US 20130282155A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2013/0282155 A1

(43) Pub. Date: Oct. 24, 2013

Li

(54) METHODS, SYSTEMS, AND DEVICES FOR COLLECTING AND ANALYZING MOVEMENT DATA OF AN ATHLETE

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(21) Appl. No.: **13/789,095**

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

Related U.S. Application Data

(60) Provisional application No. 61/615,126, filed on Mar. 23, 2012.

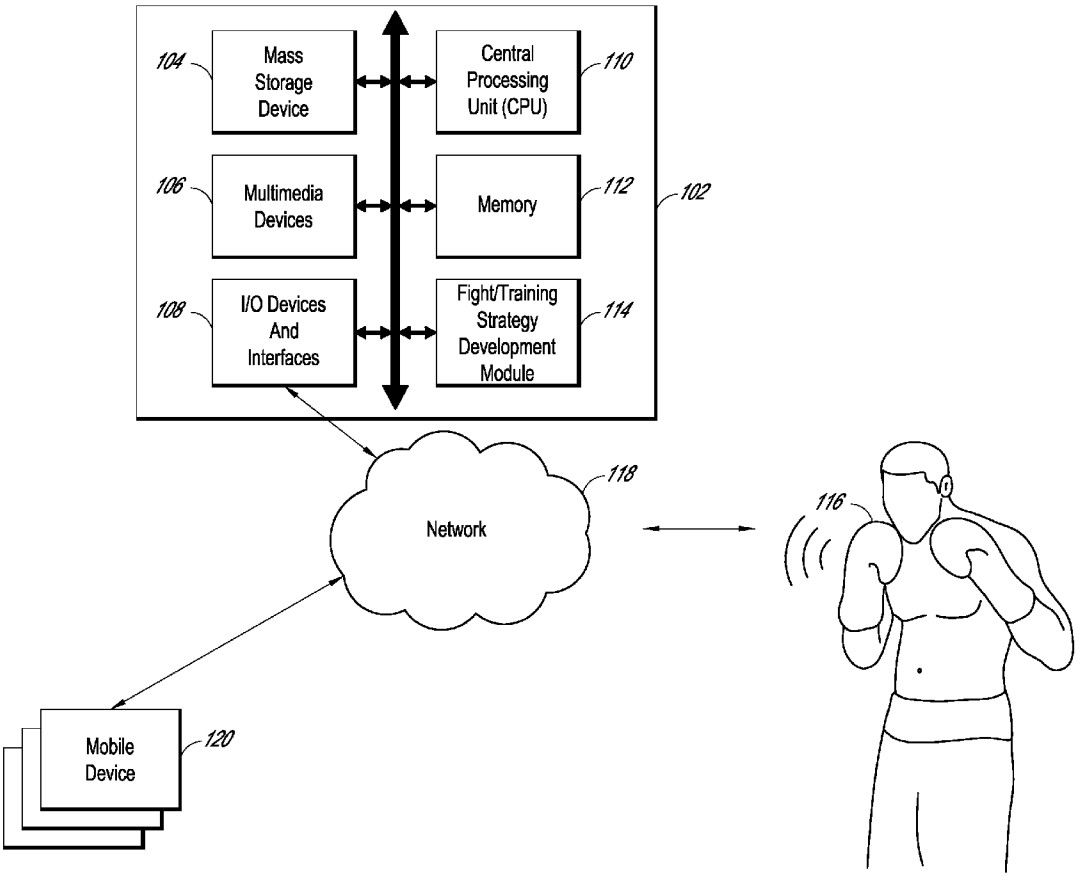
Publication Classification

(51) **Int. Cl.**
A63B 24/00 (2006.01)

(52) **U.S. Cl.**
CPC *A63B 24/0062* (2013.01)
USPC **700/91**

(57) **ABSTRACT**

The disclosure herein provides methods, systems, and devices for collecting movement data of an athlete or a combat athlete using sensors attached to the athlete or combat athlete, transmitting the data to a computing system, analyzing the data according to at least one predetermined parameter, determining a training strategy for the combat athlete based on the analyzed data, and other processing steps.



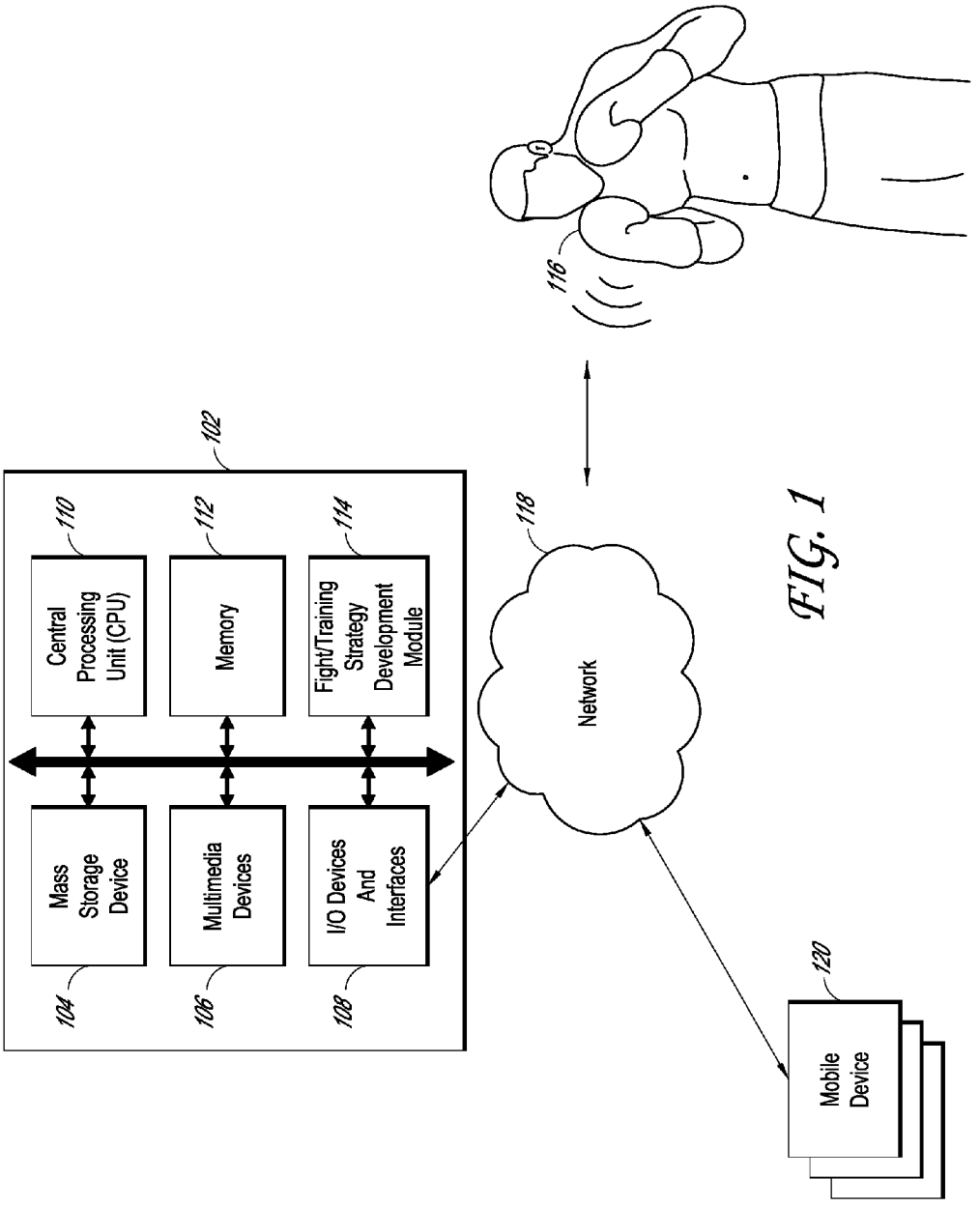

102
110
Central Processing Unit (CPU)
112
Memory
114
Fight/Training Strategy Development Module
Mass Storage Device
Multimedia Devices
I/O Devices And Interfaces
104
106
108
116
118
Network
120
Mobile Device

FIG. 1

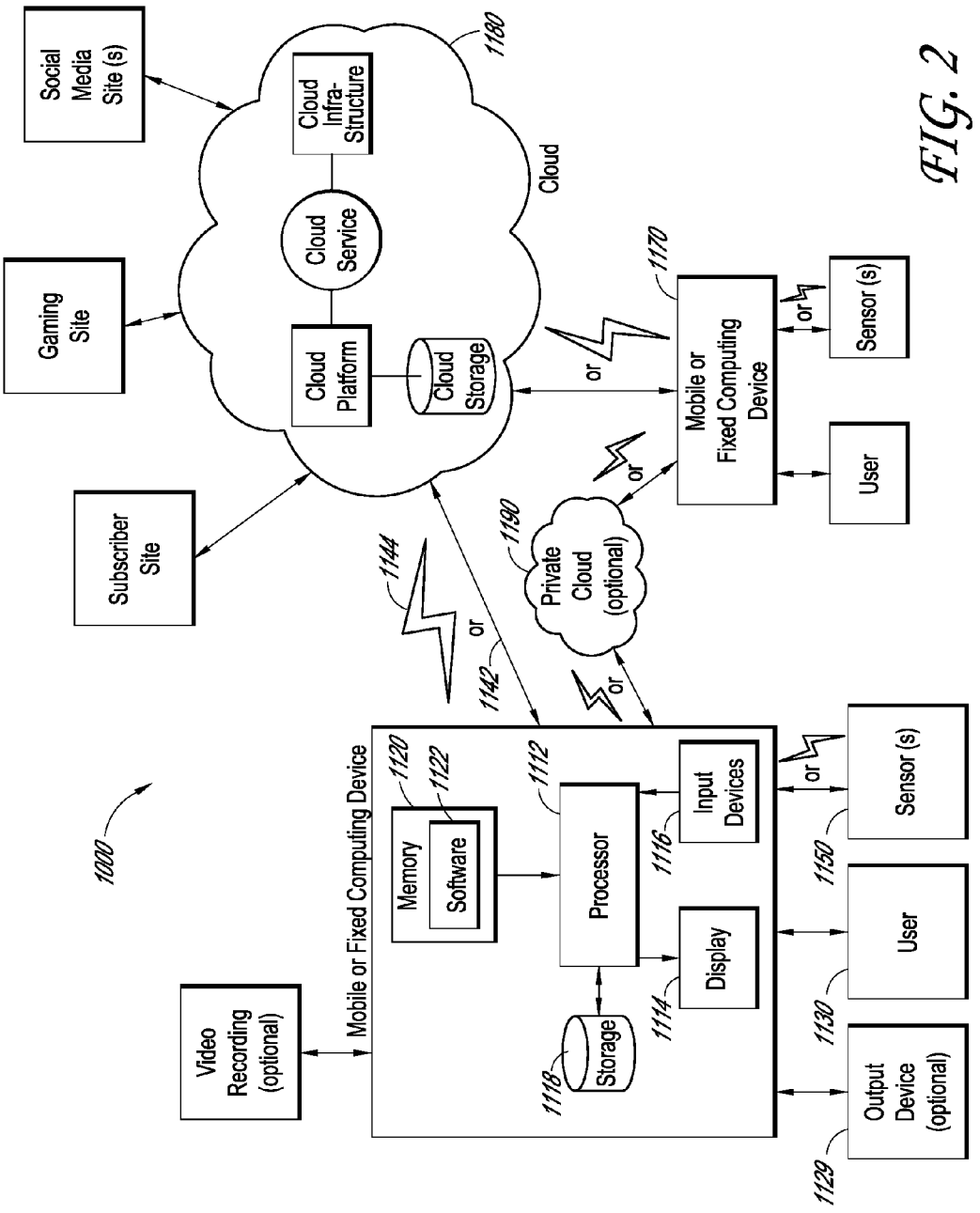

1000
Social Media Site (s)
Gaming Site
Subscriber Site
Cloud
1180
Cloud Infra-Structure
Cloud Service
Cloud Platform
Cloud Storage
1170
Mobile or Fixed Computing Device
Sensor (s)
User
or
1190
Private Cloud (optional)
1144
1142
Video Recording (optional)
Mobile or Fixed Computing Device
1120
Memory
1122
Software
1112
Processor
1116
Input Devices
1114
Display
1118
Storage
1150
Sensor (s)
1130
User
1129
Output Device (optional)

FIG. 2

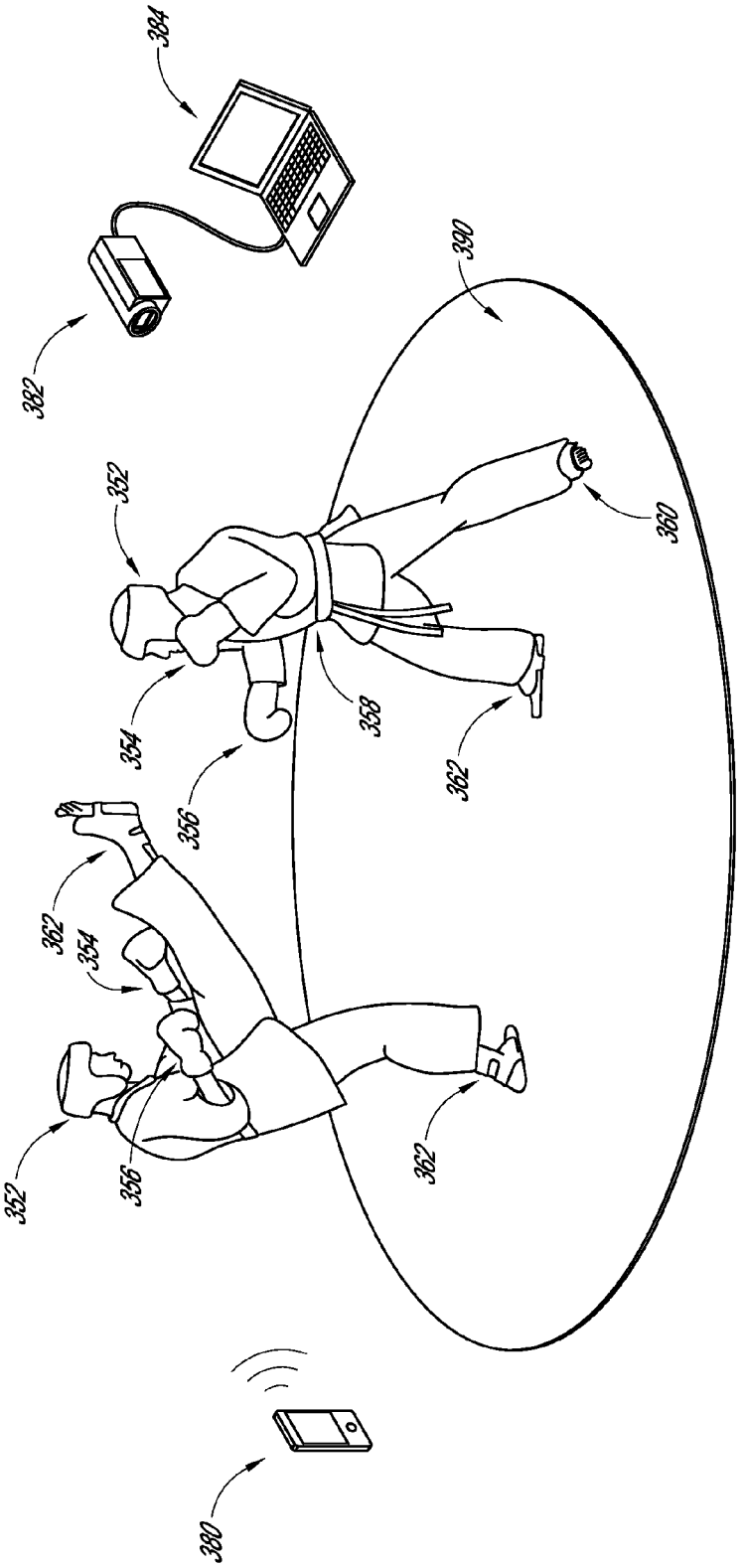
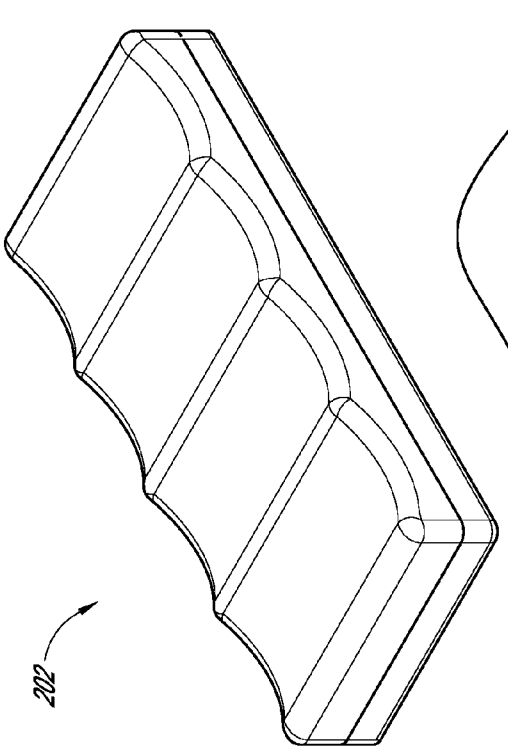


