SMART ATHLETIC TRAINING SYSTEM

A system for evaluating and/or improving the performance characteristics of an athlete, such as speed, agility and quickness, includes a plurality of training objects that can be arranged on a drill circuit, wherein each training object includes a radio frequency transceiver for communicating with another training object, a visual display for signaling an athlete, a sensor for detecting the athlete’s position relative to the training object, and a battery with required conductors for powering the radio frequency transceiver, visual display and sensor.
SMART ATHLETIC TRAINING SYSTEM

STATEMENT REGARDING FEDERALLY FUNDED RESEARCH

[0001] This invention was not made under contract with an agency of the U.S. Government, nor by any agency of the U.S. Government.

CROSS-REFERENCE TO RELATED APPLICATIONS

[0002] Not Applicable.

FIELD OF THE DISCLOSURE

[0003] This disclosure relates to systems comprising training objects used for improving and/or evaluating athletic skills such as speed, agility and/or quickness.

BACKGROUND OF THE DISCLOSURE

[0004] Cones and various other elements or training objects have been used to evaluate and improve athletic skills such as speed, agility, quickness and team work. These systems have not been interactive, are subject to error due to improper placement of the training objects and/or stopwatch errors, and cannot automatically catalog performance milestones and improvements.

SUMMARY OF THE DISCLOSURE

[0005] Disclosed is a smart training system that employs transmitters/receivers, sensors and display screens to facilitate accurate placement of training objects for a particular drill that can be selected from a plurality of catalogued drills, to allow interactive drills with unpredictable direction changes in a drill circuit to evaluate reaction time, and/or accurate timing of circuit completion and the time for completing various segments of the drill circuit.

[0006] The training system includes a plurality of training objects that can be positioned at predetermined or arbitrary locations on an athletic field, athletic court, or other training area to evaluate and/or improve athletic skills, such as speed, agility, quickness, and team work. Each training object includes a radio frequency transmitter/receiver for communicating with another training object, a visual display for signaling an athlete, a sensor for detecting the athlete’s position relative to the training object, and a battery and electrical conductors for supplying power to the radio frequency transmitter/receiver, visual display, and sensor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a perspective view of a single cone-shaped training object in accordance with this disclosure.

[0008] FIG. 2 is a perspective view of a plurality of nested cone-shaped training objects positioned on a charger for recharging batteries contained in the training objects.

[0009] FIG. 3 is a cross section of a cone-shaped training object in accordance with this invention showing the battery, transmitter/receiver, and sensor.

DETAILED DESCRIPTION OF THE DISCLOSURE

[0010] Shown in FIG. 1 is a single cone-shaped training object or training cone 10 having a conical portion 12 and a base 14. A plurality of such cones 10 can be arranged on an athletic field, athletic court, or other athletic training or athletic performance evaluation facility to allow athletes to perform timed drills that test their athletic skills such as agility, speed, quickness and/or team work.

[0011] A smart training system or kit in accordance with this disclosure includes a plurality of training objects (at least two), such as cones 10, and may further comprise a charger 16 for simultaneously recharging a battery in each of a plurality of nested cones 10, as shown in FIG. 2. The disclosed training systems or kits are smart in the sense that the training objects can communicate and/or sense each other and/or the athlete using the system.

[0012] Examples of drills that can be performed include X-drill, 123 Buck Drill, 3 Cone Drill (also known as L-drill), Pro Agility Drill, Run-Shuttle-Run Drill, Cone Alley Drills, etc.

[0013] Each training object includes a visual display 20, a radio frequency transmitter and receiver (transceiver) 22 (as shown in FIG. 3), a battery 24, and a sensor 26. As shown in FIG. 3, the battery 24, sensor 26, transceiver 22 and display 20 can be embedded within a wall 30 of training object 10 to facilitate nesting for recharging and/or storage. Each cone 10 can be provided with contacts 32, 33 that have upper surfaces that project above the top 34 of cone 10 and that extend downwardly through the top to engage either the upwardly facing surface of contacts 32, 33 of another underlying nested cone or contacts 35, 36 extending upwardly from charger 16. The combination of displays, sensors and transmitters/receivers facilitates automation, sensing, visualization and feedback to provide a smart system.

