US 20070191106A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2007/0191106 A1

Sonoda et al. (43) Pub. Date: Aug. 16, 2007

(54) COMMUNICATION GAME SYSTEM, GAME CONTROL PROGRAM AND MEMORY MEDIUM

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(21) Appl. No.: **11/707,676**

(22) Filed: **Feb. 15, 2007**

(30) **Foreign Application Priority Data**

Feb. 16, 2006 (JP) 2006-040019

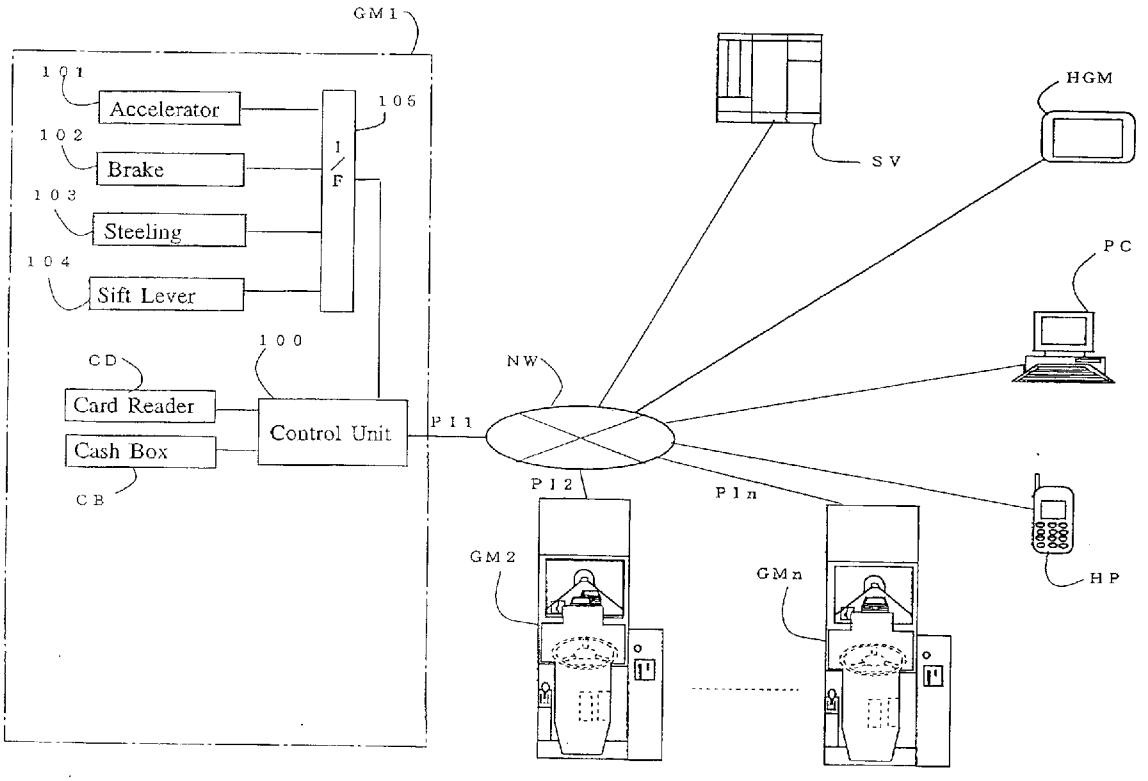
Publication Classification

(51) **Int. Cl.**
A63F 9/24 (2006.01)

(52) **U.S. Cl.** **463/42**

(57) **ABSTRACT**

When players play car race by means of game machines, for example, a first machine game operates the object by an accelerator, brake, steering wheel and shift lever, calculates a prediction position the object reaches after a predetermined time from the current time, and transmits the prediction position to a second game machine as a position information. The time td is a time for transferring information through the network from the first game machine to the second game machine, that is, a delay time due to the communication. Similarly, other game machines can transmit the position information. Therefore, low process speed of a game is prevented due to communication load, with maintaining game quality.



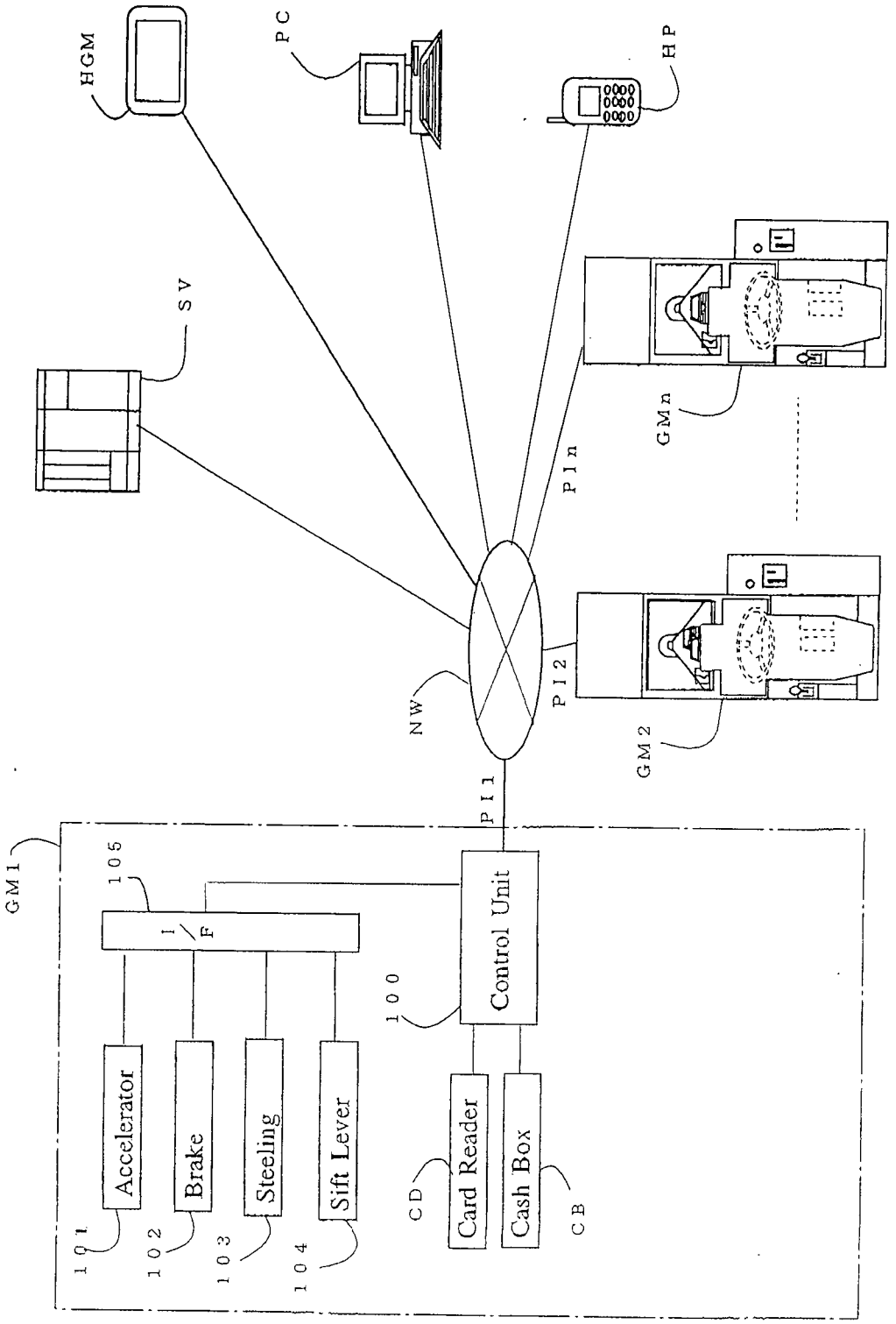
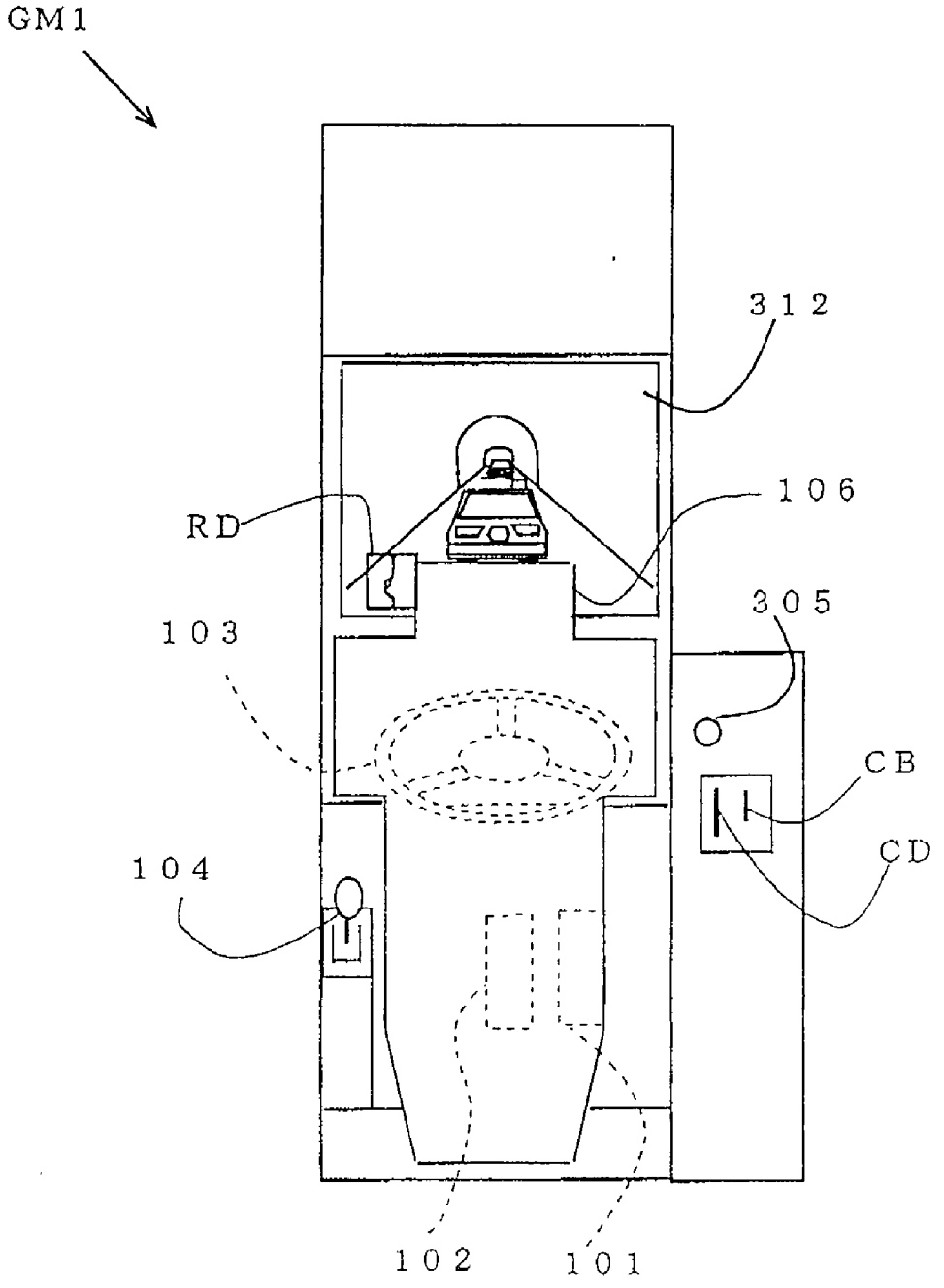

