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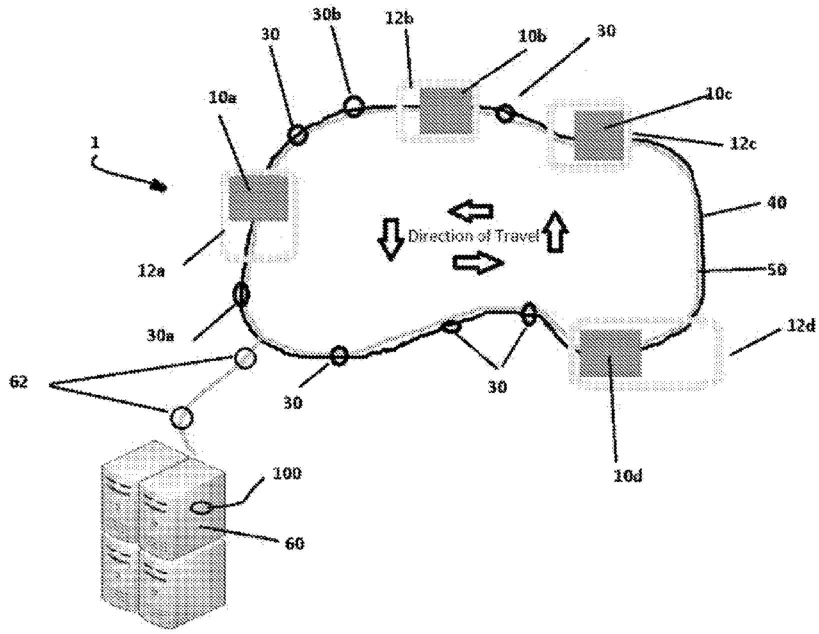

FIGURE 1

(57) Abstract: A ride control system uses logic to define and track a virtual space, or bubble, in real time around a plurality of ride vehicles deployed along a predefined vehicle path to operate each independently of, and safely with respect to, the other ride vehicles deployed along the same predefined vehicle path at substantially the same time.

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BUBBLE LOGIC FOR RIDE VEHICLE CONTROL

Inventors: Michael Boshears; Lauren Marie Etta

RELATION TO PRIOR APPLICATIONS

[0001] This application claims the benefit of, and priority through, United States Provisional Application 62/129,725, titled “Bubble Logic for Ride Vehicle Control,” filed March 6, 2015.

BACKGROUND

[0002] Dark ride vehicle systems have typically relied on “zone logic” type systems, where position around the track is defined by a zone area. The system knows which zones are occupied by vehicles but not where in the zone the vehicle is. Spacing the vehicle so that an empty zone is between each vehicle ultimately helps ensure that the ride vehicles do not collide with each other.

[0003] The zone logic approach is effective, but ultimately results in inefficient design of a dark ride vehicle system. Considerable effort is required to ensure that the zones are properly placed along the ride vehicle path, and final installation and programming may be inhibited due to the zone definitions. In addition, operation of the attraction containing the dark ride vehicle systems is inefficient due to the limitations of the zone logic approach. For example, the precise location of the ride vehicles is not known with a zone logic system, so the control system must take into account a large variance of position, thus limiting the error and recovery modes available for safe operation.

[0004] Although discussed below in terms of a dark ride system, the invention is equally applicable to other instances of multiple computer controlled vehicles on a path, such as with driverless automobiles or the like.

FIGURES

[0005] Various figures are included herein which illustrate aspects of embodiments of the disclosed inventions.

[0006] **Fig. 1** is a block schematic diagram of an exemplary ride control system;

[0007] **Fig. 2** is a diagram of an exemplary ride control system virtual space; and

[0008] **Fig. 3** is a flowchart of an exemplary ride control system method.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0009] Referring to **Fig. 1**, ride control system 1, a dynamic and finite system for sensing a position of one or more ride vehicles 10 (e.g., 10a-10d), comprises a plurality of vehicle path sensors 30 (e.g. 30a-30d) deployed about predefined vehicle path 40, each vehicle path sensor 30a-30d of the plurality of vehicle path sensors 30 comprising a unique position identifier; control system 60; data communication system 50 deployed proximate predefined vehicle path 40 and operative to transmit data at a predetermined rate of speed to control system 60; and software 100 operatively resident in control system 60.

[0010] Predefined vehicle path 40 comprises a tracked vehicle path, a non-tracked vehicle path, or a combination thereof.

[0011] In an embodiment, data communication system 50 comprises a high data rate communication system which may further comprise a leaky coaxial communication system. In most embodiments, the data rate should be sufficient to overcome any lag inherent in transmitting data, processing the data, and sending one or more commands as necessary to each ride vehicle 10 to achieve the desired safety distances 30 (e.g., 30a-30d).

