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(54) **WIRELESS COMMUNICATION SYSTEM, WIRELESS COMMUNICATION METHOD, AND STORAGE MEDIUM**

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(52) **U.S. Cl.**

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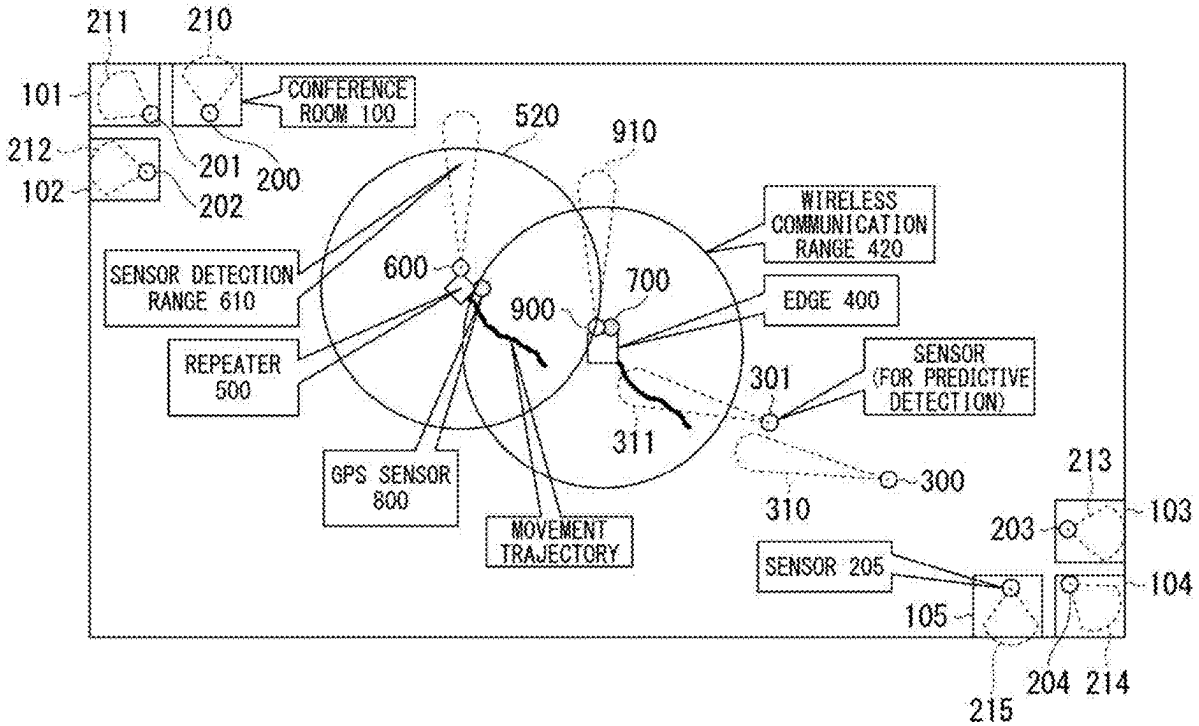
(57) **ABSTRACT**

A wireless communication system includes a receiver that is configured to be capable of self-propelled movement, performs movement control of the receiver based on a transmission timing of sensing information of a sensor, an installation position of the sensor, and a range in which reception is possible in a case where the sensing information is received from the sensor, and receives the sensing information of the sensor.