HGM
PC
HP
SV
GMn
PIn
NW
PI2
GM2
PI1
GM1
105
I/F
100
Control Unit
Accelerator
Brake
Steeling
Sift Lever
101
102
103
104
CD
Card Reader
Cash Box
CB

Fig. 1

Fig. 2



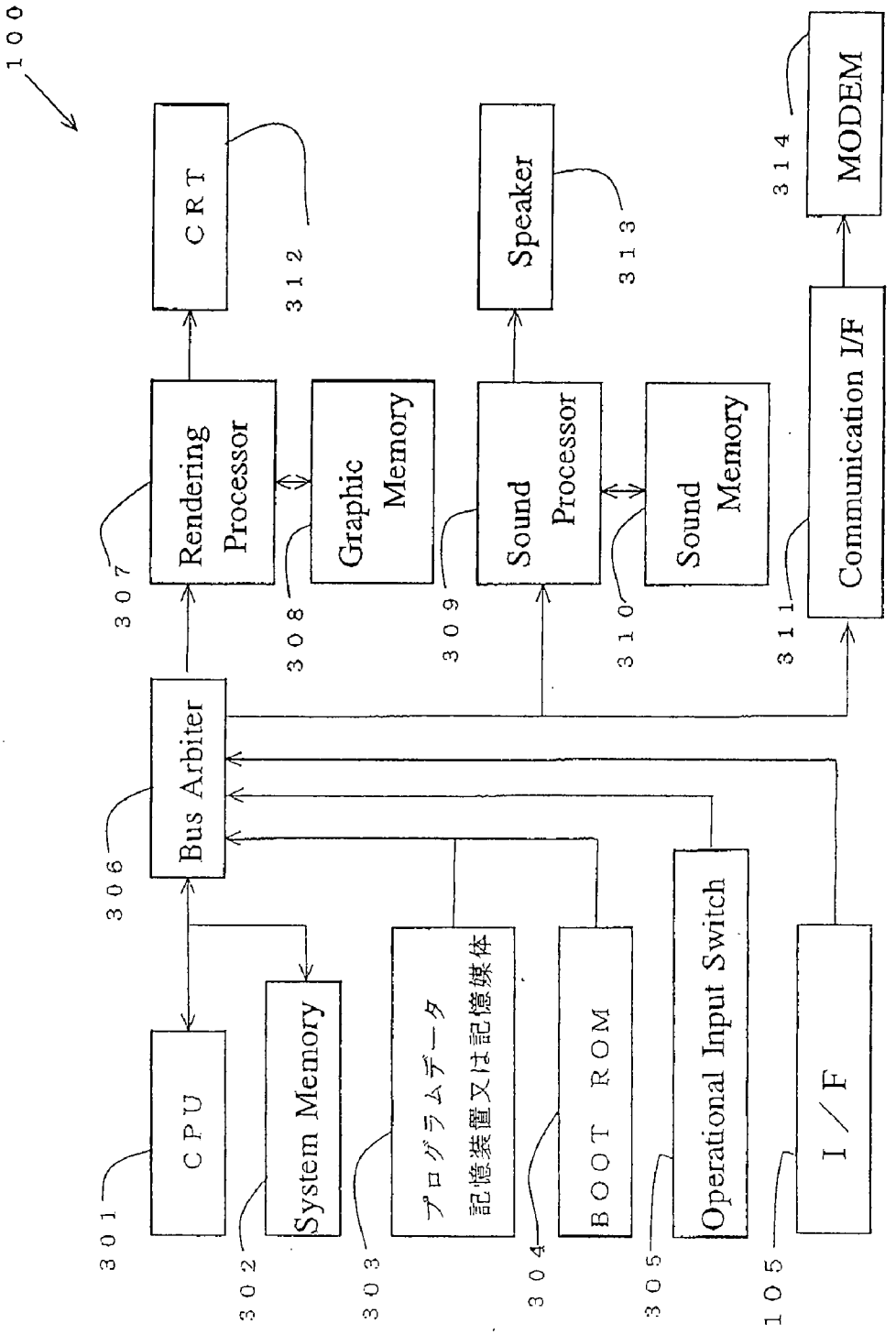

100
CRT
312
Speaker
313
MODEM
314
Rendering Processor
307
Graphic Memory
308
Sound Processor
309
Sound Memory
310
Communication I/F
311
Bus Arbiter
306
CPU
301
System Memory
302
プログラムデータ記憶装置又は記憶媒体
303
BOOT ROM
304
Operational Input Switch
305
I／F
105