FIG. 3



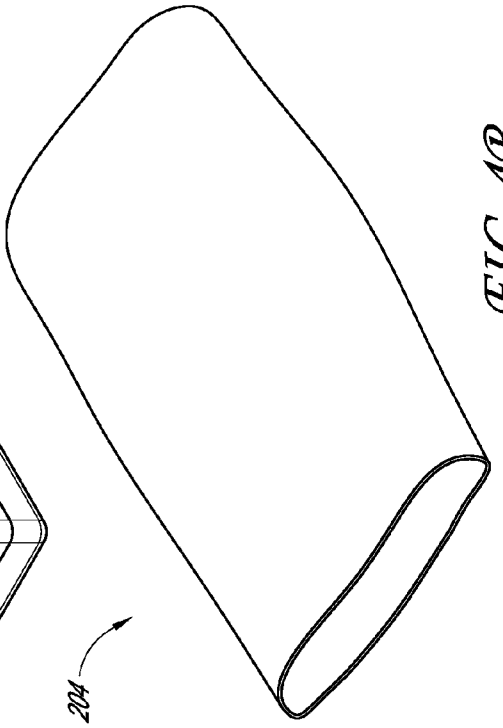


FIG. 4B

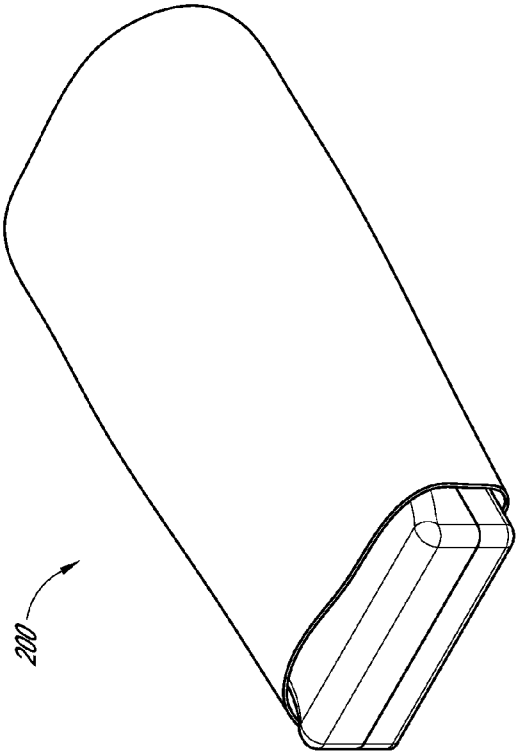


FIG. 4A

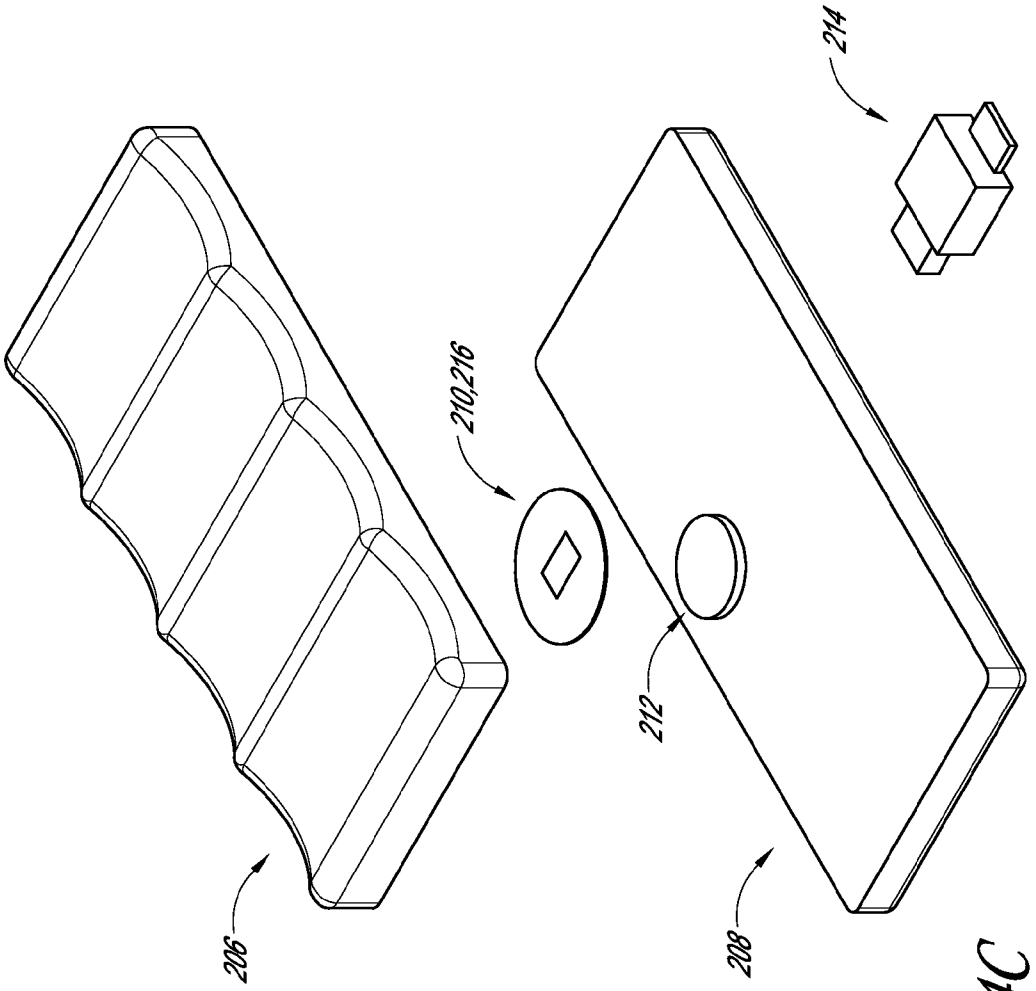


FIG. 4C

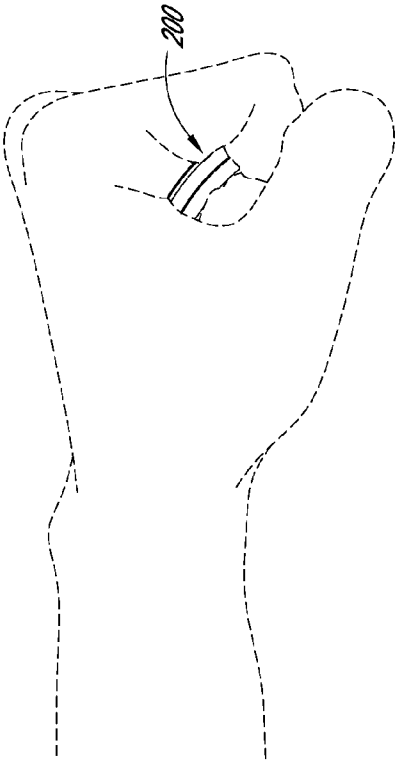


FIG. 5B

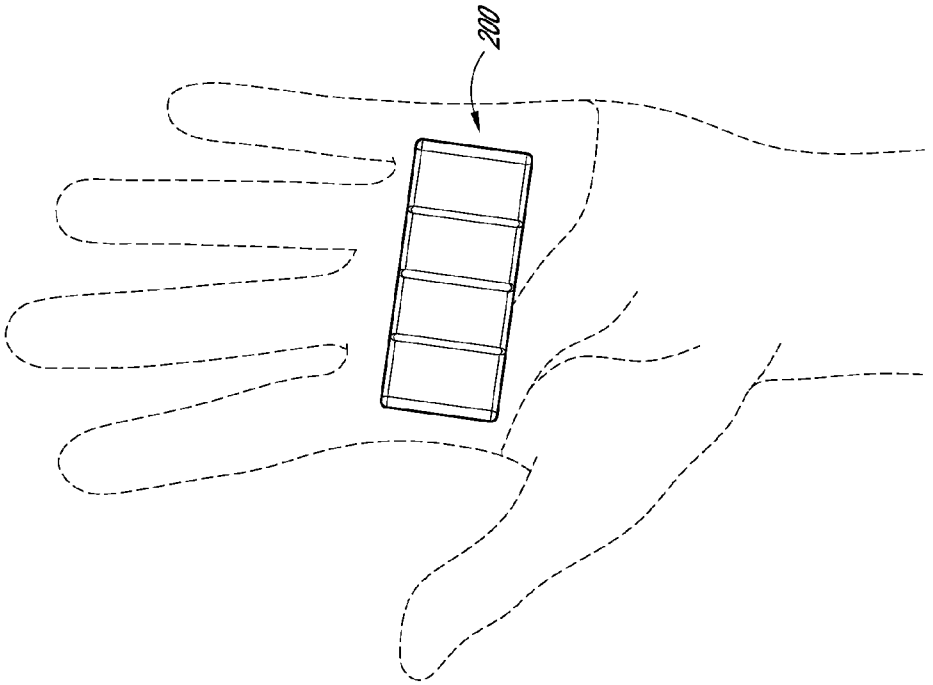


FIG. 5A

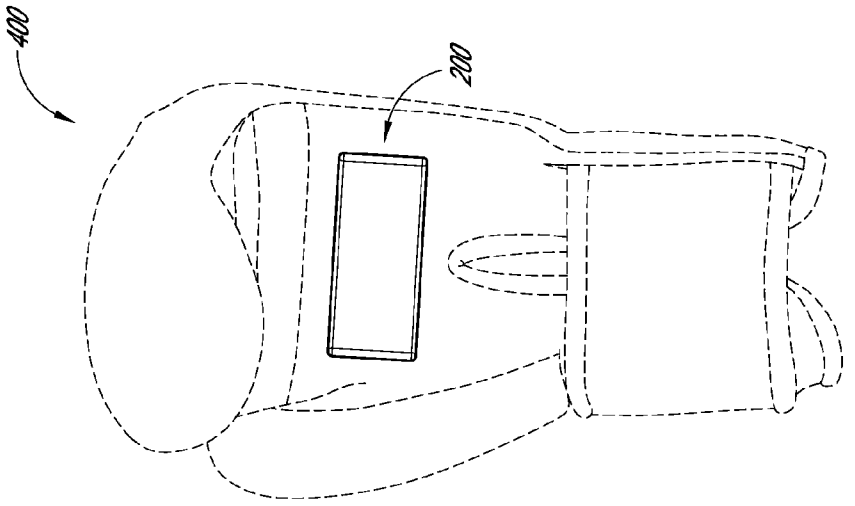


FIG. 6C

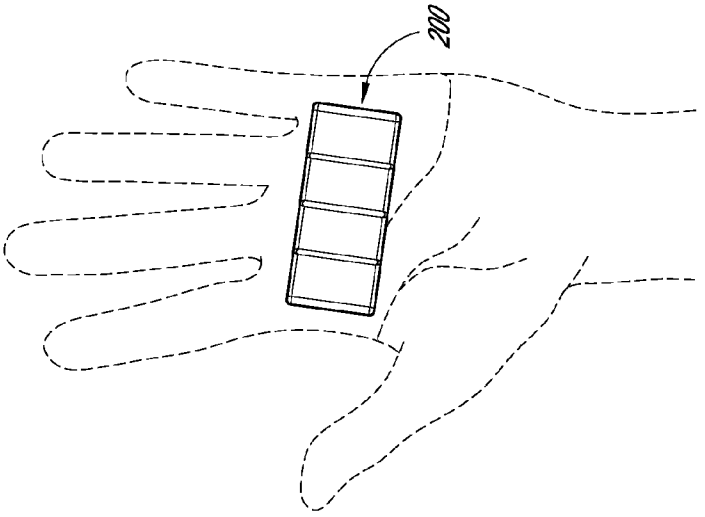


FIG. 6B

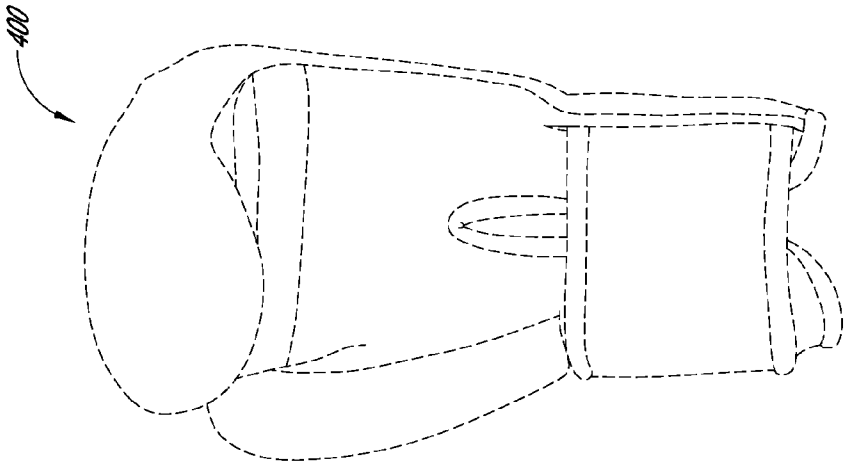


FIG. 6A

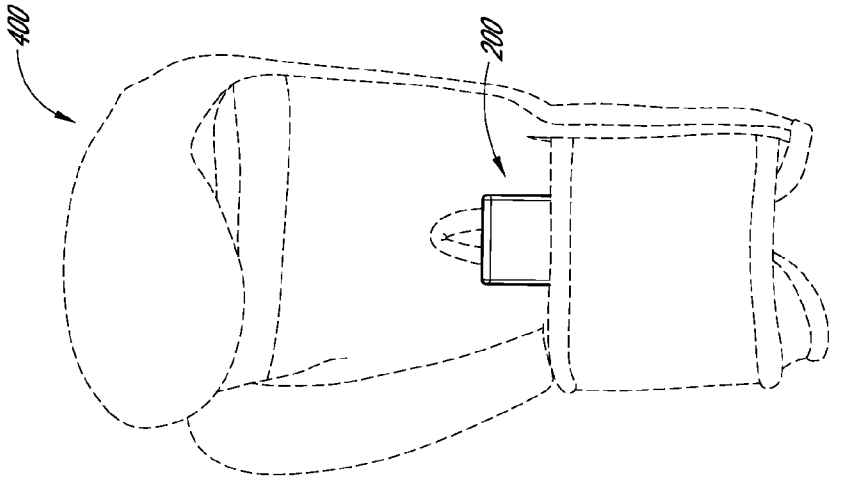


FIG. 6F

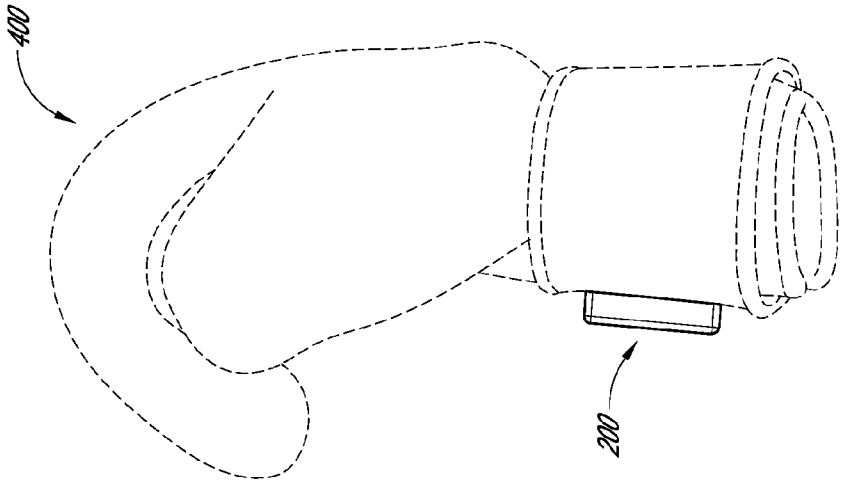


FIG. 6E

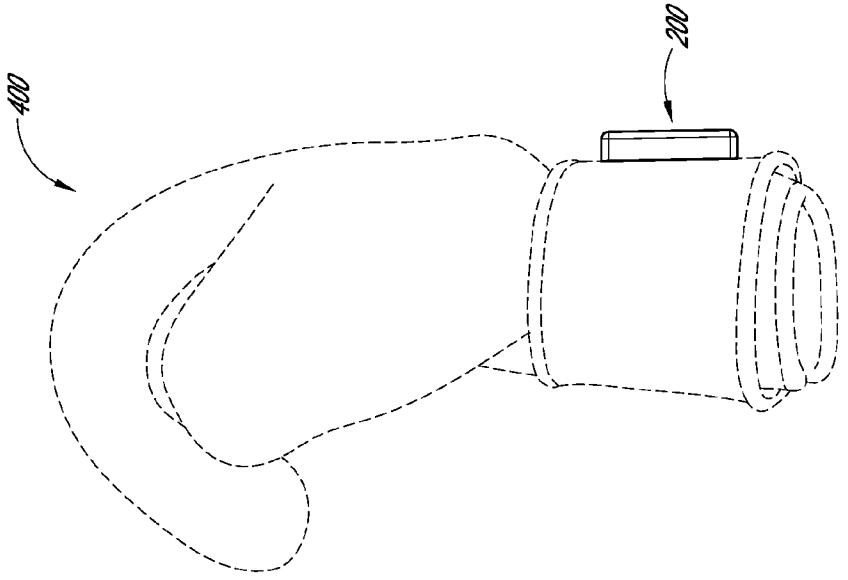


FIG. 6D

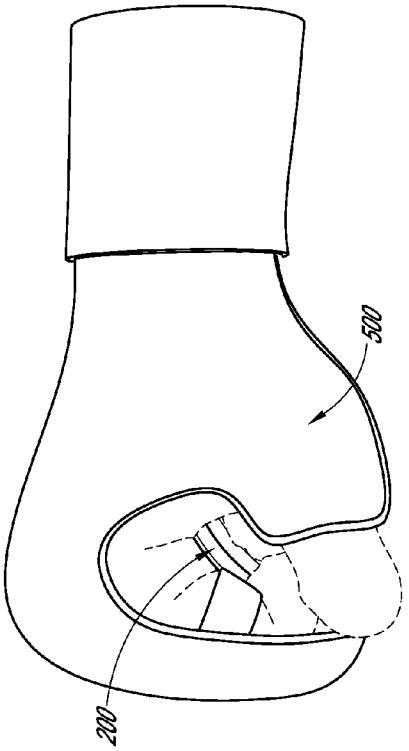


FIG. 7B

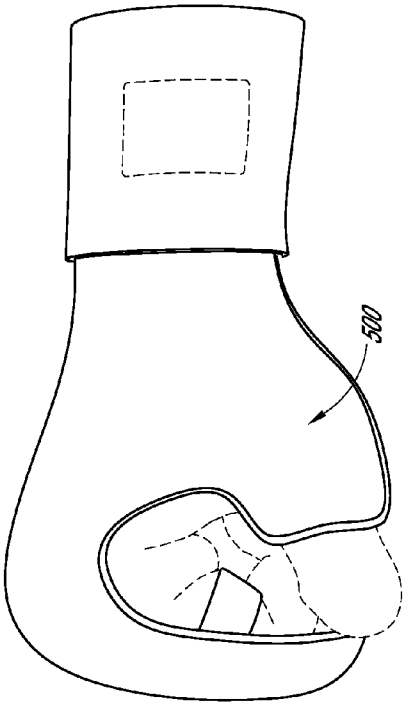


FIG. 7A

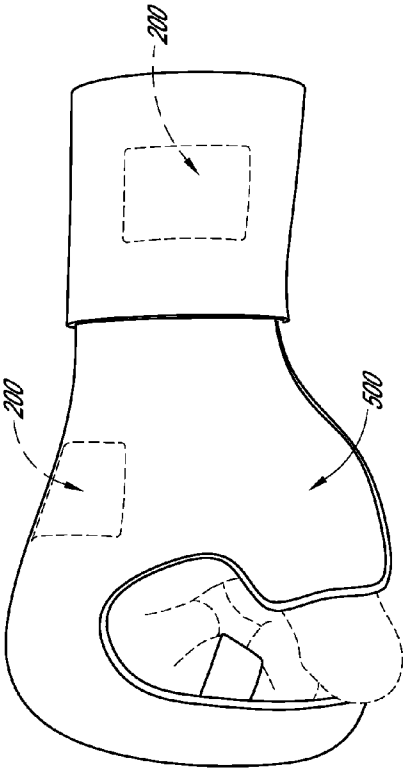


FIG. 7C

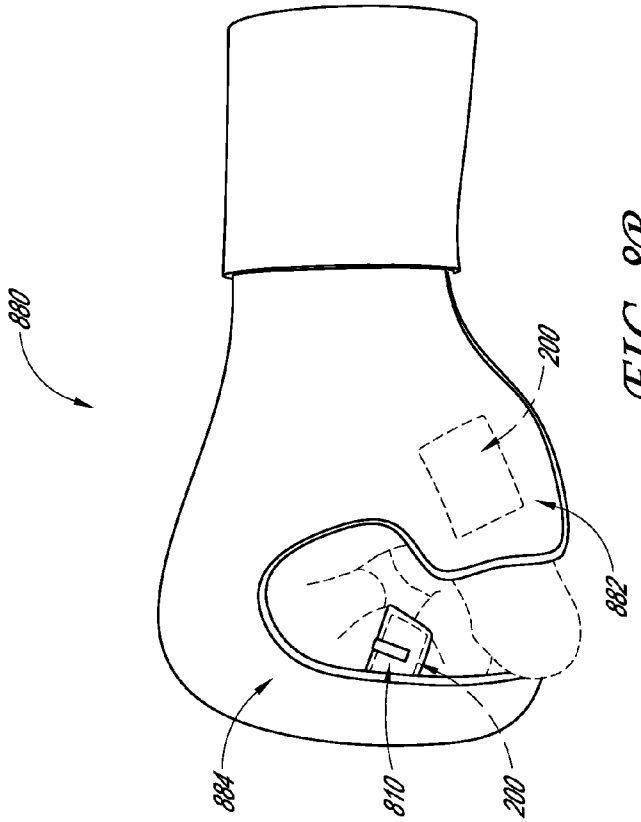


FIG. 8B

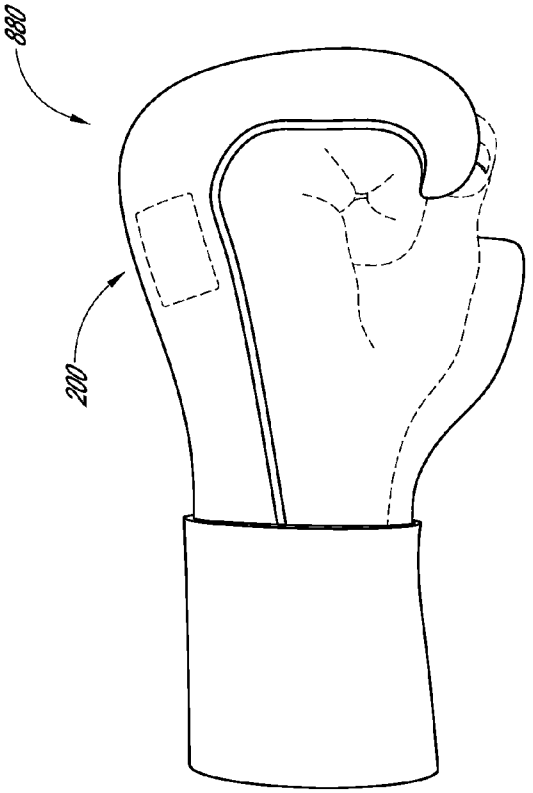


FIG. 8A

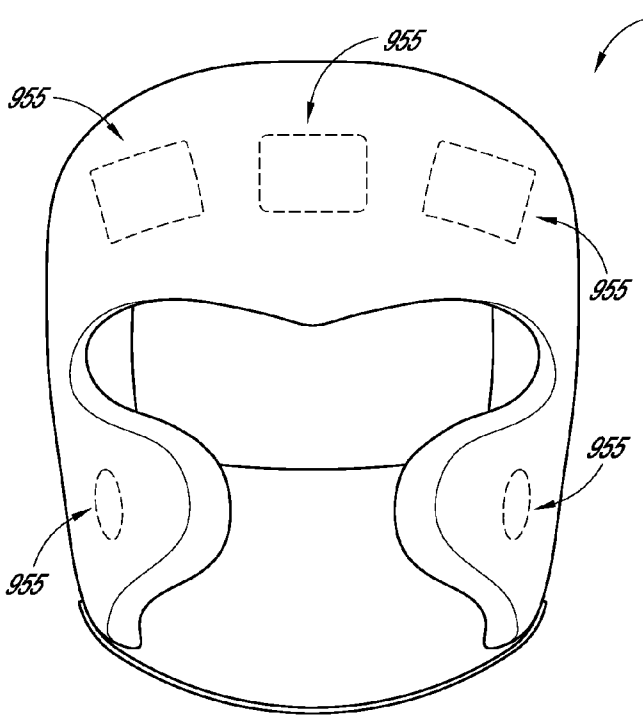


FIG. 9A

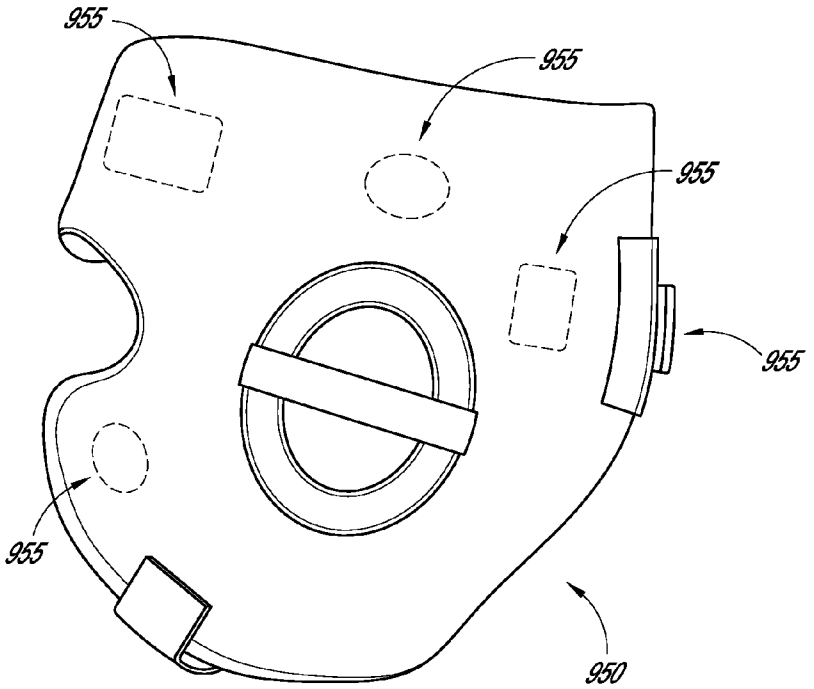


FIG. 9B

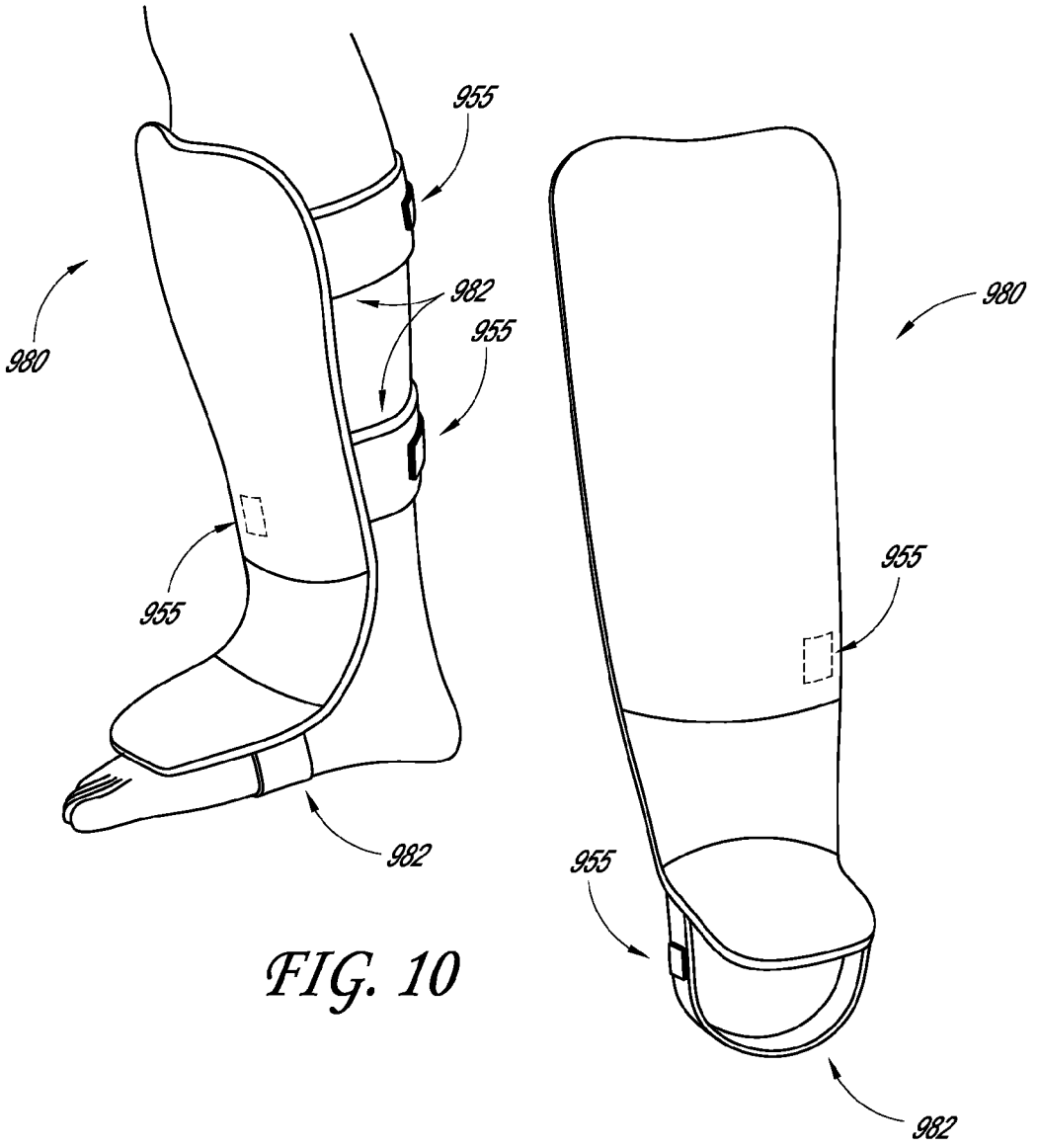


FIG. 10

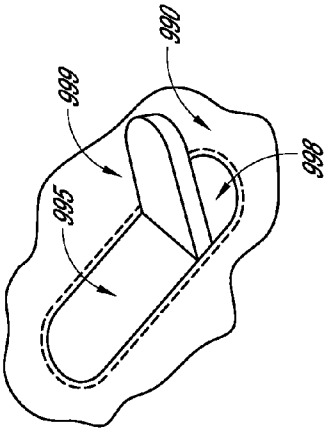


FIG. 11C

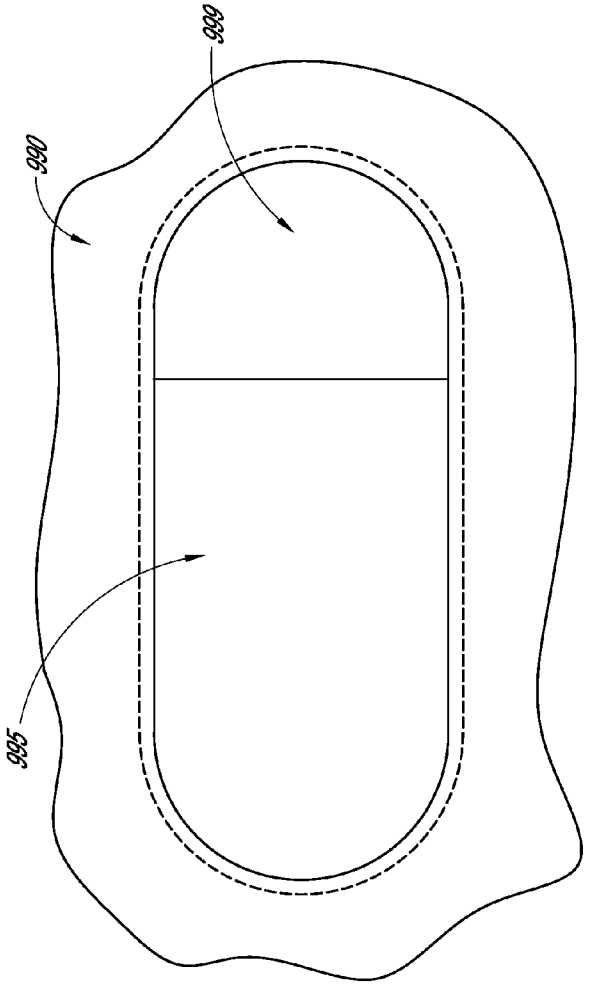


FIG. 11A

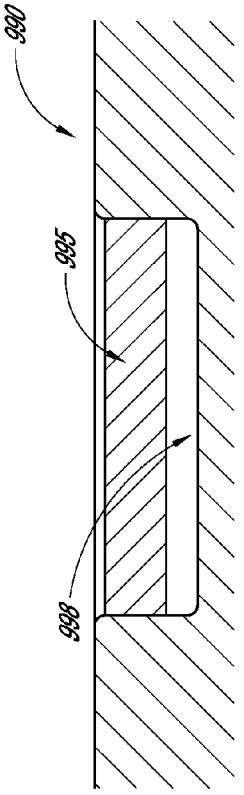


FIG. 11B