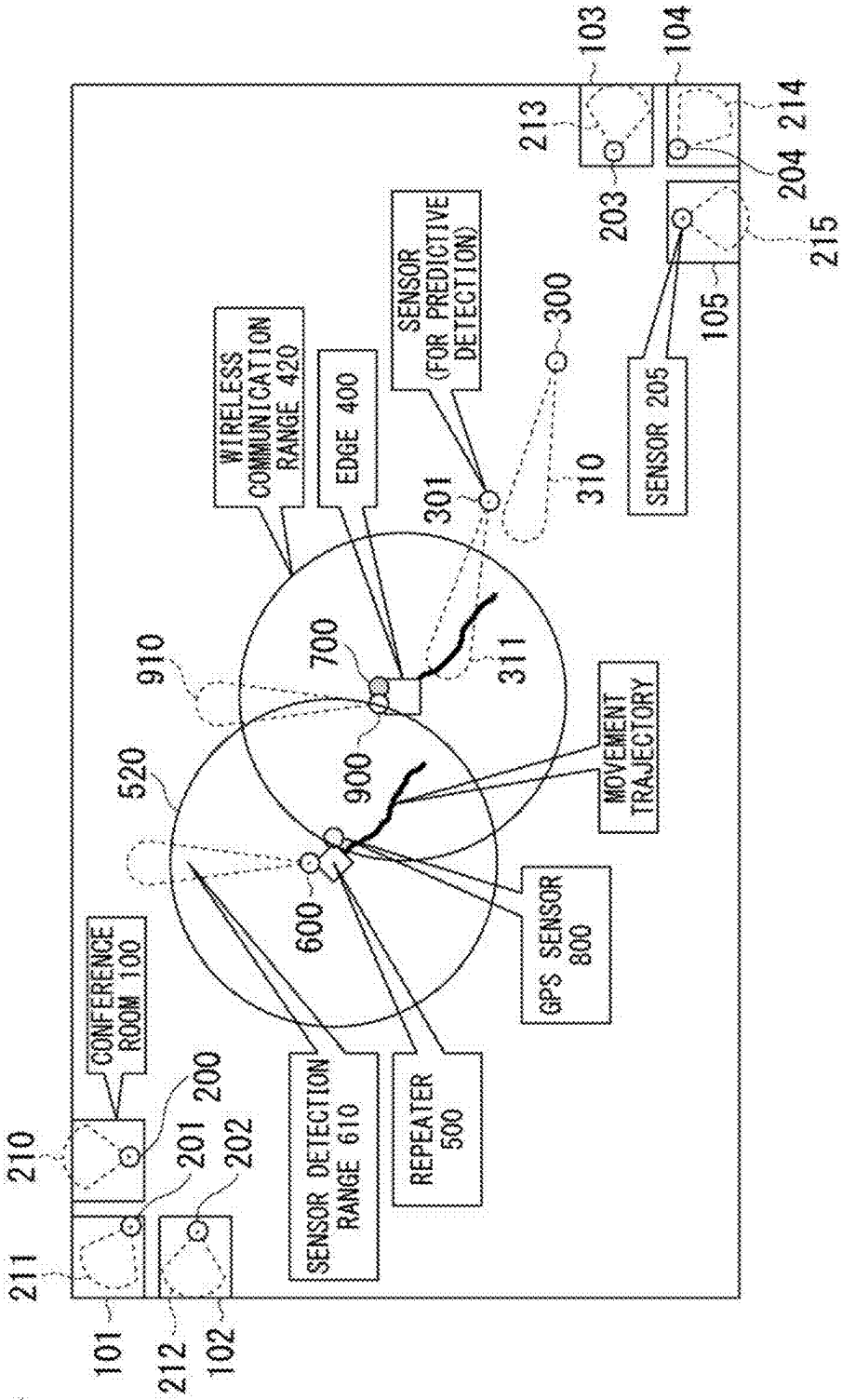

CONFERENCE ROOM 100
WIRELESS COMMUNICATION RANGE 420
EDGE 400
SENSOR (FOR PREDICTIVE DETECTION)
SENSOR 205
SENSOR DETECTION RANGE 610
REPEATER 500
GPS SENSOR 800
MOVEMENT TRAJECTORY
101
102
103
104
105
200
201
202
203
204
210
211
212
213
214
215
300
301
310
311
520
600
700
900
910

