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(54) **SYSTEM FOR MONITORING OPERATION OF A TOY VEHICLE**

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(57) **ABSTRACT**

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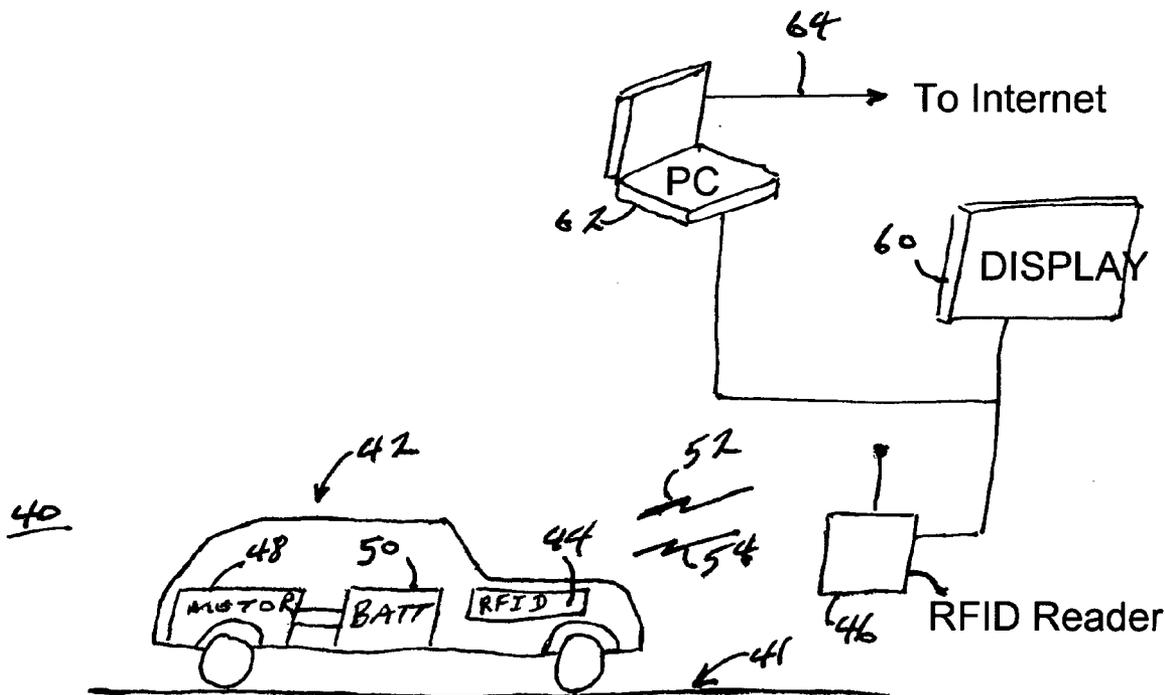
A system for monitoring operation of at least one toy vehicle traveling a path includes: (a) a respective radio frequency identification device carried on each respective vehicle; each respective radio frequency identification device being empowered by an interrogation for generating a coded response to the interrogation; the coded response distinguishing each respective vehicle from other vehicles; (b) at least one interrogating device; each respective interrogating device being situated to effect the interrogation of a respective radio frequency identification device as the respective radio frequency identification device is carried past an interrogation locus on the path; and (c) a display device coupled with the at least one interrogating device for displaying results of the interrogation.

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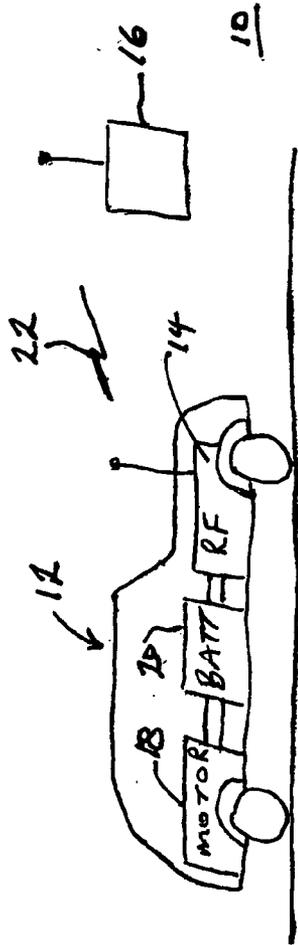