[0012] In preferred embodiments control system 60 is disposed proximate predefined vehicle path 40 but does not need to be, e.g. it can be remotely situated from predefined vehicle path 40. In certain embodiments, a data communication system 50 comprises a set of transceivers 62, which can be wired or wireless, to allow data communication between ride vehicles 10, one or more portions of data communication system 50, and control system 60. Although not illustrated in **Fig. 1**, it will be understood by those of ordinary skill in the data communication and ride vehicle arts that one or more transceivers 62 may be located on one or more, e.g. each, ride vehicles 10.

[0013] Although illustrated as being spaced at certain intervals, the actual spacing of vehicle path sensors 30 about and/or along predefined vehicle path 40 is a function of the control desired for each ride vehicle 10, e.g. in part it is a function of desired speed and/or spin and/or other characteristics such as pause/wait time along predefined vehicle path 40. Further, in various embodiments, vehicle path sensor 30 may comprise a passive sensor, a magnetic encoded strip, an acoustic positioning operator station (APOS) sensor, or the like, or a combination thereof. Further, the unique position identifier typically further comprises a predefined set of spatial coordinates related to a current position of its associated vehicle path sensor 30 with respect to predefined vehicle path 40. This unique position identifier can comprise X-Y coordinates, data produced by a gyroscopic incremental encoder, or the like, or a combination thereof.

[0014] In an embodiment, vehicle sensor detectors 14 (**Fig. 2**) may be used to interact with vehicle path sensors 30 and relay information such as the unique position identifier to control system 60 via data communication system 50 or ride vehicle communication system 15 (**Fig. 2**). In a first embodiment, these vehicle sensor detectors 14 comprise active detectors triggered by vehicle path detectors 30, and relay information such as the unique position identifier to control system 60 via data communication system 50. In other embodiments, vehicle sensor detectors 14 comprise one or more triggers operative to trigger active vehicle path sensor 30 when ride vehicle 10 passes near or over vehicle path sensor 30 and vehicle path sensors 30 relay information such as the unique position identifier to control system 60 via data communication system 50. In either embodiment, vehicle communication system 15, which may comprise a transceiver, and/or separate transceivers 62 may be used to relay the data.

[0015] Software 100, typically resident in control system 60, comprises various software modules, as will be familiar to those of ordinary skill in the computer programming art. Typically, software 100 comprises deterministic location software 101, deterministic spatial software 102, and vehicle control software 103 which are interoperably related. These are not specifically illustrated in the figures as one of ordinary skill in programming arts can understand these modules without the need of illustration.

[0016] Typically, deterministic location software 101 comprises one or more deterministic algorithms able to determine a current location of each ride vehicle 10 of a set of ride vehicles 10 currently deployed along predefined vehicle path 40 using the unique position identifiers of the plurality of vehicle path sensors.

[0017] Typically, deterministic spatial software 102 comprises one or more deterministic algorithms able to create a dynamic set of spatial coordinates describing virtual space 200 (**Fig. 2**) around each ride vehicle 10 in real time. Virtual space 200, which conceptually can describe a two or three dimensional bubble, comprises data defining a two or three dimensional set of spatial coordinates in which each ride vehicle 10 can operate at or below a predetermined probability of physical contact with another ride vehicle 10 of the set of ride vehicles 10.

[0018] Typically, vehicle control software 103 comprises one or more deterministic algorithms able to adjust a predetermined set of physical characteristics of each ride vehicle 10 based on the dynamic set of spatial coordinates and the determined current location of each ride vehicle 10 of the plurality of ride vehicles 10 along vehicle path 40, preferably in real time. The predetermined set of physical characteristics can include speed relative to predetermined vehicle path 40, orientation relative to predetermined vehicle path 40 and/or one or more other ride vehicles 10, spin rate of a specific ride vehicle 10, other ride vehicle 10 characteristics such as yaw, pitch, and roll, or the like, or a combination thereof.

[0019] **In the operation of exemplary embodiments**, referring generally to **Fig. 1** and **Fig. 3**, in general software 100, through a series of algorithms, determines the exact location of one or more ride vehicles 10 along predetermined vehicle path 40 in real time and creates a model of dynamic "bubble" virtual space 200 around each ride vehicle 10 which indicates a two or three dimensional space 12 in which each such ride vehicle 10 can operate safely without the probability of physical contact with other ride vehicles 10. This dynamic bubble's shape changes based, in part, on the speed at which ride vehicles 10 move along ride vehicle path 40 and, by way of example and not limitation, may be indicative of a worst-case collision scenario.