FIG. 1

FIG. 2A

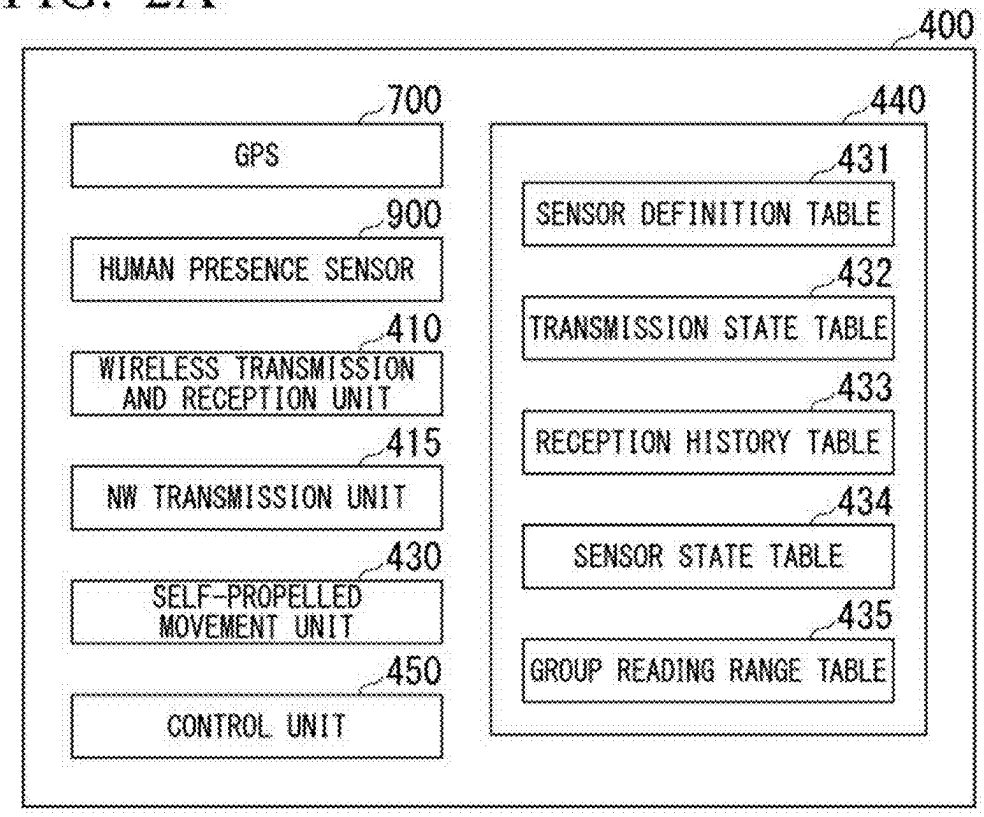

400
700
GPS
900
HUMAN PRESENCE SENSOR
410
WIRELESS TRANSMISSION AND RECEPTION UNIT
415
NW TRANSMISSION UNIT
430
SELF-PROPELLED MOVEMENT UNIT
450
CONTROL UNIT
440
431
SENSOR DEFINITION TABLE
432
TRANSMISSION STATE TABLE
433
RECEPTION HISTORY TABLE
434
SENSOR STATE TABLE
435
GROUP READING RANGE TABLE

FIG. 2B

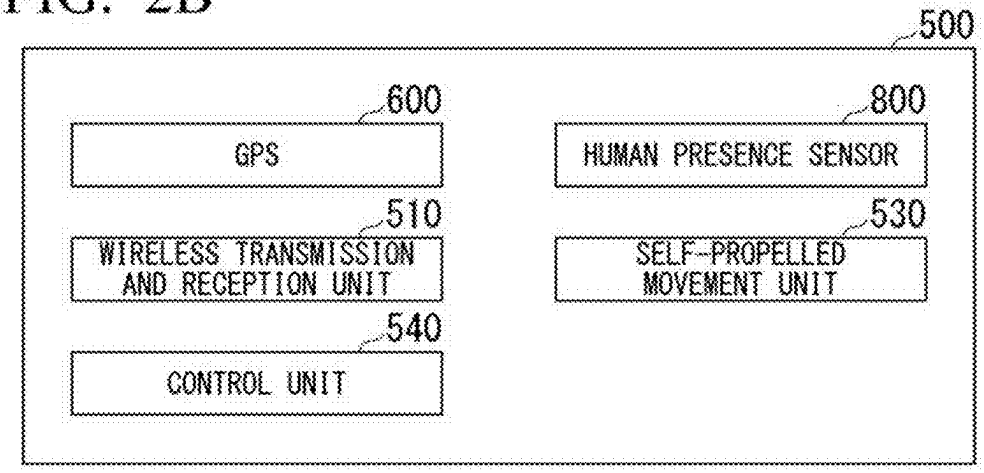

500
600
GPS
510
WIRELESS TRANSMISSION AND RECEPTION UNIT
540
CONTROL UNIT
800
HUMAN PRESENCE SENSOR
530
SELF-PROPELLED MOVEMENT UNIT