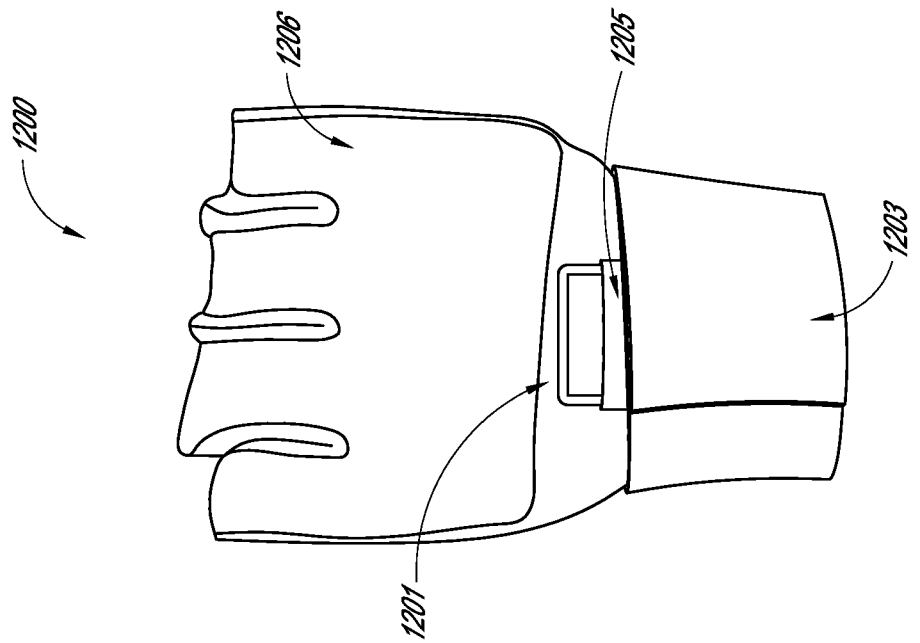


FIG. 12

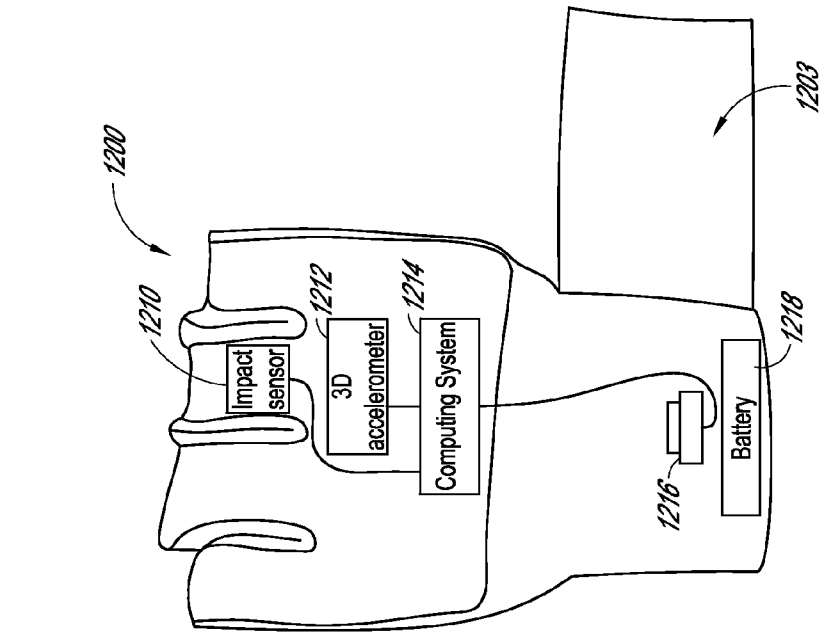


FIG. 13B

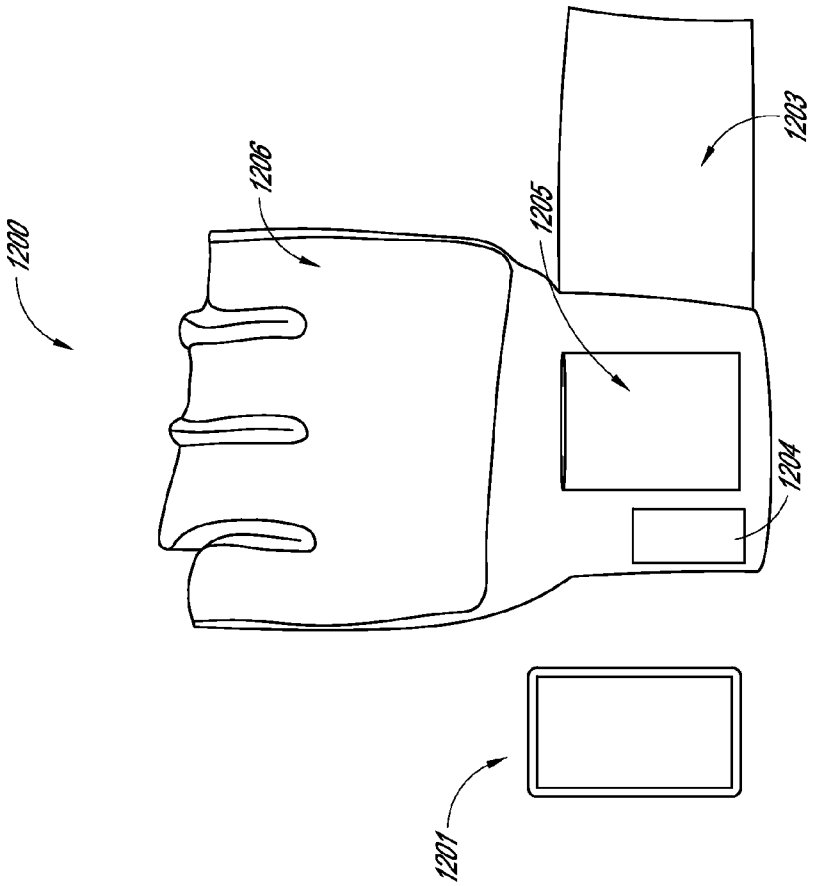


FIG. 13A

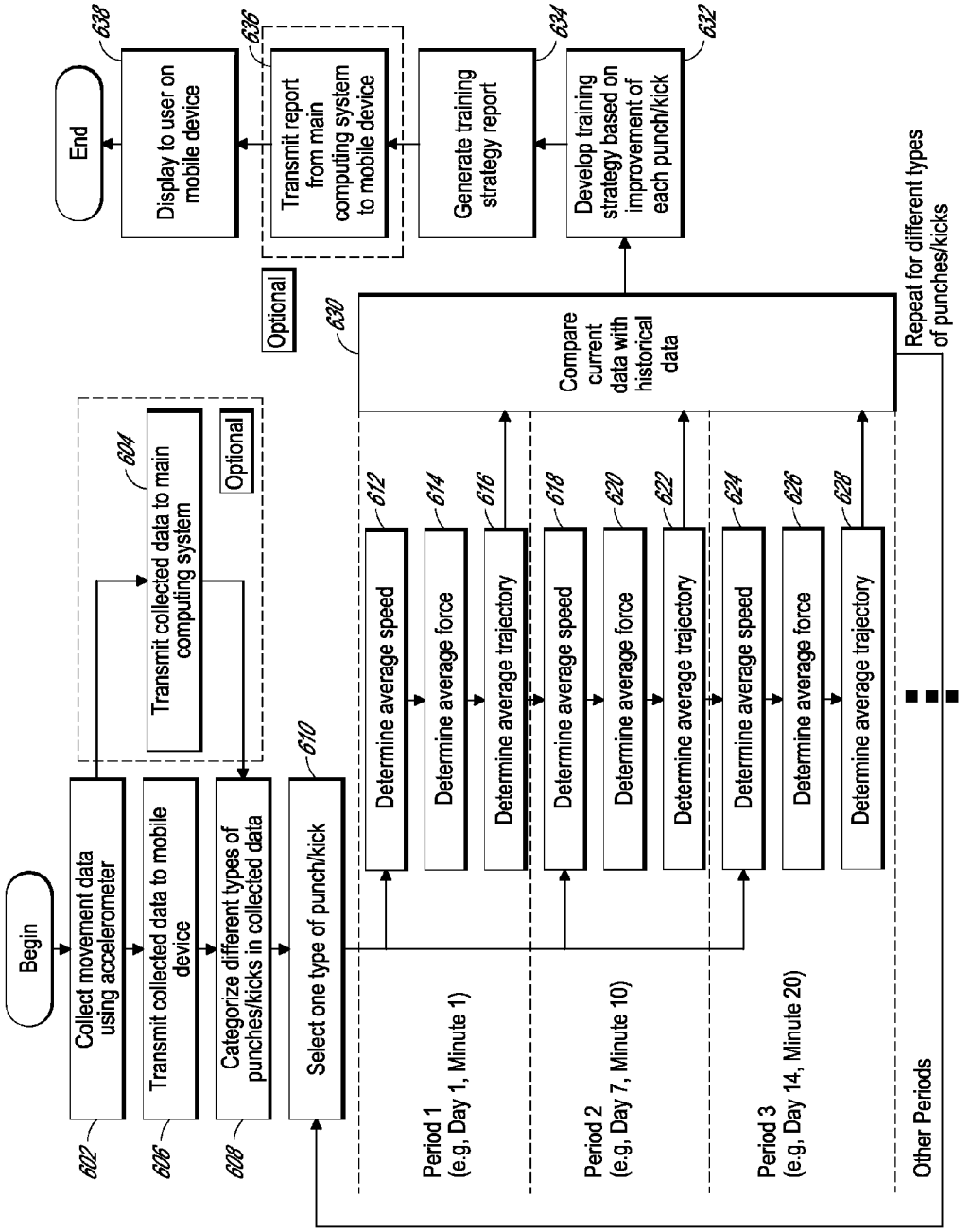

Begin
Collect movement data using accelerometer
602
Transmit collected data to mobile device
606
Categorize different types of punches/kicks in collected data
608
Select one type of punch/kick
610
Optional
Transmit collected data to main computing system
604
Determine average speed
612
Determine average force
614
Determine average trajectory
616
Period 1 (e.g, Day 1, Minute 1)
Determine average speed
618
Determine average force
620
Determine average trajectory
622
Period 2 (e.g, Day 7, Minute 10)
Determine average speed
624
Determine average force
626
Determine average trajectory
628
Period 3 (e.g, Day 14, Minute 20)
Other Periods
Compare current data with historical data
630
Repeat for different types of punches/kicks
Develop training strategy based on improvement of each punch/kick
632
Generate training strategy report
634
Optional
Transmit report from main computing system to mobile device
636
Display to user on mobile device
638
End