Fig. 3

Fig. 4

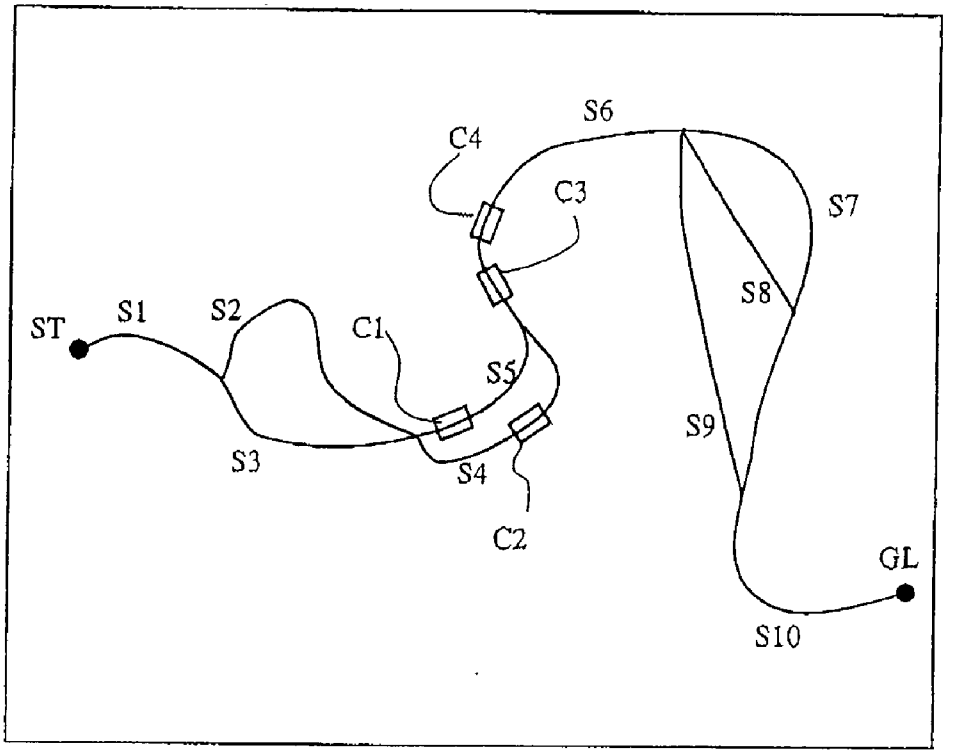


Fig. 5

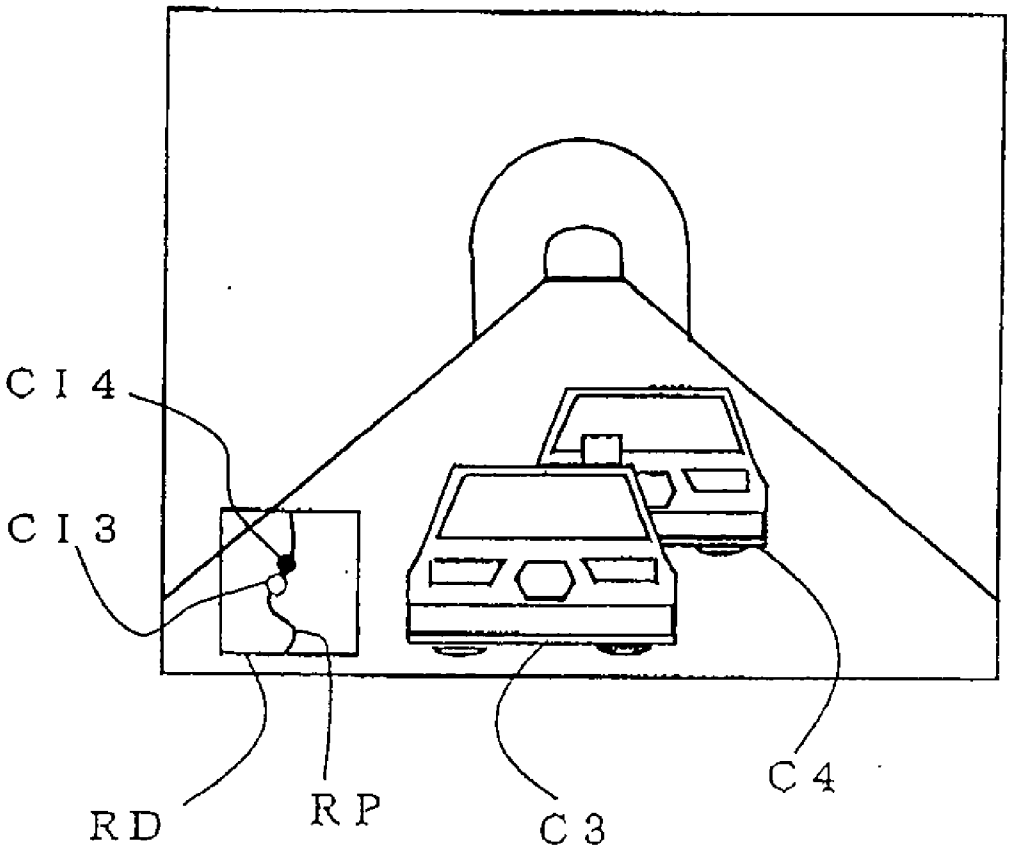


Fig. 6

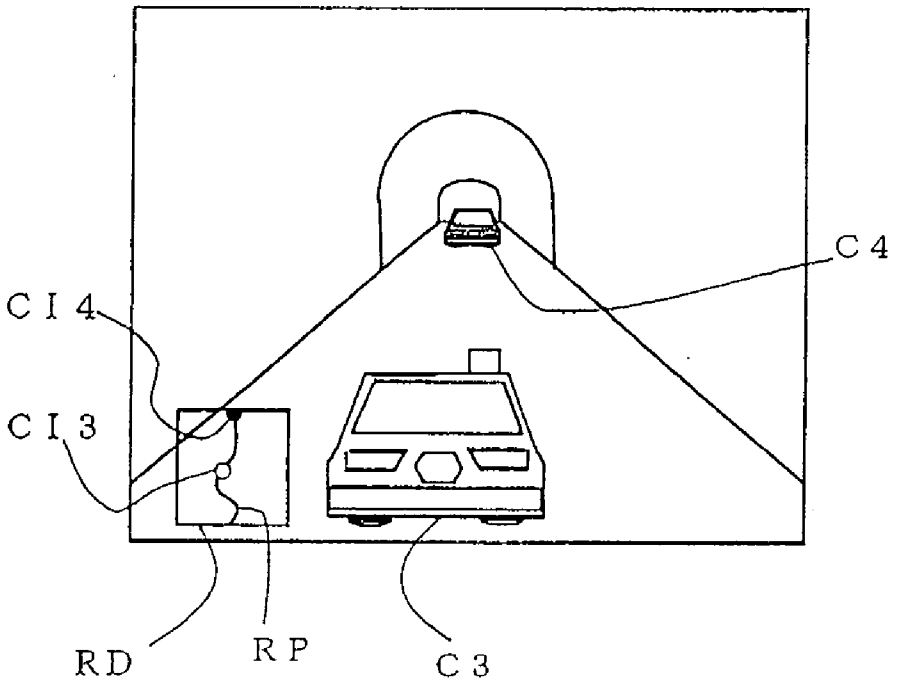


Fig. 7

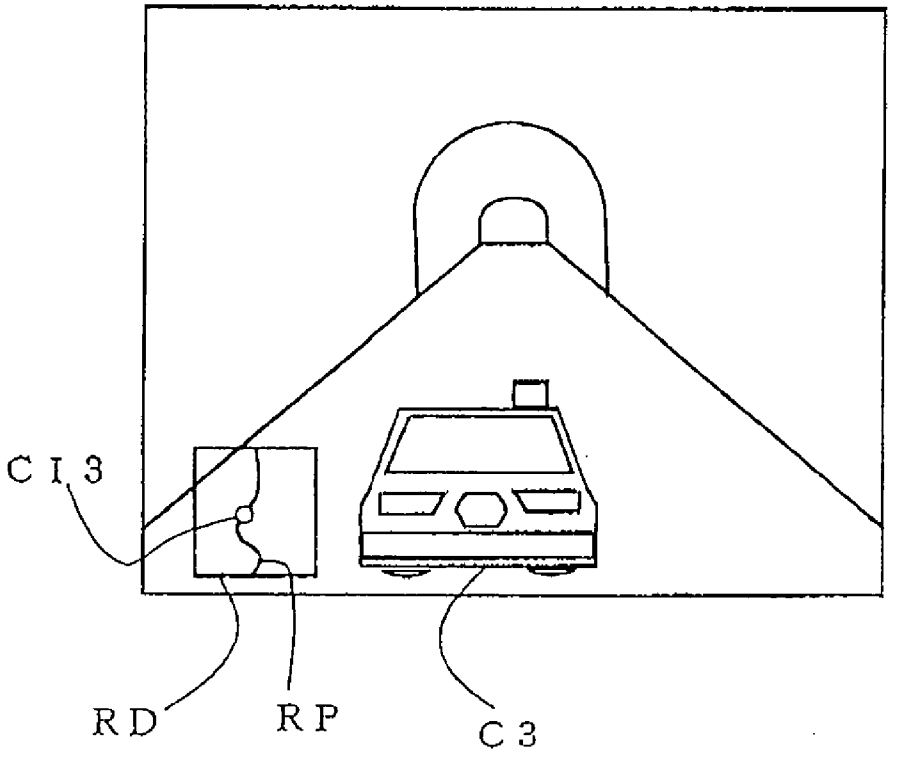


Fig. 8

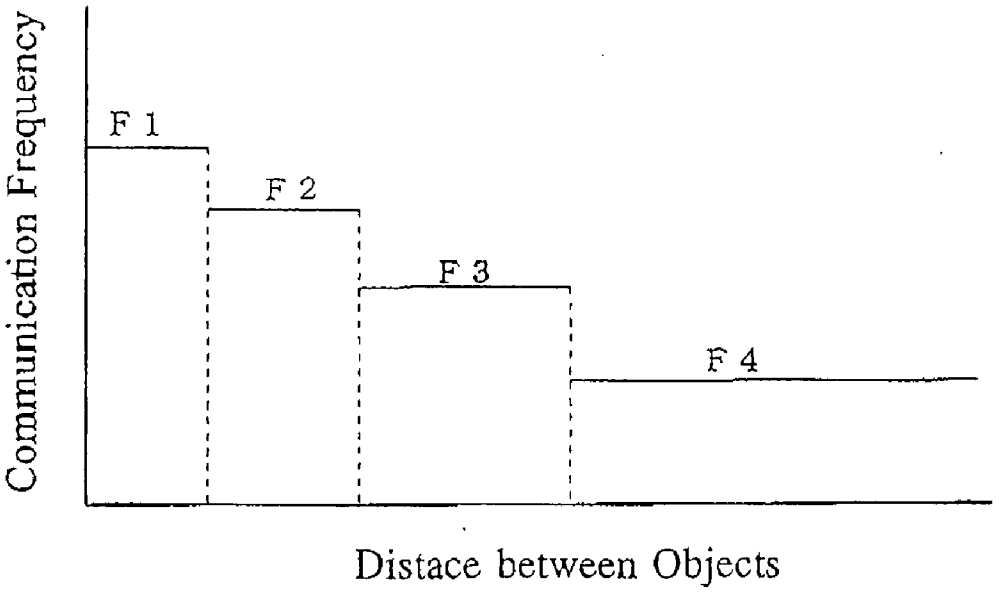

Communication Frequency
F 1
F 2
F 3
F 4
Distace between Objects

Fig. 9

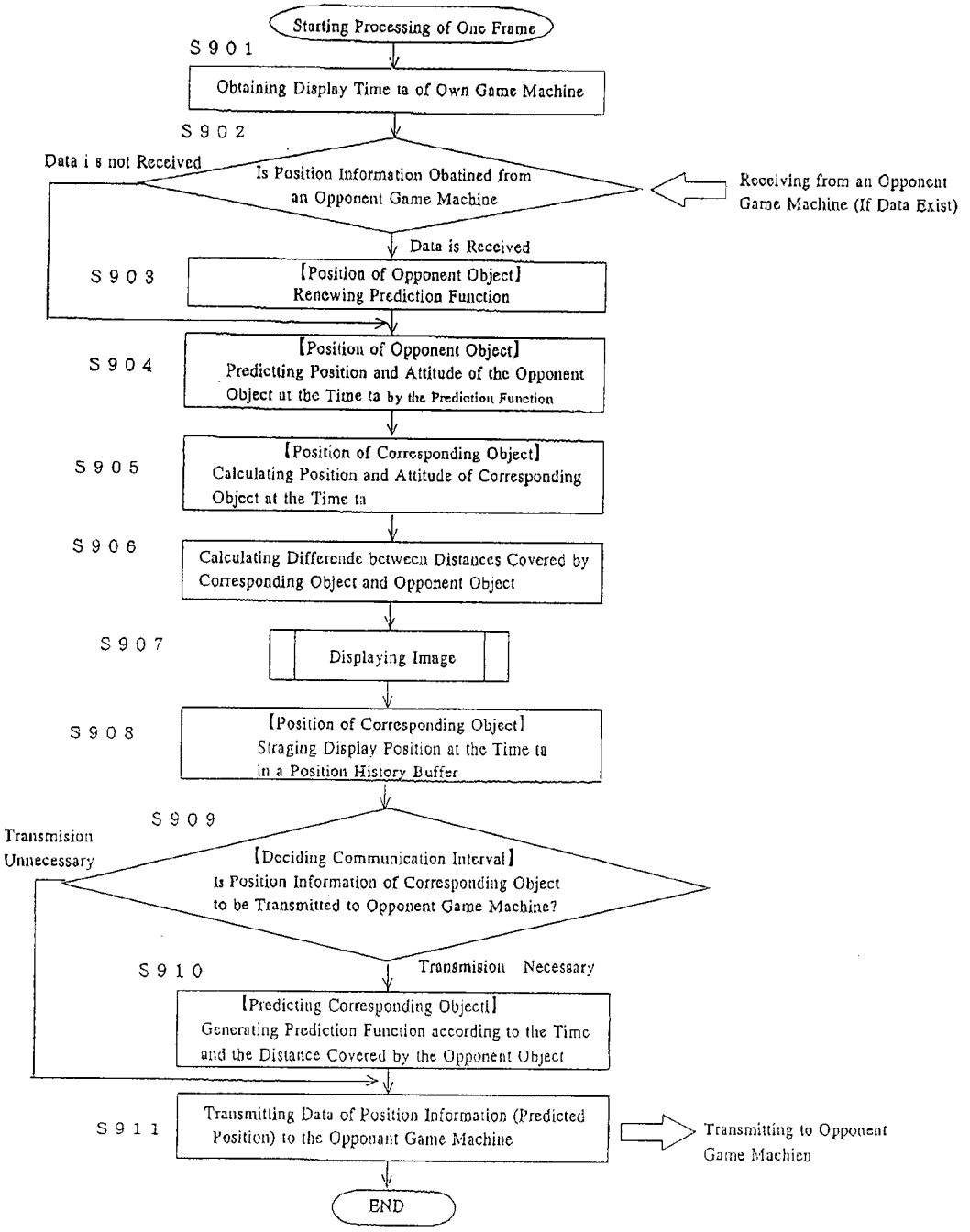

Starting Processing of One Frame
S901
Obtaining Display Time ta of Own Game Machine
S902
Data i s not Received
Is Position Information Obatined from an Opponent Game Machine
Receiving from an Opponent Game Machine (If Data Exist)
Data is Received
S903
[Position of Opponent Object] Renewing Prediction Function
S904
[Position of Opponent Object] Predictting Position and Attitude of the Opponent Object at the Time ta by the Prediction Function
S905
[Position of Corresponding Object] Calculating Position and Attitude of Corresponding Object at the Time ta
S906
Calculating Differende between Distances Covered by Corresponding Object and Opponent Object
S907
Displaying Image
S908
[Position of Corresponding Object] Straging Display Position at the Time ta in a Position History Buffer
S909
Transmision Unnecessary
[Deciding Communication Interval] Is Position Information of Corresponding Object to be Transmitted to Opponent Game Machine?
Transmision Necessary
S910
[Predicting Corresponding Object] Generating Prediction Function according to the Time and the Distance Covered by the Opponent Object
S911
Transmitting Data of Position Information (Predicted Position) to the Opponant Game Machine
Transmitting to Opponent Game Machien
END