FIG. 2C

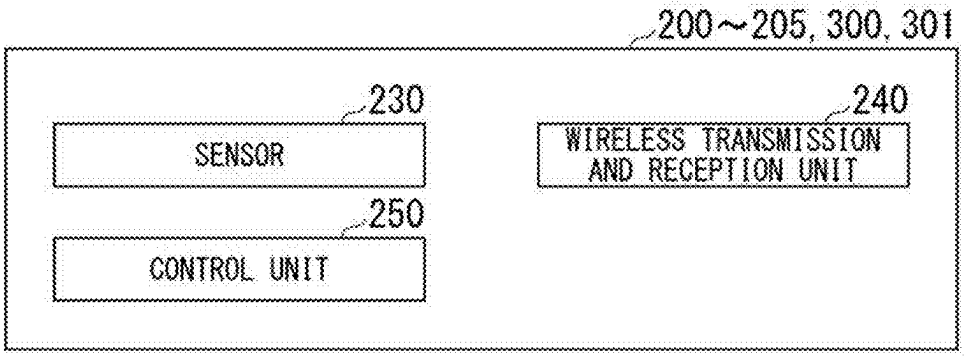

200～205, 300, 301
230
SENSOR
240
WIRELESS TRANSMISSION AND RECEPTION UNIT
250
CONTROL UNIT

FIG. 3

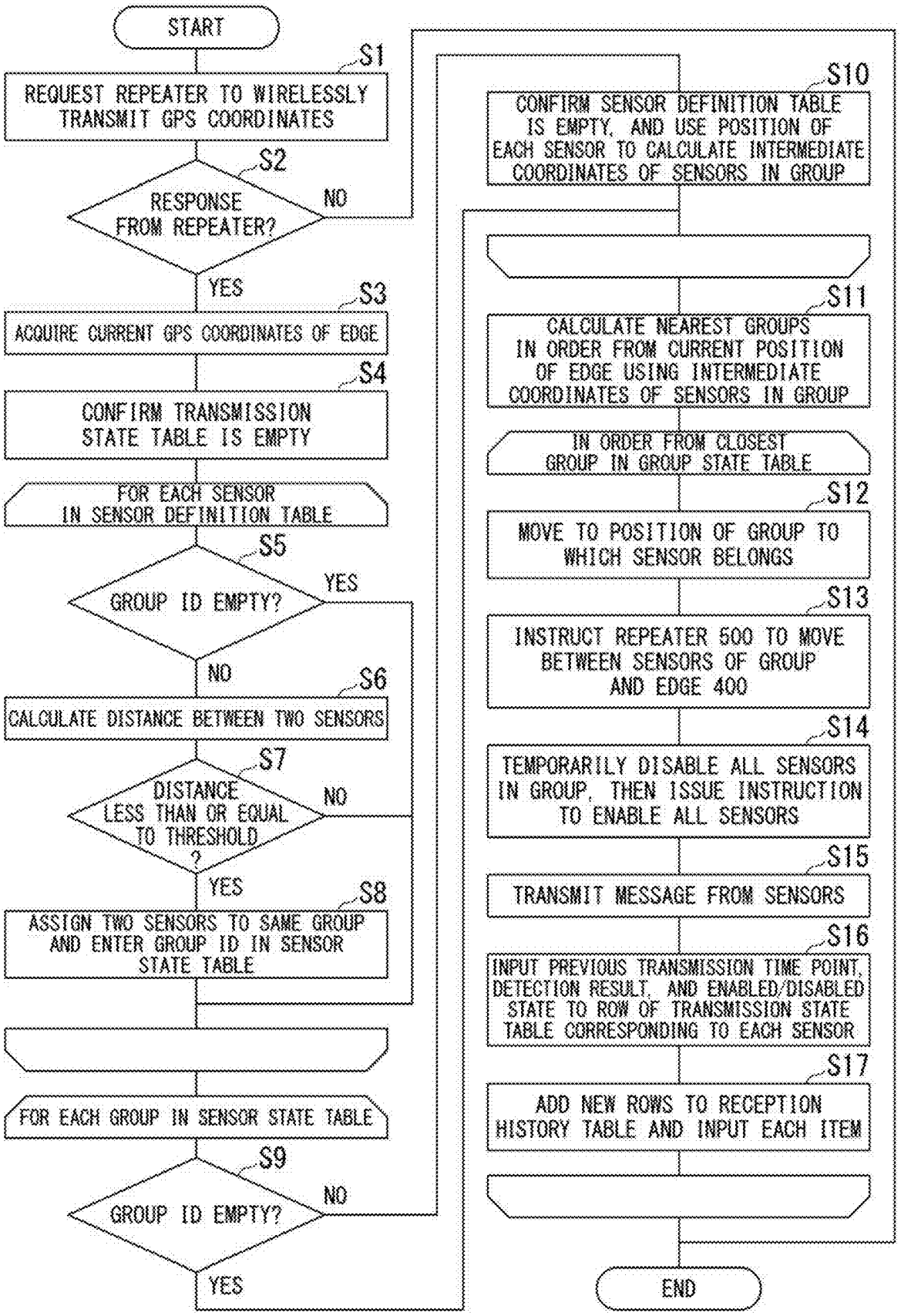

START
S1
REQUEST REPEATER TO WIRELESSLY TRANSMIT GPS COORDINATES
S2
RESPONSE FROM REPEATER?
NO
YES
S3
ACQUIRE CURRENT GPS COORDINATES OF EDGE
S4
CONFIRM TRANSMISSION STATE TABLE IS EMPTY
FOR EACH SENSOR IN SENSOR DEFINITION TABLE
S5
GROUP ID EMPTY?
YES
NO
S6
CALCULATE DISTANCE BETWEEN TWO SENSORS
S7
DISTANCE LESS THAN OR EQUAL TO THRESHOLD ?
NO
YES
S8
ASSIGN TWO SENSORS TO SAME GROUP AND ENTER GROUP ID IN SENSOR STATE TABLE
FOR EACH GROUP IN SENSOR STATE TABLE
S9
GROUP ID EMPTY?
NO
YES
S10
CONFIRM SENSOR DEFINITION TABLE IS EMPTY, AND USE POSITION OF EACH SENSOR TO CALCULATE INTERMEDIATE COORDINATES OF SENSORS IN GROUP
S11
CALCULATE NEAREST GROUPS IN ORDER FROM CURRENT POSITION OF EDGE USING INTERMEDIATE COORDINATES OF SENSORS IN GROUP
IN ORDER FROM CLOSEST GROUP IN GROUP STATE TABLE
S12
MOVE TO POSITION OF GROUP TO WHICH SENSOR BELONGS
S13
INSTRUCT REPEATER 500 TO MOVE BETWEEN SENSORS OF GROUP AND EDGE 400
S14
TEMPORARILY DISABLE ALL SENSORS IN GROUP, THEN ISSUE INSTRUCTION TO ENABLE ALL SENSORS
S15
TRANSMIT MESSAGE FROM SENSORS
S16
INPUT PREVIOUS TRANSMISSION TIME POINT, DETECTION RESULT, AND ENABLED/DISABLED STATE TO ROW OF TRANSMISSION STATE TABLE CORRESPONDING TO EACH SENSOR
S17
ADD NEW ROWS TO RECEPTION HISTORY TABLE AND INPUT EACH ITEM
END