FIG. 1
(PRIOR ART)

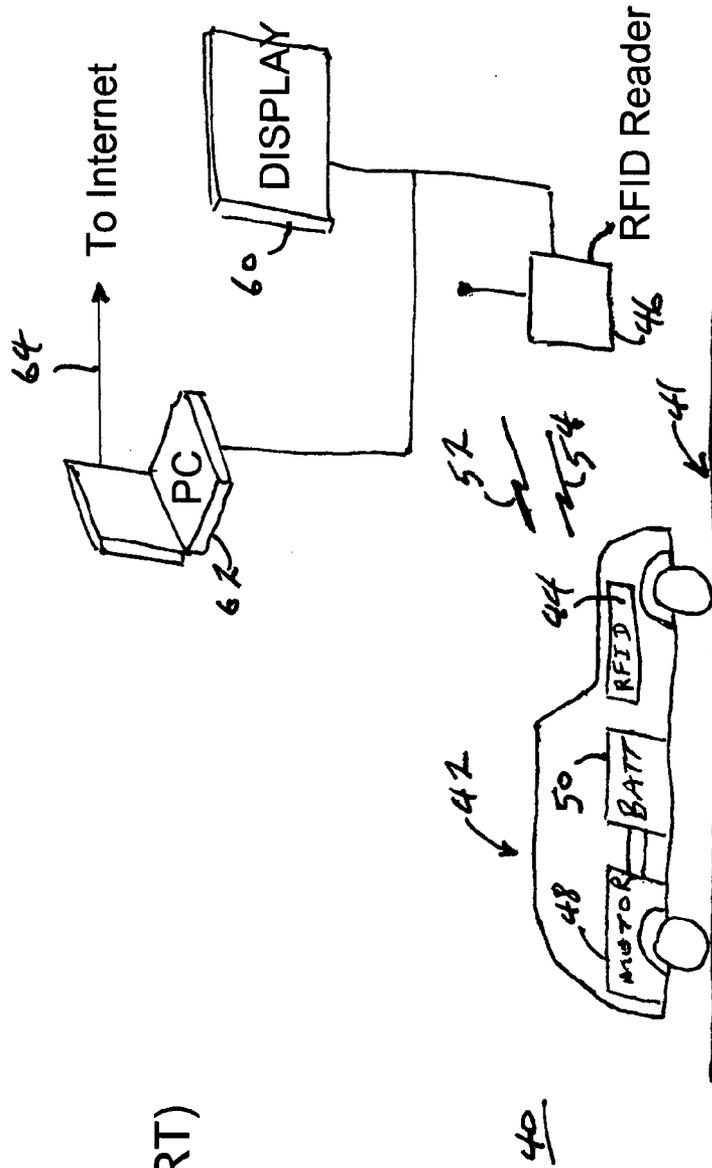


FIG. 2

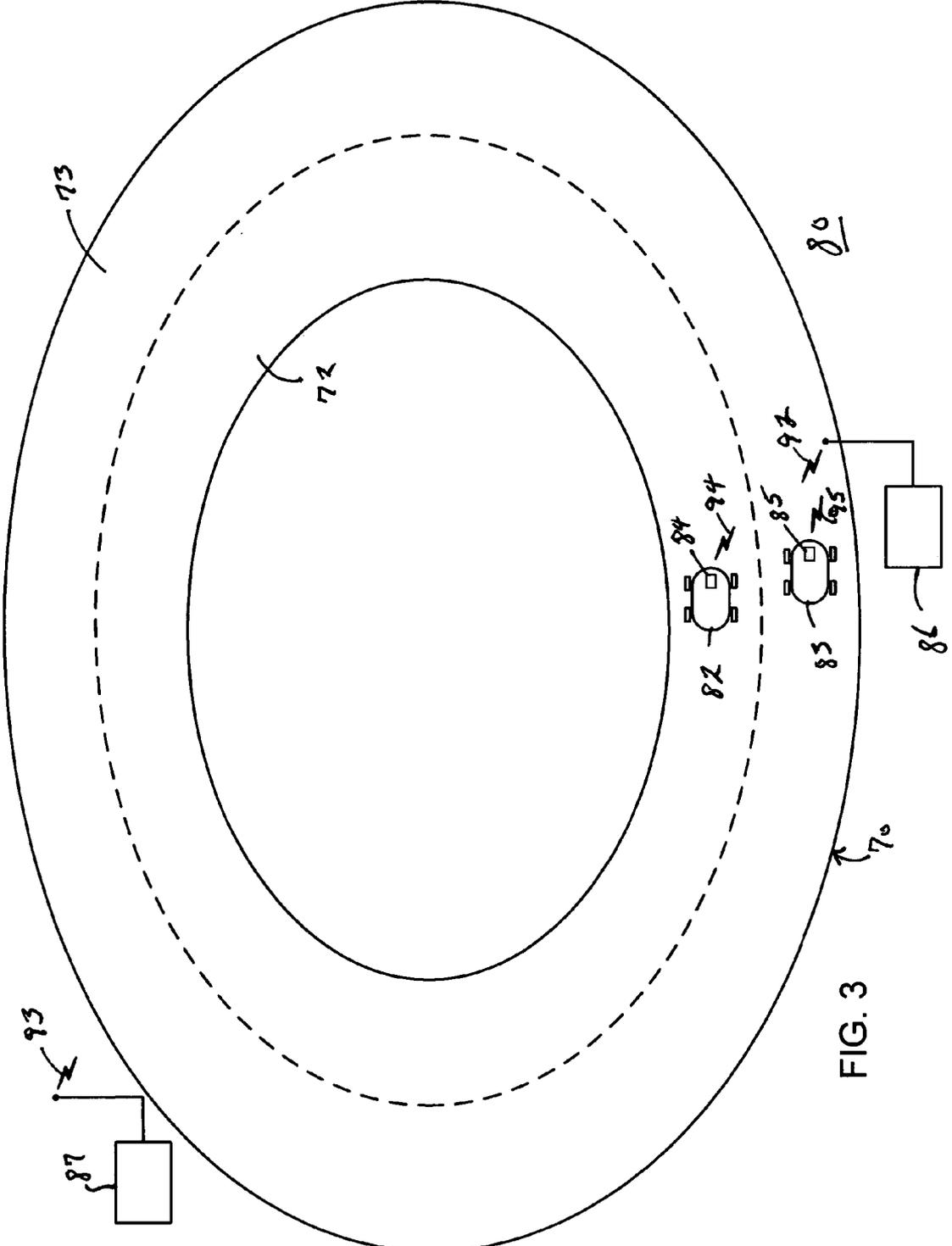


FIG. 3

SYSTEM FOR MONITORING OPERATION OF A TOY VEHICLE

BACKGROUND OF THE INVENTION

[0001] The present invention is directed to a system for monitoring operation of one or more toy vehicles traveling a path. By way of example and not by way of limitation, the toy vehicles with which the system of the present invention may be advantageously used include RC (radio-controlled) vehicles and include slot car toy vehicles operating on a slot car track.

[0002] Monitoring devices such as lap counters and timers for toy vehicles have been known in the past. However, prior art monitoring devices involved placing a radio transceiver in the toy vehicle that transmitted an identification code. There were problems with the prior art devices including the radio transceiver required on-board power to operate, so it was necessary to "rob" power from the toy vehicle's battery that could otherwise have been available for powering the vehicle's motor. The transceiver added significant weight to the vehicle, thereby further reducing the speed and battery life of the vehicle. Further, the transceiver devices were expensive, on the order of \$80.00.

[0003] There is a need for a monitoring device, such as a lap counter and timer for toy vehicles that is lightweight, inexpensive and does not require on-board power for its operation.