FIG. 14

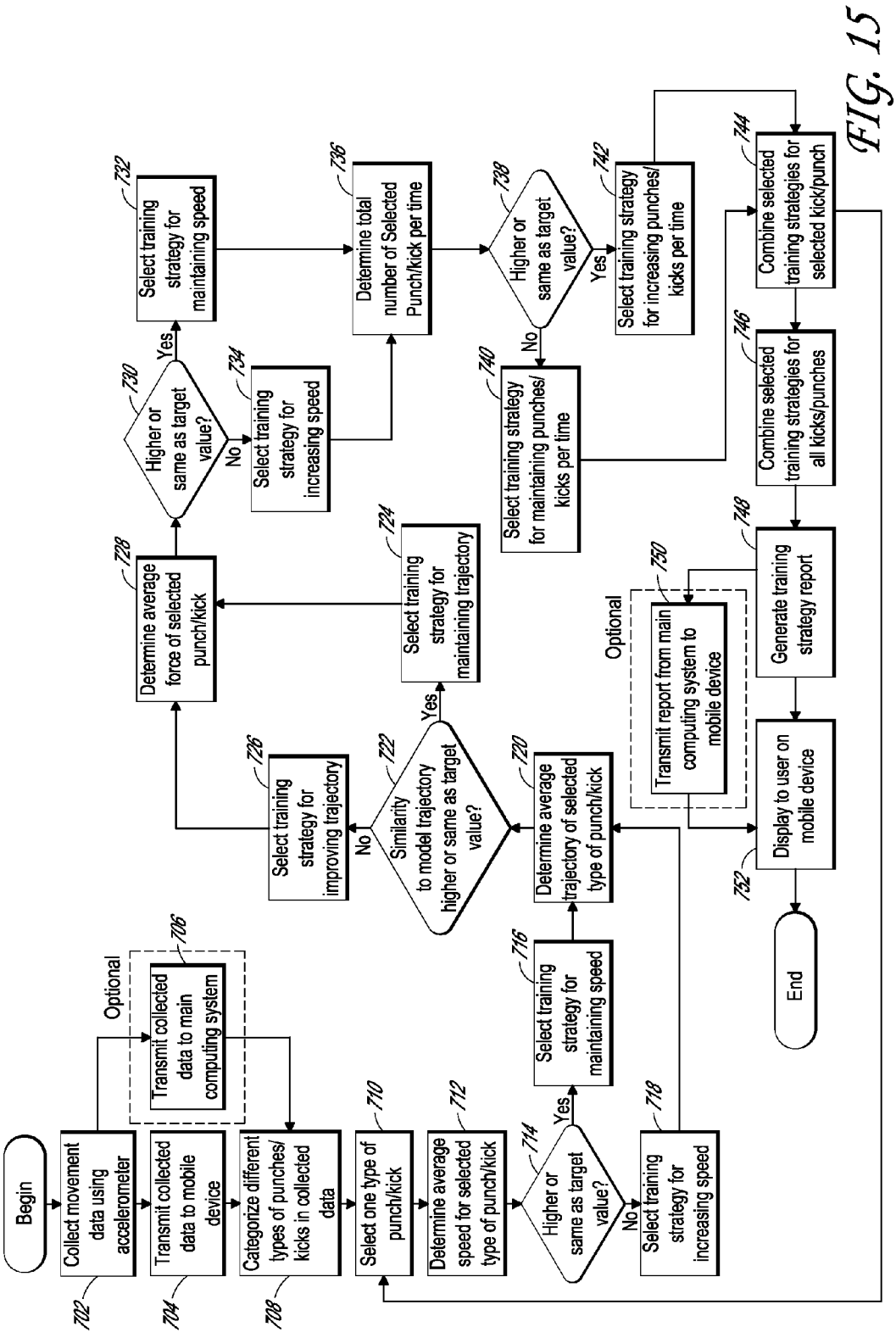

Begin
Collect movement data using accelerometer
Transmit collected data to mobile device
Optional
Transmit collected data to main computing system
Categorize different types of punches/ kicks in collected data
Select one type of punch/kick
Determine average speed for selected type of punch/kick
Higher or same as target value?
Yes
No
Select training strategy for maintaining speed
Select training strategy for increasing speed
Determine average trajectory of selected type of punch/kick
Similarity to model trajectory higher or same as target value?
Yes
No
Select training strategy for maintaining trajectory
Select training strategy for improving trajectory
Determine average force of selected punch/kick
Higher or same as target value?
Yes
No
Select training strategy for maintaining speed
Select training strategy for increasing speed
Determine total number of Selected Punch/kick per time
Higher or same as target value?
Yes
No
Select training strategy for maintaining punches/ kicks per time
Select training strategy for increasing punches/ kicks per time
Combine selected training strategies for all kicks/punches
Combine selected training strategies for selected kick/punch
Generate training strategy report
Optional
Transmit report from main computing system to mobile device
Display to user on mobile device
End
702
704
706
708
710
712
714
716
718
720
722
724
726
728
730
732
734
736
738
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FIG. 15

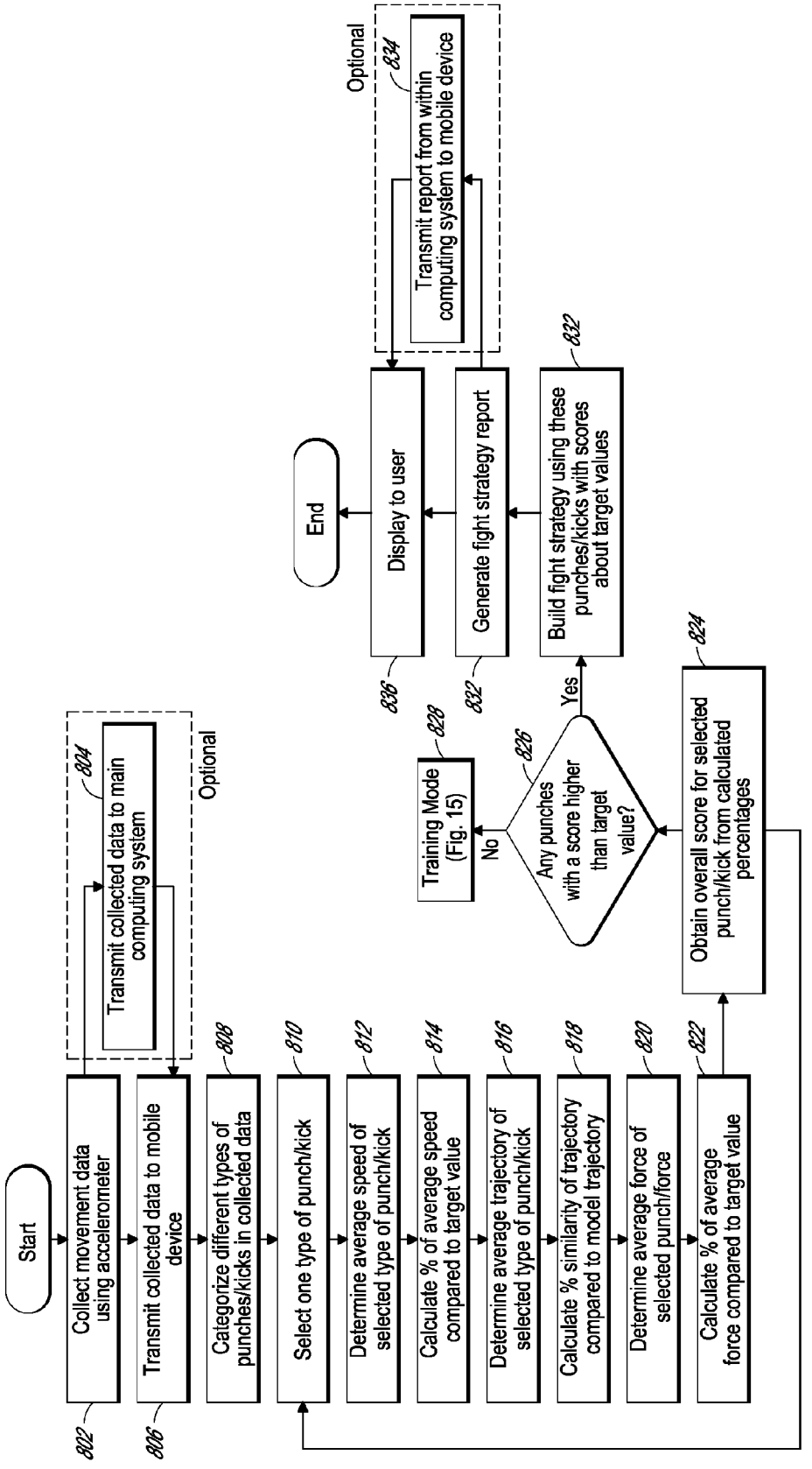
Start
Collect movement data using accelerometer
802
Transmit collected data to mobile device
806
Optional
Transmit collected data to main computing system
804
Categorize different types of punches/kicks in collected data
808
Select one type of punch/kick
810
Determine average speed of selected type of punch/kick
812
Calculate % of average speed compared to target value
814
Determine average trajectory of selected type of punch/kick
816
Calculate % similarity of trajectory compared to model trajectory
818
Determine average force of selected punch/force
820
Calculate % of average force compared to target value
822
Obtain overall score for selected punch/kick from calculated percentages
824
Any punches with a score higher than target value?
826
No
Training Mode (Fig. 15)
828
Yes
Build fight strategy using these punches/kicks with scores about target values
832
Generate fight strategy report
832
Display to user
836
End
Optional
Transmit report from within computing system to mobile device
834

FIG. 16

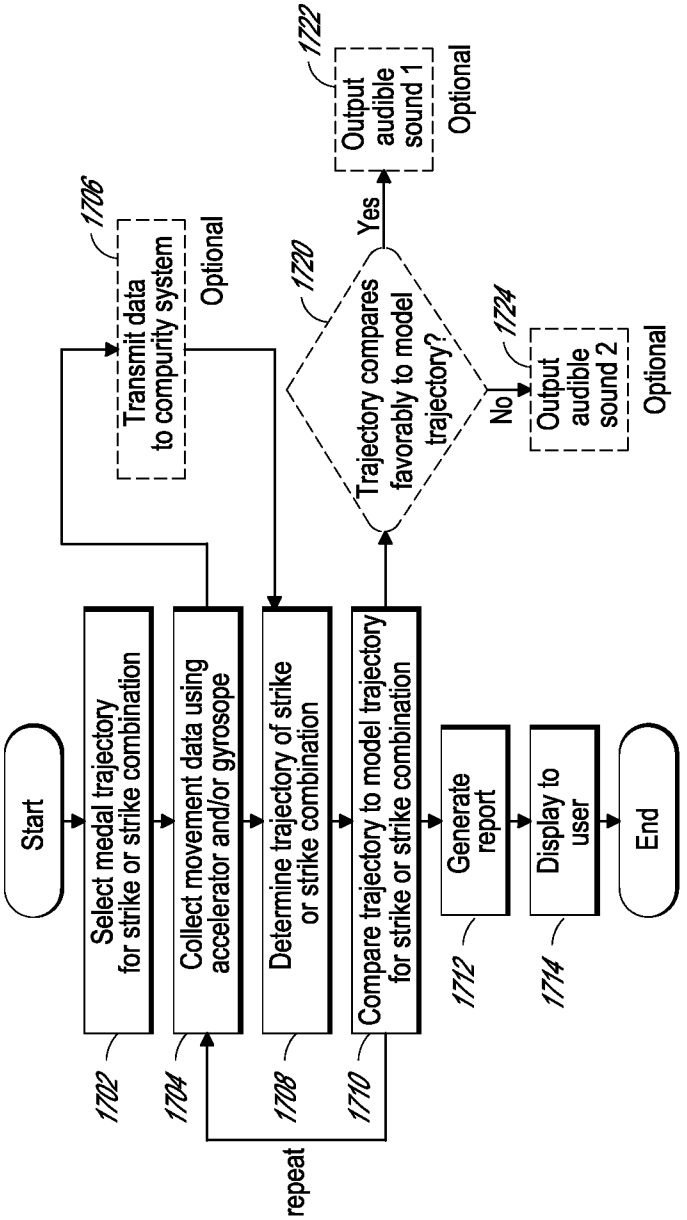
Start
Select medal trajectory for strike or strike combination
Collect movement data using accelerator and/or gyrosope
Determine trajectory of strike or strike combination
Compare trajectory to model trajectory for strike or strike combination
Trajectory compares favorably to model trajectory?
Yes
No
Output audible sound 1
Optional
Output audible sound 2
Optional
Transmit data to compurity system
Optional
Generate report
Display to user
End
repeat
1702
1704
1706
1708
1710
1712
1714
1720
1722
1724

FIG. 17

METHODS, SYSTEMS, AND DEVICES FOR COLLECTING AND ANALYZING MOVEMENT DATA OF AN ATHLETE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Patent Application No. 61/615,126, filed on Mar. 23, 2012, and entitled "METHODS, SYSTEMS, AND DEVICES FOR COLLECTING AND ANALYZING MOVEMENT DATA OF AN ATHLETE" which is hereby incorporated by reference in its entirety.

BACKGROUND

[0002] 1. Field

[0003] Embodiments of the invention relate to the field of data collection and analysis, and, in particular, to methods, systems, and devices for collecting and analyzing movement data of an athlete or a combat athlete during an athletic activity.

[0004] 2. Description

[0005] With the development of new technologies, movement data can be accurately measured and collected for use in various applications. For example, movement data can be collected and used as an input method for video games, mobile devices, and graphics, among others. Despite such advancements, however, training and performance analysis of athletes or combat athletes is still mainly conducted by a professional trainer after observing the performance of an athlete or combat athlete. Alternatively, an athlete or a combat athlete's performance is filmed using a camera for more accurate review. In either situation, however, a training professional develops training and performance strategies for the athlete or combat athlete based on the training professional's personal judgment.

SUMMARY

[0006] Advancements in technology make it possible to accurately collect data of three-dimensional movement and to analyze the collected data to generate objective training and performance strategies for athletes and combat athletes as described herein. The capability of accurately collecting movement data of an athlete or a combat athlete and generating objective training and performance strategies not only enhances objectivity and effectiveness of personalized training and performance strategies, but also enables athletes or combat athletes to develop their own training and performance strategies without depending on the personal judgment of a professional trainer.

[0007] In one embodiment, a method for analyzing movement of a combat athlete during a combat athletic activity comprises collecting data of the movement of the combat athlete by at least one three dimensional accelerometer located within a device attached to the combat athlete; transmitting the collected data by at least one transmitter located within the device over a wireless network; receiving the collected data by a computing system over the wireless network; storing the received data by the computing system; analyzing or causing analysis of the received data by the computing system according to at least one predetermined parameter; determining or causing determination by the computing system of a training strategy for the combat athlete by comparing the movement data of the combat athlete of each predetermined parameter with a corresponding target value and determining parameters that need improvement; and displaying or causing display of the training strategy by the computing system, wherein the computing system comprises at least a computer processor and an electronic storage device.

[0008] In other embodiments, the computer system in the above method of analyzing movement of a combat athlete during an athletic activity comprises one or more computing systems.

[0009] In other embodiments, the combat athletic activity is boxing in the above method of analyzing movement of a combat athlete during a combat athletic activity. In the above method of analyzing movement of a combat athlete during a combat athletic activity, the combat athletic activity can also be kick boxing, Muay That, Jiu Jitsu, San Sau, Taekwondo, Karate, Kung Fu, or any other form of martial art.

[0010] In other embodiments, the device attached to the combat athlete in the above method of analyzing movement of a combat athlete during a combat athletic activity is located on at least one of a hand(s), inside a wrist(s), outside a wrist (s), on a leg(s), on an ankle(s), or on a foot of the combat athlete.

[0011] In other embodiments, the at least one predetermined parameter in the above method of analyzing movement of a combat athlete during a combat athletic activity is selected from a group comprising punch speed, number of punches per time, total number of punches, types of punches, punch force, punch trajectory, punch acceleration, and order of types of punches, kick speed, number of kicks per time, total number of kicks, types of kicks, kick force, kick trajectory, kick acceleration, and order of types of kicks.

[0012] In other embodiments, the computing system of the above method of analyzing movement of a combat athlete during a combat athletic activity is or is accessible by a mobile device.

[0013] In other embodiments, the target value for each parameter in the above method of analyzing movement of a combat athlete during a combat athletic activity is selected by the combat athlete based on at least one of age, gender, weight, experience, and rank of the combat athlete.

[0014] In other embodiments, the above method of analyzing movement of a combat athlete during a combat athletic activity further comprises determining by the computing system a fight strategy for the athlete based on the analyzed data. The fight strategy for the combat athlete based on the analyzed data in the above method of analyzing movement of a combat athlete during a combat athletic activity can be determined based on the combat athlete's performance of each predetermined parameter to create an effective combination of different types of movement.

[0015] In other embodiments, a system for analyzing movement of a combat athlete during a combat athletic activity comprises a computer processor configured to execute modules comprising at least: a receiving module programmed to receive data collected by at least one three dimensional accelerometer and transmitted by at least one transmitter over a wireless network, wherein the at least one three dimensional accelerometer and transmitter are located within a device attached to the combat athlete; a storage module programmed to store the received data; an analysis module programmed to analyze the received data according to at least one predetermined parameter; a training module programmed to determine a training strategy for the combat athlete by comparing the movement data of the combat ath-

lete of each predetermined parameter with a corresponding target value and determining parameters that need improvement; and a display module programmed to cause display of the future training strategy.