FIG. 4

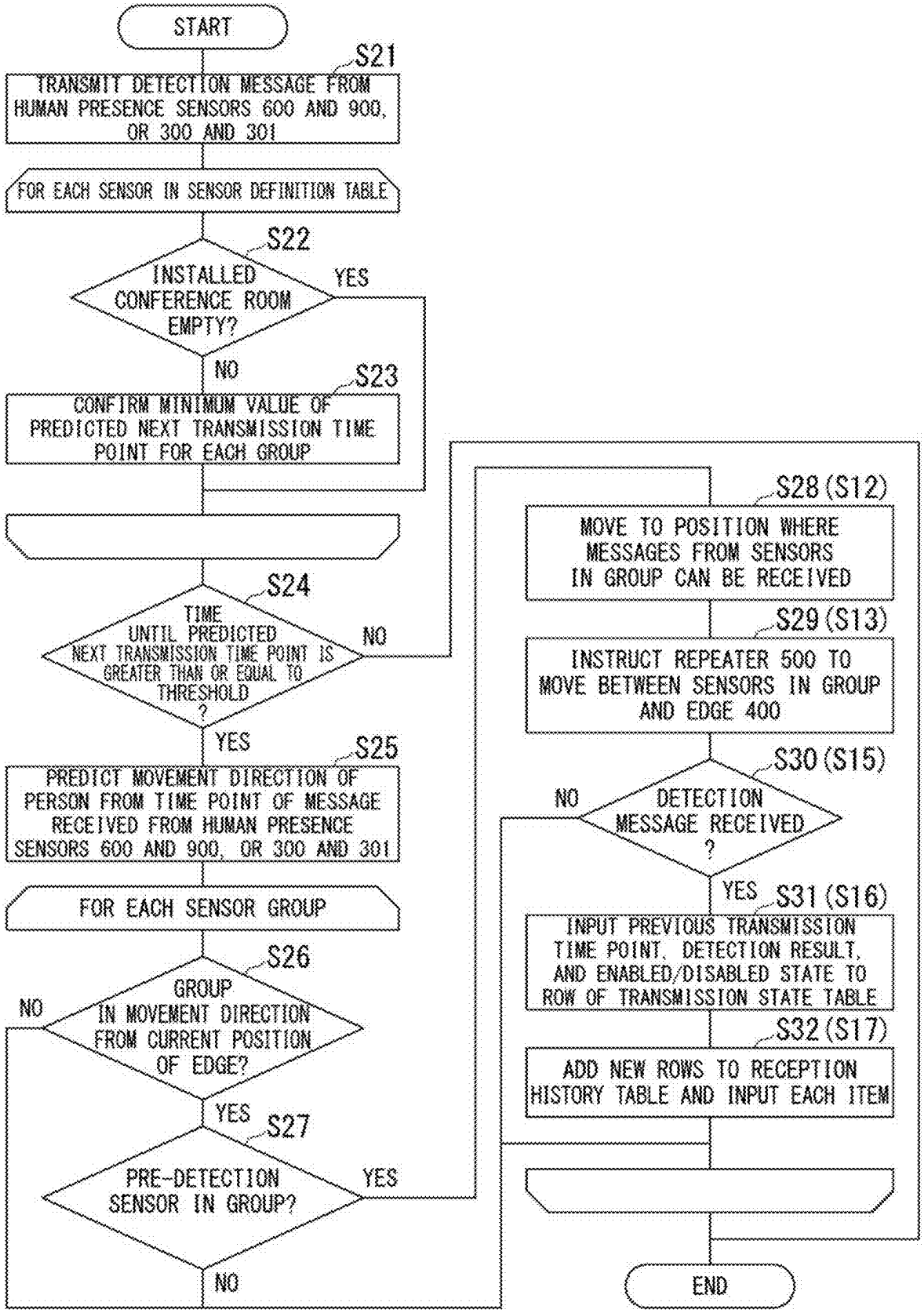

START
S21
TRANSMIT DETECTION MESSAGE FROM HUMAN PRESENCE SENSORS 600 AND 900, OR 300 AND 301
FOR EACH SENSOR IN SENSOR DEFINITION TABLE
S22
INSTALLED CONFERENCE ROOM EMPTY?
YES
NO
S23
CONFIRM MINIMUM VALUE OF PREDICTED NEXT TRANSMISSION TIME POINT FOR EACH GROUP
S24
TIME UNTIL PREDICTED NEXT TRANSMISSION TIME POINT IS GREATER THAN OR EQUAL TO THRESHOLD ?
NO
YES
S25
PREDICT MOVEMENT DIRECTION OF PERSON FROM TIME POINT OF MESSAGE RECEIVED FROM HUMAN PRESENCE SENSORS 600 AND 900, OR 300 AND 301
FOR EACH SENSOR GROUP
S26
GROUP IN MOVEMENT DIRECTION FROM CURRENT POSITION OF EDGE?
NO
YES
S27
PRE-DETECTION SENSOR IN GROUP?
YES
NO
S28 (S12)
MOVE TO POSITION WHERE MESSAGES FROM SENSORS IN GROUP CAN BE RECEIVED
S29 (S13)
INSTRUCT REPEATER 500 TO MOVE BETWEEN SENSORS IN GROUP AND EDGE 400
S30 (S15)
DETECTION MESSAGE RECEIVED ?
NO
YES
S31 (S16)
INPUT PREVIOUS TRANSMISSION TIME POINT, DETECTION RESULT, AND ENABLED/DISABLED STATE TO ROW OF TRANSMISSION STATE TABLE
S32 (S17)
ADD NEW ROWS TO RECEPTION HISTORY TABLE AND INPUT EACH ITEM
END

