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(54) **INTEGRATED FITNESS EQUIPMENT SYSTEM WITH SMART BARBELL COLLARS AND WEIGHT-BEARING DEVICES**

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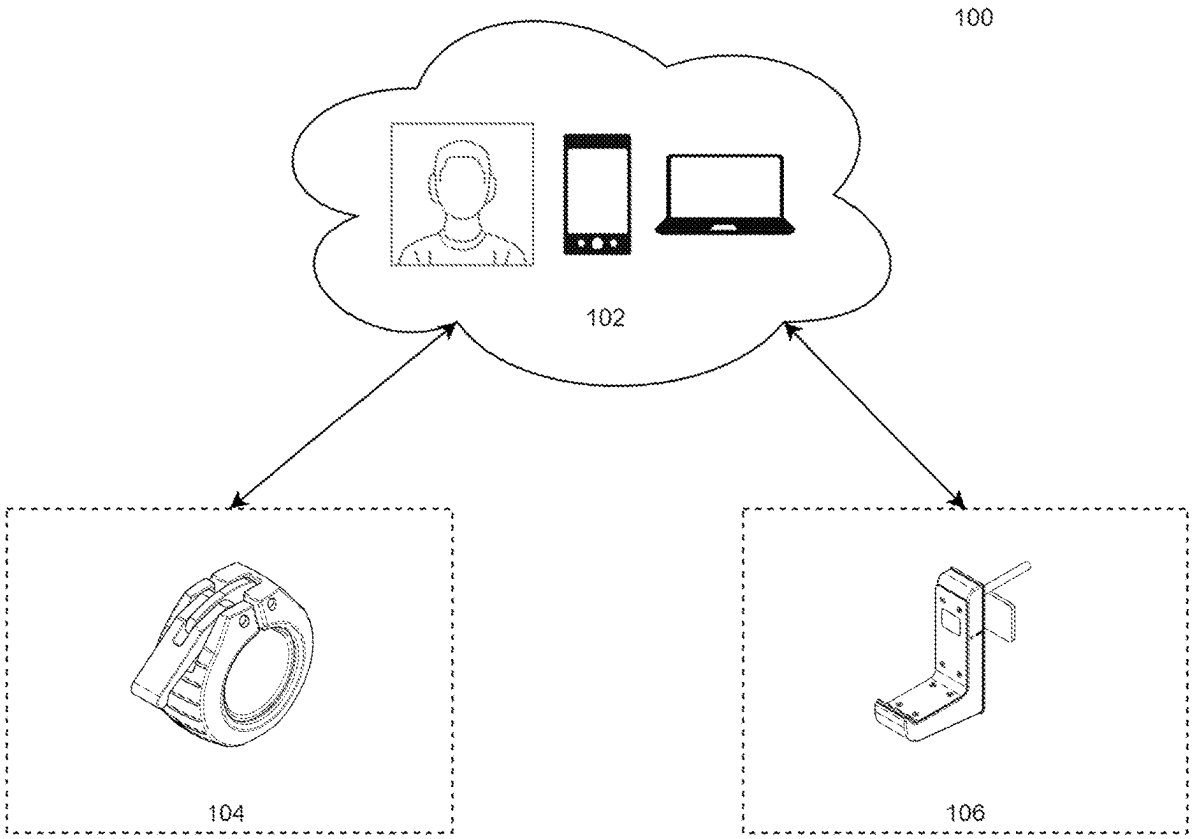
(57) **ABSTRACT**

The fitness equipment system of the invention includes one or more smart barbell collars and weight-bearing devices, each equipped with unique components to gather and transmit data. The smart barbell collars are designed to attach to a barbell and incorporate an Inertial Measurement Unit (IMU), a controller, a power source, and a wireless communication module. The IMU tracks motion-related metrics during exercise, such as the movement and orientation of the barbell. The weight-bearing devices, possibly in the form of J-hooks or similar structures, support the barbell and contain weight sensors, a controller, a power source, and a separate wireless communication module. These devices measure the weight of the barbell. The system also involves user devices with specialized software to receive and process the data transmitted from both the smart barbell collars and the weight-bearing devices. This software analyzes the performance metrics of weightlifting exercises, providing valuable feedback for users.