[0016] In other embodiments, a system for analyzing movement of a combat athlete during a combat athletic activity comprises: at least one three dimensional accelerometer located within a device and configured to collect data of the movement of the combat athlete; and at least one transmitter located within the device and configured to transmit the collected data over a wireless network, the device being attached to the body of the combat athlete, wherein the transmitted data is received over a wireless network by a computing system configured to store and analyze the transmitted data based on at least one predetermined parameter and to determine a training strategy for the combat athlete by comparing the movement data of the combat athlete of each predetermined parameter with a corresponding target value, and wherein the computing system comprises at least a computer processor and an electronic storage device.

[0017] In other embodiments, a computer-readable, non-transitory storage medium having a computer program stored thereon for causing a suitably programmed computing system to process by one or more computer processors computer-program code by performing a method when the computer program is executed on the suitably programmed computing system comprises: collecting data of movement of a combat athlete during a combat athletic activity by at least one three dimensional accelerometer located within a device; transmitting the collected data by at least one transmitter located within the device over a wireless network, wherein the device is attached to the combat athlete; receiving the collected data by a computing system over the wireless network; storing the received data in the computing system; analyzing or causing analysis of the received data by the computing system according to at least one predetermined parameter; determining or causing determination by the computing system of a training strategy for the combat athlete by comparing the movement data of the combat athlete of each predetermined parameter with a corresponding target value and determining parameters that need improvement; and displaying or causing display of the future training strategy by the computing system, wherein the computing system comprises at least a computer processor and an electronic storage device.

[0018] In other embodiments, a computer-implemented method for analyzing movement of a combat athlete during an athletic activity comprises: collecting data of the movement of the combat athlete by at least one three dimensional accelerometer located within a device attached to the athlete in a first time period; transmitting the collected data by at least one transmitter located within the device over a wireless network in a first time period; receiving the collected data by a computing system over the wireless network in a first time period; storing the received data by the computing system in a first time period; analyzing or causing analysis of the received data by the computing system according to at least one predetermined parameter in a first time period; collecting data of the movement of the combat athlete by at least one three dimensional accelerometer located within a device attached to the combat athlete in a second time period; transmitting the collected data by at least one transmitter located within the device over a wireless network in a second time period; receiving the collected data by a computing system over the wireless network in a second time period; storing the received data by the computing system in a second time period; analyzing or causing analysis of the received data by the computing system according to at least one predetermined parameter in a second time period; comparing the data analyzed according to at least one predetermined parameter in the first time period and the data analyzed according to at least one predetermine parameter in the second time period; developing a training strategy for the combat athlete based on level of improvement of the combat athlete of at least one predetermined parameter; and displaying or causing display of the training strategy by the computing system, wherein the computing system comprises at least a computer processor and an electronic storage device.

[0019] In other embodiments, the computer system in the above method of analyzing movement of a combat athlete during a combat athletic activity comprises one or more computing systems.

[0020] In other embodiments, a computer-implemented method may comprise receiving motion sensor data from a plurality of sensors attached to a plurality of combat athletes, storing the received data on a computer system, generating an electronic combat athlete profile for each combat athlete from at least a portion of the received data on the computer system, and selecting, based on the electronic combat athlete profiles from the plurality of combat athletes, similarly skilled combat athletes, wherein said selecting performed entirely by the computer system.

[0021] In some embodiments, a computer-implemented method for analyzing movement of a combat athlete during a combat athletic activity may comprise collecting data of the movement of the combat athlete by at least one three dimensional accelerometer located within a device attached to the combat athlete, transmitting the collected data by at least one transmitter located within the device over a wireless network, receiving the collected data by a computing system over the wireless network, storing the received data by the computing system, analyzing or causing analysis of the received data by the computing system, the analysis including comparing the collected data to a pre-selected model strike trajectory or pre-selected model combination of strike trajectories, and signaling to the user, in real time, with the computing system, when the received data correlates to the pre-selected strike trajectory model or pre-selected model combination of strike trajectories.

[0022] In some embodiments, a device for analyzing movement of a combat athlete during a combat athletic activity may comprise a glove configured to be attached to the extremity of a user, at least one three dimensional accelerometer configured to be coupled to a mobile phone disposed on or within the glove, and a receiving space disposed on or within the glove. The receiving space may be configured to receive and secure a mobile phone to the glove.

[0023] For purposes of this summary, certain aspects, advantages, and novel features of the invention are described herein. It is to be understood that not necessarily all such advantages may be achieved in accordance with any particular embodiment of the invention. Thus, for example, those skilled in the art will recognize that the invention may be embodied or carried out in a manner that achieves one advantage or group of advantages as taught herein without necessarily achieving other advantages as may be taught or suggested herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The foregoing and other features, aspects and advantages of the present inventions are described in detail below with reference to the drawings of various embodiments, which are intended to illustrate and not to limit the invention. The drawings comprise the following figures in which:

[0025] FIG. **1** is a block diagram depicting a high level overview of one embodiment of a system for collecting and analyzing movement data of an athlete or a combat athlete.

[0026] FIG. **2** is a block diagram of an example embodiment of a configuration for a system and method of collecting and analyzing movement data of an athlete or a combat athlete.

[0027] FIG. **3** is a schematic perspective view of system for collecting and analyzing movement data of at least one combat athlete.

[0028] FIG. **4**A is a perspective view of one embodiment of a device for collecting and transmitting movement data of an athlete or a combat athlete.

[0029] FIG. **4**B is a perspective view of the device from FIG. **4**A with the cover removed.

[0030] FIG. **4**C is an exploded view of the device from FIG. **4**A with the cover removed.

[0031] FIG. **5**A is a top view of the device from FIG. **4**A placed on the palm of the athlete or combat athlete.

[0032] FIG. **5**B is a side view of the device from FIG. **4**A being held by the bare hands of the athlete or combat athlete.

[0033] FIGS. **6**A-**6**F illustrate a device for collecting and transmitting movement data of an athlete or a combat athlete positioned in various exemplary locations on the athlete or the athlete's equipment.

[0034] FIG. **7**A is a side view of a simplified example of one embodiment of a combat training glove configured to attach one embodiment of a device for collecting and transmitting movement data of an athlete or a combat athlete.

[0035] FIG. **7**B is a side view of a simplified example of one embodiment of a device for collecting and transmitting movement data of an athlete or a combat athlete placed inside a first of an athlete or a combat athlete inside a mixed martial arts glove.

[0036] FIG. **7**C is a side view of a simplified example of one embodiment of a device for collecting and transmitting movement data of an athlete or a combat athlete placed in or disposed within a mixed martial arts glove.

[0037] FIG. **8**A is a right side view of a combat training glove including a plurality of devices for collecting and transmitting movement data of an athlete or a combat athlete.

[0038] FIG. **8**B is a left side view of a combat training glove including a plurality of devices for collecting and transmitting movement data of an athlete or a combat athlete.

[0039] FIG. **9**A is a front view of combat training headgear including a plurality of devices for collecting and transmitting movement data of an athlete or a combat athlete.

[0040] FIG. **9**B is a side view of combat training headgear including a plurality of devices for collecting and transmitting movement data of an athlete or a combat athlete.

[0041] FIG. **10** is a perspective view of combat training shin guards including a plurality of devices for collecting and transmitting movement data of an athlete or a combat athlete.

[0042] FIG. **11**A is a top view of a closed compartment for housing one or more devices for collecting and transmitting movement data.

[0043] FIG. **11**B is a side view of a closed compartment for housing one or more devices for collecting and transmitting movement data.

[0044] FIG. **11**C is a perspective view of a partially open compartment for housing one or more devices for collecting and transmitting movement data.

[0045] FIG. **12** is a top view of an embodiment of a device for collecting and transmitting movement data of an athlete or a combat athlete that includes a mobile telephone.

[0046] FIG. **13**A is a top view of the device of FIG. **12** with the glove strap open and the mobile phone removed.

[0047] FIG. **13**B is a top schematic view of components that may be included in the device of FIG. **12**.

[0048] FIG. **14** is a block diagram depicting an overview of one embodiment of a method of collecting and analyzing movement data of an athlete or a combat athlete from different periods of time to develop a training strategy based on the improvement of certain skills of the athlete or combat athlete.

[0049] FIG. **15** is a block diagram depicting an overview of one embodiment of a method of collecting and analyzing movement data of an athlete or a combat athlete to develop a training strategy by comparing the collected data with preset target values of certain skills.

[0050] FIG. **16** is a block diagram depicting an overview of one embodiment of a method of collecting and analyzing movement data of an athlete or a combat athlete to develop a fight strategy by comparing the collected data with target values of certain skills and building a fight strategy based on the highest scoring skills.

[0051] FIG. **17** is a block diagram depicting an overview of one embodiment of a method of collecting and analyzing movement data of an athlete or a combat athlete to develop a fight strategy by comparing the collected data with target values of certain strike trajectories or combinations of strike trajectories.

DETAILED DESCRIPTION OF THE EMBODIMENT

[0052] Embodiments of the invention will now be described with reference to the accompanying figures. The terminology used in the description presented herein is not intended to be interpreted in any limited or restrictive manner, simply because it is being utilized in conjunction with a detailed description of certain specific embodiments of the invention. Furthermore, embodiments of the invention may comprise several novel features, no single one of which is solely responsible for its desirable attributed or which is essential to practicing the inventions herein described.

[0053] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the disclosure. It will be understood by those within the art that if a specific number of a claim element is intended, such intent will be explicitly recited in the claim, and in the absence of such recitation, no such intent is present. For example, as used herein, the singular forms "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. As used herein, the term "and/or" includes any and all combinations of one or more of the associate listed items. It will be further understood that the terms "comprises," "comprising," "have," "having," "includes," and "including," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, inte-

gers, steps, operations, elements, components, and/or groups thereof. Expressions such as "at least one of," when preceding a list of elements, modify the entire list of elements and do not modify the individual elements of the list.

[0054] Disclosed herein is a system including one or more sensors configured to track accurate movement data of an athlete and report the data in real time to a computing device. The computing device can analyze, sort, store, and/or display the data. In some implementations, the system is configured to track and analyze the movements of a combat sports athlete. The sensors may be compact, shock resistant, use low power, and/or transmit data wirelessly. The computing device may be a mobile phone having one or more software applications configured to receive and analyze the data sent wirelessly by the sensors.

[0055] Particular implementations of the subject matter described in this disclosure can be implemented to realize one or more of the following potential advantages. With the development of new technologies, three-dimensional movement data can now be accurately measured and collected. Such technologies have been applied in a wide variety of applications, some of which include creation of new input methods for video games, mobile devices, and graphics. Despite such advancements in detecting movement in real-time, however, performance analysis and development of training strategies for athletes are still mainly conducted by professional trainers and depend on their personal judgment. An athlete using the methods, systems, and devices described herein, however, can collect his or her own movement data in real-time, conduct an objective performance review of him or herself during an athletic activity, and further generate training and fight strategies based on the data and preselected target values.

[0056] In certain embodiments, the methods, systems, and devices for collecting and analyzing movement data of an athlete or a combat athlete during an athletic activity by using ay least one three-dimensional accelerometer attached to the athlete, transmitting the data to a computing system, analyzing the data based on a set of predetermined parameters, comparing the athlete's performance of each parameter with a corresponding target value, and developing a training strategy or fight strategy for the athlete based on such comparison.

[0057] In one embodiment of the invention, a device with at least one three dimensional accelerometer and a wireless transmitter is attached to an athlete during an athletic activity. In some embodiments, the device includes one or more force sensors or load cells coupled to a wireless transmitter. In some embodiments, the device includes one or more gyroscopes coupled to a wireless transmitter. In some embodiments, the system uses a gyroscope and/or an accelerometer contained in a mobile phone. In some embodiments, the device collects accurate data of the athlete's movement or performance and further transmits such collected data to a main computing system or a mobile device. In some embodiments, the wireless transmitter utilizes the Bluetooth wireless standard to send the data to a mobile phone configured to receive such transmissions. Either the main computing system or the mobile device can analyze the collected data and generate a training strategy and/or fight strategy for the athlete. In some embodiments, the device includes a computing device. In some embodiments the data is sent, received, and displayed and/or analyzed and/or recorded in real time. In this way, for example, others, an athletic trainer for instance, can observe the data in and provide training advice in real time as well.

[0058] One or more sensors and wireless transmitters may be placed on various locations on the athlete or the athlete's equipment. Sensors and wireless transmitters may be placed, for example, on the athlete's hands, gloves, feet, feet wraps, knees, shoulders, head, headgear, waist line, or belts. In some embodiments, a sensor and/or wireless transmitter is placed on the athlete's inside palm or wrist. The sensors and/or wireless transmitters may be water and/or sweat resistant. The sensors and/or wireless transmitters may be shock resistant. In some embodiments, the sensors are disposed within a housing configured to withstand the wear and tear of, for example, a workout, a sparring session or a fight. In other words, the housing can protect components of the device from water and/or impact damage.

[0059] Portions of the device may have an ergonomic design. The ergonomic design may minimize any discomfort that may arise as a result of wearing or using the sensors. In some embodiments, the housing of the sensors is color coded for right and left hands and feet. The housing may be inserted into a wrist or finger band configured to hold the housing in place. In some embodiments, the sensors are placed within a protective gear configured to hold the sensors while maintaining the function of the protective gear.

[0060] In the context of fighting or martial arts, the systems disclosed herein can be used to collect data that can be analyzed in order to track and identify the trajectory of a foot or hand strike. In other words, the system can be used to identify punches such as, for example, uppercuts, hooks, jabs, or crosses by monitoring and analyzing the movement of a user's hand. Similarly, the system can be used to identify kicks such as, for example, front kicks, sidekicks, or roundhouses, by monitoring and analyzing the movement of a user's foot. In some embodiments, the system can be used to identify the part of the hand or foot that has contacted the opponent. For example, sensors can be used to identify if the front, back, top, or bottom of the first made contact with the opponent. In some embodiments, the system can be configured to detect if a strike contacted or missed an opponent or object such as a punching bag. In some embodiments, the system detects if a strike contacted or missed an opponent or object by using a sensor placed within the object, punching bag, or within the protective gear of an opponent. In this way, the system may determine ratio or percentage of strikes that contacted in relation to the number of strikes thrown. The system may also be used to determine the strike speed and/or strike force. In some embodiments, the system can be used to track the location of a fighter within the ring. In addition, the system can be used to identify combinations of strikes and analyze the success of such combinations. The system may, for example, analyze a combination of strikes thrown by the user and display how much power and speed that each component of the combination had and/or which portions of the combination landed on the opponent.

[0061] In some embodiments a software application is used to provide a summary of the data obtained during a training session and display the summary to the user. The data can be displayed in various forms, including for example, bar graph, pie chart, and spread sheet formats. The data can be sorted and displayed based on user input. In some embodiments, the data is categorized by the corresponding hand or foot that generated the data. For example, a bar graph can be displayed showing the number of right hand strikes thrown and landed in comparison to the number of left hand strikes thrown and landed.

[0062] In some embodiments, the system includes a clock. Thus, components of the system may be time synchronized to data points from each sensor. In some embodiments, the system can output strike and time data. In this way, a user may be able to know, for example, the time in the fight or sparring session when the user landed the most powerful strike, or attempted a certain combination, or lost strike speed.

[0063] In some embodiments, the system includes a video recorder. The video recorder may be time synced to the system. A user may watch a video of the fight while the data captured by the system is displayed and synchronized to the video. In some embodiments a display engine is configured to overlay and display data in the form of, for example, charts or graphs on the same screen in which the video is displayed.

[0064] In some embodiments, the system can be customized for a particular user. For example, a user may provide the system with height and weight information. The user may provide the system with training goals or targets. Thus, the system can provide a means for tracking a user's progress toward said goals. In some embodiments, the system can use height information to compare the location of a user's hands to the height of the user. In this way, the system may inform the user when their hands are too low. In some embodiments, the device may output an audible noise when the system detects that a user's hands are too low relative to the height of the user.

[0065] In some embodiments the system can provide output in the form of training or fight strategy. For example, the system may identify a user's fight patterns and/or tendencies and/or identify a user's weaknesses. The system may, for example, inform the user that the user is dominate with a particular hand, that the user tends to miss with specific strikes, or that the user tends to rely on predictable strike combinations. In addition, the system may be able to identify which type of strikes and/or from what angle or trajectory an opponent lands most often on the user. Accordingly, the system may identify what a user may be susceptible to. Such information can be used by the system to output a fight strategy or training session.

[0066] In some embodiments, the system compares the trajectory of punches to previously thrown punches or to preselected and/or pre-programmed punch trajectories. In this way, a user can improve their punch trajectories and improve their form. For example, the system may identify how straight a punch is and provide feedback to the user. In other words, a user may desire to throw a straight punch along a substantially straight and horizontal line as opposed to a curved or looping path. As such, the system may analyze the punch trajectory and inform the user when the punch trajectory is within this desired range of motion. In some embodiments, the device may output an audible noise when a punch trajectory is within a desired range of motion. In some embodiments, a user and/or a trainer can watch the fighter and identify when effective punches or punches with good form for the particular fighter are thrown. The trajectory of these punches may be identified and saved. Later, a user may use the system to compare the trajectory of a later punch to these saved trajectories. In some embodiments, the system includes pre-programmed sample punch trajectories that a user may compare their punch and/or kick trajectories to.

[0067] In some embodiments the system may store and/or archive data and/or video from, for example, specific fights. The system may utilize a cloud based storage system. Users may allow for others to access to the storage system to view the data and/or videos. The system may track and display, for example, a user's all-time best strikes or combinations. In some embodiments, the system may be integrated with social media providers such as Youtube®, Twitter®, or Facebook®. In this way, a user can seamlessly share fight data with others. In some embodiments, the sharing of fight data is a subscription based service in which only subscribers may access and share fight data.

[0068] In some embodiments the data obtained and/or analyzed by the system is associated with a user profile. The user profile may include one or more user avatars associated with the user profile. The user profile may comprise, for example, historical performance data, specific fight or sparring session data, performance summaries, comparisons to other user profiles, rankings, training histories, customizable statistical compilations and/or comparisons, progress towards goals, time of use, hours of training, number of uses, and/or achievements obtained. The user profile or portions thereof may be shared with other users. The sharing may include interacting with a social media provider. The user profile may be associated with a specific user name and password. In some embodiments, user data is stored in a cloud base storage system. In some embodiments, the user may control which data is shared with which other users.

[0069] The user profile may include a journal or a notes section where the user may input text that can be associated with a particular sparring or work out session. The system may allow users to review the user's pervious performance from a library of historical performances. In some embodiments, a user can review data and/or notes from particular training sessions individually.

[0070] In some embodiments, the access and/or stage of user profiles is subscription based. In some embodiments, the system can incorporate advertising which may be targeted based at least in part on specific user information received. In some embodiments, the advertising is location based advertising and/or includes coupons. In the case of a mobile phone application, the display may include advertising elements or banner ads that target a particular user's fight skills and location.

[0071] In some embodiments the system includes standard and/or customizable achievements. The system may provide a reward in response to reaching an achievement. The reward may be a virtual award. The reward may include additional system functionality that is made accessible to the user. In some embodiments, when a user reaches a preset goal or custom goal, such as, for example, spending 100 hrs of training timer or throws a 500 lbs punch, the user unlocks the corresponding achievement. This achievement may be shared with others via a user network and/or social media providers.

[0072] In some embodiments, the system may allow for users to compete against one another and/or to challenge other users to virtual or real sparring sessions or fights. The system may allow for users to challenge each other to reach one or more achievements faster than the other. The system may also be able to identify users of similar skill levels and/or in close geographic proximity and suggest that the two users meet and/or spar.