[0020] In an exemplary embodiment, first ride vehicle 10a, deployed along predefined vehicle path 40, is allowed to operate independently of second ride vehicle 10b deployed along the same predefined vehicle path 40 at substantially the same time by determining a current location of first ride vehicle 10 as deployed along predefined vehicle path 40, e.g. a real time position, by using first vehicle path sensor 30a of a predetermined set of vehicle path sensors 30 deployed about predefined vehicle path 40. A current location of second ride vehicle 10b, also deployed along predefined vehicle path 40 at substantially the same time as first ride vehicle 10a, is determined by deterministic location software 101 using second vehicle path sensor 30b of the predetermined set of vehicle path sensors 30 deployed about predefined vehicle path 40. As described above, each of these vehicle path sensors 30, e.g. 30a-30d, comprises a unique position identifier associated with a predetermined spatial set of coordinates along predefined vehicle path 40. Deterministic spatial software 101, using one or more deterministic algorithms, is typically used to create a dynamic set of spatial coordinates describing virtual space 200 (**Fig. 2**) around each ride vehicle 10 in real time, where virtual space 200 is as described above. As also noted above, the predetermined set of ride vehicle physical characteristics comprises a model of an outer boundary of each ride vehicle 10. Moreover, virtual space 200 may further be a function of the speed at which one or more ride vehicles 10a-10d is then currently moving along predefined vehicle path 40.

[0021] Based on the predetermined set of ride vehicle physical characteristics, a set of spatial coordinates is calculated, typically using deterministic spatial software 102, which describe virtual space 200 around first ride vehicle 10a and second ride vehicle 10b, in real time, within which first ride vehicle 10a can operate without the probability of physical contact with second ride vehicle 10b. A current set of spatial coordinates is also calculated for first ride vehicle 10a and second ride vehicle 10b with respect to predefined vehicle path 40 in real time, typically using deterministic spatial software 102.

[0022] A first requested set of ride vehicle directives for first ride vehicle 10a is obtained from a data source, e.g. a database or other data file (**Fig. 3**). As used herein, “directives” comprise commands and/or data and the like which can effect one or more changes in behavior of each ride vehicle 10 such as by commanding ride vehicle controller 16 to perform a function. By way of example and not limitation, this first requested set of ride vehicle directives can include a currently desired speed with respect to predefined vehicle path 40, a currently desired orientation with respect to predefined vehicle path 40, or the like, or a combination thereof.

Based on the first requested set of ride vehicle directives for first ride vehicle 10a, a current stopping distance is calculated for first ride vehicle 10a and/or second ride vehicle 10b with respect to predefined vehicle path 40 in real time. This can be calculated using vehicle control software 103 or other software operatively interoperable with vehicle control software 103.

[0023] With the current calculated set of spatial coordinates for first ride vehicle 10a and second ride vehicle 10b, the calculated current stopping distance of either or both first ride vehicle 10a and/or second ride vehicle 10b is compared to the calculated spatial coordinates of first ride vehicle 10a and second ride vehicle 10b with respect to predefined vehicle path 40 in real time. This is typically accomplished using vehicle control software 103. If the currently determined current distance between first ride vehicle 10a and second ride vehicle 10b with respect to predefined vehicle path 40 is greater than the calculated stopping distance, no change is typically made to the set of ride vehicle directives for first ride vehicle 10a or the set of ride vehicle directives for second ride vehicle 10b by software 100.

[0024] However, if the currently determined current distance between first ride vehicle 10a and second ride vehicle 10b with respect to predefined vehicle path 40 is less than the stopping distance, vehicle control software 103 changes or otherwise creates either or both of the set of ride vehicle directives for first ride vehicle 10a and second ride vehicle 10b to place first ride vehicle 10a and second ride vehicle 10b at a distance within which first ride vehicle 10a can operate without the probability of physical contact with second ride vehicle 10b. Changing either or both of the set of ride vehicle directives for first ride vehicle 10a and second ride vehicle 10b may comprise decreasing or increasing the speed of either or both of first ride vehicle 10a and second ride vehicle 10b relative to and/or along to predefined vehicle path 40.

[0025] It will be understood by those of ordinary skill in the programming arts that all these calculations and determinations are not limited to just first ride vehicle 10a and second ride vehicle 10b but may also extend or be extended to take other ride vehicles, e.g. third ride vehicle 10c and/or fourth ride vehicle 10d, into account

[0026] In these various embodiments, the predetermined rate of speed may be a high rate of data, e.g. a baud rate of 1MB or higher, e.g. 1 gigabyte. A leaky coaxial communication system may be used, where data are transmitted at a high rate of speed back to a land based control system, e.g. control system 60, which, as described above, may be housed or otherwise located proximate to or away from predefined vehicle path 40.

[0027] The foregoing disclosure and description of the inventions are illustrative and explanatory. Various changes in the size, shape, and materials, as well as in the details of the illustrative construction and/or an illustrative method may be made without departing from the spirit of the invention.