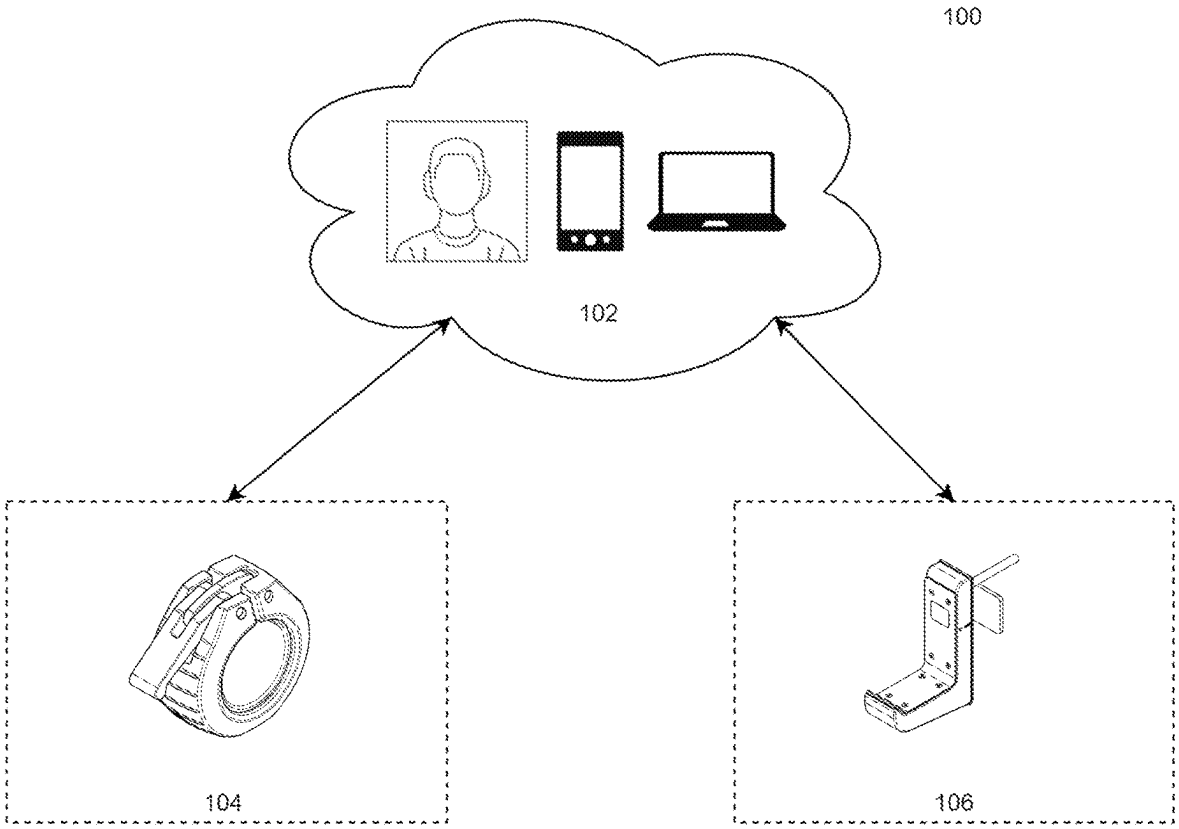


FIG. 1

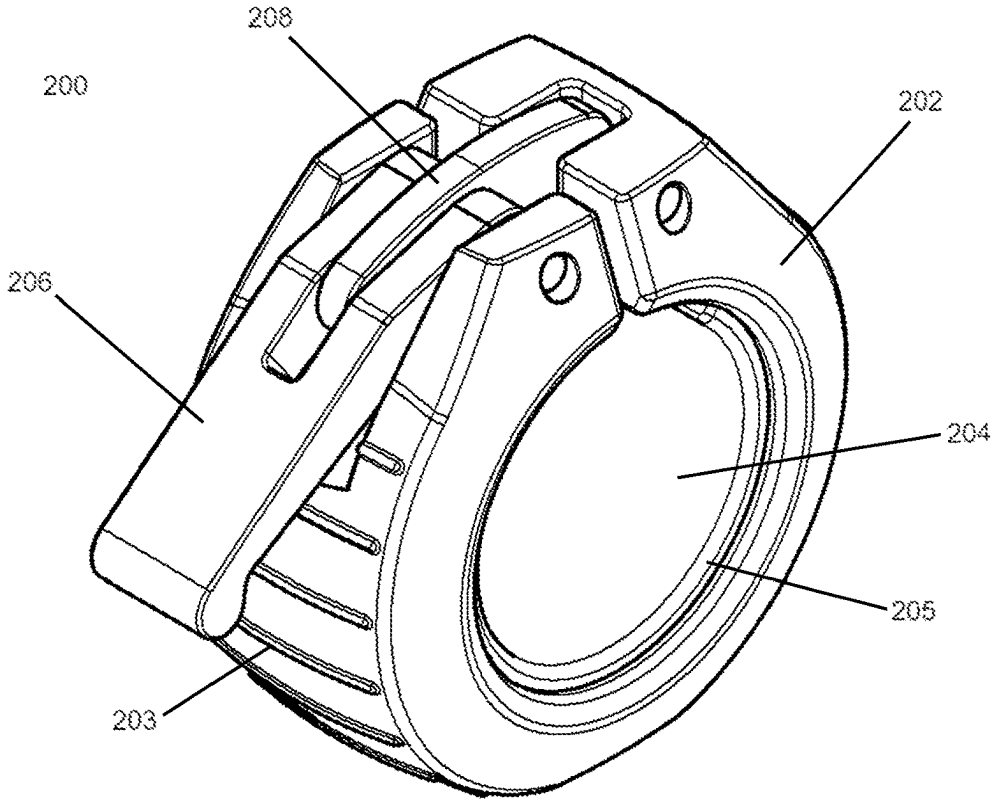


FIG. 2A

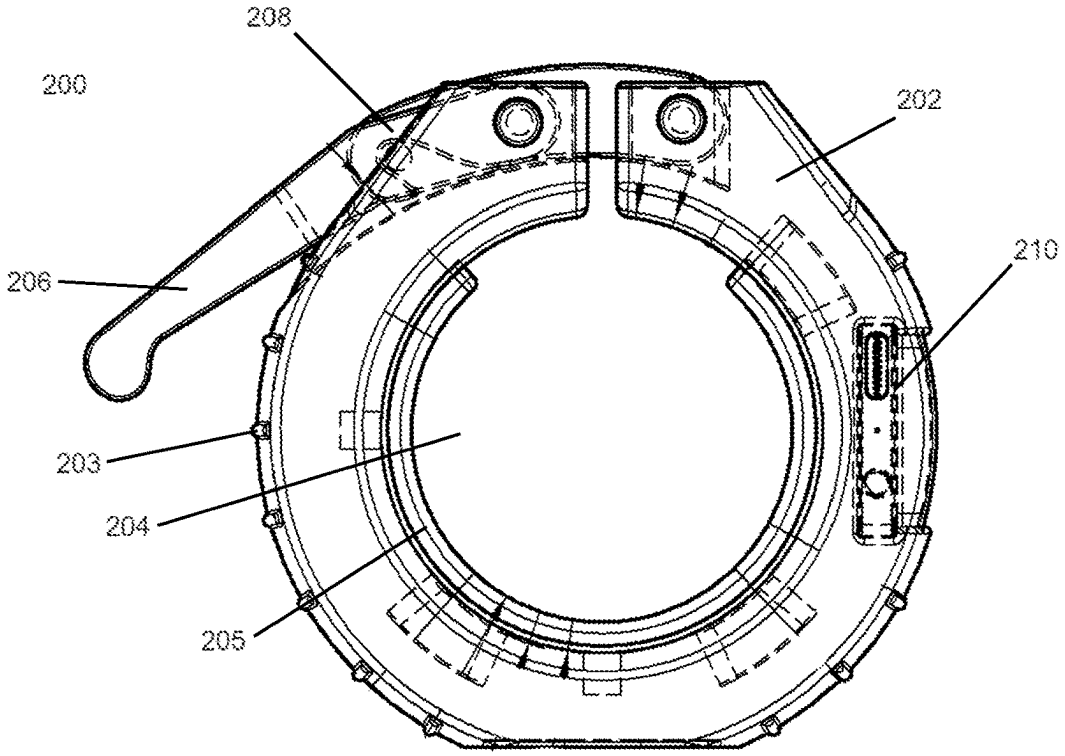


FIG. 2B

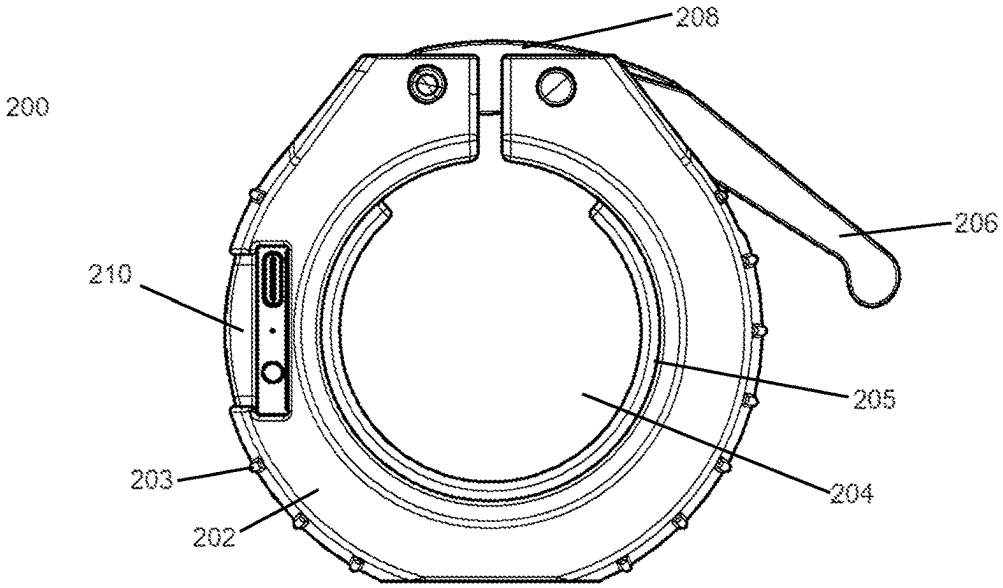


FIG. 2C

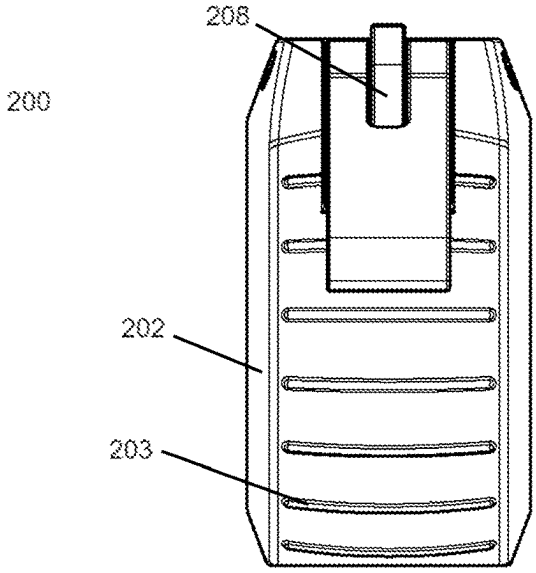


FIG. 2D

