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(54) **INFORMATION PROCESSING APPARATUS, INFORMATION PROCESSING METHOD, AND PROGRAM**

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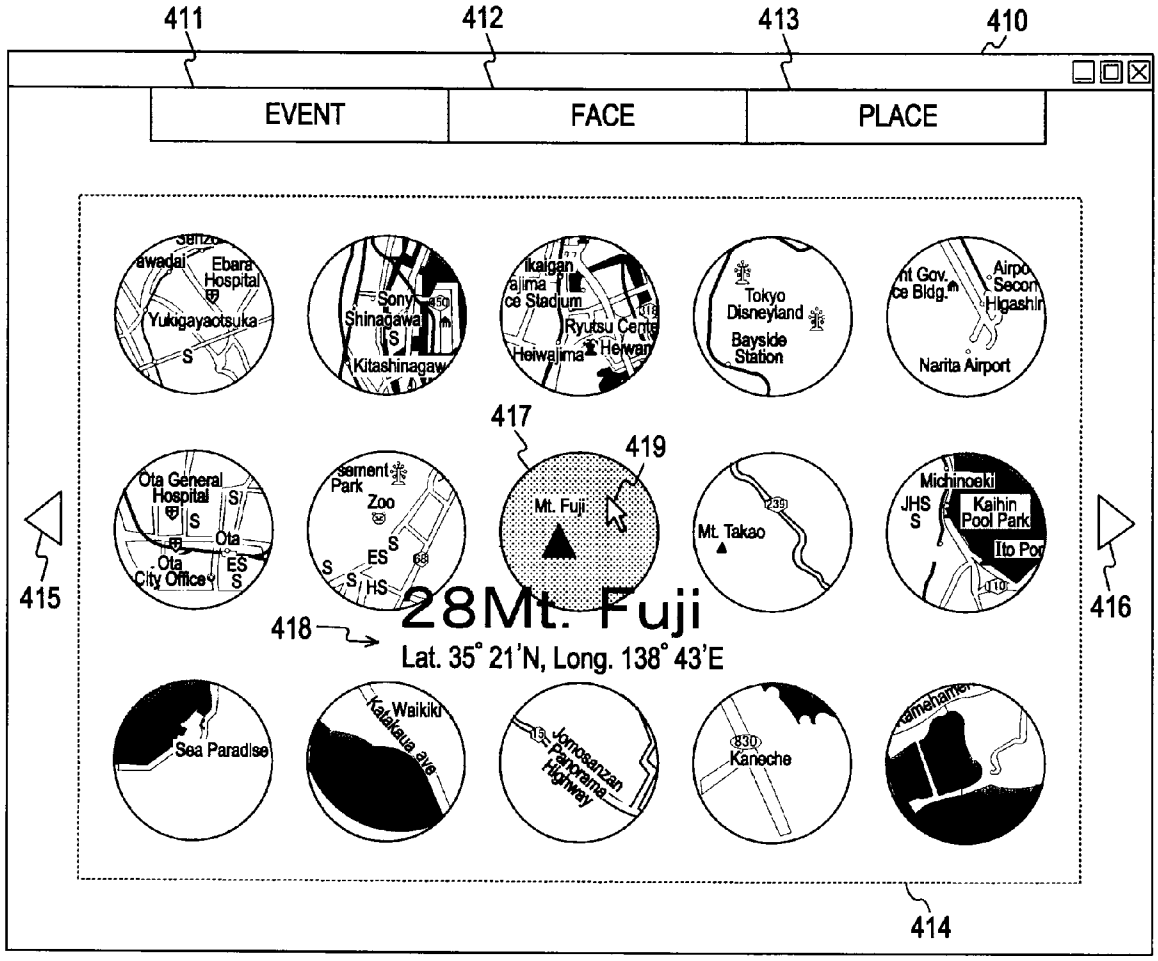
G09G 5/00 (2006.01)

(52) **U.S. Cl.** **345/629**

(57) **ABSTRACT**

An information processing apparatus includes a transformed-coordinate calculating section that calculates transformed coordinates for each of a plurality of superimposed images associated with coordinates in a background image, by transforming coordinates of other superimposed images with respect to one superimposed image as a reference image in such a way that coordinate intervals within a predetermined area with respect to the reference image become denser with increasing distance from the reference image toward the boundary, a coordinate setting section that sets coordinates of the reference image on the basis of a mean value obtained by calculating a mean of the calculated coordinates of the other superimposed images with respect to the reference image, and a display control section that displays the background image and the plurality of superimposed images on a display section in such a way that the reference image is placed at the set coordinates in the background image.



SAMSUNG 1005

FIG. 1

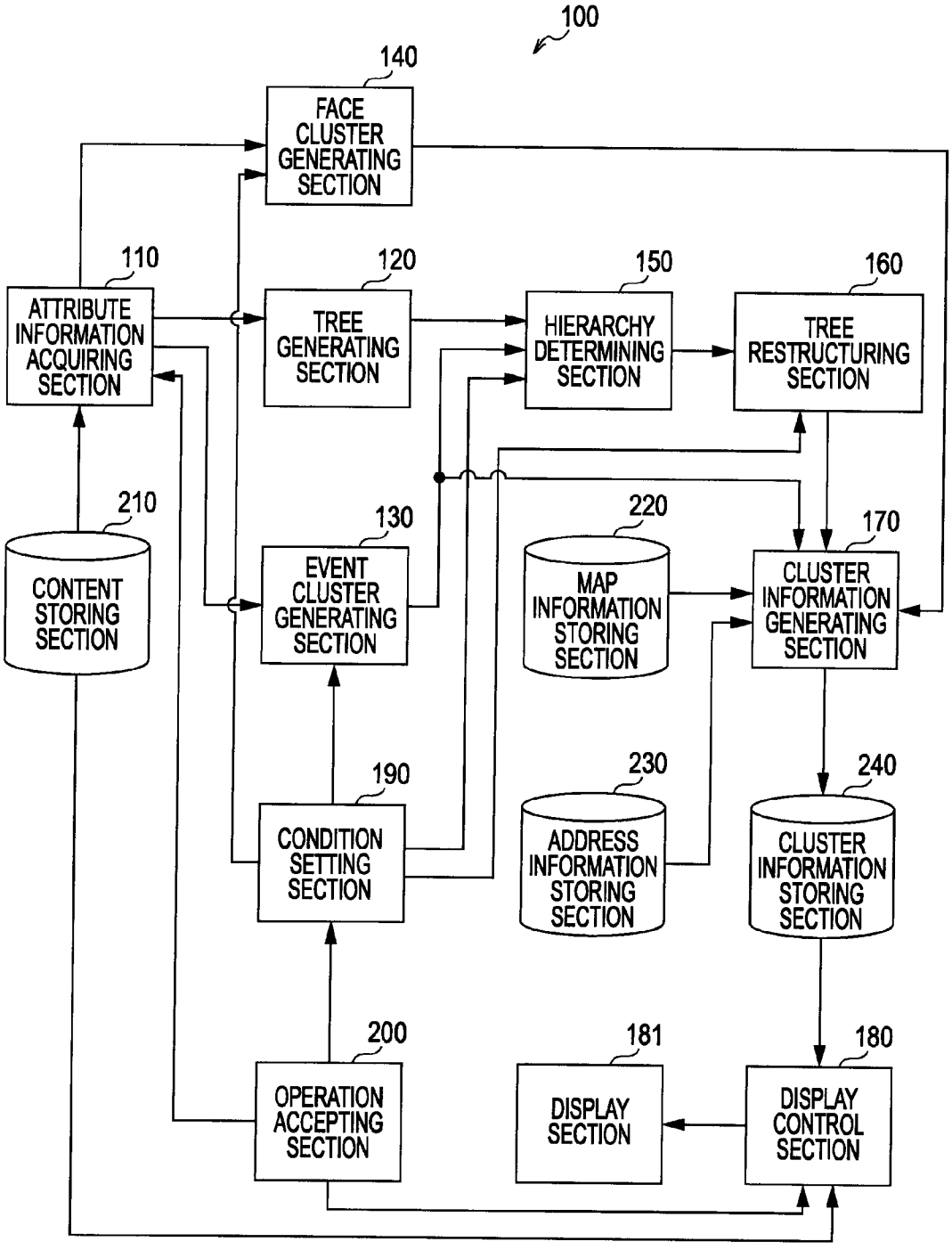

100
140
FACE CLUSTER GENERATING SECTION
110
ATTRIBUTE INFORMATION ACQUIRING SECTION
120
TREE GENERATING SECTION
150
HIERARCHY DETERMINING SECTION
160
TREE RESTRUCTURING SECTION
210
CONTENT STORING SECTION
130
EVENT CLUSTER GENERATING SECTION
220
MAP INFORMATION STORING SECTION
170
CLUSTER INFORMATION GENERATING SECTION
190
CONDITION SETTING SECTION
230
ADDRESS INFORMATION STORING SECTION
240
CLUSTER INFORMATION STORING SECTION
200
OPERATION ACCEPTING SECTION
181
DISPLAY SECTION
180
DISPLAY CONTROL SECTION

FIG. 2A

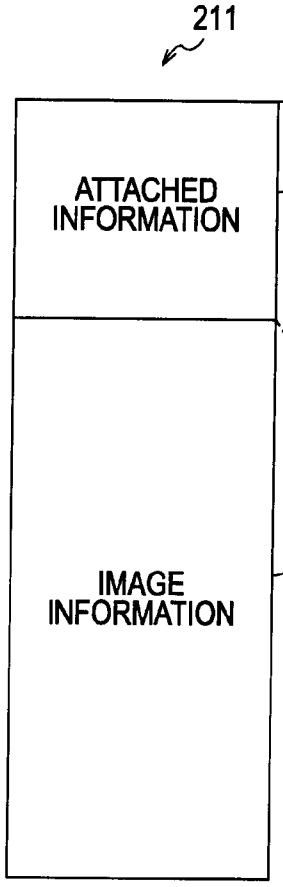

211
ATTACHED INFORMATION
212
IMAGE INFORMATION
215

FIG. 2B

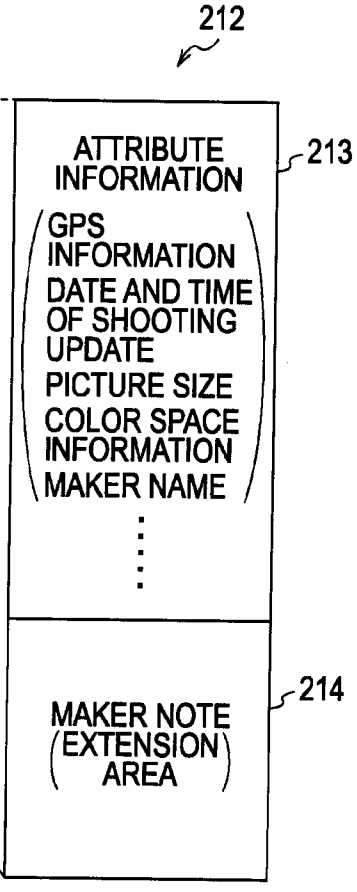

212
ATTRIBUTE INFORMATION
213
GPS INFORMATION
DATE AND TIME OF SHOOTING UPDATE
PICTURE SIZE
COLOR SPACE INFORMATION
MAKER NAME
MAKER NOTE (EXTENSION AREA)
214

FIG. 3

230

231 232

	POSITIONAL INFORMATION	ADDRESS INFORMATION
1	LATITUDE: ○○° ○○' LONGITUDE: ○○° ○○'	TOKYO-PREFECTURE SHINAGAWA-WARD KITASHINAGAWA 3-CHOME
2	LATITUDE: ○○° ○○' LONGITUDE: ○○° ○○'	TOKYO-PREFECTURE SHINAGAWA-WARD KITASHINAGAWA 3-CHOME ○○ CITY SHINAGAWA
3	LATITUDE: ○○° ○○' LONGITUDE: ○○° ○○'	TOKYO-PREFECTURE SHINAGAWA-WARD OSAKI 1-CHOME ○○ CITY OSAKI WT
4	LATITUDE: ○○° ○○' LONGITUDE: ○○° ○○'	TOKYO-PREFECTURE SHINAGAWA-WARD OSAKI 1-CHOME GOTENYAMA ○○ TOWER
5	LATITUDE: ○○° ○○' LONGITUDE: ○○° ○○'	TOKYO-PREFECTURE SHINAGAWA-WARD OSAKI 1-CHOME ○○ COMPANY
6	LATITUDE: ○○° ○○' LONGITUDE: ○○° ○○'	TOKYO-PREFECTURE SHINAGAWA-WARD OSAKI 1-CHOME ○○ COMPANY TECHNICAL CENTER
⋮	⋮	⋮

FIG. 4

	PREFECTURE (251)	MUNICIPALITY (252)	CHOME/BANCHI (253)	BUILDING NAME ETC. (254)
1	TOKYO-PREFECTURE	SHINAGAWA-WARD	KITASHINAGAWA 3-CHOME	
2	TOKYO-PREFECTURE	SHINAGAWA-WARD	KITASHINAGAWA 3-CHOME	
3	TOKYO-PREFECTURE	SHINAGAWA-WARD	KITASHINAGAWA 3-CHOME	○○ CITY SHINAGAWA
4	TOKYO-PREFECTURE	SHINAGAWA-WARD	KITASHINAGAWA 3-CHOME	
5	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI WT ~258
6	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI
7	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI
8	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	GOTENYAMA ○○ TOWER
9	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI WT
10	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI WT ~258
11	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI WT
12	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI WT
13	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI WT
14	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	GOTENYAMA ○○ TOWER
15	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI WT ~258
16	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI W TOWER
17	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI
18	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	
19	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	
20	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	
21	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI WT ~258
22	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI
23	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ COMPANY
24	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI
25	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ COMPANY TECHNICAL CENTER
26	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ COMPANY TECHNICAL CENTER
27	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ COMPANY TECHNICAL CENTER
28	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ COMPANY TECHNICAL CENTER
29	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI WT ~258
30	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ COMPANY TECHNICAL CENTER
31	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ COMPANY
32	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ COMPANY TECHNICAL CENTER
33	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI WT ~258
34	TOKYO-PREFECTURE	SHINAGAWA-WARD	OSAKI 1-CHOME	○○ CITY OSAKI

255 256 257

FIG. 5

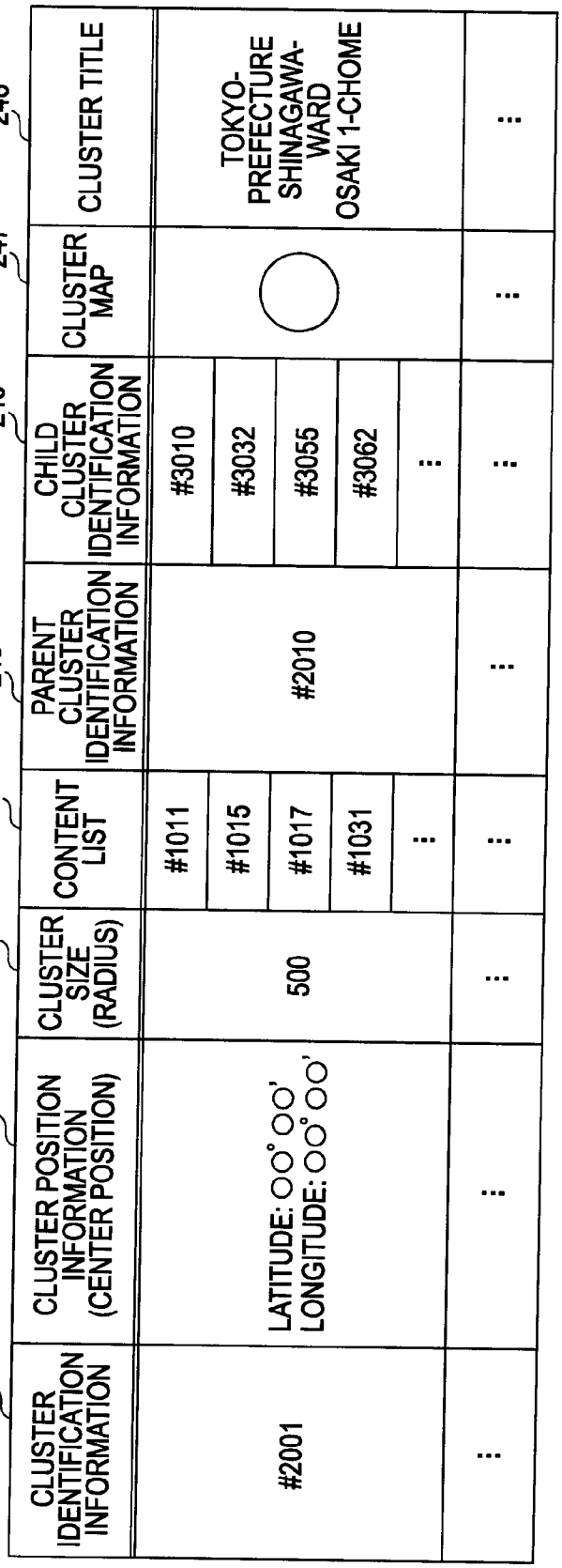

240
241
CLUSTER IDENTIFICATION INFORMATION
242
CLUSTER POSITION INFORMATION (CENTER POSITION)
243
CLUSTER SIZE (RADIUS)
244
CONTENT LIST
245
PARENT CLUSTER IDENTIFICATION INFORMATION
246
CHILD CLUSTER IDENTIFICATION INFORMATION
247
CLUSTER MAP
248
CLUSTER TITLE
#2001
LATITUDE: ○○° ○○' LONGITUDE: ○○° ○○'
500
#1011
#1015
#1017
#1031
#2010
#3010
#3032
#3055
#3062
TOKYO-PREFECTURE SHINAGAWA-WARD OSAKI 1-CHOME

FIG. 6A

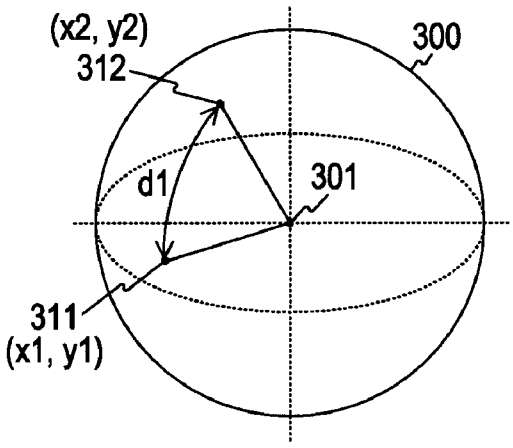


FIG. 6B

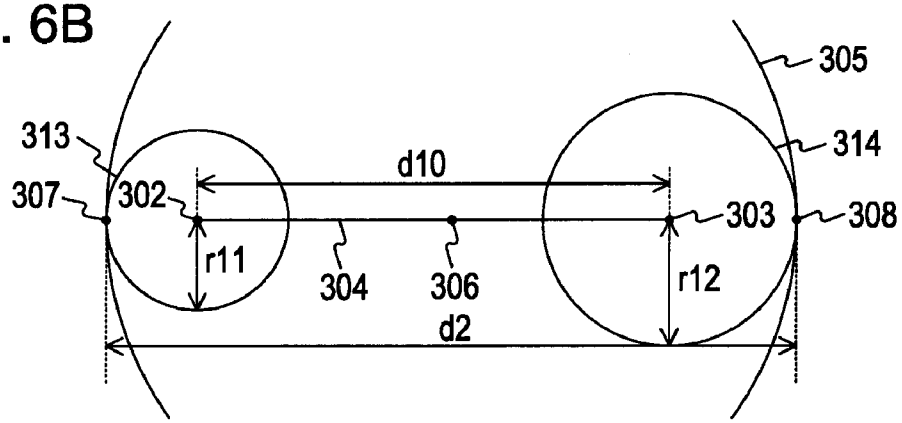


FIG. 6C

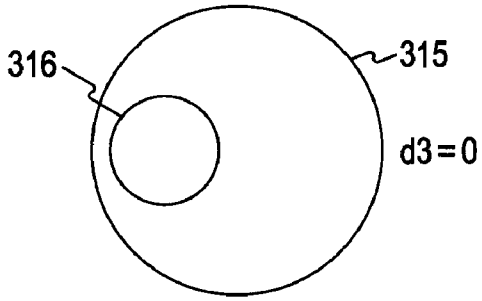


FIG. 6D

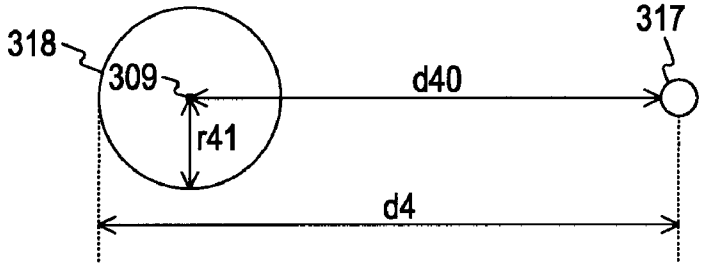


FIG. 7

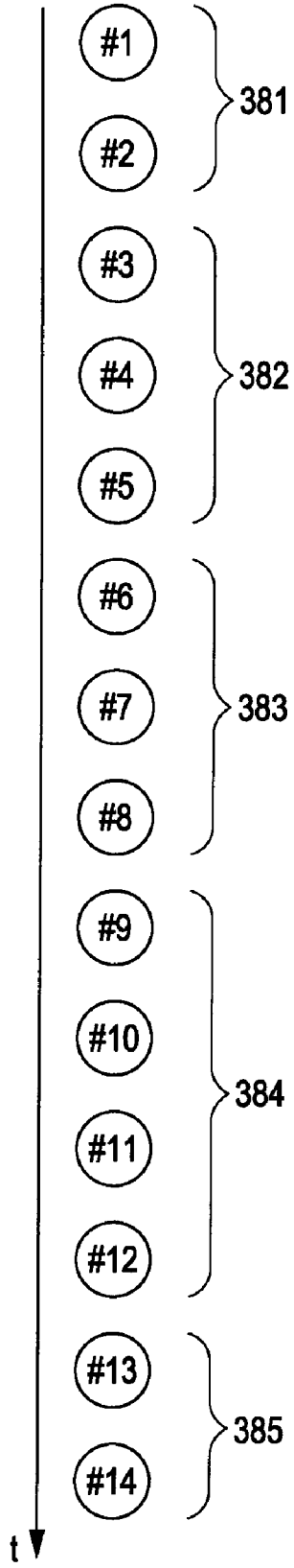
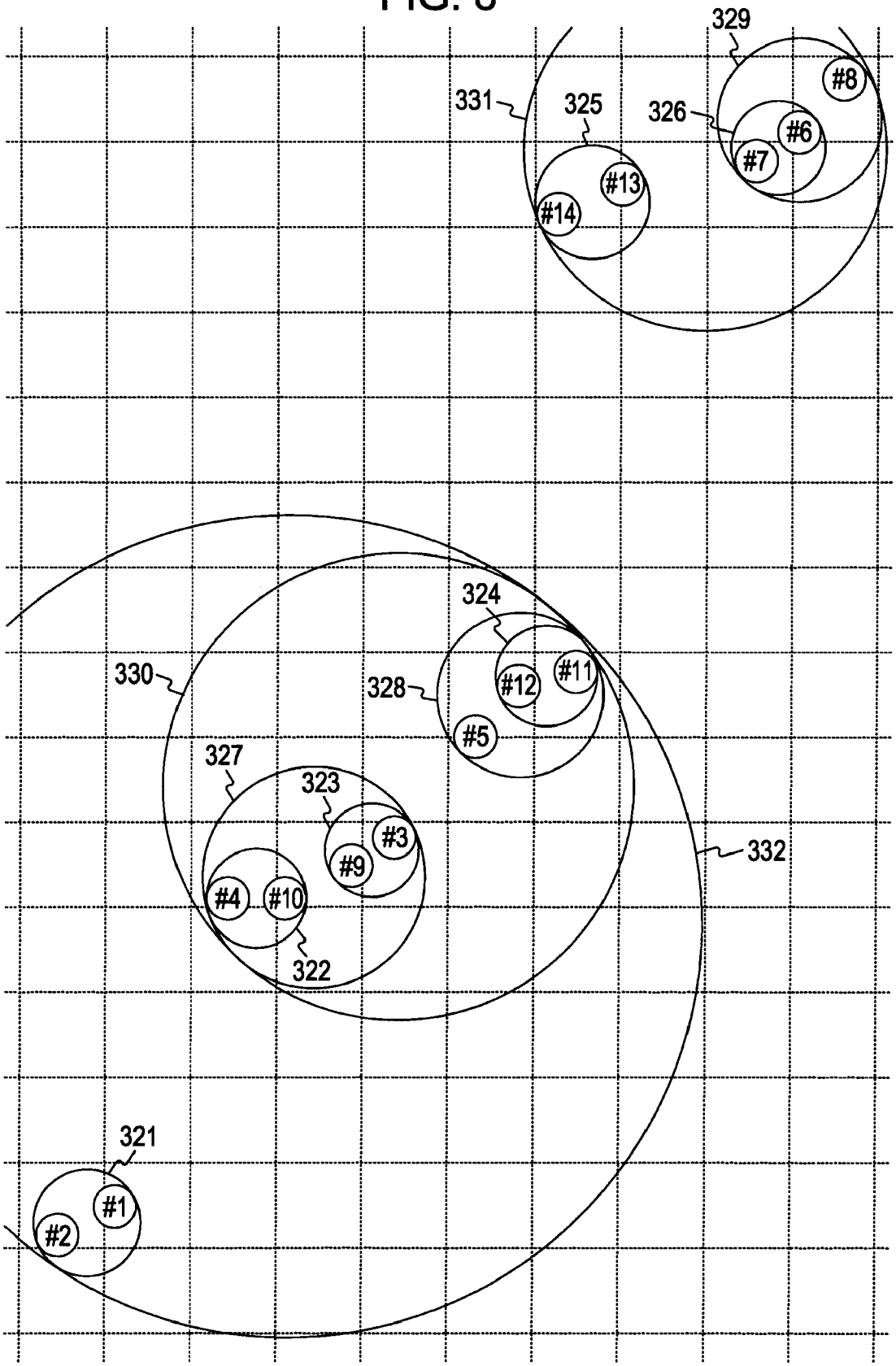


FIG. 8


329
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#11
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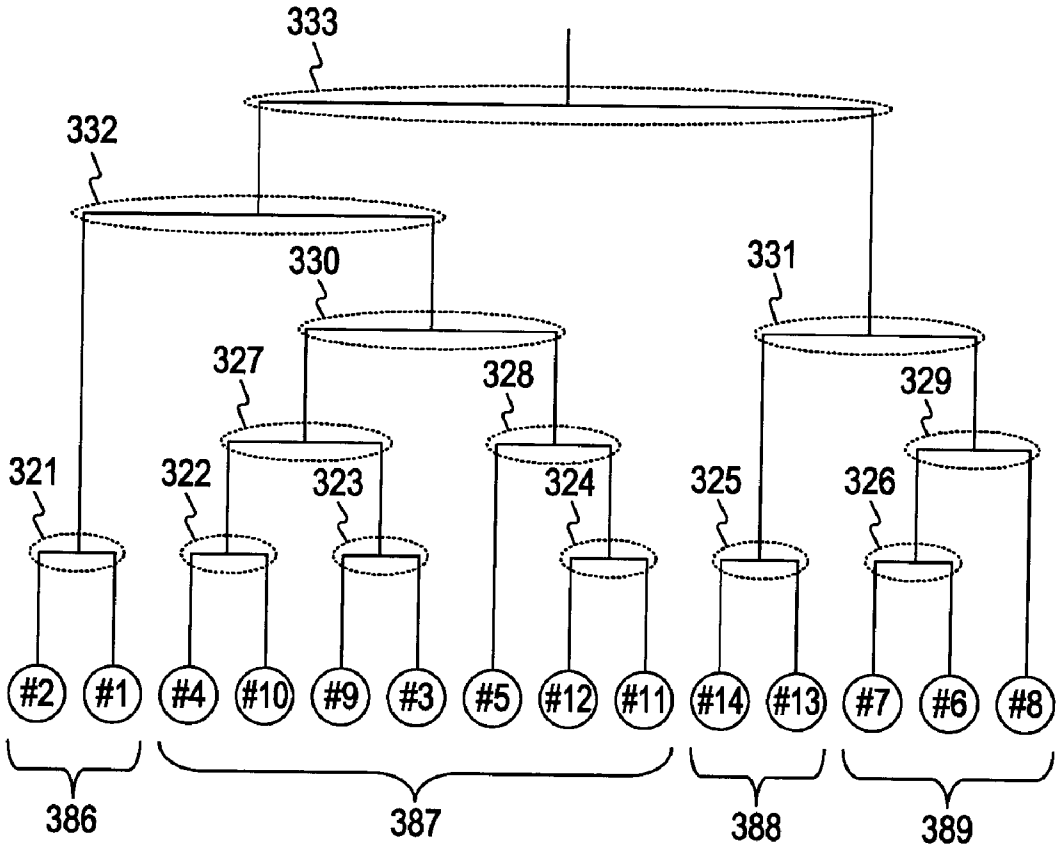
323
#3
#9
332
#4
#10
322
321
#1
#2

FIG. 9


333
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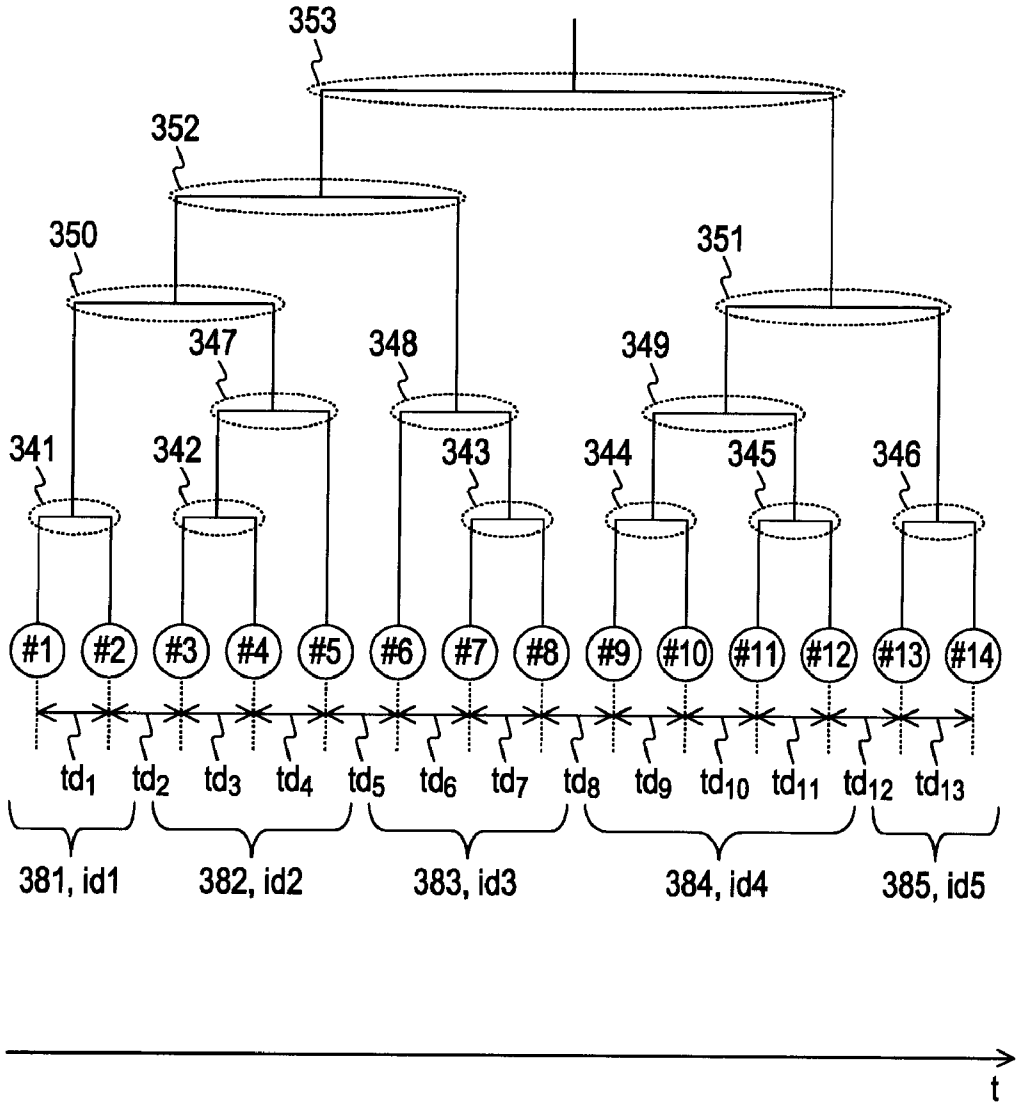
#7
#6
#8
386
387
388
389

FIG. 10


353
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td5
td6
td7
td8
td9
td10
td11
td12
td13
381, id1
382, id2
383, id3
384, id4
385, id5
t

FIG. 11A

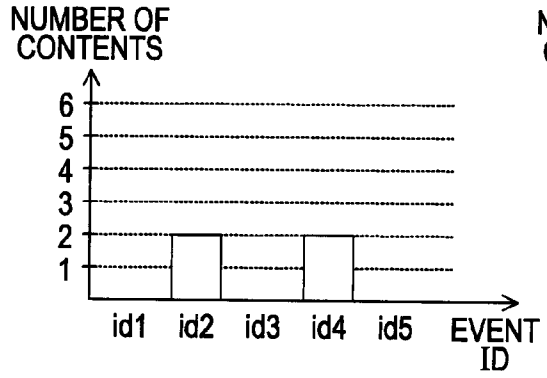


FIG. 11D

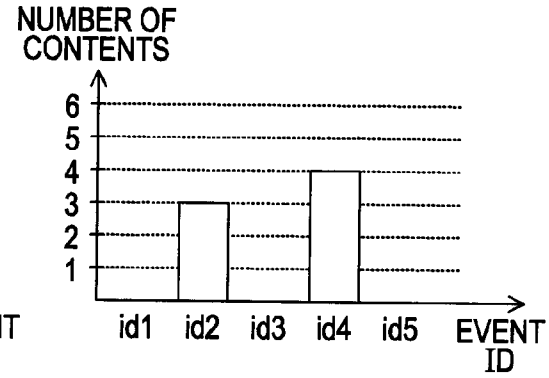


FIG. 11B

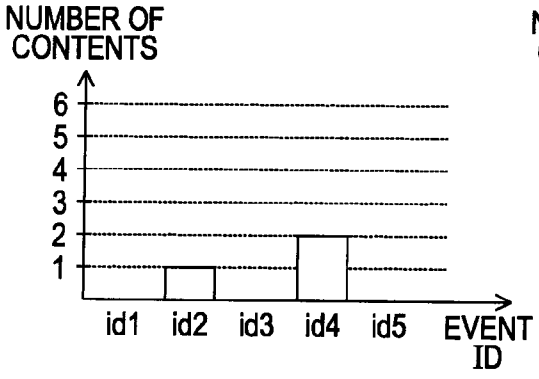


FIG. 11E

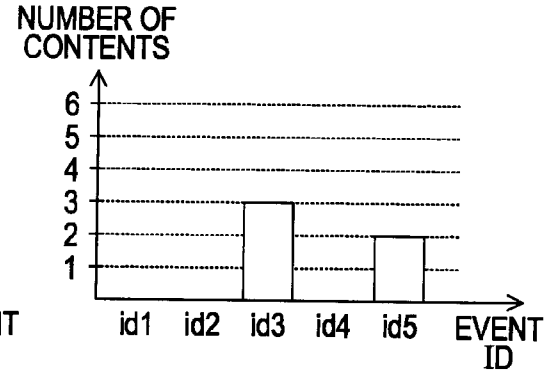


FIG. 11C

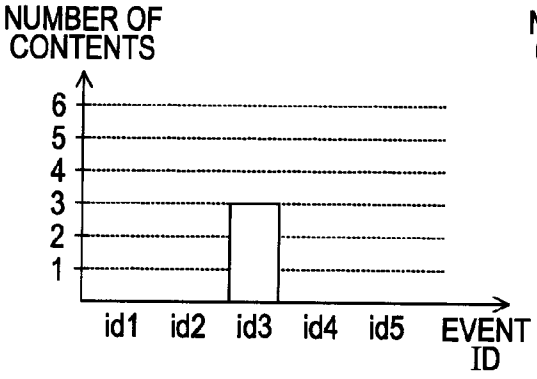


FIG. 11F

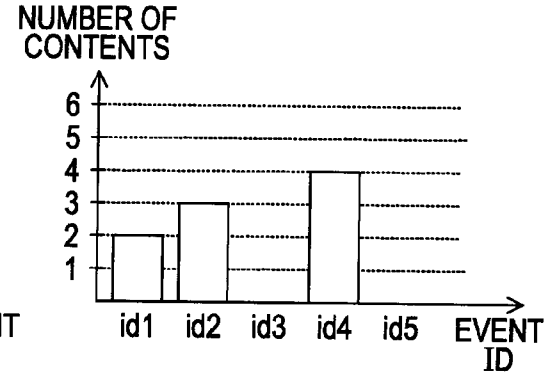


FIG. 12A

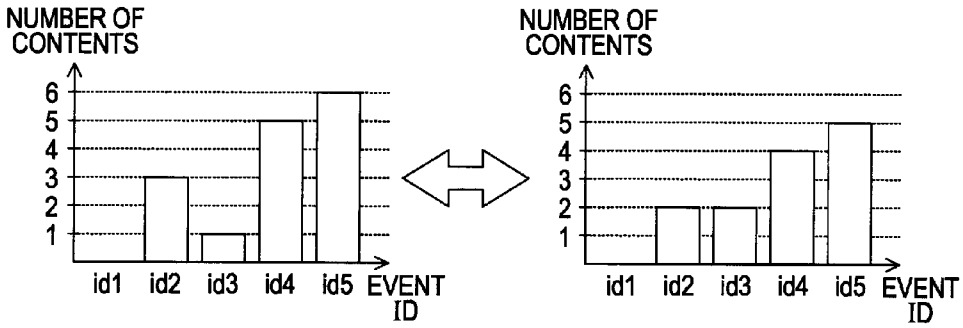


FIG. 12B

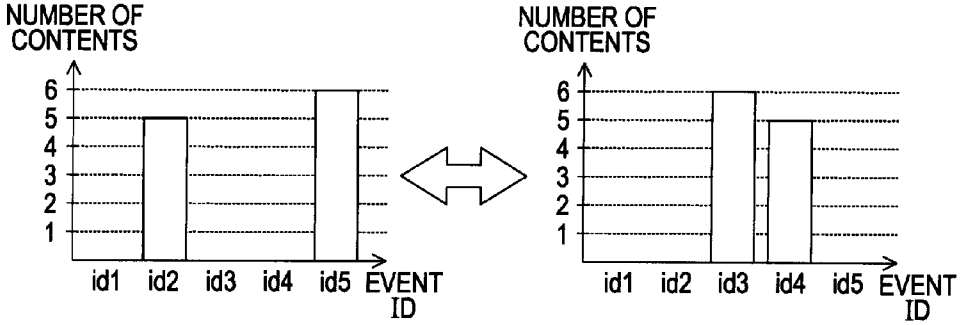
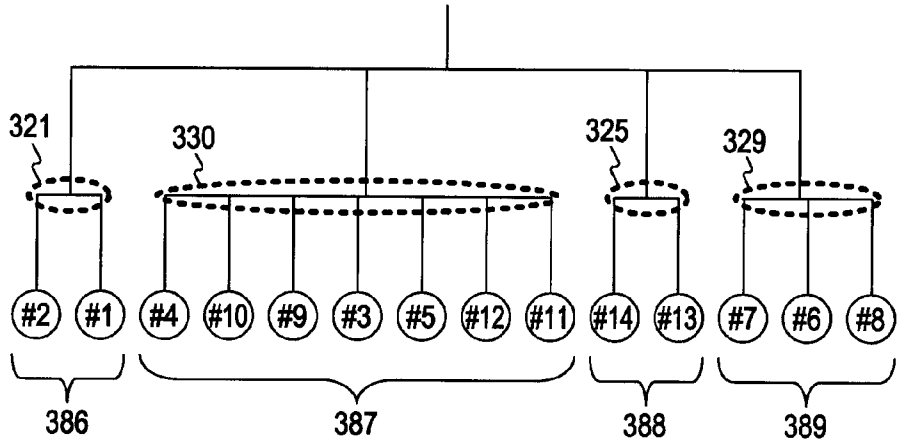


FIG. 13A



RESTRUCTURING OF TREE

FIG. 13B

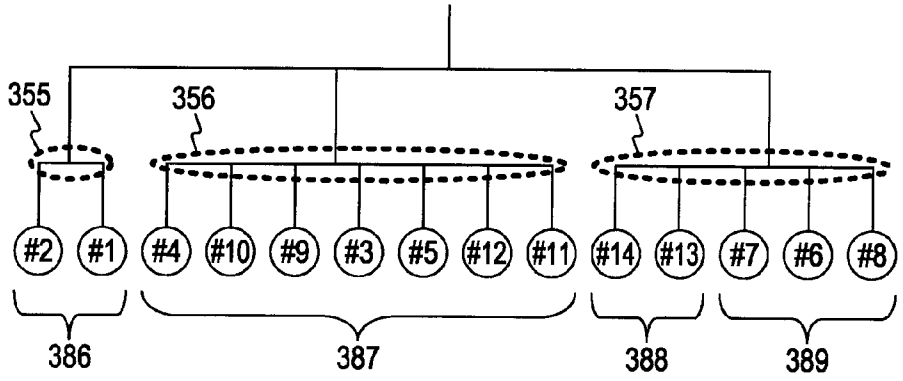


FIG. 14

171 CLUSTER DIAMETER (km)	172 MAP SCALE
0 km TO 2 km	1/100,000
2 km TO 4 km	1/200,000
4 km TO 8 km	1/400,000
8 km TO 16 km	1/800,000
16 km TO 32 km	1/1,000,000
32 km TO 64 km	1/3,200,000
64 km TO 128 km	1/6,400,000
128 km TO 256 km	1/12,800,000
256 km TO 512 km	1/25,600,000
512 km TO 1024 km	1/51,200,000
1024 km TO 2048 km	1/102,400,000
2048 km TO 4096 km	1/204,800,000
4096 km OR MORE	WORLDWIDE MAP

FIG. 15A

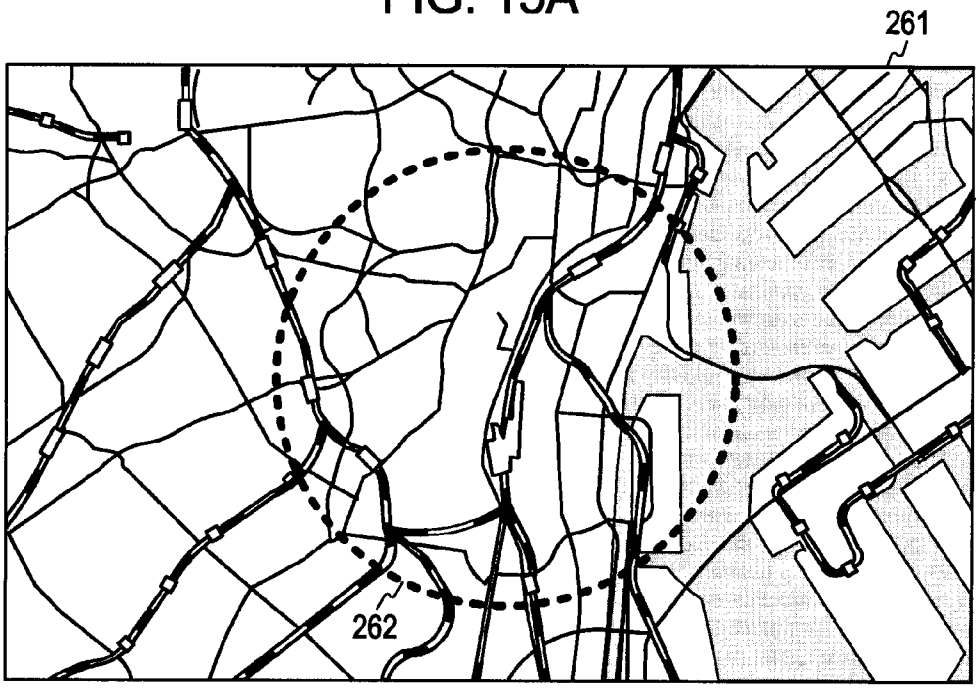


FIG. 15B

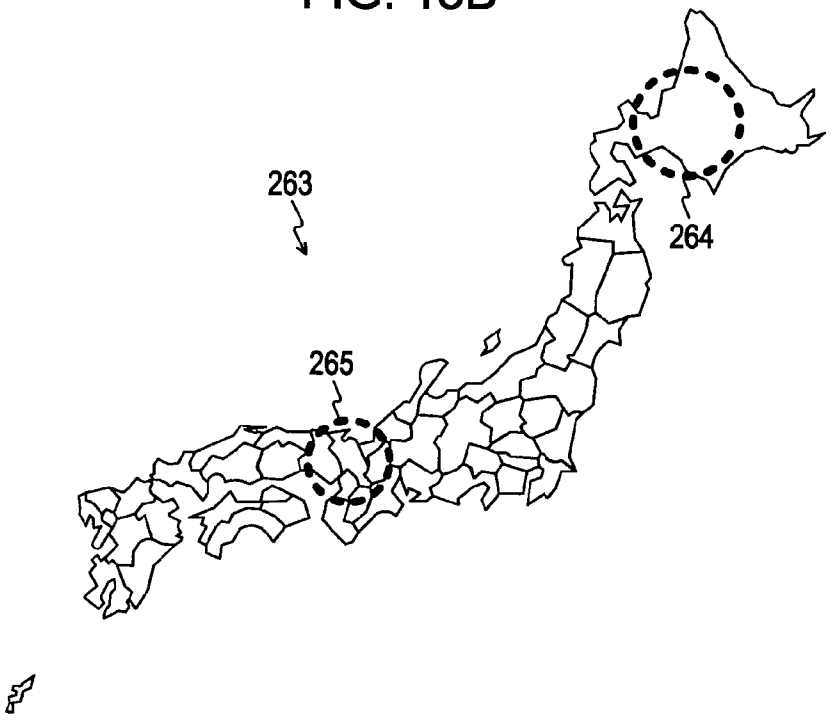


FIG. 16A

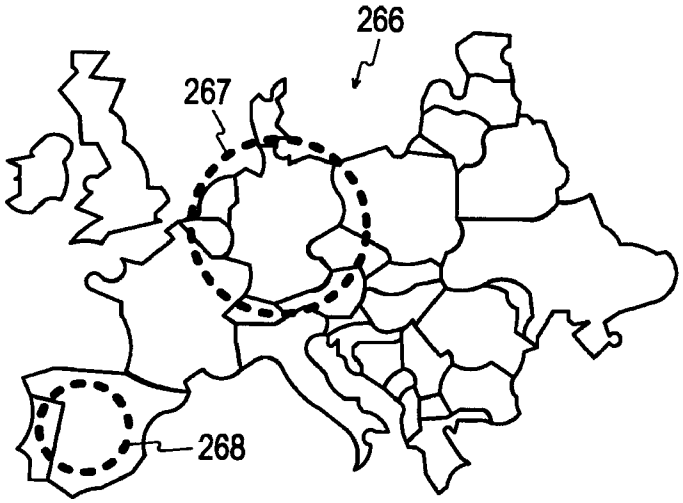


FIG. 16B

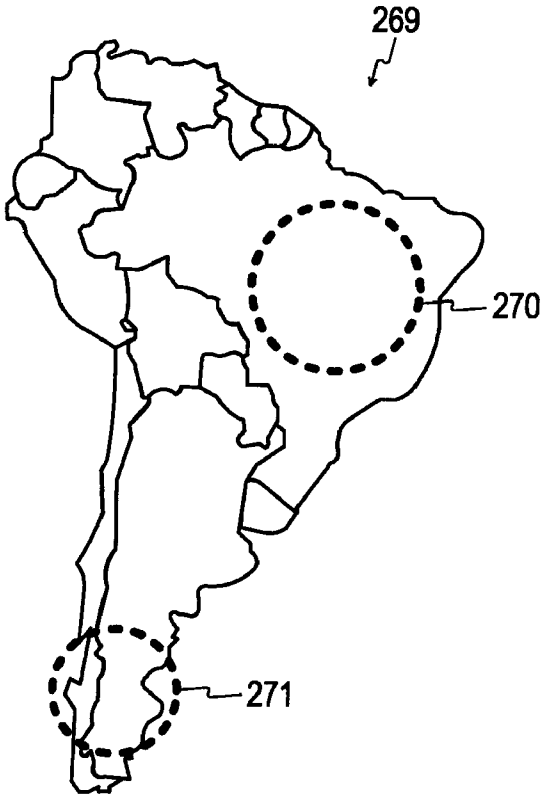
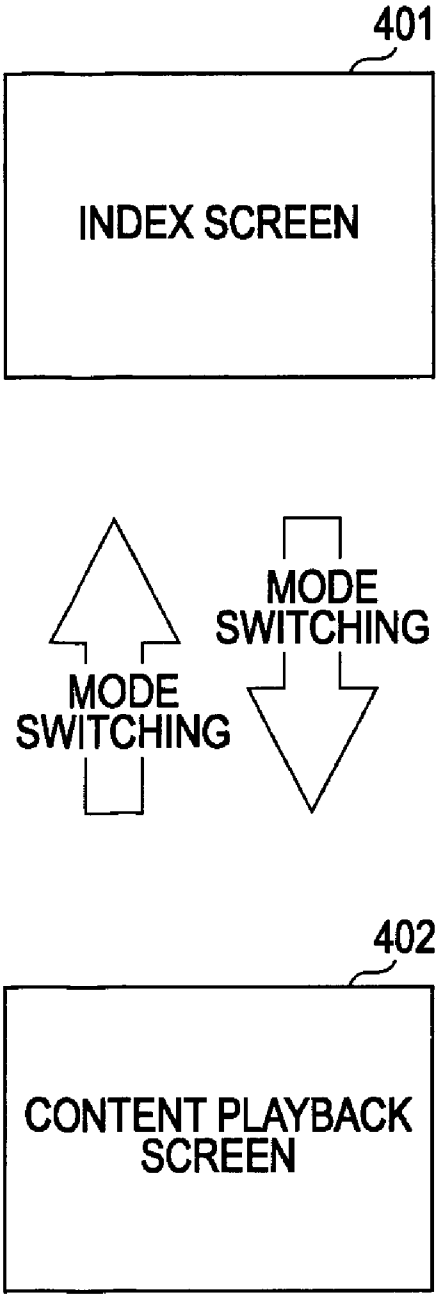


FIG. 17


401
INDEX SCREEN
MODE SWITCHING
MODE SWITCHING
402
CONTENT PLAYBACK SCREEN

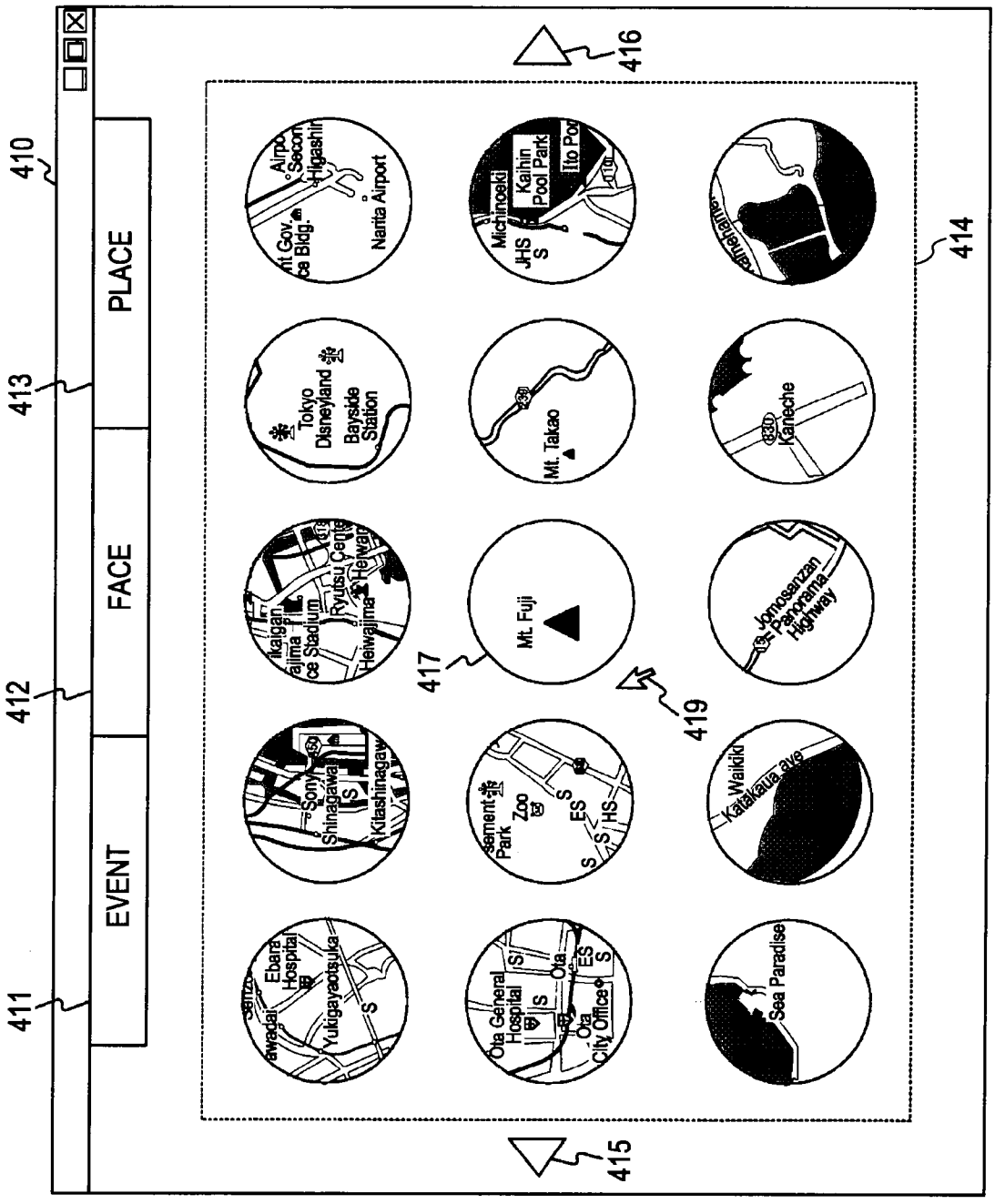

410
411
412
413
414
415
416
417
419
EVENT
FACE
PLACE
Narita Airport
Tokyo Disneyland
Bayside Station
Mt. Takao
Mt. Fuji
Kaneche
Jomosanzan Panorama Highway
Sea Paradise
Waikiki
Katakaua ave
Zoo
Ota General Hospital
Ota City Office
Yukigayaotsuka
Kitashinagawa
Sony
Shinagawa
Ryutsu Center
Heiwajima
Kaihin Pool Park
Michinoeki
JHS
S
ES
HS