CLAIMS:

What is claimed is:

1. A ride control system, comprising:

    a. a plurality of vehicle path sensors (30) deployed about a predefined vehicle path (40), each vehicle path sensor (30) of the plurality of vehicle path sensors (30) comprising a unique position identifier;

    b. a plurality of ride vehicles (10) deployed about the predefined vehicle path (40), each ride vehicle (10) comprising a ride vehicle controller (16), a ride vehicle communication system (15), and a ride vehicle detector (14) interoperative with the plurality of vehicle path sensors (30);

    c. a data communication system (50) deployed proximate the predefined vehicle path (40), the data communication system operatively in communication with the plurality of vehicle path sensors (30) and with the plurality of ride vehicles (10);

    d. a control system (60) operatively in communication with the data communication system, with the plurality of vehicle path sensors (30), and with the plurality of ride vehicles (10) deployed about the predefined vehicle path (40); and

    e. software (100) operatively resident in the control system, the software comprising:

        i. deterministic location software (101), comprising a deterministic algorithm able to determine a current location of each ride vehicle (10) of the plurality of ride vehicle (10) currently deployed along the predefined vehicle path (40) using the unique position identifiers of the plurality of vehicle path sensor (30);

ii. deterministic spatial software (102), comprising a deterministic algorithm able to create a dynamic set of spatial coordinates describing a virtual space in real time around each ride vehicle (10) of the plurality of ride vehicle (10), the virtual space defining a multi-dimensional set of spatial coordinates in which each ride vehicle (10) can operate at or below a predetermined probability of physical contact with another ride vehicle (10) of the plurality of ride vehicle (10); and

iii. vehicle control software (103), comprising a deterministic algorithm able to adjust a predetermined set of physical characteristics of each ride vehicle (10) of the plurality of ride vehicle (10) based on the dynamic set of spatial coordinates and the determined current location of each ride vehicle (10) of the plurality of ride vehicle (10).

2. The ride control system of Claim 1, wherein the ride vehicle communication system (15) comprises a transceiver.

3. The ride control system of Claim 1, wherein:

a. the vehicle path sensor (30) comprises an active sensor; and

b. the ride vehicle detector (14) comprises a passive ride trigger operative to trigger the active sensor.

4. The ride control system of Claim 1, wherein:

a. the ride vehicle detector (14) comprises an active sensor;

b. the vehicle path sensor (30) comprises a passive sensor operative to trigger the active sensor.

5. The ride control system of Claim 4, wherein the passive sensor comprises a magnetically encoded strip.

6. The ride control system of Claim 1, wherein the vehicle path sensor (30) comprises an acoustic positioning operator station (APOS) sensor.

7. The ride control system of Claim 1, wherein the data communication system (50) comprises a high data rate communication system.

8. The ride control system of Claim 1, wherein the data communication system (50) comprises a leaky coaxial communication system.

9. The ride control system of Claim 1, wherein the predefined vehicle path (40) comprises a tracked vehicle path, a non-tracked vehicle path, or a combination thereof

10. The ride control system of Claim 1, wherein the unique position identifier further comprises a predefined set of spatial coordinates related to a current position of the vehicle path sensor (30) with respect to the predefined vehicle path (40).

11. The ride control system of Claim 1, wherein the control system (60) is disposed proximate the predefined vehicle path (40).

12. A method to allow a first ride vehicle (10a) deployed along a predefined vehicle path (40) to operate independently of a second ride vehicle (10b) deployed along the same predefined vehicle path (40) at substantially the same time in real time, comprising:

a. determining, in real time, a current location of a first ride vehicle (10a) deployed along a predefined vehicle path (40) by using a first vehicle path sensor (30) of a predetermined set of vehicle path sensors (30) deployed about the predefined vehicle path (40), the first vehicle path sensor (30) comprising a unique position identifier associated with a first predetermined spatial set of coordinates along the predefined vehicle path (40), and a first ride vehicle sensor (30a) interoperative with the first vehicle path sensor (30a), the first vehicle path sensor (30) reactive to proximity of the first ride vehicle detector (14) when the first ride vehicle detector (14) is deployed along the predetermined vehicle path (40);

b. determining, in real time, a current location of a second ride vehicle (10b) deployed along the predefined vehicle path (40) at substantially the same time as the first ride vehicle (10a) using a second vehicle path sensor (30b) of the predetermined set of vehicle path sensors (30) deployed about the predefined vehicle path (40), the second vehicle path sensor (30b) comprising a unique position identifier associated with a second predetermined spatial set of coordinates along the predefined vehicle path (40), and a second ride vehicle detector (14) interoperative with the second vehicle path sensor (30b), the second vehicle path sensor (30b) reactive to proximity of the second ride vehicle detector (14) when the second ride vehicle detector (14) is deployed along the predetermined vehicle path (40);