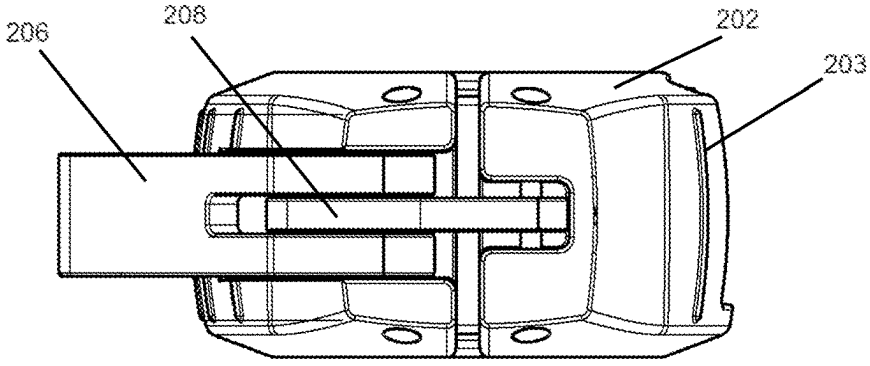


FIG. 2E

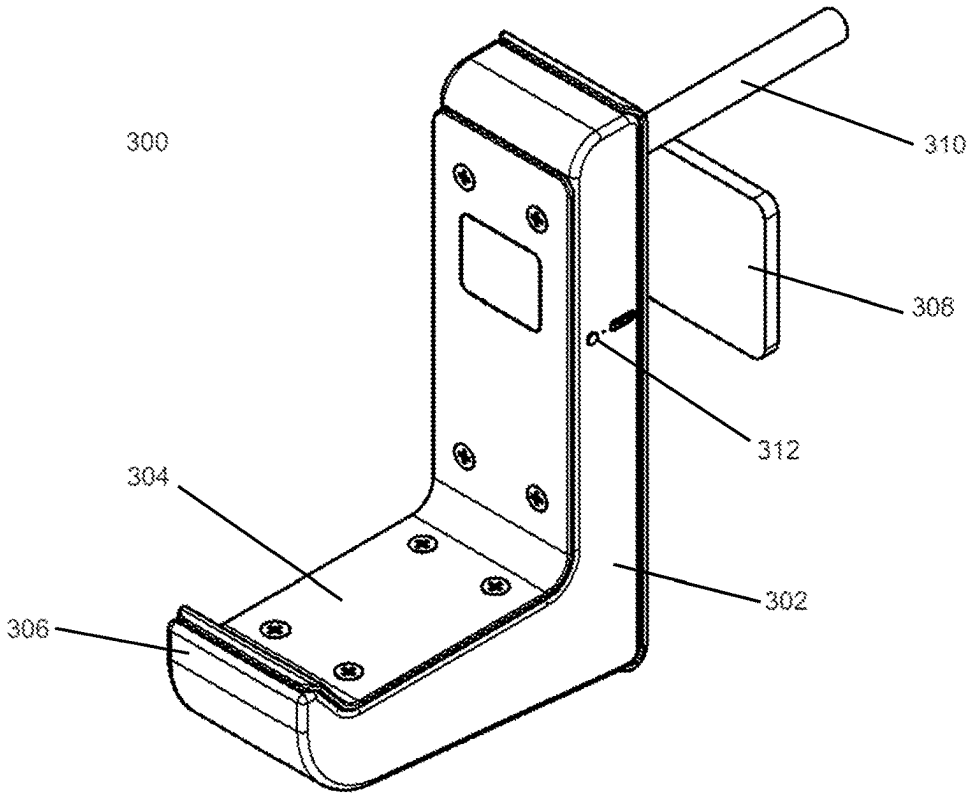


FIG. 3A

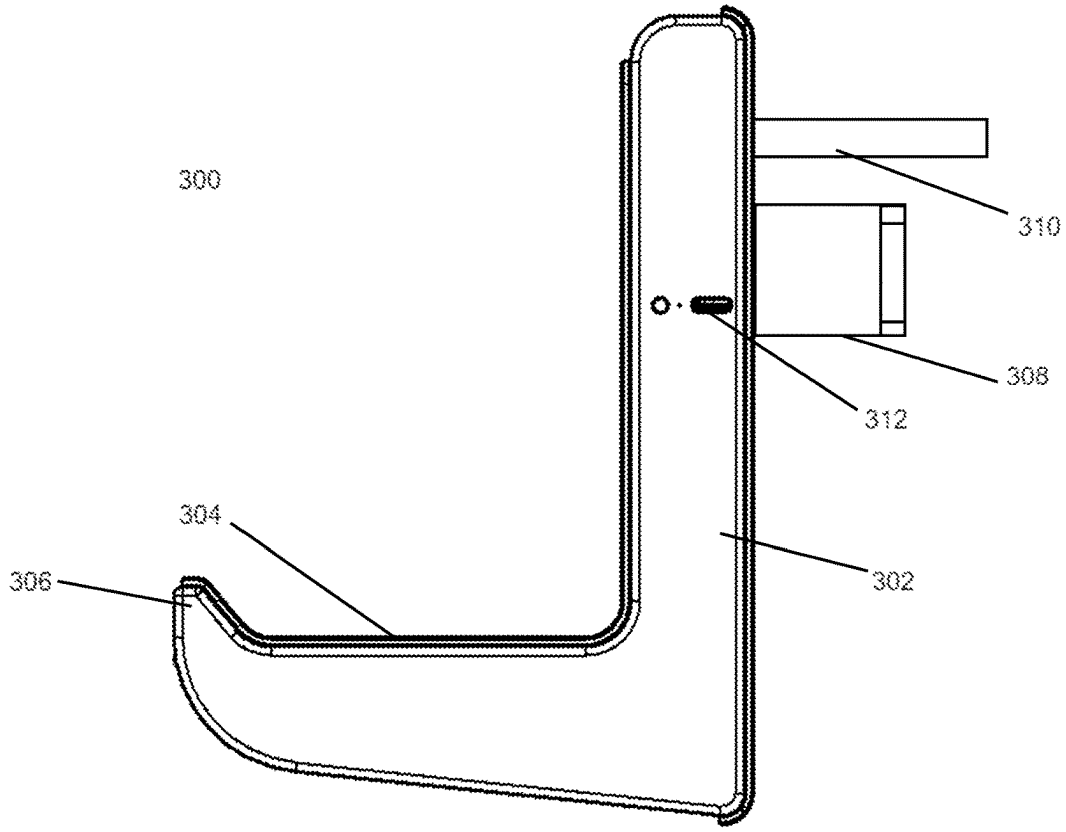


FIG. 3B

INTEGRATED FITNESS EQUIPMENT SYSTEM WITH SMART BARBELL COLLARS AND WEIGHT-BEARING DEVICES

FIELD OF INVENTION

[0001] The present invention relates generally to the field of fitness equipment, specifically to an integrated system comprising smart barbell collars and weight-bearing devices designed for tracking and analyzing weightlifting exercises.