FIG. 18

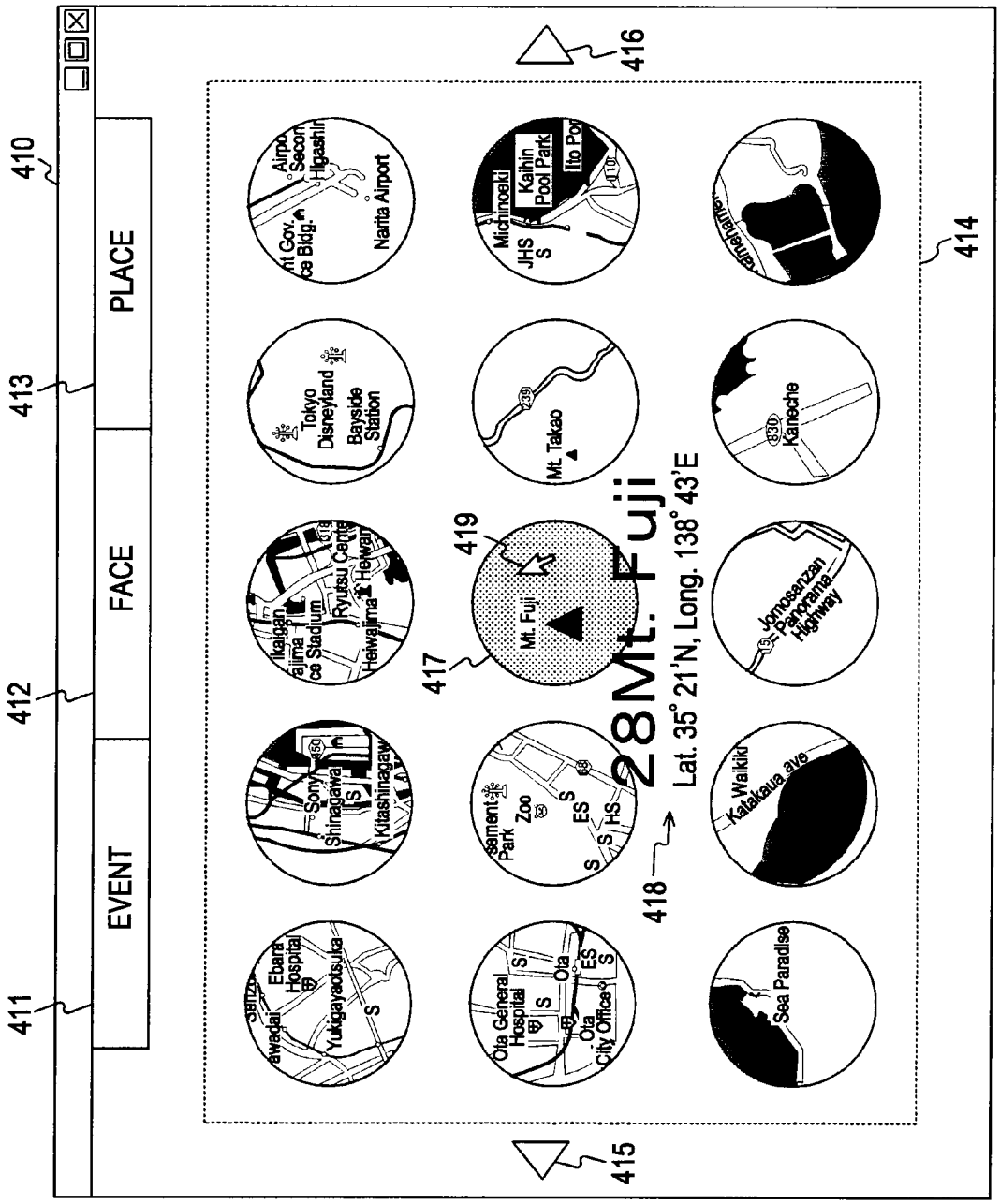

410
411
412
413
EVENT
FACE
PLACE
414
415
416
417
418
419
28Mt. Fuji
Lat. 35° 21'N, Long. 138° 43'E
Mt. Fuji
Mt. Takao
Kaneohe
Sea Paradise
Waikiki
Kalakaua ave
Jonosanzan Panorama Highway
Tokyo Disneyland
Bayside Station
Narita Airport
Kaihin Pool Park
Ota General Hospital
Ota City Office
Ebara Hospital
Yukigayaotsuka
Sony
Kitashinagawa
Ryutsu Center
Heiwajima
Zoo

FIG. 19

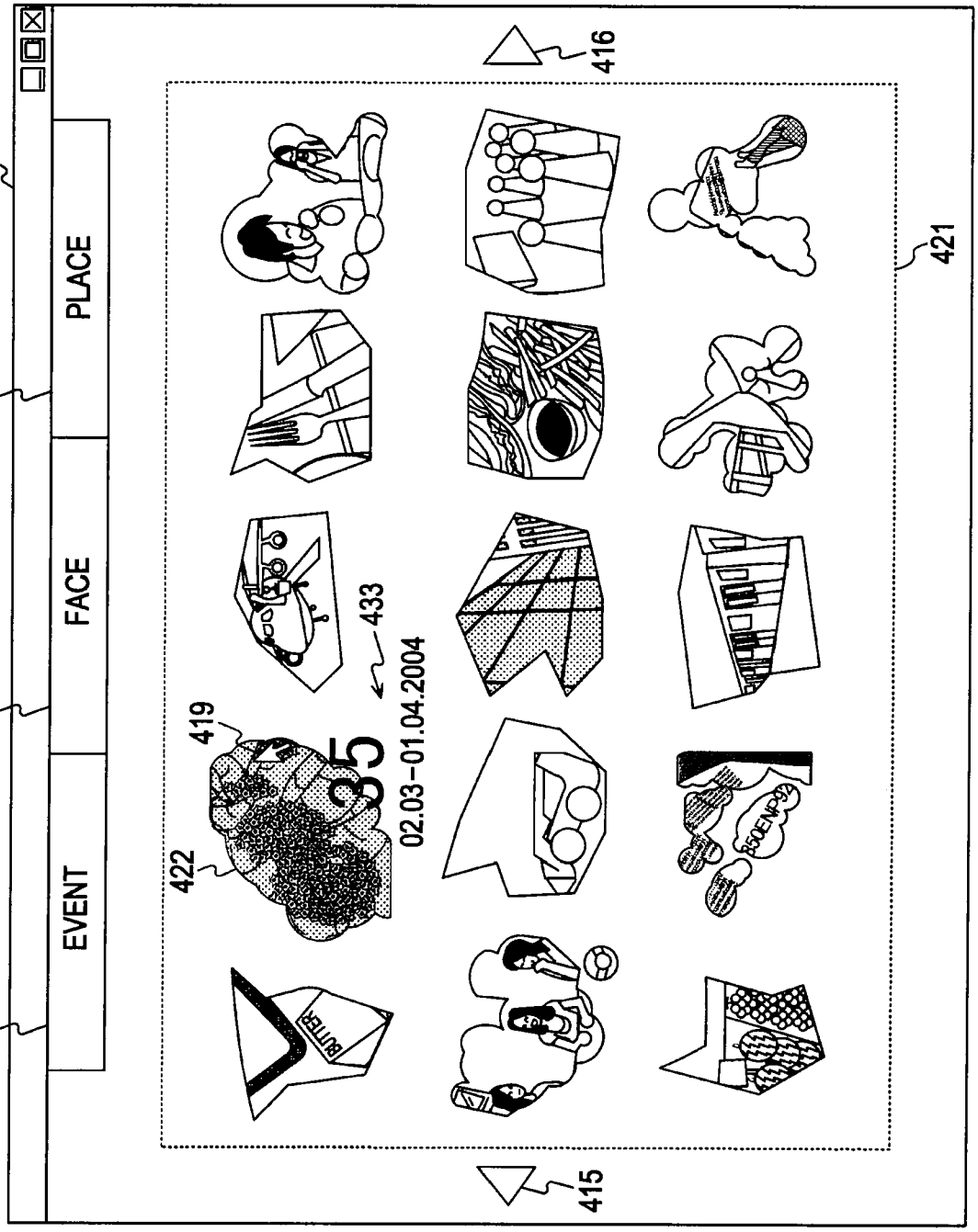

420
413
412
411
PLACE
FACE
EVENT
416
421
433
419
422
35
02.03-01.04.2004
BUTTER
415

FIG. 20

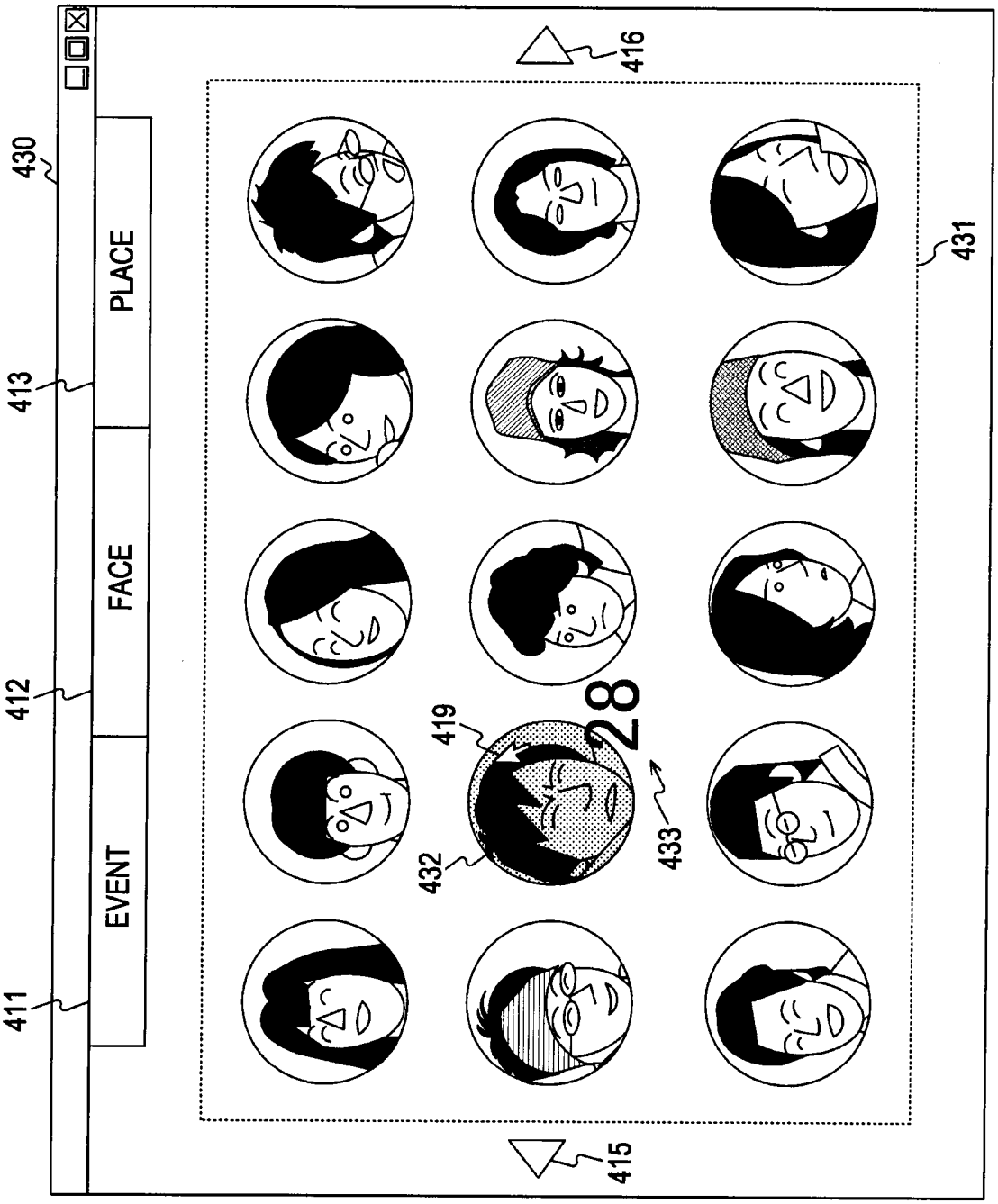


FIG. 21

FIG. 22

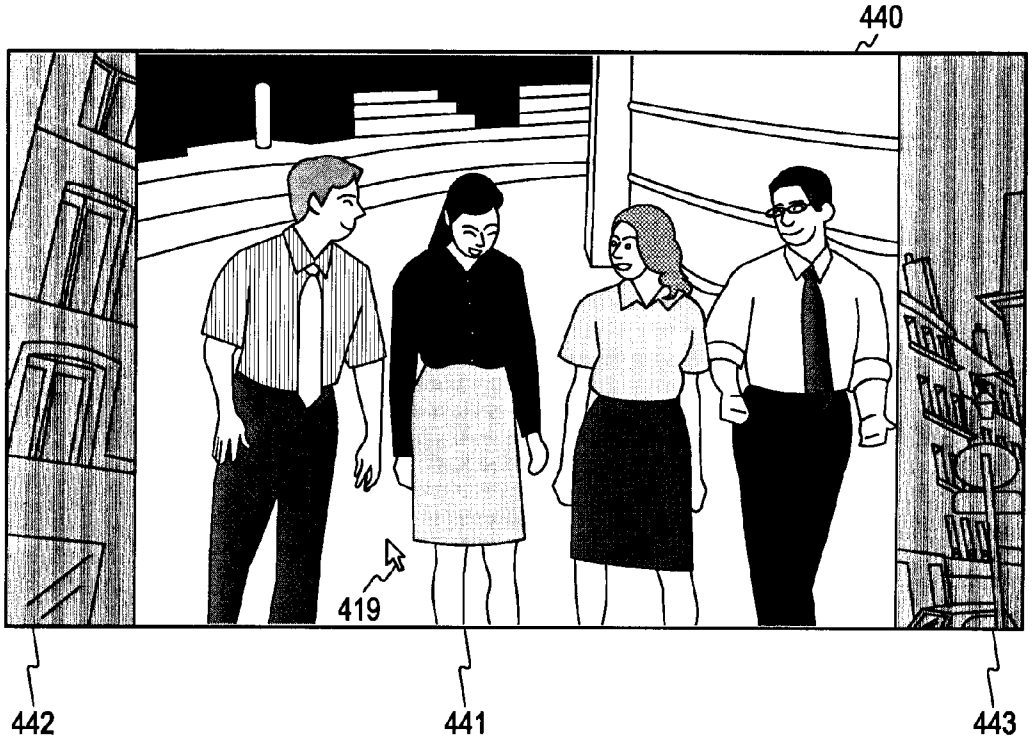


FIG. 23

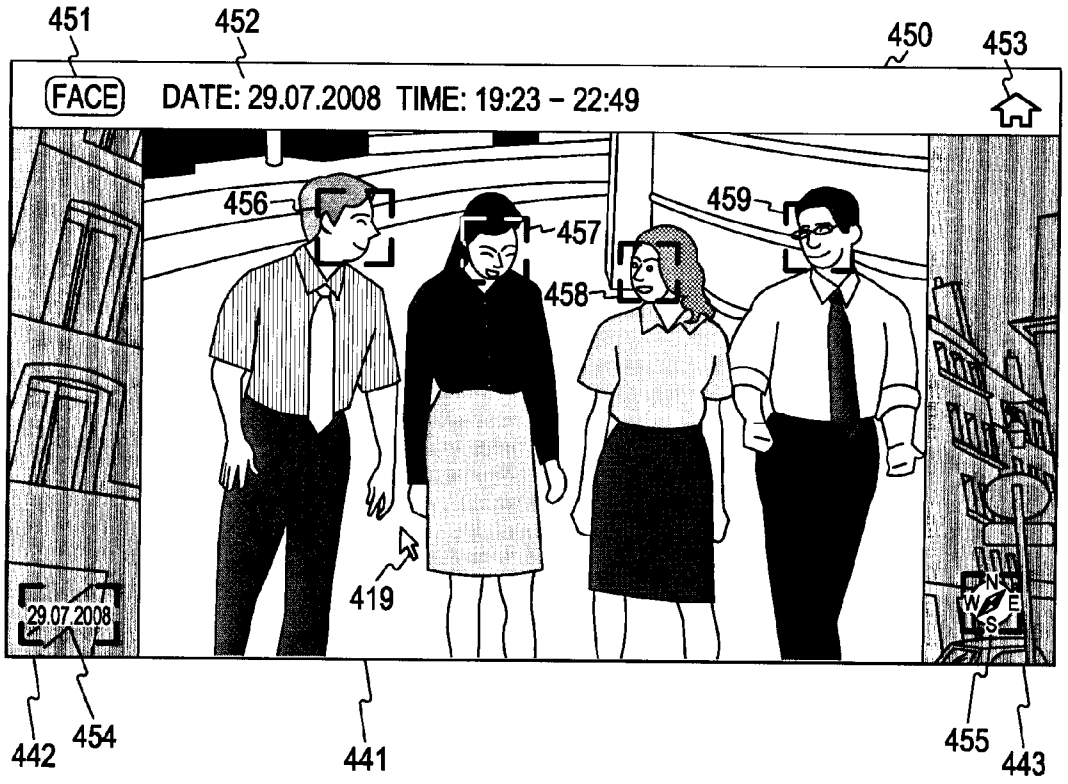

451
452
450
453
FACE
DATE: 29.07.2008 TIME: 19:23 - 22:49
456
457
458
459
419
29.07.2008
N
W
E
S
442
454
441
455
443

FIG. 24

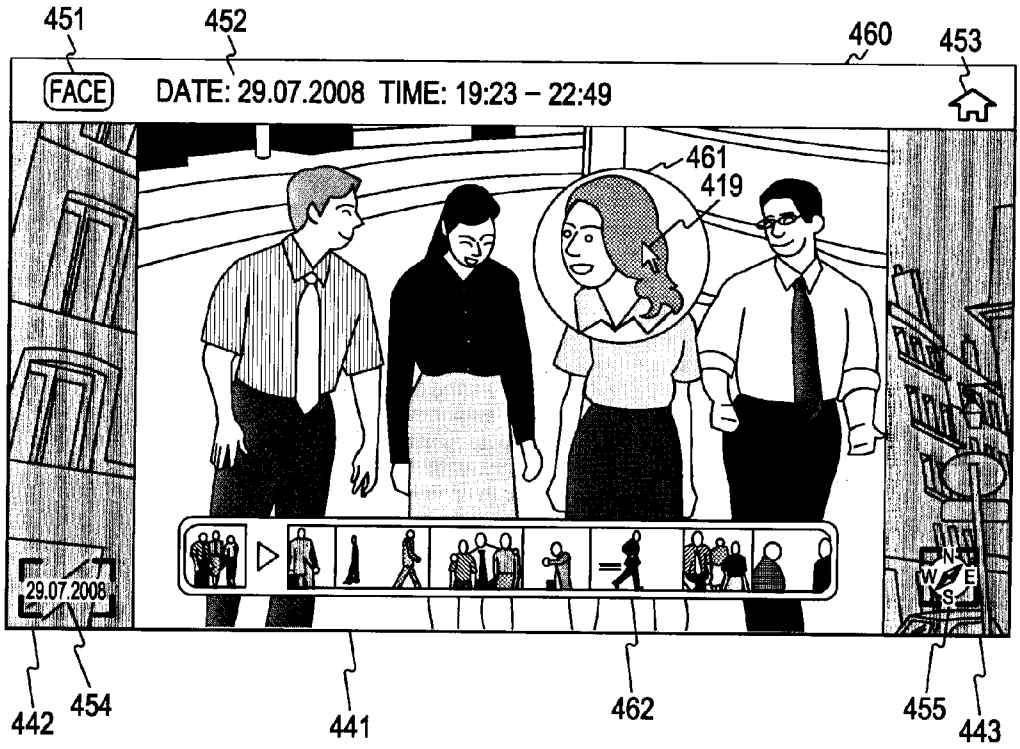

451
452
460
453
FACE
DATE: 29.07.2008 TIME: 19:23 – 22:49
461
419
29.07.2008
N
W
E
S
442
454
441
462
455
443

FIG. 25

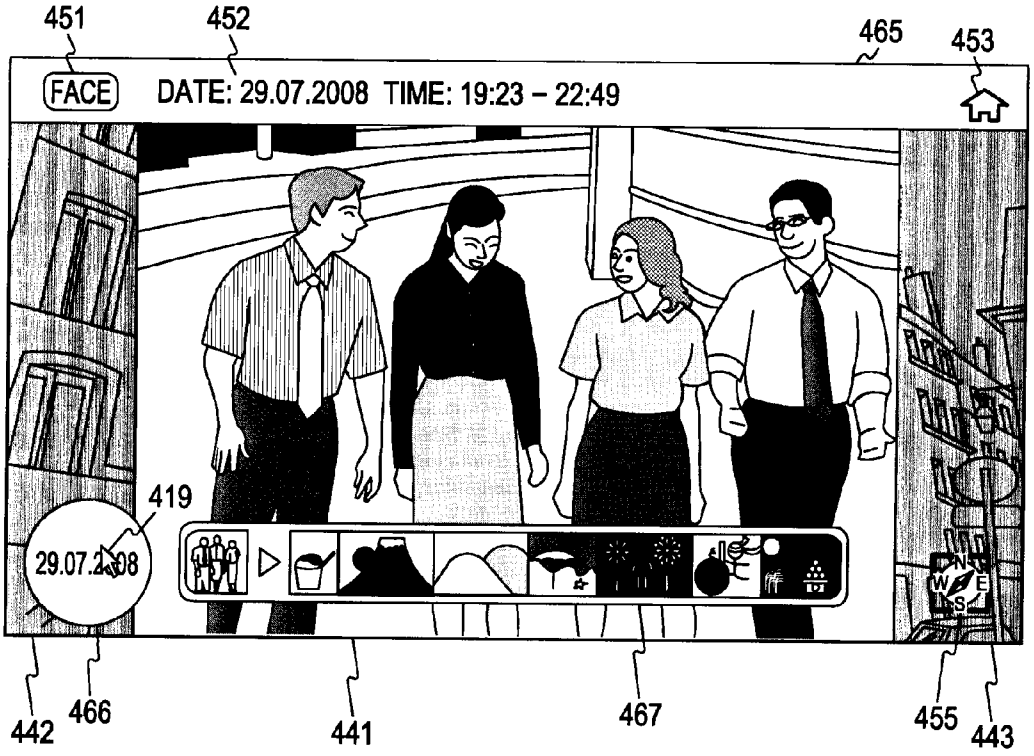

451
452
465
453
FACE
DATE: 29.07.2008 TIME: 19:23 – 22:49
419
29.07.2008
442
466
441
467
455
443

FIG. 26

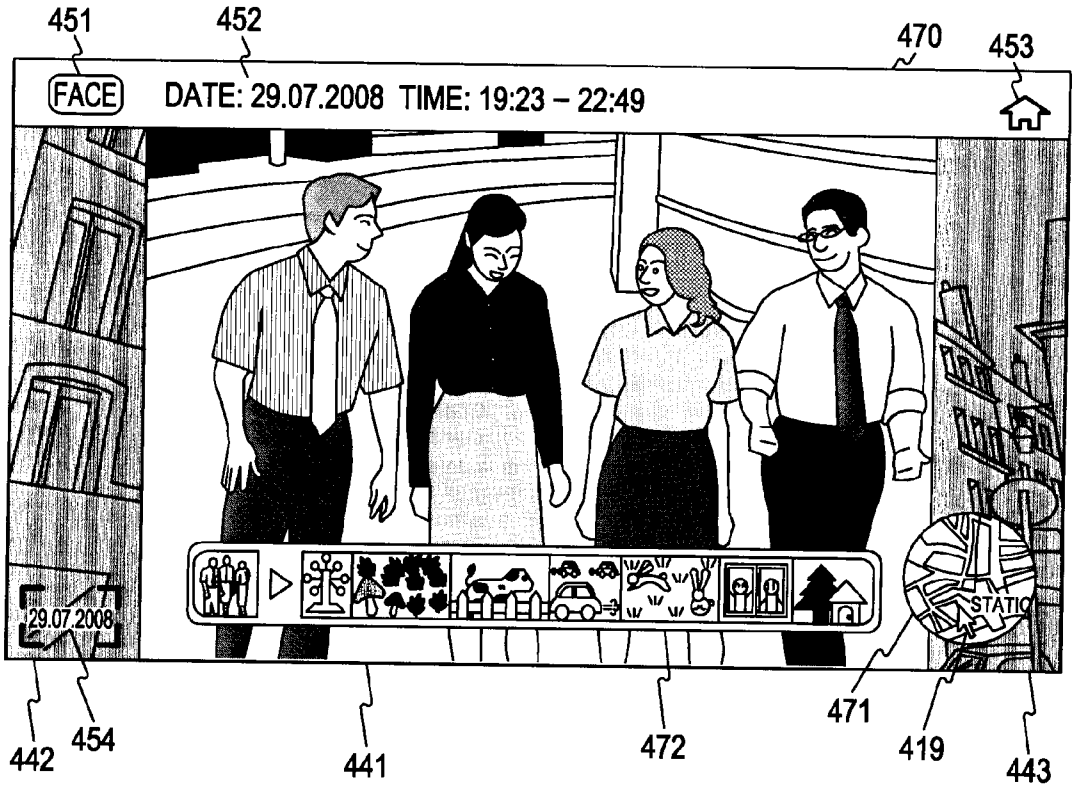

451
452
470
453
FACE
DATE: 29.07.2008 TIME: 19:23 – 22:49
29.07.2008
STATIC
442
454
441
472
471
419
443

FIG. 27A

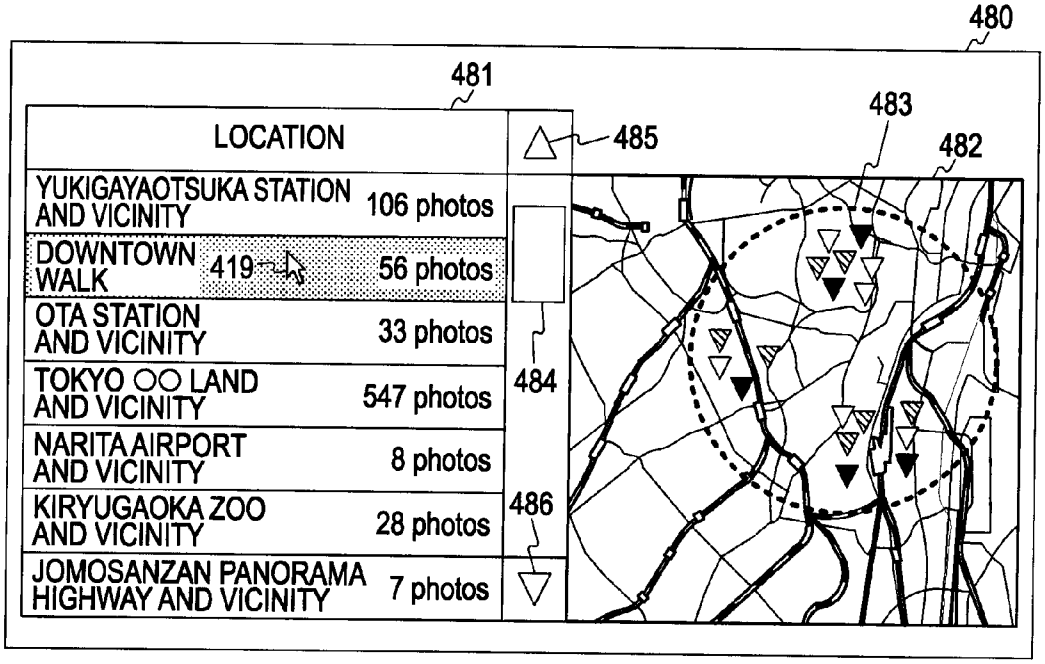


FIG. 27B

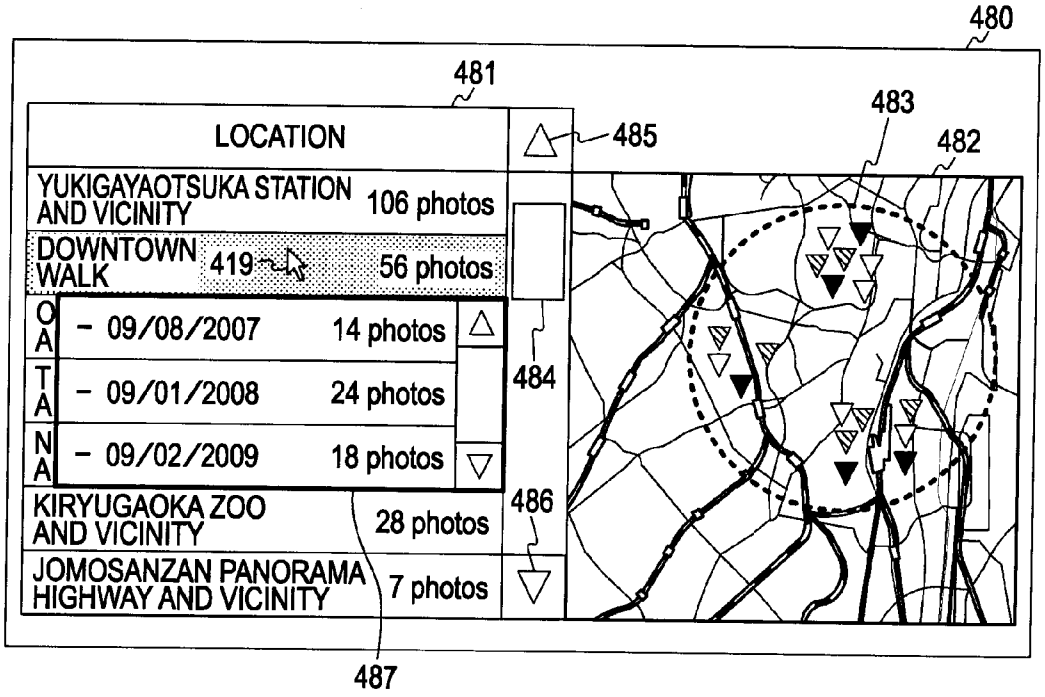


FIG. 28

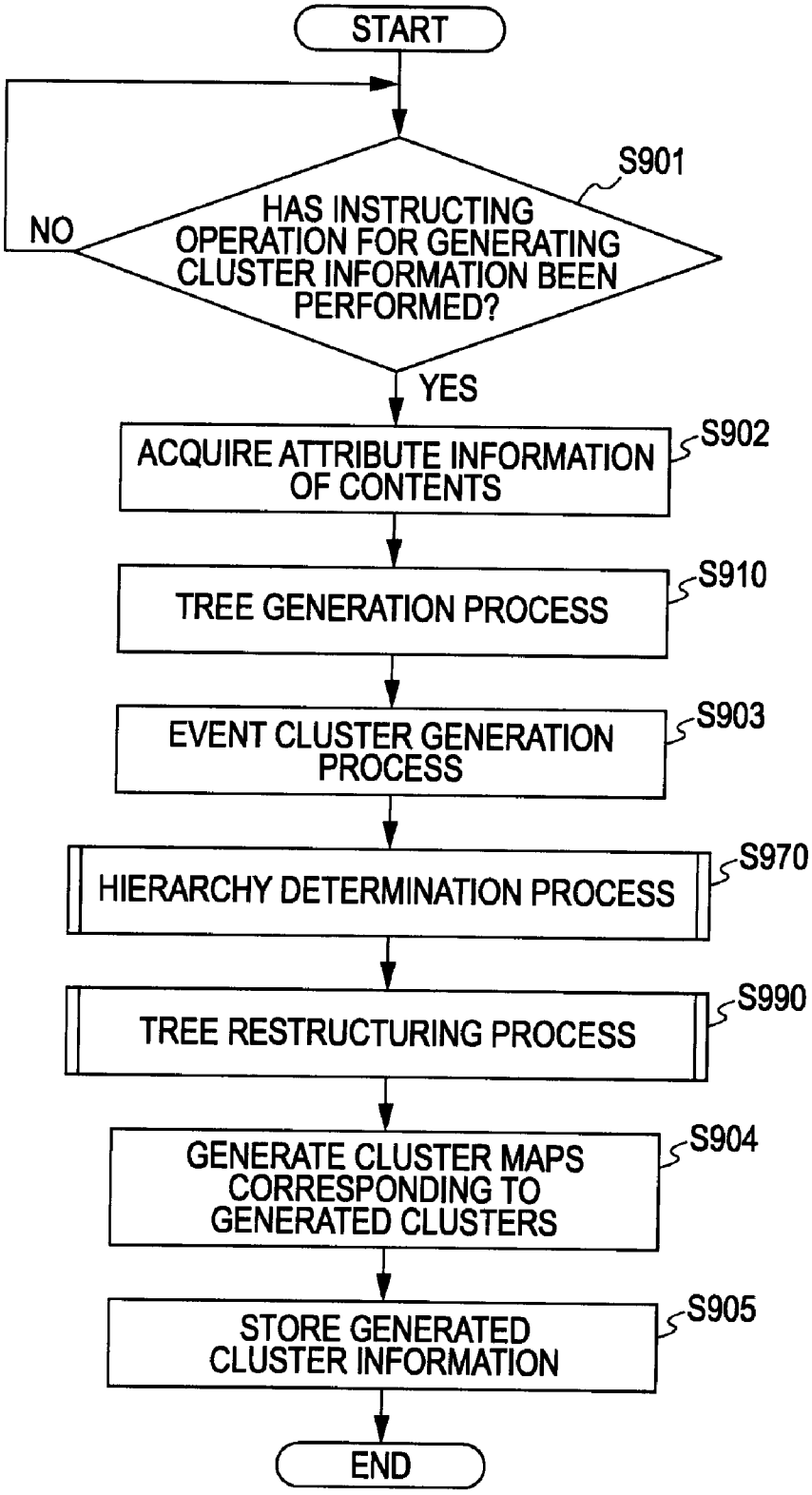

START
S901
HAS INSTRUCTING OPERATION FOR GENERATING CLUSTER INFORMATION BEEN PERFORMED?
NO
YES
ACQUIRE ATTRIBUTE INFORMATION OF CONTENTS
S902
TREE GENERATION PROCESS
S910
EVENT CLUSTER GENERATION PROCESS
S903
HIERARCHY DETERMINATION PROCESS
S970
TREE RESTRUCTURING PROCESS
S990
GENERATE CLUSTER MAPS CORRESPONDING TO GENERATED CLUSTERS
S904
STORE GENERATED CLUSTER INFORMATION
S905
END

FIG. 29

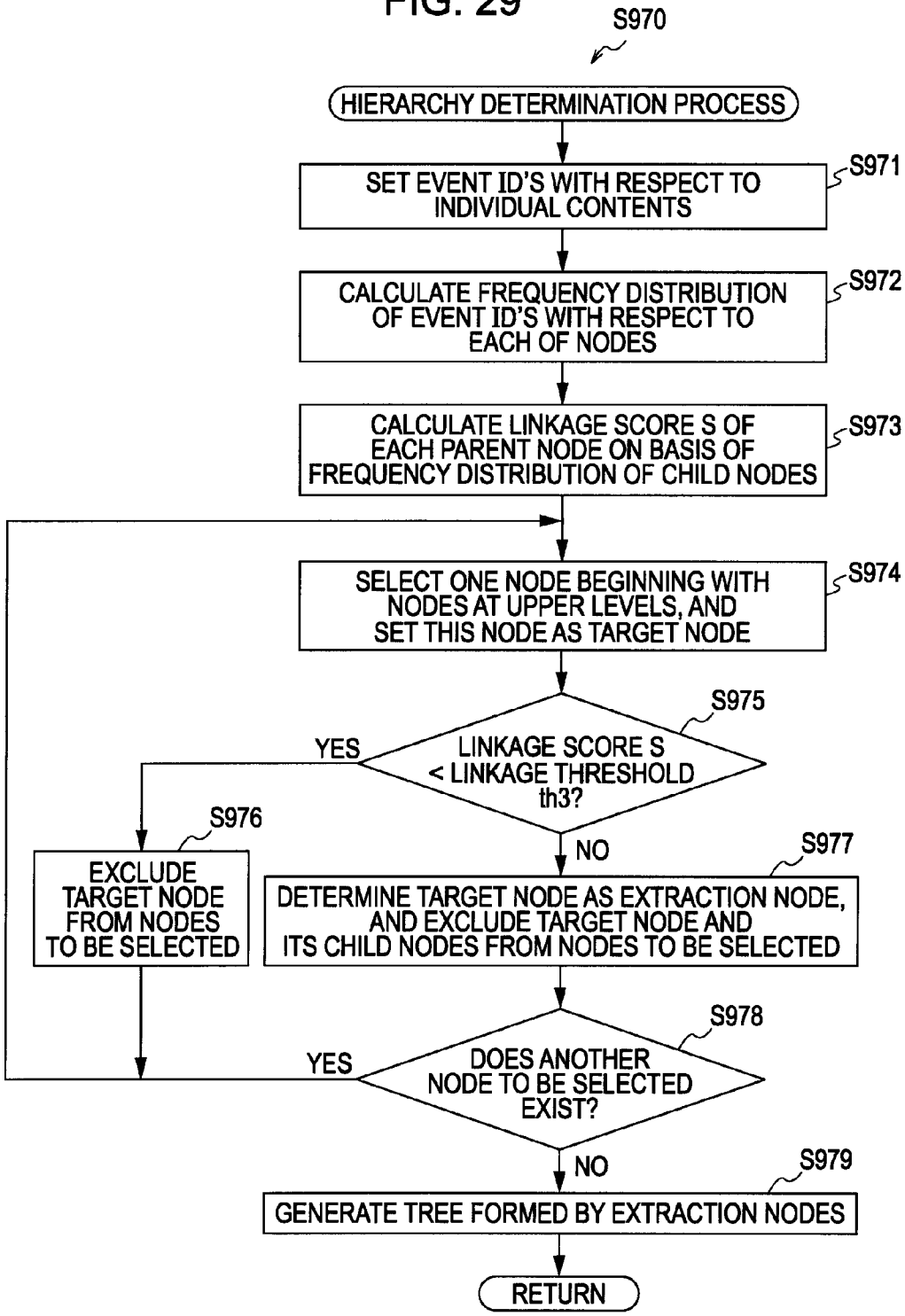

S970
HIERARCHY DETERMINATION PROCESS
SET EVENT ID'S WITH RESPECT TO INDIVIDUAL CONTENTS
S971
CALCULATE FREQUENCY DISTRIBUTION OF EVENT ID'S WITH RESPECT TO EACH OF NODES
S972
CALCULATE LINKAGE SCORE S OF EACH PARENT NODE ON BASIS OF FREQUENCY DISTRIBUTION OF CHILD NODES
S973
SELECT ONE NODE BEGINNING WITH NODES AT UPPER LEVELS, AND SET THIS NODE AS TARGET NODE
S974
S975
LINKAGE SCORE S < LINKAGE THRESHOLD th3?
YES
NO
S976
EXCLUDE TARGET NODE FROM NODES TO BE SELECTED
S977
DETERMINE TARGET NODE AS EXTRACTION NODE, AND EXCLUDE TARGET NODE AND ITS CHILD NODES FROM NODES TO BE SELECTED
S978
DOES ANOTHER NODE TO BE SELECTED EXIST?
YES
NO
S979
GENERATE TREE FORMED BY EXTRACTION NODES
RETURN

FIG. 30

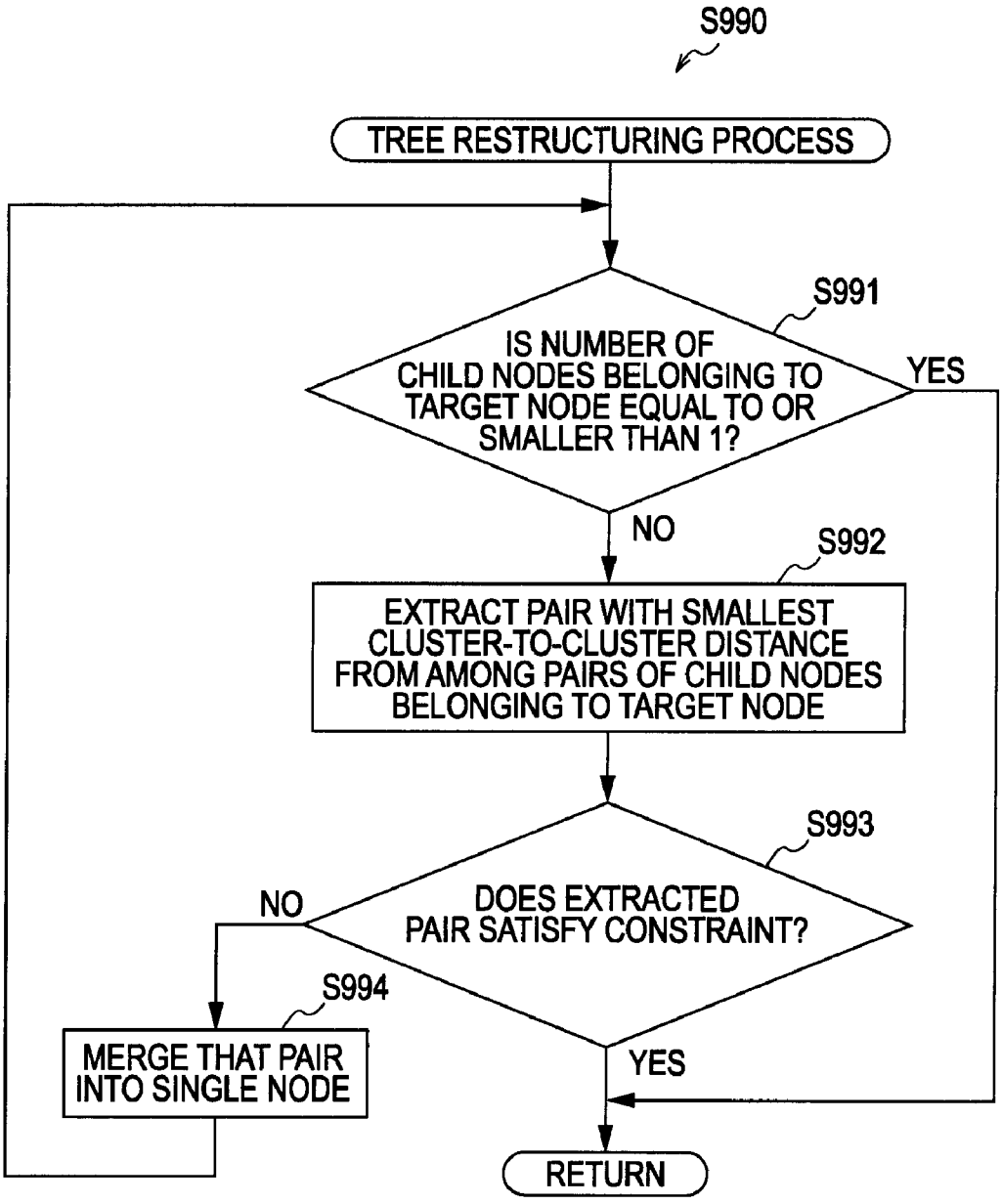

S990
TREE RESTRUCTURING PROCESS
S991
IS NUMBER OF CHILD NODES BELONGING TO TARGET NODE EQUAL TO OR SMALLER THAN 1?
YES
NO
S992
EXTRACT PAIR WITH SMALLEST CLUSTER-TO-CLUSTER DISTANCE FROM AMONG PAIRS OF CHILD NODES BELONGING TO TARGET NODE
S993
DOES EXTRACTED PAIR SATISFY CONSTRAINT?
NO
YES
S994
MERGE THAT PAIR INTO SINGLE NODE
RETURN

FIG. 31

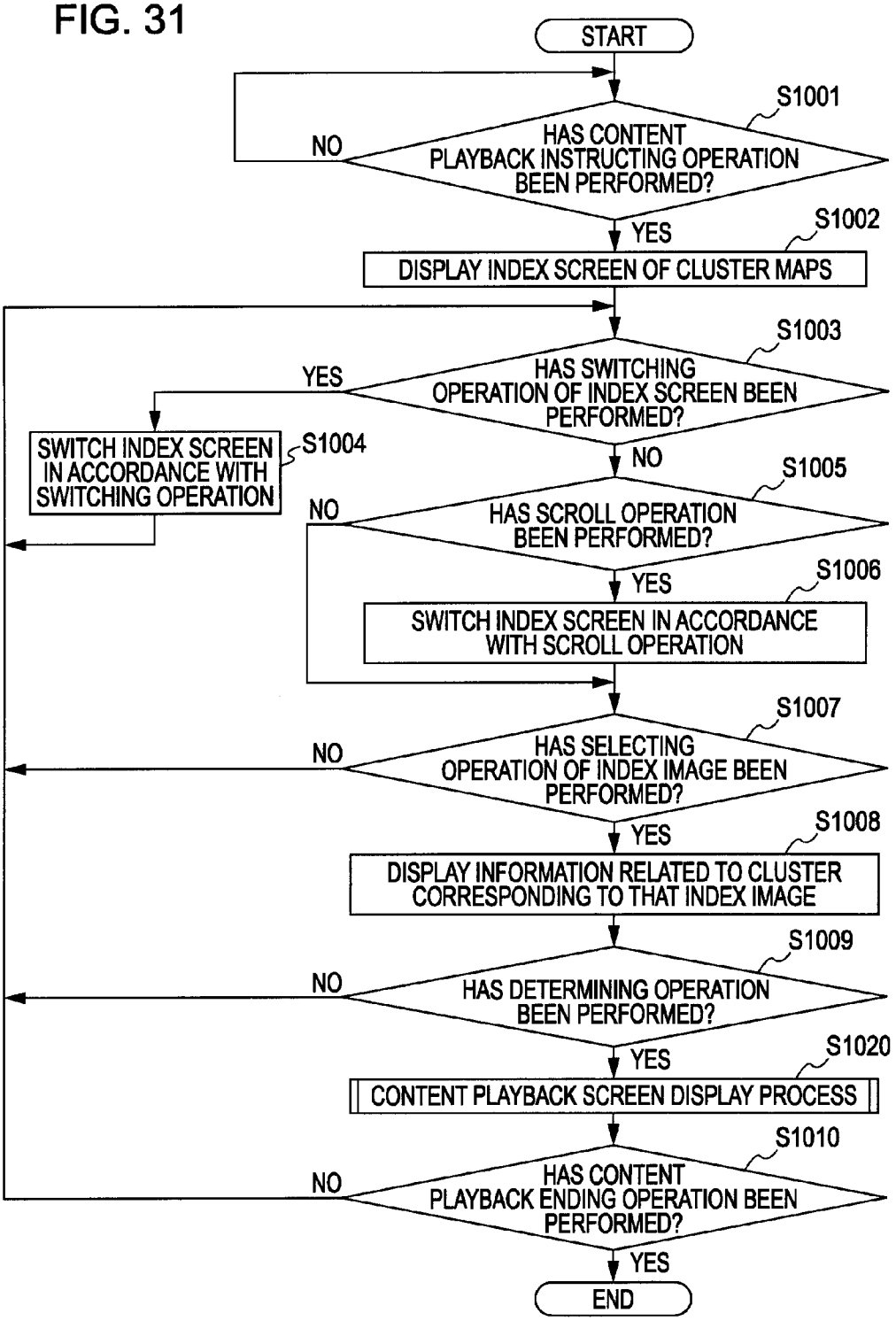

START
S1001
HAS CONTENT PLAYBACK INSTRUCTING OPERATION BEEN PERFORMED?
NO
YES
S1002
DISPLAY INDEX SCREEN OF CLUSTER MAPS
S1003
HAS SWITCHING OPERATION OF INDEX SCREEN BEEN PERFORMED?
YES
SWITCH INDEX SCREEN IN ACCORDANCE WITH SWITCHING OPERATION
S1004
NO
S1005
HAS SCROLL OPERATION BEEN PERFORMED?
NO
YES
S1006
SWITCH INDEX SCREEN IN ACCORDANCE WITH SCROLL OPERATION
S1007
HAS SELECTING OPERATION OF INDEX IMAGE BEEN PERFORMED?
NO
YES
S1008
DISPLAY INFORMATION RELATED TO CLUSTER CORRESPONDING TO THAT INDEX IMAGE
S1009
HAS DETERMINING OPERATION BEEN PERFORMED?
NO
YES
S1020
CONTENT PLAYBACK SCREEN DISPLAY PROCESS
S1010
HAS CONTENT PLAYBACK ENDING OPERATION BEEN PERFORMED?
NO
YES
END

FIG. 32

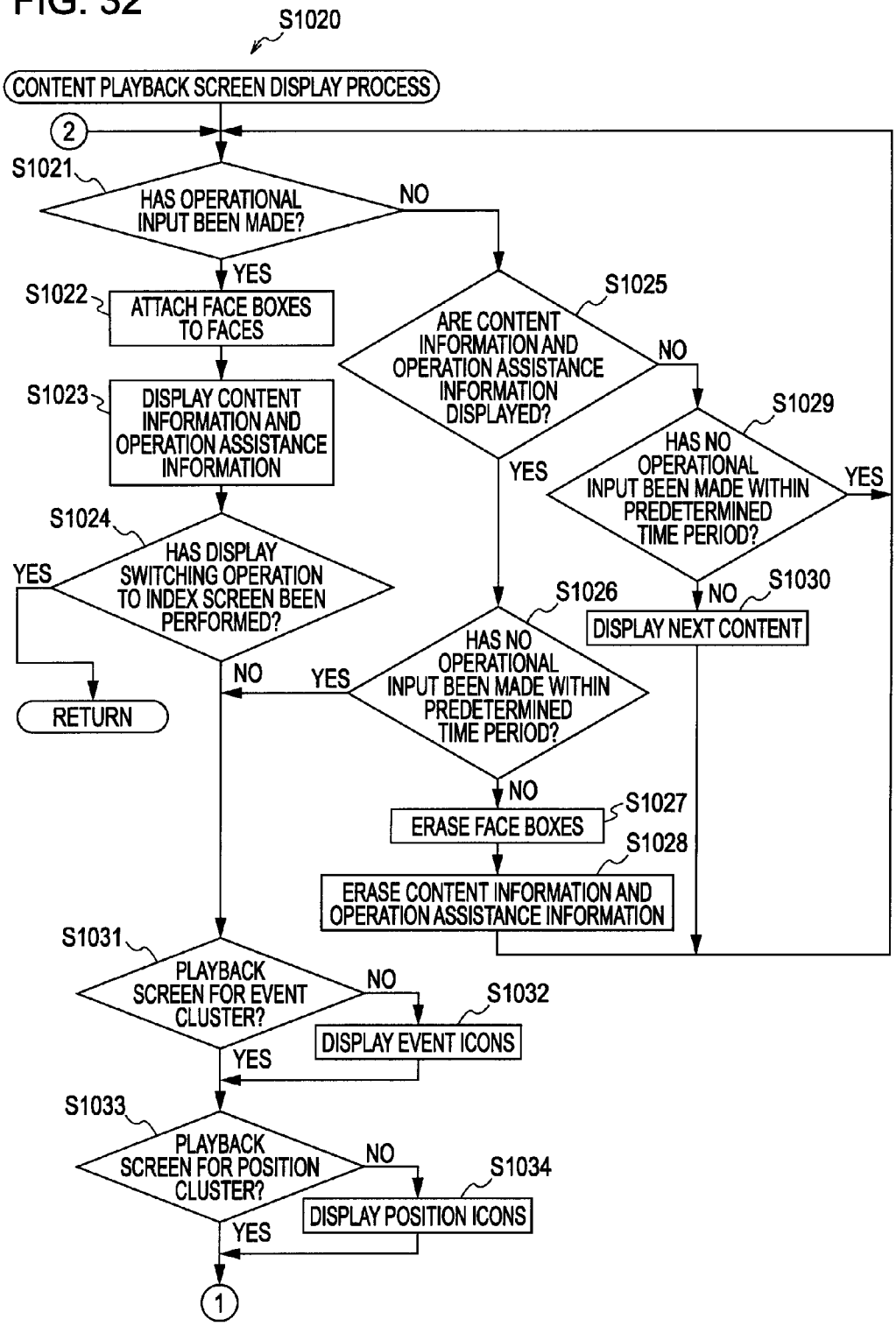

S1020
CONTENT PLAYBACK SCREEN DISPLAY PROCESS
2
S1021
HAS OPERATIONAL INPUT BEEN MADE?
NO
YES
S1022
ATTACH FACE BOXES TO FACES
S1023
DISPLAY CONTENT INFORMATION AND OPERATION ASSISTANCE INFORMATION
S1024
HAS DISPLAY SWITCHING OPERATION TO INDEX SCREEN BEEN PERFORMED?
YES
RETURN
NO
S1025
ARE CONTENT INFORMATION AND OPERATION ASSISTANCE INFORMATION DISPLAYED?
NO
YES
S1026
HAS NO OPERATIONAL INPUT BEEN MADE WITHIN PREDETERMINED TIME PERIOD?
YES
NO
S1027
ERASE FACE BOXES
S1028
ERASE CONTENT INFORMATION AND OPERATION ASSISTANCE INFORMATION
S1029
HAS NO OPERATIONAL INPUT BEEN MADE WITHIN PREDETERMINED TIME PERIOD?
YES
NO
S1030
DISPLAY NEXT CONTENT
S1031
PLAYBACK SCREEN FOR EVENT CLUSTER?
NO
S1032
DISPLAY EVENT ICONS
YES
S1033
PLAYBACK SCREEN FOR POSITION CLUSTER?
NO
S1034
DISPLAY POSITION ICONS
YES
1

FIG. 33

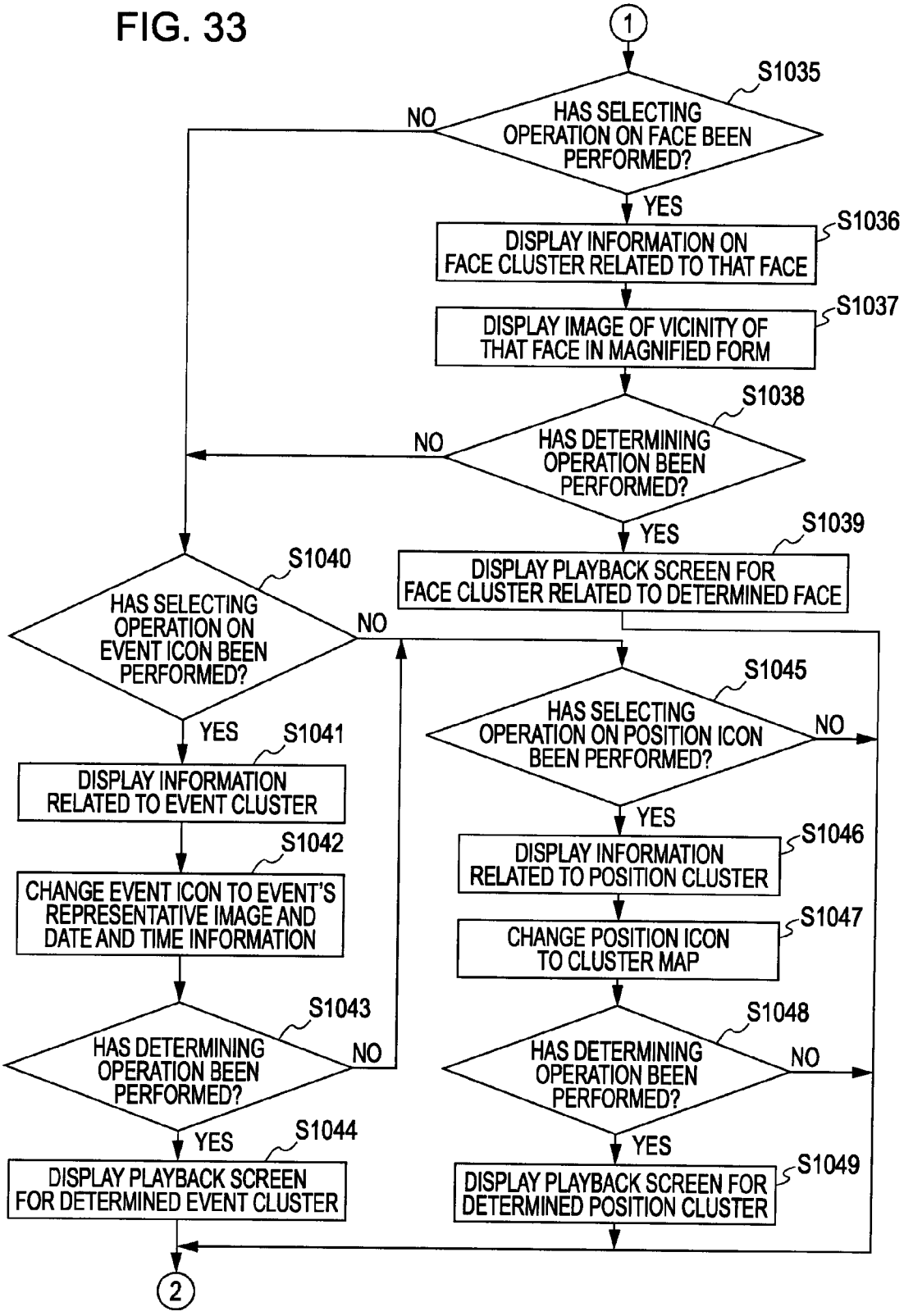

1
S1035
HAS SELECTING OPERATION ON FACE BEEN PERFORMED?
NO
YES
S1036
DISPLAY INFORMATION ON FACE CLUSTER RELATED TO THAT FACE
S1037
DISPLAY IMAGE OF VICINITY OF THAT FACE IN MAGNIFIED FORM
S1038
HAS DETERMINING OPERATION BEEN PERFORMED?
NO
YES
S1039
DISPLAY PLAYBACK SCREEN FOR FACE CLUSTER RELATED TO DETERMINED FACE
S1040
HAS SELECTING OPERATION ON EVENT ICON BEEN PERFORMED?
NO
YES
S1041
DISPLAY INFORMATION RELATED TO EVENT CLUSTER
S1042
CHANGE EVENT ICON TO EVENT'S REPRESENTATIVE IMAGE AND DATE AND TIME INFORMATION
S1043
HAS DETERMINING OPERATION BEEN PERFORMED?
NO
YES
S1044
DISPLAY PLAYBACK SCREEN FOR DETERMINED EVENT CLUSTER
S1045
HAS SELECTING OPERATION ON POSITION ICON BEEN PERFORMED?
NO
YES
S1046
DISPLAY INFORMATION RELATED TO POSITION CLUSTER
S1047
CHANGE POSITION ICON TO CLUSTER MAP
S1048
HAS DETERMINING OPERATION BEEN PERFORMED?
NO
YES
S1049
DISPLAY PLAYBACK SCREEN FOR DETERMINED POSITION CLUSTER
2