[0073] In some embodiments, the system further comprises a gaming element. The gaming element may allow for two users to virtually compete against one another. The gaming element may use historical data for each user and simulate a fight between the two users. The gaming element may be able to predict a user's chance of success against another user. A

user may have the ability to transfer user training data into an in-game virtual character. In some embodiments the attributes of the in-game virtual character are linked to the user. In this way, the attributes of the in-game virtual character can only be increased by a user improving their real life performance.

[0074] These, as well as other various aspects, components, steps, features, objects benefits, and advantages will now be described with reference to specific forms or embodiments selected for the purposes of illustration. It will be appreciated that the spirit and scope of the inventions disclosed herein is not limited to the selected forms. Moreover, it is to be noted that the figures provided herein are not drawn to any particular proportion or scale, and that many variations can be made to the illustrated embodiments.

[0075] FIG. **1** is a block diagram illustrating a high level overview of one embodiment of a system for collecting and analyzing movement data of an athlete. In the depicted embodiment, a device **116** is attached to boxing gloves on an athlete and is connected through a network **118** to a main computing system **102** and at least one mobile device **120**.

[0076] The network may take a conventional form including but not limited to virtual private network (VPN) connections over the internet, private network connections, dedicated network connections (for example, ISDN, T1, etc.), wireless or cellular connections, or the like. In some embodiments, the network can be a wireless internet network, Bluetooth, a service provider's **3**G or **4**G network, or the like.

[0077] In certain embodiments, the device **116** collects movement data of an athlete and then transmits the collected data over a network **118** to a main computing system **102**. Then, in some embodiments, the main computing system **102** analyzes the received data and develops a fight strategy and/or a training strategy using a fight/training strategy development module **114**. In certain embodiments, the main computing can then transmit the developed strategy or strategies to a mobile device **120**, which further displays the strategy or strategies to the athlete or a user.

[0078] In other embodiments, the device **116** collects the athlete's movement data and transmits the collected data directly to a mobile device **120**. In some embodiments, the mobile device **120** then analyzes the received data and develops a fight strategy and/or a training strategy using a fight/training strategy development module **114**. In certain embodiments, the mobile device **120** then displays the generated strategy or strategies to the athlete or user.

Main Computing System

[0079] In some embodiments, the main computing system **102** takes the form as shown in FIG. **1**, which is a block diagram of one embodiment of a main computing system **102** that is in communication with one or more mobile devices **120** and a device **116** for collecting and transmitting movement data of an athlete over a network **118**.

[0080] The computing system **102** may be used to implement one or more of the systems and methods described herein. In addition, in one embodiment, the computing system **102** may be configured to receive data collected by a device **116** attached to an athlete, analyze such data, and generate a training strategy and or fight strategy by comparing the collected data to a pre-stored set of target values and/or the athlete's own historical data.

[0081] While FIG. **1** illustrates one embodiment of a main computing system **102**, it is recognized that the functionality provided for in the components and modules of the main computing system **102** may be combined into fewer components and modules or further separated into additional components and modules.

Main Computing System Components

[0082] In one embodiment, the main computing system **102** also comprises a mainframe computer or other computing system or device suitable for controlling and/or communicating with large databases, performing high volume transaction processing, and generating reports from large databases. The main computing system **102** also comprises a central processing unit ("CPU") **110**, which may comprise a conventional microprocessor. The computing system **102** further comprises a memory **112**, such as random access memory ("RAM") for temporary storage of information and/or a read only memory ("ROM") for permanent storage of information, and a mass storage device **104**, such as a hard drive, diskette, or optical media storage device. Typically, the modules of the main computing system **102** are connected to the computer using a standards based bus system. In different embodiments, the standards based bus system could be Peripheral Component Interconnect ("PCI"), Microchannel, SCSI, Industrial Standard Architecture ("ISA") and Extended ISA ("EISA") architectures, for example.

[0083] The exemplary main computing system **102** comprises one or more commonly available input/output ("I/O") devices and interfaces **108**, such as a keyboard, mouse, touchpad, and printer. In one embodiment, the I/O devices and interfaces **108** comprise one or more display devices, such as a monitor, that allows the visual presentation of data to a user. More particularly, a display device provides for the presentation of GUIs, application software data, and multimedia presentations, for example. In the embodiment of FIG. **1**, the I/O devices and interfaces **108** also provide a communications interface to various external devices. The computing system **102** may also comprise one or more multimedia devices **106**, such as speakers, video cards, graphics accelerators, and microphones, for example.

Main Computing System Device/Operating System

[0084] The main computing system **102** may run on a variety of computing devices, such as, for example, a server, a Windows server, an Structure Query Language server, a Unix server, a personal computer, a mainframe computer, a laptop computer, a cell phone, a personal digital assistant, a kiosk, an audio player, and so forth. The main computing system **102** is generally controlled and coordinated by operating system software, such as z/OS, Windows 95, Windows 98, Windows NT, Windows 2000, Windows XP, Windows Vista, Linux, BSD, SunOS, Solaris, or other compatible operating systems. In Macintosh systems, the operating system may be any available operating system, such as MAC OS X. In other embodiments, the main computing system **102** may be controlled by a proprietary operating system. Conventional operating systems control and schedule computer processes for execution, perform memory management, provide file system, networking, and I/O services, and provide a user interface, such as a graphical user interface ("GUI"), among other things.

Network

[0085] In the embodiment of FIG. **1**, the main computing system **102** is coupled to a network **118**, such as a LAN,

WAN, or the Internet, for example, via a wired, wireless, or combination of wired and wireless, communication link. The network **118** communicates with various computing devices and/or other electronic devices via wired or wireless communication links. In the exemplary embodiment of FIG. **1**, the network **118** is communicating with one or more main computing systems **118**, one or more mobile devices **120**, and one or more devices **116** for collecting and transmitting movement data of athletes.

[0086] Access to the generated training strategy, fight strategy, and/or other strategies may be through a web-enabled user access point via the main computing systems(s) **102** or one or more mobile devices **120**. Mobile devices **120** includes but is not limited to a personal computer, cellular phone, laptop, tablet device, or other device capable of connecting to the network **118**. Such a device may have a browser module is implemented as a module that uses text, graphics, audio, video, and other media to present data and to allow interaction with data via the network **118**. In certain embodiments, a specially written computer program or webpage can be utilized in connection with such a device.

[0087] The browser module may be implemented as a combination of an all points addressable display such as a cathode-ray tube (CRT), a liquid crystal display (LCD), a plasma display, or other types and/or combinations of displays. In addition, the browser module may be implemented to communicate with input devices **108** and may also comprise software with the appropriate interfaces which allow a user to access data through the use of stylized screen elements such as, for example, menus, windows, dialog boxes, toolbars, and controls (for example, radio buttons, check boxes, sliding scales, and so forth). Furthermore, the browser module may communicate with a set of input and output devices to receive signals from the user.

[0088] The input device(s) may comprise a keyboard, roller ball, pen and stylus, mouse, trackball, voice recognition system, or pre-designated switches or buttons. The output device (s) may comprise a speaker, a display screen, a printer, or a voice synthesizer. In addition a touch screen may act as a hybrid input/output device. In another embodiment, a user may interact with the system more directly such as through a system terminal connected to the score generator without communications over the Internet, a WAN, or LAN, or similar network.

[0089] In some embodiments, the computer system **102** may comprise a physical or logical connection established between a remote microprocessor and a mainframe host computer for the express purpose of uploading, downloading, or viewing interactive data and databases on-line in real time. The remote microprocessor may be operated by an entity operating the computer system **102**. In some embodiments, terminal emulation software may be used on the microprocessor for participating in the micro-mainframe link.

Mobile Device

[0090] In one embodiment, a mobile device comprises a personal computer, a laptop computer, a cellular phone, a GPS system, a Blackberry® device, a portable computing device, a tablet computing device, a server, a computer workstation, a local area network of individual computers, an interactive kiosk, a personal digital assistant, an interactive wireless communications device, a handheld computer, an embedded computing device, or the like.

Other Systems

[0091] In addition to the systems that are illustrated in FIG. **1**, the network **118** may communicate with other data sources or other computing devices. The computing system **102** may also comprise one or more internal and/or external data sources. In some embodiments, one or more of the data repositories and the data sources may be implemented using a relational database, such as DB2, Sybase, Oracle, CodeBase and Microsoft® SQL Server as well as other types of databases such as, for example, a flat file database, an entity-relationship database, and object-oriented database, and/or a record-based database.

Example System Configuration

[0092] Certain embodiments of a system utilize a cloud, as described in conjunction with FIG. **2**. An example configuration of components of an embodiment of a system **1000** will now be described. Cloud computing can include web-based tools or applications that users can access and use through a web browser as if it were a program installed locally on their own computer. In certain embodiments, the cloud **1180** comprises various computers, servers and data storage devices that function to provide a cloud platform (e.g., a web front end), cloud service (e.g., a queue), cloud infrastructure, and cloud storage (e.g., one or more databases). A public/external cloud can be used with a private cloud **1190** in a hybrid cloud or a combined cloud environment in certain embodiments.

[0093] A mobile or fixed computing device **1110** may be operated by a user **1130**. There may be other mobile or fixed computing devices such as a device **1170** operated by other users. The computing device **1110** can be a handheld computing device or other portable computing device such as a Palm, Pocket personal computer (PC), Linux based handheld, PDA, smartphone such as an iPhone®, Tablet computer such as an iPad®, or PC having a display. In other embodiments, the computing device can be any form of Internet connected device, including but not limited to PCs, mobile devices, PDA, laptops, tablets, chips, keyboards, voice audio and video software, mouse, keypads, touch pads, track ball, microphones, videos, storage devices, network devices, databases, scanners, copiers, digital pens, image recognition software and device, screens and other forms of displays, netbooks and other forms of computer hardware. The computing device **1110** in certain embodiments operates in a stand-alone (independent) manner. In other embodiments, the computing device **1110** is in communication with one or more servers via a network, such as a wide area network or the Internet. The server(s) include one or processors, memory, one or more data storages and system software executed by the processor (s), and input or output devices.

[0094] The computing device **1110** includes a processor **1112**, memory **1122**, a display **1114**, and one or more input devices **1116**. The processor **1112** is in data communication with one or more data storages **1118**. In certain embodiments, the data storage **1118** may store prior records of the user and/or other data or software. System software **1120** is executed by the processor **1112**. The system software **1120** may include an application graphical user interface (GUI). The application GUI can include a database interface to the data storage **1118** of the computing device. In certain embodiments, the software is loaded from the data storage **118**. One or more of the data storages may be located external to the computing device **1110**. In embodiments where the comput-

ing device **1110** communicates with a web site, the processor utilizes browser software in place of or in addition to the software **1120**. The network browser may be, for example, Microsoft Internet Explorer®, Apple Safari®, Mozilla Firefox®, Google Chrome™, browsers from Opera Software™, and so forth. An optional output device **1129**, such as a printer is connected to the computing device **1110**. The connection from the computing device **1110** to the cloud **1180** can be a wireless or a satellite connection **1144** or a direct connection **1142**. One or more sensors **1150** can record movement and/or force data and transmit the data wirelessly to the computing device **1110**.

System for Monitoring Combat Athletes

[0095] Turning to FIG. **3**, a schematic perspective view of system for collecting and analyzing movement data of at least one combat athlete is illustrated. As shown, two fighters are equipped with protective gear comprising headgear, fighting gloves, and footgear. One or more sensors may be placed on or within the headgear **352**, on or within left and/or right gloves **356**, **354** and/or on or within left and/or right footgear **362**, **360**. The sensors may comprise one dimensional accelerometers, two dimensional accelerometers, three dimensional accelerometers, motion sensors, and/or force sensors. The accelerometers may be configured to detect rapid acceleration and/or deceleration. The sensors may continuously stream data to a computer **384** or mobile device **380**. As shown, the computer **384** is coupled to a digital video recorder **382**. In some embodiments, the mobile device **380** includes a digital video recorder. In some embodiments, a fighting mat **390** may also include one or more force sensors (not shown) that may collect impact data and send the data to one or more computing devices. The sensors in the mat **390** may be coupled to a wireless transmitter.

[0096] The computer **384** or mobile device **380** may be configured or may include software applications configured to analyze the data received by the sensors. Data received in comparison to threshold values may at least in part be used by the system to identify specific movements of a user. The data may be used to identify events, such as for example, a punch thrown, a kick thrown, a punch landed, a kick landed, a combination of strikes thrown, or a combination of strikes landed, and corresponding times and durations of such events. The computer **384** or mobile device **380** may include one or more threshold values that the data is compared to. For example, threshold values may comprise speed in a certain direction, acceleration in a certain direction, device orientation, force in a certain direction, average speed, total acceleration, and/or total force.

Device for Collectin and/or Transmitting Movement Data

[0097] In some embodiments, a device for collecting and/or transmitting movement data of an athlete takes the form as shown in FIGS. **4**A-**4**C and **5**A-**5**B. As shown in FIGS. **4**A-**4**B, the device **200** comprises an outer shell or cover **204** that can cover substantially all of the inner housing **202**. In certain embodiments, the outer shell or cover **204** is made of a material to provide comfort to a user or athlete while using the device **200**. The outer layer **204** can take the form of a cushion or sponge. The outer layer shell **204** can be made from a number of materials, including silicon, sponge, polyester, polyurethane, foam, and polystyrene, among others. In other embodiments, the outer layer **204** is configured to be waterproof or water resistant.

[0098] In some embodiments, the outer layer shell **204** is configured to absorb shock or force exerted thereupon. Again, the outer layer shell **204** can be made from a number of materials, including silicon, sponge, polyester, polyurethane, foam, and polystyrene, among others for such purposes as well. In certain embodiments, the outer layer shell **204** can be designed to absorb sufficient force to protect the device housing **202** and its components. In other embodiments, the outer layer shell **204** can be designed to absorb sufficient force to protect the user or athlete.

[0099] In certain embodiments, the inner device housing **202** contains and protects components necessary for collecting and transmitting movement data of an athlete. In some embodiments, the device housing **202** is made from a shock resistant or shock absorbing material to protect the components therein. In other embodiments, the device housing **202** is made from a shock absorbing material to protect the user or athlete.

[0100] In certain embodiments, the outer layer cover **204**, the device housing **202**, or both are ergonomically designed to provide comfort to the athlete or user while using the device. For example, in an embodiment, the outer layer cover **204**, the device housing **202**, or both are ergonomically designed such that an athlete can comfortably hold the device **200** in his or her hand. In another embodiment, the outer layer cover **204**, the device housing **202**, or both are ergonomically designed such that the device **200** can comfortably be placed inside, outside, or near the athlete's wrist without substantially restricting the athlete's movement. For example, as shown in FIG. **4**B, the housing **202** may include one or more grooves shaped receive the fingers of a user. In other embodiments, the outer layer cover **204**, the device housing **202**, or both are ergonomically designed such that the device **200** can comfortably be placed on the legs or on the feet of an athlete without substantially restricting the athlete's movement.

[0101] In certain embodiments, the outer layer cover **204**, the device housing **202**, or both are designed such that it can further act as a safety device for the athlete. For example, in some embodiments, the device **200** can be held inside the fists of a mixed martial arts fighter. In such embodiments, because the outer layer cover **204**, the device housing **202**, or both are ergonomically designed, there is a less chance that the mixed martial arts fighter will break his or her fingers if the fighter is holding onto the device **200**. Similarly, in other embodiments where the device **200** is attached to the wrists of an athlete, the outer layer cover **204**, the device housing **202**, or both can be designed such that the device **200** further acts as a shield to dampen impact. Devices **200** of other embodiments where the device **200** is configured to be attached to the legs or feet of an athlete can also be designed to further act as a shield to dampen impact as well.

Device Components

[0102] Turning to FIG. **4**C, in some embodiments the housing **202** further comprises a three-dimensional accelerometer **210** and a transmitter **216** located within the housing. The accelerometer **210** can be of any type or model generally available for sale to the public either now or in the future. The three dimensional accelerometer **210** measures and collects data related to the user's movement. For example, in some embodiments, the three dimensional accelerometer **210** traces the movement of the user to allow collection of data such as the direction of movement, speed, acceleration, impact, force, and movement path, among others. In some

embodiments, the three dimensional accelerometer **210** is configured to continuously collect and/or transmit data in real time.

[0103] In some embodiments, the housing **202** further includes a power source **212**. The power source **212** can be a battery, a rechargeable battery, or any other type of power source available now or in the future. In some embodiments, the power source **212** is easily removable from the housing **202** for replacement or recharging via a lid. In some embodiments, the device further includes a gyroscope **214** to detect the orientation of the device. In other embodiments, the power source **202** is not easily removable but the housing **202** includes a mechanism for recharging the power source without removing the power source **212**.

[0104] In certain embodiments, data measured and collected by the three dimensional accelerometer **210** is subsequently transmitted by a transmitter **216** over a network **118**. In some embodiments, the transmitter **216** is configured to transmit the collected data to one or more main computing systems **102** or one or more mobile devices **120**. In some embodiments, the transmitter **216** is configured to continuously transmit collected data. In other embodiments, the transmitter **216** is configured to transmit data in batches per a preset period of time.

[0105] In some embodiments, the device **200** further includes an on/off switch (not shown) to turn the data collection device **200** on or off. In certain embodiments, the on/off switch is in a form of a button located on the device **200**. In other embodiments, the device **200** comprises a force detector (not shown) and turns on when a certain amount of pressure is exerted on the device **200**. In some embodiments, the device **200** is configured to turn on and off when a preset movement is detected by the device **200**.

Device Placement on Athlete

[0106] In some embodiments, the device **200** is attached to the athlete to accurately detect an athlete's movements. The device **200** can be attached to the athlete in a number of locations depending on the athletic activity and the preference of the athlete.

[0107] In an embodiment, the device **200** is held within an athlete's bare hands as shown in FIGS. **5**A-**5**B. Devices **200** designed to be held within an athlete's bare hands can virtually be used for any type of athletic activity that does not require the athlete's hands to be free. In other embodiments, the device **200** can be placed on the inside, outside, or around the wrists of an athlete. In some embodiments, the device housing can be placed on the inside, outside, or around the ankles of an athlete.

[0108] In some embodiments in which the device **200** is to be held inside an athlete's bare hands, the device **200** can be ergonomically designed to match the shape of the inside of a fist. In certain embodiments, the device **200** can be personalized to match the exact shape of the inside of a specific user's fist. In these embodiments, the housing **202**, the outer layer **204**, or both can be ergonomically designed.

[0109] In yet other embodiments, the device **200** can be placed within or on the athlete's clothing and/or sports gear. In addition, in certain embodiments, the device **200** can be embedded within an athlete's clothing and/or sports gear. In certain embodiments, sports gear can include boxing gloves, MMA gloves, shin guards, headgear, or any other sports gear.

[0110] Moving on to FIGS. **6**A-**6**F, in some embodiments, the device **200** can be configured to be attached to a boxing glove **400**. The device **200** can be configured to be attached to various locations within or on a boxing glove **400** as shown in FIGS. **6**A and **6**C-**6**F.

[0111] In an embodiment as shown in FIG. **6**B, the device **200** can be configured to be held by the athlete's bare hand while wearing a boxing glove **400**. In such embodiments, the device **200** can be ergonomically designed to match the shape of the inside of a fist. Further, the device **200** may be designed to protect the athlete from breaking or otherwise injuring the athlete's fingers.

[0112] In another embodiment as shown in FIG. **6**C, the device **200** can be configured to be held or attached to the palm side of a boxing glove **400**. In such embodiments, the device **200** can be ergonomically designed to match the general shape of the palm side of a boxing glove **400**. Further the device **200** may be designed to protect the athlete from breaking or otherwise injuring the athlete's fingers or hand.