BACKGROUND

[0002] In the domain of fitness and athletic training, the use of technology to augment workout efficiency and effectiveness has seen significant advancements. Particularly, wearable devices and mobile applications have become integral in monitoring and enhancing workout routines for fitness enthusiasts and athletes. These tools often provide valuable data on various aspects of individual performance, including heart rate, calories burned, and distance traveled. However, a noticeable limitation exists in the realm of strength training, specifically in the equipment used for weightlifting exercises.

[0003] Conventional weightlifting gear, such as barbells, has remained largely untouched by the wave of smart technology that has swept through other areas of fitness. Traditional barbell collars, for example, have a singular function: to secure weights to the bar. They lack any form of integrated technology that could capture and relay data regarding the lifter's performance. This is a notable shortfall, as such data could significantly enhance the training experience by providing insights into crucial aspects like the number of repetitions, consistency across sets, and form correctness. These metrics are vital not only for tracking progress and ensuring effective training but also for reducing the risk of injury.

[0004] The issue extends to the stationary components of weightlifting equipment, such as J-hook barbell holders. These holders, typically used to support the barbell when not in use, also do not offer any data capture capabilities. As a result, they miss out on providing information about the weight load, which is a critical parameter in strength training. This gap in data collection and analysis presents a challenge for athletes and fitness enthusiasts striving to optimize their training regimes.

[0005] Despite the increasing incorporation of smart technology in various fitness applications, its integration into the fundamental tools of strength training, especially those used for free weight exercises like barbells, is noticeably lacking. Existing smart fitness devices often operate as standalone units, each requiring its own application. This approach can lead to a cluttered and cumbersome user experience, as it necessitates the use of multiple apps, each for a different piece of equipment. This fragmentation in the smart fitness device market underscores a clear demand for a more integrated system. Such a system would not only consolidate the data from various smart workout devices but would also be compatible with the most commonly used strength training equipment.

[0006] The advent of smart technology in other fitness domains has set a precedent, creating an expectation among users for similar advancements in weightlifting gear. The convergence of these factors—the limitations of current equipment, the importance of detailed performance metrics, and the growing user expectation for integrated smart technology—has catalyzed the development of a new approach to strength training equipment. This approach aims to bridge the existing technological gap and offer a comprehensive, user-friendly solution to the modern athlete and fitness enthusiast.

[0007] It is within this context that the present invention is provided.

SUMMARY

[0008] The present invention relates to a fitness equipment system designed to enhance weightlifting workouts. The system comprises one or more smart barbell collars and one or more weight-bearing devices, each equipped with their respective controllers, power sources, and wireless communication modules. The smart barbell collar includes an Inertial Measurement Unit (IMU) for tracking motion-related metrics of the barbell during exercise. The weight-bearing device is equipped with weight sensors for measuring the weight of the barbell. Additionally, the system includes one or more user devices with installed software configured to receive and process data transmitted by both the smart barbell collar and the weight-bearing device, offering insights into performance metrics of weightlifting exercises.

[0009] In some embodiments, the smart barbell collar includes adjustable rubber inserts to accommodate barbells of various diameters. This feature ensures a secure attachment of the collar to different barbells, enhancing the system's versatility and applicability across various weightlifting equipment.

[0010] In some embodiments, the Inertial Measurement Unit of the smart barbell collar is detachable and secured within the collar by a magnetic mechanism. This design facilitates easy transfer and utilization of the IMU between different exercise equipment, increasing the flexibility and convenience of the system for users engaging in diverse training routines.

[0011] In some embodiments, the weight-bearing device is of a J-hook design, including a rigid body with a supporting surface for resting the bar of a barbell and attachment means for coupling to a frame of gym equipment. This design contributes to the stability and safety of the weightlifting setup.

[0012] In some embodiments, the supporting surface of the J-hook is lined with a protective material. This lining serves to prevent damage to the barbell and reduce noise during use, contributing to the longevity of the equipment and a more pleasant workout environment.

[0013] In some embodiments, the weight-bearing device includes high-precision sensors capable of measuring weight loads up to 1,000 pounds. These sensors provide accurate data for heavy lifting exercises, supporting a wide range of weightlifting activities from light to heavy lifting.

[0014] In some embodiments, environmental sensors are integrated into either the smart barbell collar or the weight-bearing device, or both. These sensors measure environmental conditions such as temperature, humidity, and air quality, offering valuable information that can influence workout conditions and user comfort.

[0015] In some embodiments, both the smart barbell collar and the weight-bearing device include a rechargeable power source compatible with a wireless charging dock. This

feature simplifies the charging process, ensuring that the devices are consistently powered for use.

[0016] In some embodiments, one or more vibration sensors are integrated within the smart barbell collar or weight-bearing device. These sensors analyze the stability and form of lifts, providing feedback on lifting technique, which can be instrumental in enhancing the effectiveness of workouts and reducing the risk of injury.

[0017] In some embodiments, the system includes social integration features in the user device software. This allows users to share workout progress and compete with peers through social media platforms or a dedicated community platform, fostering a sense of community and motivation.

[0018] In some embodiments, the system further comprises one or more modular weight sensing mats. These mats are equipped with weight sensors, a power source, a controller, and a wireless communications module. The mats are designed to be placed under weightlifting benches or racks, measuring the total weight lifted, including the lifter's body weight, for a comprehensive overview of the lifting session.