c. based on a predetermined set of ride vehicle physical characteristics for each of the first ride vehicle (10a) and the second ride vehicle (10b), calculating a set of spatial coordinates describing a first virtual space (200) in real time around the first ride vehicle (10a) and a second virtual space (200) in real time around the second ride vehicle (10b), the first virtual space describing coordinates within which the first ride vehicle (10a) can operate without the probability of physical contact with the second ride vehicle (10b);

d. calculating a current set of spatial coordinates for the first ride vehicle (10a) and the second ride vehicle (10b) with respect to the predefined vehicle path (40) in real time;

e. obtaining a first requested set of ride vehicle directives for the first ride vehicle (10a);

f. based on the first requested set of ride vehicle directives for the first ride vehicle (10a), calculating a current stopping distance for the first ride vehicle (10a) with respect to the predefined vehicle path (40) in real time;

g. with the calculated set of spatial coordinates for the first ride vehicle (10a) and the second ride vehicle (10b), comparing the calculated current stopping distance of the first ride vehicle (10a) to the calculated spatial coordinates of the first ride vehicle (10a) and the second ride vehicle (10b) with respect to the predefined vehicle path (40) in real time;

h. if the currently determined current distance between the first ride vehicle (10a) and the second ride vehicle (10b) with respect to the predefined vehicle path (40) is greater than the calculated stopping distance, making no change to the set of ride vehicle directives for the first ride vehicle (10a) or set of ride vehicle directives for the second ride vehicle (10b); and

i. if the currently determined current distance between the first ride vehicle (10a) and the second ride vehicle (10b) with respect to the predefined vehicle path (40) is less than the stopping distance, changing either or both of the set of ride vehicle directives for the first ride vehicle (10a) and set of ride vehicle directives for the second ride vehicle (10b) to place the first ride vehicle (10a) and the second ride vehicle (10b) at a distance within which the first ride vehicle (10a) can operate without the probability of physical contact with the second ride vehicle (10b).

13. The method to allow a first ride vehicle (10a) currently deployed along a predefined vehicle path (40) to operate independently of a second ride vehicle (10b) currently deployed along the same predefined vehicle path (40) of Claim 12, wherein the set of ride vehicle directives comprises speed.

14. The method to allow a first ride vehicle (10a) currently deployed along a predefined vehicle path (40) to operate independently of a second ride vehicle (10b) currently deployed along the same predefined vehicle path (40) of Claim 13, wherein changing either or both of the set of ride vehicle directives for the first ride vehicle (10a) and set of ride vehicle directives for the second ride vehicle (10b) comprises decreasing or increasing the speed of either or both of the first ride vehicle (10a) and the second ride vehicle (10b).

15. The method to allow a first ride vehicle (10a) currently deployed along a predefined vehicle path (40) to operate independently of a second ride vehicle (10b) currently deployed along the same predefined vehicle path (40) of Claim 12, wherein the predetermined set of ride vehicle characteristics comprises a representative outer boundary of each ride vehicle (10).

16. The method to allow a first ride vehicle (10a) currently deployed along a predefined vehicle path (40) to operate independently of a second ride vehicle (10b) currently deployed along the same predefined vehicle path (40) of Claim 12, wherein the virtual space (200) is a function of the speed at which the specific ride vehicle (10) is then currently moving along the predefined vehicle path (40).

17. The method to allow a first ride vehicle (10a) currently deployed along a predefined vehicle path (40) to operate independently of a second ride vehicle (10b) currently deployed along the same predefined vehicle path (40) of Claim 12, wherein:

a. the first ride vehicle detector (14) comprises an active sensor;

b. the second ride vehicle detector (14) comprises an active sensor;

c. the first vehicle path sensor (30a) is passively reactive to proximity of the first ride vehicle detector (14) and triggers the active ride vehicle detector (14) at a predetermined distance between the first vehicle path sensor (30) and the first ride vehicle detector (14); and

d. the second vehicle path sensor (30b) is passively reactive to proximity of the second ride vehicle detector (14)and triggers the active ride vehicle detector (14) at a predetermined distance between the second vehicle path sensor (30b) and the second ride vehicle detector (14).

18. The method to allow a first ride vehicle (10a) currently deployed along a predefined vehicle path (40) to operate independently of a second ride vehicle (10b) currently deployed along the same predefined vehicle path (40) of Claim 11, wherein:

a. the first ride path sensor (30a) comprises an active sensor;

b. the second ride path sensor (30b) comprises an active sensor;

c. the first vehicle path sensor (30a) is triggered by the ride vehicle detector (14) at a predetermined distance between the first vehicle path sensor (30) and the ride vehicle detector (14); and

d. the second vehicle path sensor (30b) is triggered by the ride vehicle detector (14) at a predetermined distance between the second vehicle path sensor (30b) and the second ride vehicle detector (14).

