



- [54] **SPORTS COMPUTER WITH GPS RECEIVER AND PERFORMANCE TRACKING CAPABILITIES**
- [76] Inventor: **William R. Fry**, 605 Echoglen Ct., Colorado Springs, Colo. 80906
- [21] Appl. No.: **08/742,373**
- [22] Filed: **Nov. 1, 1996**
- [51] Int. Cl.⁶ **G06F 165/00**
- [52] U.S. Cl. **701/213; 701/211; 701/214; 340/427; 340/432; 482/57**
- [58] Field of Search 701/200, 201, 701/207, 208, 209, 213, 214, 216, 211; 340/427, 432; 482/57

| | | | |
|-----------|--------|-------------|------------|
| 5,335,188 | 8/1994 | Brisson | 364/551.01 |
| 5,506,774 | 4/1996 | Nobe et al. | 701/213 |
| 5,629,668 | 5/1997 | Downs | 340/427 |

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Assistant Examiner—Gertrude Arthur
Attorney, Agent, or Firm—Gifford, Krass, Groh, Sprinkle, Anderson & Citkowski, PC

[57] **ABSTRACT**

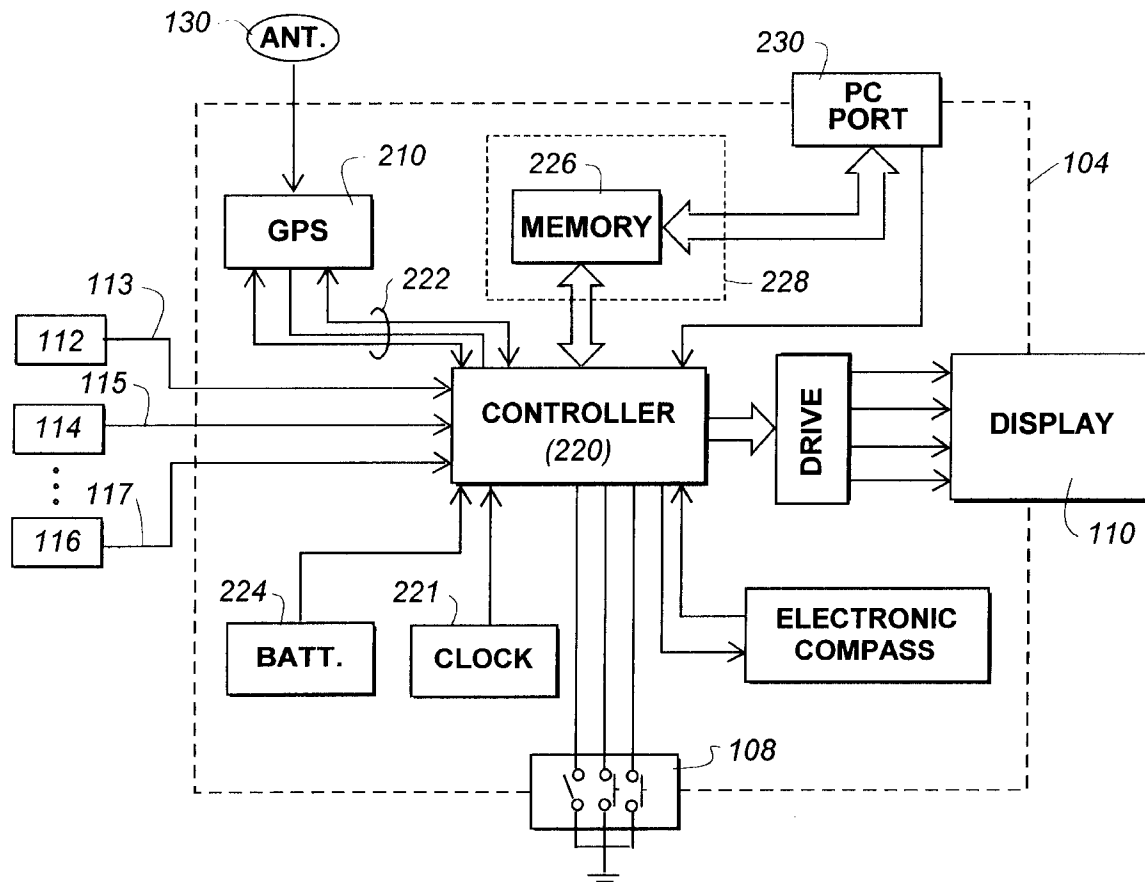
A sports computer having an integral global satellite positioning (GPS) receiver and computer interfacing capability enables functional and/or performance characteristics to be tracked and analyzed as a function of geographical position and/or elevation. The computer includes mounting means and/or interfaces to one or more sensors to measure operational and/or physiological parameters such as heart rate, or weather conditions such as temperature. Means are provided for downloading the stored geographical and sensor parameters to an external personal computer so that the data collected during a workout may be reviewed and analyzed on the screen of the PC. Preferably, map data may also be stored enabling the collected data to be viewed relative to the map information, for example, in superposition.