FIG. 34

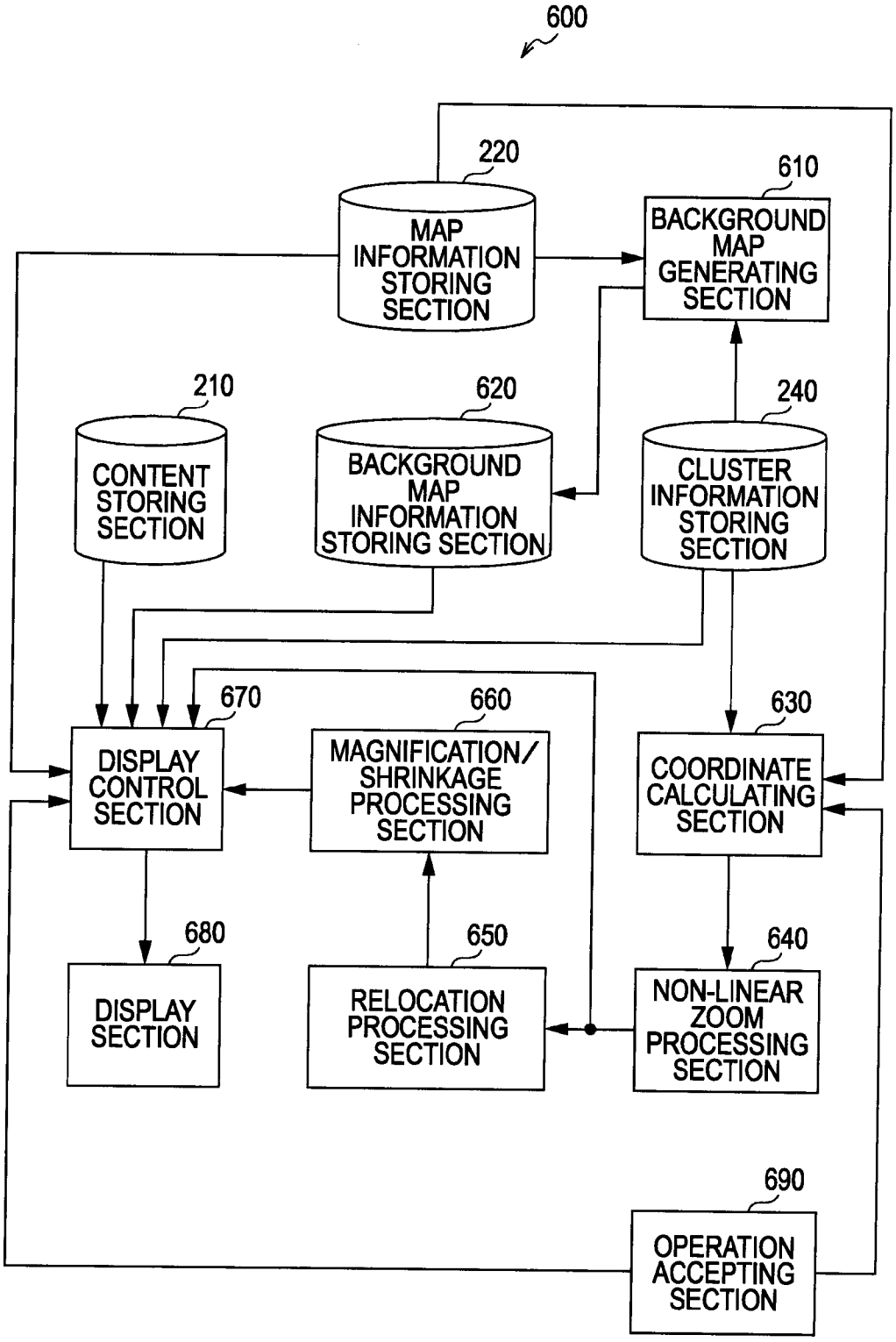

600
220
MAP INFORMATION STORING SECTION
610
BACKGROUND MAP GENERATING SECTION
210
CONTENT STORING SECTION
620
BACKGROUND MAP INFORMATION STORING SECTION
240
CLUSTER INFORMATION STORING SECTION
670
DISPLAY CONTROL SECTION
660
MAGNIFICATION/ SHRINKAGE PROCESSING SECTION
630
COORDINATE CALCULATING SECTION
680
DISPLAY SECTION
650
RELOCATION PROCESSING SECTION
640
NON-LINEAR ZOOM PROCESSING SECTION
690
OPERATION ACCEPTING SECTION

FIG. 35

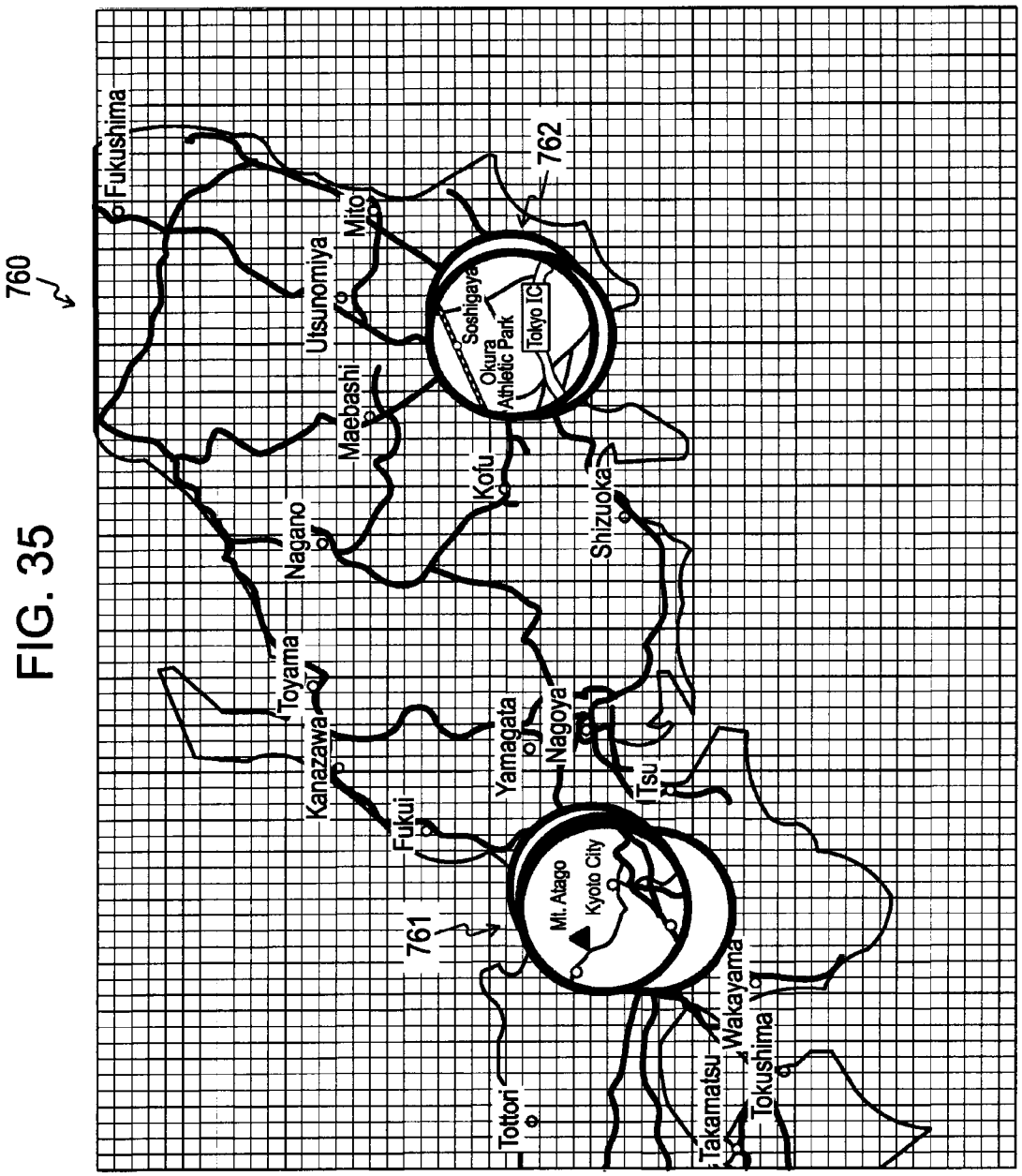

760
Fukushima
Mito
Utsunomiya
762
Soshigaya
Okura Athletic Park
Tokyo IC
Maebashi
Kofu
Nagano
Shizuoka
Toyama
Kanazawa
Yamagata
Nagoya
Tsu
Fukui
761
Mt. Atago
Kyoto City
Tottori
Takamatsu
Wakayama
Tokushima

FIG. 36

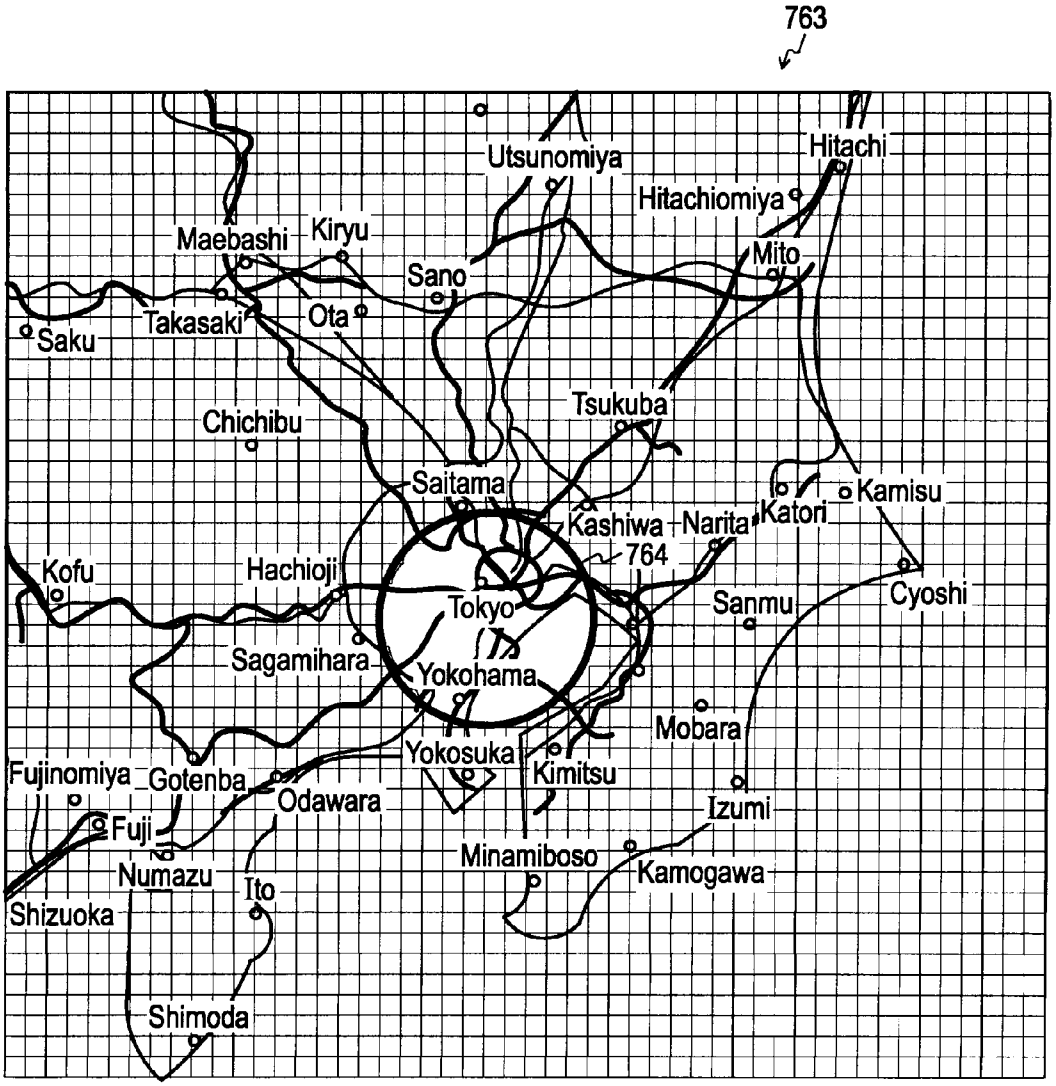

763
Utsunomiya
Hitachi
Hitachiomiya
Maebashi
Kiryu
Mito
Sano
Takasaki
Ota
Saku
Tsukuba
Chichibu
Saitama
Kamisu
Katori
Kashiwa
Narita
764
Kofu
Hachioji
Tokyo
Cyoshi
Sanmu
Sagamihara
Yokohama
Mobara
Yokosuka
Kimitsu
Fujinomiya
Gotenba
Odawara
Izumi
Fuji
Minamiboso
Kamogawa
Numazu
Ito
Shizuoka
Shimoda

FIG. 37

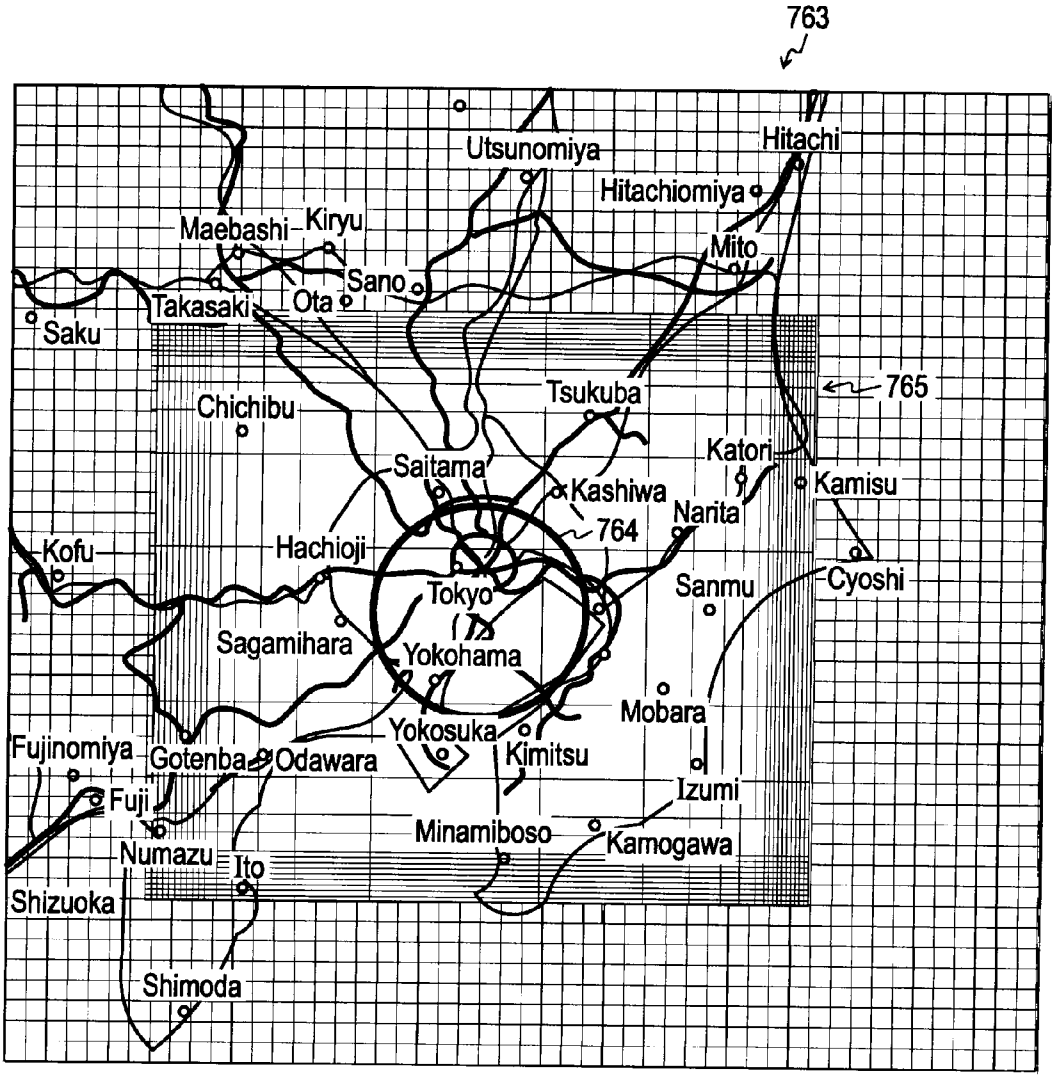

763
Utsunomiya
Hitachi
Hitachiomiya
Maebashi
Kiryu
Mito
Sano
Takasaki
Ota
Saku
765
Tsukuba
Chichibu
Katori
Saitama
Kashiwa
Kamisu
Narita
764
Kofu
Hachioji
Cyoshi
Sanmu
Tokyo
Sagamihara
Yokohama
Mobara
Yokosuka
Fujinomiya
Gotenba
Odawara
Kimitsu
Izumi
Fuji
Minamiboso
Kamogawa
Numazu
Ito
Shizuoka
Shimoda

FIG. 38

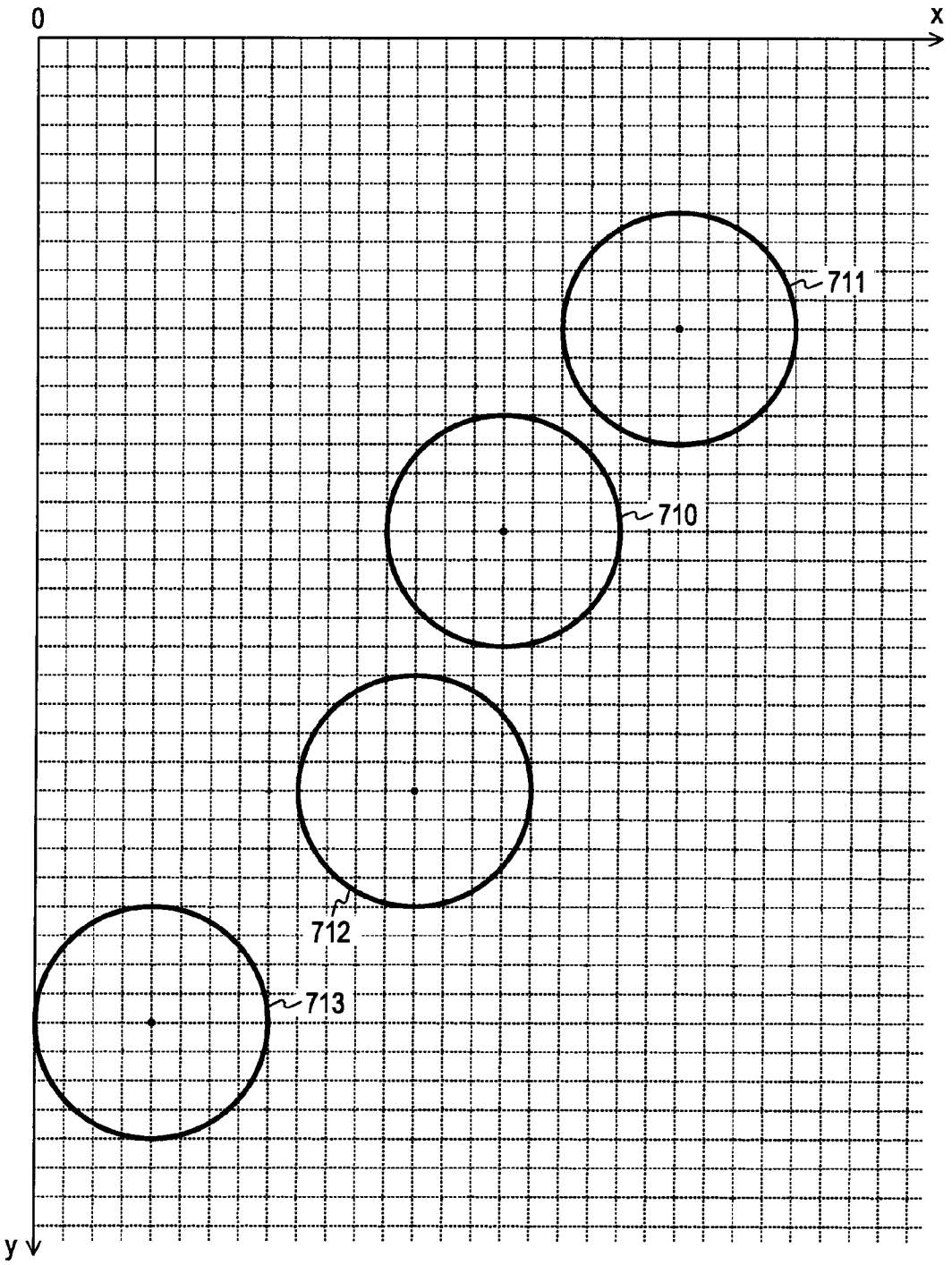


FIG. 39

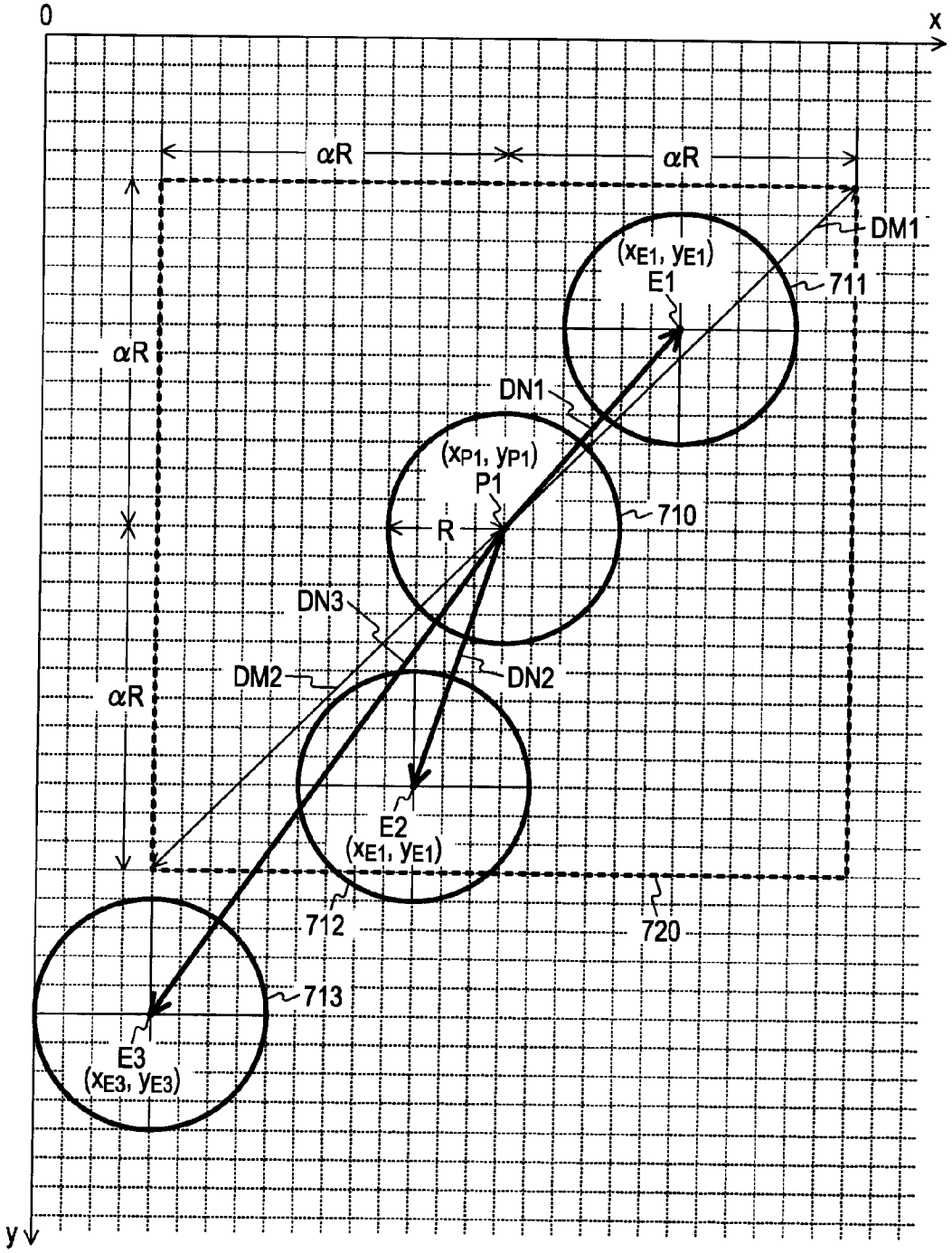

0
x
αR
αR
DM1
(xE1, yE1)
E1
711
αR
DN1
(xP1, yP1)
P1
R
710
DN3
DM2
DN2
αR
E2
(xE1, yE1)
712
720
713
E3
(xE3, yE3)
y

FIG. 40

770
Fukushima
Mito
Utsunomiya
Maebashi
Nagano
Soshigaya
Okura
Athletic Park
Tokyo IC
Minatomira
Yokohama
Shizuoka
772
774
773
Toyama
Kanazawa
Nagoya
Fukui
Shorinincho
Mt. Kurama
Ryuodake
Mt. Atago
Kyoto City
Higashiyama
Nara
Takatsuki
Tottori
Takamatsu
Tokushima
771

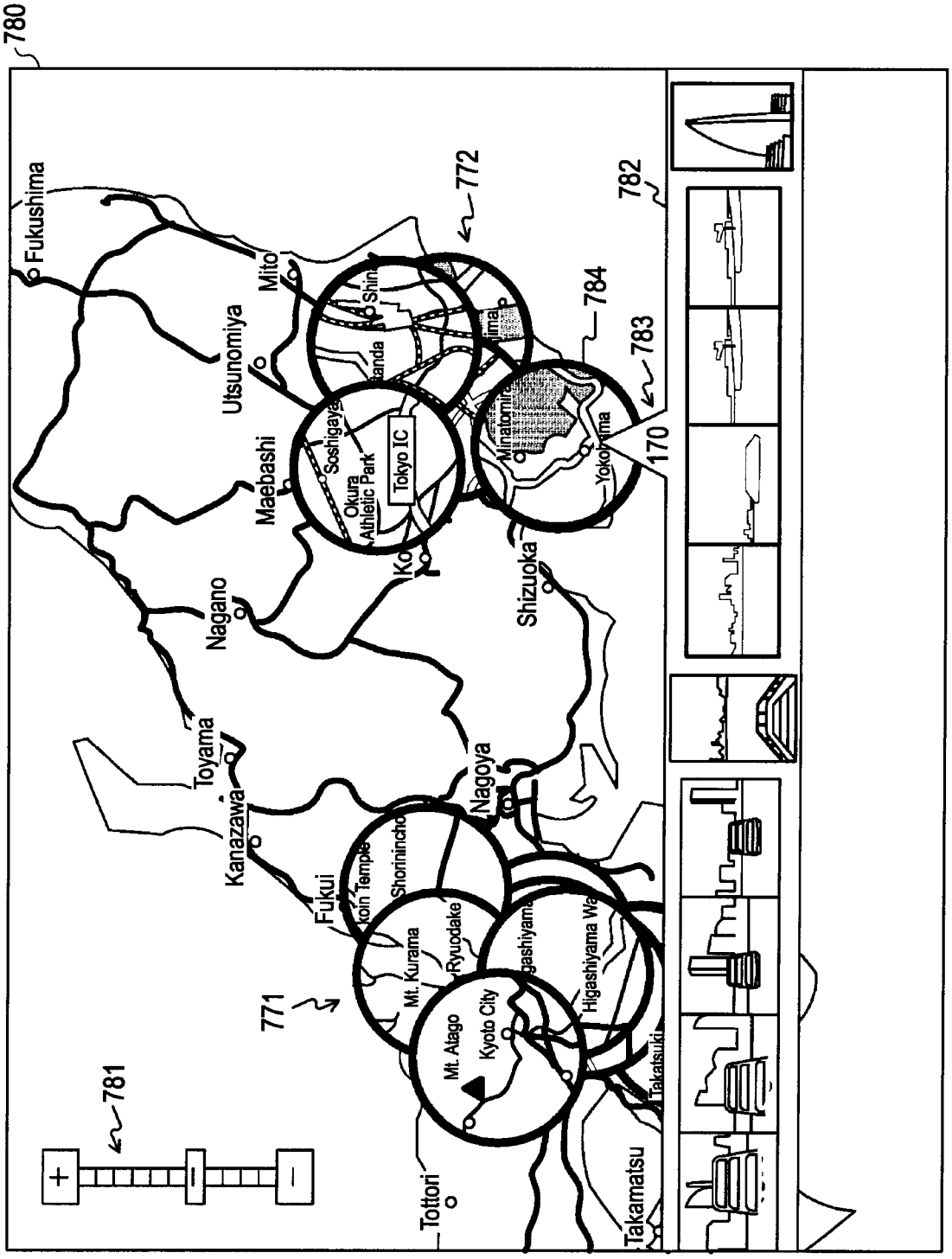

780
Fukushima
Mito
Utsunomiya
Maebashi
Nagano
Toyama
Kanazawa
Fukui
Nagoya
Shizuoka
Tottori
Takamatsu
Mt. Atago
Kyoto City
Mt. Kurama
Ryuodake
Shorinincho
Higashiyama Wa
Takatsuki
Soshigaya
Okura Athletic Park
Tokyo IC
Minatomira
Yokohama
Shin
Shinanda
771
772
781
782
783
784
170

FIG. 41

FIG. 42

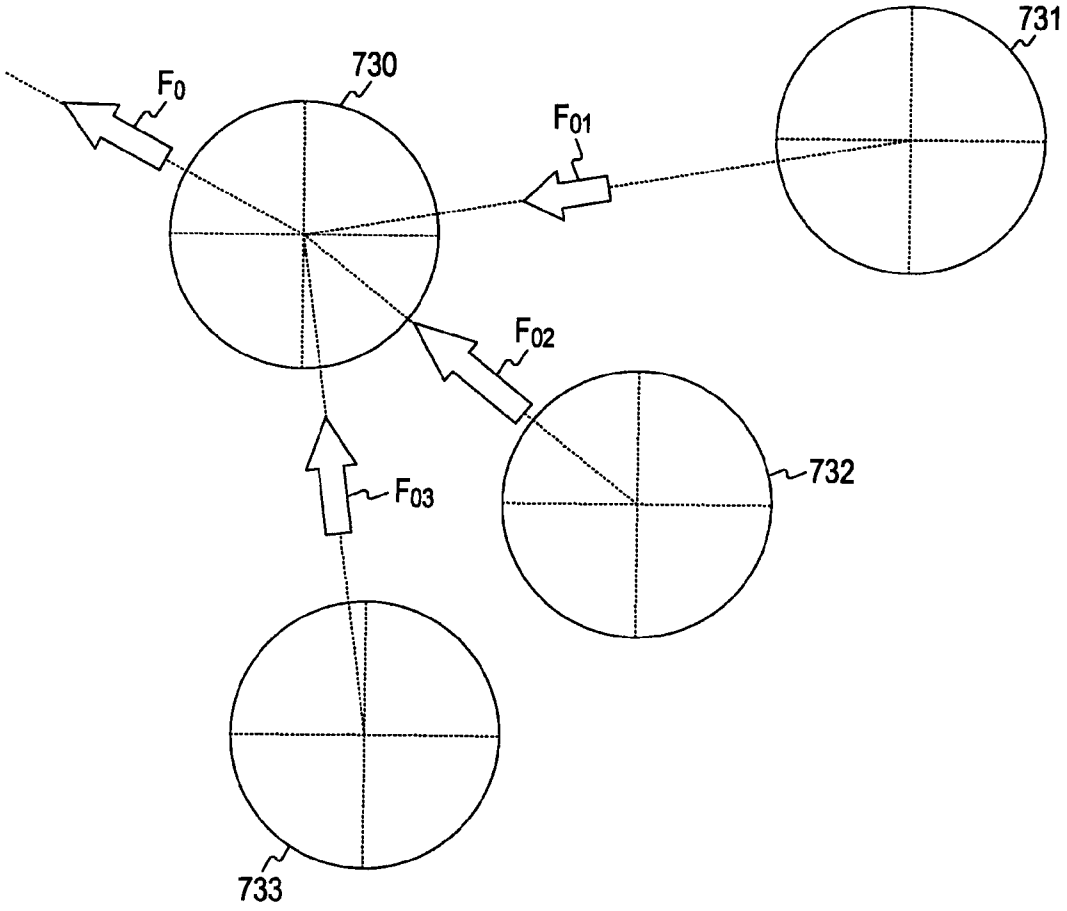


FIG. 43A

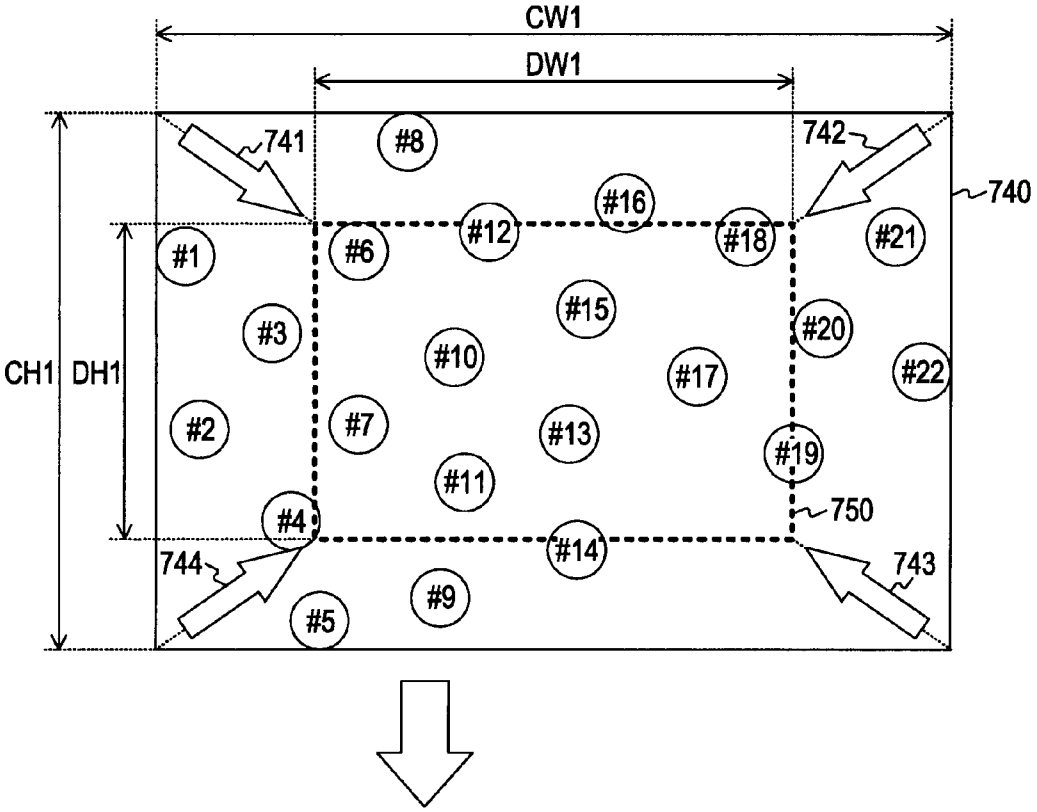


FIG. 43B

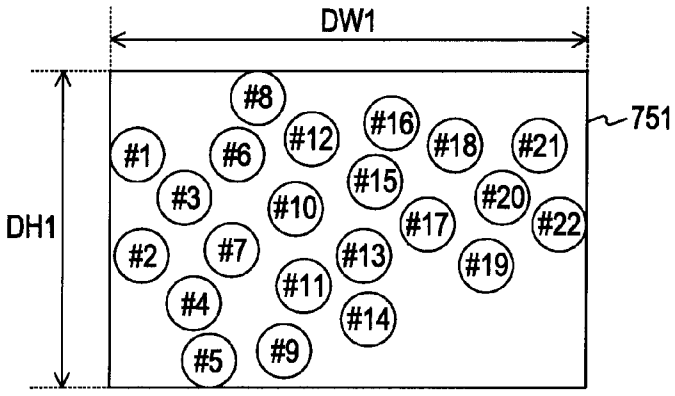


FIG. 44A

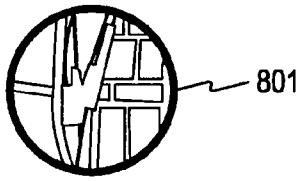


FIG. 44B

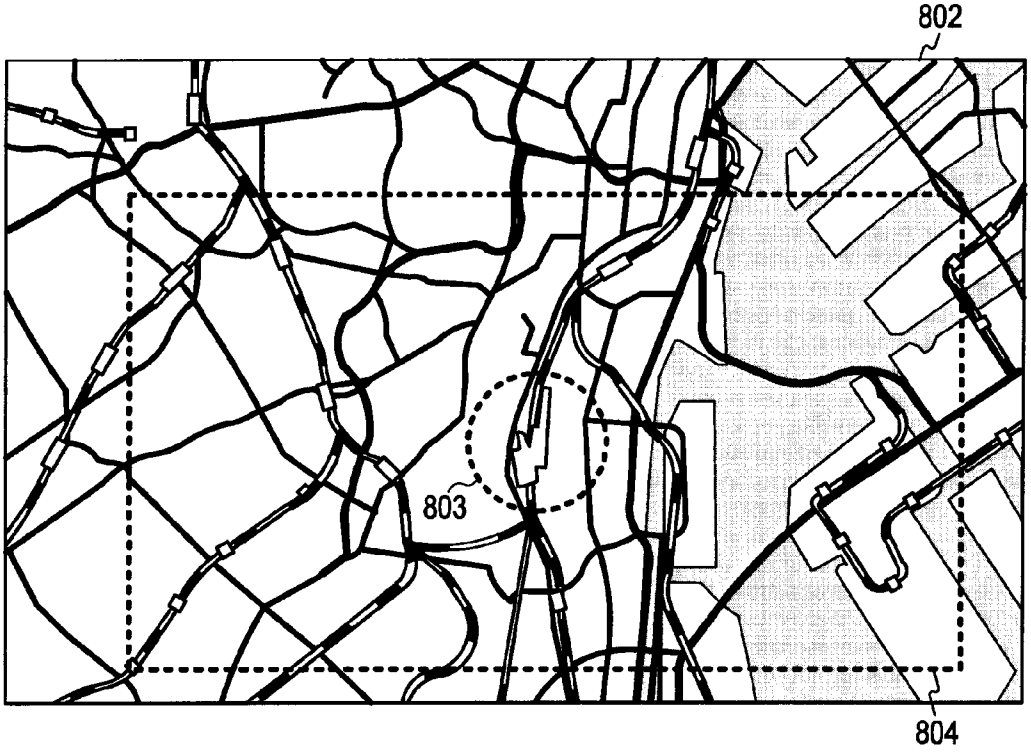
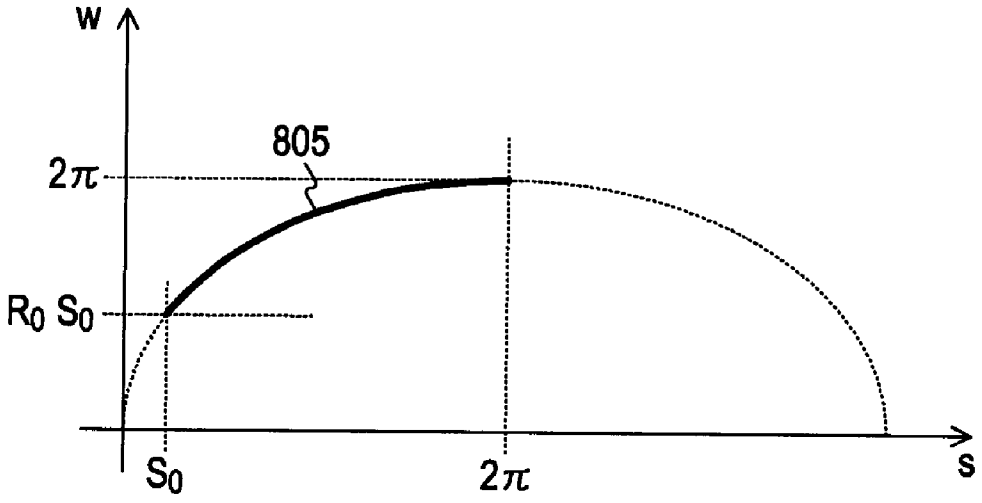


FIG. 45



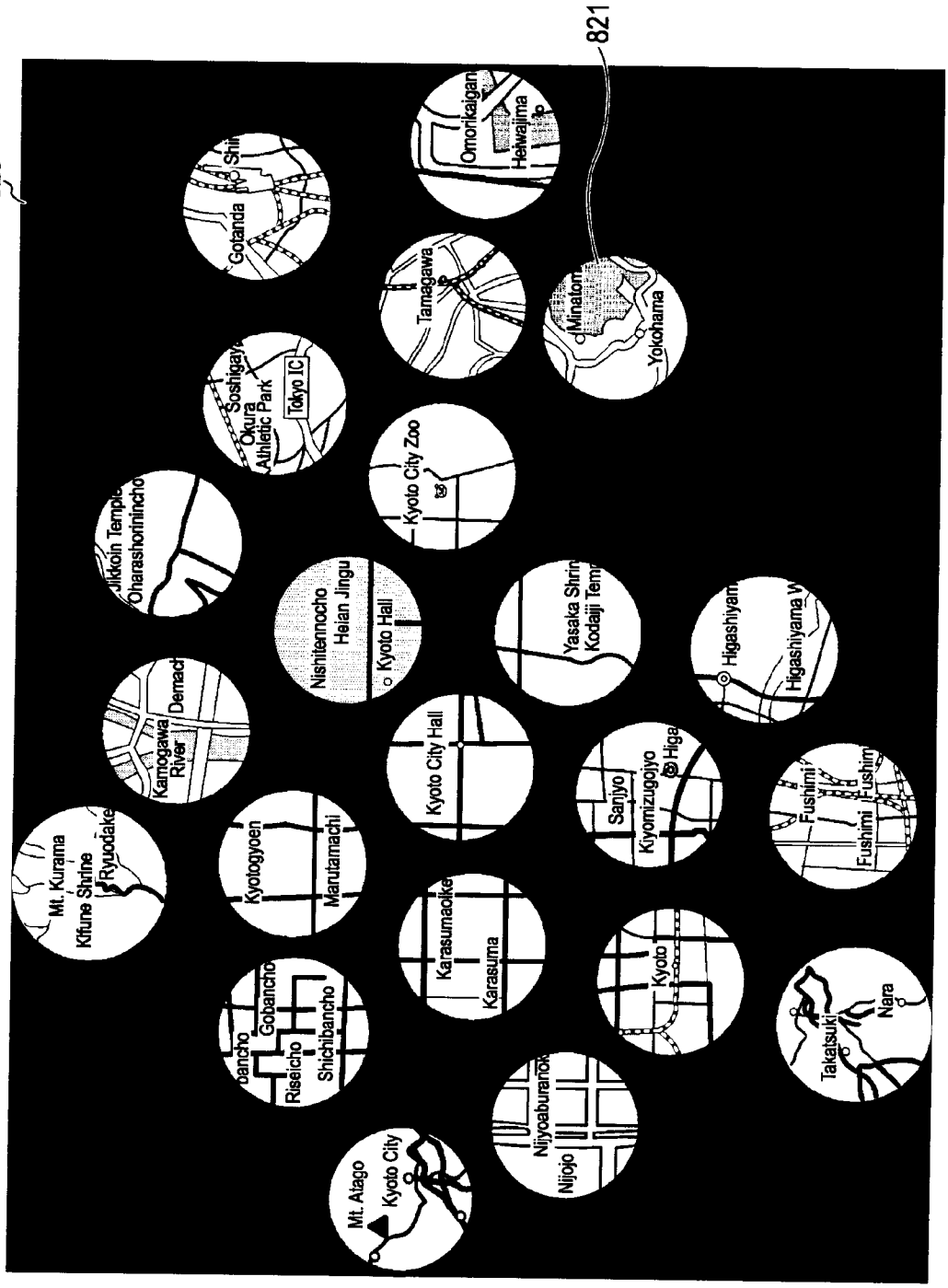

820
821
Gotanda
Omorikaigan
Heiwajima
Tamagawa
Minatom
Yokohama
Soshigaya
Okura
Athletic Park
Tokyo IC
Kyoto City Zoo
Jikkoin Temple
Oharashorinincho
Nishitennocho
Heian Jingu
Kyoto Hall
Yasaka Shrin
Kodaiji Temp
Higashiyam
Higashiyama W
Kamogawa
River
Demach
Kyoto City Hall
Sanjyo
Kiyomizugojyo
Higa
Fushimi
Fushimi
Fushimi
Mt. Kurama
Kifune Shrine
Ryuodake
Kyotogyoen
Marutamachi
Karasumaoike
Karasuma
Kyoto
Gobancho
Riseicho
Shichibancho
Takatsuki
Nara
Nijyoaburanoki
Nijojo
Mt. Atago
Kyoto City

FIG. 46

FIG. 47

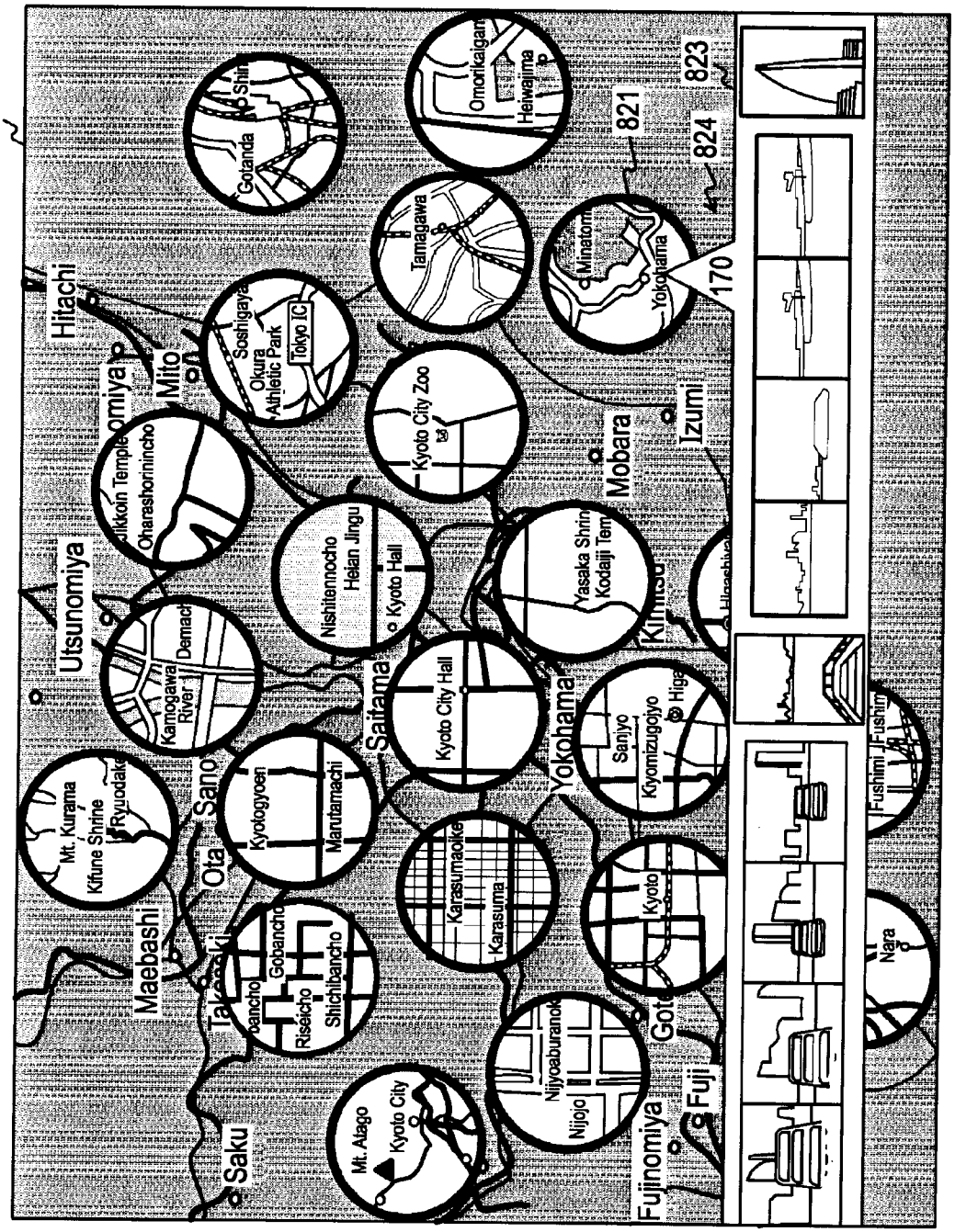

822
Hitachi
Mito
Utsunomiya
Saitama
Yokohama
Mobara
Izumi
Saku
Fujinomiya
Fuji
Maebashi
Ota
Sano
Mt. Kurama
Kifune Shrine
Kamogawa River
Oharashorinincho
Nishitennocho
Heian Jingu
Kyoto Hall
Kyoto City Zoo
Kyoto City Hall
Kyotogyoen
Marutamachi
Gobancho
Riseicho
Shichibancho
Karasumaoike
Karasuma
Nijyoaburanoko
Nijojo
Mt. Atago
Kyoto City
Sanjyo
Kiyomizugojyo
Yasaka Shrine
Kodaiji Temple
Tamagawa
Soshigaya
Okura Athletic Park
Tokyo IC
Gotanda
Omorikaigan
Heiwajima
Minatomi
Yokohama
821
823
824
170
Fushimi
Nara

FIG. 48A

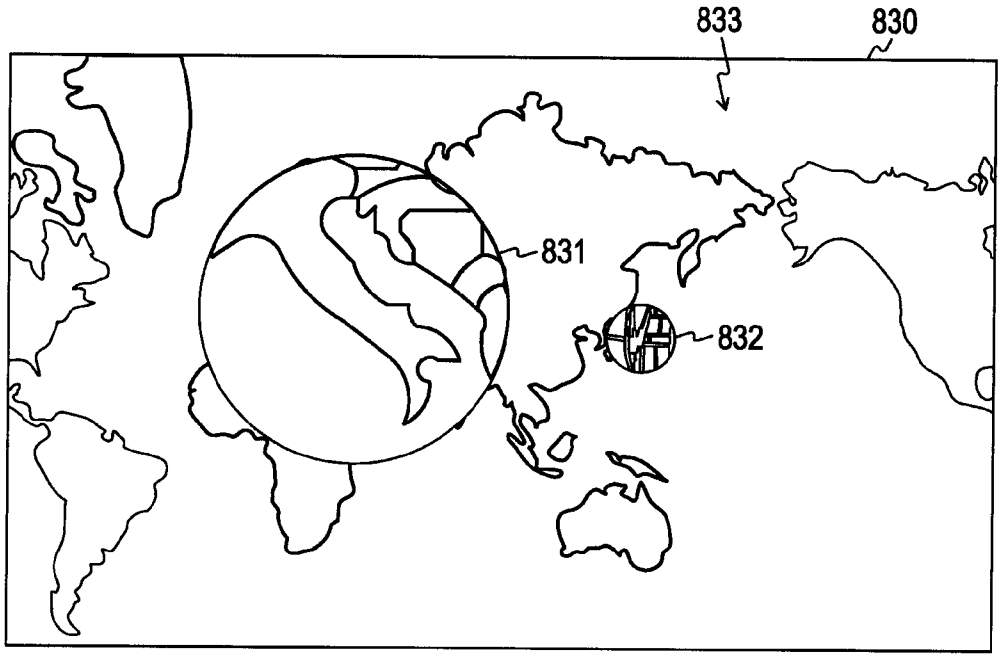


FIG. 48B

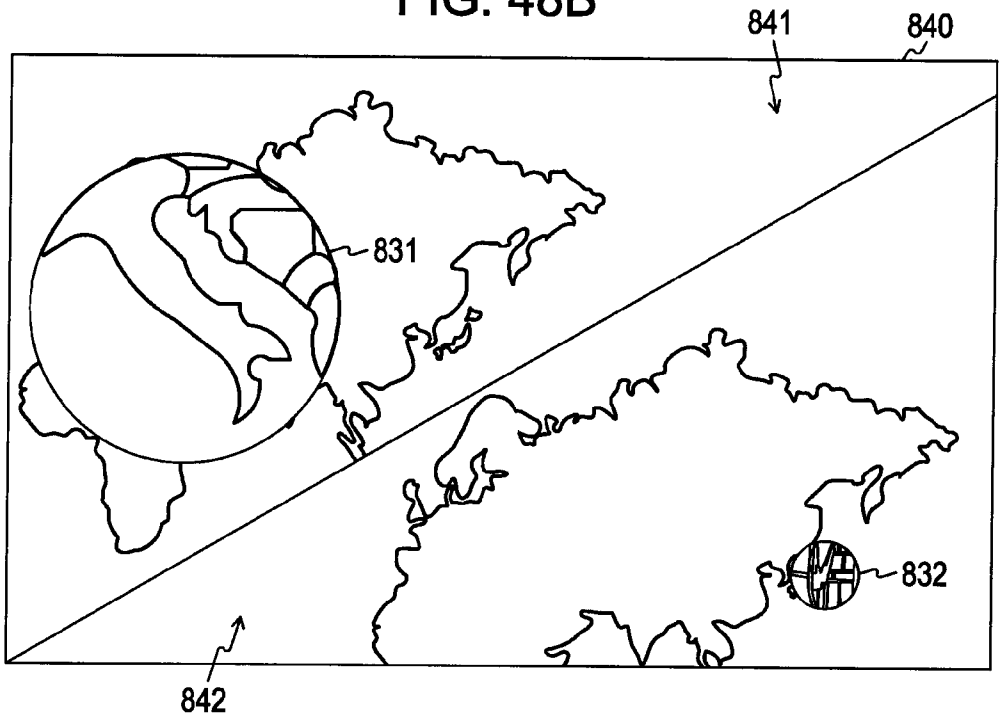


FIG. 49

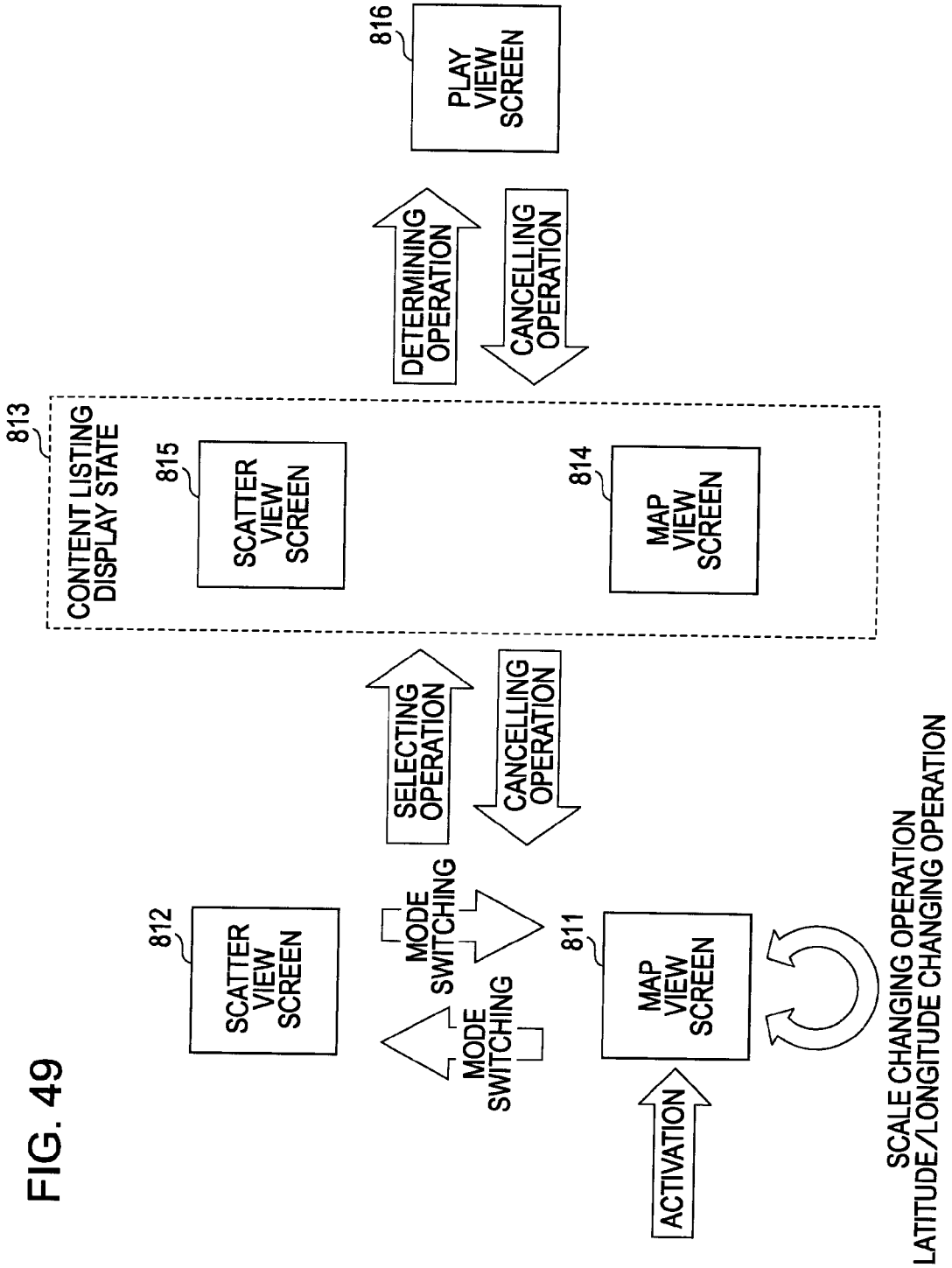

812
SCATTER VIEW SCREEN
MODE SWITCHING
MODE SWITCHING
811
MAP VIEW SCREEN
ACTIVATION
SCALE CHANGING OPERATION
LATITUDE/LONGITUDE CHANGING OPERATION
SELECTING OPERATION
CANCELLING OPERATION
813
CONTENT LISTING DISPLAY STATE
815
SCATTER VIEW SCREEN
814
MAP VIEW SCREEN
DETERMINING OPERATION
CANCELLING OPERATION
816
PLAY VIEW SCREEN