19. The method to allow a first ride vehicle (10a) currently deployed along a predefined vehicle path (40) to operate independently of a second ride vehicle (10b) currently deployed along the same predefined vehicle path (40) of Claim 12, wherein each of the first and second ride vehicles (10a,10b) communicates with the control system (60) to provide the control system with their currently associated vehicle path sensor's (30) unique position identifiers and to receive their respective sets of the set of ride vehicle directives from the control system.

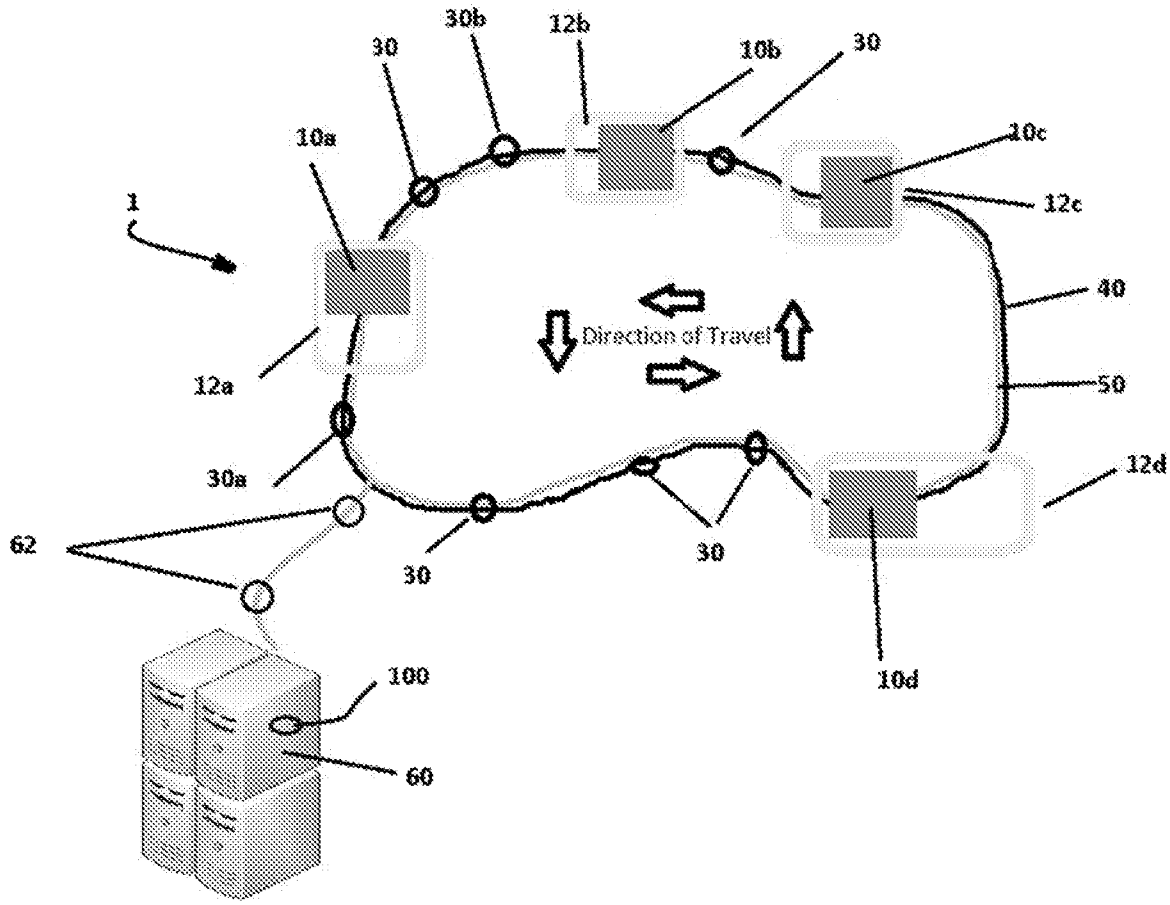

FIGURE 1

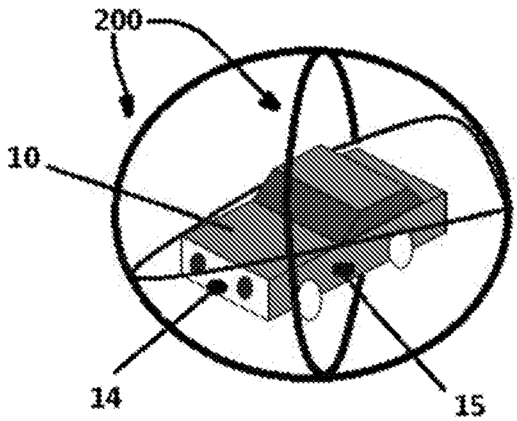

FIGURE 2