[56] **References Cited**

U.S. PATENT DOCUMENTS

| | | | |
|-----------|--------|--------------|------------|
| 4,163,216 | 7/1979 | Arpino | 340/870.13 |
| 4,642,606 | 2/1987 | Tsuyama | 324/174 |
| 4,862,395 | 8/1989 | Fey et al. | 364/561 |
| 5,008,647 | 4/1991 | Brunt et al. | 324/168 |
| 5,210,540 | 5/1993 | Masumoto | 701/213 |

21 Claims, 3 Drawing Sheets



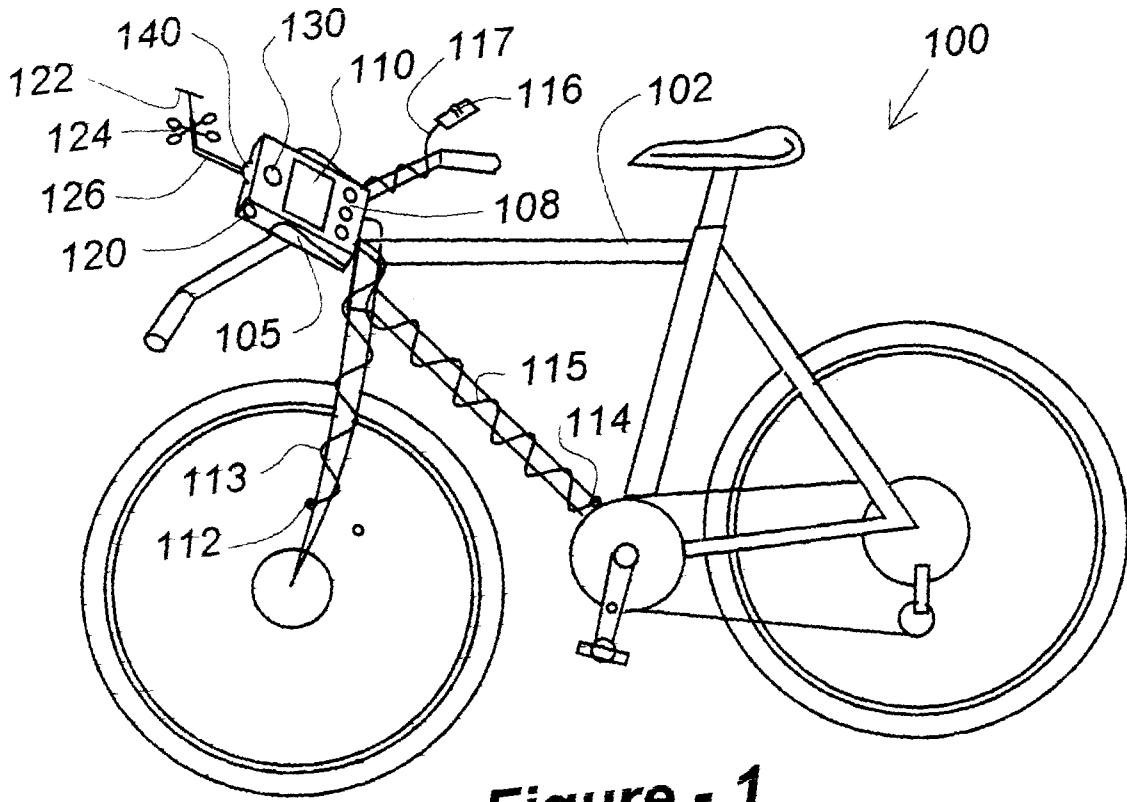


Figure - 1

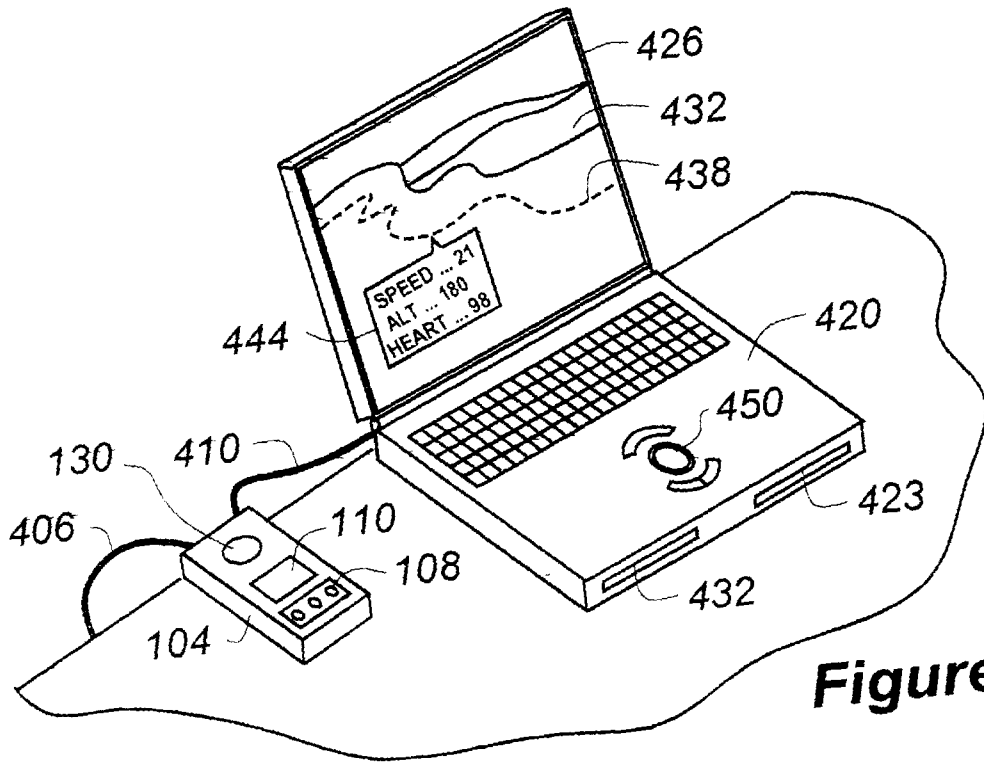
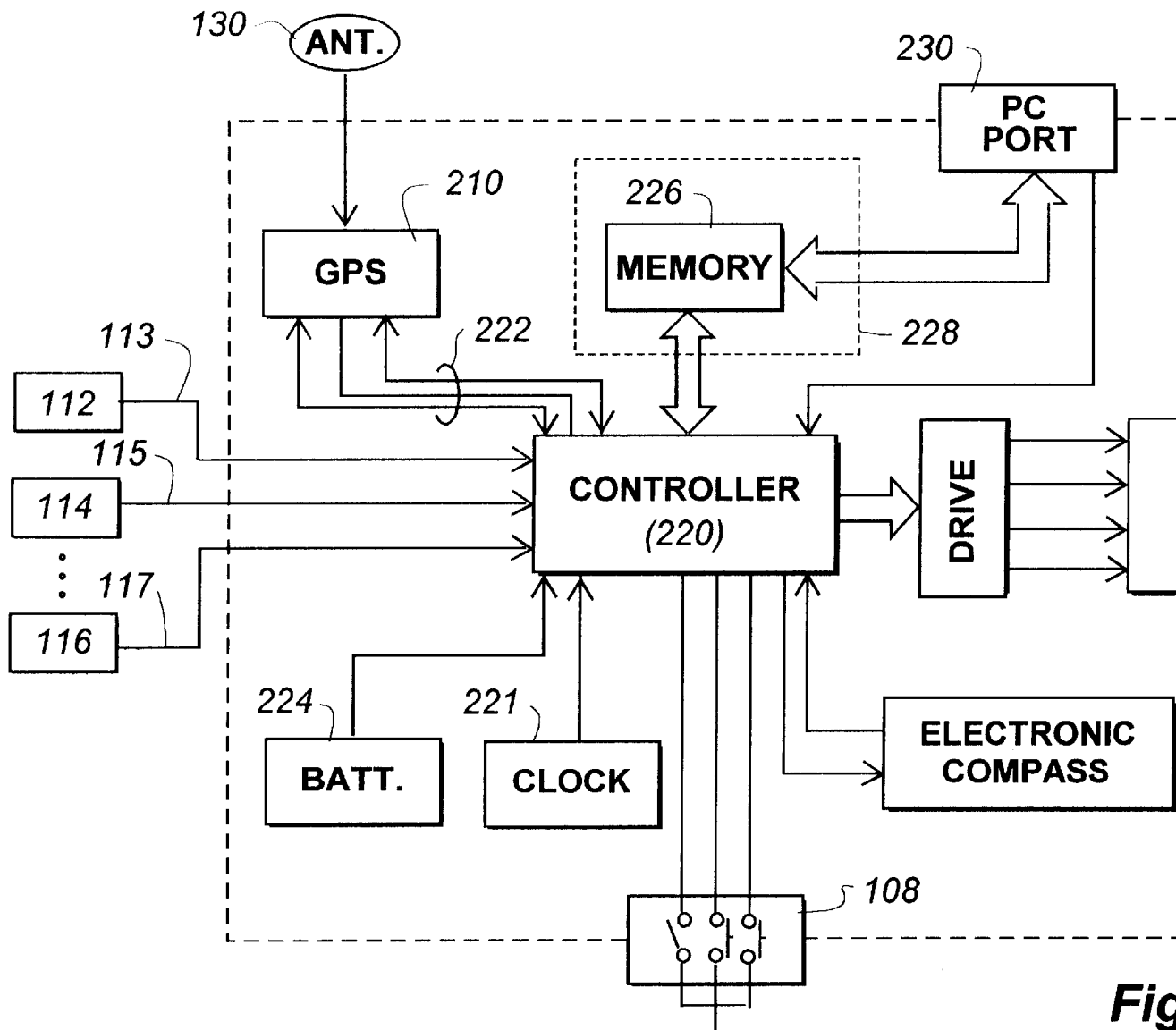