[0019] In some embodiments, the system is integrated with one or more smart mirror devices, each having a display. This integration enables the system to display real-time data from the J-hook and smart barbell collar in the smart mirror display for simultaneous monitoring of form and performance metrics.

[0020] In some embodiments, the system includes smart weight plates configured to automatically record and sync their weight with the J-hook system. This feature streamlines the data collection process, enhancing the overall efficiency of the workout tracking.

[0021] In some embodiments, the system features voice control integration via the user devices. This enables hands-free operation, allowing users to make adjustments or access data during workouts without interrupting their exercise routine.

[0022] In some embodiments, the user device software includes user-specific customization features. These features allow for the setting of personal goals, tracking of individual progress, and receiving tailored workout recommendations based on user profiles, offering a personalized workout experience.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] Various embodiments of the invention are disclosed in the following detailed description and accompanying drawings.

[0024] FIG. **1** illustrates an example system architecture of the fitness equipment system, showing user devices in wireless communication with a collar and weight holder.

[0025] FIG. **2**A depicts an isometric perspective view of a collar device of the invention.

[0026] FIG. **2**B presents an isometric transparent side view of the collar, highlighting the hinge connection between the lever and locking element.

[0027] FIG. **2**C displays an isometric side view of the collar device.

[0028] FIG. **2**D shows an isometric rear view of the collar configuration.

[0029] FIG. **2**E provides an isometric top-down view of the collar device.

[0030] FIGS. **3**A and **3**B offer perspective and side isometric views, respectively, of a J-hook weight holder device of the invention.

[0031] Common reference numerals are used throughout the figures and the detailed description to indicate like elements. One skilled in the art will readily recognize that the above figures are examples and that other architectures, modes of operation, orders of operation, and elements/functions can be provided and implemented without departing from the characteristics and features of the invention, as set forth in the claims.

DETAILED DESCRIPTION AND PREFERRED EMBODIMENT

[0032] The following is a detailed description of exemplary embodiments to illustrate the principles of the invention. The embodiments are provided to illustrate aspects of the invention, but the invention is not limited to any embodiment. The scope of the invention encompasses numerous alternatives, modifications and equivalent; it is limited only by the claims.

[0033] Numerous specific details are set forth in the following description in order to provide a thorough understanding of the invention. However, the invention may be practiced according to the claims without some or all of these specific details. For the purpose of clarity, technical material that is known in the technical fields related to the invention has not been described in detail so that the invention is not unnecessarily obscured.

Definitions

[0034] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention.

[0035] As used herein, the term "and/or" includes any combinations of one or more of the associated listed items.

[0036] As used herein, the singular forms "a," "an," and "the" are intended to include the plural forms as well as the singular forms, unless the context clearly indicates otherwise.

[0037] It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, steps, operations, elements, components, and/or groups thereof.

[0038] As used herein, the term "fitness equipment system" refers to an assembly of devices and software designed to enhance physical exercises, specifically weightlifting. The system includes, but is not limited to, smart barbell collars, weight-bearing devices, and user devices with installed software. This term is intended to encompass various modifications and configurations of such equipment that are capable of performing the functions described herein.

[0039] The term "smart barbell collar" as used herein refers to a device designed to be affixed to a barbell, equipped with sensors, controllers, power sources, and communication modules. These collars are capable of tracking, recording, and transmitting motion-related metrics of the barbell during exercise. The term includes various forms and embodiments of such collars, including those with adjustable features, detachable components, and different methods of securing to barbells of various sizes.

[0040] The phrase "weight-bearing device" as described herein encompasses any structure or apparatus configured to

support a barbell, equipped with weight sensors, controllers, power sources, and communication modules. This includes devices such as J-hooks or other support structures that can measure the weight of the barbell. Variations of these devices may include different sensor types, mounting mechanisms, and materials to suit specific weightlifting environments and requirements.

[0041] The term "user device" as used in this context refers to electronic devices such as smartphones, tablets, computers, or specialized fitness equipment interfaces. These devices are equipped with or capable of running software that receives, processes, and displays data transmitted by the smart barbell collars and weight-bearing devices. The software may offer functionalities such as data analysis, feedback provision, performance tracking, and integration with other fitness systems.

[0042] In the context of this patent, "wireless communication module" refers to any electronic component or system capable of transmitting and receiving data wirelessly. This includes, but is not limited to, technologies such as Bluetooth, Wi-Fi, NFC, and other forms of wireless communication suitable for transmitting data between the components of the fitness equipment system and the user devices.

DESCRIPTION OF DRAWINGS

[0043] The fitness equipment system of the present application is designed to enhance the weightlifting experience by offering comprehensive tracking and analysis of workout data. This system integrates smart technology into traditional weightlifting equipment, specifically focusing on barbells and their supporting apparatus. The primary components of this system include smart barbell collars and weight-bearing devices, each equipped with advanced sensor technology and wireless communication capabilities.

[0044] The smart barbell collars are designed to attach securely to a barbell and are equipped with Inertial Measurement Units (IMUs). These IMUs are capable of tracking various motion-related metrics during exercise, such as the speed, angle, and range of motion of the barbell. This data is then transmitted wirelessly for processing and analysis. The collars are adaptable to fit barbells of different diameters and are designed for ease of transfer between different pieces of exercise equipment.

[0045] Complementing the smart barbell collars are the weight-bearing devices. These devices, which can be in the form of J-hooks or similar structures, are designed to support the barbell and are equipped with weight sensors. These sensors accurately measure the weight of the barbell, providing vital data for the monitoring and optimization of strength training. Like the smart barbell collars, the weight-bearing devices have wireless communication modules to transmit the collected data.