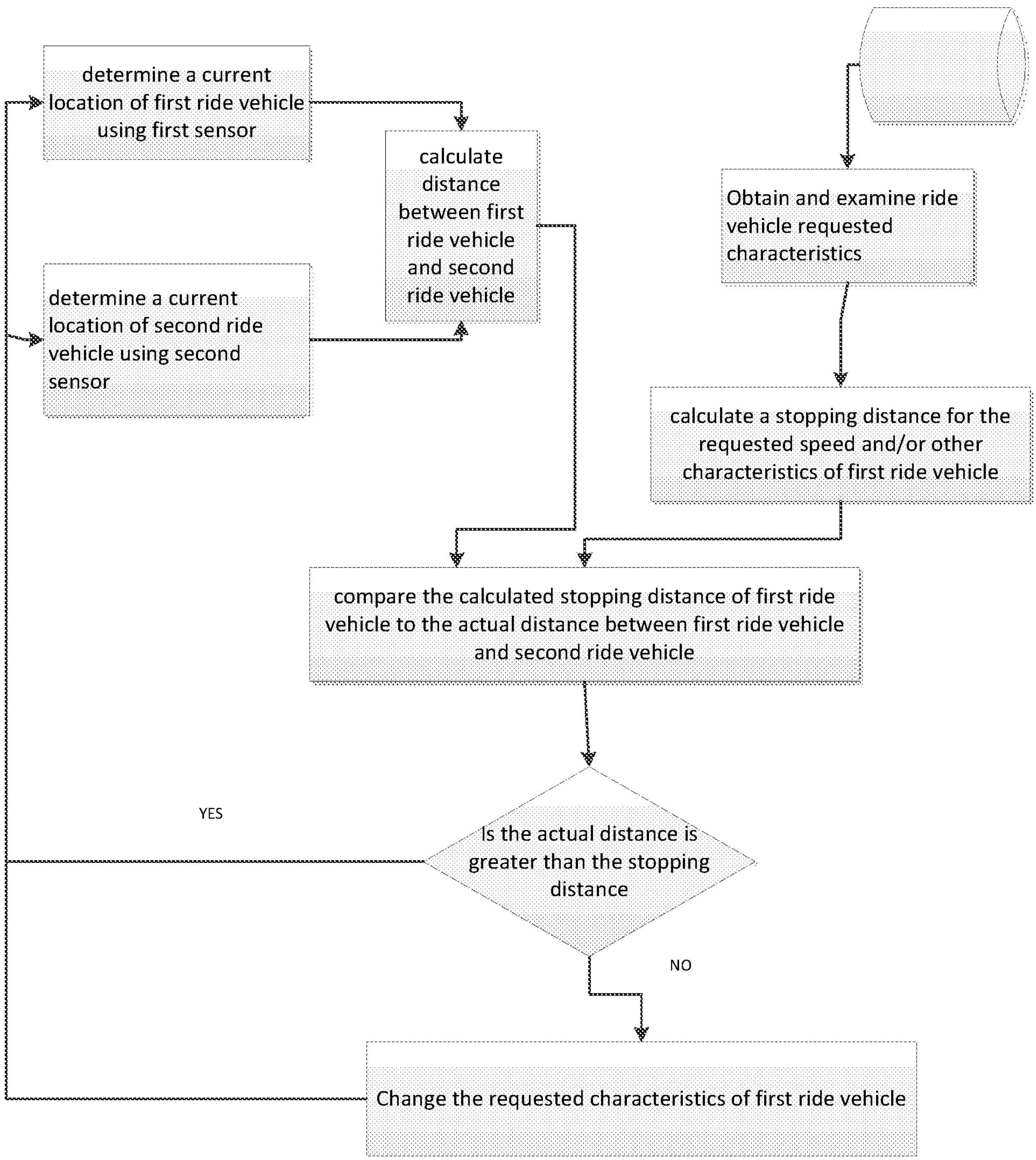
determine a current location of first ride vehicle using first sensor
determine a current location of second ride vehicle using second sensor
calculate distance between first ride vehicle and second ride vehicle
Obtain and examine ride vehicle requested characteristics
calculate a stopping distance for the requested speed and/or other characteristics of first ride vehicle
compare the calculated stopping distance of first ride vehicle to the actual distance between first ride vehicle and second ride vehicle
YES
Is the actual distance is greater than the stopping distance
NO
Change the requested characteristics of first ride vehicle

