hypertension), the large language model 140 may specify an exercise difficulty level at or below a specific difficulty level (e.g., a third difficulty level), based on a difficulty restriction criterion matched to the specific underlying disease.

In addition, a fourth setting criterion 634 among the plurality of difficulty setting criteria may refer to a difficulty setting criterion based on at least one of an exercise frequency, an exercise duration, and an exercise location included in exercise habit and environment information included in the prompt.

Specifically, the fourth setting criterion 634 may include a difficulty restriction criterion for each of an exercise frequency, an exercise duration, and an exercise location.

As one example, when the exercise frequency of the user is a first frequency (e.g., three times per week), the large language model 140 may specify an exercise difficulty level at or below a specific difficulty level (e.g., a fifth difficulty level), based on a difficulty restriction criterion matched to the first frequency.

As another example, when the exercise location of the user is a first location (e.g., a company), the large language model 140 may specify an exercise difficulty level at or below a specific difficulty level (e.g., a second difficulty level), based on a difficulty restriction criterion matched to the first location.

In this way, the large language model 140 may specify the exercise difficulty level to be set in the exercise program, based on a difficulty setting criterion based on at least one of the response data and the exercise performance capability evaluation result and history information included in the prompt.

Furthermore, the controller 130 may obtain a specific exercise difficulty level as an answer of the large language model 140.

In this case, the specific exercise difficulty level may refer to an exercise difficulty level satisfying any one of the plurality of different setting criteria.

Alternatively, the specific exercise difficulty level may refer to an exercise difficulty level satisfying all of the plurality of different setting criteria.

In the present disclosure, a process of generating an exercise program related to the indication of the user based on the obtained exercise difficulty level may be performed (S280, see FIG. 2).

As described above, the exercise program according to the present disclosure is configured to include a plurality of exercise modules, each of the plurality of exercise modules is matched to a different exercise type, and may include at least one exercise motion content item related to the exercise type matched to each of the exercise modules.

The controller 130 may obtain a specific exercise difficulty level specified according to the preset difficulty setting criterion among a plurality of different exercise difficulty levels.

Here, each of the plurality of different exercise difficulty levels may have a preset motion difficulty level of exercise content to be included in a specific exercise module.

Specifically, the at least one exercise motion content item may include motion difficulty level information, and each of the plurality of exercise modules may include at least one specific exercise motion content item satisfying a preset motion difficulty level condition, based on the specific exercise difficulty level.

Here, a "preset motion difficulty level condition" may refer to a condition that restricts the difficulty level of exercise motion content items included in at least one exercise module constituting an exercise program for which a specific exercise difficulty level is set.

In this case, a preset motion difficulty level attribute value may be labeled on the exercise motion content item.

For example, at least one of a first motion difficulty level attribute value (e.g., "1"), a second motion difficulty level attribute value (e.g., "2"), a third motion difficulty level attribute value (e.g., "3"), a fourth motion difficulty level attribute value (e.g., "4"), a fifth motion difficulty level attribute value (e.g., "5"), and a sixth motion difficulty level attribute value (e.g., "6") may be labeled on the exercise motion content item.

As shown in (a) of FIG. 6B, the exercise difficulty level set in the exercise program according to the present disclosure may refer to at least one of a plurality of exercise difficulty levels.

Here, each of the plurality of exercise difficulty levels may be classified into a first difficulty level 621 through a sixth difficulty level 625, based on preset motion difficulty level setting criteria for different exercise types.

As one example, a first difficulty level (e.g., "A") may refer to an exercise difficulty level that causes a first exercise module (or a main exercise module) corresponding to a first exercise type (or a main exercise type) to include exercise motion content items having a motion

difficulty level set to a first motion difficulty level or a second motion difficulty level among a plurality of motion content items associated with the first exercise type.

In addition, the first difficulty level (e.g., "A") may refer to an exercise difficulty level that causes a second exercise module (or a warm-up exercise module) corresponding to a second exercise type (or a warm-up exercise type) to include exercise motion content items having a motion difficulty level set to a first motion difficulty level among a plurality of motion content items associated with the second exercise type.