SUMMARY OF THE INVENTION

[0004] A system for monitoring operation of at least one toy vehicle traveling a path includes: (a) a respective radio frequency identification device carried on each respective vehicle; each respective radio frequency identification device being empowered by an interrogation for generating a coded response to the interrogation; the coded response distinguishing each respective vehicle from other vehicles; (b) at least one interrogating device; each respective interrogating device being situated to effect the interrogation of a respective radio frequency identification device as the respective radio frequency identification device is carried past an interrogation locus on the path; and (c) a display device coupled with the at least one interrogating device for displaying results of the interrogation.

[0005] It is, therefore, an object of the present invention to provide a monitoring device, such as a lap counter and timer for toy vehicles that is lightweight, inexpensive and does not require on-board power for its operation.

[0006] Further objects and features of the present invention will be apparent from the following specification and claims when considered in connection with the accompanying drawings, in which like elements are labeled using like reference numerals in the various figures, illustrating the preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a schematic diagram of a prior art monitoring device used with a toy vehicle.

[0008] FIG. 2 is a schematic diagram of a monitoring device for use with a toy vehicle according to the present invention.

[0009] FIG. 3 is a schematic plan view of the monitoring device of the present invention employed in connection with a slot car track and a plurality of toy vehicles.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0010] The present invention employs a radio frequency identification (RFID) device such as an RFID tag mounted inside a toy vehicle. The toy vehicle may be any sort of toy vehicle for which it is desirable that certain operational parameters be measured. Operational parameters measurable by the present invention include, by way of example and not by way of limitation, passing of the vehicle by a predetermined locus, elapsed time since the vehicle last passed by the predetermined locus, speed of the vehicle and comparison of parameters between two or more vehicles operating together. Providing a memory capability to the system enables comparison of operating parameters among vehicles operating separately over time. Such a time-independent capability permits establishment of track records and other indicators or milestones that add realism to play with toy vehicles.

[0011] Toy vehicles contemplated as usefully employing the present invention include radio-controlled (RC) cars (gas powered or battery powered), slot car-type vehicles used with slot car race tracks and other substantially non-tethered vehicles.

[0012] An interrogating device, preferably embodied in an RFID reader device, is situated near a path over which the toy vehicle will travel, such as a race track or a slot car track. The interrogating device interrogates RFID tags attached or secured to toy vehicles as the vehicles pass the interrogating device. The time of passage is noted for each vehicle. Intervals between passings may be recorded for calculating speed of vehicles.

[0013] The process of interrogation generally involves sending a coded or otherwise recognizable radio frequency (RF) signal that is received by an RFID tag. The interrogating signal excites circuitry contained on or in the RFID tag (e.g., a resonant circuit) and the RFID tag emits a coded signal in response to the interrogating signal. Each RFID tag is configured to emit a predetermined coded response, and each coded response identifies a respective toy vehicle sufficiently to distinguish the respective toy vehicle from other toy vehicles. Adding new coding to RFID tags is a relatively simple matter during the process of manufacturing the RFID tags. Thus, it is preferred (and easily accomplished) that each respective toy vehicle have its own distinct and unique coded response signal emitted by its attached RFID tag.

[0014] Providing each vehicle with its own unique code for transmission by its attached RFID tag significantly increases versatility of the toy vehicles. For example, one user could take a toy vehicle to a friend's track and a monitoring system at the friend's track can distinguish the new vehicle from other vehicles without confusion.

[0015] A display device coupled with the interrogating device in the system of the present invention cooperated with the interrogating device to display which vehicles are on the track and how fast the vehicles are going. Other information may also be displayed, including by way of

example and not by way of limitation, track records, average speeds, comparisons for each vehicle with track records and average speeds, and other interesting information that may be calculated from noted times at which each respective vehicle passes the locus or position at which the RFID tags send their coded response signals in response to interrogation.

[0016] Interrogating devices, or display units or both interrogating devices and display units may be coupled with a personal computer (PC) or other computing equipment for calculating or displaying other information. A connection with the Internet or another network may be established with the system, directly or through computing equipment such as a PC, for linking with other vehicle racing systems. Using such a linking arrangement permits organizing competitive racing events and other contemporaneous events among vehicles at locations that are remote from each other.