FIG. 5

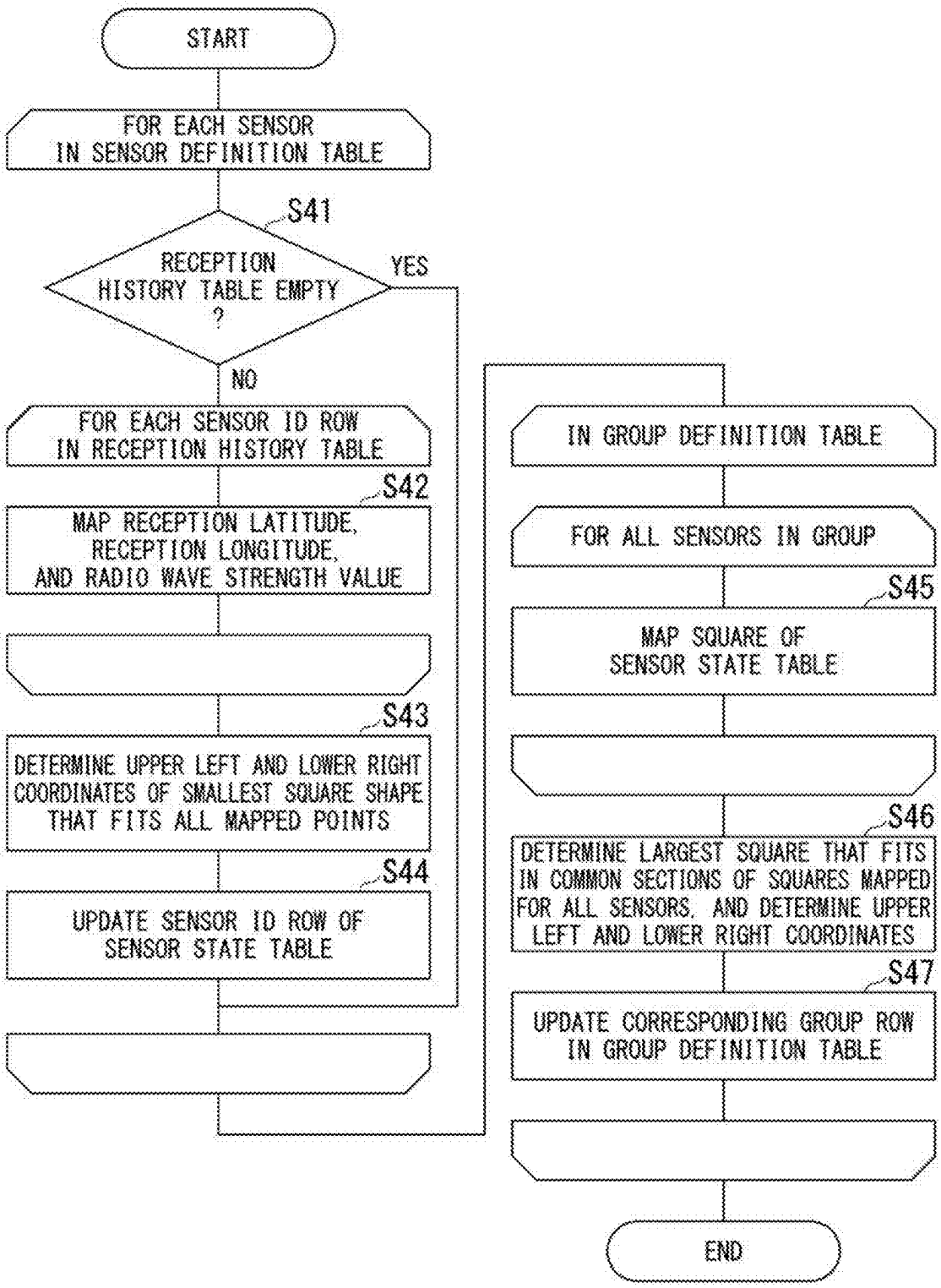

START
FOR EACH SENSOR IN SENSOR DEFINITION TABLE
S41
RECEPTION HISTORY TABLE EMPTY ?
YES
NO
FOR EACH SENSOR ID ROW IN RECEPTION HISTORY TABLE
S42
MAP RECEPTION LATITUDE, RECEPTION LONGITUDE, AND RADIO WAVE STRENGTH VALUE
S43
DETERMINE UPPER LEFT AND LOWER RIGHT COORDINATES OF SMALLEST SQUARE SHAPE THAT FITS ALL MAPPED POINTS
S44
UPDATE SENSOR ID ROW OF SENSOR STATE TABLE
IN GROUP DEFINITION TABLE
FOR ALL SENSORS IN GROUP
S45
MAP SQUARE OF SENSOR STATE TABLE
S46
DETERMINE LARGEST SQUARE THAT FITS IN COMMON SECTIONS OF SQUARES MAPPED FOR ALL SENSORS, AND DETERMINE UPPER LEFT AND LOWER RIGHT COORDINATES
S47
UPDATE CORRESPONDING GROUP ROW IN GROUP DEFINITION TABLE
END

FIG. 6

HUMAN PRESENCE SENSOR ID	MANUFACTURER NAME	MODEL NUMBER	TRANSMISSION INTERVAL UPON DETECTION	PRE-DETECTION TRANSMISSION INTERVAL	INSTALLATION CONFERENCE ROOM ID	INSTALLATION POSITION LATITUDE	INSTALLATION POSITION LONGITUDE	INSTALLATION HEIGHT
200	COMPANY A	HS-001	2 MINUTES	30 MINUTES	100	35.999940	139.999920	2
201	COMPANY A	HS-001	2 MINUTES	30 MINUTES	101	35.999940	139.999900	2
202	COMPANY A	HS-001	2 MINUTES	30 MINUTES	102	35.999960	139.999900	2
203	COMPANY A	HS-001	2 MINUTES	30 MINUTES	103	36.000040	140.000100	2
204	COMPANY A	HS-001	2 MINUTES	30 MINUTES	104	36.000060	140.000100	2
205	COMPANY A	HS-001	2 MINUTES	30 MINUTES	105	36.000060	140.000080	2
300	COMPANY A	HS-001	2 MINUTES	30 MINUTES		36.000020	140.000060	2
301	COMPANY A	HS-001	2 MINUTES	30 MINUTES		36.000010	140.000040	2