Fig. 10

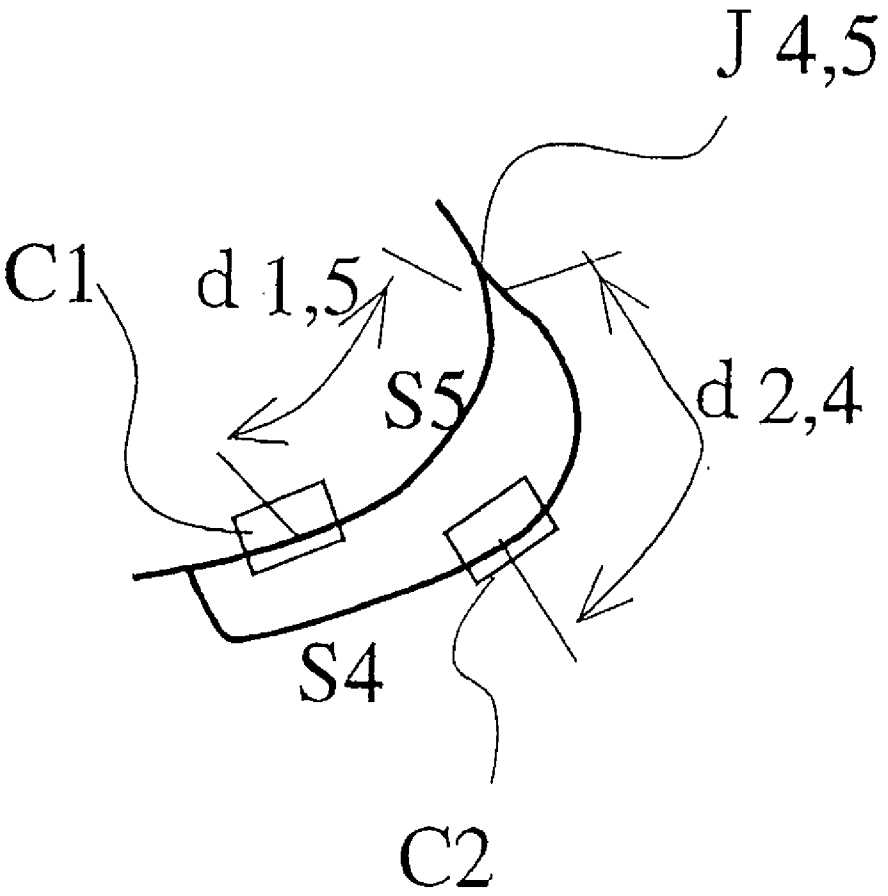
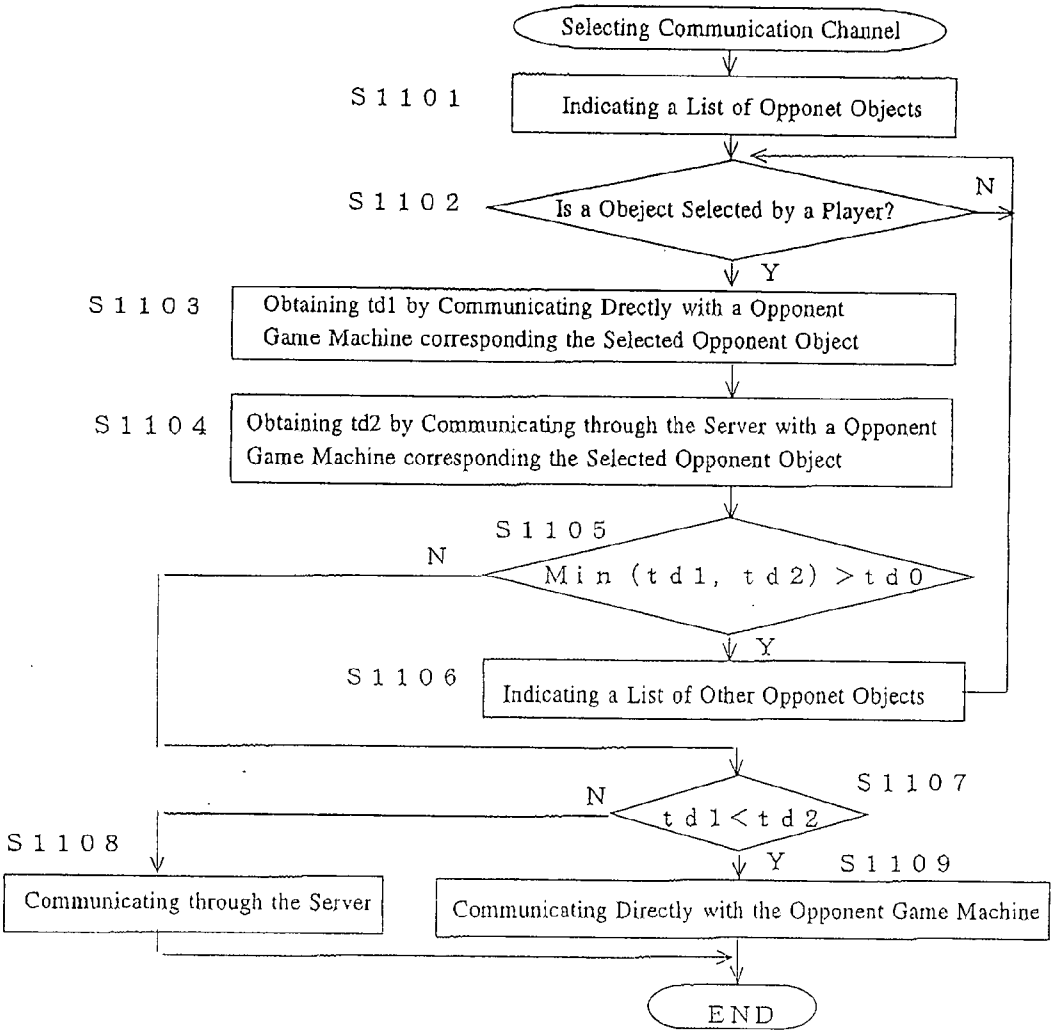


Fig. 11


Selecting Communication Channel
S1101
Indicating a List of Opponet Objects
S1102
Is a Obeject Selected by a Player?
N
Y
S1103
Obtaining td1 by Communicating Drectly with a Opponent Game Machine corresponding the Selected Opponent Object
S1104
Obtaining td2 by Communicating through the Server with a Opponent Game Machine corresponding the Selected Opponent Object
S1105
N
Min (td1, td2) >td0
Y
S1106
Indicating a List of Other Opponet Objects
S1107
N
td1<td2
Y
S1108
S1109
Communicating through the Server
Communicating Directly with the Opponent Game Machine
END

COMMUNICATION GAME SYSTEM, GAME CONTROL PROGRAM AND MEMORY MEDIUM

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a communication game system, a game control program and a memory medium.

[0003] 2. Prior Art

[0004] In a communication game system having a plurality of game machines and a network for connecting the game machines to a server, on which a plurality of players-operate objects in real time, it is necessary that the server provides each game machine information concerning objects of other players. The more the players join the game, the heavier the communication load becomes. Then, the game processing speed decreases, the operational performance and the reality of the game are deteriorated.

[0005] Hitherto, data volume in each packet is decreased so that the problem of low process speed of the game is prevented.

[0006] The conventional technologies are known for adjusting the communication load of the Patent Publication 2001-044922 (patent document 1), Patent Publication 2000-331187 (patent document 2) and Patent Publication 2003-090728 (patent document 3).

[0007] In the patent document 1, a vehicles communication system is disclosed that communication interval is expanded as vehicles such as transportation trucks are farther remote from a base station. Then, the communication load is adjusted to be suitable for the communication necessity.

[0008] In the patent document 2, a moving picture generating method is disclosed, concerning a moving picture display of computer graphics, that a display area is divided into a plurality of areas and renewal of physical parameters is reduced.

[0009] In the patent document 3, a map display apparatus is disclosed, concerning a map data obtaining through wireless communication, that frequency of obtaining the map data is adjusted according to distance from the current place to the destination.

SUMMARY OF THE INVENTION

[0010] In the conventional communication game system, even if the data volume is decreased for each packet, the minimum information volume is not so small and the communication load cannot be sufficiently improved.

[0011] The present invention is invented to solve the conventional problems and has an object to prevent low process speed of a game due to communication load with maintaining game quality.