Figure - 4



Fig

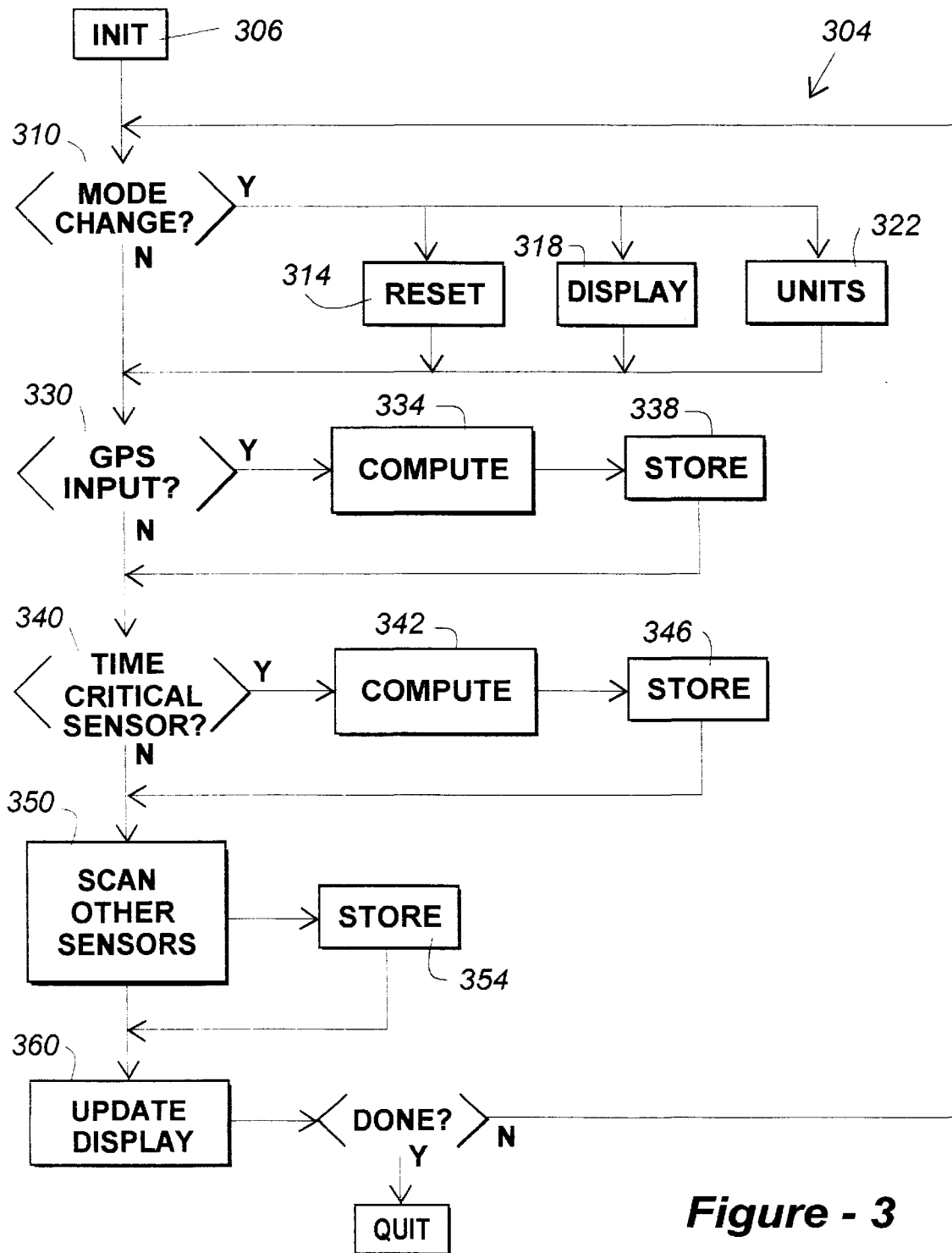


Figure - 3

**SPORTS COMPUTER WITH GPS RECEIVER
AND PERFORMANCE TRACKING
CAPABILITIES**

FIELD OF THE INVENTION

The present invention relates generally to computer-based systems of the type which display speed, used for sports training purposes, and, more particularly, to a system including a GPS receiver and means for transferring measurements to a personal computer to facilitate the tracking and mapping of route and athlete performance parameters.

BACKGROUND OF THE INVENTION

Sports-related measurement systems have grown dramatically in sophistication, over the years. With respect to bicycling, such systems have evolved from older, heavy speedometers, and the like, to modern electronic units capable of monitoring and displaying a number of performance characteristics.

So-called bicycle computers, which for example, track and electronically display speed, distance, and so forth, are now common in the art. The following examples are illustrative of known systems of this type. In U.S. Pat. No. 4,642,606, entitled "DATA DISPLAY UNIT FOR A BICYCLE" to Tsuyama, there is disclosed a handlebar-mounted display unit to which a wheel and crank sensor are communicatively interfaced, affording the calculation of running data such as speed, distance, average speed, maximum speed and so forth, based upon electrical pulses received from the wheel and crank sensors. U.S. Pat. No. 4,862,395 entitled "DATA DISPLAY INSTRUMENT FOR A BICYCLE" to Fey et al. includes most of the same features of the device of Tsuyama, but claims to improve upon the display by providing an analog scale field to display traveling speed and pedaling speed on a momentary, more readable basis. The '395 patent also includes a sensor associated with wheel rotation, and an additional sensor associated with pedal speed to determine cadence. In addition to the devices just described, others exist, both in patent literature and as commercially available products.