FIG. 50

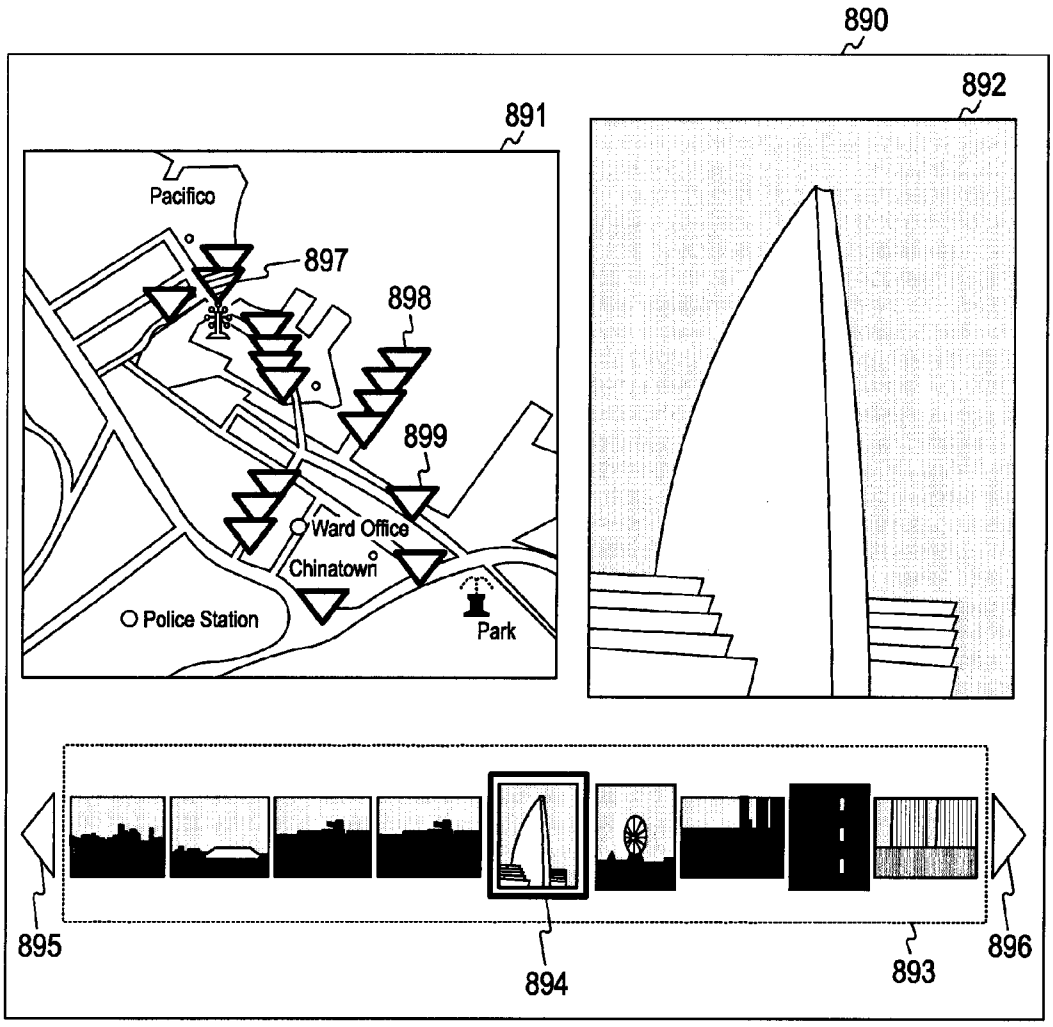

890
891
892
Pacifico
897
898
899
Ward Office
Chinatown
Police Station
Park
895
894
893
896

FIG. 51

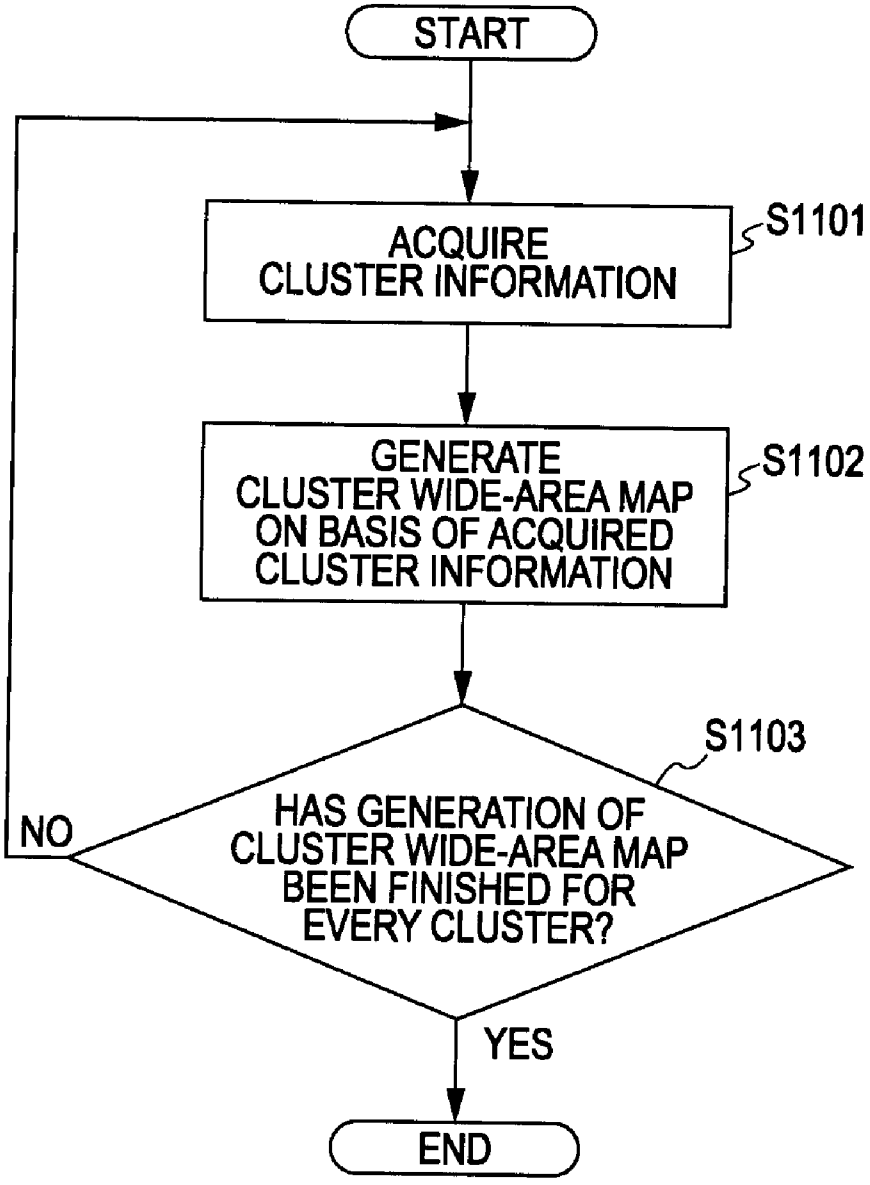

START
ACQUIRE CLUSTER INFORMATION
S1101
GENERATE CLUSTER WIDE-AREA MAP ON BASIS OF ACQUIRED CLUSTER INFORMATION
S1102
S1103
HAS GENERATION OF CLUSTER WIDE-AREA MAP BEEN FINISHED FOR EVERY CLUSTER?
NO
YES
END

FIG. 52

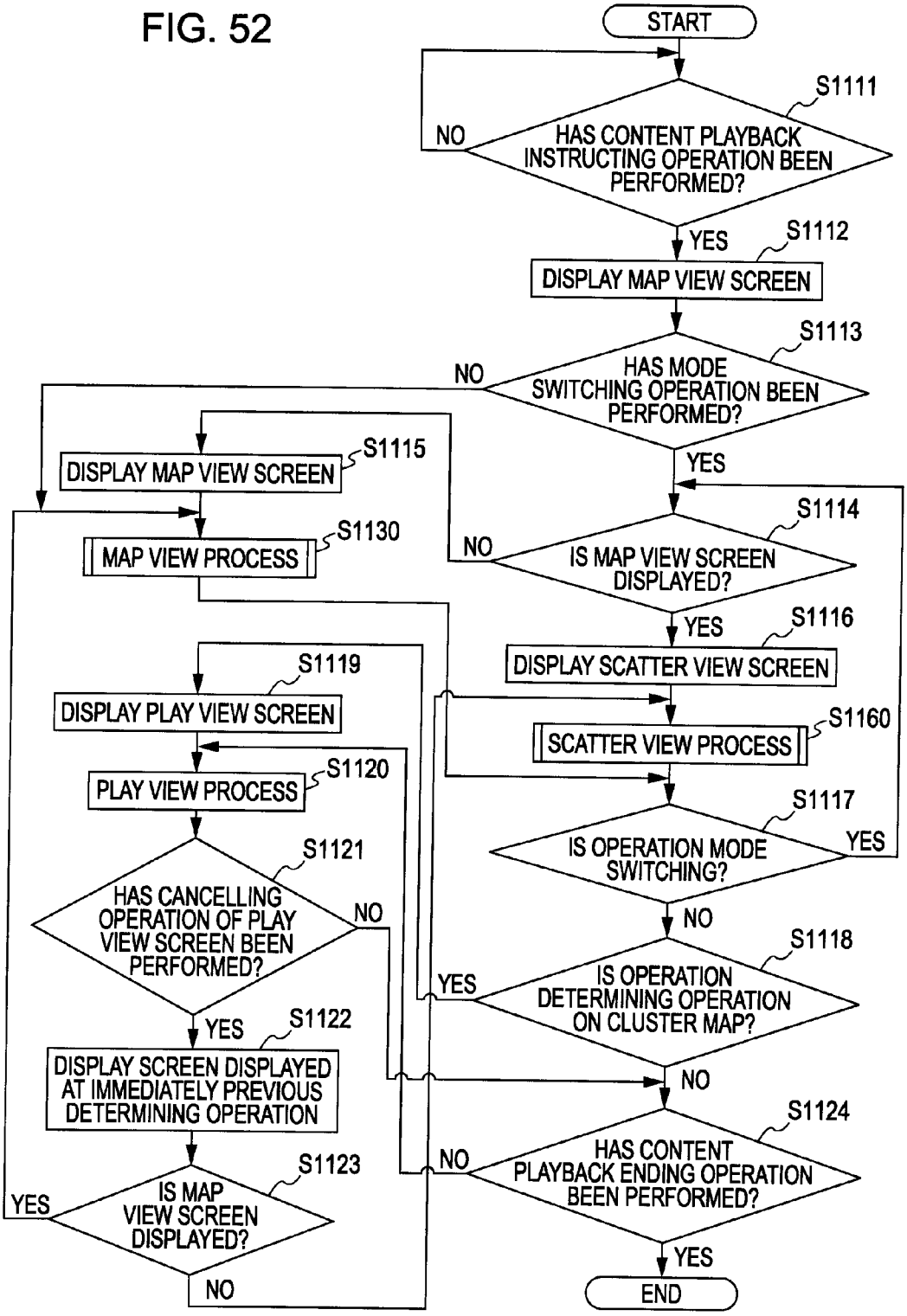

START
S1111
HAS CONTENT PLAYBACK INSTRUCTING OPERATION BEEN PERFORMED?
NO
YES
S1112
DISPLAY MAP VIEW SCREEN
S1113
HAS MODE SWITCHING OPERATION BEEN PERFORMED?
NO
YES
S1115
DISPLAY MAP VIEW SCREEN
S1130
MAP VIEW PROCESS
S1114
IS MAP VIEW SCREEN DISPLAYED?
NO
YES
S1116
DISPLAY SCATTER VIEW SCREEN
S1160
SCATTER VIEW PROCESS
S1117
IS OPERATION MODE SWITCHING?
YES
NO
S1118
IS OPERATION DETERMINING OPERATION ON CLUSTER MAP?
YES
NO
S1124
HAS CONTENT PLAYBACK ENDING OPERATION BEEN PERFORMED?
NO
YES
END
S1119
DISPLAY PLAY VIEW SCREEN
S1120
PLAY VIEW PROCESS
S1121
HAS CANCELLING OPERATION OF PLAY VIEW SCREEN BEEN PERFORMED?
NO
YES
S1122
DISPLAY SCREEN DISPLAYED AT IMMEDIATELY PREVIOUS DETERMINING OPERATION
S1123
IS MAP VIEW SCREEN DISPLAYED?
YES
NO

FIG. 53

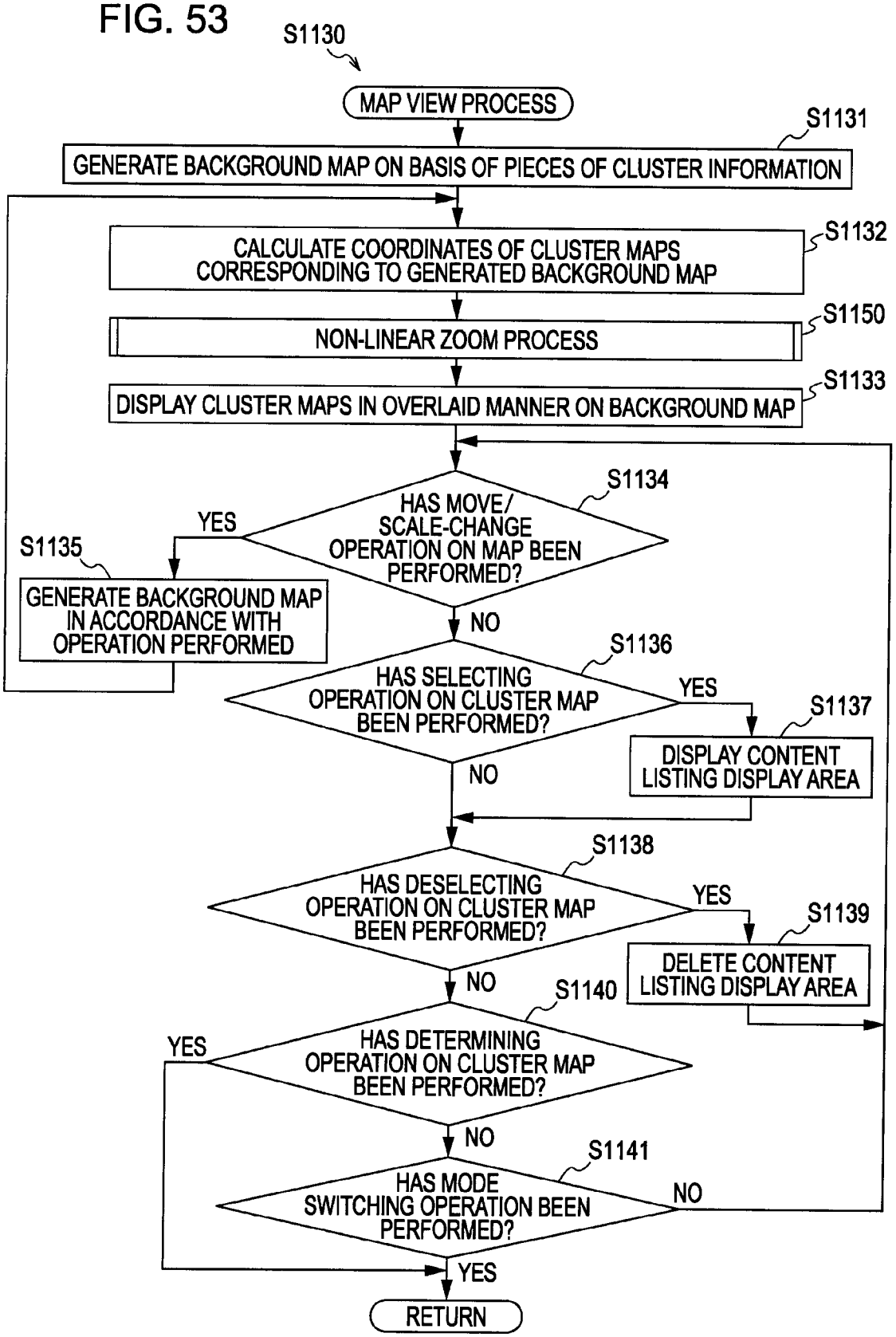

S1130
MAP VIEW PROCESS
S1131
GENERATE BACKGROUND MAP ON BASIS OF PIECES OF CLUSTER INFORMATION
S1132
CALCULATE COORDINATES OF CLUSTER MAPS CORRESPONDING TO GENERATED BACKGROUND MAP
S1150
NON-LINEAR ZOOM PROCESS
S1133
DISPLAY CLUSTER MAPS IN OVERLAID MANNER ON BACKGROUND MAP
S1134
HAS MOVE/ SCALE-CHANGE OPERATION ON MAP BEEN PERFORMED?
YES
S1135
GENERATE BACKGROUND MAP IN ACCORDANCE WITH OPERATION PERFORMED
NO
S1136
HAS SELECTING OPERATION ON CLUSTER MAP BEEN PERFORMED?
YES
S1137
DISPLAY CONTENT LISTING DISPLAY AREA
NO
S1138
HAS DESELECTING OPERATION ON CLUSTER MAP BEEN PERFORMED?
YES
S1139
DELETE CONTENT LISTING DISPLAY AREA
NO
S1140
HAS DETERMINING OPERATION ON CLUSTER MAP BEEN PERFORMED?
YES
NO
S1141
HAS MODE SWITCHING OPERATION BEEN PERFORMED?
NO
YES
RETURN

FIG. 54

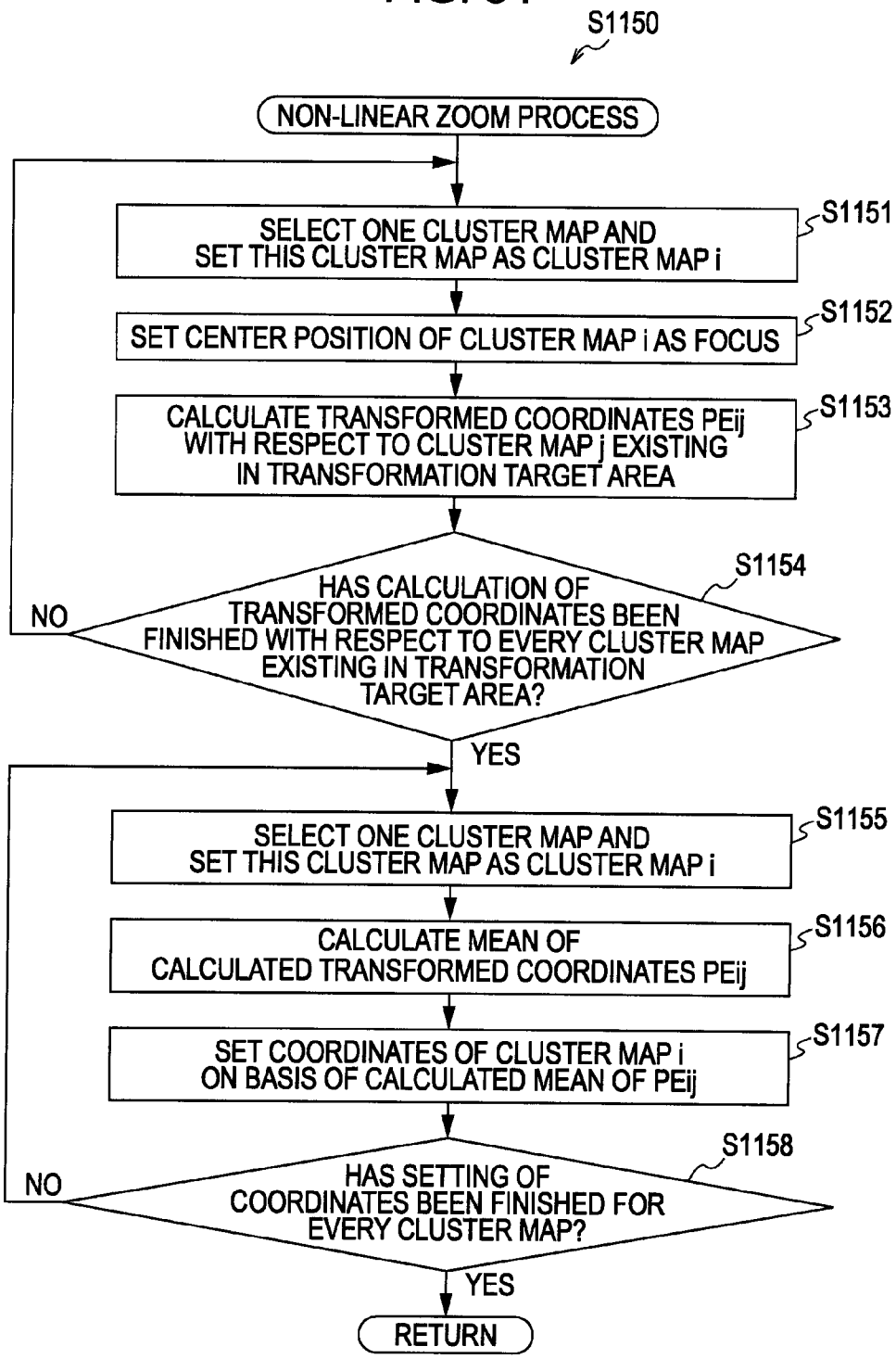

S1150
NON-LINEAR ZOOM PROCESS
SELECT ONE CLUSTER MAP AND SET THIS CLUSTER MAP AS CLUSTER MAP i
S1151
SET CENTER POSITION OF CLUSTER MAP i AS FOCUS
S1152
CALCULATE TRANSFORMED COORDINATES PEij WITH RESPECT TO CLUSTER MAP j EXISTING IN TRANSFORMATION TARGET AREA
S1153
HAS CALCULATION OF TRANSFORMED COORDINATES BEEN FINISHED WITH RESPECT TO EVERY CLUSTER MAP EXISTING IN TRANSFORMATION TARGET AREA?
S1154
NO
YES
SELECT ONE CLUSTER MAP AND SET THIS CLUSTER MAP AS CLUSTER MAP i
S1155
CALCULATE MEAN OF CALCULATED TRANSFORMED COORDINATES PEij
S1156
SET COORDINATES OF CLUSTER MAP i ON BASIS OF CALCULATED MEAN OF PEij
S1157
HAS SETTING OF COORDINATES BEEN FINISHED FOR EVERY CLUSTER MAP?
S1158
NO
YES
RETURN

FIG. 55

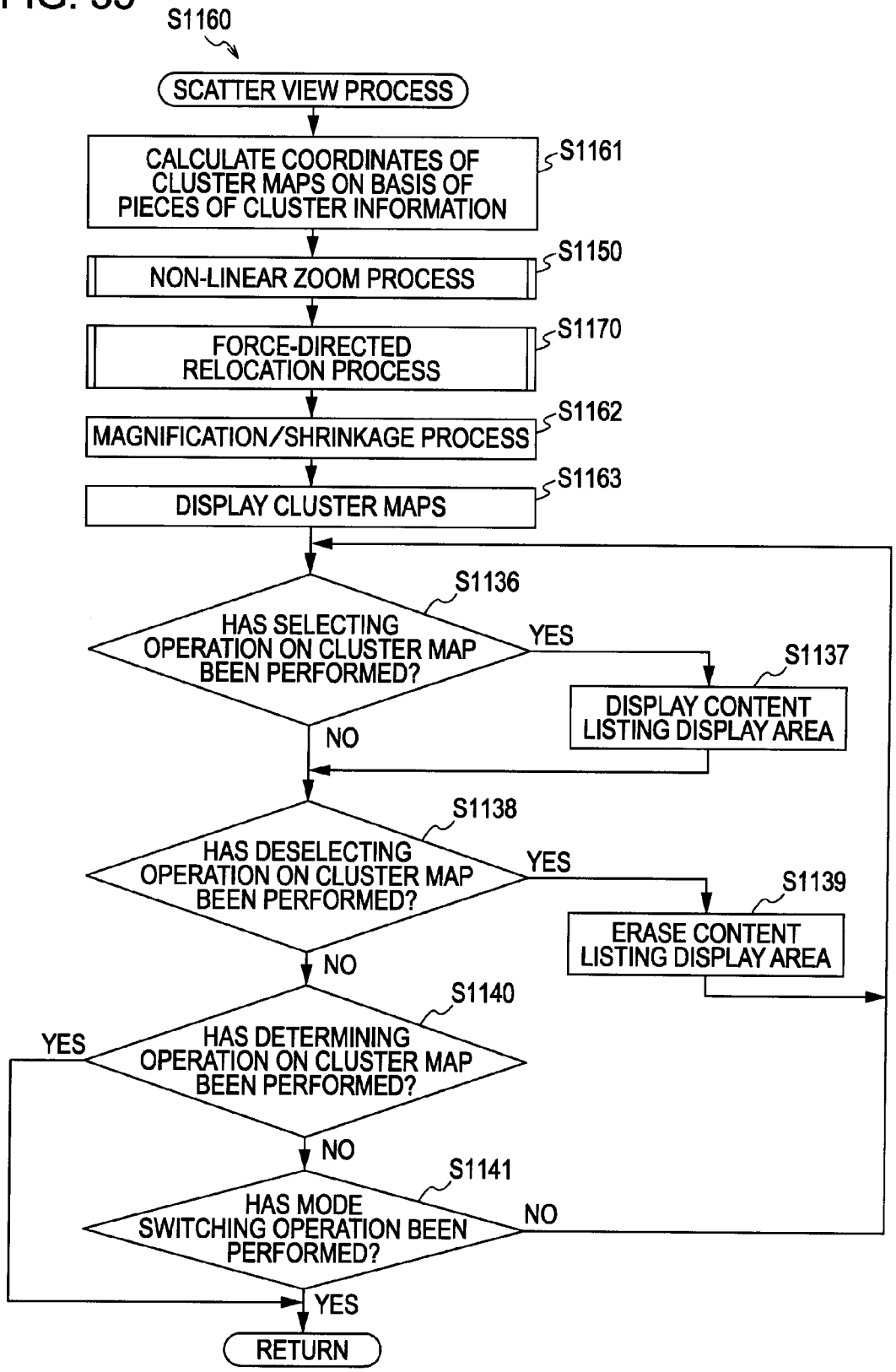

S1160
SCATTER VIEW PROCESS
CALCULATE COORDINATES OF CLUSTER MAPS ON BASIS OF PIECES OF CLUSTER INFORMATION
S1161
NON-LINEAR ZOOM PROCESS
S1150
FORCE-DIRECTED RELOCATION PROCESS
S1170
MAGNIFICATION/SHRINKAGE PROCESS
S1162
DISPLAY CLUSTER MAPS
S1163
S1136
HAS SELECTING OPERATION ON CLUSTER MAP BEEN PERFORMED?
YES
S1137
DISPLAY CONTENT LISTING DISPLAY AREA
NO
S1138
HAS DESELECTING OPERATION ON CLUSTER MAP BEEN PERFORMED?
YES
S1139
ERASE CONTENT LISTING DISPLAY AREA
NO
S1140
HAS DETERMINING OPERATION ON CLUSTER MAP BEEN PERFORMED?
YES
NO
S1141
HAS MODE SWITCHING OPERATION BEEN PERFORMED?
NO
YES
RETURN

FIG. 56

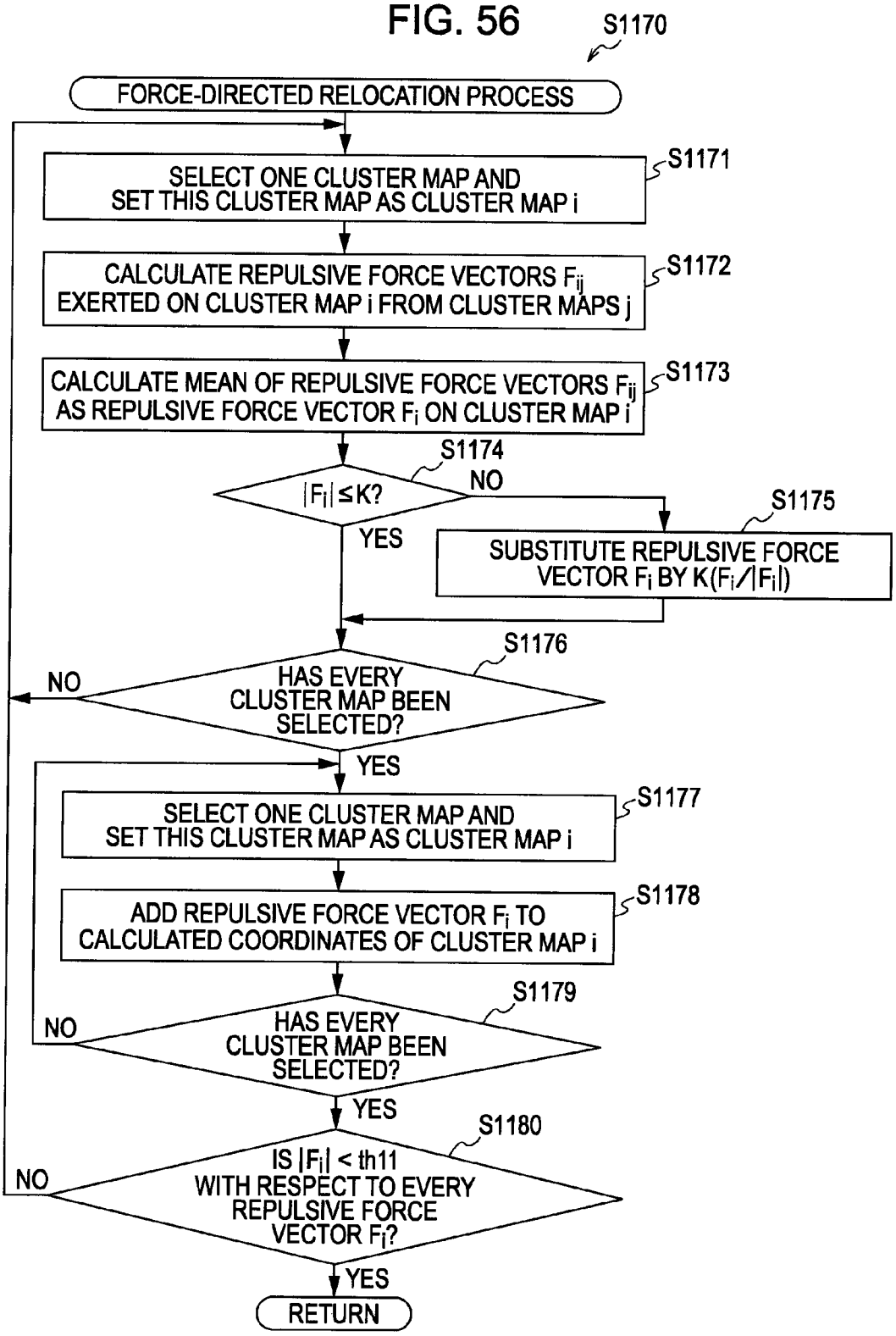

S1170
FORCE-DIRECTED RELOCATION PROCESS
SELECT ONE CLUSTER MAP AND SET THIS CLUSTER MAP AS CLUSTER MAP i
S1171
CALCULATE REPULSIVE FORCE VECTORS Fij EXERTED ON CLUSTER MAP i FROM CLUSTER MAPS j
S1172
CALCULATE MEAN OF REPULSIVE FORCE VECTORS Fij AS REPULSIVE FORCE VECTOR Fi ON CLUSTER MAP i
S1173
S1174
|Fi| ≤ K?
NO
YES
S1175
SUBSTITUTE REPULSIVE FORCE VECTOR Fi BY K(Fi/|Fi|)
S1176
HAS EVERY CLUSTER MAP BEEN SELECTED?
NO
YES
SELECT ONE CLUSTER MAP AND SET THIS CLUSTER MAP AS CLUSTER MAP i
S1177
ADD REPULSIVE FORCE VECTOR Fi TO CALCULATED COORDINATES OF CLUSTER MAP i
S1178
S1179
HAS EVERY CLUSTER MAP BEEN SELECTED?
NO
YES
S1180
IS |Fi| < th11 WITH RESPECT TO EVERY REPULSIVE FORCE VECTOR Fi?
NO
YES
RETURN

FIG. 57A

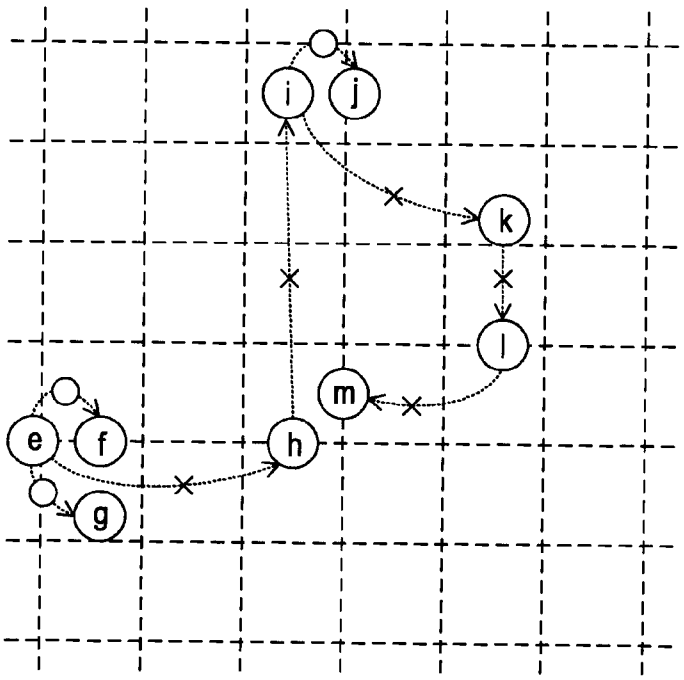


FIG. 57B

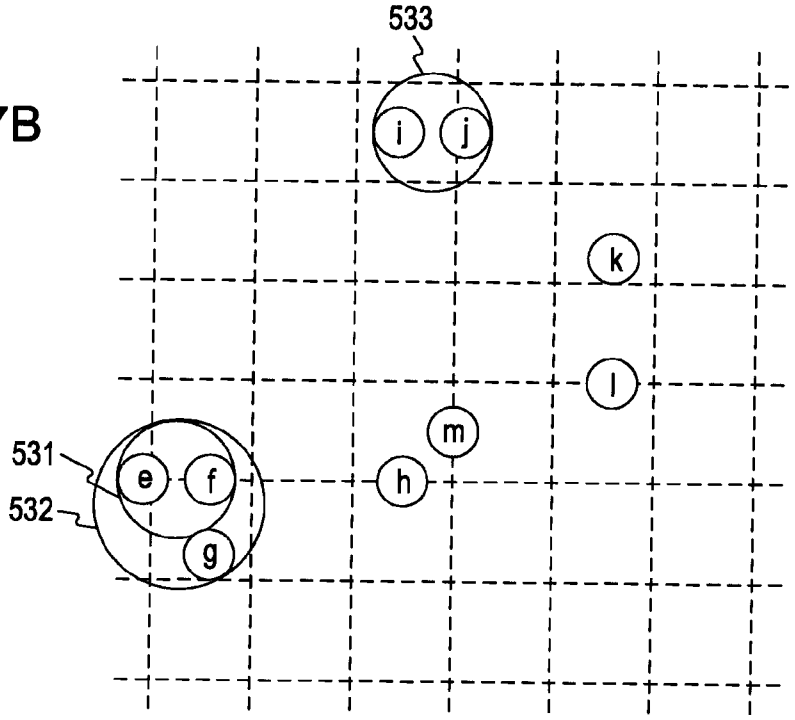


FIG. 58A

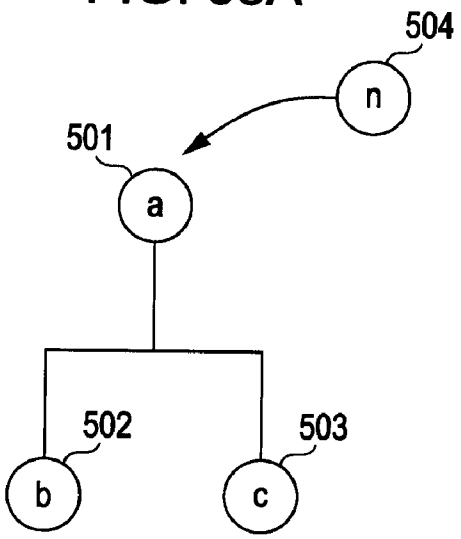


FIG. 58B

DO b AND c OVERLAP?	IS b INCLUDED IN n?	IS c INCLUDED IN n?	CASE
false	false	false	0
false	false	true	1
false	true	false	2
false	true	true	3
true	false	false	4
true	false	true	5
true	true	false	6
true	true	true	7

FIG. 59A

CASE 0

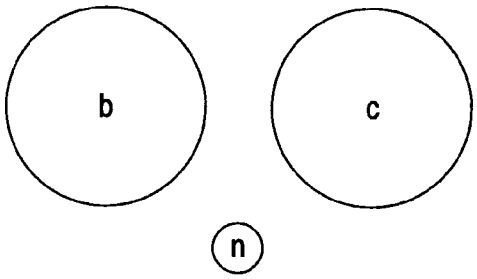


FIG. 59B

CASE 1

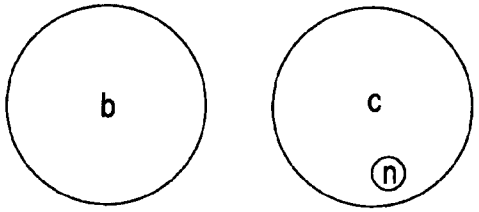


FIG. 59C

CASE 2

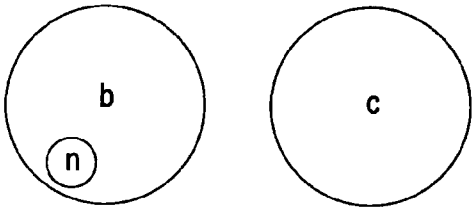


FIG. 59D

CASE 3

undefined

FIG. 59E

CASE 4

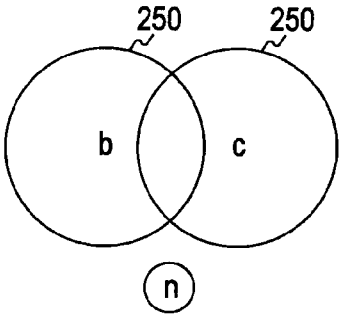


FIG. 59F

CASE 5

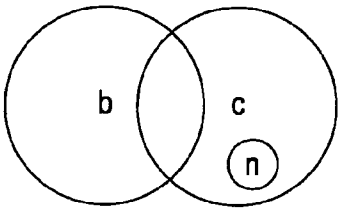


FIG. 59G

CASE 6

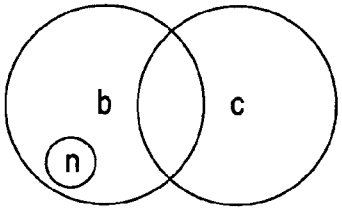


FIG. 59H

CASE 7

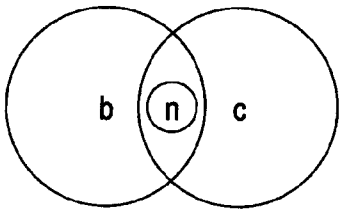


FIG. 60A

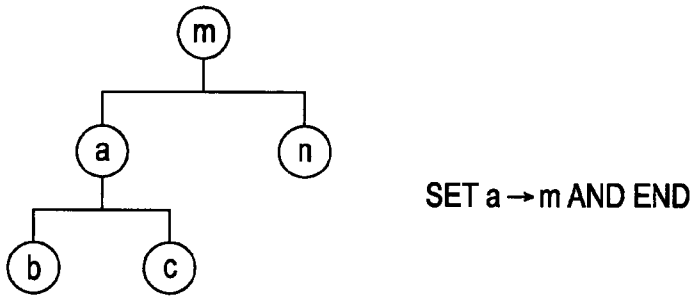


FIG. 60B

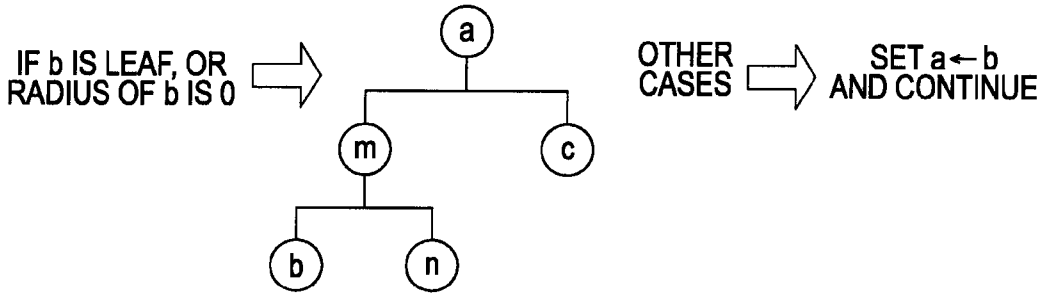


FIG. 60C

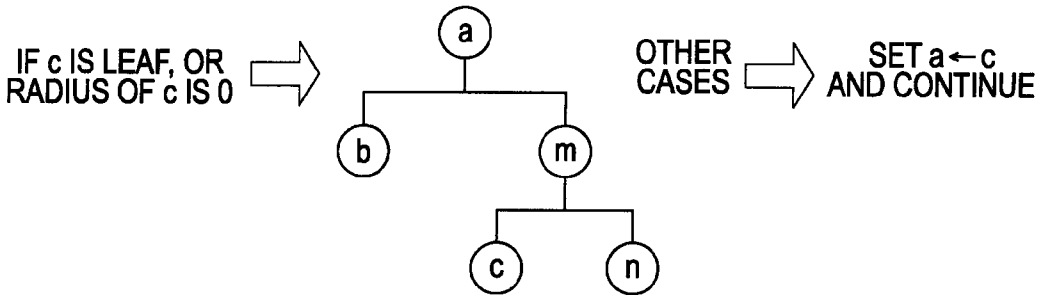


FIG. 61A

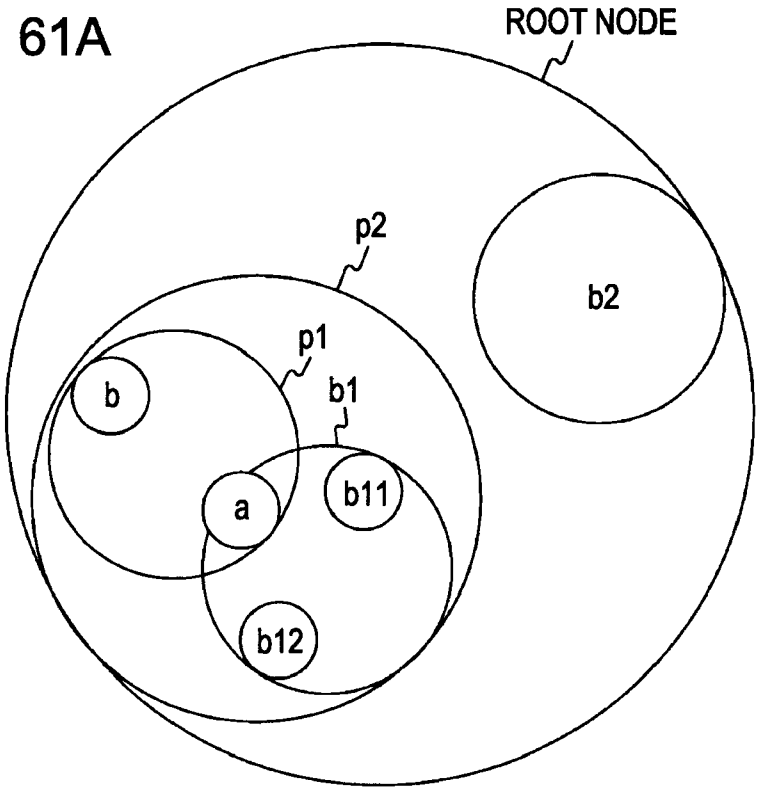


FIG. 61B

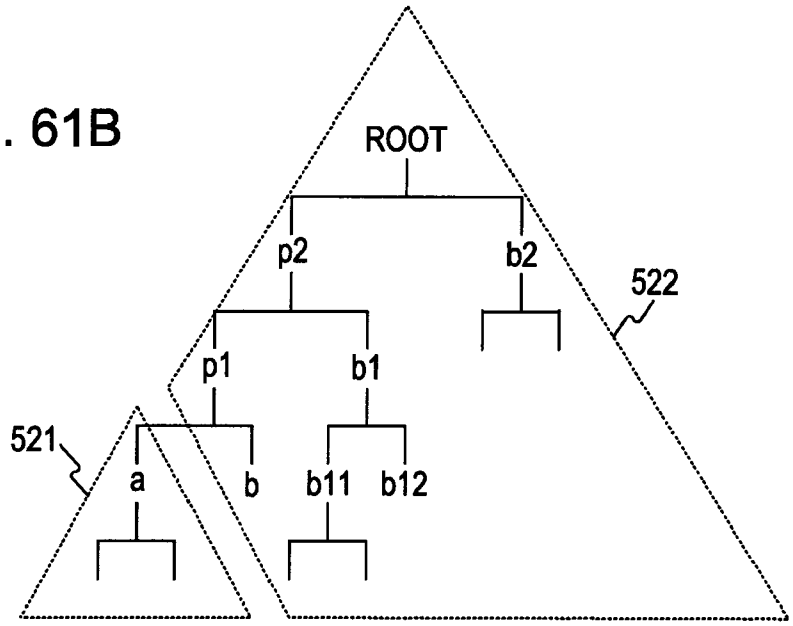


FIG. 62

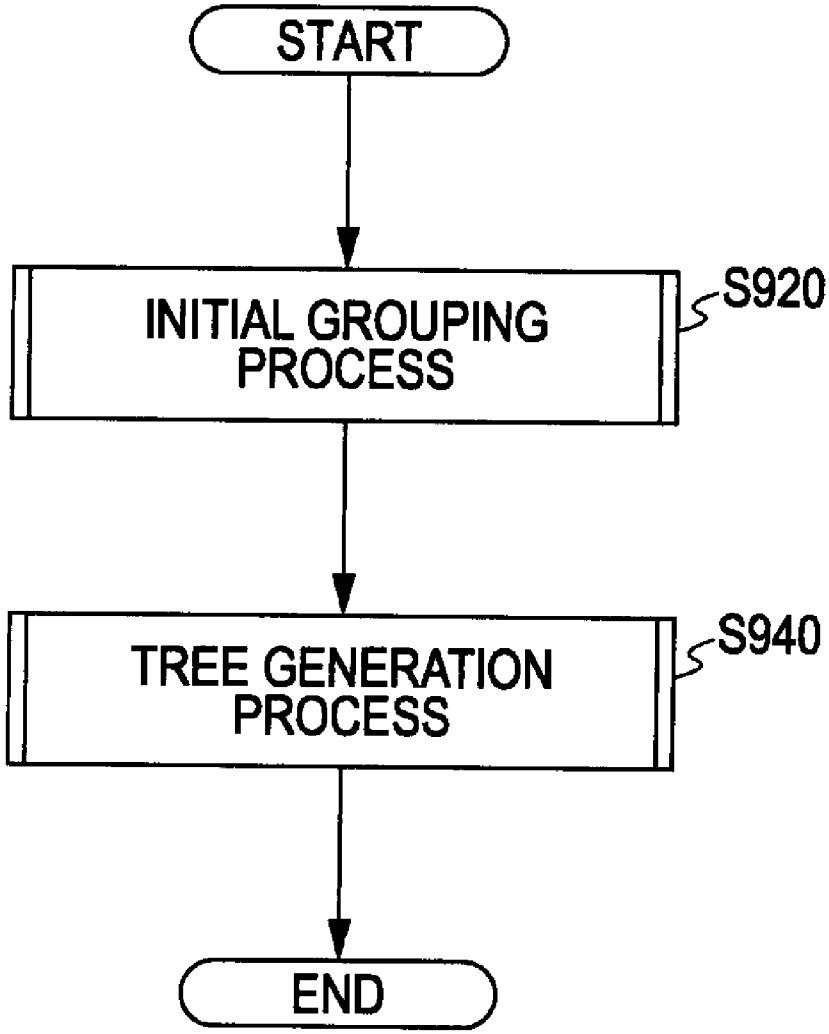

START
INITIAL GROUPING PROCESS
S920
TREE GENERATION PROCESS
S940
END

FIG. 63

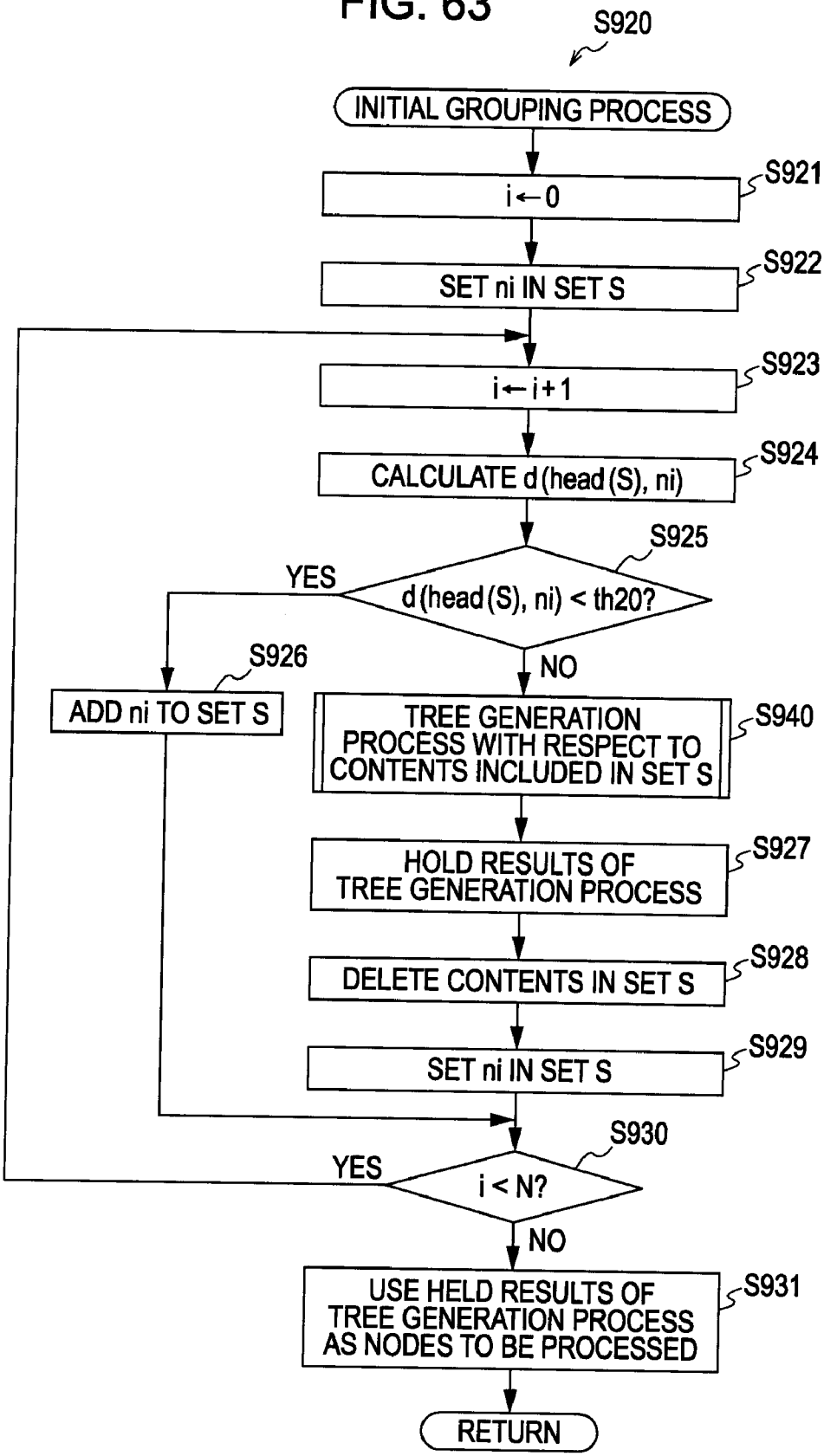

S920
INITIAL GROUPING PROCESS
i←0
S921
SET ni IN SET S
S922
i←i+1
S923
CALCULATE d(head(S), ni)
S924
S925
d(head(S), ni) < th20?
YES
NO
S926
ADD ni TO SET S
TREE GENERATION PROCESS WITH RESPECT TO CONTENTS INCLUDED IN SET S
S940
HOLD RESULTS OF TREE GENERATION PROCESS
S927
DELETE CONTENTS IN SET S
S928
SET ni IN SET S
S929
S930
i < N?
YES
NO
USE HELD RESULTS OF TREE GENERATION PROCESS AS NODES TO BE PROCESSED
S931
RETURN

FIG. 64

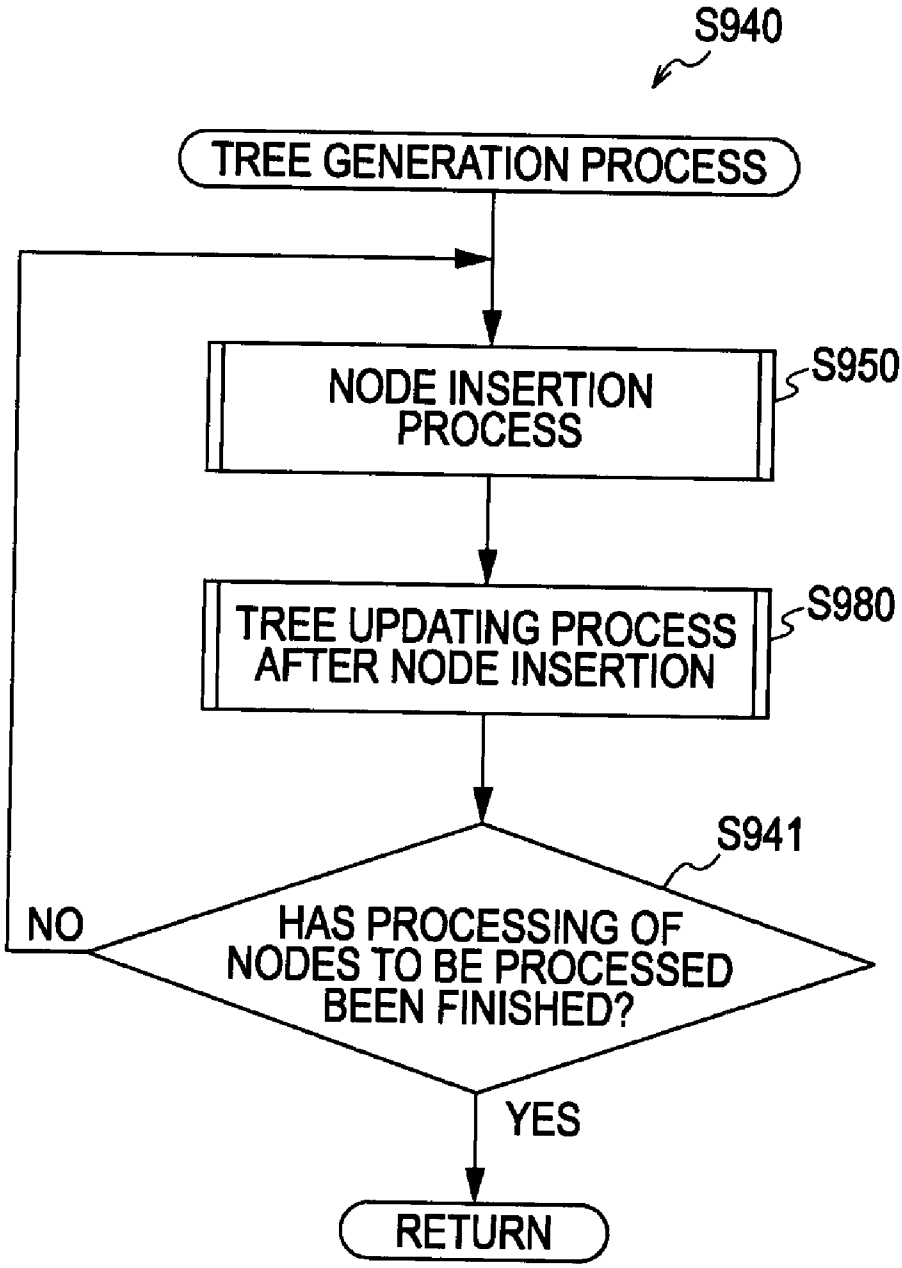

S940
TREE GENERATION PROCESS
NODE INSERTION PROCESS
S950
TREE UPDATING PROCESS AFTER NODE INSERTION
S980
S941
NO
HAS PROCESSING OF NODES TO BE PROCESSED BEEN FINISHED?
YES
RETURN

