APPARATUS FOR ASSISTING SWIMMING TRAINING

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ABSTRACT

A training system for assisting a coach to train a swimmer, including a swimmer side system and a coach side system electronically communicated. The swimmer wears a headgear which includes a swimmer's data collection kit (SWDCK) which includes in turn sensors, a processor and a transceiver. A display for the swimmer is attached to a head belt or to goggles. A speaker for transferring audible information to the swimmer is typically a bone-conduction speaker. A control module is operated by the coach, which includes a transmitter for communicating with the swimmer worn head-gear, a computer and a display and software,
Fig. 1
Fig. 3
APPARATUS FOR ASSISTING SWIMMING TRAINING

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

[0001] This application claims priority from U.S. Provisional patent application 61/361,927, entitled “Apparatus for assisting swimming training”, filed on Jul. 7, 2010.

FIELD OF THE INVENTION

[0002] The present invention relates to training devices for sportspeople and their instructor/coach.

BACKGROUND OF THE INVENTION

[0003] Training system for sportspeople and others who toil about their fitness are available today in several forms, providing a multiplicity of data that can be used as grounds for physiological analysis and performance study. Such commercially available training systems currently support sports activity related to athletics but there is a need for a system that can specifically support swimmers. The environment in which swimming is performed is typically more challenging than the environment surrounding athletes. First, a swimmer is submerged in water fully or partially which is in itself challenging for a system including electrical circuits and components. Second, a swimmer is not at all times immersed in water and is at times out of the water, resting, doing out of water exercise, or even when swimming, raising parts of the body out of the water. In other words, the swimmer’s environment is changing between aqueous and atmospheric from time to time and even at a fast rate.

SUMMARY OF THE INVENTION

[0004] Head-gear worn by the swimmer includes several items that function together for sending information to the coach on the one hand, and for receiving information and instructions from the coach on the other hand. A swimmer’s data collection kit (SWDCK), worn by the swimmer, includes an assemblage of hardware components. A part of the assemblage is a variety of sensors which collect data relating to positioning of the swimmer, physiological data and physical data. A processor receives the data from the sensors, typically modified signals from the respective sensors signals. The processor, employing a memory, is also connected to transceiver for sending information to the coach. The coach receives at his/her remote location the data/information from the swimmer and is able to analyze it by employing the control module which includes a transceiver and visualizing components and microphone and a small computer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] The invention may be understood upon reading of the following detailed description of non-limiting exemplary embodiments thereof, with reference to the following drawings, in which:

[0006] FIG. 1 is a block diagram describing the component layout of the swimmers data collection kit of the invention;

[0007] FIG. 2 is a schematic contour view of a data collection kit of the invention;

[0008] FIG. 3 is a block diagram describing the connectivity of the data conveying apparatuses available to the swimmer while swimming.

DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0009] A swimmer’s data collection kit (SWDCK) 20 in accordance with the present invention features an assemblage of hardware components, mostly electronic, mounted on a swimmer-worn gear. Referring first to FIG. 1, the assemblage of components includes a variety of sensors 22 connected to a processor 24. This connection typically employs an adaptor (not shown) to condition the signal of a sensor to the processor, for example by digitizing the electrical signal of the sensor. Processor 24 connects to display 26, and to transceiver 28. Memory 32, is typically a flash memory unit, and is connected to processor 24. Power supply 36 powers all the components in the assemblage. In another embodiment, the signals emanating from the sensors, after being digitized are stored in a data storage device before being processed. The signals, or information derived from such signals can be stored after processed. SWDCK 20 and some of its components can be shared with other modules of the invention.

[0010] User (Swimmer) Worn Gear

[0011] The present invention is implementable requiring that the user, which is the swimming trainee, wears a gear on his/her body, for two reasons: to collect physiological data from the body and to collect physical data associated with the swimmer’s movements as he/she swims. Most typically, the gear is a head gear, worn on or applied as a belt around the head. One preferable option is that the user’s gear is associated with the swimming goggles. This option has several advantages. One advantage is that at least a part of the burden and weight of the SWDCK 20 is being shared via a contraption which is worn by the swimmer in most cases. Another advantage is that a visor showing data to be viewed by the swimmer can be installed on one or two of the glasses of the goggles. It can be understood that although SWDCK 20 is described schematically as including a display, the visor itself may not necessarily be housed in connection with the rest of the hardware components but rather be separated such as being housed in connection with goggles, while the rest is housed in connection with a belt worn on the head.