Bicycle computers also exist which have output ports enabling the device to be interfaced to a commercially available personal computer. The invention, "BICYCLE COMPUTER WITH MEMORY AND MEANS FOR COMPARING PRESENT AND PAST PERFORMANCE IN REAL TIME," disclosed in U.S. Pat. No. 5,335,188 to Brisson, for example, discloses a device for monitoring and comparing present, past and ideal performance on an exercise machine such as a bicycle. The system operates under a predetermined set of user-controlled instructions, to store a set of performance data in memory, which can then be compared against a stored, user selected performance data. Comparisons among these various data sets may then be displayed.

The exercise computer of Brisson includes a connector (65) for linking to an external computer, but the capabilities involved are extremely limited. In one example given, data in the memory of the computer itself may be transmitted to the external computer for "safekeeping," then transferred back to the cycle computer at a later time. The specified purpose is to ensure that the data are not lost should the memory suffer from a power failure, should the cycle computer be stolen. Alternatively, if the user rides on many different routes, the cycle computer may not have enough memory to save all ride data, in which case the connector (65) may be used to transfer a larger number of pace files to

an external computer such as a PC. Thus, according to the '188 patent, although a computer interface is provided, it is essentially limited in function to that of a memory expansion port.

5 Despite the various speed, distance and cadence functions available through existing cycle-mounted computers, none receive geographical coordinates through, for example, a global positioning satellite (GPS) receiver. Although a variety of vehicle-oriented tracking and mapping systems do exist which include GPS capabilities, none exist for bicycles. However, the inclusion of such a capability within a bicycle computer provides a number of unique advantages, as will be explained in the sections herein detailing the instant invention. As one such advantage, by utilizing an additional satellite to obtain altitude as well as longitude/latitude coordinates, the cyclist may be provided with elevation as well as geographic location information, which may be particularly useful in determining performance, endurance, and other characteristics. Moreover, by obtaining and storing position and/or altitude information, these characteristics may be tracked in terms of location and/or altitude, enabling the cyclist to visualize speed, cadence and other external and/or physiological characteristics as a function of geographical position, further allowing performance attributes to be tracked and plotted, for example, on an external personal computer. By combining GPS capabilities with the various functional and performance monitoring and tracking capabilities disclosed herein, the rider may not only visualize performance as a function of geometry, including incline, but will also be more equipped to optimize performance, by determining when cadence, gearshifting, and other riding changes were, or should have been, executed.

SUMMARY OF THE INVENTION

The present invention improves upon the prior art by providing a sports computer having an integral global satellite positioning (GPS) receiver and computer interfacing capability, enabling functional and/or performance characteristics to be tracked and analyzed as a function of geographical position and/or elevation. Though the descriptions herein focus on a bicycling implementation, the invention is readily applicable to other sports involving travel over time, regardless of the equipment involved, including running, rowing, kayaking, gliding, etc. In a cycling application, for example, in addition to sensors for vehicle speed and cadence, the invention further includes, in alternative embodiments, sensors for heart rate, and weather conditions such as temperature and wind speed/direction.

In a preferred embodiment, the device according to the invention includes means for mounting an enclosed mobile computer system directly to the athlete or equipment in use, with interfaces to one or more sensors which measure performance characteristics. A GPS receiver and small antenna are also included within and on the device, enabling the geographical information to be gathered and stored therein. Preferably the receiver communicates with sufficient satellites to determine altitude information as well as longitudinal and latitudinal coordinates. The device according to the invention includes sufficient memory to store geographical coordinates on a periodic basis, even for a long-term use, which may constitute several days.

Also in a preferred embodiment, the inventive device is capable of being interfaced to an external computer such as a personal computer (PC), including a laptop computer, so that the data collected during a workout may be reviewed

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