FIG. 65

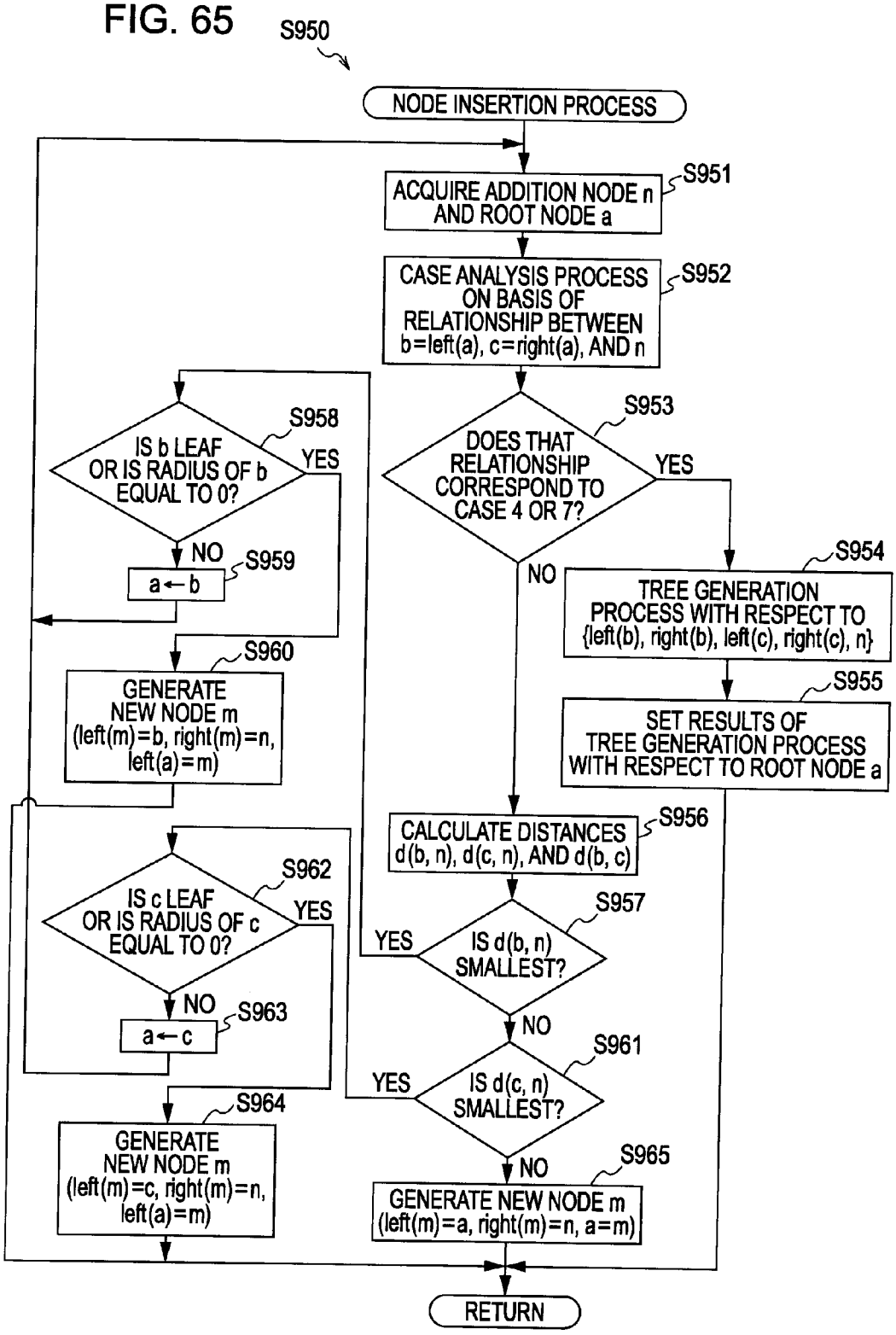
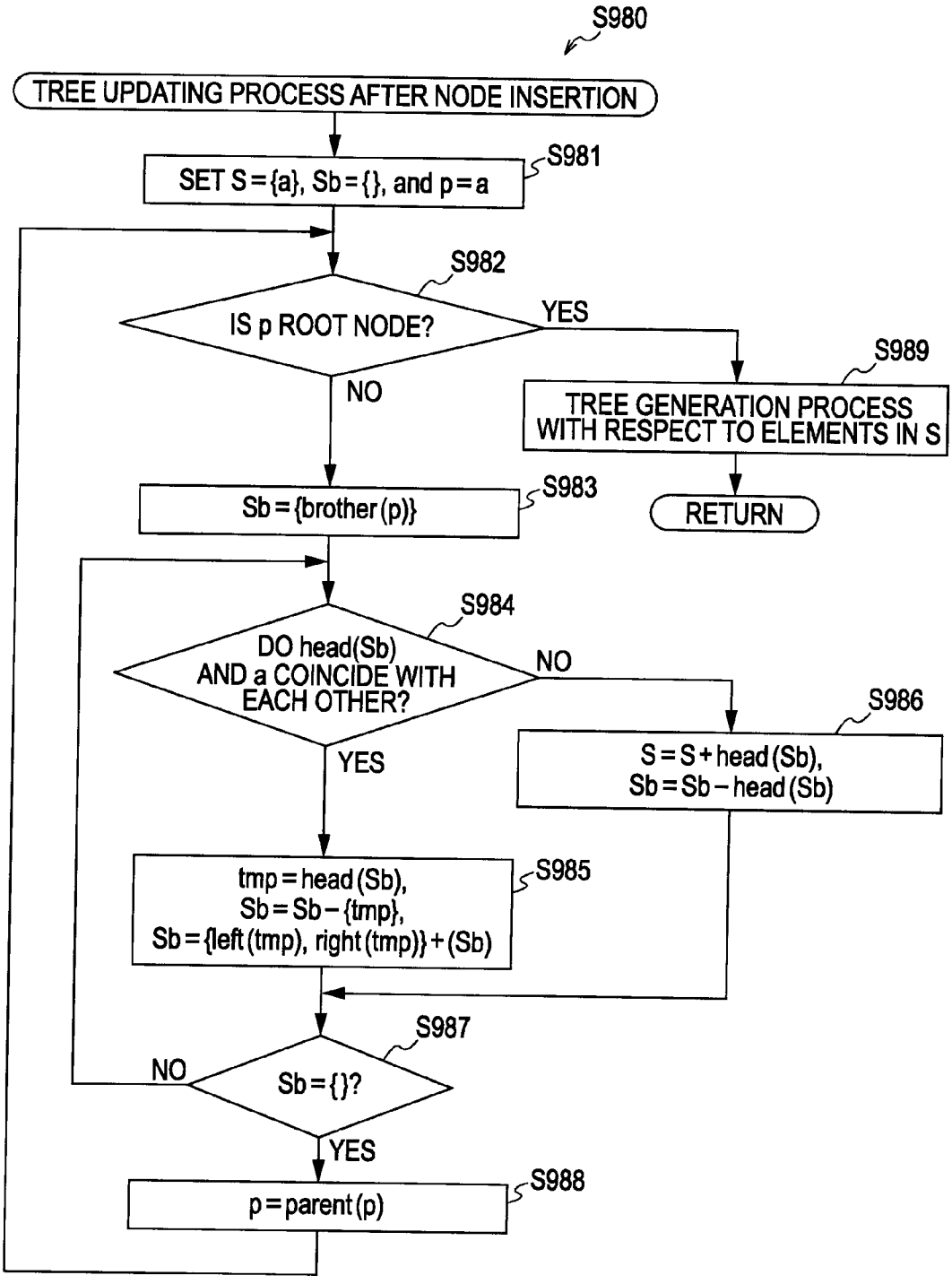

S950
NODE INSERTION PROCESS
ACQUIRE ADDITION NODE n AND ROOT NODE a
S951
CASE ANALYSIS PROCESS ON BASIS OF RELATIONSHIP BETWEEN b=left(a), c=right(a), AND n
S952
DOES THAT RELATIONSHIP CORRESPOND TO CASE 4 OR 7?
S953
YES
NO
TREE GENERATION PROCESS WITH RESPECT TO {left(b), right(b), left(c), right(c), n}
S954
SET RESULTS OF TREE GENERATION PROCESS WITH RESPECT TO ROOT NODE a
S955
CALCULATE DISTANCES d(b, n), d(c, n), AND d(b, c)
S956
IS d(b, n) SMALLEST?
S957
YES
NO
IS d(c, n) SMALLEST?
S961
YES
NO
GENERATE NEW NODE m (left(m)=a, right(m)=n, a=m)
S965
IS b LEAF OR IS RADIUS OF b EQUAL TO 0?
S958
YES
NO
a←b
S959
GENERATE NEW NODE m (left(m)=b, right(m)=n, left(a)=m)
S960
IS c LEAF OR IS RADIUS OF c EQUAL TO 0?
S962
YES
NO
a←c
S963
GENERATE NEW NODE m (left(m)=c, right(m)=n, left(a)=m)
S964
RETURN

FIG. 66


S980
TREE UPDATING PROCESS AFTER NODE INSERTION
SET S={a}, Sb={}, and p=a
S981
S982
IS p ROOT NODE?
YES
NO
S989
TREE GENERATION PROCESS WITH RESPECT TO ELEMENTS IN S
RETURN
Sb={brother(p)}
S983
S984
DO head(Sb) AND a COINCIDE WITH EACH OTHER?
NO
YES
S986
S=S+head(Sb), Sb=Sb-head(Sb)
tmp=head(Sb), Sb=Sb-{tmp}, Sb={left(tmp), right(tmp)}+(Sb)
S985
S987
NO
Sb={}?
YES
S988
p=parent(p)

INFORMATION PROCESSING APPARATUS, INFORMATION PROCESSING METHOD, AND PROGRAM

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to an information processing apparatus, in particular, an information processing apparatus which displays contents such as image files, an information processing method, and a program for causing a computer to execute the information processing method.

[0003] 2. Description of the Related Art

[0004] In recent years, there has been a proliferation of image capturing apparatuses such as a digital still camera and a digital video camera (for example, an integrated camera-recorder) which capture a subject such as a landscape or a person to generate an image, and record the generated image as an image file (content). Also, there are image capturing apparatuses which can record a generated image in association with positional information on the position where the image is captured. There have been proposed information processing apparatuses with which, when displaying contents generated in this way, the generated positions of the contents identified by their positional information are displayed in association with the contents.

[0005] For example, there has been proposed an information processing apparatus which arranges thumbnail icons of images side by side in time series and displays the thumbnail icons in a film window, displays position icons indicating the shooting locations of these images in a map window, and displays these icons in association with each other (see, for example, Japanese Unexamined Patent Application Publication No. 2001-160058 (FIG. 12)). This information processing apparatus is configured such that, for example, when a click operation on a thumbnail icon is performed by the user, a position icon indicating the shooting location of an image corresponding to the clicked thumbnail icon is displayed at the center of the map window.

[0006] Also, there has been proposed an information processing system which arranges thumbnail images side by side in time series and displays the thumbnail images on an image list display section, displays markers at positions on a map corresponding to the shooting locations of these images, and displays these images and markers in association with each other (see, for example, Japanese Unexamined Patent Application Publication No. 2007-323544 (FIG. 7)). In this information processing system, when a click operation on a marker displayed on the map is performed by the user, an image associated with the clicked marker is displayed on the map as a pop-up.

SUMMARY OF THE INVENTION

[0007] According to the related art described above, images representing contents are displayed while being arranged side by side, and marks indicating the generated positions of these contents are displayed on a map. Thus, the user can grasp the correspondence between individual contents and their generated positions on a single screen. Also, the correspondence between each individual content and its generated position can be grasped more clearly through a click operation on an image representing a content or a mark indicating its generated position.

[0008] However, in the related art described above, images representing contents, and marks indicating the generated positions of these contents are displayed relatively far apart from each other, which supposedly makes it difficult to intuitively grasp the geographical correspondence between individual contents.

[0009] Also, for example, it is supposed that images taken by a person living in Tokyo include relatively many images of Tokyo and its vicinity (for example, Shinagawa ward, Setagaya ward, and Saitama city), and relatively few images of other regions (for example, United States or United Kingdom visited by the person on a trip). Accordingly, when displaying the correspondence between images taken in Tokyo and its vicinity and images taken in other regions, and their generated positions, for example, it is necessary to display the map at a scale sufficiently large to show the countries of the world. In this case, marks indicating the generated positions of the images taken in Tokyo and its vicinity (for example, Shinagawa ward, Setagaya ward, and Saitama city) are displayed at substantially the same position on the map, which may make it difficult to grasp the geographical correspondence between the images taken in Tokyo and its vicinity.

[0010] On the other hand, for example, when the map is displayed at a scale sufficiently small to show regions in the vicinity of Tokyo, marks indicating the generated positions of the images taken in Tokyo and its vicinity (for example, Shinagawa ward, Setagaya ward, and Saitama city) are displayed in suitable placement on the map. Therefore, the generated positions of the images taken in Tokyo and its vicinity can be grasped. However, in this case, it is not possible to display the generated positions of images taken in other regions (for example, the United States or United Kingdom) on the map, making it difficult to grasp the generated positions of individual images.

[0011] Accordingly, when displaying images representing contents associated with positions on a map, it is important to be able to easily grasp the correspondence between a plurality of contents on the map, and each individual content.

[0012] It is thus desirable to be able to easily grasp, when displaying superimposed images associated with positions in a background image, the correspondence between a plurality of superimposed images in the background image, and each individual superimposed image.

[0013] According to an embodiment of the present invention, there are provided an information processing apparatus, an information processing method, and a program for causing a computer to execute the information processing method, the information processing apparatus including: a transformed-coordinate calculating section that calculates transformed coordinates for each of a plurality of superimposed images associated with coordinates in a background image, by taking one superimposed image of the plurality of superimposed images as a reference image, and transforming coordinates of other superimposed images on the basis of corresponding coordinates of the reference image in the background image, distances in the background image from the reference image to the other superimposed images, and a distance in the background image from the reference image to a boundary within a predetermined area with respect to the reference image, the coordinates of the other superimposed images being transformed in such a way that coordinate intervals within the predetermined area become denser with increasing distance from the reference image toward the boundary within the predetermined area; a coordinate setting section that sets

coordinates of the reference image on the basis of a mean value obtained by calculating a mean of the calculated coordinates of the other superimposed images with respect to the reference image; and a display control section that displays the background image and the plurality of superimposed images on a display section in such a way that the reference image is placed at the set coordinates in the background image. Therefore, transformed coordinates are calculated for each of superimposed images by transforming coordinates of other superimposed images in such a way that coordinate intervals within a predetermined area become denser with increasing distance from a reference image toward a boundary within the predetermined area, and coordinates of the reference image are set on the basis of a mean value obtained by calculating a mean of the calculated coordinates of the other superimposed images with respect to the reference image, and a background image and a plurality of superimposed images are displayed in such a way that the reference image is placed at the set coordinates in the background image.

[0014] Also, in an embodiment of the present invention, the information processing apparatus may further include a second transformed-coordinate calculating section that calculates transformed coordinates for each of the superimposed images by transforming the set coordinates on the basis of a size of the background image on a display screen of the display section, the number of the superimposed images, and distances between the superimposed images in the background image, the set coordinates being transformed in such a way that the distances between the superimposed images increase under a predetermined condition in accordance with the distances between the superimposed images in the background image, and the display control section may display the background image and the plurality of superimposed images in such a way that the superimposed images are placed at the coordinates in the background image calculated by the second transformed-coordinate calculating section. Therefore, transformed coordinates are calculated for each of the superimposed images by transforming the coordinates in such a way that the distances between the superimposed images increase under a predetermined condition in accordance with the distances between the superimposed images in the background image, and the background image and the plurality of superimposed images are displayed in such a way that the superimposed images are placed at the calculated coordinates in the background image.

[0015] Also, in an embodiment of the present invention, the information processing apparatus may further include a magnification/shrinkage processing section that magnifies or shrinks the coordinates calculated by the second transformed-coordinate calculating section with reference to a specific position on the display screen, on the basis of a coordinate size subject to coordinate transformation by the second transformed-coordinate calculating section, and a size of the background image on the display screen of the display section, and the display control section may display the background image and the plurality of superimposed images in such a way that the superimposed images are placed at the coordinates in the background image magnified or shrunk by the magnification/shrinkage processing section. Therefore, the coordinates of the superimposed images are magnified or shrunk with reference to a specific position on the display screen, and the background image and the plurality of superimposed images are displayed in such a way that the superimposed images are placed at the magnified or shrunk coordinates in the background image.

[0016] Also, in an embodiment of the present invention, the background image may be an image representing a map, and the superimposed images may be images representing a plurality of contents with each of which positional information indicating a position in the map is associated. Therefore, images representing a map and a plurality of contents are displayed so that the reference image is placed at the set coordinates on the map.

[0017] Also, in an embodiment of the present invention, the information processing apparatus may further include a group setting section that sets a plurality of groups by classifying the plurality of contents on the basis of the positional information, and a mark generating section that generates marks representing the groups on the basis of the positional information associated with each of contents belonging to the set groups, and the display control section may display a listing of the marks representing the groups as the superimposed images. Therefore, a plurality of groups are set by classifying the plurality of contents on the basis of the positional information, marks representing the groups are generated on the basis of the positional information associated with each of contents belonging to the set groups, and a listing of the marks representing the groups is displayed as the superimposed images.

[0018] Also, in an embodiment of the present invention, the mark generating section may generate maps as the marks representing the groups, the maps each corresponding to an area including a position identified by the positional information associated with each of the contents belonging to the set groups. Therefore, maps are generated as the marks representing the groups, the maps each corresponding to an area including a position identified by the positional information associated with each of the contents belonging to the set groups.

[0019] Also, in an embodiment of the present invention, the mark generating section may generate the marks representing the groups by changing a map scale for each of the set groups so that each of the maps becomes an image with a predetermined size. Therefore, the marks representing the groups are generated by changing a map scale for each of the set groups so that each of the maps becomes an image with a predetermined size.

[0020] Also, in an embodiment of the present invention, the information processing apparatus may further include a background map generating section that generates a background map corresponding to each of the groups at a scale determined in accordance with a scale of each of maps generated as the marks representing the groups, and the display control section may display, as the background image, the background map generated with respect to a group corresponding to a map selected from among the displayed listing of maps. Therefore, a background map corresponding to each of the groups is generated at a scale determined in accordance with a scale of each of maps generated as the marks representing the groups, and as the background image, the background map generated with respect to a group corresponding to a map selected from among the displayed listing of maps is displayed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] FIG. **1** is a block diagram showing an example of the functional configuration of an information processing apparatus according to a first embodiment of the present invention;

[0022] FIGS. **2**A and **2**B are diagrams showing an example of the file structure of an image file stored in a content storing section according to the first embodiment of the present invention;

[0023] FIG. **3** is a diagram schematically showing information stored in an address information storing section according to the first embodiment of the present invention;

[0024] FIG. **4** is a diagram schematically showing a method of determining addresses assigned to cluster information generated by a cluster information generating section according to the first embodiment of the present invention;

[0025] FIG. **5** is a diagram schematically showing information stored in a cluster information storing section according to the first embodiment of the present invention;

[0026] FIGS. **6**A to **6**D are diagrams showing an example of distances in the case when a tree having a binary tree structure is generated by a tree generating section according to the first embodiment of the present invention;

[0027] FIG. **7** is a diagram schematically showing contents stored in a content storing section according to the first embodiment of the present invention;

[0028] FIG. **8** is a diagram schematically showing how contents are clustered by a tree generating section on the basis of positional information according to the first embodiment of the present invention;

[0029] FIG. **9** is a conceptual clustering tree diagram of a binary tree structure representing binary tree structured data generated with respect to contents by a tree generating section according to the first embodiment of the present invention;

[0030] FIG. **10** is a conceptual clustering tree diagram of a binary tree structure representing binary tree structured data generated on the basis of data and time information by an event cluster generating section according to the first embodiment of the present invention;

[0031] FIGS. **11**A to **11**F are diagrams each showing an example of a histogram generated by a hierarchy determining section according to the first embodiment of the present invention;

[0032] FIGS. **12**A and **12**B are diagrams each showing an example of comparison of histograms generated by a hierarchy determining section according to the first embodiment of the present invention;

[0033] FIGS. **13**A and **13**B are diagrams schematically showing the flow of a tree restructuring process by a tree restructuring section according to the first embodiment of the present invention;

[0034] FIG. **14** is a diagram showing a correspondence table used for generating map information by a cluster information generating section according to the first embodiment of the present invention;

[0035] FIGS. **15**A and **15**B are diagrams each showing an example of a map generated by a cluster information generating section according to the first embodiment of the present invention;

[0036] FIGS. **16**A and **16**B are diagrams each showing an example of a map generated by a cluster information generating section according to the first embodiment of the present invention;

[0037] FIG. **17** is a diagram showing an example of transition of the display screen of a display section which is performed by a display control section according to the first embodiment of the present invention;

[0038] FIG. **18** is an example of display of an index screen displayed by a display control section according to the first embodiment of the present invention;

[0039] FIG. **19** is an example of display of an index screen displayed by a display control section according to the first embodiment of the present invention;

[0040] FIG. **20** is an example of display of an index screen displayed by a display control section according to the first embodiment of the present invention;

[0041] FIG. **21** is an example of display of an index screen displayed by a display control section according to the first embodiment of the present invention;

[0042] FIG. **22** is a diagram showing an example of display of a content playback screen displayed by a display control section according to the first embodiment of the present invention;

[0043] FIG. **23** is a diagram showing an example of display of a content playback screen displayed by a display control section according to the first embodiment of the present invention;

[0044] FIG. **24** is a diagram showing an example of display of a content playback screen displayed by a display control section according to the first embodiment of the present invention;

[0045] FIG. **25** is a diagram showing an example of display of a content playback screen displayed by a display control section according to the first embodiment of the present invention;

[0046] FIG. **26** is a diagram showing an example of display of a content playback screen displayed by a display control section according to the first embodiment of the present invention;

[0047] FIGS. **27**A and **27**B are diagrams each showing an example of display of a cluster map display screen displayed by a display control section according to the first embodiment of the present invention;

[0048] FIG. **28** is a flowchart showing an example of the procedure of a content information generation process by an information processing apparatus according to the first embodiment of the present invention;

[0049] FIG. **29** is a flowchart showing an example of a hierarchy determination process of the procedure of a content information generation process by an information processing apparatus according to the first embodiment of the present invention;

[0050] FIG. **30** is a flowchart showing an example of a tree restructuring process of the procedure of a content information generation process by an information processing apparatus according to the first embodiment of the present invention;

[0051] FIG. **31** is a flowchart showing an example of the procedure of a content playback process by an information processing apparatus according to the first embodiment of the present invention;

[0052] FIG. **32** is a flowchart showing an example of a content playback screen display process of the procedure of a content playback process by an information processing apparatus according to the first embodiment of the present invention;

[0053] FIG. **33** is a flowchart showing an example of a content playback screen display process of the procedure of a content playback process by an information processing apparatus according to the first embodiment of the present invention;

[0054] FIG. **34** is a block diagram showing an example of the functional configuration of an information processing apparatus according to a second embodiment of the present invention;

[0055] FIG. **35** is a diagram schematically showing a case in which cluster maps to be coordinate-transformed by a non-linear zoom processing section are placed on coordinates according to the second embodiment of the present invention;

[0056] FIG. **36** is a diagram schematically showing the relationship between a background map and a cluster map displayed on a display section according to the second embodiment of the present invention;

[0057] FIG. **37** is a diagram schematically showing the relationship between a background map and a cluster map displayed on a display section according to the second embodiment of the present invention;

[0058] FIG. **38** is a diagram schematically showing a case in which cluster maps subject to a non-linear zoom process by a non-linear zoom processing section are placed on coordinates according to the second embodiment of the present invention;

[0059] FIG. **39** is a diagram schematically showing a coordinate transformation process by a non-linear zoom processing section according to the second embodiment of the present invention;

[0060] FIG. **40** is a diagram schematically showing a case in which cluster maps that have been coordinate-transformed by a non-linear zoom processing section are placed on coordinates according to the second embodiment of the present invention;

[0061] FIG. **41** is a diagram showing an example of a map view screen displayed on a display section according to the second embodiment of the present invention;

[0062] FIG. **42** is a diagram schematically showing cluster maps that are subject to a force-directed relocation process by a relocation processing section according to the second embodiment of the present invention;

[0063] FIGS. **43**A and **43**B are diagrams schematically showing cluster maps that are subject to a relocation process by a magnification/shrinkage processing section according to the second embodiment of the present invention;

[0064] FIGS. **44**A and **44**B are diagrams schematically showing a background map generation process by a background map generating section according to the second embodiment of the present invention;

[0065] FIG. **45** is a diagram showing the relationship between the diameter of a wide-area map generated by a background map generating section, and the diameter of a cluster map according to the second embodiment of the present invention;

[0066] FIG. **46** is a diagram showing an example of a scatter view screen displayed on a display section according to the second embodiment of the present invention;

[0067] FIG. **47** is a diagram showing an example of a scatter view screen displayed on a display section according to the second embodiment of the present invention;

[0068] FIGS. **48**A and **48**B are diagrams each showing an example of a scatter view screen displayed on a display section according to the second embodiment of the present invention;

[0069] FIG. **49** is a diagram showing an example of transition of the display screen of a display section which is performed by a display control section according to the second embodiment of the present invention;

[0070] FIG. **50** is a diagram showing an example of a play view screen displayed on a display section according to the second embodiment of the present invention;

[0071] FIG. **51** is a flowchart showing an example of the procedure of a background map generation process by an information processing apparatus according to the second embodiment of the present invention;

[0072] FIG. **52** is a flowchart showing an example of the procedure of a content playback process by an information processing apparatus according to the second embodiment of the present invention;

[0073] FIG. **53** is a flowchart showing an example of a map view process of the procedure of a content playback process by an information processing apparatus according to the second embodiment of the present invention;

[0074] FIG. **54** is a flowchart showing an example of a non-linear zoom process of the procedure of a content playback process by an information processing apparatus according to the second embodiment of the present invention;

[0075] FIG. **55** is a flowchart showing an example of a scatter view process of the procedure of a content playback process by an information processing apparatus according to the second embodiment of the present invention;

[0076] FIG. **56** is a flowchart showing an example of a force-directed relocation process of the procedure of a content playback process by an information processing apparatus according to the second embodiment of the present invention;

[0077] FIGS. **57**A and **57**B are diagrams for explaining a tree generation process performed by a tree generating section according to a modification of the first embodiment of the present invention;

[0078] FIGS. **58**A and **58**B are diagrams for explaining a tree generation process performed by a tree generating section according to a modification of the first embodiment of the present invention;

[0079] FIG. **59**A to **59**H are diagrams for explaining a tree generation process performed by a tree generating section according to a modification of the first embodiment of the present invention;

[0080] FIGS. **60**A to **60**C are diagrams for explaining a tree generation process performed by a tree generating section according to a modification of the first embodiment of the present invention;

[0081] FIGS. **61**A and **61**B are diagrams for explaining a tree generation process performed by a tree generating section according to a modification of the first embodiment of the present invention;

[0082] FIG. **62** is a flowchart showing an example of the procedure of a clustering process by an information processing apparatus according to a modification of the first embodiment of the present invention;

[0083] FIG. **63** is a flowchart showing an example of the procedure of a clustering process according to a modification of the first embodiment of the present invention;

[0084] FIG. **64** is a flowchart showing an example of the procedure of a clustering process according to a modification of the first embodiment of the present invention;

[0085] FIG. **65** is a flowchart showing an example of the procedure of a clustering process according to a modification of the first embodiment of the present invention; and

[0086] FIG. **66** is a flowchart showing an example of the procedure of a clustering process according to a modification of the first embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0087] Hereinbelow, modes for carrying out the present invention (hereinafter, referred to as embodiments) will be described. The description will be given in the following order.

[0088] 1. First Embodiment (cluster information generation control; example of generating cluster information on the basis of positional information and date and time information)

[0089] 2. Second Embodiment (cluster information display control; example of displaying cluster information while taking geographical position relationship into consideration)

[0090] 3. Modifications

1. First Embodiment

Example of Configuration of Information Processing Apparatus

[0091] FIG. **1** is a block diagram showing an example of the functional configuration of an information processing apparatus **100** according to a first embodiment of the present invention. The information processing apparatus **100** includes an attribute information acquiring section **110**, a tree generating section **120**, an event cluster generating section **130**, a face cluster generating section **140**, a hierarchy determining section **150**, a tree restructuring section **160**, and a cluster information generating section **170**. In addition, the information processing apparatus **100** includes a display control section **180**, a display section **181**, a condition setting section **190**, an operation accepting section **200**, a content storing section **210**, a map information storing section **220**, an address information storing section **230**, and a cluster information storing section **240**. The information processing apparatus **100** can be realized by, for example, an information processing apparatus such as a personal computer capable of managing contents such as image files recorded by an image capturing apparatus such as a digital still camera.

[0092] The content storing section **210** stores contents such as image files recorded by an image capturing apparatus such as a digital still camera, and supplies the stored contents to the attribute information acquiring section **110** and the display control section **180**. Also, attribute information including positional information and date and time information is recorded in association with each content stored in the content storing section **210**. It should be noted that a description of contents stored in the content storing section **210** will be given later in detail with reference to FIGS. **2**A and **2**B.

[0093] The map information storing section **220** stores map data related to maps displayed on the display section **181**. The map information storing section **220** supplies the stored map data to the cluster information generating section **170**. For example, the map data stored in the map information storing section **220** is data identified by latitude and longitude, and divided into a plurality of areas in units of predetermined latitude and longitude widths. Also, the map information storing section **220** stores map data corresponding to a plurality of scales.

[0094] The address information storing section **230** stores conversion information for converting positional information into addresses, and supplies the stored conversion information to the cluster information generating section **170**. It should be noted that information stored in the address information storing section **230** will be described later with reference to FIG. **3**.

[0095] The cluster information storing section **240** stores cluster information generated by the cluster information generating section **170**, and supplies the stored cluster information to the display control section **180**. It should be noted that information stored in the cluster information storing section **240** will be described later with reference to FIG. **5**.

[0096] The attribute information acquiring section **110** acquires attribute information associated with contents stored in the content storing section **210**, in accordance with an operational input accepted by the operation accepting section **200**. Then, the attribute information acquiring section **110** outputs the acquired attribute information to the tree generating section **120**, the event cluster generating section **130**, or the face cluster generating section **140**.

[0097] The tree generating section **120** generates binary tree structured data on the basis of attribute information (positional information) outputted from the attribute information acquiring section **110**, and outputs the generated binary tree structured data to the hierarchy determining section **150**. The method of generating this binary tree structured data will be described later in detail with reference to FIGS. **8** and **9**.

[0098] The event cluster generating section **130** generates binary tree structured data on the basis of attribute information (date and time information) outputted from the attribute information acquiring section **110**, and generates event clusters (clusters based on date and time information) on the basis of this binary tree structured data. Then, the event cluster generating section **130** outputs information related to the generated event clusters to the hierarchy determining section **150** and the cluster information generating section **170**. The event clusters are generated on the basis of various kinds of condition corresponding to a user operation outputted from the condition setting section **190**. It should be noted that the method of generating the event clusters will be described later in detail with reference to FIG. **10**.

[0099] The face cluster generating section **140** generates face clusters related to faces on the basis of attribute information (face information and the like) outputted from the attribute information acquiring section **110**, and outputs information related to the generated face clusters to the cluster information generating section **170**. The face clusters are generated on the basis of various kinds of condition corresponding to a user operation outputted from the condition setting section **190**. For example, the face clusters are generated in such a way that on the basis of the similarity between faces, similar faces belong to the same face cluster.

[0100] The hierarchy determining section **150** determines a plurality of groups related to contents, on the basis of information related to event clusters outputted from the event cluster generating section **130**, and binary tree structured data outputted from the tree generating section **120**. Specifically, the hierarchy determining section **150** calculates the frequency distributions of a plurality of contents with respect to a plurality of groups identified by the event clusters generated by the event cluster generating section **130**, for individual nodes in the binary tree structured data generated by the tree generating section **120**. Then, the hierarchy determining section **150** compares the calculated frequency distributions with each other, extracts nodes that satisfy a predetermined con-

dition from among the nodes in the binary tree structured data on the basis of this comparison result, and determines a plurality of groups corresponding to the extracted nodes. Then, the hierarchy determining section **150** outputs tree information generated by the determination of the plurality of groups (for example, the binary tree structured data and information related to the extracted nodes) to the tree restructuring section **160**. The extraction of nodes in the binary tree structured data is performed on the basis of various kinds of condition corresponding to a user operation outputted from the condition setting section **190**. Also, the method of extracting nodes in the binary true structured data will be described later in detail with reference to FIGS. **11**A to **11**F and FIGS. **12**A and **12**B.

[0101] The tree restructuring section **160** generates clusters by restructuring tree information outputted from the hierarchy determining section, on the basis of various kinds of condition corresponding to a user operation outputted from the condition setting section **190**. Then, the tree restructuring section **160** outputs information related to the generated clusters to the cluster information generating section **170**. It should be noted that the method of restructuring tree information will be described later in detail with reference to FIGS. **13**A and **13**B. The tree generating section **120**, the hierarchy determining section **150**, and the tree restructuring section **160** each represent an example of a group setting section described in the claims.

[0102] The cluster information generating section **170** records the information related to clusters outputted from the tree restructuring section **160**, to the cluster information storing section **240** as cluster information. In addition, the cluster information generating section **170** generates individual pieces of attribute information related to clusters on the basis of the information related to clusters outputted from the tree restructuring section **160**, causes these pieces of attribute information to be included in cluster information, and stores the cluster information into the cluster information storing section **240**. These pieces of attribute information (such as Cluster Map **247** and Cluster Title **248** shown in FIG. **5**) are generated on the basis of map data stored in the map information storing section **220**, or conversion information stored in the address information storing section **230**. In addition, the cluster information generating section **170** also records information related to clusters outputted from the event cluster generating section **130** and the face cluster generating section **140**, to the cluster information storing section **240** as cluster information. It should be noted that the method of generating cluster maps will be described later in detail with reference to FIGS. **14** to **16**B. Also, the method of generating cluster titles will be described later in detail with reference to FIG. **4**. It should be noted that the cluster information generating section **170** represents an example of a mark generating section described in the claims.

[0103] The display control section **180** displays various kinds of image on the display section **181** in accordance with an operational input accepted by the operation accepting section **200**. For example, in accordance with an operational input accepted by the operation accepting section **200**, the display control section **180** displays on the display section **181** cluster information (for example, a listing of cluster maps) stored in the cluster information storing section **240**. Also, in accordance with an operational input accepted by the operation accepting section **200**, the display control section **180** displays contents stored in the content storing section **210** on the display section **181**. These examples of display will be described later in detail with reference to FIGS. **18** to **27**B and the like.

[0104] The display section **181** is a display section that displays various kinds of image on the basis of control of the display control section **180**.

[0105] The condition setting section **190** sets various kinds of condition in accordance with an operational input accepted by the operation accepting section **200**, and outputs information related to the set condition to individual sections. That is, the condition setting section **190** outputs information related to the set condition to the event cluster generating section **130**, the face cluster generating section **140**, the hierarchy determining section **150**, and the tree restructuring section **160**.

[0106] The operation accepting section **200** is an operation accepting section that accepts an operational input from the user, and outputs information on an operation corresponding to the accepted operational input to the attribute information acquiring section **110**, the display control section **180**, and the condition setting section **190**.

[Example of Image File Configuration]

[0107] FIGS. **2**A and **2**B are diagrams showing an example of the file structure of an image file stored in the content storing section **210** according to the first embodiment of the present invention. The example shown in FIGS. **2**A and **2**B schematically illustrates the file structure of a still image file recorded in the DCF (Design rule for Camera File system) standard. The DCF is a file system standard for realizing mutual use of images between devices such as a digital still camera and a printer via a recording medium. Also, the DCF defines the file naming method and folder configuration in the case of recording onto a recording medium on the basis of Exif (Exchangeable image file format). The Exif is a standard for adding image data and camera information into an image file, and defines a format (file format) for recording an image file. FIG. **2**A shows an example of the configuration of an image file **211**, and FIG. **2**B shows an example of the configuration of attached information **212**.

[0108] The image file **211** is a still image file recorded in the DCF standard. As shown in FIG. **2**A, the image file **211** includes the attached information **212** and image information **215**. The image information **215** is, for example, image data generated by an image capturing apparatus such as a digital still camera. This image data is image data that has been captured by the imaging capturing device of the image capturing apparatus, subjected to resolution conversion by a digital signal processing section, and compressed in the JPEG format.

[0109] As shown in FIG. **2**B, the attached information **212** includes attribute information **213** and a maker note **214**. The attribute information **213** is attribute information or the like related to the image file **211**, and includes, for example, GPS information, date and time of shooting update, picture size, color space information, and maker name. The GPS information includes, for example, positional information such as latitude and longitude (for example, TAGID=1000001 to 100004).

[0110] The maker note **214** is generally an area in which data unique to the user is recorded, and is an extension area in which each maker can freely record information (TAGID=37500, MakerNote). It should be noted that date and time information such as time of shooting, positional information such as GPS information, or face information related

to a face included in an image (for example, the position and size of the face) may be recorded in the maker note **214**. While the first embodiment is directed to the case in which cluster information is generated by using positional information recorded in an image file, it is also possible to record positional information into a management file for managing contents, and generate cluster information by using this positional information.

[Example of Information Stored in Address Information Storing Section]

[0111] FIG. **3** is a diagram schematically showing information stored in the address information storing section **230** according to the first embodiment of the present invention. The address information storing section **230** stores conversion information for converting positional information into addresses. Specifically, the address information storing section **230** stores Positional Information **231** and Address Information **232** in association with each other.

[0112] In the Positional Information **231**, data for identifying each of locations corresponding to addresses stored in the Address Information **232** is stored. The example shown in FIG. **3** illustrates a case in which each of locations corresponding to addresses stored in the Address Information **232** is specified by a single position (latitude and longitude). It should be noted that the specific numeric values of latitude and longitude stored in the Positional Information **231** are not shown.

[0113] In the Address Information **232**, data related to addresses assigned to cluster information generated by the cluster information generating section **170** is stored. As each address assigned to cluster information generated by the cluster information generating section **170**, for example, a place name corresponding to administrative divisions, and a building name etc. can be used. The units of such administrative divisions can be, for example, countries, prefectures, and municipalities. It should be noted that in the first embodiment of the present invention, it is assumed that the prefecture, municipality, chome (district in Japanese)/banchi (block in Japanese), and building name etc. are divided into corresponding hierarchical levels, and data thus separated by hierarchical levels is stored in the Address Information **232**. Thus, each piece of data divided into hierarchical levels can be used. An example of using each piece of data divided into hierarchical levels in this way will be described later in detail with reference to FIG. **4**.

[Example of Determination of Addresses Assigned to Clusters]

[0114] FIG. **4** is a diagram schematically showing a method of determining addresses assigned to cluster information generated by the cluster information generating section **170** according to the first embodiment of the present invention. This example is directed to a case in which on the basis of address information converted with respect to each content belonging to a target cluster, the address of the cluster is determined.

[0115] The cluster information generating section **170** acquires address information from the address information storing section **230** shown in FIG. **3**, on the basis of the latitudes and longitudes of individual contents belonging to a cluster generated by the tree restructuring section **160**. For example, the cluster information generating section **170** extracts, from among the latitudes and longitudes stored in the Positional Information **231** (shown in FIG. **3**), latitudes and longitudes that are the same as those of individual contents belonging to a cluster, for each of the contents. Then, the cluster information generating section **170** acquires address information stored in the Address Information **232** (shown in FIG. **3**) in association with the extracted latitudes and longitudes, as address information of individual contents. It should be noted that for a content with no matching latitudes and longitudes stored in the Positional Information **231**, a latitude and a longitude that are closest to the latitude and longitude of the content are extracted, and address information can be acquired by using the extracted latitude and longitude.

[0116] Subsequently, on the basis of the address information acquired with respect to the individual contents belonging to the target cluster, the cluster information generating section **170** determines an address to be assigned to the cluster. It should be noted that as the address information used for this determination, for example, all the pieces of address information acquired with respect to the individual contents belonging to the cluster can be used. However, it is also possible to use only a predetermined number of pieces of address information selected in accordance with a preset rule (for example, randomly selecting a predetermined number of pieces of address information) from among all the pieces of acquired address information. Also, if another cluster (child node) belongs to a level below a target cluster (parent node), only address information acquired with respect to a content corresponding to the center position (or in its close proximity) of the other cluster (child node) may be used.

[0117] As described above, address information acquired from the address information storing section **230** can be divided into hierarchical levels such as Prefecture **251**, Municipality **252**, Chome/Banchi **253**, and Building Name etc. **254** for use, for example. Accordingly, in the first embodiment of the present invention, each piece of address information acquired with respect to each of contents belonging to a target cluster is divided into hierarchical levels, and an address to be assigned to the group is determined on the basis of frequencies calculated at each level. That is, frequencies of individual pieces of address information are calculated at each level, and of the calculated frequencies, the most frequent value is calculated at each level. Then, if the calculated most frequent value accounts for a fixed percentage (ADDRESS_ADOPT_RATE) or more within the entire level, it is determined to use the address information corresponding to the most frequent value. This fixed percentage can be set as, for example, 70%. This fixed percentage may be changed by a user operation to suit the user's preferences. If it is determined to use address information at a given level, then an address determination process is performed similarly with respect to levels below that level. On the other hand, if the calculated most frequent value accounts for less than the fixed percentage within the entire level, it is determined not to use the address information corresponding to the most frequent value. If it is determined not to use address information corresponding to the most frequent value in this way, the address determination process with respect to levels below that level is discontinued. That is, if it is determined not to use address information corresponding to the most frequent value, the address determination process is discontinued because there is supposedly a strong possibility that a determination not to use address information corresponding to the most frequent value will be similarly made with respect to levels below that

level. For example, if it is determined not to use address information at the level of the Prefecture **251**, it is supposed that a determination not to use address information will be similarly made with respect to levels (the Municipality **252**, the Chome/Banchi **253**, and the Building Name etc. **254**) below that level.

[0118] For example, with respect to the first level (the Prefecture **251**), the prefecture representing the most frequent value is identified from among 34 pieces of address information. In the example shown in FIG. **4**, the prefecture representing the most frequent value is "Tokyo-prefecture" bounded by thick dotted lines **255**. Since there are 34 pieces of the address information "Tokyo-prefecture" representing the most frequent value out of 34 pieces of address information, its percentage at the entire level is 100%. In this way, since the percentage (100%) of "Tokyo-prefecture" representing the most frequent value at the entire level of the Prefecture **251** is equal to or more than a fixed percentage (70%), it is determined to use "Tokyo-prefecture" as address information.

[0119] Subsequently, with respect to the level (the Municipality **252**) below the Prefecture **251**, the municipality representing the most frequent value is identified from among 34 pieces of address information. In the example shown in FIG. **4**, the municipality representing the most frequent value is "Shinagawa-ward" bounded by thick dotted lines **256**. Since there are 34 pieces of the address information "Shinagawa-ward" representing the most frequent value out of 34 pieces of address information, its percentage at the entire level is 100%. In this way, since the percentage (100%) of "Shinagawa-ward" representing the most frequent value at the entire level of the Municipality **252** is equal to or more than a fixed percentage (70%), it is determined to use "Shinagawa-ward" as address information.

[0120] Subsequently, with respect to the level (the Chome/Banchi **253**) below the Municipality **252**, the chome/banchi representing the most frequent value is identified from among 34 pieces of address information. In the example shown in FIG. **4**, the chome/banchi representing the most frequent value is "Osaki 1-chome" bounded by thick dotted lines **257**. Since there are 30 pieces of the address information "Osaki 1-chome" representing the most frequent value out of 34 pieces of address information, its percentage at the entire level is approximately 88%. In this way, since the percentage (approximately 88%) of "Osaki 1-chome" representing the most frequent value at the entire level of the Chome/Banchi **253** is equal to or more than a fixed percentage (70%), it is determined to use "Osaki 1-chome" as address information.

[0121] Subsequently, with respect to the level (the Building Name etc. **254**) below the Chome/Banchi **253**, the building name etc. representing the most frequent value is identified from among 34 pieces of address information. In the example shown in FIG. **4**, the building name etc. representing the most frequent value is "○○ City Osaki WT" bounded by thick dotted lines **258**. However, since there are 10 pieces of the address information "○○City Osaki WT" representing the most frequent value out of 34 pieces of address information, its percentage at the entire level is approximately 29%. In this way, since the percentage (approximately 29%) of "○○ City Osaki WT" representing the most frequent value at the entire level of the Building Name etc. **254** is less than a fixed percentage (70%), it is determined not to use "○○ City Osaki WT" as address information. When it is determined not to use address information in this way, even if there is another level that exists below the level of the Building Name etc. **254**, processing with respect to the lower level is discontinued.

[0122] As described above, "Tokyo-prefecture Shinagawa-ward Osaki 1-chome" is determined as the place name assigned to the target group.

[0123] By determining a place name assigned to each group in this way, for example, "Tokyo-prefecture" is determined as the place name for a group including image files (so-called photographs) shot throughout the Tokyo-prefecture. Also, for example, even in the case of a group including image files captured throughout the Tokyo-prefecture, if the group includes many images shot mostly throughout the Shinagawa-ward, a place name such as "Tokyo-prefecture Shinagawa-ward" is determined for the group.

[0124] Since in many cases the person who has shot the images knows the place name, there are supposedly cases where it is redundant to write the place name starting with the prefecture name. For this reason, address display may be simplified in such a way that if a place name includes only a prefecture name, the place name is displayed as it is, and if a place name continues down to the municipality name and so on, the place name may be displayed with the prefecture name omitted.

[0125] If, for example, the above-described address determination method is used with respect to a cluster including image files shot throughout a plurality of prefectures (for example, Tokyo-prefecture and Saitama-prefecture), cases can also be supposed where an address is not determined. In such cases, for example, with respect to the first level (Prefecture), the prefecture representing the most frequent value and the prefecture representing the second most frequent value are identified from among a plurality of pieces of address information. Then, it is judged whether or not the percentages of these two prefectures are equal to or more than a fixed percentage, and the prefecture part of address information may be determined on the basis of this judgment result. The same applies to the case of determining an address with respect to three or more prefectures. Also, each of these place name determination methods may be set by a user operation. Also, if a plurality of prefectures (for example, Tokyo-prefecture, Chiba-prefecture, and Saitama-prefecture) are determined as address information, for example, the top two prefectures ranked in order of highest frequency may be displayed. For example, the display may be in the manner of "Tokyo-prefecture, Chiba-prefecture, and Others".

[0126] While this example is directed to the case in which an address in Japan is assigned as a place name to be assigned to a group, the same applies to the case where an address in a foreign country is assigned as a place name to be assigned to a group. An address in a foreign country often differs from an address in Japan in the order in which the address is written but is the same in that the address is made up of a plurality of hierarchical levels. Therefore, a place name can be determined by the same method as the address determination method described above.

[0127] While the first embodiment of the present invention is directed to the case in which address information is stored in the information processing apparatus **100** in advance, and an address assigned to a cluster is determined on the basis of this address information, an address assigned to a cluster may be determined by using address information stored in an external apparatus.

[Example of Information Stored in Cluster Information Storing Section]

[0128] FIG. **5** is a diagram schematically showing information stored in the cluster information storing section **240**

according to the first embodiment of the present invention. The cluster information storing section **240** stores cluster information related to clusters generated by the cluster information generating section **170**. Specifically, the cluster information storing section **240** stores Cluster Identification Information **241**, Cluster Position Information **242**, Cluster Size **243**, and Content List **244**. In addition, the cluster information storing section **240** stores Parent Cluster Identification Information **245**, Child Cluster Identification Information **246**, Cluster Map **247**, and Cluster Title **248**. These pieces of information are stored in association with each other.

[0129] The Cluster Identification Information **241** stores identification information for identifying each cluster. For example, identification information "#**2001**", identification information "#**2002**", and so on are stored in order of generation by the cluster information generating section **170**.

[0130] The Cluster Position Information **242** stores positional information related to each cluster. As the positional information, for example, the latitude and longitude of the center position of a circle corresponding to each cluster is stored.

[0131] The Cluster Size **243** stores a size related to each cluster. As this size, for example, the value of the radius of a circle corresponding to each cluster is stored. Here, if, for example, the great-circle distance is used as the distance between two points as shown in FIG. **6**A, the unit of the value of the radius of a circle is set as [radian]. If, for example, the Euclidean distance is used as the distance between two points, the unit of the value of the radius of a circle is set as [m].

[0132] The Content List **244** stores information (for example, content addresses and the like) for acquiring contents belong to each cluster. It should be noted that in FIG. **5**, "#**1011**", "#**1015**", and so on are schematically shown as the Content List **244**.

[0133] The Parent Cluster Identification Information **245** stores identification information for identifying another cluster (parent cluster) to which each cluster belongs. It should be noted that since there is normally a single parent cluster, the Parent Cluster Identification Information **245** stores identification information for a single parent cluster.

[0134] The Child Cluster Identification Information **246** stores identification information for identifying other clusters (child clusters) that belong to each cluster. That is, all the pieces of identification information for one or a plurality of clusters belonging to each cluster and existing at levels below the cluster are stored. It should be noted that since there are normally a plurality of child clusters, the Child Cluster Identification Information **246** stores identification information for each of a plurality of child clusters.

[0135] The Cluster Map **247** stores the image data of a thumbnail image representing each cluster. This thumbnail image is, for example, a map image formed by a map included in a circle corresponding to each cluster. The thumbnail image is generated by the cluster information generating section **170**. In FIG. **5**, the thumbnail image representing a cluster is schematically indicated by a void circle. The method of generating this thumbnail image will be described later in detail with reference to FIGS. **14** to **16**B.

[0136] The Cluster Title **248** stores a title assigned to each cluster. For example, an address "Tokyo-prefecture Shinagawa-ward Osaki 1-chome" determined by the cluster information generating section **170** as shown in FIG. **4** is stored.

[0137] It should be noted that depending on the content or application, cluster information may include, in addition to the data shown in FIG. **5**, the metadata of contents belonging to a cluster themselves (for example, event IDs shown in FIGS. **10** to **12**B), statistical information thereof, and the like. To each of contents, a content ID and a cluster ID to which the corresponding content belongs are attached as metadata. When attaching a cluster ID as the metadata of each content, although the suitable method is to embed the cluster ID in the content itself by using a file area such as Exif, it is also possible to separately manage only the metadata of the content.

[Example of Cluster Generation]

[0138] Next, a clustering method for clustering (hierarchical clustering) a plurality of contents will be described in detail with reference to the drawings.

[0139] Clustering refers to grouping (classifying) together a plurality of pieces of data within a short distance from each other in a data set. It should be noted that in the first embodiment of the present invention, contents (for example, image contents such as still image files) are used as data. The distance between contents refers to the distance between the positions (such as geographical positions, positions along the temporal axis, or positions along the axis representing the similarity between faces) of two points corresponding to contents. A cluster is a unit in which contents are grouped together by clustering. Through an operation such as linking or splitting of such clusters, it finally becomes possible to handle grouped contents. It should be noted that the first embodiment of the present invention is directed to a case in which such grouping is performed by using binary tree structured data as described below.

[Example of Calculation of Distances Between Contents, Clusters, etc.]

[0140] FIGS. **6**A to **6**D are diagrams showing an example of distances in the case when a tree having a binary tree structure is generated by the tree generating section **120** according to the first embodiment of the present invention. FIG. **6**A shows an example of a content-to-content distance identified by two contents. FIGS. **6**B and **6**C each show an example of a cluster-to-cluster distance identified by two clusters. FIG. **6**D shows an example of a content-to-cluster distance identified by a single content and a single cluster.

[0141] FIG. **6**A schematically shows an example in which contents **311** and **312** are placed at their respective generated positions on Earth **300**. Also, the latitude and longitude of the content **311** are x**1** and y**1**, respectively, and the latitude and longitude of the content **312** are x**2** and y**2**, respectively. The first embodiment of the present invention is directed to a case in which the great-circle distance is used as the distance between two points. When the Earth **300** is taken as a sphere, this great-circle distance is the angle between two points as seen from a center **301** of the sphere which is measured as a distance. The distance d**1** [radian] between the contents **311** and **312** shown in FIG. **6**A can be found by using the following equation:

$$d1=\arccos(\sin(x1)\sin(x2)+\cos(x1)\cos(x2)\cos(y1-y2))$$

where $\arccos(x)=\cos^{-1}(x)$.

[0142] In the case where clustering is performed with respect to such localized contents that all the target contents can be approximated to exist on a plane, for example, the Euclidean distance may be used as the distance between two

points. Also, for example, the Manhattan distance may be used as the distance between two points.

[0143] FIGS. **6**B and **6**C show an example in which clusters **313** to **316** generated by the tree generating section **120** are placed on a two-dimensional plane on the basis of the generated positions of contents included in the respective clusters. Here, for example, the area of a cluster to which a plurality of contents belong can be represented as an area having the shape of a circle identified by the positions of all of the contents belonging to the cluster. The cluster has, as attribute information, the center position (center point) and radius of the circle.

[0144] The first embodiment of the present invention is directed to a case in which, as a cluster-to-cluster distance identified by two clusters, the distance between the farthest edges of two circles corresponding to the two clusters is used. Specifically, as shown in FIG. **6**B, as the distance d**2** between the clusters **313** and **314**, the distance between the farthest edges of the two circles corresponding to the clusters **313** and **314** is used. For example, suppose that the radius of the circle corresponding to the cluster **313** is a radius r**11**, and the radius of the circle corresponding to the cluster **314** is a radius r**12**. Also, suppose that the distance indicated by a straight line **304** connecting between a center position **302** of the circle corresponding to the cluster **313** and a center position **303** of the circle corresponding to the cluster **314** is a distance d**10**. In this case, the distance d**2** between the clusters **313** and **314** can be found by the following equation.

$$d2=d10+r11+r12$$

[0145] Here, for example, the area of a cluster made up of two contents can be represented as the area of a circle including the two contents and in which the two contents are inscribed. The center position of the cluster made up of the two contents can be represented as the middle position on a straight line connecting between the positions of the two contents. The radius of the cluster can be represented as half of the straight line connecting between the positions of the two contents.

[0146] Also, for example, the area of a cluster **305** made up of the two clusters **313** and **314** shown in FIG. **6**B can be represented as the area of a circle which includes the clusters **313** and **314** and in which the respective circles of the clusters **313** and **314** are inscribed. It should be noted that FIG. **6**B only shows a part of the circle corresponding to the cluster **305**. Also, an example of clusters each made up of two clusters is shown in FIG. **8** (for example, a cluster **330** made up of clusters **327** and **328** shown in FIG. **8**). Also, a center position **306** of the cluster **305** is the middle position on a straight line connecting between positions **307** and **308** where the respective circles of the clusters **313** and **314** are inscribed in the circle corresponding to the cluster **305**. It should be noted that the center position **306** of the cluster **305** lies on a straight line connecting between the respective center positions **302** and **303** of the clusters **313** and **314**.

[0147] If, as shown in FIG. **6**C, one of the two circles corresponding to the clusters **315** and **316** is completely included in the other, the distance between the clusters is regarded as 0. Also, the cluster made up of the two clusters **315** and **316** shown in FIG. **6**C can be regarded as the same as the cluster **315**. That is, the center position and radius of the cluster made up of the two clusters **315** and **316** can be regarded as the same as those of the cluster **315**.

[0148] FIG. **6**D shows an example in which a content **317** and a cluster **318** generated by the tree generating section **120** are placed on the basis of the positions of contents included in these. Here, a content can be also considered as a cluster corresponding to a circle whose radius is 0. Accordingly, for example, as shown in FIG. **6**D, the distance d**4** between the content **317** and the cluster **318** can be also calculated in a manner similar to the cluster-to-cluster distance described above. For example, suppose that the radius of a circle corresponding to the cluster **318** is a radius r**41**, and the distance indicated by a straight line connecting between the center position of the circle corresponding to the cluster **318** and the position of the content **317** is a distance d**40**. In this case, the distance d**4** between the content **317** and the cluster **318** can be found by the following equation.

$$d4=d40+r41$$

[Example of Contents]

[0149] FIG. **7** is a diagram schematically showing contents stored in the content storing section **210** according to the first embodiment of the present invention. Contents #**1** to #**14** shown in FIG. **7** are, for example, still image files recorded with an image capturing apparatus. It should be noted that in FIG. **7**, for the ease of explanation, only the corresponding symbols (#**1** to #**14**) are depicted inside the respective circles representing the contents #**1** to #**14**. Also, in FIG. **7**, the contents #**1** to #**14** are depicted as being arranged in time series on the basis of date and time information (shooting time) recorded in association with each of the contents #**1** to #**14**. It should be noted that while the vertical axis represents the temporal axis, this temporal axis is only a schematic representation, and does not accurately represent the time intervals between individual contents.

[0150] For example, the contents #**1** and #**2** are generated during a wedding ceremony **381** attended by Goro Koda (the user of the information processing apparatus **100**), and the contents #**3** to #**5** are generated during a 2007 Sports Day **382** in which a Goro Koda's child participated. Also, the contents #**6** to #**8** are generated during a ○○ trip **383** done by Goro Koda, and the contents #**9** to #**12** are generated during a 2008 Sports Day **384** in which the Goro Koda's child participated. Further, the contents #**13** and #**14** are generated during a ΔΔ trip **385** done by Goro Koda.