Likewise, the first difficulty level (e.g., "A") may refer to an exercise difficulty level that causes a third exercise module (e.g., a cool-down exercise module) corresponding to a third exercise type (or a cool-down exercise type) to include exercise motion content items having a motion difficulty level set to a first motion difficulty level among a plurality of motion content items associated with the third exercise type.

As another example, a second difficulty level (e.g., "B") may refer to an exercise difficulty level that causes a first exercise module (or a main exercise module) corresponding to a first exercise type (or a main exercise type) to include exercise motion content items having a motion difficulty level set to any one of a first motion difficulty level through a third motion difficulty level among a plurality of motion content items associated with the first exercise type.

In addition, the second difficulty level (e.g., "B") may refer to an exercise difficulty level that causes a second exercise module (or a warm-up exercise module) corresponding to a second exercise type (or a warm-up exercise type) to include exercise motion content items having a motion difficulty level set to a first motion difficulty level or a second motion difficulty level among a plurality of motion content items associated with the second exercise type.

Likewise, the second difficulty level (e.g., "B") may refer to an exercise difficulty level that causes a third exercise module (e.g., a cool-down exercise module) corresponding to a third exercise type (or a cool-down exercise type) to include exercise motion content items having a motion difficulty level set to a first motion difficulty level or a second motion difficulty level among a plurality of motion content items associated with the third exercise type.

In the following, in order to avoid redundant description, a description of the preset motion difficulty level setting criteria for the third difficulty level ("C"), the fourth difficulty level ("D"), the fifth difficulty level ("E"), and the sixth difficulty level ("F") shown in (a) of FIG. 6B will be omitted.

It may be understood that each of the motion difficulty levels and the preset motion difficulty level setting criteria according to the present disclosure is not limited to the examples described above.

The plurality of different motion difficulty levels and the preset motion difficulty level setting criteria described in the present disclosure may be variously set by at least one of the electronic device 10 to which a medical professional account is logged in and the difficulty level setting system 100.

The controller 130 may process, as an input to the large language model 140, a prompt generated using at least one of the questionnaire response data and the exercise performance capability evaluation result, and the specified motion difficulty level.

Furthermore, the controller 130 may extract at least one specific exercise motion content item satisfying a preset motion difficulty level condition, using the specific exercise difficulty level and the prompt.

Specifically, the controller 130 may extract a plurality of different exercise motion content items from the database 200 including the exercise program DB 710, using the large language model 140.

In the exercise program DB 710 according to the present disclosure, a plurality of different exercise motion content items 711 to 713 related to each of various body parts (or pain areas) of a person may be stored.

As described above, an "exercise motion content item" may include various pieces of information such as a name for a specific exercise motion, exercise duration information, motion difficulty level information, exercise type information, exercise area information, exercise posture information, and exercise equipment information.

In this case, each piece of information included in the plurality of exercise motion content items 711 to 713 stored in the exercise program DB 710 (e.g.,

a name for a specific exercise motion, exercise duration information, motion difficulty level information, exercise type information, exercise area information, exercise posture information, and exercise equipment information) may be labeled (or tagged) with a preset attribute value.

For example, based on exercise type information matched to the plurality of exercise motion content items 711 to 713 stored in the exercise program DB 710, exercise motion content

items corresponding to a second exercise type ("warm-up exercise type") and a third exercise type ("cool-down exercise type") may be labeled with a first type attribute value (e.g., "1"), and exercise motion content items corresponding to a first exercise type ("main exercise type") may be labeled with a second type attribute value (e.g., "2").

The description of the attribute values described above is merely one embodiment, and the attribute values labeled on the information constituting the exercise motion content items are not limited to the described examples and may be variously set.

Furthermore, the large language model 140 may extract an attribute value for each of a plurality of pieces of information included in the exercise motion content items, in order to extract at least one exercise motion content item to be included in the exercise program.

The large language model 140 may receive attribute values corresponding to each of the extracted plurality of pieces of information, and extract exercise motion content items including information corresponding to the extracted attribute values from the exercise program DB 710.

The controller 130 may extract a plurality of different exercise motion content items from the exercise program DB 710 using the large language model 140, and generate at least one exercise module based on the exercise type matched to each of the extracted plurality of exercise motion content items.

For example, the controller 130 may specify exercise motion content items related to a pain area of the user, based on information about the pain area of the user included in the prompt 600 among the plurality of different exercise motion content items 711 to 713 from the exercise program DB 710.