[0017] Using RFID tags for identification respective toy vehicles is advantageous because no power is required for operating the identification equipment carried on-board the toy vehicle and, therefore, no power “robbing” from the vehicle occurs.

[0018] RFID tags are lightweight. The RFID tags of the present invention are preferably embodied in a sticker that is adhesively secured or attached to an inside surface of the vehicle. The essentially negligible weight of the tag is advantageous because it requires negligible additional power for the toy vehicle to haul it about.

[0019] RFID tags are inexpensive, especially as compared with the prior art RF transceivers used to identify toy vehicles. RFID tags presently cost less than ten cents each.

[0020] RFID technology is easily and inexpensively scaled to meet whatever identification demands may be presented. There is virtually no limit to the number of identification codes that can be provided for distinguishing individual toy vehicles. RFID tags may be easily installed when the toy vehicles are manufactured. In such manner, a manufacturer can keep track of individualizing coding for each respective vehicle, and can anticipate when additional coding will be required to maintain individuality of code identifications among vehicles.

[0021] More than one interrogating device may be used so that additional data may be observed, calculated or derived, such as vehicle performance in particular portions of a track or other data.

[0022] **FIG. 1** is a schematic diagram of a prior art monitoring device used with a toy vehicle. In **FIG. 1**, a monitoring system 10 for monitoring operation of a toy vehicle 12 includes a radio frequency (RF) transceiver 14 and an RF receiver device 16. Vehicle 12 is propelled by an on-board motor 18 powered by an on-board battery 20. RF transceiver 14 is also powered by battery 20. RF transceiver 14 transmits a coded signal 22 identifying vehicle 12. RF receiver 16 receives and decodes coded signal 22 to identify vehicle 12. Other components such as a display (not shown in **FIG. 1**) may be included in prior art system 10 for presenting data to a user, including for example identity of vehicle 12, time of passing of vehicle 12 past RF receiver device 16, number of laps past RF receiver device 16, time elapsed between passes past RF receiver device 16 and other data.

[0023] There are problems with prior art system 10. Powering RF transceiver device 16 using on-board battery 20 “robs” power from battery 20 that could otherwise be available for powering motor 20. RF transceiver device 16 adds significant weight to vehicle 12, thereby further reducing the speed of vehicle 12 and reducing life of battery 20. RF transceiver device 16 is expensive, on the order of \$80.00.

[0024] **FIG. 2** is a schematic diagram of a monitoring device for use with a toy vehicle according to the present invention. In **FIG. 2**, a monitoring system 40 for monitoring operation of a toy vehicle 42 includes a radio frequency identification (RFID) device 44 and an RF interrogating device 46. Vehicle 42 is propelled by an on-board motor 48 powered by an on-board battery 50. RFID device 44 is preferably embodied in an RFID tag, and is most preferable embodied in an adhesively attached RFID tag attached or secured to an inner surface of vehicle 42.

[0025] Interrogating device 46 is preferably embodied in an RFID reader device situated near a path 41 over which vehicle 42 travels. By way of example and not by way of limitation, path 41 may be embodied in a race track or a slot car track. Interrogating device 46 interrogates RFID device 44 as vehicle 42 passes interrogating device 46. The time at which passage occurs is noted for vehicle 42. Intervals between passings may be recorded for calculating speed of vehicle 44.

[0026] The process of interrogation generally involves interrogating device 46 sending a coded or otherwise recognizable radio frequency (RF) interrogating signal 52 that is received by RFID device 44. Interrogating signal 52 excites circuitry contained on or in RFID device 44 (e.g., a resonant circuit) and RFID device 44 emits a coded signal 54 in response to interrogating signal 52. RFID device 44 is configured to emit a predetermined coded signal 54 that identifies vehicle 42 sufficiently to distinguish vehicle 42 from other toy vehicles (not shown in **FIG. 2**). Interrogating device 46 receives and decodes coded signal 54 to identify vehicle 42. Other components such as a display device 60 may be included in system 40 for presenting data to a user, including for example identity of vehicle 42, time at which vehicle 42 passes interrogating device 46, number of laps vehicle 42 makes past interrogating device 46, time elapsed between passes by vehicle 42 past interrogating device 46 and other data.