[Example of Binary Tree Generation Based on Positional Information]

[0151] FIG. **8** is a diagram schematically showing how the contents #**1** to #**14** are clustered by the tree generating section **120** on the basis of positional information according to the first embodiment of the present invention. FIG. **8** shows a case in which the contents #**1** to #**14** stored in the content storing section **210** are virtually placed on a plane on the basis of their positional information. It should be noted that the contents #**1** to #**14** are the same as those shown in FIG. **7**. Also, in FIG. **8**, for the ease of explanation, the distances between individual contents and between individual clusters are depicted as being relatively short.

[0152] In the first embodiment of the present invention, clustering performed by the tree generating section **120** generates binary tree structured data with each content as a leaf. Each node in this binary tree structured data corresponds to a cluster.

[0153] First, the tree generating section **120** calculates distances between individual contents on the basis of positional information. On the basis of the calculation results, the tree generating section **120** extracts two contents with the smallest inter-content distance, and generates a new node having these two contents as its child elements. Subsequently, the tree generating section **120** calculates distances between the generated new node and the other individual contents on the basis of positional information. Then, on the basis of the calculation results, and the results of calculation of the distances between individual contents described above, the tree generating section **120** extracts a pair of two elements with the smallest distance, and generates a new node having this pair of two elements as its child elements. Here, the pair of two elements to be extracted is one of a pair of a node and a content, a pair of two contents, and a pair of two nodes.

[0154] Subsequently, the tree generating section **120** repetitively performs the new node generation process in the same manner until the number of nodes to be extracted becomes 1. Thus, binary tree structured data with respect to the contents #**1** to #**14** is generated. For example, as shown in FIG. **8**, clusters **321** to **326** are each generated as a pair of two contents. Also, clusters **328** and **329** are each generated as a pair of a node and a content. Also, clusters **327**, **330**, **331**, **332**, and **333** are each generated as a pair of two nodes. It should be noted that the cluster **333** is a cluster corresponding to the root node to which the contents #**1** to #**14** belong, and the cluster **333** is not shown in FIG. **8**.

[0155] The above example is directed to the case in which distances between individual contents are calculated, and binary tree structured data is generated while keeping on extracting a pair with the smallest distance. However, when shooting photographs or moving images, for example, in many cases shooting is performed successively within a predetermined range. For example, when shooting photographs at a destination visited on a trip, in many cases group photographs or landscape photographs are shot in the same region. For this reason, for example, an initial grouping process may be performed to group together those contents which are shot within a short distance from each other in advance. By performing an initial grouping process in this way, the number of nodes to be processed can be reduced, thereby enabling a faster clustering process. This initial grouping process will be described later in detail with reference to FIGS. **57**A and **57**B and FIG. **63**. Also, a modification (sequential clustering) of the tree generation process will be described later in detail with reference to FIGS. **58**A to **62**, and FIGS. **64** to **66**.

[0156] FIG. **9** is a conceptual clustering tree diagram of a binary tree structure representing binary tree structured data generated with respect to the contents #**1** to #**14** by the tree generating section **120** according to the first embodiment of the present invention. When, as shown in FIG. **8**, the contents #**1** to #**14** are clustered to generate the clusters **321** to **333**, binary tree structured data corresponding to the generated clusters **321** to **333** is generated. It should be noted that in this binary tree, each content corresponds to a leaf, and each cluster corresponds to a node. Thus, in the clustering tree diagram shown in FIG. **9**, leaves corresponding to the contents #**1** to #**14** are denoted by the same symbols as those of the corresponding contents, and nodes corresponding to the clusters **321** to **333** are denoted by the same symbols as those of the corresponding clusters. It should be noted that while the contents #**1** to #**14** independently constitute clusters, the cluster numbers of these clusters are not particularly shown in FIG. **9**.

[0157] For example, the contents #**1** and #**2** are generated in a wedding ceremony hall **386** (corresponding to the wedding ceremony **381** shown in FIG. **7**) Goro Koda went to. The contents #**3** to #**5**, and #**9** to #**12** are generated in an elementary school **387** (corresponding to the 2007 Sports Day **382** and the 2008 Sports Day **384** shown in FIG. **7**) a Goro Koda's child goes to. Also, the contents #**13** and #**14** are generated at a ΔΔ trip destination **388** (corresponding to the AA trip **385** shown in FIG. **7**) Goro Koda visited. Also, the contents #**6** to #**8** are generated at a ○○ trip destination **389** (corresponding to the ○○ trip **383** shown in FIG. **7**) Goro Koda visited.

[Example of Event Clustering Based on Date and Time Information]

[0158] The above example is directed to the case in which binary tree structured data is generated on the basis of positional information. Next, a description will be given of event clustering performed on the basis of date and time information. This event clustering generates binary tree structured data on the basis of date and time information (see, for example, Japanese Unexamined Patent Application Publication No. 2007-94762). Also, event clusters generated by this event clustering are used to generate event IDs used to extract desired nodes by the user from among nodes in binary tree structured data generated on the basis of positional information.

[0159] FIG. **10** is a conceptual clustering tree diagram of a binary tree structure representing binary tree structured data generated on the basis of data and time information by the event cluster generating section **130** according to the first embodiment of the present invention. This example illustrates a case in which binary tree structured data is generated with respect to the contents #**1** to #**14** shown in FIG. **8**.

[0160] In the first embodiment of the present invention, separately from the binary tree structured data generated on the basis of positional information (shown in FIG. **9**), the event cluster generating section **130** generates binary tree structured data on the basis of date and time information related to contents outputted from the attribute information acquiring section **110**. This binary tree structured data can be generated by the same method as that used in the above-described clustering based on positional information, except in that as the distance between contents, a distance (time interval) along the temporal axis is used instead of a geographical distance. It should be noted that in the example according to the first embodiment of the present invention, as the distance between nodes when generating event clusters, the distance between the nearest edges of two segments along the temporal axis corresponding to two nodes is used. For example, of the two nodes to be compared, the time interval between the rear end position of a segment corresponding to the node located earlier along the temporal axis and the front end position of a segment corresponding to the node located later along the temporal axis is taken as the distance between the two nodes.

[0161] Now, the method of generating binary tree structured data on the basis of date and time information will be specifically described. The event cluster generating section **130** calculates time intervals between individual contents on the basis of date and time information. On the basis of the calculation results, the event cluster generating section **130**

extracts two contents that make the inter-content time interval smallest, and generates a new node having these two contents as its child elements. Subsequently, the event cluster generating section **130** calculates time intervals between the generated new node and the other individual contents on the basis of date and time information. Then, on the basis of this calculation results, and the results of calculation of the time intervals between individual contents described above, the event cluster generating section **130** extracts a pair of two elements with the smallest time interval, and generates a new node having this pair of two elements as its child elements. Here, the pair of two elements to be extracted is one of a pair of a node and a content, a pair of two contents, and a pair of two nodes.

[0162] Subsequently, the event cluster generating section **130** repetitively performs the new node generation process in the same manner until the number of nodes to be extracted becomes 1. Thus, binary tree structured data with respect to the contents #**1** to #**14** is generated. For example, as shown in FIG. **10**, clusters **341** to **346** are each generated as a pair of two contents. Also, clusters **347** and **348** are each generated as a pair of a node and a content. Also, clusters **349** to **353** are each generated as a pair of two nodes. It should be noted that the cluster **353** is a cluster corresponding to the root node to which the contents #**1** to #**14** belong.

[0163] It should be noted that the leaves in the binary tree shown in FIG. **10** correspond to the respective contents #**1** to #**14** shown in FIG. **7**, and are denoted by the same symbols as those shown in FIG. **7**. Also, td_1 to td_{14} are values each indicating the time interval between adjacent contents along the temporal axis. That is, td_n is a value indicating the time interval between adjacent contents #n and #(n+1) (the n-th time interval along the temporal axis) in the binary tree shown in FIG. **10**.

[0164] After the binary tree structured data corresponding to the binary tree shown in FIG. **10** is generated, the event cluster generating section **130** performs clustering based on a grouping condition with respect to the binary tree.

[0165] First, the event cluster generating section **130** calculates the standard deviation of the time intervals between individual contents, with respect to each of nodes in the binary tree generated on the basis of date and time information. Specifically, by taking one node in the binary tree generated by the event cluster generating section **130** as a focus node, the standard deviation sd of time intervals between the times of shooting associated with all of individual contents belonging to this focus node is calculated by using equation (1) below.

$$sd = \sqrt{\frac{\sum_{i=1}^{N} (td_n - \overline{td})^2}{N}} \quad (1)$$

[0166] Here, N denotes the number of time intervals between the times of shooting of contents, and N=(the number of contents belonging to the focus node)−1. Also, td with "‾" attached denotes the mean value of the time intervals td_n ($1 \leqq n \leqq N$) between contents belonging to the focus node.

[0167] Subsequently, with respect to two child nodes whose parent node is the focus node, the deviation of the time interval between these two nodes (the absolute value of the difference between the time interval between the child nodes and the mean of the time intervals between the times of shooting) is calculated. Specifically, the deviation dev of the time interval between the two nodes is calculated by using equation (2) below.

$$dev = |td_c - \overline{td}| \quad (2)$$

[0168] Here, td_c is a value indicating the time interval between the two child nodes whose parent node is the focus node. Specifically, the time interval td_c is the time interval between the time of shooting of the last content of contents belonging to the child node of the two child nodes which is located earlier along the temporal axis, and the time of shooting of the first content of contents belonging to the child node located later along the temporal axis.

[0169] Subsequently, the event cluster generating section **130** calculates the value of the ratio between the deviation dev calculated using equation (2), and the standard deviation sd calculated using equation (1), as a splitting parameter th**1** for the focus node. Specifically, the splitting parameter th**1** as the value of the ratio between the deviation dev and the standard deviation sd is calculated by using equation (3) below.

$$th1 = dev/sd \quad (3)$$

[0170] The splitting parameter th**1** calculated by using equation (3) in this way is a parameter that serves as a criterion for determining whether or not to split the two child nodes whose parent node is the focus node from each other as belonging to different clusters. That is, the event cluster generating section **130** compares the splitting parameter th**1** with a threshold th**2** that is set as a grouping condition, and judges whether or not the splitting parameter th**1** exceeds the threshold th**2**. Then, if the splitting parameter th**1** exceeds the threshold th**2**, the event cluster generating section **130** splits the two child nodes whose parent node is the focus node, as child nodes belonging to different clusters. On the other hand, if the splitting parameter th**1** does not exceed the threshold th**2**, the event cluster generating section **130** judges the two child nodes whose parent node is the focus node as belonging to the same cluster. It should be noted that the threshold th**2** is set by the condition setting section **190** in accordance with a user operation, and is held by the event cluster generating section **130**. In the following, a description will be given of a specific example of event clustering, by using the binary tree structured data shown in FIG. **10**.

[0171] For example, of the nodes constituting the binary tree structured data shown in FIG. **10**, the node corresponding to the cluster **350** (hereinafter, referred to as focus node **350**) is taken as a focus node. First, with respect to the focus node **350** in the binary tree generated on the basis of date and time information, the event cluster generating section **130** calculates the deviations of the time intervals between individual contents. Then, the standard deviation sd of the time intervals between the times of shooting associated with the respective contents #**1** to #**5** belonging to the focus node **350** is calculated by using equation (1) below. Specifically, the standard deviation sd is calculated by the following equation.

$$sd = \sqrt{\frac{(td_1 - \overline{td})^2 + (td_2 - \overline{td})^2 + (td_3 - \overline{td})^2 + (td_4 - \overline{td})^2}{4}}$$

[0172] Here, N=4 since the number of time intervals between the times of shooting of the contents #**1** to #**5** belonging to the focus node **350** is 4. Also, the mean value (td

attached with "") of the time intervals td_n ($1 \leqq n \leqq N$) between the contents belonging to the focus node **350** is found by the following equation.

$$\overline{td} = \frac{td_1 + td_2 + td_3 + td_4}{4}$$

[0173] Subsequently, with respect to the two child nodes **341** and **347** whose parent node is the focus node **350**, the event cluster generating section **130** calculates the deviation dev of the time interval between the two nodes by using equation (2). Specifically, the deviation dv is calculated by the following equation.

$$dev = |td_3 - \overline{td}|$$

[0174] Here, the last content belonging to the child node **341** located earlier along the temporal axis is the content #**2**, and the first content belonging to the child node **347** located later along the temporal axis is the content #**3**. Therefore, the time interval td_c between the two child nodes **341** and **347** whose parent node is the focus node **350** is the time interval td_3.

[0175] Subsequently, by using equation (3), the event cluster generating section **130** calculates the value (the splitting parameter th**1** for the focus node **350**) of the ratio between the deviation dev calculated using equation (2), and the standard deviation sd calculated using equation (1). The splitting parameter th**1** calculated in this way is held by the event cluster generating section **130** as the splitting parameter th**1** for the focus node **350**. Also, the event cluster generating section **130** similarly calculates the splitting parameter th**1** with respect to each of the other nodes in the binary tree structured data.

[0176] Subsequently, the event cluster generating section **130** compares the splitting parameter th**1** calculated with respect to each of nodes in the binary tree structured data, with the threshold th**2**, thereby sequentially judging whether or not to split two child nodes belonging to each node. Then, with respect to a node for which the splitting parameter th**1** exceeds the threshold th**2**, the event cluster generating section **130** splits two child nodes having this node as their parent node from each other as belonging to different clusters. On the other hand, with respect to a node for which the splitting parameter th**1** does not exceed the threshold th**2**, the event cluster generating section **130** judges two child nodes having this node as their parent node as belonging to the same cluster.

[0177] That is, if the value of a calculated splitting parameter is equal to or smaller than the threshold, individual contents belonging to the node with respect to which the splitting parameter has been calculated are regarded as nodes belonging to a single cluster. That is, the node with respect to which the splitting parameter has been calculated serves as a boundary. Therefore, for example, the larger the threshold, the less likely each node becomes a boundary, so the granularity of clusters in the binary tree as a whole becomes coarser. On the other hand, if the value of a calculated splitting parameter is larger than the threshold, two child nodes belonging to the node with respect to which the splitting parameter has been calculated are classified into different clusters. That is, a boundary is set between the two child nodes belonging to the node with respect to which the splitting parameter has been calculated. Therefore, for example, the smaller the threshold, the more likely each node becomes the boundary between clusters, so the granularity of clusters in the binary tree as a whole becomes finer.

[0178] In this way, with respect to each node in the binary tree structured data, the event cluster generating section **130** sequentially judges whether or not to split two child nodes belonging to each node, and generates clusters based on date and time information on the basis of the judgment results. For example, it is determined to split two child nodes belonging to each of the respective nodes corresponding to the clusters **350** to **353**. That is, respective event clusters (clusters based on date and time information) corresponding to the wedding ceremony **381**, the 2007 Sports Day **382**, the ○○trip **383**, the 2008 Sports Day **384**, and the ΔΔ trip **385** are generated.

[0179] Here, each of the clusters generated by the event cluster generating section **130** is referred to as event. Also, letting the number of such events be M, event IDs (id**1** to idM) are assigned to the respective events. Then, the event cluster generating section **130** associates the generated event clusters and the event IDs assigned to these event clusters with each other, and outputs the event clusters and the event IDs to the hierarchy determining section **150**. In FIG. **10**, event IDs assigned to individual events are shown inside the brackets below the names indicating the respective events. The frequencies of individual events are calculated with the event IDs assigned in this way taken as classes. An example of this calculation is shown in FIGS. **11**A to **11**F.

[Example of Histogram Generation]

[0180] FIGS. **11**A to **11**F are diagrams each showing an example of a histogram generated by the hierarchy determining section **150** according to the first embodiment of the present invention. FIGS. **11**A to **11**F show histograms generated with respect to respective nodes in the binary tree structured data (shown in FIG. **9**) based on positional information, by using the binary tree structured data based on date and time information (shown in FIG. **10**). Specifically, FIG. **11**A shows a histogram generated with respect to the node **327** shown in FIG. **9**, and FIG. **11**B shows a histogram generated with respect to the node **328** shown in FIG. **9**. Also, FIG. **11**C shows a histogram generated with respect to the node **329** shown in FIG. **9**, and FIG. **11**D shows a histogram generated with respect to the node **330** shown in FIG. **9**. Further, FIG. **11**E shows a histogram generated with respect to the node **331** shown in FIG. **9**, and FIG. **11**F shows a histogram generated with respect to the node **332** shown in FIG. **9**. In each of the histograms shown in FIGS. **11**A to **11**F, the horizontal axis is an axis indicating event IDs, and the vertical axis is an axis indicating the frequencies of contents.

[0181] In this example, as the classes in a frequency distribution, individual events (event IDs) of event clusters generated by the event cluster generating section **130** are defined. Then, the hierarchy determining section **150** calculates the number of contents with respect to each of event IDs, for each of nodes in the binary tree structured data generated by the tree generating section **120**. For example, contents belonging to the node **327** in the binary tree structured data based on positional information shown in FIG. **9** are the contents #**3**, #**4**, #**9**, and #**10**. As shown in FIG. **10**, the event ID assigned to each of the contents #**3** and #**4** is "id**2**", and the event ID assigned to each of the contents #**9** and #**10** is "id**4**". Thus, for the node **327** in the binary tree structured data based on positional information shown in FIG. **9**, the number of contents with respect to the event ID "id**2**" is 2, and the number of

contents with respect to the event ID "id**4**" is 2. Also, the number of contents with respect to each of the other event IDs "id**1**", "id**3**", and "id**5**" is 0.

[0182] Then, the hierarchy determining section **150** calculates the frequency distribution of contents with the cluster IDs generated by the event cluster generating section **130** taken as classes, with respect to each of nodes in the binary tree structured data generated by the tree generating section **120**. For example, as shown in FIG. **11**A, the hierarchy determining section **150** calculates the frequency distribution of individual contents with the cluster IDs generated by the event cluster generating section **130** taken as classes, with respect to the node **327** in the binary tree structured data generated by the tree generating section **120**.

[0183] The frequency distribution of individual contents calculated in this way can be expressed by an M-th order vector like H**1**=(v**1**, v**2**, . . . , vM). That is, this M-th order vector is generated with respect to each of nodes in the binary tree structured data generated by the tree generating section **120**. For example, the histogram generated with respect to the node **327** shown in FIG. **11**A can be expressed as H**11**=(0, 2, 0, 2, 0).

[0184] A linking process of nodes is performed on the basis of the frequency distribution calculated with respect to each of nodes in the binary tree structured data generated by the tree generating section **120** in this way. This linking process will be described later in detail with reference to FIGS. **12**A and **12**B.

[0185] It should be noted that while histograms can be similarly generated for the nodes **321** to **326**, and **333** shown in FIG. **9** as well, the histograms with respect to the nodes **321** to **326** and **333** are not shown in FIGS. **11**A to **11**F.

[Example of Cluster Extraction Using Event Clusters]

[0186] FIGS. **12**A and **12**B are diagrams each showing an example of comparison of histograms generated by the hierarchy determining section **150** according to the first embodiment of the present invention. FIG. **12**A shows an example of comparison of histograms in the case when there is high relevance between two child nodes belonging to a parent node. Also, FIG. **12**B shows an example of comparison of histograms in the case when there is low relevance between two child nodes belonging to a parent node.

[0187] As shown in FIGS. **11**A to **11**F, frequency distributions are calculated with respect to individual nodes in the binary tree structured data generated by the tree generating section **120**, and histograms are generated. Each of the histograms generated in this way represents the characteristics of contents belonging to the node with respect to which the histogram is generated.

[0188] For example, the contents #**3** to #**5**, and #**9** to #**12** belonging to the nodes **327**, **328**, and **330** shown in FIG. **9** are contents generated in the elementary school **387** shown in FIG. **9**. Therefore, the respective histograms generated with respect to the nodes **327**, **328**, and **330** shown in FIGS. **11**A, **11**B, and **11**D are similar to each other. Specifically, the frequencies of the class "id**2**" and class "id**4**" are high, whereas the frequencies of the other classes "id**1**", "id**3**", and "id**5**" are 0.

[0189] In this way, by comparison between histograms generated with respect to individual nodes in the binary tree structured data generated by the tree generating section **120**, the degree of relevance between two nodes to be compared can be determined. This determination process is performed by comparing between two child nodes belonging to a single parent node.

[0190] For example, as shown in FIG. **12**A, if classes with relatively high frequencies are substantially the same, and classes with relatively low frequencies are also substantially the same between two child nodes, the relevance between these two child nodes is considered to be high. In this case, the hierarchy determining section **150** links these two nodes together.

[0191] Also, for example, as shown in FIG. **12**B, if classes with relatively high frequencies are completely different, and classes with relatively low frequencies are also completely different between two child nodes, the relevance between these two child nodes is considered to be low. In this case, without linking these two child nodes together, the hierarchy determining section **150** performs a judgment process with respect to two child nodes having each of these child nodes as their parent node.

[0192] Specifically, the hierarchy determining section **150** calculates a linkage score S with respect to each of nodes in the binary tree structured data generated by the tree generating section **120**. This linkage score S is calculated by using, for example, an M-th order vector generated with respect to each of two child nodes belonging to a target node (parent node) for which to calculate the linkage score S.

[0193] For example, the hierarchy determining section **150** normalizes the inner product between an M-th order vector H_L, which is calculated with respect to one of the two child nodes belonging to a parent node as a calculation target, and an M-th order vector H_R calculated with respect to the other child node, by the vector size. Then, the hierarchy determining section **150** calculates the normalized value (that is, the cosine between the vectors) as the linkage score S. That is, the linkage score is calculated by using equation (4) below.

$$S=(H_L \cdot H_R)/|H_L||H_R| \tag{4}$$

[0194] At this time, the value of the cosine between the vectors is $-1 \leqq x \leqq 1$. Also, the M-th order vector H_L and the M-th order vector H_R for which to calculate the linkage score S are both vectors including only non-negative values. Therefore, the value of the linkage score S is $0 \leqq S \leqq 1$. Also, the linkage score S of a leaf is defined as 1.0.

[0195] On the basis of the linkage score S calculated in this way, the degree of relevance between two child nodes belonging to a parent node as a calculation target can be determined. For example, if the linkage score S of the parent node as a calculation target is relatively small, the relevance between two child nodes belonging to the parent node can be judged to be low. On the other hand, if the linkage score S of the parent node as a calculation target is relatively large, the relevance between two child nodes belonging to the parent node can be judged to be high.

[0196] Specifically, the hierarchy determining section **150** calculates the linkage score S with respect to each of nodes in binary tree structured data generated by the tree generating section **120**. Then, the hierarchy determining section **150** compares the calculated linkage score S with a linkage threshold (Linkage_Threshold) th**3**, and performs a node linking process on the basis of this calculation result. In this case, the hierarchy determining section **150** sequentially performs calculation and comparison processes of the linkage score S from the root node in the binary tree structured data generated by the tree generating section **120** toward the lower

levels. Then, if the calculated linkage score S is larger than the linkage threshold th**3**, the hierarchy determining section **150** determines the corresponding node as an extraction node. On the other hand, if the calculated linkage score S is not larger than the linkage threshold th**3**, the hierarchy determining section **150** does not determine the corresponding node as an extraction node but repeats the same linking process with respect to each of two child nodes belonging to that node. These linking processes are repeated until there is no more node whose linkage score S is equal to the linkage threshold th**3** or smaller, or until the node (content) at the bottom level is reached. It should be noted that the linkage threshold th**3** is set by the condition setting section **190** in accordance with a user operation, and held by the hierarchy determining section **150**. As the linkage threshold th**3**, for example, 0.25 can be used.

[0197] By performing linking processes in this way, for example, the nodes **321**, **325**, **329**, and **330** shown in FIG. **9** are determined as extraction nodes.

[0198] Subsequently, the hierarchy determining section **150** generates a root node whose child elements (child nodes) are the extraction nodes determined by the linkage score calculation and comparison processes, thereby generating a tree. An example of a tree generated in this way is shown in FIG. **13**A. This tree is a tree including the root node, clusters, and contents. Then, the hierarchy determining section **150** outputs the generated tree to the tree restructuring section **160**. By correcting the binary tree generated by the tree generating section **120** in this way, clusters with high event-based linkage score can be linked together. Also, on the basis of the tree generated by the hierarchy determining section **150**, a listing of marks (for example, cluster maps) representing individual clusters (groups) can be displayed. As a result, grouping can be performed in an appropriate manner in accordance with the user's preferences, and a listing of the corresponding groups can be displayed.

[0199] The above-described example is directed to the case in which, as the method of calculating the linkage score S, the cosine between vectors related to two child nodes belonging to a parent node as a calculation target is calculated. However, for example, it is also possible to calculate the Euclidean distance between vectors related to two child nodes belonging to a parent node as a calculation target, and use this Euclidean distance as the linkage score S. In the case where the Euclidean distance is used as the linkage score S in this way, if the value of the linkage score S is relatively large, for example, the relevance between two child nodes belonging to the parent node as a calculation target is judged to be high. On the other hand, if the value of the linkage score S is relatively small, for example, the relevance between the two child nodes belonging to the parent node as a calculation target is judged to be low. Also, a similarity may be calculated by using another similarity calculation method (for example, a method using the sum of histogram differences in individual classes) that can calculate the similarity between two frequency distributions to be compared (degree of how similar the two frequency distributions are), and this similarity may be used as the linkage score.

[0200] Extraction nodes determined by the hierarchy determining section **150** are determined on the basis of event clustering based on date and time information. Thus, by adjusting the parameter for clustering based on date and time, the granularity of extraction nodes can be adjusted. For example, if the granularity of event clusters is set relatively small, relatively small nodes are determined as extraction nodes.

[Example of Tree Restructuring]

[0201] By linking two clusters (nodes) together through the linking process described above, contents belonging to a plurality of clusters of high mutual event-based relevance can be classified into the same cluster. However, when displaying a listing of marks (for example, cluster maps) representing individual clusters, it is supposed that unless the number of cluster maps is appropriate, the number of pages will become large, making it difficult to view the cluster maps. For this reason, for example, it is preferable to set an upper limit for the number of clusters, and perform a further linking process if the number of clusters generated by the hierarchy determining section **150** exceeds this upper limit. This upper limit may be set in accordance with the size of the display screen on the display section **181**, or user's preferences.

[0202] Also, for example, a case can be supposed where the precision of positional information (for example, GPS information) acquired at the time of generation of a content is poor, and such positional information is associated with the content in that state. In such a case, if the distance between two adjacent clusters is very short, then there will not be much point in clearly separating those clusters from each other. Also, even when the relevance between two adjacent clusters is low, if these clusters are within a very short distance from each other, then in some cases it will be more convenient for the user to regard the two clusters as the same cluster. For example, if clusters (two adjacent clusters) corresponding to a region far from the region where the user lives are within a moderate distance (for example, 100 m) from each other, in some cases it will be more convenient for the user to regard these two clusters as the same cluster. For example, even if hot spring trips to two hot spring areas (○○ hot spring and AA hot spring) separated by a moderate distance (for example, 500 m) are taken on different dates, it will be better in some cases to regard those two clusters as the same cluster so that the user can view them as a single hot spring trip cluster.

[0203] Accordingly, after the linking process by the hierarchy determining section **150** is finished, the tree restructuring section **160** restructures the tree generated by the hierarchy determining section **150**, on the basis of a specified constraint.

[0204] As this constraint, a minimum cluster size (MINIMUM_LOCATION_DISTANCE) or a tree's child element count (MAXIMUM_CHILD_NUM) can be specified. This constraint is set by the condition setting section **190** in accordance with a user operation, and held by the tree restructuring section **160**.

[0205] Here, when a minimum cluster size is set as the constraint, it is possible to generate a tree in which the diameter of each cluster is larger than the minimum cluster size. For example, if a node whose diameter is equal to or smaller than the minimum cluster size exists among nodes in the tree generated by the hierarchy determining section **150**, the node and another node located at the shortest distance to the node are linked together to generate a new node. In this way, for example, in cases when the accuracy of positional information associated with each content is poor, or when there is no much point in clearly separating two adjacent clusters from each other, these clusters can be linked together as the same cluster. Also, for example, if the ΔΔ trip destination **388** and

the ○○ trip destination **389** are both narrow regions and located very close to each other, by linking the respective corresponding nodes **325** and **329** together as the same cluster, easy-to-view cluster information can be provided to the user.

[0206] When a child element count is specified as the constraint, it is possible to generate a tree whose number of nodes is equal to or less than the child element count. Each of these examples of tree restructuring is shown is FIGS. **13**A and **13**B.

[0207] FIGS. **13**A and **13**B are diagrams schematically showing the flow of a tree restructuring process by the tree restructuring section **160** according to the first embodiment of the present invention. FIG. **13**A shows a tree made up of extraction nodes determined by the hierarchy determining section **150** in the clustering tree diagram having the binary tree structured shown in FIG. **9**. It should be noted that since the method of generating this tree is the same as the method described above, description thereof is omitted here.

[0208] FIG. **13**B shows a tree made up of nodes generated by a tree restructuring process by the tree restructuring section **160**. This example illustrates a case in which 3 is specified as a tree's child element count (MAXIMUM_CHILD_NUM).

[0209] If, for example, the number of nodes determined by the hierarchy determining section **150** is larger than the child element count that is a specified constraint, the tree restructuring section **160** extracts a pair of nodes with the smallest distance from among those nodes, and merges this pair. If the number of nodes after this merging is larger than the child element count as a specified constraint, the tree restructuring section **160** extracts a pair of nodes with the smallest distance from among the nodes obtained after the merging, and merges this pair. These merging processes are repeated until the number of child nodes belonging to the root node becomes equal to or less than the child element count.

[0210] For example, as shown in FIG. **13**A, the number of nodes determined by the hierarchy determining section **150**, namely the nodes **321**, **325**, **329**, and **330**, is larger than the child element count (3) as a specified constraint. Therefore, the tree restructuring section **160** extracts a pair of nodes with the smallest distance from among the nodes **321**, **325**, **329**, and **330**, and merges this pair. In this case, as shown in FIG. **8**, the nodes **325** and **329** are the pair with the smallest distance. Thus, the tree restructuring section **160** extracts the pair of the nodes **325** and **329**, and merges the nodes **325** and **329**. As the nodes **325** and **329** are merged in this way, the number of nodes after this merging becomes equal to the child element count (3) as a specified constraint. Thus, the merging process ends. FIG. **13**B shows a tree in the case when the number of nodes is set equal to the child element count (3) as a specified constraint in this way.

[0211] As shown in FIG. **13**B, by the tree restructuring section **160**, the number of nodes is set equal to the number of child elements (3) as a specified constraint, and nodes **355**, **356**, and **357** are determined. It should be noted that the node **355** corresponds to the wedding ceremony hall **386**, the node **356** corresponds to the elementary school **387**, and the node **357** corresponds to each of the ΔΔ trip destination **388** and the ○○ trip destination **389**. Also, the node **355** corresponds to the node **321** shown in FIG. **9**, the node **356** corresponds to the node **330** shown in FIG. **9**, and the node **357** corresponds to the node **331** shown in FIG. **9**. Here, since the contents belonging to the node **357** are generated at the ΔΔ trip destination **388** or the ○○ trip destination **389**, it is possible to consider these contents as having low mutual relevance. However, as described above, even when nodes have low mutual relevance as events, if the nodes are located close to each other, there is a possibility that it is better to group such nodes together for the ease of viewing by the user. For example, if the ΔΔ trip destination **388** and the ○○ trip destination **389** are within close proximity of each other in the ★★ prefecture, the respective corresponding nodes **325** and **329** are linked together as a single trip cluster for the ★★ prefecture, thereby making it possible to provide easy-to-view cluster information to the user.

[0212] By performing these tree restructuring processes, grouping can be performed in an appropriate manner in accordance with the user's preferences. It should be noted that the first embodiment of the present invention is directed to the case in which positional information (first attribute information) and date and time information (second attribute information) are used as two different pieces of attribute information. However, among the pieces of attribute information associated with contents, other pieces of attribute information that can identify the relationship between contents may be used as the first attribute information and the second attribute information. For example, the first embodiment of the present invention can be applied to a case in which, with respect to song contents, attribute information corresponding to coordinates in the xy-coordinate system with the mood of each song taken along the x-axis and the tempo of each song taken along the y-axis is used as the first attribute information, and attribute information related to the writer of each song is used as the second attribute information. In this case, for example, binary tree structured data with respect to a plurality of songs is generated on the basis of distances on the xy-coordinates, and the songs are grouped by their characteristics on the basis of attribute information related to the writers of the songs (for example, age, sex, nationality, and the number of songs written). Then, on the basis of the binary tree structured data based on the first attribute information, and the song groups based on the second attribute information, a plurality of groups are determined with respect to the songs. It should be noted that the above example is directed to the case in which a plurality of groups are set by classifying individual contents. In the following, a description will be given of a case in which marks (for example, cluster maps) representing the set groups are generated.

[Method of Generating Maps Corresponding to Clusters]

[0213] As described above, for clusters generated by the three stages of clustering process, for example, marks representing individual clusters are displayed on the display section **181**, thereby making it possible to select a desired cluster from a plurality of clusters. Here, as images representing individual clusters, for example, maps corresponding to individual clusters can be used. For example, on the basis of positional information associated with each of contents belonging to a cluster, an area corresponding to the cluster can be identified, and a map covering this identified area can be used as a map (cluster map) corresponding to the cluster.

[0214] However, the size of a cluster generated through the three stages of clustering process is based on the positions of contents belonging to each cluster. Thus, as for the size of each cluster, there is no relevance whatsoever between clusters. Therefore, the size of an area (for example, a circle) specified by such a cluster varies from cluster to cluster.

[0215] Here, suppose that, when using a map as a mark representing each cluster, for example, a map at a specific scale is used. In this case, the position corresponding to each cluster can be grasped from a map corresponding to each cluster. However, it is supposed that by changing the scale of a map representing each cluster in accordance with the size of a circle corresponding to each cluster, the shooting area or the like of each of contents belonging to each cluster can be also easily grasped by the user. Accordingly, in the first embodiment of the present invention, a case is illustrated in which the scale of a map stored in association with each cluster is changed in accordance with the size of a circle corresponding to each cluster. In the following, with reference to the drawings, a detailed description will be given of the method of generating a map associated with each of clusters generated by the tree restructuring section **160**.

[0216] FIG. **14** is a diagram showing a correspondence table used for generating map information by the cluster information generating section **170** according to the first embodiment of the present invention. This correspondence table is held by the cluster information generating section **170**.

[0217] The correspondence table shown in FIG. **14** is a table showing the correspondence between the diameter (Cluster Diameter **171**) of a circle corresponding to each of clusters generated by the tree restructuring section **160**, and Map Scale **172**.

[0218] The Cluster Diameter **171** is a value indicating the range of the size of each cluster generated by the tree restructuring section **160**. The size of a cluster is identified by the diameter of a circle corresponding to the cluster.

[0219] The Map Scale **172** is a map scale that is to be stored in association with each cluster generated by the tree restructuring section **160**. It should be noted that in this example, a plurality of segments are set in advance for the Cluster Diameter **171**, and these segments and a plurality of scales corresponding to these segments are prepared in advance. However, it is also possible, for example, to sequentially calculate a map scale corresponding to a cluster diameter, and use this calculated map scale.

[0220] When generating a map corresponding to a cluster generated by the tree restructuring section **160**, the cluster information generating section **170** uses the correspondence table shown in FIG. **14** to identify a map scale to be assigned to the cluster from the size of the cluster. For example, if the diameter of a circle corresponding to a cluster generated by the tree restructuring section **160** is 3.5 km, this corresponds to "2 km to 4 km" of the Cluster Diameter **171** in the correspondence table shown in FIG. **14**. Thus, "1/200000" is identified as the map scale to be assigned to the cluster.

[0221] Subsequently, with respect to the cluster for which the map scale has been identified, the cluster information generating section **170** identifies the center position of the cluster, and extracts from the map information storing section **220** a map covering a predetermined area from the center position (a map of the identified scale). Then, the cluster information generating section **170** records the extracted map as a thumbnail in association with the cluster to the cluster information storing section **240** (the Cluster Map **247** shown in FIG. **5**).

[0222] It is also possible to set a circle corresponding to the radius of a cluster from the center position of the cluster as an extraction range, extract a map covering this extraction range from a map of a predetermined scale, and magnify or shrink the extracted map in accordance with the size of the cluster to thereby generate a cluster map. In this way, in the same manner as in the above-described case, a thumbnail image of a cluster map according to the size of the corresponding cluster can be generated.

[0223] Now, consider a case where the size of a cluster generated by the tree restructuring section **160** is small. If the size of a cluster is small as in this case, when a map is extracted by using the map extraction method described above, a map covering a relatively small area is generated. In the case of such a map covering a relatively small area, a case can be supposed where no landmark (for example, a public facility or a park) is present in the map. In such a case, for example, there is a possibility that when a map is displayed as a thumbnail image, although the details of the map can be grasped, it is hard to easily grasp what region the map is showing. Accordingly, when creating the correspondence table shown in FIG. **14**, it is preferable to set a lower limit value for the cluster size. That is, if the size of a cluster is smaller than the lower limit value, a map with a size equal to the lower limit value is used. In this case, although a map with the size equal to the lower limit value may be used as it is as a thumbnail image for display, for example, the contour of a circle corresponding to the area of the cluster may be drawn on the extracted map. In this way, by using a map covering a relatively large area, the region corresponding to the map can be easily grasped, and the area of the cluster can be also easily grasped.

[0224] FIGS. **15**A and **15**B and FIGS. **16**A and **16**B are diagrams each showing an example of a map generated by the cluster information generating section **170** according to the first embodiment of the present invention. It should be noted that in FIGS. **15**A and **15**B and FIGS. **16**A and **16**B, an extraction area of the map is indicated by a thick dotted circle.

[0225] FIG. **15**A shows an extraction area **262** at which a cluster map is extracted from a map **261** of the vicinity of the Shinagawa station. The cluster corresponding to the extraction area **262** is a cluster made up of contents generated in the vicinity of the Shinagawa station.

[0226] FIG. **15**B shows extraction areas **264** and **265** at which cluster maps are extracted from a map **263** of the Japanese archipelago. The cluster corresponding to the extraction area **264** is a cluster made up of contents generated in Hokkaido (for example, Hokkaido trip). Also, the cluster corresponding to the extraction area **265** is a cluster made up of contents generated in the Kansai region (for example, Kansai trip).

[0227] FIG. **16**A shows extraction areas **267** and **268** at which cluster maps are extracted from a map **266** of the Europe region. The cluster corresponding to the extraction area **267** is a cluster made up of contents generated in the vicinity of Germany (for example, Germany trip). Also, the cluster corresponding to the extraction area **268** is a cluster made up of contents generated in the vicinity of Spain (for example, Spain/Portugal trip).

[0228] FIG. **16**B shows extraction areas **270** and **271** at which cluster maps are extracted from a map **269** of the South America region. The cluster corresponding to the extraction area **270** is a cluster made up of contents generated within Brazil (for example, Brazil business trip). Also, the cluster corresponding to the extraction area **271** is a cluster made up of contents generated in the vicinity of Argentine/Chile (for example, Argentine/Chile trip).

[0229] As shown in FIGS. **15**A and **15**B and FIGS. **16**A and **16**B, with respect to each cluster generated by the tree restructuring section **160**, a thumbnail image (cluster map) to be stored in association with this cluster is generated. Also, as shown in FIG. **4**, with respect to each cluster generated by the tree restructuring section **160**, a cluster title (address) to be stored in association with this cluster is determined.

[0230] Then, the cluster information generating section **170** records the thumbnail image (cluster map) generated in this way into the cluster information storing section **240** in association with the corresponding cluster (the Cluster Map **247** shown in FIG. **5**). Also, the cluster information generating section **170** records the cluster title (address) generated in this way into the cluster information storing section **240** in association with the corresponding cluster (the Cluster Title **248** shown in FIG. **5**). Also, the cluster information generating section **170** records individual pieces of cluster information related to a cluster generated by the tree restructuring section **160** into the cluster information storing section **240** in association with the corresponding cluster (the Cluster Position Information **242**, the Cluster Size **243**, and so on shown in FIG. **5**).

[0231] It should be noted that in the case where map information stored in the map information storing section **220** is the map information of a vector map, and the positions of landmarks or the like can be detected on the basis of the map information, the position of the area that has been cut out or the scale may be adjusted so that the landmarks or the like are included. For example, even if no landmark is included in the extraction area from which to extract a cluster map, if a landmark exists in the vicinity of the extraction area, the position of the extraction area or the scale of the map from which to extract the extraction area is changed so that the landmark is included. Also, the size of the extraction area may be changed. In the case where the information processing apparatus **100** can access a database in which the positions of landmarks or the like are stored, likewise, the position of the area that has been cut out or the scale may be adjusted so that the landmarks or the like are included. With landmarks or the like included in the map cut out in this way, it is possible to create a thumbnail image which makes it easy for the user to grasp the region corresponding to the map, as compared with a map inclusive of only roads.

[Example of Display Screen Transition]

[0232] FIG. **17** is a diagram showing an example of transition of the display screen of the display section **181** which is performed by the display control section **180** according to the first embodiment of the present invention. The first embodiment of the present invention is directed to the case of displaying an index screen and a content playback screen.

[0233] For example, when an operational input for activating a content playback application is accepted by the operation accepting section **200** in the information processing apparatus **100**, the display control section **180** displays an index screen **401** on the display section **181**. The index screen **401** is a display screen that displays a listing of clusters from which to select a desired cluster. Examples of display of the index screen **401** are shown in FIGS. **18** to **21**. Also, when an operational input for determining a desired cluster is accepted by the operation accepting section **200** on the index screen **401** displayed on the display section **181**, the display control section **180** displays a content playback screen **402** on the display section **181**. The content playback screen **402** is a display screen that displays contents belonging to the cluster on which a determining operation has been made. Examples of display of the content playback screen **402** are shown in FIGS. **22** to **27**B.

[0234] FIGS. **18** to **21** are diagrams each showing an example of display of an index screen displayed by the display control section **180** according to the first embodiment of the present invention. FIGS. **18** and **19** each show an example of display of an index screen that displays cluster maps as index images. FIG. **20** shows an example of display of an index screen that displays index images generated on the basis of date and time information, and FIG. **21** shows an example of display of an index screen that displays index images generated on the basis of face information. It should be noted that a cursor (mouse pointer) **419** that moves with the movement of a mouse (not shown) is displayed on the screen displayed on the display section **181**. The cursor **419** is a mouse pointer used to point to an object of instruction or operation on the screen displayed on the display section **181**.

[0235] On an index screen **410** shown in FIG. **18**, there are provided an "EVENT" tab **411**, a "FACE" tab **412**, a "PLACE" tab **413**, a cluster map display area **414**, and left and right buttons **415** and **416**.

[0236] The "EVENT" tab **411**, the "FACE" tab **412**, and the "PLACE" tab **413** are tabs for displaying another index screen. For example, when the "FACE" tab **412** is depressed using the cursor **419** by a user operation, an index screen **420** shown in FIG. **20** is displayed. Also, when the "PLACE" tab **413** is depressed using the cursor **419** by a user operation, an index screen **430** shown in FIG. **21** is displayed. Also, when the "EVENT" tab **411** is depressed using the cursor **419** by a user operation on the index screen **420** shown in FIG. **20** or the index screen **430** shown in FIG. **21**, the index screen **410** shown in FIG. **18** is displayed.

[0237] In the cluster map display area **414**, a listing of marks (cluster maps) representing clusters generated by the tree restructuring section **160** and stored in the cluster information storing section **240** is displayed. For example, as shown in FIG. **18**, cluster maps of the same size are displayed in a 3×5 matrix fashion, for example.

[0238] The left and right buttons **415** and **416** are operating buttons that are displayed when there are cluster maps other than the cluster maps being displayed in the cluster map display area **414**. For example, when the left button **415** or the right button **416** is depressed, in accordance with this depressing operation, the cluster maps being displayed in the cluster map display area **414** are moved to the left or right, thereby making it possible to display other cluster maps.

[0239] Here, a description will be given of a case in which a mouse-over is performed on a desired cluster map by a user operation on the index screen **410** shown in FIG. **18**. A mouse-over refers to a visual effect that performs display control such as changing the color of a desired image when a cursor is placed over the image.

[0240] For example, when the mouse is placed over a cluster map **417** by a user operation on the index screen **410** shown in FIG. **18**, as shown in FIG. **19**, the color of the cluster map **417** is changed, and pieces of information **418** related to the cluster map **417** are displayed. For example, the entire cluster map **417** is changed to a conspicuous color (for example, grey) and displayed. As the pieces of information **418** related to the cluster map **417**, for example, the number of contents "28" belonging to a cluster corresponding to the cluster map **417**, and the cluster title "Mt. Fuji" of the cluster

are displayed. Also, as the pieces of information **418** related to the cluster map **417**, for example, information on the latitude and longitude of the center position of the cluster corresponding to the cluster map **417**, "Lat. 35°21'N, Long. 138°43'E", is displayed.

[0241] As the pieces of information **418** related to the cluster map **417**, information indicating the size of the cluster may be also displayed together. For example, the diameter of a circle corresponding to the cluster can be displayed as "○○ km". Also, for example, in order to allow the user to intuitively grasp whether the size of a circle corresponding to a cluster is large or small, display of icons or color can be made to differ depending on whether the size is large or not. For example, when comparing an urban area and a rural area with each other, it is supposed that while buildings, roads, and the like are densely packed in the urban area, in the rural area, there are relatively many mountains, farms, and the like, and there are relatively few buildings, roads, and the like. For this reason, the amount of information in a map often differs between the urban area and the rural area. Due to this difference in the amount of information in a map, it is supposed that when cluster maps of the urban area and rural area are displayed simultaneously, the user feels a difference in the perceived sense of scale between the urban area and the rural area. Accordingly, for example, by displaying these cluster maps in different manners depending on whether the size of a circle corresponding to a cluster is large or small, it is possible to prevent a difference in the perceived sense of scale between the urban area and the rural area, and intuitively grasp whether the size of a circle corresponding to a cluster is large or small. Also, as the pieces of information **418** related to the cluster map **417**, other pieces of information such as the time range of the corresponding contents may be displayed.

[0242] On the index screen **420** shown in FIG. **20**, there are provided the "EVENT" tab **411**, the "FACE" tab **412**, the "PLACE" tab **413**, the left and right buttons **415** and **416**, and an event cluster image display area **421**.

[0243] On the index screen **430** shown in FIG. **21**, there are provided the "EVENT" tab **411**, the "FACE" tab **412**, the "PLACE" tab **413**, the left and right buttons **415** and **416**, and a face cluster image display area **421**. It should be noted that since the "EVENT" tab **411**, the "FACE" tab **412**, the "PLACE" tab **413**, and the left and right buttons **415** and **416** shown in FIGS. **20** and **21** are the same as those shown in FIGS. **18** and **19**, these are denoted by the same reference numerals, and their description is omitted.

[0244] In the event cluster image display area **421** shown in FIG. **20**, images representing event clusters generated by the event cluster generating section **130** and stored in the cluster information storing section **240** are displayed. As each of these images representing event clusters, for example, a thumbnail image of a single representative image extracted from among the contents belonging to each event cluster can be used. Also, a thumbnail image obtained by applying predetermined image processing (for example, image processing for shaping the boundary of each image area into an aesthetically pleasing geometrical contour as shown in FIG. **20**) to the representative image can be used. Such thumbnail images are displayed, for example, in a 3×5 matrix fashion in the same manner as in FIG. **18**.

[0245] Also, for example, when the mouse is placed over a thumbnail image **422** by a user operation on the index screen **420** shown in FIG. **20**, the color of the thumbnail image **422** changes, and pieces of information **423** related to the thumbnail image **422** are displayed. As the pieces of information **423** related to the thumbnail image **422**, for example, the number of contents "35" belonging to a cluster corresponding to the thumbnail image **422**, and the time range "02.03-01.04.2004" of the contents belonging to the cluster are displayed. Also, as the pieces of information **423** related to the thumbnail image **422**, other pieces of information such as a title may be displayed as well.

[0246] In the face cluster image display area **431** shown in FIG. **21**, images representing face clusters generated by the face cluster generating section **140** and stored in the cluster information storing section **240** are displayed. As such an image representing a face cluster, for example, a thumbnail image of each of faces included in contents belonging to the face cluster can be used. For example, as such a thumbnail image of a face, faces included in the contents belonging to the face cluster are extracted, the best-shot face is selected from among these extracted faces, and the thumbnail image of this selected face can be used. Such thumbnail images are displayed, for example, in a 3×5 matrix fashion in the same manner as in FIG. **18**.

[0247] Also, for example, when the mouse is placed over a thumbnail image **432** by a user operation on the index screen **430** shown in FIG. **21**, the color of the thumbnail image **432** changes, and pieces of information **433** related to the thumbnail image **432** are displayed. As the pieces of information **433** related to the thumbnail image **432**, for example, the number of contents "28" belonging to a cluster corresponding to the thumbnail image **432** is displayed. Also, as the pieces of information **433** related to the thumbnail image **432**, for example, other pieces of information such as the name of the person corresponding to the face may be displayed as well.

[0248] When a desired cluster is determined by a user operation on the index screen shown in each of FIGS. **18** to **21**, the display control section **180** displays a content playback screen on the display section **181**.

[0249] FIGS. **22** to **26** are diagrams each showing an example of display of a content playback screen displayed by the display control section **180** according to the first embodiment of the present invention.

[0250] FIG. **22** shows a content playback screen **440** that automatically displays contents belonging to a cluster determined by a user operation in slide show. The content playback screen **440** is provided with a content display area **441**, a preceding content display area **442**, and a succeeding content display area **443**. Contents are sequentially displayed on the content playback screen **440** on the basis of a predetermined rule (for example, in time series).

[0251] The content display area **441** is an area for displaying a content in the central portion of the content playback screen **440**. The preceding content display area **442** is an area for displaying a content positioned before the content being displayed in the content display area **441**. The succeeding content display area **443** is an area for displaying a content positioned after the content being displayed in the content display area **441**. That is, in the content display area **441**, the preceding content display area **442**, and the succeeding content display area **443**, successive contents are displayed while being arranged side by side in accordance with a predetermined rule. Also, when no user operation is made for a predetermined period of time (for example, three seconds) in the state with the content playback screen **440** displayed on the display section **181**, the content displayed in the succeeding content display area **443** is displayed in the content display

area **441**. That is, the contents displayed in the content display area **441**, the preceding content display area **442**, and the succeeding content display area **443** are displayed while being made to slide over one another.

[0252] When a user operation (for example, a mouse operation) is made in the state with the content playback screen **440** displayed on the display section **181**, a content playback screen **450** shown in FIG. **23** is displayed.

[0253] On the content playback screen **450**, display mode information **451**, content information **452**, an index screen transition button **453**, a date and time cluster transition button **454**, and a position cluster transition button **455** are displayed. That is, various kinds of operation assistance information are displayed on the content playback screen **440** shown in FIG. **22**.

[0254] The display mode information **451** is information indicating the current display mode. For example, when "FACE" is displayed as the display mode information **451** as shown in FIG. **23**, this indicates that the current display mode is the display mode for face clusters. Also, for example, when "LOCATION" is displayed as the display mode information **451**, this indicates that the current display mode is the display mode for position cluster. Also, for example, when "EVENT" is displayed as the display mode information **451**, this indicates that the current display mode is the display mode for date and time cluster.

[0255] The content information **452** is information related to the content being displayed in the content display area **441**. In the content information **452**, as information related to a content, for example, the time of generation of the content, the time range of the contents of a cluster to which the content belongs, and the like are displayed.

[0256] The index screen transition button **453** is a button that is depressed when transitioning to an index screen. For example, as shown in FIG. **23**, a house-shaped icon can be used as the index screen transition button **453**. When the index screen transition button **453** is depressed, the index screen for a cluster corresponding to the display mode displayed in the display mode information **451** is displayed. For example, in the case where the content playback screen **450** shown in FIG. **23** is displayed, when the index screen transition button **453** is depressed, the index screen **420** shown in FIG. **21** is displayed.

[0257] The date and time cluster transition button **454** is a button that is depressed when transitioning to the content playback screen for date and time cluster. In the date and time cluster transition button **454**, the time range of a date and time cluster to which the content displayed in the content display area **441** belongs is displayed inside a rectangular box indicated by broken lines. It should be noted that in the date and time cluster transition button **454**, other pieces of information related to the date and time cluster to which the content displayed in the content display area **441** belongs may be displayed as well. Also, an example of display when the mouse is placed over the date and time cluster transition button **454** is shown in FIG. **25**.

[0258] The position cluster transition button **455** is a button that is depressed when transitioning to the content playback screen for position cluster. In the position cluster transition button **455**, an icon representing a compass depicted in graphic form is displayed inside a rectangular box indicated by broken lines. It should be noted that in the position cluster transition button **455**, information related to a position cluster to which the content displayed in the content display area **441** belongs may be displayed as well. It should be noted that an example of display when the mouse is placed over the position cluster transition button **455** is shown in FIG. **26**.

[0259] When a person's face is included in the content displayed in the content display area **441**, a face box (for example, a rectangular box indicated by broken lines) is attached to the face and displayed. This face box is used as a button that is depressed when transitioning to the content playback screen for face cluster. For example, since the faces of four persons are included in the content displayed in the content display area **441** shown in FIG. **23**, face boxes **456** to **459** are attached to the respective faces. It should be noted that as the method of detecting a face included in a content, for example, a face detection method based on matching between a template in which face brightness distribution information is recorded, and a content image (see, for example, Japanese Unexamined Patent Application Publication No. 2004-133637) can be used. Also, it is possible to use a face detection method based on a skin color portion included in a content image, or the features of a human face. Such face detection may be performed every time a content is displayed, or may be performed in advance as part of content attribute information and this content attribute information may be used.

[0260] An example of display when the mouse is placed over the face portion included in the face box **458** on the content playback screen **450** shown in FIG. **23** is shown in FIG. **24**.

[0261] FIG. **24** shows a content playback screen **460** that is displayed when the mouse is placed over the face portion included in the face box **458** on the content playback screen **450** shown in FIG. **23**. As shown in FIG. **24**, when the mouse is placed over the face portion included in the face box **458** on the content playback screen **450**, an image **461** of the vicinity of the face included in the face box **458** is displayed in magnified form. Also, a content listing display area **462** is displayed on the image of the content displayed in the content display area **441**. The content listing display area **462** is an area where a listing of contents included in the face cluster to which the content displayed in the content display area **441** belongs is displayed. For example, the thumbnail image of the content being displayed in the content display area **441** is displayed at the left end portion of the content listing display area **462**, and the thumbnail images of the other contents included in the same face cluster are displayed while being arranged side by side in the left-right direction on the basis of a predetermined rule. If the number of contents included in the same cluster is large, the contents may be scroll-displayed by a user operation.

[0262] Also, for example, as shown in FIG. **24**, in the state with the mouse placed over the face portion included in the face box **458** on the content playback screen **460**, when a determining operation (for example, a click operation with the mouse) is made on the face, the screen transitions to the content playback screen for face cluster. On this content playback screen, contents included in the face cluster to which the face on which the determining operation has been made belongs are automatically displayed in slide show as shown in FIG. **22**, for example.

[0263] FIG. **25** shows a content playback screen **465** that is displayed when the mouse is placed over the date and time cluster transition button **454** on the content playback screen **450** shown in FIG. **23**. As shown in FIG. **25**, when the mouse is placed over the date and time cluster transition button **454**

on the content playback screen **450**, date and time information (for example, the time range of the corresponding date and time cluster) **466** included in the date and time cluster transition button **454** is displayed in magnified form. Also, as in the case shown in FIG. **24**, a content listing display area **467** is displayed on the image of the content being displayed in the content display area **441**. The content listing display area **467** is an area where a listing of contents included in the date and time cluster to which the content displayed in the content display area **441** belongs is displayed. It should be noted that since the method of display in the content listing display area **467** is substantially the same as the example shown in FIG. **24**, description thereof is omitted here.

[0264] Also, for example, as shown in FIG. **25**, in the state with the mouse placed over the date and time information **466** on the content playback screen **465**, when a determining operation (for example, a click operation with the mouse) is made on the date and time information **466**, the screen transitions to the content playback screen for date and time cluster. On this content playback screen, contents included in the date and time cluster to which the content displayed in the content display area **441** at the time of the determining operation belongs are automatically displayed in slide show as shown in FIG. **22**, for example.

[0265] FIG. **26** shows a content playback screen **470** that is displayed when the mouse is placed over the position cluster transition button **455** on the content playback screen **450** shown in FIG. **23**. As shown in FIG. **26**, when the mouse is placed over the position cluster transition button **455** on the content playback screen **450**, a cluster map **471** corresponding to the position cluster to which the content displayed in the content display area **441** belongs is displayed in magnified form. Also, as in the case shown in FIG. **24**, a content listing display area **472** is displayed on the image of the content displayed in the content display area **441**. The content listing display area **472** is an area where a listing of contents included in the position cluster to which the content displayed in the content display area **441** belongs is displayed. It should be noted that since the method of display in the content listing display area **472** is substantially the same as the example shown in FIG. **24**, description thereof is omitted here.