[0012] The present invention is a communication game system comprising a plurality of game machines and a network for connecting said game machines with one another, each said game machine (one game machine, hereafter) comprising a virtual space generating means for generating a virtual space in which a plurality of objects exist, an input means for inputting movement input information which causes movement of said object (corresponding object, hereafter) corresponding to said one game machine in said virtual space, a position information obtaining means for obtaining position information of other objects (opponent objects, hereafter) corresponding to other game machines (opponents' game machines) than said game machine, from said opponents game machines, a position information calculation means for calculating a position information of said corresponding object according to said movement input information, a position information transmission means for transmitting said position information to said opponent game machines, a distance calculation means for calculating distances between said corresponding object and opponent objects, according to said position information of said corresponding object and position information of said opponent objects, and an information volume calculation means for calculating necessary information volume of said position information of corresponding object to be transmitted to each said opponent game machine, according to distances between said opponent object and opponents objects, wherein said position information transmission means transmits said position information by said necessary information volume to said opponent game machines.

[0013] Therefore, low process speed of a game is prevented due to communication load, with maintaining game quality.

[0014] A communication game system according to the present invention may further comprises a position prediction calculation means for calculating a predicted position of said corresponding object at a time after a current time by a transfer time through said network, according to said position information of said corresponding object, and said position information transmission means may transmit said predicted position of said corresponding object as said position information to said opponent game machines.

[0015] Therefore, an error due to communication delay time is minimized concerning positional relationship between the corresponding object and the opponent objects.

[0016] A communication game system according to the present invention may further comprises a server which comprises a position information receiving means connected to said network for receiving said position information from said game machines, and a position information transmission means for transmitting said position information of each said game machine to opponent game machines.

[0017] In this case, each said game machine may further comprises a communication speed comparison means for comparing communication transfer time of a communication channel through said server and a communication channel not through said server, and a communication channel selecting means for selecting communication channel of higher communication speed, from said communication channels through and not through said server.

[0018] Therefore, the communication channel is optimized.

[0019] In a communication game system according the present invention, each said game machine may further comprises a reference communication speed comparison means for comparing communication transfer time of a predetermined reference transfer time with said transfer time

of said communication channel through said server and not through said server, and an additional game machine comparison means for comparing communication transfer time of one of said opponent game machines of a communication channel through said server and not through said server, with said predetermined reference transfer time.

[0020] Therefore, playing condition of games is improved.

[0021] In a communication game system according to the present invention, said virtual space generating means generates further a moving path through which said corresponding object moves in said virtual space, and said distance calculation means calculates said distance along said moving path.

[0022] Therefore, information volume is suitably set for game of car race etc. in which objects run on a moving path with giving good game impression.

[0023] In certain communication game systems according to the invention, said distance between said objects is one-line (Euclid) distance.

[0024] Therefore, information volume is suitably set for fighting game etc. according to feeling of distance between objects.

[0025] In a communication game system according to the present invention, wherein said position information transmission means adjusts said information volume by communication frequency.

[0026] Therefore, communication load is decreased with maintaining the information volume of each communication. So, low process speed of a game is prevented due to communication load, with maintaining game quality.

[0027] Or, in a communication game system according to the present invention, positions on said moving path are included in said position information, and further widthwise positions when said information volume is a lot.

[0028] Therefore, not so important information of widthwise position can be omitted of remote object in a game of car race etc. in which objects run on a moving path.

[0029] In a communication game system according to the present invention, said information volume calculation means may adjust said information volume, further according to positional relationship between said corresponding object and said opponent objects.

[0030] The objects adjacent to each other but on independent moving paths from each other after branch off are handled similarly to remote objects. The information volume is further decreased.

[0031] The present invention is a game control program executed on a game machine for a communication game system which comprises a plurality of game machines and a network for connecting said game machines with one another, comprising: a virtual space generating step for generating a virtual space in which a plurality of objects exist, an input step for inputting movement input information which causes movement of said object (corresponding object, hereafter) corresponding to said one game machine in said virtual space, a position information obtaining step for obtaining position information of other objects (opponent objects, hereafter) corresponding to other game machines (opponents' game machines) than said game machine, from said opponents game machines, a position information calculation step for calculating a position information of said corresponding object according to said movement input information, a position information transmission step for transmitting said position information to said opponent game machines, a distance calculation step for calculating distances between said corresponding object and opponent objects, according to said position information of said corresponding object and position information of said opponent objects, and an information volume calculation step for calculating necessary information volume of said position information of corresponding object to be transmitted to each said opponent game machine, according to distances between said opponent object and opponents objects, wherein said position information transmission step transmits said position information by said necessary information volume to said opponent game machines.

[0032] Therefore, low process speed of a game is prevented due to communication load, with maintaining game quality.

BRIEF DESCRIPTION OF DRAWINGS

[0033] FIG. **1** is a block diagram showing an embodiment of communication game system according to the present invention.

[0034] FIG. **2** is a elevation view showing a game machine in FIG. **1**.

[0035] FIG. **3** is a block diagram of a control unit of the game machine in FIG. **2**.

[0036] FIG. **4** is a figure showing a moving path in a game executed by the communication game system in FIG. **1**.

[0037] FIG. **5** is a figure of a display image showing a relationship between two objects in the game executed by the communication game system in FIG. **1**.

[0038] FIG. **6** is a figure of a display image showing another relationship between two objects in the game executed by the communication game system in FIG. **1**.

[0039] FIG. **7** is a figure of a display image showing further another relationship between two objects in the game executed by the communication game system in FIG. **1**.

[0040] FIG. **8** is a graph showing communication frequency of position information in a game executed by the communication game system in FIG. **1**.

[0041] FIG. **9** is a flowchart showing a processing executed by the embodiment of the communication game system according to the present invention.

[0042] FIG. **10** is a partially enlarged figure of the moving path in FIG. **4**.

[0043] FIG. **11** is a flowchart showing a communication channel selection processing.

DETAILED DESCRIPTION OF THE INVENTION

Embodiment

[0044] Hereafter, preferable embodiments of the communication game system and game control program according to the present invention are described with reference to the drawings.

[Communication Game System]

[0045] FIG. **1** is a block diagram showing an embodiment of communication game system according to the present invention, FIG. **2** is a elevation view showing a game machine in FIG. **1**, and FIG. **3** is a block diagram of a control unit of the game machine in FIG. **2**.

[0046] In FIG. **1**, a plurality of game machines GM**1**, GM**2**, . . . , GMn are connected to a network NW. A server SV, one or more personal computers PC, communication terminals such as a portable game machine HGM, mobile phone HP and so forth are connected to the network NW. The network NW may be a computer network constructed by a LAN, a wide area network through internet etc.

[0047] The server SV executes information communication with the game machines GM**1** to GMn and controls the game machines when necessary. Players (not shown) of the game machines GM**1** to GMn execute operational input by control units **100** included within the game machines GM**1** to GMn so that communication is executed among the game machines GM**1** to GMn and a game such as car race is executed.

[0048] The server SV has a position information receiving means and position information transmission means for receiving and transmitting position information mentioned below. The position information receiving means and position information transmission means are constructed by various calculation means and communication means which are known.

[0049] The control unit **100** is connected with a cash box CB so as to detect insertion of charge (coin) coin into the cash box CB for the game execution. The control unit **100** is connected with a card reader CD for reading cards such as item card etc.

[0050] On the personal computer PC, the portable game machine HGM and other communication terminals, the game or its tiny version can be executed, similar to the game executed on the game machines GM**1** to GMn. Statistic of game result, ranking of players, various events and other information on games can be obtained on the communication terminals.

[0051] In FIG. **2**, the game machine GM**1** is representatively explained. The game machine GM**1** is modeled on a cockpit of a car. A sheet **106** is provided. And an accelerator **101**, a brake **102**, a steering wheel **103** and a shift lever **104** connected with the control unit **100** are provided, which cooperatively function as input means for the position information input, mentioned below.

[0052] A CRT **312** is provided at a position of a front window in front of the sheet **106**, for displaying information of car race. As car race information, traveling situation of a car (corresponding object) operated by the game machine GM**1** and a car (opponent object) operated by the opponent game machine (opponent game machine GM**2**, for example). A radar image RD is further displayed for indicating a positional relationship between both cars on a driving lane.

[0053] In FIG. **3**, the control unit **100** includes a CPU **301** for controlling the total components, a boot ROM **304** starting the control **100** unit up, and a system memory **302** for storing programs and data executed by the CPU **301**.