In addition, the controller 130 may specify exercise motion content items related to a body part in which a joint range of motion of the user satisfies a preset condition, based on a motion analysis evaluation result of the user included in the prompt 600 among the plurality of different exercise motion content items 711 to 713 from the exercise program DB 710.

Here, the "preset condition" may refer to a condition satisfied based on the joint range of motion of the user not falling within a normal reference range or being limited to a specific threshold value or below.

In this case, the "normal reference range" and the specific threshold value may be variously set by at least one of the electronic device 10 to which a medical professional account is logged in and the difficulty level setting system 100.

Furthermore, the large language model 140 may generate an exercise program composed of a plurality of exercise modules, using the specified exercise motion content items so as to correspond to the obtained exercise difficulty level.

In the present disclosure, the controller 130 is described as generating an exercise program using the large language model 140; however, the present disclosure is not limited thereto, and the controller 130 itself may include the functions of the large language model 140 or perform the same functions to generate an exercise program.

Therefore, in the present specification, obtaining an exercise program by the controller 130 and generating an exercise program by the large language model 140 may be used interchangeably.

As shown in FIG. 7, the controller 130 may generate the exercise program composed of a plurality of exercise modules, based on the exercise type matched to the extracted at least one specific exercise motion content item, through the large language model 140.

Specifically, the controller 130 may generate a plurality of different exercise modules 720, 730, 740, based on the exercise type matched to each of the specified exercise motion content items.

In this case, the exercise motion content items included in each of the plurality of exercise modules may be configured based on a preset motion difficulty level setting criterion for the specific difficulty level 610 obtained from the large language model 140.

For example, based on the obtained exercise difficulty level being a "second difficulty level," the controller 130 may generate the exercise program 700 such that exercise motion content items of the first exercise type ("warm-up exercise type") among the specified exercise motion content items (e.g., "bilateral hip circular rotation 1 - difficulty level 1," "inner thigh dynamic stretching - difficulty level 2," 721) are included in a first exercise module ("warm-up exercise module," 720).

In this case, the controller 130 may generate an exercise program 700 composed in the order of a first exercise module ("warm-up exercise module," 720), a second exercise module ("main exercise module," 730), and a third exercise module ("cool-down exercise module," 740), using the large language model 140.

Furthermore, the large language model 140 may generate an exercise program 700 that causes a user to continuously perform exercise motions of the same posture, based on exercise

posture information included in exercise motion content items, for continuity of motion postures in a specific exercise module.

Specifically, the large language model 140 may extract a plurality of exercise motion content items including the same exercise posture information, and generate an exercise program in which the plurality of exercise motion content items are continuously arranged by a preset number (e.g., three).

Meanwhile, the controller 130 may generate an exercise program 700 including exercise motion content items that can be performed using an exercise device 750 possessed by the user, using the large language model 140.

Specifically, the large language model 140 may extract at least one exercise motion content item including specific exercise device information, using response data of the user for a question related to an exercise device from the questionnaire response data included in the prompt 600.

For example, the large language model 140 may extract at least one exercise motion content item including exercise device information corresponding to a "foam roller" and a "stretching band," based on the user's response in the questionnaire response data indicating that the user has a "foam roller" and a "stretching band."

Furthermore, the large language model 140 may generate an exercise program 700 including the extracted at least one exercise motion content item.

Meanwhile, the controller 130 may generate an exercise program 700 corresponding to a preset total exercise duration, based on a preset total exercise duration 760 set in advance on the electronic device 10 to which a medical professional account is logged in, using the large language model 140.

More specifically, the large language model 140 may cause a plurality of exercise motion content items to be included in different exercise modules so as to correspond to the preset total exercise duration, based on exercise duration information included in the exercise motion content items.

As one example, when the preset total exercise duration on the electronic device 10 to which a medical professional account is logged in is "20" minutes, the controller 130 may set an exercise duration of 5 minutes for each of the warm-up exercise module and the cool-down exercise module, and set an exercise duration of 10 minutes for the main exercise module.

Furthermore, the large language model 140 may combine a plurality of exercise motion content items to satisfy the exercise duration set for each exercise module, and generate an exercise program 700 reflecting the preset total exercise duration 760 in the exercise program.