[0266] Also, for example, as shown in FIG. **26**, in the state with the mouse placed over the cluster map **471** on the content playback screen **470**, when a determining operation (for example, a click operation with the mouse) is made on the cluster map **471**, the screen transitions to the content playback screen for position cluster. On this content playback screen, contents included in the position cluster to which the content displayed in the content display area **441** at the time of the determining operation belongs are automatically displayed in slide show as shown in FIG. **22**, for example.

[0267] Each one of contents stored in the content storing section **210** belongs to any one cluster of each of position clusters, event clusters, and face clusters. That is, each one of contents belongs to any one cluster of positional clusters, belongs to any one cluster of event clusters, and belongs to any one cluster of face clusters. For this reason, with one of the contents stored in the content storing section **210** taken as a base point, display can be made to transition from a given cluster to another cluster.

[0268] For example, suppose a case in which a desired cluster map is selected on the index screen **420** shown in FIG. **18**. In this case, contents belonging to a position cluster corresponding to the selected cluster map are sequentially displayed on the content playback screen **440** shown in FIG. **22**, for example. A case can be supposed where among the contents displayed in this way, it is desired to see other contents related to a given person. For example, suppose a case in which among the persons displayed on the content playback screen **440** shown in FIG. **22**, the user is to view other contents related to the second person from the right. In this case, by performing a user operation in the state in which the content playback screen **440** is displayed, as shown in FIG. **23**, the content playback screen **450** provided with various pieces of operation assistance information is displayed. On the content playback screen **450** displayed, face boxes are attached to the faces of persons included in the content displayed in the content display area **441**. Accordingly, to see other contents related to the second person from the right (the person attached with the face box **458**), the face box **458** is selected and a determining operation is made. With this determining operation, contents included in the face cluster to which the face of the person attached with the face box **458** belongs are sequentially displayed on the content playback screen **440** shown in FIG. **22**, for example.

[0269] Also, a case can be supposed where among contents belonging to a face cluster to which a desired face belongs, it is desired to see other contents generated at times close to the time of generation of a given content. In this case, by performing a user operation in the state in which the content playback screen **440** is displayed, as shown in FIG. **23**, the content playback screen **450** provided with various pieces of operation assistance information is displayed. On the content playback screen **450**, there is provided the date and time cluster transition button **454** for transitioning to the content playback screen for date and time cluster. Accordingly, to see other contents generated at times close to the time of generation of the content displayed in the content display area **441**, the date and time cluster transition button **454** is selected and a determining operation is made. With this determining operation, contents included in the date and time cluster to which the content displayed in the content display area **441** belongs are sequentially displayed on the content playback screen **440** shown in FIG. **22**, for example.

[0270] Also, a case can be supposed where among the contents belonging to a date and time cluster to which a content generated during a desired time period belongs, it is desired to see other contents generated at places close to the place of generation of a given content. In this case, by performing a user operation in the state in which the content playback screen **440** is displayed, as shown in FIG. **23**, the content playback screen **450** provided with various pieces of operation assistance information is displayed. On the content playback screen **450**, there is provided the position cluster transition button **455** for transitioning to the content playback screen for position cluster. Accordingly, to see other contents generated at places close to the place of generation of the content displayed in the content display area **441**, the position cluster transition button **455** is selected and a determining operation is made. With this determining operation, contents included in the position cluster to which the content displayed in the content display area **441** belongs are sequentially displayed on the content playback screen **440** shown in FIG. **22**, for example.

[0271] In this way, with one of the contents stored in the content storing section **210** taken as a base point, transition of display from a given cluster to another cluster can be easily performed, thereby making it possible to enhance interest

during content playback. In addition, since content search can be performed quickly, and searching can be performed from a variety of perspectives, it is possible to enhance the fun of content playback.

[0272] The foregoing description is directed to the case in which cluster maps are displayed on an index screen or content playback screen. In this regard, a cluster map includes the generated positions of contents belonging to a cluster corresponding to the cluster map. Accordingly, on the cluster map to be displayed, generated-position marks (for example, inverted triangles) indicating the generated positions of contents belonging to a cluster corresponding to this cluster map may be displayed in a superimposed fashion. The generated-position marks may be superimposed when, for example, a cluster map is generated by the cluster information generating section **170**, or may be superimposed when the display control section **180** displays a cluster map. When marks indicating the generated positions of contents are displayed while being superimposed on a cluster map in this way, in addition to an overview of the corresponding position cluster, the user can easily grasp the distribution of the locations of generation of contents included in the position cluster, and the like.

[0273] Also, for example, by using event IDs calculated at the time of event clustering, contents belonging to a position cluster can be classified by event within the position cluster to generate sub-clusters. For example, as for contents generated in an annual theme park event held every year on a huge site, the contents can be classified by year to generate sub-clusters. Accordingly, for example, each generated-position mark superimposed on a cluster map can be displayed in a different manner for each event ID (for example, in a different color). Also, a case can be supposed where there are many overlapping areas. In this case, for example, a circle corresponding to each sub-cluster may be displayed so as to be superimposed on a cluster map. Such a circle corresponding to a sub-cluster can be displayed in a different manner for each event ID, for example, like the generated-position mark. Thus, the distribution of the generated positions of contents generated in different years can be easily grasped.

[0274] Also, when displaying pieces of information related to the cluster being displayed, as sub-items related to the cluster map, for example, pieces of attribute information on a sub-cluster basis may be displayed. Such pieces of attribute information on a sub-cluster basis are, for example, the range of the times of generation of contents belonging to a sub-cluster (the start time and the end time), the number of the contents, and the center position and radius of a circle corresponding to the sub-cluster.

[0275] For example, as the pieces of information **418** related to the cluster map **417** displayed when the mouse is placed over the cluster map **417** by a user operation on the index screen **410** shown in FIG. **18**, pieces of attribute information on a sub-cluster basis may be displayed. Also, an example of pieces of attribute information displayed on a sub-cluster basis in the case of displaying position clusters in list form is shown in FIG. **27**B.

[0276] FIGS. **27**A and **27**B are diagrams each showing an example of display of a cluster map display screen displayed by the display control section **180** according to the first embodiment of the present invention. A cluster map display screen **480** shown in FIG. **27**A is a modification of the index screen shown in each of FIGS. **18** and **19**. The cluster map display screen **480** is provided with a list display area **481** and a map display area **482**.

[0277] The list display area **481** is an area in which a listing of the cluster titles of position clusters is displayed. For example, by placing the mouse over a desired cluster title among the cluster titles displayed in the list display area **481**, the desired cluster title can be selected. In FIG. **27**A, the display area of the cluster title being selected, "Downtown Walk", is shown in grey. It should be noted that a scroll bar **484**, and up and down buttons **485** the **486** can be used to move up and down through the cluster titles displayed in the list display area **481** to thereby display another cluster title.

[0278] The map display area **482** is an area for displaying a cluster map corresponding to the cluster title being currently selected from among the listing of the position clusters displayed in the list display area **481**. For example, a wide-area map including a cluster map corresponding to the cluster title "Downtown Walk" being selected is displayed, and within this wide-area map, a circle corresponding to the cluster map is displayed by a dotted circle **483**. Also, on the wide-area map displayed in the map display area **482**, generated-position marks having the shape of an inverted triangle are displayed in a superimposed manner. Each of the generated-position marks is displayed in a different manner for each event ID. For example, for every three event IDs, it is possible to use an inverted triangle with oblique lines drawn inside, an inverted triangle that is painted black inside, and an inverted triangle that is painted white inside. This makes it possible to easily grasp the distribution of generated positions of contents corresponding to different events. While this example is directed to the case in which a wide-area map including a cluster map corresponding to the cluster title being selected is displayed in the map display area **482**, it is also possible to display a cluster map corresponding to the cluster title being selected. Also, it is also possible to display a wide-area map of a certain size (for example, a map of the entire Tokyo-prefecture), and display all the position clusters included within this wide-area map.

[0279] FIG. **27**B shows a sub-cluster attribute information display area **487** that is displayed when a predetermined operation (for example, a mouse-over performed for a predetermined period of time or more) is made on the cluster title "Downtown Walk" being displayed in the list display area **481** shown in FIG. **27**A.

[0280] The sub-cluster attribute information display area **487** is an area in which, when a predetermined operation is made on the cluster title being displayed in the list display area **481**, pieces of attribute information on a sub-cluster basis corresponding to the cluster title are displayed. For example, when a predetermined operation is made on the cluster title "Downtown Walk" being displayed in the list display area **481**, pieces of attribute information on a sub-cluster basis corresponding to the cluster title "Downtown Walk" are displayed in the sub-cluster attribute information display area **487**. As the pieces of attribute information on a sub-cluster basis, for example, the date and time of contents belonging to a sub-cluster, and the number of the contents are displayed. The example shown in FIG. **27**B illustrates a case in which, as the pieces of attribute information on a sub-cluster basis corresponding to the cluster title "Downtown Walk", pieces of attribute information corresponding to three sub-clusters are displayed. Also, for example, among the pieces of attribute information displayed in the sub-cluster attribute information display area **487**, for the piece of attribute information that has been selected, the generated-position mark of the corresponding sub-cluster displayed in the map display

area **482** may be changed so as to be displayed in a different manner of display. It should be noted that a scroll bar, and up and down buttons can be used to move up and down through the pieces of attribute information displayed in the sub-cluster attribute information display area **487** to thereby display another piece of attribute information.

[0281] For example, when a desired cluster title is selected from among the cluster titles displayed in the list display area **481**, contents belonging to a position cluster corresponding to the selected cluster title are sequentially displayed on a content playback screen.

[Example of Operation of Information Processing Apparatus]

[0282] FIG. **28** is a flowchart showing an example of the procedure of a content information generation process by the information processing apparatus **100** according to the first embodiment of the present invention.

[0283] First, it is judged whether or not an instructing operation for generating content information has been performed (step S**901**). If an instruction operation for generating content information has not been performed, monitoring is continuously performed until an instructing operation for generating content information is performed. If an instruction operation for generating content information has been performed (step S**901**), the attribute information acquiring section **110** acquires attribute information associated with contents stored in the content storing section **210** (step S**902**).

[0284] Subsequently, the tree generating section **120** performs a tree generation process of generating binary tree structured data on the basis of the acquired attribute information (positional information) (step S**910**). Subsequently, the event cluster generating section **130** generates binary tree structured data on the basis of the acquired attribute information (date and time information), and generates event clusters (clusters based on date and time information) on the basis of this binary tree structured data (step S**903**).

[0285] Subsequently, the hierarchy determining section **150** performs a hierarchy determination process of linking and correcting nodes in the binary tree structured data generated by the tree generating section (step S**970**). This hierarchy determination process will be described later in detail with reference to FIG. **29**.

[0286] Subsequently, the tree restructuring section **160** performs a tree restructuring process of restructuring the tree generated by the hierarchy determining section **150** to generate clusters (step S**990**). This tree restructuring process will be described later in detail with reference to FIG. **30**.

[0287] Subsequently, on the basis of information related to the clusters generated by the tree restructuring section **160**, the cluster information generating section **170** generates individual pieces of attribute information related to the clusters (for example, cluster maps and cluster titles) (step S**904**). Subsequently, the cluster information generating section **170** records information (cluster information) related to the clusters generated by the tree restructuring section **160**, and the individual pieces of attribute information related to these clusters, into the cluster information storing section **240** (step S**905**).

[0288] FIG. **29** is a flowchart showing an example of the hierarchy determination process (the procedure in step S**970** shown in FIG. **28**) of the procedure of the content information generation process by the information processing apparatus **100** according to the first embodiment of the present invention.

[0289] First, individual events (event IDs) of the event clusters generated by the event cluster generating section **130** are set (step S**971**). Subsequently, the hierarchy determining section **150** calculates the frequency distribution of individual contents with the cluster IDs generated by the event cluster generating section **130** taken as classes, with respect to each of nodes in the binary tree structured data generated by the tree generating section **120** (step S**972**).

[0290] Subsequently, the hierarchy determining section **150** calculates a linkage score S with respect to each of the nodes in the binary tree structured data generated by the tree generating section **120** (step S**973**). This linkage score S is calculated by using, for example, an M-th order vector generated with respect to each of two child nodes belonging to a target node (parent node) for which to calculate the linkage score S.

[0291] Subsequently, the hierarchy determining section **150** selects one node from among the nodes in the binary tree structured data generated by the tree generating section **120**, and sets this node as a target node (step S**974**). For example, with each of the nodes in the binary tree structured data generated by the tree generating section **120** as a node to be selected, each node is sequentially selected, beginning with the nodes at upper levels.

[0292] Subsequently, the hierarchy determining section **150** compares the calculated linkage score S with the linkage threshold th**3**, and judges whether or not $S<th3$ (step S**975**). If $S<th3$ (step S**975**), the corresponding target node is excluded from the nodes to be selected (step S**976**), and the process returns to step S**974**. On the other hand, if $S \geqq th3$ (step S**975**), the hierarchy determining section **150** determines the corresponding target node as an extraction node, and excludes the target node and child nodes belonging to this target node from the nodes to be selected (step S**977**). That is, for the target node determined as an extraction node, since its child nodes are linked together, no comparison process is performed with respect to other lower-level nodes belonging to the extraction node.

[0293] Subsequently, it is judged whether or not another node to be selected exists among the nodes in the binary tree structured data generated by the tree generating section **120** (step S**978**). If there is another node to be selected (step S**978**), the process returns to step S**974**, in which one node is selected from the nodes to be selected, and set as a target node. On the other hand, if there is no another node to be selected (step S**978**), the hierarchy determining section **150** generates a tree with each of determined extraction nodes as a child element (child node) (step S**979**).

[0294] FIG. **30** is a flowchart showing an example of the tree restructuring process (the procedure in step S**990** shown in FIG. **28**) of the procedure of the content information generation process by the information processing apparatus **100** according to the first embodiment of the present invention.

[0295] First, with the root node of the tree generated by the hierarchy determining section **150** as a target node, the tree restructuring section **160** judges whether or not the number of child nodes belonging to this target node is equal to or smaller than 1 (step S**991**). If the number of child nodes belonging to the target node is equal to or smaller than 1 (step S**991**), the operation of the tree restructuring process is ended. On the other hand, if the number of child nodes belonging to the target node is equal to or larger than 2 (step S**991**), the tree

restructuring section **160** extracts a pair with the smallest distance from among the child nodes belonging to the target node (step S**992**).

[0296] Subsequently, it is judged whether or not the extracted pair satisfies a specified constraint (step S**993**). If the extracted pair does not satisfy the specified constraint, the tree restructuring section **160** merges the pair into a single node (step S**994**). On the other hand, if the extracted pair satisfies the specified constraint (step S**993**), the operation of the tree restructuring process is ended. While this example is directed to a tree restructuring process with respect to a one-level tree, the same can be applied to the case of performing a tree restructuring process with respect to a multi-level tree (for example, a tree with a binary tree structure). When performing a tree restructuring process with respect to a multi-level tree, if it is determined that the extracted pair satisfies a specified constraint (step S**993**), each of the nodes of the extracted pair is set as a new target node. Then, with respect to the newly set target node, the above-mentioned tree restructuring process (steps S**991** to S**994**) is repeated.

[0297] FIG. **31** is a flowchart showing an example of the procedure of a content playback process by the information processing apparatus **100** according to the first embodiment of the present invention.

[0298] First, it is judged whether or not a content playback instructing operation for instructing content playback has been performed (step S**1001**). If a content playback instructing operation has not been performed, monitoring is continuously performed until a content playback instructing operation is performed. If a content playback instructing operation has been performed (step S**1001**), an index screen that displays a listing of cluster maps is displayed (step S**1002**). Subsequently, it is judged whether or not a switching operation of the index screen has been performed (step S**1003**). If a switching operation of the index screen has been performed (step S**1003**), the index screen is switched in accordance with the switching operation (step S**1004**), and the process returns to step S**1003**.

[0299] If a switching operation of the index screen has not been performed (step S**1003**), it is judged whether or not a scroll operation has been performed (step S**1005**). If a scroll operation has been performed (step S**1005**), display of the index screen is switched in accordance with the scroll operation (step S**1006**). If a scroll operation has not been performed (step S**1005**), the process proceeds to step S**1007**.

[0300] If display of the index screen has been switched in accordance with the scroll operation (step S**1006**), it is judge whether or not a selecting operation (for example, a mouse-over) of selecting any one of index images has been performed (step S**1007**). If the selecting operation has been performed (step S**1007**), pieces of information related to a cluster corresponding to the index image on which the selecting operation has been performed are displayed (step S**1008**). If the selecting operation has not been performed (step S**1007**), the process returns to step S**1003**.

[0301] Subsequently, it is judged whether or not a determining operation has been performed on the index image on which the selecting operation has been performed (step S**1009**). If the determining operation has been performed (step S**1009**), a content playback screen display process is performed (step S**1020**). This content playback screen display process will be described later in detail with reference to FIGS. **32** and **33**. If the determining operation has not been performed (step S**1009**), the process returns to step S**1003**.

[0302] Subsequently, after the content playback screen display process is performed (step S**1020**), it is judged whether or not a content playback ending operation for instructing the end of content playback has been performed (step S**1010**). If the content playback ending operation has not been performed, the process returns to step S**1003**. On the other hand, if the content playback ending operation has been performed (step S**1010**), the operation of the content playback process is ended.

[0303] FIGS. **32** and **33** are each a flowchart showing an example of the content playback screen display process (the procedure in step S**1020** shown in FIG. **31**) of the procedure of the content playback process by the information processing apparatus **100** according to the first embodiment of the present invention.

[0304] First, it is judged whether or not an operational input (for example, a mouse operation) has been made (step S**1021**). If an operational input has been made (step S**1021**), face boxes are attached to faces included in the content displayed on the content playback screen (step S**1022**), and content information and operation assistance information are displayed (step S**1023**). It should be noted that no face box is displayed if there is no face included in the content displayed on the content playback screen.

[0305] Subsequently, it is determined whether or not a display switching operation to an index screen has been performed (step S**1024**). If the display switching operation to an index screen has been performed (step S**1024**), the operation of the content playback screen display process is ended. If the display switching operation to an index screen has not been performed (step S**1024**), the process proceeds to step S**1031**.

[0306] Also, if an operational input has not been made (step S**1021**), it is judged whether or not content information and operation assistance information are displayed (step S**1025**). If content information and operation assistance information are displayed (step S**1025**), it is judged whether or not no operational input has been made within a predetermined period of time (step S**1026**), and if an operational input has been made within a predetermined period of time, the process proceeds to step S**1031**. On the other hand, if no operational input has been made within a predetermined period of time (step S**1026**), the displayed face boxes are erased (step S**1027**), the displayed content information and operation assistance information are erased (step S**1028**), and the process returns to step S**1021**.

[0307] Also, if content information and operation assistance information are not displayed (step S**1025**), it is judged whether or not no operational input has been made within a predetermined period of time (step S**1029**). If no operational input has been made within a predetermined period of time (step S**1029**), the next content is displayed (step S**1030**). That is, a slide display is performed. On the other hand, if an operational input has been made within a predetermined period of time (step S**1029**), the process returns to step S**1021**.

[0308] Subsequently, it is judged whether or not a content playback screen for event cluster is displayed (step S**1031**), and if the content playback screen of event cluster is not displayed, event icons are displayed (step S**1032**). Also, it is judged whether or not a content playback screen for position cluster is displayed (step S**1033**), and if the content playback screen for position cluster is not displayed, position icons are displayed (step S**1034**).

[0309] Subsequently, it is judged whether or not a selecting operation (for example, a mouse-over) on a face has been

performed (step S1035). If the selecting operation on a face has not been performed, the process proceeds to step S1040. On the other hand, if the selecting operation on a face has been performed (step S1035), information related to a face cluster related to the face on which the selecting operation has been performed (for example, a listing of the thumbnail images of contents belonging to the face cluster) is displayed (step S1036). Subsequently, the image of the vicinity of the face on which the selecting operation has been performed is displayed in magnified form (step S1037). Subsequently, it is judged whether or not a determining operation (for example, a mouse click operation) on the face has been performed (step S1038). If the determining operation has not been performed, the process proceeds to step S1040. On the other hand, if the determining operation on the face has been performed (step S1038), a content playback screen for the face cluster to which the face on which the determining operation has been performed belongs is displayed (step S1039).

[0310] Subsequently, it is judged whether or not a selecting operation (for example, a mouse-over) on an event icon has been performed (step S1040). If the selecting operation on an event icon has not been performed, the process proceeds to step S1045. On the other hand, if the selecting operation on an event icon has been performed (step S1040), information related to an event cluster to which the content being currently displayed belongs is displayed (step S1041). As this information related to the event cluster, for example, a listing of the thumbnail images of contents belonging to the event cluster is displayed. Subsequently, the manner of display of the event icon is changed (step S1042). For example, information related to the event cluster to which the content being currently displayed belongs (for example, the representative image and date and time information of the event cluster) is displayed. Subsequently, it is judged whether or not a determining operation (for example, a mouse click operation) on the event icon has been performed (step S1043). If the determining operation has not been performed, the process proceeds to step S1045. On the other hand, if the determining operation on the event icon has been performed (step S1043), a content playback screen for the event cluster to which the content being currently displayed belongs is displayed (step S1044).

[0311] Subsequently, it is judged whether or not a selecting operation (for example, a mouse-over) on a position icon has been performed (step S1045). If the selecting operation on a position icon has not been performed, the process returns to step S1021. On the other hand, if the selecting operation on a position icon has been performed (step S1045), information related to a position cluster to which the content being currently displayed belongs (for example, a listing of the thumbnail images of contents belonging to the position cluster) is displayed (step S1046). Subsequently, the manner of display of the position icon is changed (step S1047). For example, information related to the position cluster to which the content being currently displayed belongs (for example, the cluster map of the position cluster) is displayed. Subsequently, it is judged whether or not a determining operation (for example, a mouse click operation) on the position icon has been performed (step S1048). If the determining operation has not been performed, the process returns to step S1021. On the other hand, if the determining operation on the position icon has been performed (step S1048), a content playback screen for the position cluster to which the content being currently displayed belongs is displayed (step S1049), and the process returns to step S1021.

2. Second Embodiment

[0312] The first embodiment of the present invention is directed to the case of displaying a listing of cluster maps or the case of displaying cluster maps together with contents. In this regard, for example, in the case when a listing of cluster maps having the same size is displayed in a matrix fashion, there is a fear that it may not be possible to intuitively grasp the geographical correspondence between the cluster maps. Also, for example, in the case when cluster maps are displayed so as to be placed at their corresponding positions on a map, there is a fear that not all the cluster maps can be displayed unless a map of an area corresponding to the cluster maps is displayed. Accordingly, for example, it is conceivable to display a world map so that it is possible to get a bird's eye view of the entire world. Although all cluster maps can be displayed when a world map is displayed in this way, in a region where cluster maps are concentrated, there is a fear that the cluster maps overlap each other, and thus it is not possible to display some cluster maps. Accordingly, in a second embodiment of the present invention, by taking the geographical correspondence between cluster maps into consideration, the cluster maps are displayed while being placed in such a way that the geographical correspondence between the cluster maps can be grasped intuitively.

[Example of Configuration of Information Processing Apparatus]

[0313] FIG. **34** is a block diagram showing an example of the functional configuration of an information processing apparatus **600** according to the second embodiment of the present invention. The information processing apparatus **600** includes the content storing section **210**, the map information storing section **220**, and the cluster information storing section **240**. In addition, the information processing apparatus **600** includes a background map generating section **610**, a background map information storing section **620**, a coordinate calculating section **630**, a non-linear zoom processing section **640**, a relocation processing section **650**, a magnification/shrinkage processing section **660**, a display control section **670**, and a display section **680**. The information processing apparatus **600** can be realized by, for example, an information processing apparatus such as a personal computer capable of managing contents such as image files recorded by an image capturing apparatus such as a digital still camera. It should be noted that since the content storing section **210**, the map information storing section **220**, and the cluster information storing section **240** are substantially the same as those described above in the first embodiment of the present invention, these components are denoted by the same reference numerals, and their description is omitted. Also, it is assumed that cluster information generated by the cluster information generating section **170** shown in FIG. **1** is stored in the cluster information string section **240**.

[0314] The background map generating section **610** generates a background map (cluster wide-area map) corresponding to each cluster on the basis of cluster information stored in the cluster information storing section **240**, and stores the generated background map into the background map information storing section **620** in association with each cluster.

Specifically, on the basis of the cluster information stored in the cluster information storing section **240**, the background map generating section **610** acquires map information from the map information storing section **220**, and generates a background map corresponding to the cluster information on the basis of this acquired map information. It should be noted that the method of generating a background map will be described later in detail with reference to FIGS. **44** and **45**.

[0315] The background map information storing section **620** stores the background map generated by the background map generating section **610** in associated with each cluster, and supplies the stored background map to the display control section **670**.

[0316] The coordinate calculating section **630** calculates the coordinates of the center positions of cluster maps on a display screen in accordance with an alteration input accepted by an operation accepting section **690**, on the basis of cluster information stored in the cluster information storing section **240**. Then, the coordinate calculating section **630** outputs the calculated coordinates to the non-linear zoom processing section **640**.

[0317] The non-linear zoom processing section **640** performs coordinate transformation on the coordinates outputted from the coordinate calculating section **630** (the coordinates of the center positions of cluster maps on the display screen) by a non-linear zoom process, and outputs the transformed coordinates to the relocation processing section **650** or the display control section **670**. This non-linear zoom process is a process which performs coordinate transformation so that the coordinates of the center positions of cluster maps associated with a highly concentrated region are scattered apart from each other. This non-linear zoom process will be described later in detail with reference to FIGS. **35** to **40**. It should be noted that the non-linear zoom processing section **640** is an example of each of a transformed-coordinate calculating section and a coordinate setting section described in the claims.

[0318] The relocation processing section **650** performs coordinate transformation by a force-directed relocation process on the coordinates outputted from the non-linear zoom processing section **640**, on the basis of the distances between individual coordinates, the size of the display screen on the display section **680**, and the number of cluster maps to be displayed. Then, the relocation processing section **650** outputs the transformed coordinates to the magnification/shrinkage processing section **660**. This force-directed relocation process will be described later in detail with reference to FIG. **42**. It should be noted that the relocation processing section **650** is an example of a second transformed-coordinate calculating section described in the claims.

[0319] The magnification/shrinkage processing section **660** performs coordinate transformation by magnification or shrinking, on the coordinates outputted from the relocation processing section **650**, on the basis of the size of an area subject to coordinate transformation by the relocation process, and the size of the display screen on the display section **680**. Then, the magnification/shrinkage processing section **660** outputs the transformed coordinates to the display control section **670**. This magnification/shrinkage process will be described later in detail with reference to FIGS. **43**A and **43**B.

[0320] Each of the coordinate transformations by the non-linear zoom processing section **640**, the relocation processing section **650**, and the magnification/shrinkage processing section **660** is a coordinate transformation with respect to the center positions of cluster maps. Therefore, in these coordinate transformations, the cluster maps themselves do not undergo deformation (for example, magnification/shrinkage of their circular shape, or deformation from a circle to an ellipse).

[0321] The display control section **670** displays various kinds of image on the display section **680** in accordance with an operational input accepted by the operation accepting section **690**. For example, in accordance with an operational input accepted by the operation accepting section **690**, the display control section **670** displays on the display section **680** cluster information (for example, a listing of cluster maps) stored in the cluster information storing section **240**. When a predetermined user operation is performed in the state with a listing of cluster maps displayed on the display section **680**, the display control section **670** displays a background map (cluster wide-area map) stored in the background map information storing section **620** on the display section **680**. Also, in accordance with an operational input accepted by the operation accepting section **690**, the display control section **670** displays contents stored in the content storing section **210** on the display section **680**. These examples of display will be described later in detail with reference to FIGS. **41**, **46** to **48**B, and **50**.

[0322] The display section **680** is a display section that displays various kinds of image on the basis of control by the display control section **670**.

[0323] The operation accepting section **690** is an operation accepting section that accepts an operational input from the user, and outputs information on an operation corresponding to the accepted operational input to the coordinate calculating section **630** and the display control section **670**.

[Example of Display in which Cluster Maps are Superimposed on Generated Positions of Contents]

[0324] FIG. **35** is a diagram schematically showing a case in which cluster maps to be coordinate-transformed by the non-linear zoom processing section **640** are placed on coordinates according to the second embodiment of the present invention. FIG. **35** illustrates a case in which, with a map **760** being a map at a scale allowing regions including Tokyo and Kyoto to be displayed on the display section **680**, cluster maps stored in the cluster information storing section **240** are displayed at corresponding positions in the map **760**. Also, in this example, a case is supposed where contents are generated by the user intensively in the neighborhood of Tokyo and in the neighborhood of Kyoto, and a plurality of clusters are generated for these contents. It should be noted that coordinates (grid-like points (points where two dotted lines intersect)) in the map **760** are schematically indicated by grad-like straight lines in the map **760**. It should be noted that for the ease of explanation, these coordinates are depicted in a simplified fashion with a relatively large interval between the coordinates. The same also applies to grid-like straight lines in each of the drawings described below. When clusters are generated in this way, clusters whose center positions are located within relatively narrow ranges in Tokyo and Kyoto are generated. In this case, it is supposed that for example, as shown in FIG. **35**, when displaying cluster maps at the corresponding positions in the map **760**, the generated cluster maps are displayed in an overlaid manner. Specifically, in FIG. **35**, there are shown a cluster map group **761** indicating a set of cluster maps related to contents generated in Kyoto, and a cluster map group **762** indicating a set of cluster maps related to contents generated in Tokyo.

[0325] In the case when the scale of the background map is set relatively large in this way, it is supposed that the cluster maps overlap each other, making it difficult to grasp individual cluster maps in regions where the cluster maps are densely concentrated. Accordingly, for example, it is also conceivable to display individual cluster maps in a smaller size. However, it is necessary for cluster maps to be somewhat large for the user to recognize these cluster maps. That is, if cluster maps are reduced in size, it is supposed that the cluster maps become hard to see, making it difficult to grasp the details of the cluster maps.

[0326] Accordingly, the second embodiment of the present invention is directed to optimal placement of individual cluster maps on a map which makes it possible to avoid overlapping of cluster maps in regions where the cluster maps are densely concentrated, without changing the size of the cluster maps. When placing the cluster maps in this way, the placement is performed in accordance with the following placement criteria (1) to (3).

[0327] (1) For cluster maps overlapping each other on the background map, their center positions are to be spaced apart by some interval.

[0328] (2) The positional relationship between cluster maps is to be maintained. This positional relationship includes, for example, the distances between the cluster maps, and their orientations.

[0329] (3) When cluster maps overlap each other, the order (precedence) in which individual cluster maps are overlaid at the upper side are determined in accordance with a predetermined condition.

[0330] As the predetermined condition mentioned in (3) above, for example, it is possible to adopt such a condition that the larger the number of contents belonging to a cluster, the higher the precedence. That is, the cluster map of the cluster to which the largest number of contents belong is assigned the first precedence. Also, as the predetermined condition, for example, it is possible to use a condition such as the relative size of a cluster, the relative number of events (the number of times of visit) corresponding to contents belonging to a cluster, or the frequency of the number of times a cluster is browsed. Such a predetermined condition can be set by a user operation. Thus, cluster maps with higher precedence can be overlaid at the upper side, and it is possible to prevent part of the cluster maps with higher precedence from being hidden, and quickly grasp their details.

[0331] In this regard, a cluster map is a map related to a location where contents belonging to the corresponding cluster are generated. Therefore, even when latitudes and longitudes on a background map do not completely match latitudes and longitudes on cluster maps, it is possible to grasp the geographical relationship between individual cluster maps. As described above, although it is not necessary to match latitudes and longitudes on a background map with latitudes and longitudes on cluster maps, if the cluster maps are spaced too far apart, it may become no longer possible to recognize where on the background map the cluster maps correspond to in the first place. Accordingly, it is important to minimize overlaps while still allowing the geographical correspondence to be recognized.

[0332] Here, the second embodiment of the present invention is directed to a case in which in order to satisfy the criteria (1) and (2) mentioned above, on a map with a scale specified by a user operation, the coordinates of the center positions of cluster maps associated with a highly concentrated region are transformed. For example, in the related art, there exists a fisheye coordinate transformation method for displaying coordinates within a predetermined area around a focus area in magnified view in the manner of a fisheye lens. For example, a fisheye coordinate transformation method ("Graphical Fisheye Views of Graphs", Manojit Sarkar and Marc H. Brown, Mar. 17, 1992) has been proposed. The second embodiment of the present invention is directed to a case in which this fisheye coordinate transformation method is applied to a scattering technique for a concentrated region. Specifically, a description will be given of a case in which the placement positions of individual cluster maps on a map which satisfy the criteria (1) and (2) mentioned above are determined by a non-linear zoom process to which the fisheye coordinate transformation method is applied.

[0333] For example, suppose a case in which when marks (for example, cluster maps) having a predetermined surface area are displayed in an overlaid manner within a background image (for example, a background map), the fisheye coordinate transformation method alone is applied independently with respect to each such mark. In this case, the background map covering a predetermined range around a focus area of the mark (for example, the center position of the mark) is magnified. However, since the entire mark also undergoes coordinate transformation simultaneously with this magnification, areas close to the focus area of the mark are magnified, whereas areas far from the focus area are shrunk. In this way, when the fisheye coordinate transformation method alone is applied independently, the background image covering a predetermined range around the focus area is magnified, and also the entire mark undergoes coordinate transformation, with the result that the mark itself is distorted. In contrast, in the second embodiment of the present invention, coordinate transformation is performed only with respect to the focus area of a mark (for example, the center position of the mark), thereby making it possible to appropriately scatter individual marks in accordance with distances from the focus area, without deforming (magnifying/shrinking) the background image and the marks.

[Example of Display Transition by Fisheye Coordinate Transformation]

[0334] FIGS. **36** and **37** are diagrams each schematically showing the relationship between a background map and a cluster map displayed on the display section **680** according to the second embodiment of the present invention. This example schematically illustrates the relationship between a background map and a cluster map in the case when the cluster map is displayed in an overlaid manner at its corresponding position on the background map.

[0335] FIG. **36** shows a case in which a circle **764** representing the size of a cluster map is overlaid on a map **763** of the Kanto region centered about Tokyo. This cluster map is a map corresponding to a cluster to which a plurality of contents generated in the neighborhood of Tokyo belong.

[0336] FIG. **37** shows a case in which by applying the fisheye coordinate transformation method described above, coordinates are distorted with the center of the cluster map **764** as a focus, with respect to points arranged in a grid shown in FIG. **36**. That is, a case is illustrated in which with the center position of the cluster map **764** as a focus, coordinates around the center position of the cluster map **764** (coordinates within a transformation target area **765** indicated by a rectangle) are distorted.

[0337] This fisheye coordinate transformation method is a coordinate transformation method which performs coordinate transformation in such a way that the rate of distortion of coordinates becomes greater with increasing proximity to the focus. Also, the coordinates of the cluster map **764** itself do not change because the center position of the cluster map **764** is taken as the focus. In the following, a description will be given in detail of a non-linear zoom process which performs coordinate transformation through application of this fisheye coordinate transformation method.

[Example of Non-Linear Zoom Process]

[0338] FIG. **38** is a diagram schematically showing a case in which cluster maps subject to a non-linear zoom process by the non-linear zoom processing section **640** are placed on coordinates according to the second embodiment of the present invention. In the example shown in FIG. **38**, the upper left corner on the background map to be displayed on the display section **680** is taken as an origin, the horizontal direction is taken along the x-axis, and the vertical direction is taken along the y-axis. It should be noted that for the ease of explanation, grid-like points (points where two dotted lines intersect) on the xy coordinates each indicate a coordinate transformation by a non-linear zoom process in a simplified manner. Also, this example will be described while supposing that the center positions of cluster maps **711** to **714** are placed at the grid-like points. It should be noted that in FIGS. **38** and **39**, as the cluster maps **711** to **714**, only circles corresponding to these cluster maps are schematically shown.

[0339] FIG. **39** is a diagram schematically showing a coordinate transformation process by the non-linear zoom processing section **640** according to the second embodiment of the present invention. In the example shown in FIG. **39**, arrows and the like indicating a transformation target area and the relationship between cluster maps are added to the xy coordinates shown in FIG. **38**. Also, the example shown in FIG. **39** illustrates a coordinate transformation method for each cluster map in the case where the center position of the cluster map **710** is taken as a focus P**1**(x_{P1}, y_{P1}), and an area within a predetermined range from this focus is taken as a transformation target area **720**.

[0340] Here, the transformation target area **720** is a square whose center is located at the focus and which has a side equal to 2α times the radius r of each cluster map. For example, α can be set as α=3. Also, let a parameter d be a parameter that determines the extent to which the transformation target area **720** is stretched. For example, the larger the value of the parameter d, the greater the degree of stretching. For example, the parameter d can be set as d=1.5.

[0341] Here, let the vector from the focus P**1** to a point as a transformation target (transformation target point) Ei(x_{Ei}, y_{Ei}) be DNi(x_{DNi}, y_{DNi}). Also, let the vector determined in accordance with the position of the transformation target point Ei(x_{Ei}, y_{Ei}) (vector from the focus P**1** to the boundary of the transformation target area **720**) be DMi(x_{DMi}, y_{DMi}). Here, in FIG. **39**, if the transformation target point Ei is located to the upper right with reference to the focus P**1**, a vector pointing toward the upper right vertex of the boundary of the transformation target area **720** from the focus P**1** is taken as DMi (for example, DM**1** shown in FIG. **39**). Also, if the transformation target point Ei is located to the lower right with reference to the focus P**1**, a vector pointing toward the lower right vertex of the boundary of the transformation target area **720** from the focus P**1** is taken as DMi. Further, if the transformation target point Ei is located to the upper left with reference to the focus P**1**, a vector pointing toward the upper left vertex of the boundary of the transformation target area **720** from the focus P**1** is taken as DMi. Also, if the transformation target point Ei is located to the lower left with reference to the focus P**1**, a vector pointing toward the lower left vertex of the boundary of the transformation target area **720** from the focus P**1** is taken as DMi (for example, DM**2** shown in FIG. **39**). It should be noted that in the example shown in FIG. **39**, the cluster maps **711** to **713** are targets for which to compute transformed coordinates with respect to the focus P**1**.

[0342] Here, g(x)=(d+1)x/(dx+1). In this equation, x denotes a variable. In this case, coordinates PE(x_{PE}, y_{PE}) obtained after applying coordinate transformation using the fisheye coordinate transformation method to the transformation target point Ei with respect to the focus P**1** can be found by equation (11) below.

$$PE(x_{PE},y_{PE})=(g(x_{DNi}/x_{DMi})x_{DMi}+x_{P1},g(y_{DNi}/y_{DMi})y_{DMi}+y_{P1}) \quad (11)$$

[0343] In this way, by using the fisheye coordinate transformation method described above, the coordinates of the points arranged in a grid as shown in FIG. **36** can be distorted as shown in FIG. **37** with the cluster map **764** taken as the center.

[0344] In the case where a plurality of cluster maps exist in the transformation target area as shown in FIGS. **38** and **39**, a transformation based on each of these cluster maps affects the other cluster maps. That is, coordinate transformations based on a plurality of cluster maps affect each other.

[0345] For this reason, in the second embodiment of the present invention, in the case when the center coordinates of a given cluster map are taken as a focus, the coordinates obtained after coordinate transformations of the other cluster maps that exist in the transformation target area with respect to this focus are calculated for each of cluster maps. Then, by using the coordinates calculated for each of cluster maps, the coordinates of each individual cluster map are calculated anew.

[0346] Specifically, the non-linear zoom processing section **640** selects a cluster map i (0≦i≦N−1: N is the number of cluster maps). Then, with the center coordinates of the cluster map i taken as a focus, the non-linear zoom processing section **640** calculates coordinates PEij with respect to another cluster map j (i≠j, and 0≦j≦N−1: N is the number of cluster maps) by using equation (11). Here, as for the coordinates PEij, only the coordinates PEij for another cluster map j that exists in the transformation target area with respect to the focus (the center coordinates of the cluster map i) are calculated. That is, the coordinates PEij for the cluster map j that does not exist within the transformation target area are not calculated. In this way, the coordinates PEij are sequentially calculated by using equation (11) with respect to N cluster maps.

[0347] Subsequently, when calculation of the coordinates PEij with respect to the N cluster maps is finished, the non-linear zoom processing section **640** calculates the mean of the individual coordinates PEij, as transformed coordinates with respect to the cluster map i. Specifically, the non-linear zoom processing section **640** calculates the mean value of the individual coordinates PEij (i≠j, and 0≦j≦N−1: N is the number of cluster maps). Then, the non-linear zoom processing section **640** sets the calculated mean value as the transformed coordinates of the cluster map i.

[0348] For example, in the example shown in FIG. **39**, the cluster map **710** is selected as the cluster map i (i=0). Then, with the center coordinates of the cluster map **710** taken as a focus, the respective coordinates PE**01** and PE**02** of the cluster maps **711** and **712** (j=1 to 3) with respect to the cluster map **710** are calculated by using equation (11). It should be noted that since the center coordinates of the cluster map **713** do not exist within the transformation target area **720**, its coordinates PE**03** are not calculated. Likewise, the cluster map **711** is selected as the cluster map i (i=0). Then, with the center coordinates of the cluster map **711** taken as a focus, the coordinates PE**10** of the cluster map **710** (j=0, 2, 3) with respect to the cluster map **711** are calculated by using equation (11). It should be noted that since the center coordinates of the cluster maps **712** and **713** do not exist within the transformation target area with respect to the focus (the center coordinates of the cluster map **711**), their coordinates PE**12** and PE**13** are not calculated. Thereafter, likewise, the cluster maps **712** and then **713** are each sequentially selected as the cluster map i (i=2, 3), and with the center coordinates of the selected cluster map taken as a focus, the respective coordinates PEij of the other cluster maps with respect to the selected cluster map are calculated.

[0349] Subsequently, by using the respective coordinates PEij calculated with respect to the four cluster maps, the non-linear zoom processing section **640** calculates the mean of transformed coordinates with respect to the cluster map i (i=1 to 3). For example, in the case of the cluster map **710** (i=0), the non-linear zoom processing section **640** calculates the mean value of the coordinates PE**10** and PE**20**. That is, the mean value TM**1** of the coordinates PE**10** and PE**20** is calculated by the following equation.

$$TM1=(PE10+PE20)/2$$

[0350] As described above, transformed coordinates PEij are calculated only for cluster maps whose center coordinates exist within the transformation target area with respect to a cluster map selected as a focus. Therefore, the denominator on the right side of this equation is the number of cluster maps for which the transformed coordinates PEij have been calculated. That is, coordinates PE**30** are not calculated with respect to the cluster map **710** (i=0). Therefore, when calculating the mean value TM**1** of the coordinates PE**10** and PE**20**, not "3" but "2" is used as the denominator on the right side of the corresponding equation. Then, the non-linear zoom processing section **640** sets the calculated mean value as the transformed center coordinates of the cluster map **710**.

[0351] In this way, cluster maps can be placed on the basis of the calculated center coordinates of the cluster maps. FIG. **40** shows an example of the placement of cluster maps after coordinate transformation.

[0352] FIG. **40** is a diagram schematically showing a case in which cluster maps that have been coordinate-transformed by the non-linear zoom processing section **640** are placed on coordinates according to the second embodiment of the present invention. The example shown in FIG. **40** illustrates a case in which cluster maps obtained by performing coordinate transformation with respect to the example shown in FIG. **35** are placed. That is, the individual cluster maps belonging to the cluster map groups **761** and **762** shown in FIG. **35** can be placed in such a way that these cluster maps are scattered apart from each other, thereby forming new cluster map groups **771** and **772**. Inside near-rectangles **773** and **774**, grid-like straight lines after coordinate transformation obtained when coordinates are distorted by a non-linear zoom process are shown in a simplified fashion.

[0353] In the case when, for example, as shown in FIG. **35**, cluster maps generated on the basis of contents generated intensively in the neighborhood of Tokyo are placed at positions on a map corresponding to their center positions, there is a possibility that the cluster maps placed in the neighborhood of Tokyo are displayed in an overlaid manner. The same is conceivable for contents generated intensively in the neighborhood of Kyoto. When cluster maps are displayed in an overlaid manner in this way, although the cluster maps overlaid at the upper side are entirely visible, for cluster maps overlaid at the lower side, part or the entirety of the cluster maps is not visible. Accordingly, by placing cluster maps in the manner as shown in FIG. **40**, for example, cluster maps displayed in an overlaid manner can be scattered apart from each other. Therefore, even those cluster maps which are not visible in their entirety become partially visible, thereby making it possible to recognize cluster maps placed on the map.

[Example of Display of Map View]

[0354] FIG. **41** is a diagram showing an example of a map view screen displayed on the display section **680** according to the second embodiment of the present invention. A map view screen **780** shown in FIG. **41** is a display screen that displays a map in which cluster maps coordinate-transformed by a non-linear zoom process are placed. It should be noted that FIG. **41** shows an example of display in the case where the cluster maps shown in FIG. **40** coordinate-transformed by a non-linear zoom process are placed on a map **770**. That is, the cluster map groups **771** and **772** shown in FIG. **41** are the same as those shown in FIG. **40**. Thus, the cluster maps **771** and **772** are denoted by the same reference numerals, and their description is omitted.

[0355] The map view screen **780** includes a scale-changing bar **781**. By operating the scale-changing bar **781**, the user can change the scale of a map displayed on the map view screen **780**. When the scale of a map is changed in this way, every time the scale of a map is changed, the above-described non-linear zoom process is performed, and placement of map clusters is changed.

[0356] Also, when a desired cluster map is selected by a user operation from among cluster maps displayed on the map view screen **780**, a listing of contents belonging to the selected cluster map is displayed in a content listing display area **782**. FIG. **41** shows an example of display of a listing of contents in the content listing display area **782** in the case when a cluster map **784** is selected. Also, in an area **783** connecting between the selected cluster map **784** and the content listing display area **782**, various kinds of information related to the contents belonging to the selected cluster map **784** are displayed. For example, as the various kinds of information related to the contents belonging to the selected cluster map **784**, the number of contents "170" is displayed.

[0357] Also, in the cluster map groups **771** and **772**, the display control section **670** overlays cluster maps with higher precedence at the upper side for display, on the basis of pieces of information stored in the content storing section **210** or the cluster information storing section **240**.

[0358] By placing cluster maps on the map in this way for display, overlapping cluster maps are spread out in accordance with a predetermined condition. Therefore, the geo-

graphical correspondence between contents can be intuitively grasped, and a listing screen that is easy for the user to view can be provided.

[0359] Also, the display control section **670** may display a background image while changing its display state on the basis of the straight lines corresponding to coordinates shown in FIG. **40**. For example, by changing color in accordance with the size of distortion in each of the near-rectangles **773** and **774**, a content density map can be displayed. For example, it is supposed that in regions where cluster maps are densely packed, the size of each cluster is small. Therefore, by changing display color in accordance with the size of distortion, the relative sizes of clusters can be expressed smoothly substantially in the manner of contour lines on a map. This makes it possible to provide the user with additional information related to contents and clusters.

[Example of Force-Directed Relocation Process]

[0360] Next, a description will be given of a case in which a listing of cluster maps is displayed so that the geographical correspondence between the cluster maps can be intuitively grasped.

[0361] FIG. **42** is a diagram schematically showing cluster maps that are subject to a force-directed relocation process by the relocation processing section **650** according to the second embodiment of the present invention.

[0362] In this force-directed relocation process, processing is performed to achieve the criteria (4) to (6) below.

[0363] (4) The positional relationship between cluster maps is to be maintained.

[0364] (5) Cluster maps are not to overlap each other.

[0365] (6) There is to be no unnecessary gap between cluster maps.

[0366] FIG. **42** shows a case in which four cluster maps **730** to **733** that have been coordinate-transformed by a non-linear zoom process are placed on their corresponding coordinates. Here, in the second embodiment of the present invention, it is assumed that each of the cluster maps receives from each of the other cluster maps a force acting to cause these cluster maps to repel from each other, in accordance with the distance between the center positions of the corresponding cluster maps. In the description of this example, the force acting to cause cluster maps to repel from each other will be referred to as "repulsive force". Here, a repulsive force means a force acting to cause two objects to repel from each other. The repulsive force according to the second embodiment of the present invention becomes greater as the distance between the center positions of the corresponding clusters becomes shorter.

[0367] The relocation processing section **650** finds a repulsive force vector F_{ij} exerted on a cluster map i ($0 \leqq i \leqq N-1$: N is the number of cluster maps) from another cluster map j ($i \neq j$, and $0 \leqq j \leqq N-1$: N is the number of cluster maps) by equation (12) below.

$$F_{ij}=K\times K/D_{ij} \tag{12}$$

[0368] Here, D_{ij} is a vector from the center position of the cluster map j to the center position of the cluster map i. Also, K is a parameter identified by the size of the display screen and the number of cluster maps, and can be found by equation (13) below.

$$K=\sqrt{(DW1\times DH1/N)} \tag{13}$$

[0369] Here, DW**1** is the length in the left-right direction of the display screen of the display section **680** (the width of the display screen), and DH**1** is the length in the top-bottom direction of the display screen of the display section **680** (the height of the display screen). Also, N is the number of cluster maps. It should be noted that the width and height of the display screen correspond to the number of pixels in the display screen. When the display area of cluster maps on the display screen is to be magnified or shrunk, the values of DW**1** and DH**1** are changed as appropriate in accordance with the size of the display area.

[0370] Then, by using equation (12), the relocation processing section **650** calculates the repulsive force vectors F_{ij} with respect to the cluster map i, for all the other cluster maps. That is, repulsive force vectors F_{i1} to F_{iN} (where $i \neq 1$, N) with respect to the cluster map i are calculated.

[0371] Then, after finishing calculation of the repulsive force vectors F_{i1} to F_{iN} with respect to all cluster maps, the relocation processing section **650** calculates the mean of the repulsive force vectors F_{ij} with respect to the cluster map i (repulsive force vector F_i). The mean of the repulsive force vectors F_{ij} (repulsive force vector F_i) is a value indicating a repulsive force supposed to be exerted on the cluster map i from each of the other cluster maps.

[0372] Subsequently, the relocation processing section **650** performs coordinate transformation on the cluster map i by using the repulsive force vector F_i. Specifically, the absolute value $|F_i|$ of the repulsive force vector F_i is compared with the parameter K, and coordinate transformation is performed on the cluster map i on the basis of this comparison result. For example, if $|F_i|$ is equal to or smaller than the parameter K (that is, if $|F_i| \leqq K$), coordinate transformation is performed so as to move the coordinates of the center position of the cluster map i by the repulsive force vector F_i. On the other hand, if $|F_i|$ is larger than the parameter K (that is, if $|F_i| > K$), coordinate transformation is performed so as to move the coordinates of the center position of the cluster map i by the distance of K in the direction of the repulsive force vector F_i. That is, coordinate transformation is performed so as to move the coordinates by a vector $K(F_i/|F_i|)$. Here, the parameter K is scalar. Therefore, by multiplying the unit vector of the repulsive force vector F_i by K so that the direction becomes the same as the repulsive force vector F_i, the amount of movement (vector $K(F_i/|F_i|)$ is determined.

[0373] In this way, the relocation processing section **650** performs a coordinate transformation process using a repulsive force vector with respect to each of cluster maps. That is, until coordinate transformation using a repulsive force vector is performed with respect to all of cluster maps, the relocation processing section **650** sequentially selects a cluster map on which a coordinate transformation process has not been performed, and repetitively performs the above-described coordinate transformation process.

[0374] Then, if coordinate transformation using a repulsive force vector has been performed with respect to all of cluster maps, it is judged whether or not the repulsive force vectors $|F_i|$ ($0 \leqq i \leqq N-1$: N is the number of cluster maps) calculated with respect to individual cluster maps are less than a threshold th**11**. If all the repulsive force vectors $|F_i|$ are less than the threshold th**11**, the coordinate transformation process is ended.

[0375] If any one of the repulsive force vectors $|F_i|$ is equal to or greater than the threshold th**11**, the coordinate transfor-

mation process is repeated until all the repulsive force vectors $|F_i|$ become less than the threshold th**11**.

[0376] Here, for example, if the threshold th**11** is set to a relatively large value (for example, th**11**>1), the iteration count becomes small, and thus the computation time becomes short. Also, since the relocation process is discontinued midway, the probability of overlapping of cluster maps becomes higher.

[0377] On the other hand, for example, if the threshold th**11** is set to a relatively small value (for example, th**11**<1), the iteration count becomes large, and thus the computation time becomes long. Also, due to the larger number of iterations, the probability of overlapping of cluster maps becomes lower.

[0378] For example, the threshold th**11** can be set as th**11**=1. If the threshold th**11** is set as th**11**=1 in this way, a plurality of cluster maps can be displayed with substantially no overlap. Also, for example, if the threshold th**11** is set as th**11**=0, by appropriately determining the size of each cluster map with respect to the display area on the display screen, a plurality of cluster maps can be displayed with no overlap without fail. In this regard, for example, since cluster maps have a circular shape, a gap occurs between the cluster maps. Also, in this example, relocation is performed so as to maintain the positional relationship between cluster maps. Thus, it is necessary to make the total surface area occupied by the cluster maps to be displayed smaller than the display area. For this reason, it is necessary to set an appropriate cluster map size. It should be noted that a description regarding a cluster map size will be described later in detail with reference to FIGS. **43**A and **43**B.

[0379] It should be noted that while the threshold th**11** is used in this example as the criterion for judging whether or not to repeat a coordinate transformation process, this may be judged on the basis of whether or not another criterion is satisfied. For example, whether or not "$|F_i|$<th**11**" and "iteration count <upper limit count" are satisfied with respect to all repulsive force vectors F_i may serve as the criterion for judging whether or not to repeat a coordinate transformation process. This iteration count is a count indicating how many times a loop based on this conditional expression has been passed.

[0380] Now, a description will be given of a case in which, as shown in FIG. **42**, a force-directed relocation process is performed with respect to the four cluster maps **730** to **733** that have been coordinate-transformed by a coordinate transformation process.

[0381] The relocation processing section **650** calculates repulsive force vectors F_{01}, F_{02}, and F_{03} with respect to the cluster map **730** by using equation (12). It should be noted that the repulsive force vector F_{01} is a repulsive force vector on the cluster map **730** with respect to the cluster map **731**. Also, the repulsive force vector F_{02} is a repulsive force vector on the cluster map **730** with respect to the cluster map **732**, and the repulsive force vector F_{03} is a repulsive force vector on the cluster map **730** with respect to the cluster map **733**.

[0382] Then, upon finishing calculation of the repulsive force vectors F_{01}, F_{02}, and F_{03} with respect to the cluster map **730**, the relocation processing section **650** calculates the mean (repulsive force vector F_0) of the repulsive force vectors F_{01}, F_{02}, and F_{03}.

[0383] Subsequently, the relocation processing section **650** performs coordinate transformation on the cluster map **730** by using the repulsive force vector F_0. Specifically, if $|F_0|$ is equal to or smaller than the parameter K, coordinate transformation is performed so as to move the coordinates of the center position of the cluster map **730** by the repulsive force vector F_0. On the other hand, if $|F_0|$ is larger than the parameter K, coordinate transformation is performed so as to move the coordinates of the center position of the cluster map **730** by the distance of K in the direction of the repulsive force vector F_0.

[0384] Thereafter, likewise, the coordinate transformation process using a repulsive force vector is repetitively performed for the cluster maps **731** to **733**. For example, let the repulsive force vector calculated with respect to the cluster map **731** be a repulsive force vector F_1, the repulsive force vector calculated with respect to the cluster map **733** be a repulsive force vector F_2, and the repulsive force vector calculated with respect to the cluster map **733** be a repulsive force vector F_3.

[0385] Subsequently, when coordinate transformation using a repulsive force vector has been performed with respect to all of the cluster maps **730** to **733**, it is judged whether or not all of the repulsive force vectors calculated with respect to the respective cluster maps **730** to **733** are smaller than the threshold th**11**. That is, it is judged whether or not all of $|F_0|$, $|F_1|$, $|F_2|$, and $|F_3|$ are smaller than the threshold th**11**. If all of $|F_0|$, $|F_1|$, $|F_2|$, and $|F_3|$ are smaller than the threshold th**11**, the coordinate transformation process is ended.

[0386] If any one of $|F_0|$, $|F_1|$, $|F_2|$, and $|F_3|$ is equal to or larger than the threshold th**11**, the coordinate transformation process is repeated until all of $|F_0|$, $|F_1|$, $|F_2|$, and $|F_3|$ become smaller than the threshold th**11**.

[Example of Magnification/Shrinkage Process]

[0387] FIGS. **43**A and **43**B are diagrams schematically showing cluster maps that are subject to a magnification/shrinkage process by the magnification/shrinkage processing section **660** according to the second embodiment of the present invention.

[0388] In this magnification/shrinkage process, processing is performed to achieve criteria (7) and (8) below.

[0389] (7) All cluster maps are to fit within a single screen.

[0390] (8) There is to be no unnecessary gap between cluster maps.