[0046] The system also includes user devices with installed software, which receive and process the data transmitted by both the smart barbell collars and the weight-bearing devices. This software presents the data in a user-friendly format, allowing for real-time feedback and detailed analysis of the user's performance. The software is capable of integrating data from multiple workout sessions and equipment, offering a comprehensive overview of the user's progress and areas for improvement.

[0047] FIG. **1** presents an example system architecture **100** of the fitness equipment system.

[0048] In this architecture, a set of user devices **102**, which includes a smartphone and a laptop, establishes direct wireless communication with the key components of the invention: a collar **104** and a weight holder **106**. The collar **104**, designed to attach to a barbell, is equipped with sensors and a wireless communication module, enabling it to transmit exercise-related data to the user devices **102**. This data includes motion-related metrics captured by the Inertial Measurement Unit (IMU) within the collar **104**.

[0049] The weight holder **106**, depicted as a J-hook barbell holder, is also equipped with sensors and a wireless communication module. It is responsible for measuring the weight of the barbell and transmitting this data to the user devices **102**. The sensors in the weight holder **106** can be high-precision weight sensors capable of accurately measuring heavy loads, potentially up to 1,000 pounds.

[0050] The wireless communication between the collar **104**, weight holder **106**, and user devices **102** can utilize various protocols such as Bluetooth, Wi-Fi, or other suitable wireless technologies. This enables real-time transmission of data, ensuring that users receive immediate feedback on their performance.

[0051] The smartphone and laptop as user devices **102** run the dedicated software application of the system. This software is responsible for receiving, processing, and displaying the data transmitted from the collar **104** and weight holder **106**. The user interface of the software on these devices is designed to present the data in an easily interpretable format, such as graphical displays, charts, and numerical values. This setup allows users to monitor their workout progress and analyze their performance metrics conveniently.

[0052] FIGS. **2**A through **2**E provide an in-depth look at various views of an example configuration of a collar device **200**. These figures illustrate the structural and functional aspects of the collar device **200** designed to enhance weightlifting workouts.

[0053] FIG. **2**A presents an isometric perspective view of the collar device **200**. The collar includes a rounded ring-shaped body **202**, forming an opening **204** through which a barbell bar can be inserted. The outer rim of the body **202** is adorned with a set of grip elements **203** distributed around its circumference, providing a secure grip and ease of handling.

[0054] The inner surface of the ring that forms the opening **204** is lined with a rubber grip **205**. This rubber grip **205** ensures a snug and secure fit around the barbell bar, preventing slippage and enhancing the stability of the weights during exercise.

[0055] The collar device **200** features a latch-based opening and locking mechanism, which includes a hinge-mounted lever **206**. This lever **206** can be pulled open to widen the collar, facilitating easy placement or removal from a barbell. Additionally, a locking element **208**, coupled to the lever **206**, securely keeps the collar closed when the lever is in a closed position, ensuring the weights remain firmly in place during lifting.

[0056] A set of controls **210** is strategically positioned on one side of the collar device **200**. These controls may include an on/off switch and other interface elements, such as a button for establishing wireless connections. The control set **210** is integrated with the inner electronics of the collar, comprising a set of sensors, a power source, a controller, and a wireless communications module. These components

work together to track motion-related metrics and transmit data wirelessly to user devices.

[0057] FIG. **2**B shows an isometric transparent side view of the collar configuration, highlighting the hinged connection between the lever **206** and the locking element **208**. This view provides insight into the mechanical functionality of the opening and locking mechanism

[0058] FIG. **2**C displays an isometric side view of the collar configuration, offering a different perspective on the collar device **200**'s external features and the positioning of the control set **210**.

[0059] FIG. **2**D illustrates an isometric rear view of the collar configuration, showcasing the rear aspects of the collar device **200**, including the hinge mechanism and the alignment of the locking element **208**.

[0060] Finally, FIG. **2**E presents an isometric top-down view of the collar configuration, providing a comprehensive view of the top surface of the collar device **200**, including the placement of the control set **210** and the distribution of the grip elements **203**.

[0061] FIGS. **3**A and **3**B provide detailed perspective and side views of an example configuration of a J-hook weight holder device **300**.

[0062] The J-hook weight holder device **300** comprises a body **302** that is specifically designed to support the bar of a barbell. The upper supporting surface **304** of the body **302** is shaped to accommodate the barbell bar securely. Along one side of this supporting surface **304**, there is a curved hook **306**. This hook **306** ensures that the barbell bar does not roll off during placement or removal, thereby enhancing the safety and stability of the weightlifting setup.

[0063] At the rear of the body **302**, there are a pair of attachment elements designed to facilitate the device's secure attachment to an exercise equipment frame. These elements include a peg **310** and a hook **308**. The peg **310** and hook **308** are structured to enable easy yet firm attachment to various types of gym equipment, ensuring versatility and compatibility with different workout environments.

[0064] A set of controls **312** is positioned on one side of the weight holder device **300**. These controls may include an on/off switch and other interface elements such as a button for establishing wireless connections. The control set **312** is integrated with the internal electronics of the device, which includes a set of weight load sensors, a power source, a controller, and a wireless communications module. The weight load sensors measure the weight of the barbell placed on the holder, providing data for the user's strength training analysis.

[0065] The wireless communications module within the J-hook weight holder device **300** facilitates the transmission of weight load data to user devices. This data transmission can be executed through various wireless protocols such as Bluetooth or Wi-Fi, allowing real-time tracking and analysis of weightlifting metrics.

Dedicated Software Application

[0066] The software aspect of the fitness equipment system provides functionality in conjunction with the smart barbell collars and weight-bearing devices. The software, executed on user devices, is responsible for receiving, processing, and presenting the collected data.