FIG. 7A

HUMAN PRESENCE SENSOR ID	PREVIOUS TRANSMISSION TIME POINT	DETECTION RESULT	PREDICTED NEXT TRANSMISSION TIME POINT	ENABLED /DISABLED STATE
200				
201				
202				
203				
204				
205				
300				
301				

FIG. 7B

HUMAN PRESENCE SENSOR ID	PREVIOUS TRANSMISSION TIME POINT	DETECTION RESULT	PREDICTED NEXT TRANSMISSION TIME POINT	ENABLED /DISABLED STATE
200	2023/12/1 12:00	YES	2023/12/1 12:02	ENABLED
201	2023/12/1 12:00	YES	2023/12/1 12:02	ENABLED
202	2023/12/1 12:00	NO	2023/12/1 12:30	ENABLED
203				
204				
205				
300				
301				

FIG. 7C

HUMAN PRESENCE SENSOR ID	PREVIOUS TRANSMISSION TIME POINT	DETECTION RESULT	PREDICTED NEXT TRANSMISSION TIME POINT	ENABLED /DISABLED STATE
200	2023/12/1 13:00	YES	2023/12/1 13:02	ENABLED
201	2023/12/1 13:00	YES	2023/12/1 13:02	ENABLED
202	2023/12/1 12:40	NO	2023/12/1 13:10	ENABLED
203	2023/12/1 13:00	YES	2023/12/1 13:02	ENABLED
204	2023/12/1 13:00	YES	2023/12/1 13:02	ENABLED
205	2023/12/1 12:45	NO	2023/12/1 13:15	ENABLED
300	2023/12/1 13:01	YES	2023/12/1 13:03	ENABLED
301	2023/12/1 13:00	YES	2023/12/1 13:02	ENABLED

FIG. 8

HUMAN PRESENCE SENSOR ID	RECEPTION TIME POINT	DETECTION RESULT	SIGNAL STRENGTH	RECEPTION LATITUDE	RECEPTION LONGITUDE
200	2023/12/1 12:00	YES	-85	35.999980	139.999960
201	2023/12/1 12:00	YES	-88	35.999980	139.999960
202	2023/12/1 12:00	NO	-86	35.999980	139.999960

FIG. 9A

HUMAN PRESENCE SENSOR ID	GROUP ID	READING RANGE x1	READING RANGE y1	READING RANGE x2	READING RANGE y2
200					
201					
202					
203					
204					
205					
300					
301					