[0113] In yet other embodiments as shown in FIG. **6**D, the device **200** can be configured to be attached to the outer wrist portion of a boxing glove **400**. In such embodiments, the device can be ergonomically designed to match the outer wrist surface of a boxing glove **400**. Further, the device **200** can be designed to protect the athlete from breaking or otherwise injuring the athlete's wrists.

[0114] In certain embodiments as shown in FIG. **6**E, the device **200** can be configured to be attached to the inner wrist portion of a boxing glove **400**. In such embodiments, the device can be ergonomically designed to match the inner wrist surface of a boxing glove **400**. Further, the device **200** can be designed to protect the athlete from breaking or otherwise injuring the athlete's wrists.

[0115] In certain embodiments as shown in FIG. **6**F, the device **200** can be configured to be attached to the inside of a boxing glove **400** underneath the glove's laces or strap, if any. In such embodiments, the device can be ergonomically designed to match the inner surface of a boxing glove **400** near the laces or the athlete's lower palm. Further, the device **200** can be designed to protect the athlete from breaking or otherwise injuring the athlete's wrists.

[0116] In some embodiments as shown in FIG. **7**A, the device **200** can be configured for use in conjunction with open or closed finger mixed martial arts gloves **500**. In certain embodiments as shown in FIG. **7**B, the device **200** can be configured to be held inside an athlete's bare hand while wearing a mixed martial arts glove **500**. In such embodiments, the device **200** can be ergonomically designed to match the shape of the inside of a fist. Further, the device **200** may be designed to protect the athlete from breaking or otherwise injuring the athlete's fingers.

[0117] In certain embodiments as shown in FIG. **7**C, the device **200** may be disposed on an external surface of the mixed martial arts glove **500** or may be embedded within the mixed martial arts glove **500**. As shown, the device **200** is disposed on the external surface of the wrist area of the mixed martial arts glove **500**. In this way, the device **200** may be less susceptible to damage from, for example, impacts. In other embodiments, the one or more devices may be embedded within the mixed martial arts glove **500**. Embedding the device within the mixed martial arts glove **500** may further protect the device from, for example, impact damage.

[0118] Turning to FIGS. **8**A-**8**B, in some embodiments, a mixed martial arts glove **880** may include a plurality of devices **200** for collecting and transmitting movement data. A shown in FIG. **8**A, the mixed martial arts glove **880** may

include a device **200** embedded within the right side wall of the glove **880**. Moving to FIG. **8**B, the left side wall of the glove **880** may also include an embedded device **200**. The glove **880** may also include an embedded device **200** within the thumb portion **882** of the glove **880**. The glove may further include a device **200** that includes an accelerometer and/or impact sensor embedded within the first portion **884** of the glove **880** (not shown). As also shown in FIG. **8**B, a device **200** may be secured within the area between the thumb portion **882** and the first portion **884** by, for example, a clip **890**. In other words, it may be advantageous to position the devices **200** in portions of a glove that are less susceptible to impact damage and/or in portions of a glove that may be less likely to interfere with or distract a user when wearing the glove.

[0119] FIGS. **9**A-**9**B illustrate that in some embodiments, the system includes one or more devices for collecting and transmitting movement data **955** located in headgear **950** to be worn by a user. Such headgear **950** may be used by combat athletes while training or sparring. The devices for collecting and transmitting movement data **955** may comprise one or aspects of the sensors shown and described above. For example, the devices for collecting and transmitting movement data **955** may include accelerometers or load cells and may be configured to continually obtain and send data wirelessly. As shown, the devices **955** may be positioned on any suitable area on or embedded within the headgear **950**. In some embodiments, the devices **955** are placed on one or more external surfaces of the headgear **950**. In some embodiments, the devices **955** are placed in areas where they are unlikely to be contacted during combat activity, for example, on an external surface at the rear of the headgear as shown in FIG. **9**B.

[0120] Similarly, as shown in FIG. **10**, in some embodiments, the system includes one or more devices for collecting and transmitting movement data **955** located in protective shin guards **980** to be worn by a user. As shown, the devices **955** may be embedded within the shin guards **980** or be attached to the straps **982** used to secure the shin guards **980** to the feet and legs of the user.

[0121] Turning to FIGS. **11**A-**11**C, in some embodiments, protective equipment worn by users may include one or more compartments configured to house one or more devices for collecting and transmitting movement data **955**. The compartments may include a cover configured to open and close. As shown, a portion of the protective equipment **990** may include a receiving space **998** and a cover **995** disposed over the receiving space **998**. The cover **998** may include a movable flap portion **999** that may move from a closed position to an open position. In this way, one more devices for collecting and transmitting movement data may be inserted and removed from the protective equipment **990**. Furthermore, the padding or cushioning of the protective equipment **990** may further protect the device and/or sensors within the device from, for example, impact and/or moisture damage.

Device Utilizing a Mobile Phone

[0122] With reference to FIGS. **12** and **13**A-**13**B, the system may include a glove configured to receive a mobile phone **1200**. As shown in FIG. **12**, the glove **1206** may include a housing or a receiving space **1205** configured to receive a mobile telephone **1201**. The housing or receiving space **1205** configured to receive a mobile telephone **1201** may comprise a pouch, sleeve, enclosure, clip, or other means for securing the mobile telephone to the glove. In some embodiments, the mobile phone can slide into and out of the housing **1205**. In other embodiments, the housing **1205** includes a strap that secures the mobile phone to the glove. The housing **1205** may be made of any suitable materials, such as, plastic, cloth, or synthetic fibers. In some embodiments, the glove **1206** may include an abutment surface **1220**. The abutment surface **1220** may be formed by one or more pads or cushioning components located within the finger portion of the glove **1206**. In this way, the abutment **1220** surface can help prevent the mobile telephone **1201** from exiting the glove **1206** when a strike is thrown. The mobile telephone **1201** may be further secured to the glove **1206** with a strap **1203** configured to fold over or otherwise couple to and secure the mobile phone **1201** to the glove.

[0123] FIG. **13**A illustrates a glove configured to receive a mobile phone **1200** with the strap **1203** in the open position and a mobile phone **1201** removed from the receiving space **1205**. Velcro **1204** may be used to keep the strap **1203** in the closed position. FIG. **13**B illustrates a schematic view of components located within the glove configured to receive a mobile phone **1200**. As shown the glove **1206** may include an impact sensor **1210** positioned in the finger pad area of the glove, a three dimensional accelerometer **1212**, a computing system **1214**, one or more batteries **1218**, and a connector **1216** configured to connect to the mobile phone **1201**. While FIG. **13**B illustrates the components coupled with wiring, the components may be coupled wirelessly. In addition, not all of the components are necessary and the glove **1200** may not include each component that is shown in FIG. **13**B. The battery **1218** may power one or more of the components. The batteries may be rechargeable batteries.

[0124] The mobile telephone **1201** may include one or more gyroscopes and/or one or more accelerometers. In some embodiments the mobile telephone is an iPhone®. In some embodiments, the glove includes a wired connection with a port configured to connect to an iPhone®. In other embodiments, the glove does not include a wired connection and the mobile phone receives data from the sensor(s) and/or computing system wirelessly.

[0125] In use, the mobile phone **1201** may be coupled to the connector **1216** and secured to the glove with the receiving space and/or strap **1203**. In some embodiments, the mobile phone **1201** is connected to one or more sensors and/or a separate computing system. The computing system **1214** may receive electronic signals representative of the impact force when the glove strikes a target from the impact sensor **1210**. The computing system **1214** may receive electronic signals representative of the three dimensional acceleration of the glove when the glove is in motion from the accelerometer **1212**. The computing **1214** system may receive electronic signals representative of the orientation and/or acceleration of the mobile phone **1201**. The computing system **1214** and/or the mobile phone **1201** may then analyze the received signals. By including a computing system **1214** within the glove, less computing power is required from the mobile phone **1201**. However, the computing system **1214** is not required and the mobile phone **1201** may process all of the data received from the sensor(s) directly. The mobile phone **1201** may output audible sounds in response to certain data that is received. The mobile phone **1201** may display a summary of the data received and/or may display training results, strategies, and/or recommendations.

Types of Athletic Activity

[0126] The placement of the device **200** on the athlete as well as the design of the device **200** can vary depending on the sport or the athletic activity that the device **200** is to collect data of.

[0127] In some embodiments, the device **200** can be utilized to collect movement data of an athlete performing boxing, kick boxing, mixed martial arts, Muay That, Jiu Jitsu, San Sau, Taekwondo, Karate, Kung Fu, or some other form of martial art. In other embodiments, the device **200** can be utilized to collect movement data of a sport where proper form is important such as golf, tennis, badminton, gymnastics, figure skating, bowling, table tennis, and squash among others. In yet other embodiments, the device **200** can be utilized to collect movement data of an athlete playing soccer, basketball, football, baseball, rugby, track and field, and crew among others.

Data Collection and Transmittal

[0128] In some embodiments, the device **200** tracks movement of the athlete during an athletic activity and transmits the collected data to at least one main computing system **102**. In other embodiments, the device **200** tracks movement of the athlete during an athletic activity and transmits the collected data to at least one mobile device **120**.

General Data Analysis

[0129] In some embodiments, the at least one main computing system **102** receives the data collected by the device **200** for further analysis. In other embodiments, the at least one mobile device **120** receives the data collected by the device **200** for further analysis.

[0130] In certain embodiments, once data collected by the device **200** is received, either the main computing system **102** or the mobile device **120** classifies the received data by each type of punch or kick. In some embodiments, the computing system **102** or the mobile device **120** sorts the data based on which sensor the data was obtained from. For example, in some embodiments, the received data can be separated by the type of boxing punch, including left or right-handed jabs, straights, hooks, and uppercuts. In other embodiments, the received data can be separated by the type of kick, including a front kick, side kick, semi-circular kick, roundhouse kick, hook kick, crescent kick, axe kick, back kick, and sweeping. In other embodiments, the received data can be separated by particular type of other movements, such as a straight knee thrust, raising knee strike, hooking knee strike, and side knee snap strike.

[0131] In some embodiments, once the collected data is categorized by type of punch, kick, or other movement, the data is further analyzed to determine each movement's speed, force, trajectory, total number, number per time, acceleration, and order, among others. In some embodiments, these parameters can include a subset of those listed or may include others not listed. In certain embodiments, the user or athlete can select or define parameters to be analyzed before using the device. In some embodiments, this data is further analyzed to determine strike combinations.

[0132] In some embodiments, once each type of movement is analyzed according to each parameter, each parameter can be compared to a target value. In certain embodiments, the target value is preselected by the user or athlete. In other embodiments, the target value is automatically selected by the main computing system **102** or mobile device **120** according to factors such as age, gender, weight, experience, and rank of the athlete. In yet other embodiments, the target value is historical data of the same user or athlete. In some embodiments, the target value is data of a competitor or other user's movements.

Training Strategy Based on Historical Data

[0133] In some embodiments, as shown in FIG. **14**, the system compares current movement data of the athlete or user to historical data of the same athlete or user and develops a training strategy based on such comparison. FIG. **14** is a block diagram depicting an overview of one embodiment of a method of collecting and analyzing movement data of an athlete from different periods of time to develop a training strategy based on the improvement of certain skills of the athlete.

[0134] At block **602**, the accelerometer **212** within the device **200** collects movement data of the athlete over a period of time. Then, in some embodiments where the main computing system **102** is configured to receive and analyze the collected data, the data collected by the accelerometer **212** is transmitted to the main computing system **102** at block **604**. In other embodiments where the mobile device **120** is configured to receive and analyze the collected data, the data collected by the accelerometer **212** is transmitted to the mobile device **120** at block **606**.

[0135] At block **608**, the transmitted data is then separated or classified by each type of punch, kick, or other movement performed by the athlete while data was collected by the accelerometer **210**. Once the collected data is categorized by type of movement, the main computing system **102** or mobile device **120**, at block **610**, selects one type of punch, kick, or other movement for further analysis.

[0136] In some embodiments, the main computing system **102** or mobile device **120** analyzes data for each type of movement according to predetermined parameters. Such parameters can include, in some embodiments, speed, force, trajectory, total number, number per time, acceleration, and order, among others.

[0137] In certain embodiments, such further analysis according to predetermined parameters can be conducted at certain intervals of time to create a database of historical data. For example, at blocks **612**, **614**, and **616**, the main computing system **102** or mobile device **120** can determine the average speed, force, and trajectory respectively of a single type of movement from one data collection period. Then, after a second data collection period, at blocks **618**, **620**, and **622**, the main computing system **102** or mobile device **120** can again determine the average speed, force, and trajectory respectively of the same type of movement from the second data collection period. Similarly, after a third data collection period, at blocks **624**, **626**, and **628**, the main computing system **102** or mobile device **120** can determine the average speed, force, and trajectory respectively of the same type of movement from the third data collection period.

[0138] Once the main computing system **102** or mobile device **120** combines data analyzed according to predetermined parameters from different points in time, then the main computing system **102** or mobile device **120** can compare current data with the historical data at block **630**. This process from block **610** to block **630** can be repeated in some embodiments for different types of movements performed by the athlete.

[0139] Then, in some embodiments, the main computing system **102** or mobile device **120** develops a training strategy based on the comparison of current data to historical data of each movement of the athlete at block **632**. In some embodiments, if a first type of punch, kick, or movement of an athlete has improved over time while a second type of punch, kick, or movement has not, then the training strategy will focus on tasks designed to improve the athlete's second type of punch, kick, or movement. Similarly, if a first parameter of a punch, kick, or movement of an athlete has improved while a second parameter of the same punch, kick, or movement has not over time, then the training strategy will focus on tasks designed to improve the second parameter. For example, if the athlete's right-hand straight punches have improved in speed while the athlete's swing trajectory has become worse, then the main computing system **102** or mobile device **120** will select a strategy designed to improve the athlete's straight punch trajectory.

[0140] Once the main computing system **102** or mobile device **120** completes selecting different training tasks for the athlete, then at block **634**, an overall training strategy report is generated. In some embodiments, such report is a combination of all the selected tasks. In other embodiments, the report is a combination of all the selected tasks ordered in a way to maximize results.

[0141] In embodiments where the main computing system **102** has analyzed the data and generated the report, the main computing system **102** then transmits the report to the mobile device **120** at block **636**. This step is omitted in embodiments where the mobile device **120** has analyzed the data and generated the report. Then, the training strategy report is displayed to the athlete or user at block **638**.

Training Strategy Based on Target Values

[0142] In some embodiments, as shown in FIG. **15**, the system compares movement data of the athlete or user to preset target values and develops a training strategy based on such comparison. FIG. **15** is a block diagram depicting an overview of one embodiment of a method of collecting and analyzing movement data of an athlete to develop a training strategy by comparing the collected data with preset target values of certain skills.

[0143] At block **702**, the accelerometer **212** within the device **200** collects movement data of the athlete over a period of time. Then, in some embodiments where the main computing system **102** is configured to receive and analyze the collected data, the data collected by the accelerometer **212** is transmitted to the main computing system **102** at block **704**. In other embodiments where the mobile device **120** is configured to receive and analyze the collected data, the data collected by the accelerometer **212** is transmitted to the mobile device **120** at block **704**.

[0144] At block **708**, the transmitted data is then separated or classified by each type of punch, kick, or other movement performed by the athlete while data was collected by the accelerometer **210**. Once the collected data is categorized by type of movement, then at block **710**, the main computing system **102** or mobile device **120** selects one type of punch, kick, or other movement for further analysis.

[0145] In some embodiments, the main computing system **102** or mobile device **120** analyzes data for each type of movement according to predetermined parameters. Such parameters can include, in some embodiments, speed, force, trajectory, total number, number per time, acceleration, and order, among others.

[0146] In certain embodiments, the main computing system **102** or mobile device **120** determines the average speed for one type of punch, kick, or other movement at block **712**. Then, in some embodiments, the average speed is compared to a pre-stored target value of speed at block **714**. In some embodiments, if the determined average speed is higher or the same as the target value, then the main computing system **102** or mobile device **120** selects an appropriate training method for maintaining speed of that punch, kick, or other movement at block **716**. In certain embodiments, if the determined average speed is lower than the target value, then the main computing system **102** or mobile device **120** selects an appropriate training method for improving speed of that punch, kick, or other movement at block **718**.

[0147] In certain embodiments, the main computing system **102** or mobile device **120** determines the average trajectory for one type of punch, kick, or other movement at block **720**. Then, in some embodiments, the average trajectory is compared to a pre-stored model trajectory at block **722**. In some embodiments, if the similarity of the determined average trajectory is higher or the same as a target similarity value to the model trajectory, then the main computing system **102** or mobile device **120** selects an appropriate training method for maintaining trajectory of that punch, kick, or other movement at block **724**. In certain embodiments, if the similarity of the determined average trajectory is lower than a target similarity value to the model trajectory, then the main computing system **102** or mobile device **120** selects an appropriate training method for improving trajectory of that punch, kick, or other movement at block **726**.

[0148] In certain embodiments, the main computing system **102** or mobile device **120** determines the average force for one type of punch, kick, or other movement at block **728**. Then, in some embodiments, the average force is compared to a pre-stored target value of force at block **730**. In some embodiments, if the determined average force is higher or the same as the target value, then the main computing system **102** or mobile device **120** selects an appropriate training method for maintaining force of that punch, kick, or other movement at block **732**. In certain embodiments, if the determined average force is lower than the target value, then the main computing system **102** or mobile device **120** selects an appropriate training method for improving force of that punch, kick, or other movement at block **734**.

[0149] In certain embodiments, the main computing system **102** or mobile device **120** determines the total number of one type of punch, kick, or other movement performed per time at block **736**. Then, in some embodiments, the total number per time is compared to a pre-stored target value of total number per time at block **738**. In some embodiments, if the determined total number per time is higher or the same as the target value, then the main computing system **102** or mobile device **120** selects an appropriate training method for maintaining the total number per time of that punch, kick, or other movement at block **740**. In certain embodiments, if the determined total number per time is lower than the target value, then the main computing system **102** or mobile device **120** selects an appropriate training method for improving the total number per time of that punch, kick, or other movement at block **742**.

[0150] In other embodiments, the order of analysis of the parameters discussed above, such as average speed, trajectory, force, and total number of movements per time, may vary. In certain embodiments, the main computing system **102** or mobile device **120** is configured to analyze a subset of these parameters discussed above or may analyze other parameters for analyzing an athlete's movement not discussed herein.

[0151] Then, in some embodiments, the main computing system **102** or mobile device **120** combines the selected training strategies for a kick, punch, or other movement at block **744**. This process from block **710** to block **744** can be repeated in some embodiments as many times as necessary to analyze different types of punches, kicks, or other movements performed by the athlete.

[0152] Then, in some embodiments, the main computing system **102** or mobile device **120** combines all selected strategies for all types of punches, kicks, and other movements at block **746**. The main computing system **102** or mobile device **120** can then, in certain embodiments, use the combined strategies to develop a training strategy at block **748**. In some embodiments, such report is a combination of all the selected training strategies. In other embodiments, the report is a combination of all the selected training strategies ordered in a way to maximize results.

[0153] In embodiments where the main computing system **102** has analyzed the data and generated the report, the main computing system **102** then transmits the report to the mobile device **120** at block **750**. This step is omitted in embodiments where the mobile device **120** has analyzed the data and generated the report. Then, the training strategy report is displayed to the athlete or user at block **752**.

[0154] In certain embodiments, certain steps or methods of an embodiment of a method of collecting and analyzing movement data of an athlete to develop a training strategy by comparing the collected data with preset target values of certain skills as shown in FIG. **15** can be combined with certain steps or methods of an embodiment of a method of collecting and analyzing movement data of an athlete from different periods of time to develop a training strategy based on the improvement of the athlete of certain skills as shown in FIG. **14**.