[0027] Display device 60 is coupled with interrogating device 46 and cooperates with interrogating device 46 to display whether vehicle 42 is alone on path 41 (or show that other vehicles also are using path 41; not shown in **FIG. 2**) and how fast vehicle 42 (and other vehicles, if present) are going. Individual coding of RFID devices 44 for each respective vehicle 42 permits individual tracking and display of respective vehicles by display device 60 when more than one vehicle 42 is present on a track, such as path 41. Other information may also be displayed by display unit 60, including by way of example and not by way of limitation, track records, average speeds, comparisons for each vehicle with track records and with average speeds, and other information that may be calculated from noted times at which each respective vehicle passes the locus or position at which RFID devices 44 send their coded response signals in response to interrogation by interrogating device 46.

[0028] Interrogating device 46, or display unit 60 or both interrogating device 46 and display unit 60 may be coupled with a personal computer (PC) or other computing equipment 62. Computing equipment 62 may be used to calculate other information or effect displaying of other information by computing equipment 62 or by display device 60. A connection 64 with the Internet or another network may be established with system 40, directly or through computing equipment 62, for linking with other vehicle racing systems (not shown in FIG. 2). Using such a linking arrangement permits organizing competitive racing events and other contemporaneous events among vehicles at locations that are remote from each other.

[0029] Using RFID device 44 for identification of vehicle 42 is advantageous because no power is required from battery 50 for operating the RFID device 44 and, therefore, no power “robbing” from vehicle 42 occurs.

[0030] RFID device 44 is lightweight. RFID device 44 is preferably embodied in a sticker that is adhesively secured or attached to an inside surface of vehicle 42. The essentially negligible weight of RFID device 44 is advantageous because it requires negligible additional power for the vehicle 42 to haul it about.

[0031] RFID device 44 is inexpensive, especially as compared with the prior art RF transceivers used to identify toy vehicles (FIG. 1). Typical devices such as RFID device 44 presently cost less than ten cents each.

[0032] More than one interrogating device 46 (not shown in FIG. 2) may be used in system 40 so that additional data may be observed, calculated or derived, such as vehicle acceleration, vehicle performance in particular portions of a track or other data.

[0033] FIG. 3 is a schematic plan view of the monitoring device of the present invention employed in connection with a slot car track and a plurality of toy vehicles. In FIG. 3, a monitoring system 80 for monitoring operation of toy vehicles 82, 83 on a slot car track 70 includes a radio frequency identification (RFID) device 84 on vehicle 82 and an RFID device 85 on vehicle 83. System 80 further includes RF interrogating devices 86, 87 arranged about the periphery of track 70. Vehicles 82, 83 are each propelled by an on-board motor powered by an on-board battery (not shown in detail in FIG. 3; see FIG. 2). Vehicle 82 travels in a lane 72 of track 70, and vehicle 83 travels in a lane 73 of track 70. RFID devices 84, 85 are each preferably embodied in an RFID tag, and are most preferably each embodied in an adhesively attached RFID tag attached or secured to an inner surface of vehicles 84, 85.

[0034] Interrogating devices 86, 87 are each preferably embodied in an RFID reader device situated near track 70. Interrogating device 86 interrogates RFID device 84 as vehicle 82 passes interrogating device 86, and interrogates RFID device 85 as vehicle 83 passes interrogating device 86. Interrogating device 87 also interrogates RFID device 84 as vehicle 82 passes interrogating device 87, and interrogates RFID device 85 as vehicle 83 passes interrogating device 87. The time at which passage occurs for each vehicle 82, 83 is noted by each of interrogating devices 86, 87. Noting intervals between successive passages past a respective interrogating device 86, 87 permits calculation of the speed at which a vehicle 82, 83 is going. Using more than one

interrogating device 86, 87 (in contrast with using only one interrogating device; e.g., interrogating device 46, FIG. 2) permits additional data to be observed, calculated or derived, such as vehicle performance in particular portions of a track or other data.