[0391] FIGS. **43**A and **43**B show a case in which 22 cluster maps (#**1** to #**22**) that have been coordinate-transformed by a force-directed relocation process are corrected in accordance with the size of the display screen on the display section **680**. Also, in FIGS. **43**A and **43**B, for the 22 cluster maps (#**1** to #**22**), pieces of identification information (#**1** to #**22**) corresponding to the respective cluster maps are shown attached inside the circles representing the respective cluster maps.

[0392] FIG. **43**A shows 22 cluster maps (#**1** to #**22**) coordinate-transformed by the relocation processing section **650**, and a rectangle **740** corresponding to the coordinates of these cluster maps (#**1** to #**22**) to be transformed. The rectangle **740** is a rectangle corresponding to the coordinates in the case when the 22 cluster maps (#**1** to #**22**) are coordinate-transformed by the relocation processing section **650**. In FIG. **43**A, the size of the rectangle **740** is CW**1**×CH**1**. Here, CW**1** is the length in the left-right direction of the rectangle **740**, and CH**1** is the length in the top-bottom direction of the rectangle **740**.

[0393] In FIG. **43**A, a rectangle having a size corresponding to the display screen of the display section **680** is indicated by a dotted rectangle **750**, and the size of the rectangle **750** is set as DW**1**×DH**1**. It should be noted that DW**1** and DH**1** are

the same as those indicated in equation (13). That is, DW**1** is the width of the display screen of the display section **680**, and DH**1** is the height of the display screen of the display section **680**.

[0394] Here, if relocation is performed with respect to the cluster maps (#**1** to #**22**) by a force-directed relocation process as shown in FIG. **42**, it is supposed that gaps occur between individual cluster maps. Also, in the case when relocation is performed in this way, it is supposed that the rectangle including the 22 cluster maps (#**1** to #**22**) becomes large in comparison to the size of the display screen on the display section **680**. Accordingly, a magnification process or a shrinkage process is performed so as to satisfy the criteria (7) and (8) described above. In the example shown in FIG. **43**A, since gaps are present between the cluster maps (#**1** to #**22**), for example, the coordinates of the respective cluster maps (#**1** to #**22**) can be corrected as indicated by arrows **741** to **744**. In this coordinate transformation, only the center coordinates of the cluster maps are transformed, and the size of the cluster maps is not changed. By correcting the coordinates so that the rectangle **740** fits in the rectangle **750** in this way, appropriate correction can be performed.

[0395] Also, for example, with respect to the center coordinates (x, y) of all cluster maps, the coordinates of the respective cluster maps after correction can be found by using xy coordinates with the respective minimum values x**0** and y**0** of x and y coordinates taken as an origin. For example, in FIG. **43**A, with the left-right direction defined as the x axis, and the top-bottom direction defined as the y axis, the respective minimum values x**0** and y**0** of the x and y coordinates are set. For example, the x coordinate of the center position of the cluster map #**1** located at the leftmost end of the rectangle **740** is taken as the minimum value x**0**, and the y coordinate of the center position of the cluster map #**8** located at the uppermost end of the rectangle **740** is taken as the minimum value y**0**. Then, in the xy coordinates whose origin is (x**0**, y**0**), the center coordinates CC**1**(x_{CC1}, y_{CC1}) of individual cluster maps after correction can be found by equation (14) below, with respect to the center coordinates (x, y) of the individual cluster maps. Here, let the radius of each cluster map be R.

$$CC1(x_{CC1},y_{CC1})=((x-x0)\times(DW1-R)/(CW1-R)+R/2,\ (y-y0)\times(DH1-R)/(CH1-R)+R/2) \quad (14)$$

[0396] Here, the transformation performed using equation (14) involves transformation of only the center coordinates CC**1**(x_{CC1}, y_{CC1}) of each cluster map, and does not change the size of each cluster map.

[0397] FIG. **43**B shows 22 cluster maps (#**1** to #**22**) that have been coordinate-transformed by using equation (14), and a display screen **751** of the display section **680** on which these cluster maps (#**1** to #**22**) are displayed. The display screen **751** has the same size as the rectangle **740** shown in FIG. **43**A.

[0398] As shown in FIG. **43**B, by transforming the center coordinates CC**1**(x_{CC1}, y_{CC1}) of individual cluster maps by using equation (14), all the cluster maps can be placed so as to fit in a single screen. Also, since only the center coordinates CC**1**(x_{CC1}, y_{CC1}) of cluster maps are transformed, and the size of the cluster maps is not changed, the cluster maps can be placed in such a way that no unnecessary gaps are present between the cluster maps.

[0399] Here, if the number of cluster maps to be displayed is large, cases can be supposed where not all the cluster maps fit within a single screen. For example, letting the radius of each cluster map be R, and the number of cluster maps to be displayed be N, not all the cluster maps fit within a single screen if equation (15) below does not hold.

$$DW1\times DH1>N\times\pi\times R^2 \quad (15)$$

[0400] Here, the left side of equation (15) represents the surface area of the display screen **751**, and the right side of equation (15) represents the sum of the surface areas of cluster maps to be displayed.

[0401] It should be noted that considering the facts that relocation is determined by taking the positional correspondence into account to some extent in the force-directed relocation process, and that gaps occur between cluster maps having a circular shape, it is necessary to set the value of the right side of equation (15) to a further smaller value.

[0402] In the case when the value of the right side of equation (15) is set to a further smaller value in this way, if equation (15) does not hold, it is supposed that not all the cluster maps fit within a single screen. In this case, for example, to ensure that the cluster maps can fit within a single screen, the cluster maps may be shrunk, and then the above-mentioned three processes (the non-linear zoom process, the force-directed relocation process, and the magnification/shrinkage process) may be performed anew. In this case, it is preferable to set the shrinkage ratio for cluster maps appropriately by taking the size of the display screen **751** and the number of cluster maps into account.

[0403] In this regard, if cluster maps are excessively shrunk, it is supposed that the cluster maps displayed on the display screen **751** become hard to view. For this reason, if the number of cluster maps is relatively large (for example, if the number of cluster maps exceeds a threshold th**12**), the cluster maps may be placed so as to be presented across a plurality of screens to prevent the cluster maps from becoming extremely small. In this case, for example, cluster maps included in the display screens can be displayed by a user's scroll operation.

[0404] When displaying a listing of cluster maps coordinate-transformed through the three processes (the non-linear zoom process, the force-directed relocation process, and the magnification/shrinkage process) described above, for example, a wide-area map corresponding to a cluster map that has been selected can be displayed as a background image. Thus, the location where contents constituting each cluster are generated can be grasped more easily. As this wide-area map, for example, a map with a diameter that is 10 times the diameter of the corresponding cluster map can be used. However, it is supposed that depending on the size of the cluster map selected, this size may not be an appropriate size. Accordingly, in the following, a description will be given of a case in which a wide-area map (cluster wide-area map) corresponding to such maps is generated.

[Example of Wide-Area Map Generation]

[0405] FIGS. **44**A and **44**B are diagrams schematically showing a background map generation process by the background map generating section **610** according to the second embodiment of the present invention.

[0406] FIG. **44**A shows a cluster map **801** corresponding to cluster information stored in the cluster information storing section **240**. The cluster map **801** is a simplified map corresponding to the region in the vicinity of the Shinagawa station that exists in the Tokyo-prefecture.

[0407] FIG. **44**B shows an example of a map corresponding to map data stored in the map information storing section **220**. A map **802** shown in FIG. **44**B is a simplified map corre-

sponding to the region in the vicinity of the Shinagawa station that exists in the Tokyo-prefecture. It should be noted that in the map **802**, an area **803** corresponding to the cluster map **801** shown in FIG. **44**A is indicated by a dotted circle.

[0408] First, the background map generating section **610** acquires map data from the map information storing section **220**, on the basis of cluster information stored in the cluster information storing section **240**. Then, on the basis of the acquired map data, the background map generating section **610** generates a background map (cluster wide-area map) corresponding to the cluster information.

[0409] For example, as shown in FIG. **44**B, the background map generating section **610** sets an area including the area **803** corresponding to the cluster map **801**, as an extraction area **804** out of maps corresponding to the map data stored in the map information storing section **220**. Then, the background map generating section **610** generates a map included in the extraction area **804** as a background map (cluster wide-area map) corresponding to the cluster map **801**. Here, the extraction area can be set as, for example, a rectangle of a predetermined size centered about the center position of the cluster map. Also, for example, with the radius of the cluster map taken as a reference value, the extraction area can be set as a rectangle whose one side has a length equal to predetermined times of the reference value.

[0410] Here, as described above, the scale of each cluster map varies with the generated position of each content constituting the corresponding cluster. That is, the size of a location corresponding to a cluster map varies from cluster to cluster. For example, when the diameter of a cluster map is relatively large, this means that a map covering a relatively wide area is included, so the general outline of the cluster map is easy to grasp. Therefore, it is considered that when the diameter of a cluster map is relatively large, it is not necessary for the background map corresponding to the cluster map to cover a relatively wide area.

[0411] In contrast, for example, when the diameter of a cluster map is relatively small, this means that only a map covering a relatively narrow area is included, so it is supposed that the general outline of the cluster map is hard to grasp. For this reason, when the diameter of a cluster map is relatively small, it is preferable that the background map corresponding to the cluster map be relatively large with respect to the cluster map.

[0412] Accordingly, for example, the size of an extraction area may be changed in accordance with the diameter of a cluster map. In the following, a description will be given of a case in which the size of an extraction area is changed in accordance with the diameter of a cluster map.

[0413] FIG. **45** is a diagram showing the relationship between the diameter of a cluster wide-area map generated by the background map generating section **610**, and the diameter of a cluster map according to the second embodiment of the present invention.

[0414] In the graph shown in FIG. **45**, the horizontal axis represents the diameter (s) of a cluster map corresponding to cluster information stored in the cluster information storing section **240**, and the vertical axis represents the diameter (w) of a cluster wide-area map generated by the background map generating section **610**.

[0415] Here, for example, let S_0 be the minimum value of the diameter of a cluster map generated by the cluster information generating section **170** (shown in FIG. **1**) according to the first embodiment of the present invention, and let R_0 be the magnification ratio with respect to the diameter of the cluster map when $s=S_0$. In this case, the diameter w of the cluster wide-area map generated by the background map generating section **610** can be found by equation (16) below.

$$w=a(s-2\pi)^2+2\pi \tag{16}$$

[0416] Here, $a=(R_0S_0-2\pi)/(S_0-2\pi)^2$. Also, equation (16) corresponds to a curve **805** of the graph shown in FIG. **45**.

[0417] In this way, the minimum value S_0 of the cluster map generated by the cluster information generating section **170** is set in advance, and the minimum value R_0S_0 of the diameter of the cluster wide-area map corresponding to this minimum value S_0 is set in advance. Then, as the diameter size of the cluster map becomes larger, the magnification ratio per unit of the diameter of the cluster wide-area map with respect to the diameter of the cluster map is decreased. As a result, a more appropriate cluster wide-area map can be generated.

[Example of Display of Scatter View]

[0418] FIGS. **46** and **47** are diagrams each showing an example of a scatter view screen displayed on the display section **680** according to the second embodiment of the present invention. Here, the word scatter means, for example, the state of being scattered, and the scatter view screen means, for example, a screen that displays a listing of cluster maps while scattering the cluster maps apart from each other on the basis of a predetermined rule.

[0419] A scatter view screen **820** shown in FIG. **46** is a display screen that displays a listing of cluster maps coordinate-transformed through the three coordinate transformation processes (the non-linear zoom process, the force-directed relocation process, and the magnification/shrinkage process) described above. On the scatter view screen **820**, the area (background area) other than the display areas of cluster maps can be displayed in a relatively inconspicuous color (for example, black color).

[0420] When a desired cluster map is selected by a user operation from among the listing of cluster maps displayed on the scatter view screen **820**, a background map (cluster wide-area map) corresponding to the selected cluster map is displayed in the background area.

[0421] FIG. **47** shows an example of display of a scatter view screen **822** in the case when a cluster map **821** is selected. As shown in FIG. **47**, a background map (cluster wide-area map) corresponding to the selected cluster map is displayed in the background area.

[0422] Also, a listing of contents belonging to the selected cluster map is displayed in a content listing display area **823**. FIG. **47** shows an example of display of a listing of contents in the content listing display area **823** when the cluster map **821** is selected. It should be noted that since information displayed in the content listing display area **823**, and various kinds of information displayed in an area **824** connecting between the cluster map **821** and the content listing display area **823** are the same as those in the case of the map view screen shown in FIG. **41**, description thereof is omitted here.

[0423] In this way, the scatter view screen can provide a display of a listing of contents which satisfies the criteria (4) to (8) mentioned above. This allows a display of a listing of cluster maps to be viewed by the user while taking the geographical positional relationship into consideration. Since a cluster map is a map obtained by extracting only an area corresponding to a cluster, cases can be supposed where when there are no characteristic place names, geographical fea-

tures, or the like within the cluster map. Accordingly, by displaying a background map (cluster wide-area map) corresponding to a cluster map that has been selected, it becomes easier to grasp which location is indicated by the cluster.

[Example of Display when Plural Cluster Maps are Selected]

[0424] The above description is directed to the case in which one cluster map is selected. Here, suppose a case in which a plurality of cluster maps can be selected simultaneously with a single operation (for example, a multi-tap). For example, when two cluster maps are selected by using two fingers, it is supposed that the respective background maps (cluster wide-area maps) corresponding to the selected cluster maps are different from each other. In this case, a case can be also supposed where one of the background maps does not include the position corresponding to the other selected cluster map. Accordingly, when a plurality of cluster maps are selected, it is preferable to display background maps corresponding to the respective cluster maps selected. Also, when a plurality of cluster maps are selected in this way, it is supposed that the selected cluster maps have different sizes. Accordingly, when a plurality of cluster maps are selected, it is preferable to display the cluster maps at the same scale (or at such scales that allow their relative size comparison) so that the sizes of the selected cluster maps can be grasped intuitively.

[0425] FIGS. **48**A and **48**B are diagrams each showing an example of a scatter view screen displayed on the display section **680** according to the second embodiment of the present invention. This example illustrates an example of display in the case when two cluster maps are selected on the scatter view screen. For example, a case is shown in which a cluster map (cluster map of Italy) **831** to which a cluster generated throughout Italy belongs, and a cluster map (cluster map of the vicinity of the Shinagawa station) **832** to which a cluster generated in the vicinity of the Shinagawa station belongs are selected.

[0426] FIG. **48**A shows an example of display in the case when two cluster maps (the cluster map **831** and the cluster map **832**) are selected. In this example, with the center position of each of the two selected cluster maps (the cluster map **831** and the cluster map **832**) taken as a reference, a background map generated on the basis of this reference is displayed. For example, a background map **833** whose center position is the middle position of the line segment connecting the center positions of the two cluster maps is generated, and the background map **833** is displayed. This background map may be generated sequentially every time a plurality of cluster maps are selected, or may be generated in advance for every combination of cluster maps. Also, for example, a world map may be used as the background map.

[0427] Also, for example, the two selected cluster maps (the cluster map **831** and the cluster map **832**) are displayed at such scales that allow their relative size comparison. For example, with the cluster map **832** of the smaller size taken as a reference, the other cluster map **831** is displayed in magnified form.

[0428] FIG. **48**B shows another example of display in the case when two cluster maps (the cluster map **831** and the cluster map **832**) are selected. In this example, the two selected cluster maps are each set to a scale that allows a relative size comparison, and the display area of the background map is separated for each of the two cluster maps. For example, the background map for the cluster map **831** is displayed in a background map display area **841**, and the background map for the cluster map **832** is displayed in a background map display area **842**. While the background map display areas are divided from each other by an oblique line running from the upper right to the lower left in this example, the background map display areas may be divided from each other by another dividing method. Also, while two cluster maps are selected in these examples, the same applies to the case when three or more cluster maps are selected.

[Example of Display Screen Transition]

[0429] FIG. **49** is a diagram showing an example of transition of the display screen of the display section **680** which is performed by the display control section **670** according to the second embodiment of the present invention. The second embodiment of the present invention is directed to a case in which contents are displayed by three different display screens, a map view screen, a scatter view screen, and a play view screen.

[0430] For example, when an operational input for activating a content playback application is accepted by the operation accepting section **690** in the information processing apparatus **600**, the display control section **670** displays a map view screen **811** on the display section **680**. Also, when the operational input for activating a content playback application is accepted, the coordinate calculating section **630** calculates the coordinates of the center position of each cluster map on the display screen, on the basis of cluster information stored in the cluster information storing section **240**.

[0431] The map view screen **811** is a display screen that displays cluster maps in an overlaid manner on a map, and corresponds to the map view screen **780** shown in FIG. **41**. By performing an operational input with the operation accepting section **690** in the state with the map view screen **811** displayed on the display section **680**, the user can change the scale or latitudes and longitudes of the displayed background map for cluster maps.

[0432] Such an operational input can be made by using, for example, an operating member such as a mouse including two left and right buttons, and a wheel placed between these two buttons. In the following, a description will be given of a case in which a mouse is used as the operating member. For example, a cursor (mouse pointer) that moves with each mouse movement is displayed. The cursor is a mouse pointer used on the screen displayed on the display section **680** to point to an object of instruction or operation.

[0433] For example, by operating the mouse's wheel up and down, the scale of a background map can be changed. Also, by a drag operation on a background map, the latitudes and longitudes of the background map can be changed. This drag operation is, for example, an operation of moving a target image by moving the mouse while keeping on pressing the left-side button of the mouse.

[0434] When a changing operation for changing the scale or latitudes and longitudes of a background map is made by the user in the state with the map view screen **811** displayed on the display section **680** in this way, the coordinate calculating section **630** calculates new coordinates of the corresponding cluster maps in accordance with the changing operation. That is, in accordance with updating of the background map, the corresponding coordinates are calculated and updated.

[0435] A mode switch from the map view screen **811** to the scatter view screen **812** is effected by performing a right click operation in the state with the map view screen **811** displayed

on the display section **680**. Also, a mode switch from the scatter view screen **812** to the map view screen **811** is effected by performing a right click operation in the state with the scatter view screen **812** displayed on the display section **680**. That is, the modes are switched between each other every time a right click operation is done by the user in the state with the map view screen **811** or the scatter view screen **812** displayed on the display section **680**. The scatter view screen **812** is a display screen that displays a listing of cluster maps, and corresponds to, for example, the scatter view screens **820** and **822** respectively shown in FIGS. **46** and **47**.

[0436] In the state with the map view screen **811** or the scatter view screen **812** displayed on the display section **680**, one of cluster maps can be selected by a user's mouse operation. For example, in the state with the map view screen **811** or the scatter view screen **812** displayed on the display section **680**, a cursor is moved over (moused-over) one of cluster maps by a user's mouse operation. By this mouse operation, the moused-over cluster map becomes selected (focused). It should be noted that when, in the state with a cluster map selected, a cursor is moved from the selected cluster map to another display area by a user's mouse operation, the selection is deselected. It should be noted, however, that when a cursor is moved from a selected cluster map to another cluster map, the cluster map to which the cursor has been moved becomes newly selected.

[0437] When a selecting operation is performed in the state with the map view screen **811** or the scatter view screen **812** displayed on the display section **680** in this way, a content listing display area is displayed on the view screen on which the selecting operation has been performed (a content listing display state **813**). This content listing display area is an area that displays a listing of contents belonging to a cluster corresponding to the cluster map being selected. Such an example of display is shown in each of FIGS. **41** and **47**.

[0438] When a left click operation is performed in the state with one of cluster maps selected on the map view screen **811** or the scatter view display screen **812**, a play view screen **816** is displayed. That is, this left click operation corresponds to a determining operation. The play view screen **816** displays a listing of contents belonging to a cluster corresponding to the cluster map on which a determining operation has been made, a content's magnified image, and the like. Also, for example, when a right click operation is performed in the state with the play view screen **816** displayed on the display section **680**, the state returns to the state before the display of the play view screen **816**. That is, this right click operation corresponds to a deselecting operation. An example of display of this play view screen will be described later in detail with reference to FIG. **50**.

[Example of Display of Play View]

[0439] FIG. **50** is a diagram showing an example of a play view screen displayed on the display section **680** according to the second embodiment of the present invention.

[0440] As described above, a play view screen **890** shown in FIG. **50** is a screen that is displayed when a left click operation is performed in the state with one of cluster maps selected on the map view screen or the scatter view screen. Then, on the play view screen **890**, images related to a cluster corresponding to the cluster map on which a determining operation has been made are displayed. For example, a listing of contents belonging to the cluster, a content's magnified image, and the like are displayed.

[0441] The play view screen **890** includes, for example, three display areas, a map display area **891**, a magnified image display area **892**, and a content listing display area **893**. It should be noted that although not shown in FIG. **50**, in the area other than these three display areas, a wide-area map (cluster wide-area map) related to the corresponding cluster can be displayed as a background image. In this case, the wide-area map may be displayed in an inconspicuous color (for example, grey).

[0442] In the map display area **891**, a map related to the corresponding cluster (for example, a magnified map of the cluster map corresponding to the cluster) is displayed. In the example shown in FIG. **50**, a map of the vicinity of the Yokohama Chinatown is displayed. Also, on the map displayed in the map display area **891**, marks indicating the generated positions of contents belonging to the corresponding cluster are displayed. In the example shown in FIG. **50**, inverted triangles (marks **897** to **899** and the like) having a thick-lined contour are displayed as such marks. These marks are plotted while having their placement determined on the basis of the latitudes and longitudes of the corresponding contents. The mark **897** indicating the generated position of the content (the content with a selection box **894** attached) being selected in the content listing display area **893** is displayed in a different manner of display from that of the other marks. For example, the inverted triangle of the mark **897** is an inverted triangle with oblique lines drawn inside, and the inverted triangle of each of the other marks (**898**, **899**, and the like) is an inverted triangle that is painted with white inside.

[0443] In the magnified image display area **892**, an image corresponding to the content (the content with the selection box **894** attached) being selected in the content listing display area **893** is displayed in magnified form.

[0444] In the content listing display area **893**, a listing of contents belonging to the corresponding cluster is displayed as thumbnails. For example, if there is a large number of contents to be listed for display, only some of the contents to be listed for display may be displayed in the content listing display area **893**, and the other contents may be displayed by a scroll operation. For example, the other contents may be scroll displayed by a scroll operation using a left button **895** and a right button **896**. Also, at least one content can be selected from among the listing of contents displayed in the content listing display area **893**. In the example shown in FIG. **50**, the content displayed at the center portion of the content listing display area **893** is selected. The content thus selected is displayed while being attached with the selection box **894** indicating the selected state. This selection box **894** can be in, for example, yellow color. A selecting operation on a content can be made by using a cursor. An image corresponding to the content attached with the selection box **894** in the content listing display area **893** is displayed in magnified form in the magnified image display area **892**. Editing, processing, and the like can be performed on each content by a user operation.

[Example of Operation of Information Processing Apparatus]

[0445] FIG. **51** is a flowchart showing an example of the procedure of a background map generation process by the information processing apparatus **600** according to the second embodiment of the present invention.

[0446] First, the background map generating section **610** acquires cluster information stored in the cluster information storing section **240** (step S**1101**). Subsequently, on the basis of the acquired cluster information, the background map gen-

erating section **610** generates a background map (cluster wide-area map) corresponding to the cluster, and stores the generated background map into the background map information storing section **620** in association with the cluster (step S**1102**). Subsequently, it is judged whether or not generation of a background image (cluster wide-area map) has been finished for every cluster (step S**1103**). If generation of a background image has not been finished for every cluster, the process returns to step S**1101**. On the other hand, if generation of a background image has been finished for every cluster (step S**1103**), the operation of the background map generation process is ended.

[0447] FIG. **52** is a flowchart showing an example of the procedure of a content playback process by the information processing apparatus **600** according to the second embodiment of the present invention.

[0448] First, it is judged whether or not a content playback instructing operation for instructing content playback has been performed (step S**1111**). If a content playback instructing operation has not been performed, monitoring is continuously performed until a content playback instructing operation is performed. If a content playback instructing operation has been performed (step S**1111**), a map view screen is displayed (step S**1112**).

[0449] Subsequently, it is determined whether or not a mode switching operation has been performed (step S**1113**). If a mode switching operation has been performed (step S**1113**), it is determined whether or not a map view screen is displayed (step S**1114**). If a map view screen is not displayed, a map view screen is displayed (step S**1115**). Subsequently, a map view process is performed (step S**1130**), and the process proceeds to step S**1117**. This map view process will be described later in detail with reference to FIG. **53**.

[0450] If a map view screen is displayed (step S**1114**), a scatter view screen is displayed (step S**1116**), a scatter view process is performed (step S**1160**), and the process proceeds to step S**1117**. This scatter view process will be described later in detail with reference to FIG. **55**.

[0451] Subsequently, it is judged whether or not the accepted operation is a mode switching operation (step S**1117**). If the accepted operation is a mode switching operation (step S**1117**), the process returns to step S**1114**. If the accepted operation is not a mode switching operation (step S**1117**), it is judged whether or not the operation is a determining operation on a cluster map (step S**1118**). If the operation is a determining operation on a cluster map (step S**1118**), a play view map is displayed (step S**1119**), and a play view process is performed (step S**1120**). Subsequently, it is determined whether or not a cancelling operation on the play view screen has been performed (step S**1121**). If a cancelling operation on the play view screen has been performed, a screen (a map view screen or scatter view screen) displayed at the time of the determining operation on the current play view screen is displayed (step S**1122**). Subsequently, it is judged whether or not the displayed screen is a map view screen (step S**1123**). If the displayed screen is a map view screen, the process returns to step S**1130**. On the other hand, if the displayed screen is not a map view screen (that is, if the displayed screen is a scatter view screen) (step S**1123**), the process returns to step S**1160**.

[0452] If a cancelling operation on the play view screen has not been performed (step S**1121**), it is judged whether or not a content playback ending operation for instructing the end of content playback has been performed (step S**1124**). If the content playback ending operation has not been performed, the process returns to step S**1120**. On the other hand, if the content playback ending operation has been performed (step S**1124**), the operation of the content playback process is ended.

[0453] FIG. **53** is a flowchart showing an example of the map view process (the procedure of step S**1130** shown in FIG. **52**) of the procedure of the content playback process by the information processing apparatus **600** according to the second embodiment of the present invention.

[0454] First, on the basis of cluster information stored in the cluster information storing section **240**, the display control section **670** acquires map data from the map information storing section **220**, and generates a background map (step S**1131**). Subsequently, the coordinate calculating section **630** calculates the coordinates of cluster maps corresponding to the generated background map (step S**1132**), and the non-linear zoom processing section **640** performs a non-linear zoom process (step S**1150**). This non-linear zoom process will be described later in detail with reference to FIG. **54**.

[0455] Subsequently, the display control section **670** displays the cluster maps while overlaying the cluster maps on the coordinates on the map found by the non-linear zoom process (step S**1133**). It should be noted that step S**1133** is an example of a display control step described in the claims. Subsequently, it is judged whether or not a move/scale-change operation on a map has been performed (step S**1134**). If a move/scale-change operation on a map has been performed (step S**1134**), in accordance with the operation performed, the display control section **670** generates a background map (step S**1135**), and the process returns to step S**1132**. On the other hand, if a move/scale-change operation on a map has not been performed (step S**1134**), it is judged whether or not a selecting operation on a cluster map has been performed (step S**1136**). If a selecting operation on a cluster map has been performed (step S**1136**), the display control section **670** displays a content listing display area on the map view screen (step S**1137**), and the process proceeds to step S**1138**.

[0456] If a selecting operation on a cluster map has not been performed (step S**1136**), it is judged whether or not a deselecting operation on a cluster map has been performed (step S**1138**). If a deselecting operation on a cluster map has been performed (step S**1138**), the display control section **670** erases the content listing display area displayed on the map view screen (step S**1139**), and the process returns to step S**1134**.

[0457] If a deselecting operation on a cluster map has not been performed (step S**1138**), it is judged whether or not a determining operation on a cluster map has been performed (step S**1140**). If a determining operation on a cluster map has been performed (step S**1140**), the operation of the map view process is ended. On the other hand, if a determining operation on a cluster map has not been performed (step S**1140**), it is judged whether or not a mode switching operation has been performed (step S**1141**). If a mode switching operation has been performed (step S**1141**), the operation of the map view process is ended. On the other hand, if a mode switching operation has not been performed (step S**1141**), the process returns to step S**1134**.

[0458] FIG. **54** is a flowchart showing an example of the non-linear zoom process (the procedure of step S**1150** shown in FIG. **53**) of the procedure of the content playback process

by the information processing apparatus **600** according to the second embodiment of the present invention.

[0459] First, the non-linear zoom processing section **640** selects one cluster map from among cluster maps whose coordinates have been calculated by the coordinate calculating section **630**, and sets this cluster map as a cluster map i (step S**1151**). Subsequently, the non-linear zoom processing section **640** sets the coordinates (center position) of the cluster map i as a focus (step S**1152**), and calculates transformed coordinates PEij with respect to every cluster map j existing within a transformation target area (step S**1153**). It should be noted that steps S**1151** to S**1153** are each an example of a transformed coordinate calculating step described in the claims.

[0460] Subsequently, it is judged whether or not calculation of transformed coordinates has been finished with every one of the cluster maps whose coordinates have been calculated by the coordinate calculating section **630** set as a focus (step S**1154**). If calculation of transformed coordinates has not been finished with every cluster map set as a focus (step S**1154**), a cluster map for which the calculation has not been finished is selected, and this cluster map is set as the cluster map i (step S**1151**). On the other hand, if calculation of transformed coordinates has been finished with every one of cluster maps set as a focus (step S**1154**), one cluster map is selected from among the cluster maps for which calculation of the transformed coordinates has been finished, and this cluster map is set as the cluster map i (step S**1155**). Subsequently, the non-linear zoom processing section **640** calculates the mean of the calculated transformed coordinates PEij (step S**1156**), and set the calculated mean as the coordinates of the cluster map i (step S**1157**). It should be noted that steps S**1155** to **1157** are each an example of a coordinate setting step described in the claims.

[0461] Subsequently, it is judged whether or not setting of coordinates has been finished with respect to every one of the cluster maps for which calculation of the transformed coordinates has been finished (step S**1158**). If setting of coordinates has been finished with respect to every cluster map (step S**1158**), a cluster map for which the setting has not been finished is selected, and this cluster map is set as the cluster map i (step S**1155**). On the other hand, if setting of coordinates has been finished with respect to every cluster map (step S**1158**), the operation of the non-linear zoom process is ended.

[0462] FIG. **55** is a flowchart showing an example of the scatter view process (the procedure of step S**1160** shown in FIG. **52**) of the procedure of the content playback process by the information processing apparatus **600** according to the second embodiment of the present invention.

[0463] First, the coordinate calculating section **630** calculates the coordinates of cluster maps on the basis of cluster information stored in the cluster information storing section **240** (step S**1161**). Subsequently, the non-linear zoom processing section **640** performs a non-linear zoom process (step S**1150**). Since this non-linear zoom process is the same as the procedure shown in FIG. **54**, the non-linear zoom process is denoted by the same symbol, and description thereof is omitted here.

[0464] Subsequently, the relocation processing section **650** performs a force-directed relocation process (step S**1170**). This force-directed relocation process will be described later in detail with reference to FIG. **56**.

[0465] Subsequently, the magnification/shrinkage processing section **660** performs coordinate transformation by a magnification/shrinkage process, on the basis of the size of an area subject to coordinate transformation by the relocation process, and the size of the display screen on the display section **680** (step S**1162**).

[0466] Subsequently, the display control section **670** displays the cluster maps while superimposing the cluster maps on coordinates on the map found by the magnification/shrinkage process (step S**1163**). It should be noted that since steps S**1136** to S**1141** are the same as those of the procedure shown in FIG. **53**, these steps are denoted by the same symbols, and description thereof is omitted here.

[0467] FIG. **56** is a flowchart showing an example of the force-directed relocation process (the procedure of step S**1170** shown in FIG. **55**) of the procedure of the content playback process by the information processing apparatus **600** according to the second embodiment of the present invention.

[0468] First, the relocation processing section **650** selects one cluster map from among the cluster maps whose coordinates have been set by the non-linear zoom processing section **640**, and sets this cluster map as a cluster map i (step S**1171**). Subsequently, the relocation processing section **650** calculates all of repulsive force vectors F_{ij} exerted on the cluster map i from cluster maps j (step S**1172**). Subsequently, the relocation processing section calculates the mean of the calculated repulsive force vectors F_{ij} as a repulsive force vector F_i on the cluster map i (step S**1173**).

[0469] Subsequently, it is judged whether or not the absolute value $|F_i|$ of the calculated repulsive force vector F_i is equal to or smaller than K (step S**1174**). If $|F_i|$ is equal to or smaller than K, the process proceeds to step S**1176**. On the other hand, if $|F_i|$ is larger than K (step S**1174**), the relocation processing section **650** substitutes the repulsive force vector F_i by $K(F_i/|F_i|)$ (step S**1175**).

[0470] Subsequently, it is judged whether or not calculation of the repulsive force vector F_i has been finished with respect to every one of the cluster maps whose coordinates have been set by the non-linear zoom processing section **640** (step S**1176**). If calculation of the repulsive force vector F_i has not been finished with respect to every cluster map (step S**1176**), a cluster map for which the calculation has not been finished is selected, and this cluster map is set as the cluster map i (step S**1171**). On the other hand, if calculation of the repulsive force vector F_i has been finished with respect to every cluster map (step S**1176**), a cluster map is selected from among the cluster maps whose coordinates have been set by the non-linear zoom processing section **640**, and this cluster map is set as the cluster map i (step S**1177**). Subsequently, the relocation processing section **650** adds the repulsive force vector F_i to the coordinates of the cluster map i (step S**1178**).

[0471] Subsequently, it is judged whether or not addition of the repulsive force vector F_i has been finished with respect to every one of the cluster maps whose coordinates have been set by the non-linear zoom processing section **640** (step S**1179**). If addition of the repulsive force vector F_i has not been finished with respect to every cluster map (step S**1179**), a cluster map for which the addition has not been finished is selected, and this cluster map is set as the cluster map i (step S**1177**). On the other hand, if addition of the repulsive force vector F_i has been finished with respect to every cluster map (step S**1179**), it is judged whether or not repulsive force vectors $|F_i|$ calculated with respect to individual cluster maps are smaller

than the threshold th**11** (step S**1180**). If all the repulsive force vectors $|F_i|$ are smaller than the threshold th**11** (step S**1180**), the force-directed relocation process is ended. On the other hand, if any one of the repulsive force vectors $|F_i|$ is equal to or larger than the threshold th**11** (step S**1180**), the process returns to step S**1171**, and the force-directed relocation process is repeated (steps S**1171** to S**1179**).

[0472] It should be noted that while the second embodiment of the present invention is directed to the case in which a listing of cluster maps is displayed, the second embodiment of the present invention is also applicable to a case in which a listing of superimposed images other than cluster maps is displayed. For example, the second embodiment of the present invention is also applicable to a case in which icons representing individual songs are placed as superimposed images (for example, a music playback app) on the xy-coordinate system (background image) with the mood of each song taken along the x-axis and the tempo of each song taken along the y-axis. Also, the second embodiment of the present invention is applicable to a case in which short-cut icons or the like superimposed on the wallpaper displayed on a personal computer or the like are placed as superimposed images. For example, a non-linear zoom process can be performed with the superimposed image to be selected taken as the center. Also, a non-linear zoom process can be performed also when a plurality of superimposed images are to be selected.

[0473] Also, for example, in the case when a specific button is to be selected with respect to a group of buttons placed in a predetermined positional relationship, a non-linear zoom process can be performed with the button to be selected taken as the center. Also, a non-linear zoom process can be performed in the case when a plurality of buttons are to be selected. By these processes, overlapping of superimposed images is eliminated, thereby making it possible to provide a user interface that is easy to view and operate for the user.

3. Modifications

[0474] The first embodiment of the present invention is directed to the case of generating binary tree structured data while calculating distances between individual contents and sequentially extracting a pair with the smallest distance. In the following, a description will be given of a case in which binary tree structured data is generated by performing an initial grouping process and a sequential clustering process. By performing this initial clustering process, the number of pieces of data to be processed in tree generation can be reduced. That is, a faster clustering process can be achieved by reducing the number of nodes to be processed. Also, by performing a sequential clustering process, the amount of computation can be reduced as compared with a case in which exhaustive clustering (for example, the tree generation process shown in FIG. **8** and step S**910** of FIG. **28**) is performed, thereby achieving a faster clustering process. Further, a sequential clustering process can be used even in situations where not all pieces of data are available at the beginning. That is, when a new piece of data is added after binary tree structured data is generated by using pieces of data (content) that exist at the beginning, a clustering process can be performed with respect to the new piece of data by using the already-generated binary tree structured data.

[Example of Tree Generation Process]

[0475] FIGS. **57**A to **61**B are diagrams for explaining a tree generation process performed by the tree generating section **120** according to a modification of the first embodiment of the present invention. FIGS. **57**A to **61**B will be described in detail with reference to the flowcharts shown in FIGS. **62** to **66**. Here, an initial grouping process is a process performed before the tree generating section **120** performs a tree generation process, and contributes to faster processing speed. FIG. **57**A shows a case in which contents e to m are placed virtually at positions identified by respective pieces of positional information associated with the contents. That is, FIG. **57**A shows a case in which the contents e to m are placed virtually at their generated positions. Also, the times of shooting identified by respective pieces of date and time information associated with the contents e to m are in the order of the contents e, f, . . . , M.

[0476] FIGS. **62** to **66** are flowcharts each showing an example of the procedure of a clustering process by the information processing apparatus **100** according to a modification of the first embodiment of the present invention.

[0477] FIG. **62** shows an example of the procedure of the clustering process. First, an initial grouping process is performed (step S**920**). This initial grouping process will be described later in detail with reference to FIG. **63**. Subsequently, a tree generation process is performed (step S**940**). This tree generation process will be described later in detail with reference to FIG. **64**. The procedure of this tree generation process is a modification of step S**910** shown in FIG. **28**. It should be noted that the initial grouping process (step S**920**) may be performed before step S**910** (shown in FIG. **28**) according to the first embodiment of the present invention.

[0478] FIG. **63** shows an example of the initial grouping process (the procedure of step S**920** shown in FIG. **62**) of the procedure of the clustering process.

[0479] First, a variable i is initialized (step S**921**), and a content ni is set in a set S (step S**922**). Subsequently, "1" is added to the variable i (step S**923**), and a distance d(head(S), ni) is calculated (step S**924**). Here, head(S) represents the first content along the temporal axis among contents included in the set S. Also, the distance d(head(S), ni) is the distance between head(S) and the content ni.

[0480] Subsequently, it is judged whether or not the calculated distance d(head(S), ni) is smaller than a threshold (INITIAL_GROUPING_DISTANCE) th**20** (step S**925**). If the calculated distance d(head(S), ni) is smaller than the threshold th**20** (step S**925**), the content ni is added to the set S (step S**926**), and the process proceeds to step S**930**. On the other hand, if the calculated distance d(head(S), ni) is equal to or larger than the threshold th**20** (step S**925**), a tree generation process is performed with respect to the contents included in the set S (step S**940**). This tree generation process will be described later in detail with reference to FIG. **64**.

[0481] Subsequently, the results of the tree generation process are held (step S**927**), the contents in the set S are deleted (step S**928**), and the content ni is set in the set S (step S**929**).

[0482] Subsequently, it is judged whether or not the variable i is smaller than N (step S**930**), and if the variable i is smaller than N, the process returns to step S**923**. On the other hand, if the variable i is equal to or larger than N (step S**930**), the held results of the tree generation process are used as nodes to be processed (step S**931**), and the operation of the initial grouping process is ended. In this regard, while individual contents are inputted as elements to be processed in the tree generation process described above with reference to the first embodiment of the present invention, in the case when the initial grouping process is performed, a plurality of nodes

held in step S927 are inputted as elements subject to a tree generation process. That is, nodes inputted as elements subject to a tree generation process (the plurality of nodes held in step S927) serve as the nodes to be processed.

[0483] That is, in the initial grouping process, respective pieces of positional information of the first content and the second content along the temporal axis are acquired, and the distance d between the two contents is calculated on the basis of the acquired pieces of positional information of the two contents. Subsequently, the calculated distance d and the threshold th**20** are compared with each other, and it is judged whether or not the distance d is less than the threshold th**20**. If the distance d is less than the threshold th**20**, the two contents with respect to which the distance d has been calculated are determined as being subject to initial grouping, and these contents are added to the set S.

[0484] Subsequently, respective pieces of positional information of the first content and the third content along the temporal axis are acquired, and the distance d between the two contents is calculated on the basis of the acquired pieces of positional information of the two contents. Subsequently, the calculated distance d and the threshold th**20** are compared with each other, and it is judged whether or not the distance d is less than the threshold th**20**. If the distance d is less than the threshold th**20**, the two contents with respect to which the distance d has been calculated are determined as being subject to initial grouping, and these contents are added to the set S. That is, the first to third contents are set in the set S. Thereafter, likewise, with respect to the N-th (N is an integer not smaller than 2) content, addition of the corresponding content to the set S is performed until the distance d becomes larger than the threshold th**20**. On the other hand, when the distance d becomes equal to or larger than the threshold th**20**, the N-th content with respect to which this distance d has been calculated is determined as not being subject to initial grouping. That is, at the point in time when the distance d becomes equal to or larger than the threshold th**20**, contents up to the content ((N−1)-th content) immediately preceding the N-th content with respect to which this distance d has been calculated become subject to initial grouping. That is, a grouping is interrupted at the N-th content. Then, by taking the N-th content where a grouping is interrupted as the first content along the temporal axis, with respect to the (N+1)-th content (N is an integer not smaller than 2), addition of the corresponding content to a new set S is performed until the distance d becomes larger than the threshold th**20**.

[0485] For example, suppose that in the example shown in FIG. **57**A, respective distances between contents e and f, e and g, f and g, i and j, and h and m are less than the threshold th**20**, and distances between the other contents are equal to or larger than the threshold th**20**. Also, in FIG. **57**A, each two contents to be compared are depicted as being connected by a dotted arrow. If the distance between contents is less than the threshold th**20**, a circle (○) is attached on the corresponding arrow, and if the distance between contents is equal to or larger than the threshold th**20**, an X (×) is attached on the corresponding arrow.

[0486] In the example shown in FIG. **57**A, contents from the first content e to the content g to be compared with each other are subject to initial grouping, and set in the set S. Subsequently, by taking the content i where a grouping is interrupted as the first content, the contents i and j become subject to initial grouping, and are set in a new set S. While the initial grouping process is thereafter performed in a similar way, since the distances between contents are equal to or larger than the threshold th**20**, no grouping is performed. It should be noted that although the distance between contents h and m is less than the threshold th**20**, since contents where a grouping is interrupted exist between the contents h and m, and the contents h and m are thus not compared with each other, the contents h and m do not become subject to initial grouping. An example of grouping in the case when initial grouping is performed in this way is shown in FIG. **57**B. Also, respective contents that have undergone initial grouping are depicted as being bounded by circles **531** to **533**.

[0487] FIG. **64** shows an example of the tree generation process (the procedure of step S**940** shown in FIG. **62**) of the procedure of the clustering process.

[0488] First, a node insertion process is performed (step S**950**). This node insertion process will be described later in detail with reference to FIG. **65**. Subsequently, a tree updating process after node insertion is performed (step S**980**). This tree updating process after node insertion will be described later in detail with reference to FIG. **66**. Subsequently, it is judged whether or not processing of nodes to be processed has been finished (step S**941**). If processing of nodes to be processed has not been finished, the process returns to step S**950**. On the other hand, if processing of nodes to be processed has been finished (step S**941**), the operation of the tree generation process is ended.

[0489] FIG. **65** shows an example of the node insertion process (the procedure of step S**950** shown in FIG. **64**) of the procedure of the tree generation process. In this example, an internal tree is generated by using the results of an initial grouping process as nodes to be processed. Also, for contents that have undergone initial grouping, their root nodes are regarded as contents to be handled in an internal tree. Further, in the generation of an internal tree, insertion of one piece of data to an already-created internal tree at a time is repeated. In the following, child nodes or leaves of each node are denoted by left( ) and right( ) For example, two child nodes of node a are denoted by left(a) and right(a). In this case, let left(a) be the first child of the node a, and right(a) be the second child of the node a. It should be noted that when no initial grouping process is performed, individual contents are inputted as elements to be processed. That is, individual contents are inputted as nodes to be processed.

[0490] First, on the basis of two contents at the beginning, a minimum tree structure is generated with the two contents taken as leaves, and a new node containing the two contents taken as root node a. Then, each of the third and subsequent contents (addition node n) is acquired (step S**951**). That is, a node insertion process is performed with respect to the root node a and the addition node n. FIG. **58**A schematically shows the relationship between the root node a (**501**) and the addition node n (**504**).

[0491] Subsequently, on the basis of the relationship between the root node a and the addition node n, case analysis is performed in accordance with the relationships shown in FIG. **58**B and FIGS. **59**A to **59**H (step S**952**). Specifically, it is judged which one of Cases **0** to **7** shown in FIGS. **58**B and **59**A to **59**H corresponds to the relationship between the child elements (node b (**502**) and node c (**503**)) of the node a (**501**) (the root node in the initial state) with respect to which node addition is performed, and the addition node n (**504**).

[0492] If the relationship between the root node a and the addition node n corresponds to the relationship in Case **4** or **7** shown in FIG. **58**B and FIGS. **59**A to **59**H (step S**953**), the

node b (**502**) and the node c (**503**) are decomposed into their respective child elements (b**1**, b**2**, c**1**, c**2**). It should be noted that b**1**=left(b), b**2**=right(b), c**1**=left(c), and c**2**=right(c). Then, a tree generation process is performed with respect to {b**1**, b**2**, c**1**, c**2**} (step S**954**). This tree generation process is the same as the tree generation process described above with reference to the first embodiment of the present invention, in which with respect to target nodes, a pair with the smallest distance is detected, and a new node having this detected pair of nodes as child elements is sequentially generated. By repeating this tree generation process until the number of target nodes becomes 1, binary tree structured data is generated. Subsequently, the root node of the tree generated by the tree generation process is substituted by the root node a (step S**955**), and the operation of the node insertion process is ended.

[0493] Also, if the relationship between the root node a and the addition node n is the relationship corresponding to any one of Cases **0** to **2**, **5**, and **6** shown in FIG. **58**B and FIGS. **59**A to **59**H (step S**953**), distances between individual nodes are calculated. That is, distances d(b, n), d(c, n), and d(b, c) are calculated. It should be noted that the distance d(b, n) means the distance between the node b and the node n. Subsequently, a pair of nodes with the smallest distance is extracted from among the calculated distances between individual nodes (steps S**957** and S**961**), and as shown in FIGS. **60**A to **60**C, processing according to each such pair is performed (steps S**958** to **5960**, and S**962** to S**965**).

[0494] Specifically, when the distance d(b, n) is the smallest among the calculated distances between individual nodes (step S**957**), it is judged whether or not the node b is a leaf, or whether or not the radius of the node b is equal to 0 (step S**958**). If the radius of a node is equal to 0, this means that all the child elements exist at the same position. If the node b is not a leaf, and the radius of the node b is not equal to 0 (step S**958**), the node b is substituted by "a", and the process returns to step S**951**. On the other hand, if the node b is a leaf, or the radius of the node b is equal to 0 (step S**958**), a new node m having the nodes b and n as child elements is generated, and the position of the original node b is substituted by the new node m (step S**960**). Then, the node m is substituted by "a" (step S**960**), and the operation of the node insertion process is ended. A schematic of these processes is shown in FIG. **60**B.

[0495] Also, when the distance d(c, n) is the smallest among the calculated distances between individual nodes (step S**961**), by reading "b" in steps S**958** to S**960** described above as "c", the same processes are performed (steps S**962** and S**963**). A schematic of these processes is shown in FIG. **60**C.

[0496] Also, when the distance d(b, c) is the smallest among the calculated distances between individual nodes, the state of the existing tree is held, and a new node m having the nodes a and n as child nodes is generated (step S**965**). Then, the node m is substituted by "a" (step S**965**), and the operation of the node insertion process is ended. A schematic of these processes is shown in FIG. **60**A.

[0497] FIG. **66** shows an example of the tree updating process after node insertion (the procedure of step S**980** shown in FIG. **64**) of the procedure of the tree generation process. This is a process for adjusting the relationship between the node a and other nodes which is affected by an increase in the size of the node a due to node insertion. In this example, S and Sb each denote a set. Also, parent(a) denotes a parent node of the node a. Further, brother(a) denotes a brother (the other child as seen from the parent) of the node a. Also, head(S) denotes the first element of the set S. Also, tmp denotes an element to be held. FIGS. **61**A and **61**B show a schematic of the tree updating process after node insertion. The example shown in FIG. **61**A illustrates the case of {a, b, b**11**, b**12**, b**2**} being subject to clustering. Also, FIG. **61**B shows the relationship between an insertion position **521** and a portion to be restructured **522** in the example shown in FIG. **61**A.

[0498] First, S={a}, Sb={ }, and p=a are set (step S**981**). Subsequently, it is judged whether or not p is a root node (step S**982**). If p is a root node, a tree generation process is performed with respect to elements within S (step S**989**), and the operation of the tree updating process after node insertion is ended. This tree generation process is the same as the process described in step S**954**. On the other hand, if p is not a root node (step S**982**), Sb={brother(p)} is set (step S**983**), and it is judged whether or not head(Sb) and "a" coincide with each other (step S**984**).

[0499] If head(Sb) and "a" coincide with each other (step S**984**), tmp=head(Sb), Sb=Sb−{tmp}, and Sb={left(tmp), right(tmp)}+Sb are set (step S**985**). Subsequently, it is judged whether or not Sb={ } (step S**987**). That is, it is judged whether or not the set Sb is empty. If Sb={ } does not hold, the process returns to step S**984**. On the other hand, if Sb={ } (step S**987**), p=parent(p) is set (step S**988**), and the process returns to step S**982**.

[0500] Also, if head(Sb) and "a" do not coincide with each other (step S**984**), S=S+head(Sb) and Sb=Sb−head(Sb) are set (step S**986**), and the process proceeds to step S**987**.

[0501] It should be noted that while the embodiments of the present invention are directed to the case in which still images are used as contents, for example, the embodiments of the present invention can be also applied to cases where moving image contents are used. For example, in a case where one piece of positional information is assigned to one moving image content, the embodiments of the present invention can be applied in the same manner as in the case of still image contents. Also, in a case where a plurality of pieces of positional information (for example, for every frame or for every predetermined interval of frames) are assigned to one moving image content, by determining one piece of positional information with respect to one moving image content, the embodiments of the present invention can be applied in the same manner as in the case of still image contents. For example, one piece of positional information can be determined with respect to one moving image content by using the start position of shooting of a moving image content, the end position of shooting of a moving image content, the mean of positions assigned to a moving image content, or the like. Also, the embodiments of the present invention can be also applied to contents such as text files and music files with which positional information and date and time information are associated.

[0502] Also, the embodiments of the present invention can be applied to information processing apparatuses capable of handling contents, such as a portable telephone with an image capturing function, a personal computer, a car navigation system, and a portable media player.

[0503] It should be noted that the embodiments of the present invention are illustrative of an example for implementing the present invention, and as explicitly stated in the embodiments of the present invention, there is a mutual correspondence between matters in the embodiments of the present invention, and invention-defining matters in the

claims. Likewise, there is a mutual correspondence between invention-defining matters in the claims, and matters in the embodiments of the present invention which are denoted by the same names as those of the invention-defining matters. It should be noted, however, that the present invention is not limited to the embodiments, and the present invention can be implemented by making various modifications to the embodiments without departing from the scope of the present invention.

[0504] The process steps described above with reference to the embodiments of the present invention may be grasped as a method having a series of these steps, or may be grasped as a program for causing a computer to execute a series of these steps or a recording medium that stores the program. As this recording medium, for example, a CD (Compact Disc), an MD (MiniDisc), a DVD (Digital Versatile Disk), a memory card, a Blur-ray Disc (registered trademark), or the like can be used.

[0505] The present application contains subject matter related to that disclosed in Japanese Precedence Patent Application JP 2009-268661 filed in the Japan Patent Office on Nov. 26, 2009, the entire content of which is hereby incorporated by reference.

[0506] It should be understood by those skilled in the art that various modifications, combinations, sub-combinations and alterations may occur depending on design requirements and other factors insofar as they are within the scope of the appended claims or the equivalents thereof.

What is claimed is:

1. An information processing apparatus comprising:

a transformed-coordinate calculating section that calculates transformed coordinates for each of a plurality of superimposed images associated with coordinates in a background image, by taking one superimposed image of the plurality of superimposed images as a reference image, and transforming coordinates of other superimposed images on the basis of corresponding coordinates of the reference image in the background image, distances in the background image from the reference image to the other superimposed images, and a distance in the background image from the reference image to a boundary within a predetermined area with respect to the reference image, the coordinates of the other superimposed images being transformed in such a way that coordinate intervals within the predetermined area become denser with increasing distance from the reference image toward the boundary within the predetermined area;

a coordinate setting section that sets coordinates of the reference image on the basis of a mean value obtained by calculating a mean of the calculated coordinates of the other superimposed images with respect to the reference image; and

a display control section that displays the background image and the plurality of superimposed images on a display section in such a way that the reference image is placed at the set coordinates in the background image.

2. The information processing apparatus according to claim **1**, further comprising:

a second transformed-coordinate calculating section that calculates transformed coordinates for each of the superimposed images by transforming the set coordinates on the basis of a size of the background image on a display screen of the display section, the number of the superimposed images, and distances between the superimposed images in the background image, the set coordinates being transformed in such a way that the distances between the superimposed images increase under a predetermined condition in accordance with the distances between the superimposed images in the background image,

wherein the display control section displays the background image and the plurality of superimposed images in such a way that the superimposed images are placed at the coordinates in the background image calculated by the second transformed-coordinate calculating section.

3. The information processing apparatus according to claim **2**, further comprising:

a magnification/shrinkage processing section that magnifies or shrinks the coordinates calculated by the second transformed-coordinate calculating section with reference to a specific position on the display screen, on the basis of a coordinate size subject to coordinate transformation by the second transformed-coordinate calculating section, and a size of the background image on the display screen of the display section,

wherein the display control section displays the background image and the plurality of superimposed images in such a way that the superimposed images are placed at the coordinates in the background image magnified or shrunk by the magnification/shrinkage processing section.

4. The information processing apparatus according to claim **1**, wherein:

the background image is an image representing a map; and

the superimposed images are images representing a plurality of contents with each of which positional information indicating a position in the map is associated.

5. The information processing apparatus according to claim **4**, further comprising:

a group setting section that sets a plurality of groups by classifying the plurality of contents on the basis of the positional information; and

a mark generating section that generates marks representing the groups on the basis of the positional information associated with each of contents belonging to the set groups,

wherein the display control section displays a listing of the marks representing the groups as the superimposed images.

6. The information processing apparatus according to claim **5**, wherein the mark generating section generates maps as the marks representing the groups, the maps each corresponding to an area including a position identified by the positional information associated with each of the contents belonging to the set groups.

7. The information processing apparatus according to claim **6**, wherein the mark generating section generates the marks representing the groups by changing a map scale for each of the set groups so that each of the maps becomes an image with a predetermined size.

8. The information processing apparatus according to claim **6**, further comprising:

a background map generating section that generates a background map corresponding to each of the groups at a scale determined in accordance with a scale of each of maps generated as the marks representing the groups; and

the display control section displays, as the background image, the background map generated with respect to a group corresponding to a map selected from among the displayed listing of maps.

9. An information processing method comprising the steps of:

calculating transformed coordinates for each of a plurality of superimposed images associated with coordinates in a background image, by taking one superimposed image of the plurality of superimposed images as a reference image, and transforming coordinates of other superimposed images on the basis of corresponding coordinates of the reference image in the background image, distances in the background image from the reference image to the other superimposed images, and a distance in the background image from the reference image to a boundary within a predetermined area with respect to the reference image, the coordinates of the other superimposed images being transformed in such a way that coordinate intervals within the predetermined area become denser with increasing distance from the reference image toward the boundary within the predetermined area;

setting coordinates of the reference image on the basis of a mean value obtained by calculating a mean of the calculated coordinates of the other superimposed images with respect to the reference image; and

displaying the background image and the plurality of superimposed images on a display section in such a way that the reference image is placed at the set coordinates in the background image.

10. A program for causing a computer to execute the steps of:

calculating transformed coordinates for each of a plurality of superimposed images associated with coordinates in a background image, by taking one superimposed image of the plurality of superimposed images as a reference image, and transforming coordinates of other superimposed images on the basis of corresponding coordinates of the reference image in the background image, distances in the background image from the reference image to the other superimposed images, and a distance in the background image from the reference image to a boundary within a predetermined area with respect to the reference image, the coordinates of the other superimposed images being transformed in such a way that coordinate intervals within the predetermined area become denser with increasing distance from the reference image toward the boundary within the predetermined area;

setting coordinates of the reference image on the basis of a mean value obtained by calculating a mean of the calculated coordinates of the other superimposed images with respect to the reference image; and

displaying the background image and the plurality of superimposed images on a display section in such a way that the reference image is placed at the set coordinates in the background image.

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