[0067] The user interface (UI) of the software is designed to facilitate ease of use. It includes various graphical elements like buttons, sliders, icons, and display panels. These elements are organized to allow efficient user interaction and to present workout information in a clear, understandable format.

[0068] The software application may provide a user dashboard which compiles and displays key performance metrics from workouts. It presents data in formats such as charts, graphs, and numerical values, allowing users to quickly grasp their progress in terms of metrics like weight lifted, repetitions, sets, and other motion-related metrics.

[0069] Data processing algorithms within the software analyze the data sent from the smart barbell collars and weight-bearing devices. These algorithms perform calculations and interpretations of workout metrics, offering insights into performance and suggesting areas for improvement.

[0070] The software offers customizable settings, enabling users to tailor their experience. This includes setting personal fitness goals, choosing specific metrics for display on the dashboard, and adjusting notification settings.

[0071] Communication protocols in the software facilitate data transfer between the smart barbell collars, weight-bearing devices, and the user device. These protocols ensure that data transmission is efficient and secure.

[0072] Social integration features in the software allow users to share their workout progress on social media platforms or a dedicated community platform. This sharing capability aims to encourage user engagement and motivation.

[0073] Additionally, the software includes support tools such as tutorial sections, help guides, instructional videos, FAQs, and troubleshooting tips. These resources are provided to assist users in effectively using the fitness equipment system, enabling them to optimize their workouts.

CONCLUSION

[0074] Unless otherwise defined, all terms (including technical terms) used herein have the same meaning as commonly understood by one having ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and the present disclosure and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0075] The disclosed embodiments are illustrative, not restrictive. While specific configurations of the fitness equipment system of the invention have been described in a specific manner referring to the illustrated embodiments, it is understood that the present invention can be applied to a wide variety of solutions which fit within the scope and spirit of the claims. There are many alternative ways of implementing the invention.

[0076] It is to be understood that the embodiments of the invention herein described are merely illustrative of the application of the principles of the invention. Reference herein to details of the illustrated embodiments is not intended to limit the scope of the claims, which themselves recite those features regarded as essential to the invention.

What is claimed is:

1. A fitness equipment system, comprising:

one or more smart barbell collars having a body configured to attach to a barbell, each smart barbell collar further comprising:

an Inertial Measurement Unit (IMU) for tracking motion-related metrics of the barbell during exercise;

a first controller operatively connected to the IMU;

a first power source; and

a first wireless communication module for transmitting data collected by the IMU;

one or more weight-bearing devices configured to support the barbell, each weight-bearing device comprising:

a set of weight sensors for measuring the weight of the barbell;

a second controller operatively connected to the weight sensors;

a second power source; and

a second wireless communication module for transmitting data collected by the weight sensors;

and

one or more user devices having installed software, wherein the software is configured to receive and process data transmitted separately by the first wireless communication module of the smart barbell collar and the second wireless communication module of the weight-bearing device, the processed data relating to performance metrics of weightlifting exercises.

2. The fitness equipment system of claim **1**, wherein the smart barbell collar further comprises adjustable rubber inserts to accommodate barbells of various diameters, ensuring a secure attachment.

3. The fitness equipment system of claim **1**, wherein the Inertial Measurement Unit of the smart barbell collar is detachable and is secured within the collar by a magnetic mechanism, facilitating easy transfer between different exercise equipment.

4. The fitness equipment system of claim **1**, wherein the weight-bearing device is of a J-hook design, comprising a rigid body with a supporting surface for resting the bar of a barbell, and attachment means for coupling to a frame of gym equipment.

5. The fitness equipment system of claim **4**, wherein the supporting surface of the J-hook is lined with a protective material to prevent damage to the barbell and reduce noise during use.

6. The fitness equipment system of claim **1**, wherein the weight-bearing device includes high-precision sensors capable of measuring weight loads up to 1,000 pounds, providing accurate data for heavy lifting exercises.

7. The fitness equipment system of claim **1**, further comprising environmental sensors integrated into either the smart barbell collar or the weight-bearing device, or both, to measure environmental conditions such as temperature and humidity, and air quality.

8. The fitness equipment system of claim **1**, wherein the smart barbell collar and the weight-bearing device each include a rechargeable power source compatible with a wireless charging dock.

9. The fitness equipment system of claim **1**, further one or more vibration sensors within the smart barbell collar or weight-bearing device for analyzing the stability and form of lifts, providing feedback on lifting technique.

10. The fitness equipment system of claim **1**, further comprising social integration features in the user device software, allowing users to share workout progress and compete with peers through social media platforms or a dedicated community platform.

11. The fitness equipment system of claim **1**, further comprising one or more modular weight sensing mats having a set of weight sensors, a power source, a controller, and a wireless communications module, the mats being designed to be placed under weightlifting benches or racks to measure the total weight lifted including the lifter's body weight for a comprehensive overview of the lifting session.

12. The fitness equipment system of claim **1**, wherein the system is integrated with one or more smart mirror devices each having a display, and is thereby configured to display real-time data from the J-hook and smart barbell collar in the smart mirror display for simultaneous monitoring of form and performance metrics.

13. The fitness equipment system of claim **1**, further comprising smart weight plates configured to automatically record and sync their weight with the J-hook system for streamlined data collection.

14. The fitness equipment system of claim **1**, featuring voice control integration via the user devices, enabling hands-free operation for users to make adjustments or access data during workouts.

15. The fitness equipment system of claim **1**, wherein the user device software includes user-specific customization features, allowing setting of personal goals, tracking individual progress, and receiving tailored workout recommendations based on user profiles.

* * * * *