[0035] The process of interrogation generally involves an interrogating device sending an interrogating signal to a vehicle as the vehicle passes the interrogating device. Thus, interrogating device 86 sends a coded or otherwise recognizable radio frequency (RF) interrogating signal 92 that is received by RFID devices 84, 85. Interrogating signal 92 excites circuitry contained on or in RFID devices 84, 85 (e.g., a resonant circuit). RFID device 84 emits a coded signal 94 in response to interrogating signal 92. RFID device 85 emits a coded signal 95 in response to interrogating signal 92. Each of RFID devices 84, 85 is configured to emit a predetermined coded signal 94, 95 that identifies a respective vehicle 82, 83 sufficiently to distinguish each of vehicle 82, 83 from the other of vehicles 82, 83. Interrogating device 86 receives and decodes coded signals 94, 95 to identify respective vehicles 82, 83. Interrogating device 87 operates in similar manner with respect to vehicles 82, 83 when vehicles 82, 83 are in the vicinity of interrogating unit 87.

[0036] Other components such as a display device and computing equipment may be included in system 80 for use in manners similar to their use in system 40 (FIG. 2). By way of illustration and not by way of limitation, a display device may be coupled with either or both interrogating devices 86, 87 and cooperate with interrogating devices 86, 87 to display whether either of vehicles 82, 83 is alone on track 70 or how many vehicles 82, 83 are operating on track 70 and how fast vehicles 82, 83 are going. Individual coding of RFID devices 84, 85 for each respective vehicle 82, 83 permits individual tracking and display for respective vehicles 82, 83 by a display device (not shown in FIG. 3; see FIG. 2) when more than one of vehicles 82, 83 is present on track 70. Other information may also be displayed by a display unit, including by way of example and not by way of limitation, track records, average speeds, comparisons for each vehicle with track records and with average speeds, and other information that may be calculated from noted times at which each respective vehicle passes the locus or position at which RFID devices 84, 85 send their coded response signals 94, 95 in response to an interrogation signal 92, 93 received from an interrogating device 86, 87.

[0037] Interrogating devices 86, 87, or a display unit (not shown in FIG. 3) or all of interrogating devices 86, 87 and a display unit may be coupled with a personal computer (PC) or other computing equipment (not shown in FIG. 3; see FIG. 2). Computing equipment may be used to calculate other information or effect displaying of other information by the computing equipment or by a display device. A connection with the Internet or another network (not shown in FIG. 3; see FIG. 2) may be established with system 80, directly or through computing equipment, for linking with other vehicle racing systems (not shown in FIG. 3). Using such a linking arrangement permits organizing competitive racing events and other contemporaneous events among vehicles at locations that are remote from each other.

[0038] It is to be understood that, while the detailed drawings and specific examples given describe preferred embodiments of the invention, they are for the purpose of

illustration only, that the apparatus and method of the invention are not limited to the precise details and conditions disclosed and that various changes may be made therein without departing from the spirit of the invention which is defined by the following claims:

I claim:

1. A system for monitoring operation of at least one toy vehicle traveling a path; the system comprising:

- (a) a respective radio frequency identification device carried on each respective vehicle of said at least one toy vehicle; each said respective radio frequency identification device being empowered by an interrogation for generating a coded response to said interrogation; said coded response distinguishing each said respective vehicle from other vehicles of said at least one toy vehicle;
- (b) at least one interrogating device; each respective interrogating device of said at least one interrogating device being situated to effect said interrogation of a respective said radio frequency identification device as said respective radio frequency identification device is carried past an interrogation locus on said path; and
- (c) a display device coupled with said at least one interrogating device for displaying results of said interrogation.

2. A system for monitoring operation of at least one toy vehicle traveling a path as recited in claim 1 wherein said at least one radio frequency identification device is one radio frequency identification device carried on each said respective vehicle.