[0012] Sensors

[0013] Several sensors are employed in a system of the invention. These sensors can be grouped according to task as follows: positioning, physiological, physical. The positioning sensors are such devices that determine relative or absolute position of the trainee within a local or global coordinate system. Such sensors include linear accelerometer/s, multi-dimensional accelerometer/s, and magnetometer. A magnetometer is employed for the identification of turns in the practice of swimming. The turns made by swimmers clearly distinguish the practice of swimming setting them aside from athletics in which a runner does not perform turns. Turns are made as the swimmer reaches the edge of the pool and changes, usually as fast as he/she can, the direction of advancement. The magnetometer, sensitive to earth’s magnetic field can typically sense the change in the direction of that field that occurs as the swimmer makes a turn. In case the direction of earth’s magnetic field is in such an angle relative to the pool to prevent proper response to change, a local magnet can be disposed beside the pool to provide such reference. An alternative to a magnetometer is a gyroscope sensitive to vertical turns. Physiological sensors include such devices that collect information about bodily functions of the swimmer, convert them to electrical signals that can be passed on to the processor after having been converted to processor
compatible format. An oximeter is a sensor that measures the level of oxidation of the blood in the blood stream, and can also infer to the pulse, by the cyclic change in relative oxygen content in the blood. Since the oximeter requires a contact on the skin it is supported in the SWDCK 20 in such a manner as to insure that contact. As can be seen in FIG. 2 to which reference is now made, a schematic contour view of head-gear 72, bearing SWDCK 20 shows the forehead section, featuring two bulges. Bulge 74 contains oximeter such that when worn around the head, bulge 74 touches the forehead. This bulge contains an oximeter having a window to permit the exchange of light between the skin and the sensor. The list of physiological sensors that can be employed in connection with the present invention typically include breathing sensors that measure the cyclical change in the volume of the chest. Another type of sensor is a muscular activity sensor that measures electric signal in the vicinity of the muscle. Another type of breathing cycles sensor is an accelerometer that measures the movement of the head, assuming that each time the swimmer lifts his/her head up a breathing instance occurs. Blood stream pulsation sensors are available that measure the electrical activity in the vicinity of the heart and provide heart rate measurements. Physical sensors accelerometers, gyroscope and magnetometer can all be applied in addition to the reasons set forth above, to monitor physical properties of the swimmer, e.g. speed, swimming style, uniformity pace and variability. The data provided by such sensors provide the data from which the coach or indeed the trainee can infer qualitative aspects of the swimmer’s capabilities. Specifically the data can be used to determine the number of strokes per lap, number of breath per lap. Additionally they provide input which determines if the swimmer is swimming or resting between laps.

[0014] Communicating the Trainee with the Control Module

[0015] The coach/swimming instructor operates the control module which includes a transceiver and visualizing components and microphone, that enables him/her to study the trainee’s physiological parameters, his/her achievements and improvement. The control module is typically a laptop or small computer such as a smartphone either attached to or containing a transceiver and allows communications to take place between the trainee and the coach. The computer operated by the coach includes also software for maintaining the computer and for assisting the coach in his/her tasks. The coach can compile a more refined training scheme for the specific swimmer and in response to receiving online information through the transceiver of the SWDCK, can also observe, compare present and past records of a trainee that are kept on the control module or accessed via network. The coach is able to make comments or utter instructions to the trainee and modify the training program in real-time. Explained with reference to FIG. 3, the electromagnetic signal emitted by the transmitter or a transceiver at the coach’s end, is received by transceiver 28 of the trainee’s SWDCK 20, where it is passed to processor 24 after being properly conditioned (for example filtration, digitization, demodulation, etc.). A suitable driver 78 passes a signal to contact speaker 80 forms audible signals in the trainee’s head-gear 72 passes to his/her skull and ear.

[0016] Returning now to FIG. 2, a second bulge 84 contains a speaker which is in contact with the trainee’s forehead, sending audio information from the control center to the trainee while swimming. To facilitate hearing, typically bone conduction technology is used. The audio information delivered by a bone conduction loudspeaker travels along the bones of the skull reaching the inner ear and perceived as voice by the inner ear. Several products are available on the market for swimmers and divers.

[0017] Various communications standards can be used to support wireless interactions between the swimmer and the coach. Bluetooth® technology implementing the 2.4 GHz band is one possibility, although it may not be able to support communications at longer distances prescribed for the usage of the technology. ZigBee® (IEEE 802.15.4) also, like Bluetooth support traffic by low power consuming digital radios. WLAN systems like Wi-Fi are applicable as long as their energy consumption is reasonable for the application. In addition, cellular technology can be used.

[0018] Display and Visors

[0019] An additional option of presenting information to the trainee is by disclosing visually any textual or graphical output that can be compiled by the processor. Again referring to FIG. 3, the signal supplied by processor 24 is sent to driver 86 that drives display 26. This display typically is a HUD (heads up display) that can be attached to one or both of the glasses of the goggles of the trainee, in such case as the trainee wears goggles. Additionally, visual information can be presented in a display device mounted on the head-gear 72. In this case the SWDCK 20 has to be removed in order to view the display followed by repositioning it on the swimmer’s body. See for example alpine goggles by Recon Instruments Inc., 220-1050 Homer Street #6B 2W9, Vancouver, BC, Canada.

[0020] Implementation of Training Schemes Based on the Device of the Invention

[0021] A SWDCK is used on the one hand to collect data associated with the swimmer and swimming and on the other hand it performs as a tool for reviewing the performance of the swimmer. Referring to FIG. 1 again, clock 104 provides timing for the entire system, and is in some processors a part of the processor. For the assessment of swimmer’s performance, the clock can count the time between one turn (flip) and another one (as determining the time it takes for the swimmer to swim one pool (lap). Relationships between physiological parameters and speed of the trainee and the effect swimming style can be calculated either on the trainee SWDCK 20 or on the trainers control module. Additionally, the SWDCK 20 can generate audio and/or visual messages to the trainee and coach, providing real-time feedback on above mentioned calculated relationships.

1. A training system for assisting a coach to train a swimmer, said system comprising:
   - a swimmer worn head-gear; said head-gear including:
     - a swimmer’s data collection kit (SWDCK) which includes assemblage of hardware components which includes at least sensors, a processor and a transceiver;
     - a display;
     - a speaker for transferring audible information to said swimmer;
     - a clock;
   - a control module operable by said coach, which includes at least a transceiver for communicating with said swimmer worn head-gear, a computer, a display and software, and wherein said variety of sensors include at least sensors for collecting data relating to position, physiology and the physical state of said swimmer;
2. A training system as in claim 1, wherein said position sensors include at least a linear accelerometer and a magnetometer.

3. A training system as in claim 1, wherein said display is associated with goggles worn by said swimmer.

4. A training system as in claim 3, wherein said display is a HUD.

5. A training system as in claim 1 wherein said speaker is a bone-conduction loudspeaker.

6. A training system as in claim 1 wherein said control module operable by said coach includes a transmitter for communication with said swimmer.

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