FIGURE 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/020924

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G01C 21/26; G01C 21/34; G05D 1/00; G08G 1/123; G08G 1/16 (2016.01)
CPC - G08G 1/163; G08G 1/164; G01S 19/40; G08G 1/22 (2016.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - G01C 21/26; G01C 21/34; G05D 1/00; G08G 1/123; G08G 1/16 (2016.01)
CPC - G08G 1/163; G08G 1/164; G01S 19/40; G08G 1/22 (2016.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
US: 701/2; 701/117; 342/455 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Google Patents, ProQuest
Search terms used: vehicles, sensors, path, road, location, position, coordinates, control, communication

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2010/0256852 A1 (MUDALIGE) 07 October 2010 (07.10.2010) entire document	1-11
Y	WO 2015/004581 A1 (KONINKLIJKE PHILIPS N.V.) 15 January 2015 (15.01.2015) entire document	1-11
A	US 5,646,843 A (GUDAT et al) 08 July 1997 (08.07.1997) entire document	1-11
A	US 8,498,788 B2 (KONDEKAR) 30 July 2013 (30.07.2013) entire document	1-11
A	US 8,576,069 B2 (NADEEM et al) 05 November 2013 (05.11.2013) entire document	1-11
A	US 2014/0129074 A1 (OCEANEERING INTERNATIONAL, INC.) 08 May 2014 entire document	1-11

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"P" document published prior to the international filing date but later than the priority date claimed
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 June 2016	08 JUL 2016

Name and mailing address of the ISA/	Authorized officer
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/020924

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
See supplemental page

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-11

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Continued from Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-11, drawn to a ride control system.
Group II, claims 12-19, drawn to a method to allow a first ride vehicle deployed along a predefined vehicle path to operate independently of a second ride vehicle deployed along the same predefined vehicle path.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: each ride vehicle can operate at or below a predetermined probability of physical contact with another ride vehicle of the plurality of ride vehicle; and iii. vehicle control software, comprising a deterministic algorithm able to adjust a predetermined set of physical characteristics of each ride vehicle of the plurality of ride vehicle based on the dynamic set of spatial coordinates and the determined current location of each ride vehicle of the plurality of ride vehicle as claimed therein is not present in the invention of Group II. The special technical feature of the Group II invention: if the currently determined current distance between the first ride vehicle and the second ride vehicle with respect to the predefined vehicle path is greater than the calculated stopping distance, making no change to the set of ride vehicle directives for the first ride vehicle or set of ride vehicle directives for the second ride vehicle; and i. if the currently determined current distance between the first ride vehicle and the second ride vehicle with respect to the predefined vehicle path is less than the stopping distance, changing either or both of the set of ride vehicle directives for the first ride vehicle and set of ride vehicle directives for the second ride vehicle to place the first ride vehicle and the second ride vehicle at a distance within which the first ride vehicle can operate without the probability of physical contact with the second ride vehicle as claimed therein is not present in the invention of Group I.

Groups I and II lack unity of invention because even though the inventions of these groups require the technical feature of a plurality of vehicle path sensors deployed about a predefined vehicle path, each vehicle path sensor of the plurality of vehicle path sensors comprising a unique position identifier; b. a plurality of ride vehicles deployed about the predefined vehicle path, each ride vehicle comprising a ride vehicle controller, a ride vehicle communication system, and a ride vehicle detector interoperative with the plurality of vehicle path sensors; c. a data communication system deployed proximate the predefined vehicle path, the data communication system operatively in communication with the plurality of vehicle path sensors and with the plurality of ride vehicles; d. a control system operatively in communication with the data communication system, with the plurality of vehicle path sensors, and with the plurality of ride vehicles deployed about the predefined vehicle path, this technical feature is not a special technical feature as it does not make a contribution over the prior art.

Specifically, US 2014/0129074 A1 (OCEANEERING INTERNATIONAL, INC.) 08 May 2014 (08.05.2014) teaches a plurality of vehicle path sensors deployed about a predefined vehicle path , each vehicle path sensor of the plurality of vehicle path sensors comprising a unique position identifier (Para. 29); b. a plurality of ride vehicles deployed about the predefined vehicle path, each ride vehicle comprising a ride vehicle controller, a ride vehicle communication system, and a ride vehicle detector interoperative with the plurality of vehicle path sensors (Paras. 38-40); c. a data communication system deployed proximate the predefined vehicle path, the data communication system operatively in communication with the plurality of vehicle path sensors and with the plurality of ride vehicles (Para. 34); d. a control system operatively in communication with the data communication system, with the plurality of vehicle path sensors, and with the plurality of ride vehicles deployed about the predefined vehicle path (Para. 34).

Since none of the special technical features of the Group I or II inventions are found in more than one of the inventions, unity of invention is lacking.