3. A system for monitoring operation of at least one toy vehicle traveling a path as recited in claim 1 wherein said at least one radio frequency identification device is one radio frequency identification tag carried on each said respective vehicle.

4. A system for monitoring operation of at least one toy vehicle traveling a path as recited in claim 3 wherein each said respective vehicle is configured having an inside surface and an outside surface, and wherein said radio frequency identification tag is adhesively secured to said inside surface of each said respective vehicle.

5. A system for monitoring operation of at least one toy vehicle traveling a path as recited in claim 1 wherein said at least one toy vehicle is at least one radio-controlled toy vehicle.

6. A system for monitoring operation of at least one toy vehicle traveling a path as recited in claim 1 wherein said at least one toy vehicle is at least one slot car toy vehicle and wherein said path is a lane in a slot car track.

7. A system for monitoring operation of at least one toy vehicle traveling a path as recited in claim 1 wherein said at least one interrogating device and said display device cooperate to display time between appearances of said at least one vehicle at said interrogation locus.

8. A system for monitoring operation of at least one toy vehicle traveling a path as recited in claim 1 wherein said at least one interrogating device and said display device cooperate to display speed of said at least one vehicle.

9. A system for monitoring operation of at least one toy vehicle traveling a path as recited in claim 3 wherein said at least one toy vehicle is at least one radio-controlled toy vehicle.

10. A system for monitoring operation of at least one toy vehicle traveling a path as recited in claim 3 wherein said at least one toy vehicle is at least one slot car toy vehicle and wherein said path is a lane in a slot car track.

11. A system for monitoring operation of at least one toy vehicle traveling a path as recited in claim 9 wherein said at least one interrogating device and said display device cooperate to display time between appearances of said at least one vehicle at said interrogation locus.

12. A system for monitoring operation of at least one toy vehicle traveling a path as recited in claim 11 wherein said at least one interrogating device and said display device cooperate to display speed of said at least one vehicle.

13. A system for monitoring operation of at least one toy vehicle traveling a path as recited in claim 9 wherein said at least one interrogating device and said display device cooperate to display time between appearances of said at least one vehicle at said interrogation locus.

14. A system for monitoring operation of at least one toy vehicle traveling a path as recited in claim 13 wherein said at least one interrogating device and said display device cooperate to display speed of said at least one vehicle.

15. A position monitoring system for a toy vehicle; the system comprising:

- (a) an identifying device on said vehicle; said identifying device generating a coded signal in response to an interrogating signal; said coded signal identifying said vehicle;
- (b) an interrogating device situated to transmit said interrogating signal to said vehicle as said vehicle passes an interrogation locus; said interrogating device receiving said coded response; and
- (c) a display device coupled with said interrogating device; said interrogating device and said display device cooperating to display at least one operating characteristic of said vehicle.

16. A position monitoring system for a toy vehicle as recited in claim 15 wherein said identifying device is a radio frequency identification tag.

17. A position monitoring system for a toy vehicle as recited in claim 15 wherein said toy vehicle is configured having an inside surface and an outside surface, and wherein said radio frequency identification tag is adhesively secured to said inside surface.

18. A position monitoring system for a toy vehicle as recited in claim 15 wherein said toy vehicle is a radio-controlled toy vehicle.

19. A position monitoring system for a toy vehicle as recited in claim 15 wherein said toy vehicle is a slot car toy vehicle for operation on a slot car track.

20. A position monitoring system for a toy vehicle as recited in claim 18 wherein said display device and said interrogating device cooperate to display time between receiving two coded signals in response to two successive interrogating signals.

21. A position monitoring system for a toy vehicle as recited in claim 20 wherein said display device and said interrogating device cooperate to display speed of said toy vehicle between receiving two coded signals in response to two successive interrogating signals.

22. A position monitoring system for a toy vehicle as recited in claim 19 wherein said display device and said

interrogating device cooperate to display time between receiving two coded signals in response to two successive interrogating signals.

23. A position monitoring system for a toy vehicle as recited in claim 22 wherein said display device and said

interrogating device cooperate to display speed of said toy vehicle between receiving two coded signals in response to two successive interrogating signals.

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