[0014] As used herein, a proximity sensor can be any type of sensor that is able to detect the presence of a nearby object (e.g., person) without physical contact, and includes various sensors that emit an electromagnetic field or a beam of electromagnetic radiation and detects changes in the field or return signal (e.g., infrared radiation proximity sensors).

[0015] As used herein, a motion sensor can be any device that detects moving objects, such as a person, and includes passive infrared sensors, active infrared sensors, optical sensors (e.g., a camera or optical imaging device coupled to a processor executing an algorithm to detect differences between frame images), and ultrasonic sensors.

[0016] As used herein a touch sensor can be any device that detects objects, such as a person, by physical contact with the object. Such devices are also referred to as tactile sensors. Examples of touch or tactile sensors include piezoresistive sensors, piezoelectric sensors, capacitive sensors, and elastoresistive sensors.

[0017] The term “computer vision system” refers to a system comprising one or more video cameras or video imaging devices that are linked to a processor that analyzes the images to generate numerical or symbolic data to evaluate and/or quantify events captured by the imaging devices. Computer vision can be used to detect events, recognize objects, track objects and catalogue movement or position as a function of time. Computer vision systems include facility based systems including many video cameras imaging activities in the facility from multiple perspectives, as well as more compact or portable systems employing one, two or only a few imaging devices.

[0018] The disclosed Speed and Agility Kits or systems are sensor-enhanced and communicating physical objects used to advance the agility and speed of individuals or teams. While
these Speed and Agility Training Kits will be of particular interest to coaches, trainers and professional athletes, the systems can also be used for interacting games and activities by children and/or families. In addition the disclosed Speed and Agility Training Kits can be used for animal training and exercising.

[0019] The disclosed Speed and Agility Training Kits or systems are comprised of sensors, low-energy networking hardware and client software that allow interaction of users with the physical elements as well as with the configuration and analysis interface.

[0020] The disclosed Speed and Agility Training Kits or systems can include any combination of training objects such as cones, poles, steps, posts sleeves, goals, score sensors, strips, nets, hurdles, speed ladders, rings, passing arcs, charging stations, or other objects that can be positioned on a surface, hung or suspended from other objects, or otherwise located in an athletic skill evaluation or training facility. The objects can be impact, hack, tamper and/or weather resistant.

[0021] The physical elements or training objects of the system can have any combination of the following features: tripwire, touch sensitive, proximity detection, auto-calibration, range, pressure activated start/end/milestone triggers, mesh networking in router or node mode, GPS sensors, temperature sensors, humidity sensors, accelerometer, compass, light sensor, BLE connectivity, Wi-Fi low-energy connectivity, active/passive RFID capabilities, stackable charging, smart charging and maintenance station, ultra-bright, multi-color, multi-intensity light emitting diodes, flexible LED matrices, on-element displays LED, and lithium-battery.

[0022] The disclosed Speed and Agility Training Kits or systems can communicate with each other and a mobile device via Bluetooth LE and/or with a Computer Vision Engine (CVE) via active/passive RFID and optic beacons, to users (outbound) via visual displays and sounds and inbound via proximity sensors and RFIDs.

[0023] The training objects can communicate with a server for patches and updates via the internet-connected charging station.

[0024] The disclosed Speed and Agility Training systems can sense, catalogue and compute the movement of users and the milestones they achieve. Users can select from a master list of drills. Users select the drill and upon selection, those Speed and Agility Training elements necessary can light up and await to be picked up.

[0025] A display shows the user where each Speed and Agility Training element goes in the sequence or set up. The user can rely on a camera of her mobile device to confirm that the set up of the path or pattern has been properly configured. The user will rely for this on a mobile app, that is part of the kit, and that will allow detection of the shape, size, color and relative position of each of the elements using computer vision as well as the sensors available on the phone (compass, GPS and accelerometer) to determine location, orientation and position. The mobile app will evaluate this information to calibrate the drill profile and configure the kit elements in use over a network. Each element will be individually configured and it will confirm its proper configuration both on the mobile app as well as with the light up of an ultra bright LED.

[0026] The application can allow the user to play a demonstration version of the path or pattern that was configured to show the user how the drill is performed.

[0027] The system software allows mobile and desktop clients to analyze and visualize data in real-time and near-real-time mode, as well as in replay mode. Processing of data is distributed between the mobile and desktop clients as well as between the core servers for the service. Data can be encrypted between elements, devices and systems to enhance privacy and avoid data, identifier and key collisions.