[0054] The control unit is provided with a rendering processor **307** for generating and controlling images to be displayed, and a graphic memory **308** for storing images to be generated and sources of the images. The rendering processor displays the generated images.

[0055] The control unit is provided with a sound processor **309** for generating sound and a sound memory **310** for storing sound data to be generated. The sound processor **309** generates a digital signal of a sound according to the stored data in the sound memory **310** and outputs the sound from a speaker **313** and head phone (not shown).

[0056] The control unit **100** is provided with a memory device or memory medium **303** for programs and data. The program and data stored in the memory medium **303** are read into the system memory **302**, graphic memory **308** and sound memory **310**.

[0057] Information concerning game are included in the data stored in the memory medium **303**.

[0058] The control unit **100** is provided with a communication interface **311** and a MODEM **314** though which a network IN is connected.

[0059] The components of the control unit **100** above are connected to a bus arbiter **306** which arbitrates communication among the components.

[0060] The game machine GM**1** to GMn generate virtual spaces in which corresponding and opponent objects are included. As for generating the virtual space, the CPU **301**, rendering processor **307**, graphic memory **308** cooperatively function as a virtual space generating means.

[0061] FIG. **4** shows an example of a traveling (moving) path on which objects (C**1**, C**2**, C**3** and C**4**, for example). The moving path extends from a start point ST, through a path S**1**, branched paths S**2** and S**3**, branched paths S**4** and S**5**, a path S**6**, branched paths S**7**, S**8** and S**9**, and a path S**10** to a goal point GL. The object C**1** is on the path S**4**, object C**2** on the path S**5**, objects C**3** and C**4** on the path S**6**.

[0062] FIGS. **5** and **6** show display image on the CRT **312** for indicating a relationship between the object C**3** (corresponding object) corresponding to the game machine GM**1** and the object C**4** on the same path S**6**.

[0063] In FIG. **5**, the object C**3** and the object C**4** traveling just in front of the object C**3** are shown in the display image. In the radar image RD, the path of an area adjacent to the object C**3** is shown. Indicators CI**3** and CI**4** indicating the objects C**3** and C**4**, respectively, are shown on the path.

[0064] In FIG. **6**, the object C**3** and the object C**4** traveling far in front of the object C**3** are shown in the display image. In the radar image RD, the path of an area adjacent to the object C**3** is shown. Indicators CI**3** and CI**4** indicating the objects C**3** and C**4**, respectively, are shown on the path in the radar image.

[0065] In FIG. **7**, only the object C**3** is shown because the object C**4** is sufficiently remote from the object C**3**. Only the indicator C**13** indicating the object C**3** is shown on the path of the radar image RD.

[0066] When players play car race by means of the game machines GM**1** and GM**2**, for example, the game machine GM**1** operates the object C**3** by the accelerator **101**, brake

102, steering wheel 103 and shift lever 104, calculates a prediction position the object C3 reaches after a predetermined time td from the current time, and transmits the prediction position to the game machine GM2 as a position information P11. The time td is a time for transferring information through the network from the game machine GM1 to the game machine GM2, that is, a delay time due to the communication.

[0067] The prediction position is calculated by various method. For example, a position advanced by a distance of a multiplication of the current velocity V1 and the time td from the current position of the object C3, that is,

(V1×td) formula (1)

[0068] The game machine GM1 receives similar position information P12 from the game machine GM2. When PI1 is calculated, the game machine GM1 predicts a position of the object C4 and a distance D3,4 between the objects C3 and C4, also. The distance D3,4 is a distance along the moving path, for example.

[0069] The distance D3,4 is indicators of collision risk of objects C3 and C4 and of competition tension against the opponent (enemy) object. When the distance D3,4 is long, the necessity of the mutual position information PI1 and PI2 is low. Then, the game machines GM1 decreases the information volume to be transferred by decreasing transmission frequency of the position information PI1. The communication load of the game machine GM1 is lightened, and low game processing speed due to communication is prevented.

[0070] FIG. 8 is a graph showing a relationship between the distance between objects and the communication frequency. The communication frequency is declined as the distance increase, for example, by 4 steps (F1>F2>F3>F4). The communication frequency is set to be 60 times/sec at the maximum and 1 time/sec at the minimum. The lowest frequency is set to be a frequency for judging whether the communication is maintained or not, preferably.

[0071] It is also possible to execute a car race of objects C1 to C4 corresponding to more game machines GM1 to GM4, for example. In this case, information volume is adjusted according to distances between each object and other objects. If the distances from the object C1 to the object C2 is the distance of the maximum frequency F1, to the object C3 is the distance of the frequency F2 and to object C2 is the distance of the minimum frequency F4, the game machine GM1 transmits the predicted position information at the frequency of F1, F2 and F3 to the game machines GM2, Gm3 and GM4, respectively.

[0072] The position information may includes not only the position along the moving direction on the moving path but also widthwise position of the moving path, posture relative to the direction of the moving path and moving velocity of the object. The information volume may be adjusted by omitting these information.

[0073] In the game machine, as for obtaining the position information of opponent objects from the opponent game machines, the MODEM 314, communication I/F 311, CPU 301 and system memory 302 cooperatively function as a position information obtaining means.

[0074] In the game machine, as for calculating the position of the corresponding object (position information of corresponding object), the CPU 301 and system memory 302 cooperatively function as a position information calculation means.

[0075] In the game machine, as for calculating the predicted position information of the position advanced by the delay time from the current position, the CPU 301 and system memory 302 cooperatively function as a predicted position information calculation means.

[0076] In the game machine, as for transmitting the predicted position information to the opponent game machines, the CPU 301, system memory 302, communication I/F 311 and MODEM 314 cooperatively function as a position information transmission means.

[0077] In the game machine, as for calculating the distance between the objects, the CPU 301 and system memory 302 cooperatively function as a distance calculation means.

[0078] In the game machine, as for calculating the information volume of the position information to be transmitted to the opponent game machines, the CPU 301 and system memory 302 cooperatively function as an information volume calculation means.

[0079] The distance D1,2 may be a two dimensional or tree dimensional one-line distance between objects C1 and C2, in a game in which no moving path is defined, such as in a fighting game.

[0080] As shown in the enlarged moving path in FIG. 10, the distance between objects C1 and C2 on branched path S4 and S5, respectively, cannot be defined along the moving path. An summation of a distance d1,5 from the object C1 to the branch point J4,5 of the paths S4 and S5 and a distance d2,4 from the object C2 to the branch point J4,5 may be deemed as a distance D1,2, for example.

(d1,5+d2,4) formula (2)

[0081] The communication frequency may be set according to the velocity of the object. If the velocity of the objects C3 and C4 are V3 and V4, respectively, the communication frequency is set according to the time up to a collision of the objects with each other, that is,

{D3,4/(V3−V4)} formula (4)

[0082] In this case, if the velocity of the objects C1 and C2 are V1 and V2, respectively, a time calculated by division of a distance at the branch point J4,5 between the objects by the velocity deference of the objects may be similarly applicable.

[0083] Namely, α=constant is defined, and

(a) The time up to the collision is,

{d2,4−(d1,5/V1)×V2}/(V2−V1) formula (5)

when $(d1,5/V1)+\alpha<(d2,4/V2)$. (formula (4))

(b) The time up to the collision is,

{d1,5−(d2,4/V2)×V1}/(V1−V2) formula (7)

when $(d1,5/V)>(d2,4/V2)+\alpha$. (formula (6))

(c) The communication frequency is made maximum due to high possibility of collision,

when $(d1,5/V1)-(d2,4/V2)=<\alpha$. (formula (8))

[0084] The processing of the game control of the game machine (GM1, for example) is executed, for each frame of the image displayed on the CRT **312**, by the following steps.

[0085] Step S**901**: First, a time of next display timing of the game machine GM**1** is obtained.

[0086] Step S**902**: Following to the step S**901**, it is judged whether the position information is received of the opponent objects C**2** to C**4** from the opponent game machines (GM**2** to GM**4**, for example). When the position information reaches, the processing is advanced to the step S**903**, otherwise to the step S**904**.

[0087] Step S**903**: The function for predicting the positions of the opponent objects C**2** to C**4** is renewed. The function means, for example, a calculation that the current velocity V**2** to V**4** of the objects C**2** to C**4** are multiplied by a time (ta−t), from the current time t to a time ta, that is,

$$V2\times(ta-t). \qquad \text{formula (9)}$$

[0088] Position information newly received renews the velocity V**2** to V**4** according to the position of the last time. The position information may includes the velocity V**2** to V**4**.