The method and system for setting a difficulty level of an exercise program using a large language model according to the present disclosure may perform a user-customized exercise performance capability evaluation by applying different evaluation items according to a current state of the user, based on the questionnaire response data and history information of the user.

Through this, the current exercise performance capability of the user may be precisely evaluated to generate an exercise program with a difficulty level suitable for the rehabilitation of the user.

Furthermore, the method and system for setting a difficulty level of an exercise program using a large language model according to the present disclosure may minimize the risk of re-injury due to overload and provide a safe evaluation environment that does not impose excessive burden on the user, by adjusting exercise performance capability evaluation items based on medical information such as pre-existing medical history or surgical records, taking into account the user's medical records (or clinical records) included in the history information.

Furthermore, the method and system for setting a difficulty level of an exercise program using a large language model according to the present disclosure may minimize the risk of pain aggravation and program dropout during exercise performance and ensure long-term rehabilitation continuity, by generating an exercise program set to a user-customized difficulty level and providing the exercise program to the user.

Meanwhile, a computer-readable medium includes all types of recording devices in which data readable by a computer system is stored.

Examples of computer-readable media include a Hard Disk Drive (HDD), a Solid State Disk (SSD), a Silicon Disk Drive (SDD), a ROM, a RAM, a CD-ROM, a magnetic tape, a floppy disk, an optical data storage device, and the like.

Furthermore, the computer-readable medium may be a server or cloud storage that includes storage and is accessible by an electronic device through communication.

In this case, the computer may download the program according to the present disclosure from a server or cloud storage through wired or wireless communication.

Furthermore, in the present disclosure, the computer described above is an electronic device equipped with a processor, that is, a CPU (Central Processing Unit), and no particular limitation is placed on the type thereof.

Meanwhile, the detailed description above should not be construed as restrictive in all respects and should be considered as illustrative.

The scope of the present disclosure should be determined by a reasonable interpretation of the appended claims, and all modifications within the equivalent scope of the present disclosure are included in the scope of the present disclosure.

【CLAIMS】

【CLAIM 1】

A method for setting a difficulty level of an exercise program using a large language model, the method comprising:

- providing at least one questionnaire related to an indication of a user to an electronic device;

- receiving, from the electronic device, response data for the questionnaire;

- setting an evaluation criterion for evaluating an exercise performance capability of the user, based on at least one of the response data for the questionnaire and history information of the user;

- specifying at least one evaluation item among a plurality of evaluation items related to an exercise performance capability evaluation, based on the evaluation criterion;

- evaluating the exercise performance capability of the user for the at least one evaluation item, by inputting exercise data of the user into a pre-trained motion evaluation model;

- generating a prompt to be input to a large language model, using the response data for the questionnaire and an evaluation result of the exercise performance capability;

- inputting the prompt to the large language model to obtain an exercise difficulty level related to the indication of the user from the large language model; and

- generating an exercise program related to the indication of the user, based on the obtained exercise difficulty level.

【CLAIM 2】

The method of claim 1, wherein the evaluation criterion is set differently based on at least one of the response data for the questionnaire and the history information, and the specifying of the at least one evaluation item comprises:

- specifying an evaluation restriction item satisfying an unsuitability condition among the plurality of evaluation items related to the exercise performance capability evaluation, based on the differently set evaluation criterion; and

- specifying the at least one evaluation item among the plurality of evaluation items, based on the specified evaluation restriction item.

【CLAIM 3】

The method of claim 2, wherein the evaluation restriction item is specified based on at least one of a pain level for a pain area of the user and a medical record, included in at least one of the response data for the questionnaire and the history information.

【CLAIM 4】

The method of claim 3, wherein the unsuitability condition is a condition for specifying the evaluation restriction item to be excluded from the exercise performance capability evaluation of the user, based on a restriction criterion preset in at least one of the pain level and the medical record.

【CLAIM 5】

The method of claim 2, wherein the evaluating of the exercise performance capability of the user comprises:

receiving, from the electronic device, the exercise data of the user corresponding to the specified at least one evaluation item;

analyzing at least one of a static posture, a joint range of motion, a balance ability, and a muscle strength of the user, using the pre-trained motion evaluation model; and

generating an exercise performance capability evaluation result for the at least one evaluation item.