Fight Strategy Based on Target Values

[0155] In some embodiments, as shown in FIG. **16**, the system compares movement data of the athlete or user to preset target values and develops a fight strategy based on the athlete or user's punches, kicks, or other movements closest to preset target values. FIG. **16** is a block diagram depicting an overview of one embodiment of a method of collecting and analyzing movement data of an athlete to develop a fight strategy by comparing the collected data with target values of certain skills and building a fight strategy based on the highest scoring skills.

[0156] At block **802**, the accelerometer **212** within the device **200** collects movement data of the athlete over a period of time. Then, in some embodiments where the main computing system **102** is configured to receive and analyze the collected data, the data collected by the accelerometer **212** is transmitted to the main computing system **102** at block **804**. In other embodiments where the mobile device **120** is configured to receive and analyze the collected data, the data collected by the accelerometer **212** is transmitted to the mobile device **120** at block **806**.

[0157] At block **808**, the transmitted data is then separated or classified by each type of punch, kick, or other movement performed by the athlete while data was collected by the accelerometer **210**. Once the collected data is categorized by type of movement, then at block **810**, the main computing system **102** or mobile device **120** selects one type of punch, kick, or other movement for further analysis.

[0158] In some embodiments, the main computing system **102** or mobile device **120** analyzes data for each type of movement according to predetermined parameters. Such parameters can include, in some embodiments, speed, force, trajectory, total number, number per time, acceleration, and order, among others.

[0159] In certain embodiments, the main computing system **102** or mobile device **120** determines the average speed for one type of punch, kick, or other movement at block **812**. Then, in some embodiments, the average speed is compared to a pre-stored target value of speed at block **814** to determine how close the average speed is to the preset target value.

[0160] In certain embodiments, the main computing system **102** or mobile device **120** determines the average trajectory for one type of punch, kick, or other movement at block **816**. Then, in some embodiments, the average trajectory is compared to a pre-stored model trajectory at block **818** to determine how close the average trajectory is to the preset model trajectory.

[0161] In certain embodiments, the main computing system **102** or mobile device **120** determines the average force for one type of punch, kick, or other movement at block **820**. Then, in some embodiments, the average force is compared to a pre-stored target value of force at block **822** to determine how close the average force is to the preset target value.

[0162] In certain embodiments, the main computing system **102** or mobile device **120** then combines the scores determined for each parameter of one type of punch, kick, or other movement at block **824** to determine an overall score for that punch, kick, or other movement. This process from block **810** to block **824** can be repeated in some embodiments as many times as necessary to analyze different types of punches, kicks, or other movements performed by the athlete.

[0163] In other embodiments, the order of analysis of the parameters discussed above, such as average speed, trajectory, and force may vary. In certain embodiments, the main computing system **102** or mobile device **120** is configured to analyze a subset of these parameters discussed above or may analyze other parameters for analyzing an athlete's movement not discussed herein.

[0164] In some embodiments, the main computing system **102** or mobile device **120** then determines whether any punches, kicks, or other movements detected have an overall score above a certain preset target value at block **826**. If none of the detected punches, kicks, or movements meets the preset threshold target value, then the main computing system **102** or mobile device **120** in some embodiments will automatically go into a training mode at block **828**. One embodiment of such training mode is depicted in FIG. **16**.

[0165] If at least one of the detected punches, kicks, or other movements meets the preset threshold target value, then the main computing system **102** or mobile device **120** in some embodiments will develop a fight strategy at block **830** using those punches, kicks, or other movements. In certain embodiments, the main computing system **102** or mobile device **120** will combine these punches, kicks, and other movements according to a pre-stored algorithm or method to maximize

effects of the fight strategy. In some embodiments, the main computing system **102** or mobile device **120** can build more than one fight strategy at block **830**.

[0166] Then, in some embodiments, a fight strategy report is generated at block **832**. In embodiments where the main computing system **102** has analyzed the data and generated the report, the main computing system **102** then transmits the report to the mobile device **120** at block **834**. This step is omitted in embodiments where the mobile device **120** has analyzed the data and generated the report. Then, the training strategy report is displayed to the athlete or user at block **836**.

[0167] In certain embodiments, certain steps or methods of an embodiment of a method of collecting and analyzing movement data to generate a fight strategy as shown in FIG. **16** can be combined with certain steps or method of an embodiment of a method of collecting and analyzing movement data of an athlete to generate a training strategy as shown in FIG. **15** or FIG. **14**.

Training Strategy Based on Target Trajectories

[0168] In some embodiments, as shown in FIG. **17**, the system compares movement data of the athlete or user to preset target trajectories or previous trajectories selected as target trajectories thrown by a user and determines if the movements are substantially similar to or are close to or the same as the target trajectory. FIG. **17** is a block diagram depicting an overview of one embodiment of a method of collecting and analyzing movement data of an athlete to develop a fight strategy by comparing the collected data with target trajectories.

[0169] At block **1702**, a user may select one or more model strike trajectories. In some embodiments, a user selects a model trajectory for a strike or a combination of strikes. In some embodiments, the user selects a preset trajectory stored in the system memory. In other embodiments, the user selects a trajectory that the user performed previously and stored. The model trajectory may be associated with a user profile. In some embodiments, at block **1702**, the system displays a model trajectory and receives a selection from the user.

[0170] At block **1704**, an accelerometer or other sensor may collect movement data of the athlete over a period of time. In some embodiments, when the device does not contain a computing system of its own, the data is transmitted to a computing system as block **1706**. The computing system may include a mobile phone.

[0171] Once the data is collected, the system can determine the trajectory of the strike or trajectories of a combination of strikes at block **1708**. The system can then compare the strike trajectory or trajectories of a combination of strikes to the pre-selected model trajectory at block **1710** to determine how close the trajectory is to the model trajectory.

[0172] Then, in some embodiments, a fight strategy report is generated at block **1712**. The fight strategy report can be displayed to the athlete or user at block **1714**. The fight strategy report may include, for example, a summary of how many strikes thrown matched or closely matched the model trajectory. The fight strategy report may provide advice to the user by displaying certain visual prompts or recommendation or by recommending that the user watch a certain training video, perform certain physical exercises, or set a goal for improvement based at least in part on the results of the training session.

[0173] In some embodiments, at block **1720**, the system determines if a particular strike matches and/or closes matches a model trajectory in real time. If the strike matches and/or closes matches a model trajectory, the system can output a preset audible sound that represents a successful trajectory at block **1722**. If the strike does not match or compare favorably to the model trajectory, the system can output a second preset audible sound that represents an unsuccessful trajectory at block **1724**.

[0174] In certain embodiments, certain steps or methods of an embodiment of a method of collecting and analyzing movement data to generate a fight strategy as shown in FIG. **17** can be combined with certain steps or method of an embodiment of a method of collecting and analyzing movement data of an athlete to generate a training strategy as shown in FIGS. **14**, **15**, and/or **16**.

File Storage

[0175] In some embodiments, the raw data collected and transmitted by the device **200** is stored only at the main computing system **102**. In other embodiments, the raw data collected and transmitted by the device **200** is stored only at the mobile device **120**. In certain embodiments, the raw data collected and transmitted by the device **200** is stored at both the main computing system **102** and the mobile device **120**.

[0176] In some embodiments, the one or more generated reports are stored only at the main computing system **102**. In other embodiments, the one or more generated reports are stored only at the mobile device **120**. In certain embodiments, the one or more generated reports are stored at both the main computing system **102** and the mobile device **120**.

File Access

[0177] In some embodiments, the raw data and/or one or more generated reports are saved at the main computing system **102** and are accessible by the user from any computer or mobile device **120**. In certain embodiments, the raw data and/or one or more generated reports are saved at the main computing system **102** and are accessible by the user from any computer or mobile device **120**, but only when certain credentials are inputted. In other embodiments, the raw data and/or one or more generated reports are saved at the main computing system **102** and are accessible by a user only through a mobile application or computer program compatible with the main computing system **102**.

Game Input Device

[0178] In some embodiments, the device **200** can be configured to function as an input method for playing a video game on a mobile device. In certain embodiments, the accelerometer **210** within the device **200** detects a user's movements in real-time. Then, in some embodiments, a transmitter **216** within the device **200** transmits the detected movement to a mobile device **120**. In some embodiments, a video game is installed and operating on the mobile device **120**. Then, the movement data received by the mobile device **120** is processed to execute a certain demand within the video game.

[0179] In some embodiments, the device **102** can be configured to detect certain parameters of the user's movements, including speed, force, trajectory, and total number of punches, kicks, or other movements. In other embodiments, the device **102** can be configured to detect certain orders or types of movements, including kicks, punches, or other movements.

[0180] Mobile devices **120** includes but is not limited to a personal computer, cellular phone, laptop, tablet device, or other device capable of connecting to the network **118**. In some embodiments, the mobile device **120** can be connected to other mobile devices **120**, computers, or users via a network **118**.

[0181] Those of skill would further appreciate that any of the various illustrative logical blocks, modules, cores, processors, means, circuits, and algorithm steps described in connection with the aspects disclosed herein may be implemented as electronic hardware (e.g., a digital implementation, an analog implementation, or a combination of the two, which may be designed using source coding or some other technique), or various forms of program or design code incorporating instructions, or combinations of both. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present disclosure.

[0182] The various illustrative logical blocks, modules, cores, and circuits described in connection with the aspects disclosed herein may be implemented within or performed by an integrated circuit (IC), an access terminal, or an access point. The IC may comprise a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, electrical components, optical components, mechanical components, or any combination thereof designed to perform the functions described herein, and may execute codes or instructions that reside within the IC, outside of the IC, or both. The logical blocks, modules, cores, and circuits may include antennas and/or transceivers to communicate with various components within the network or within the device. A general purpose processor may be a microprocessor, but in the alternative, the processor may be any processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, for example, a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration. The functionality of the modules or cores may be implemented in some other manner as taught herein. Furthermore, the functionality described herein (e.g., with regard to one or more of the accompanying figures) may correspond in some aspects to similarly designated "means for" functionality in the appended claims.

[0183] It is understood that any specific order or hierarchy of steps in any disclosed process is an example of a sample approach. Based upon design preferences, it is understood that the specific order or hierarchy of steps in the processes may be rearranged while remaining within the scope of the present disclosure. Similarly, the accompanying method claims present elements of the various steps in a sample order, and are not meant to be limited to the specific order or hierarchy presented.

[0184] The functions described may be implemented in hardware, software, firmware, or any combination thereof. If implemented in software, the functions may be stored on or transmitted over as one or more instructions or code on a tangible, non-transitory computer-readable medium. Computer-readable media includes both computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A storage media may be any available media that can be accessed by a computer. By way of example, and not limitation, such computer-readable media can include RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to carry or store desired program code in the form of instructions or data structures and that can be accessed by a computer. A computer-readable medium may be in the form of a non-transitory or transitory computer-readable medium. Also, any connection may be properly termed a computer-readable medium. For example, if the software is transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of medium. Disk and disc, as used herein, includes compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk and blu-ray disc where disks usually reproduce data magnetically, while discs reproduce data optically with lasers. Combinations of the above should also be included within the scope of computer-readable media. In summary, it should be appreciated that a computer-readable medium may be implemented in any suitable computer-program product.

[0185] The above description is provided to enable any person skilled in the art to make or use embodiments within the scope of the appended claims. Various modifications to these aspects will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other aspects without departing from the scope of the disclosure. Thus, the present disclosure is not intended to be limited to the aspects shown herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

[0186] Although the embodiments of the inventions have been disclosed in the context of a certain preferred embodiments and examples, it will be understood by those skilled in the art that the present inventions extend beyond the specifically disclosed embodiments to other alternative embodiments and/or uses of the inventions and obvious modifications and equivalents thereof. In addition, while a number of variations of the inventions have been shown and described in detail, other modifications, which are within the scope of the inventions, will be readily apparent to those of skill in the art based upon this disclosure. It is also contemplated that various combinations or subcombinations of the specific features and aspects of the embodiments may be made and still fall within one or more of the inventions. Accordingly, it should be understood that various features and aspects of the disclosed embodiments can be combine with or substituted for one another in order to form varying modes of the disclosed inventions. Thus, it is intended that the scope of the present inventions herein disclosed should not be limited by the particular disclosed embodiments described above.

What is claimed is:

1. A system for analyzing movement of a combat athlete during a combat athletic activity, the system comprising:

at least one three dimensional accelerometer located within a device and configured to collect data of the movement of the combat athlete; and

at least one transmitter located within the device and configured to transmit the collected data over a wireless network, the device being attached to the body of the combat athlete,

wherein the transmitted data is received over a wireless network by a computing system configured to store and analyze the transmitted data based on at least one predetermined parameter and to determine a training strategy for the combat athlete by comparing the movement data of the combat athlete of each predetermined parameter with a corresponding target value, and

wherein the computing system comprises at least a computer processor and an electronic storage device.

2. The system claim **1**, wherein the target value for each parameter is based at least in part on one of age, gender, weight, experience, and rank of the combat athlete.

3. The system claim **2**, wherein the training strategy is determined based on the comparison of the movement data to a plurality of predetermined parameters to analyze an effective combination of movements.

4. A computer system for analyzing an movement of a combat athlete during a combat athletic activity comprising:

a computer processor configured to execute modules comprising at least:

a receiving module programmed to receive data collected by at least one three dimensional accelerometer and transmitted by at least one transmitter over a wireless network, wherein the at least one three dimensional accelerometer and transmitter are located within a device attached to the combat athlete;

a storage module programmed to store the received data;

an analysis module programmed to analyze the received data according to at least one predetermined parameter;

a training module programmed to determine a training strategy for the combat athlete by comparing the movement data of the combat athlete of each predetermined parameter with a corresponding target value and determining parameters that need improvement; and

a display module programmed to cause display of the future training strategy.

5. A computer-implemented method for analyzing movement of a combat athlete during a combat athletic activity, the computer-implemented method comprising:

collecting data of the movement of the combat athlete by at least one three dimensional accelerometer located within a device attached to the combat athlete;

transmitting the collected data by at least one transmitter located within the device over a wireless network;

receiving the collected data by a computing system over the wireless network;

storing the received data by the computing system;

analyzing or causing analysis of the received data by the computing system according to at least one predetermined parameter;

determining or causing determination by the computing system of a training strategy for the combat athlete by comparing the movement data of the combat athlete of each predetermined parameter with a corresponding target value and determining parameters that need improvement; and

displaying or causing display of the training strategy by the computing system,

wherein the computing system comprises at least a computer processor and an electronic storage device.

6. The computer-implemented method of claim **5**, wherein the computing system comprises one or more computer systems.

7. The computer-implemented method of claim **5**, wherein the combat athletic activity is at least one of a group comprising boxing, kick boxing, Muay That, Jiu Jitsu, San Sau, Taekwondo, Karate, Kung Fu, or some other form of martial art.

8. The computer-implemented method of claim **5**, wherein the device attached to the combat athlete is located on at least one of a hand(s), inside a wrist(s), outside a wrist(s), on a leg(s), on an ankle(s), on a foot, on a head, or on the torso of the combat athlete.

9. The computer-implemented method of claim **5**, wherein the at least one predetermined parameter is selected from a group comprising punch speed, number of punches per time, total number of punches, types of punches, punch force, punch trajectory, punch acceleration, and order of types of punches, kick speed, number of kicks per time, total number of kicks, types of kicks, kick force, kick trajectory, kick acceleration, and order of types of kicks.

10. The computer-implemented method of claim **5**, wherein the computing system is or is accessible by a mobile device.

11. The computer-implemented method of claim **5**, wherein the target value for each parameter is selected by the combat athlete based on at least one of age, gender, weight, experience, and rank of the athlete.

12. The computer-implemented method of claim **5**, further comprising determining by the computing system a fight strategy for the combat athlete based on the analyzed data.

13. The computer-implemented method of claim **12**, wherein the fight strategy is determined based on the combat athlete's performance of each predetermined parameter to create an effective combination of different types of movement.

14. A computer-readable, non-transitory storage medium having a computer program stored thereon for causing a suitably programmed computing system to process by one or more computer processors computer-program code by performing a method when the computer program is executed on the suitably programmed computing system, the method comprising:

collecting data of movement of a combat athlete during a combat athletic activity by at least one three dimensional accelerometer located within a device;

transmitting the collected data by at least one transmitter located within the device over a wireless network, wherein the device is attached to the combat athlete;

receiving the collected data by a computing system over the wireless network;

storing the received data in the computing system;

analyzing or causing analysis of the received data by the computing system according to at least one predetermined parameter;

determining or causing determination by the computing system of a training strategy for the combat athlete by

comparing the movement data of the combat athlete of each predetermined parameter with a corresponding target value and determining parameters that need improvement; and

displaying or causing display of the future training strategy by the computing system,

wherein the computing system comprises at least a computer processor and an electronic storage device.

15. A computer-implemented method for analyzing movement of a combat athlete during a combat athletic activity, the computer-implemented method comprising:

collecting data of the movement of the combat athlete by at least one three dimensional accelerometer located within a device attached to the combat athlete in a first time period;

transmitting the collected data by the at least one transmitter located within the device over a wireless network in a first time period;

receiving the collected data by a computing system over the wireless network in a first time period;

storing the received data by the computing system in a first time period;

analyzing or causing analysis of the received data by the computing system according to at least one predetermined parameter in a first time period;

collecting data of the movement of the combat athlete by at least one three dimensional accelerometer located within a device attached to the combat athlete in a second time period;

transmitting the collected data by at least one transmitter located within the device over a wireless network in a second time period;

receiving the collected data by a computing system over the wireless network in a second time period;

storing the received data by the computing system in a second time period;

analyzing or causing analysis of the received data by the computing system according to at least one predetermined parameter in a second time period;

comparing the data analyzed according to at least one predetermined parameter in the first time period and the data analyzed according to at least one predetermine parameter in the second time period;

developing a training strategy for the combat athlete based on level of improvement of the combat athlete of at least one predetermined parameter; and

displaying or causing display of the training strategy by the computing system,

wherein the computing system comprises at least a computer processor and an electronic storage device.

16. A computer-implemented method comprising:

receiving motion sensor data from a plurality of sensors attached to a plurality of combat athletes;

storing the received data on a computer system;

generating an electronic combat athlete profile for each combat athlete from at least a portion of the received data on the computer system; and

selecting, based on the electronic combat athlete profiles from the plurality of combat athletes, similarly skilled combat athletes;

said selecting performed entirely by the computer system.

17. The method of claim **16**, further comprising displaying or causing to display at least one similar electronic combat athlete profile to a similarly skilled combat athlete.

18. The method of claim **17**, further comprising receiving a location associated with each of the combat athletes and displaying or causing to display the locations of similarly skilled combat athletes.

19. A computer-implemented method for analyzing movement of a combat athlete during a combat athletic activity, the computer-implemented method comprising:

collecting data of the movement of the combat athlete by at least one three dimensional accelerometer located within a device attached to the combat athlete;

transmitting the collected data by at least one transmitter located within the device over a wireless network;

receiving the collected data by a computing system over the wireless network;

storing the received data by the computing system;

analyzing or causing analysis of the received data by the computing system, the analysis including comparing the collected data to a pre-selected model strike trajectory or pre-selected model combination of strike trajectories; and

signaling to the user, in real time, with the computing system, when the received data correlates to the pre-selected strike trajectory model or pre-selected model combination of strike trajectories.

20. The method of claim **19**, further comprising generating an electronic report including at least a portion of the collected data and displaying or causing to display the report.

21. A device for analyzing movement of a combat athlete during a combat athletic activity comprising;

a glove configured to be attached to the extremity of a user;

at least one three dimensional accelerometer configured to be coupled to a mobile phone disposed on or within the glove; and

a receiving space disposed on or within the glove; the receiving space configured to receive and secure a mobile phone to the glove.

22. The device of claim **21**, further including at least one battery and a computing system disposed on or within the glove.

23. The device of claim **22**, further including at least impact sensor system on or within the glove and coupled to the computing system.

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