[0028] Users of the system can be allowed to edit, update, add, configure and remove drills and profiles from the mobile and desktop clients. The server can also automatically provide them, as well as the elements and sensors, with relevant updates either to the core software (like those for bug fixes and improvements) as well as for new drills, patterns, paths and activities. For updates, the charging stations can be connected to the internet and provide conduit for simple and reliable firmware patches and updates as well as for automated maintenance and remote support.

[0029] Speed and Agility Training Kits can simply show the way or perform decisions based on logic, events or random behavior.

[0030] For instance, a soccer player could be directed to the left or to the right of a Speed and Agility Training system based on an arrow signal. A proximity sensor detects that a player has passed by and can relay that information to the following Smart Speed and Agility Training Kits.

[0031] Smart Speed and Agility Training Kits can record times, process players’ passages and communicate that information to the APP. Further information can be detected by a Computer Vision Engine via on-board visual beacons.

[0032] Score sensors can be placed in either targets and balls. The sensor can be optical, magnetic or ultrasound and may be complemented with computer vision which will be used both for the mobile application, recognizing obstacles, users and fixtures as well as for location and stats calculation.

[0033] The system also considers software for user devices to acquire data from the system as well as to configure and manage set up and sequences.

[0034] The system also considers the use of computer vision in several ways. First it will rely on computer vision on the user device for the detection of a sequence, path or pattern created by the user using the elements from the kit. The system can detect color, shape and relative position of the sequence, path of pattern.

[0035] GPS, differential GPS and RFIDs, Active RFID real-time locations systems (RTLX) or ultra wide band (UWB) geolocating technology can be used to aid relative location of each training object relative to other training objects and to general coordinates. Compass and other sensors (such as gyroscopes) on the user phone will be used to further aid location and directions, to overlay information and calibration.

[0036] Start/End mats will be used to open and close the circuit the users will be in. They might include pressure sensors, RFID readers and displays. RFID might be embedded in shoes, balls and/or shin guards.

[0037] Multiple on-board Multicolor High Intensity LED arrays as well as flexible LED matrices and/or on-element display screens on the elements or training objects of the system can be used to display sequences, directions, connection to network, connecting to network, low battery, and/or charging, and to provide input to and connection with a Computer Vision Engine (CVE).

[0038] This disclosure is provided to allow practice of the invention by those skilled in the art without undue experimentation, including the best mode presently contemplated and the presently preferred embodiment. Nothing in this disclo-
sure is to be taken to limit the scope of the invention, which is susceptible to numerous alterations, equivalents and substitutions without departing from the scope and spirit of the invention. The scope of the invention is to be understood from the appended claims.

1. A training system for evaluating and improving athletic skills, comprising:
   - at least two training objects, each training object having a radio frequency transmitter/receiver for communicating with another training object, a visual display, a sensor for detecting an athlete’s position relative to the training object, and a battery and electrical conductors for powering the radio frequency transmitter/receiver, visual display, and sensor.

2. The system of claim 1, in which the radio frequency transmitter/receiver is a Bluetooth device.

3. The system of claim 1, in which the radio frequency transmitter/receiver is a Wi-Fi device.

4. The system of claim 1, further comprising a mobile computing device executing an application enabling communication with the training objects.

5. The system of claim 1, in which the training objects are cones.

6. The system of claim 1, in which the sensor is a proximity sensor.

7. The system of claim 6, in which the proximity sensor is an infrared radiation proximity sensor.

8. The system of claim 1, in which the sensor is a motion detector.

9. The system of claim 8, in which the motion sensor is an optical sensor.

10. The system of claim 1, in which the sensor is a tactile sensor.

11. The system of claim 1, in which the training objects are nestable.

12. The system of claim 1, further comprising a charger for recharging the battery.

13. The system of claim 12, in which the training objects are nestable and include electrical contacts that facilitate concurrent electrical charging of a plurality of nested training objects.

14. The system of claim 1, further comprising a mobile computing device executing an application enabling communication with the training objects and with a computer vision system.

15. The system of claim 1, in which the visual display on the training object is a dot matrix display.

16. The system of claim 15, in which the dot matrix display comprises a sufficient number of dots arranged in rows and columns to facilitate display of at least any one alphabetical or numeric character.

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