[0089] Step S**904**: Following to the step S**903**, the positions of the opponent objects C**2** to C**4** at the time ta is predicted according to the position information and the formula (9).

[0090] Step S**905**: Following to the step S**904**, the position and posture of the corresponding object C**1** at the time ta is predicted according to the function of the formula (9) with the velocity V**1** and so forth.

[0091] Step S**906**: The differences between the traveling distances of the corresponding object C**1** and opponent objects C**2** to C**4** at the time ta are calculated.

[0092] Step S**907**: Following to the step S**906**, an image of one frame is displayed on the CRT **312**. Then, the processing is advanced to the step S**908**.

[0093] Step S**908**: The position (display position) at the time ta is stored in a area of position history buffer in the system memory. Then, the processing is advanced to the step S**909**.

[0094] Step S**909**: It is judged whether the position information is to be transmitted at presence or not. When the position information is to be transmitted, the processing is advanced to the step S**910**, otherwise, to the step S**911**.

[0095] Step S**910**: According to the distance between the objects mentioned above and the processing based on FIG. **8**, the position information transmission frequency is calculated. The time ta for position prediction at the next time and the prediction function are generated. Then, the processing is advanced to the step S**911**.

[0096] Step S**911**: The position information of the corresponding object C**1** is transmitted to the opponent game machines GM**1** to GM**4**. Then the processing is terminated.

[0097] As mentioned above, the communication load is lightened by adjusting the information volume according to the present invention. The communication load is further lightened by optimizing the communication channel according to evaluation of communication speed between the game machine (GM**1**, for example) and the opponent game machines (GM**2** to GM**4**, for example).

[0098] In the game machine GM**1**, the communication channel i optimized by the steps in FIG. **11**.

[0099] Step S**1101**: First, the opponent objects C**1** to Cn selectable are shown on the CRT **312** of the game machine GM**1**, for player's selection.

[0100] Step S**1102**: Waiting for the player's selection, the processing is advanced to the step S**1103** when the selection is finished.

[0101] Step S**1103**: The communication with the opponent game machines (GM**2** to GM**4**) corresponding to the selected opponent objects (C**2** to C**4** for example) is executed directly, without through the server SV. The delay times td**1** are obtained.

[0102] Step S**1104**: The communication with the opponent game machines (GM**2** to GM**4**) corresponding to the selected opponent objects (C**2** to C**4**, for example) is executed through the server SV. The delay times td**1** are obtained.

[0103] Step S**1105**: The smaller Min(td**1**, td**2**) of td**1** and td**2** for the opponent game machines GM**2** to GM**4** are compared with a predetermined reference delay time td**0** (reference communication time). When Min (td**1**, td**2**)>td**0**, the processing is advanced to the step S**1106**, otherwise, to the step S**1107**.

[0104] Step S**1106**: The objects not selected are shown. Then, the processing is returned to the step S**1102**.

[0105] Step S**1107**: The times td**1** and td**2** are compared for each game machine GM**2** to GM**4**. When td**1**<td**2**, the processing is advanced to the step S**1109**, otherwise, to the step S**1108**.

[0106] Step S**1108**: The communication channel through the server is selected for the game machine is selected. Then, the processing is terminated.

[0107] Step S**1109**: The communication channel without through the server is selected for the game machine is selected. Then, the processing is terminated.

[0108] As for the communication channel selection, as for the communication speed comparison of the communication through and without through the server SV in the step S**1107**, the CPU **301**, system memory **302**, communication I/F **311** and MODEM **314** cooperatively function as a communication speed comparison means.

[0109] As for the communication speed comparison of the communication through and without through the server SV with the reference communication speed in S**1105**, the CPU **301**, system memory **302**, communication I/F **311** and MODEM **314** cooperatively function as a reference communication speed comparison means.

[0110] As for the selection of other objects in the steps S**1106**, S**1101** and S**1102**, he CPU **301**, system memory **302**, rendering processor **307**, graphic memory **308** and CRT **312** cooperatively function as an additional game machine comparison means.

[0111] The embodiment above is described concerning car race, however, the present invention is applicable to role

playing game and other various games. As the distance between objects, various suitable distances may be applied for characteristics of the games, such as Euclid distance, Hamming distance etc.

[0112] According to the present invention, low process speed of a game is prevented due to communication load, with maintaining game quality.

What is claimed is:

1. A communication game system comprising a plurality of game machines and a network for connecting said game machines with one another, each said game machine (one game machine, hereafter) comprising:

a virtual space generating means for generating a virtual space in which a plurality of objects exist,

an input means for inputting movement input information which causes movement of said object (corresponding object, hereafter) corresponding to said one game machine in said virtual space,

a position information obtaining means for obtaining position information of other objects (opponent objects, hereafter) corresponding to other game machines (opponents' game machines) than said game machine, from said opponents game machines,

a position information calculation means for calculating a position information of said corresponding object according to said movement input information,

a position information transmission means for transmitting said position information of said corresponding object to said opponent game machines,

a distance calculation means for calculating distances between said corresponding object and opponent objects, according to said position information of said corresponding object and position information of said opponent objects, and

an information volume calculation means for calculating necessary information volume of said position information of corresponding object to be transmitted to each said opponent game machine, according to distances between said opponent object and opponents objects,

wherein said position information transmission means transmits said position information by said necessary information volume to said opponent game machines.

2. A communication game system according to claim 1, further comprising a position prediction calculation means for calculating a predicted position of said corresponding object at a time after a current time by a transfer time through said network, according to said position information of said corresponding object, wherein said position information transmission means transmits said predicted position of said corresponding object as said position information to said opponent game machines.

3. A communication game system according to claim 1, further comprising a server which comprises,

a position information receiving means connected to said network for receiving said position information from said game machines, and

a position information transmission means for transmitting said position information of each said game machine to opponent game machines.

4. A communication game system according to claim 2, each said game machine further comprising,

a communication speed comparison means for comparing communication transfer time of a communication channel through said server and a communication channel not through said server, and

a communication channel selecting means for selecting communication channel of higher communication speed, from said communication channels through and not through said server.

5. A communication game system according to claim 3, each said game machine further comprising,

a reference communication speed comparison means for comparing communication transfer time of a predetermined reference transfer time with said transfer time of said communication channel through said server and not through said server, and

an additional game machine comparison means for comparing communication transfer time of one of said opponent game machines of a communication channel through said server and not through said server, with said predetermined reference transfer time.

6. A communication game system according to claim 1, wherein said virtual space generating means generates further a moving path through which said corresponding object moves in said virtual space, and said distance calculation means calculates said distance along said moving path.

7. A communication game system according to claim 1, wherein said distance between said objects is one-line distance.

8. A communication game system according to claim 1, wherein said position information transmission means adjusts said information volume by communication frequency.

9. A communication game system according to claim 1, wherein positions on said moving path are included in said position information, and further widthwise positions when said information volume is a lot.

10. A communication game system according to claim 1, wherein said information volume calculation means adjusts said information volume, further according to positional relationship between said corresponding object and said opponent objects.

11. A game control program executed on a game machine for a communication game system which comprises a plurality of game machines and a network for connecting said game machines with one another, comprising:

a virtual space generating step for generating a virtual space in which a plurality of objects exist,

an input step for inputting movement input information which causes movement of said object (corresponding object, hereafter) corresponding to said one game machine in said virtual space,

a position information obtaining step for obtaining position information of other objects (opponent objects, hereafter) corresponding to other game machines (opponents' game machines) than said game machine, from said opponents game machines,

a position information calculation step for calculating a position information of said corresponding object according to said movement input information,

a position information transmission step for transmitting said position information to said opponent game machines,

a distance calculation step for calculating distances between said corresponding object and opponent objects, according to said position information of said corresponding object and position information of said opponent objects, and

an information volume calculation step for calculating necessary information volume of said position information of corresponding object to be transmitted to each said opponent game machine, according to distances between said opponent object and opponents objects,

wherein said position information transmission step transmits said position information by said necessary information volume to said opponent game machines.

12. A memory medium readable by a computer in which program code executable by said computer of said game control program according to claim 11.

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