【CLAIM 6】

The method of claim 1, wherein the exercise program is configured to include a plurality of exercise modules, and each of the plurality of exercise modules is matched to a different exercise type and includes at least one exercise motion content item related to the exercise type matched to each of the exercise modules.

【CLAIM 7】

The method of claim 6, wherein the obtaining of the exercise difficulty level comprises obtaining a specific exercise difficulty level among a plurality of exercise difficulty levels through the large language model to which the prompt is input, based on a preset difficulty setting criterion.

【CLAIM 8】

The method of claim 7, wherein the at least one exercise motion content item includes motion difficulty level information, and each of the plurality of exercise modules includes at least one specific exercise motion content item satisfying a preset motion difficulty level condition, based on the specific exercise difficulty level.

【CLAIM 9】

The method of claim 8, wherein the preset difficulty setting criterion comprises a plurality of different setting criteria, and the specific exercise difficulty level satisfies all of the plurality of different setting criteria.

【CLAIM 10】

The method of claim 7, wherein the generating of the exercise program comprises:
extracting at least one specific exercise motion content item satisfying the preset motion difficulty level condition, using the specific exercise difficulty level and the prompt; and
generating the exercise program composed of the plurality of exercise modules, based on the exercise type matched to the extracted at least one specific exercise motion content item, through the large language model.

【CLAIM 11】

The method of claim 1, wherein the at least one questionnaire includes at least one of a basic questionnaire including a question related to the indication of the user, and an additional questionnaire provided differently according to a response of the user to the basic questionnaire.

【CLAIM 12】

The method of claim 11, wherein each of the basic questionnaire and the additional questionnaire includes at least one of a selection-type questionnaire composed of at least one query item related to the indication of the user and a plurality of selection items corresponding to each of a plurality of different responses to the query item, and an interactive questionnaire capable of receiving a natural language input from the electronic device in relation to the indication of the user.

【CLAIM 13】

The method of claim 12, wherein the receiving of the response data for the questionnaire comprises:

receiving, from the electronic device, response data for the selection-type questionnaire including a response matched to an item selected by a user input among the plurality of selection items; and

processing the natural language input entered into the electronic device as an input to the large language model, and receiving response data for the interactive questionnaire from the large language model.

【CLAIM 14】

A system for setting a difficulty level of an exercise program using a large language model, the system comprising:

a controller configured to provide at least one questionnaire related to an indication of a user to an electronic device; and

a communication unit configured to receive, from the electronic device, response data for the questionnaire, wherein the controller is configured to:

set an evaluation criterion for evaluating an exercise performance capability of the user, based on at least one of the response data for the questionnaire and history information of the user;

specify at least one evaluation item among a plurality of evaluation items related to an exercise performance capability evaluation, based on the evaluation criterion;

evaluate the exercise performance capability of the user for the at least one evaluation item, by inputting exercise data of the user into a pre-trained motion evaluation model;

generate a prompt to be input to a large language model, using the response data for the questionnaire and an evaluation result of the exercise performance capability;

input the prompt to the large language model to obtain an exercise difficulty level related to the indication of the user from the large language model; and

generate an exercise program related to the indication of the user, based on the obtained exercise difficulty level.

【CLAIM 15】

A program executed by one or more processors in an electronic device and stored in a computer-readable recording medium, the program comprising instructions for performing:

- providing at least one questionnaire related to an indication of a user to an electronic device;

- receiving, from the electronic device, response data for the questionnaire;

- setting an evaluation criterion for evaluating an exercise performance capability of the user, based on at least one of the response data and history information of the user;

- specifying at least one evaluation item among a plurality of evaluation items related to an exercise performance capability evaluation, based on the evaluation criterion;

- evaluating the exercise performance capability of the user for the at least one evaluation item, by inputting exercise data of the user into a pre-trained motion evaluation model;

- generating a prompt to be input to a large language model, using the response data and an evaluation result of the exercise performance capability;

- inputting the prompt to the large language model to obtain an exercise difficulty level related to the indication of the user from the large language model; and

- generating an exercise program related to the indication of the user, based on the obtained exercise difficulty level.