FIG. 9B

HUMAN PRESENCE SENSOR ID	GROUP ID	READING RANGE x1	READING RANGE y1	READING RANGE x2	READING RANGE y2
200	A				
201	A				
202	A				
203	B				
204	B				
205	B				
300					
301					

FIG. 9C

HUMAN PRESENCE SENSOR ID	GROUP ID	READING RANGE x1	READING RANGE y1	READING RANGE x2	READING RANGE y2
200	A	139.999900	35.999940	139.999940	35.999960
201	A	139.999900	35.999940	139.999930	35.999970
202	A	139.999900	35.999940	139.999920	35.999980
203	B				
204	B				
205	B				
300					
301					

FIG. 10

GROUP ID	READING RANGE x1	READING RANGE y1	READING RANGE x2	READING RANGE y2
A	139.999900	35.999940	139.999920	35.999960

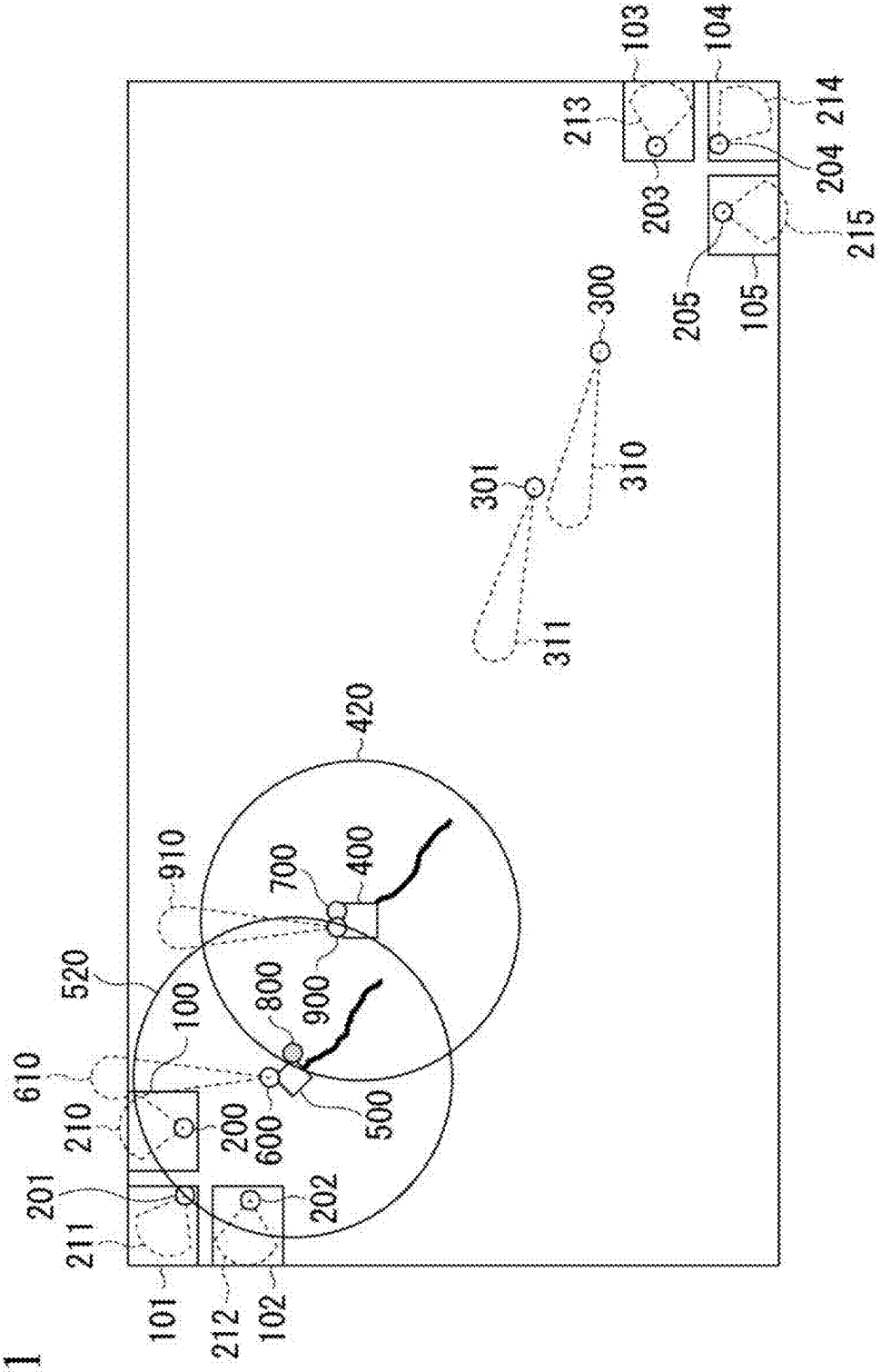

101
212
102
211
201
210
610
520
100
910
202
200
600
500
800
900
700
400
420
311
301
310
300
205
105
215
204
214
203
213
103
104

FIG. 11

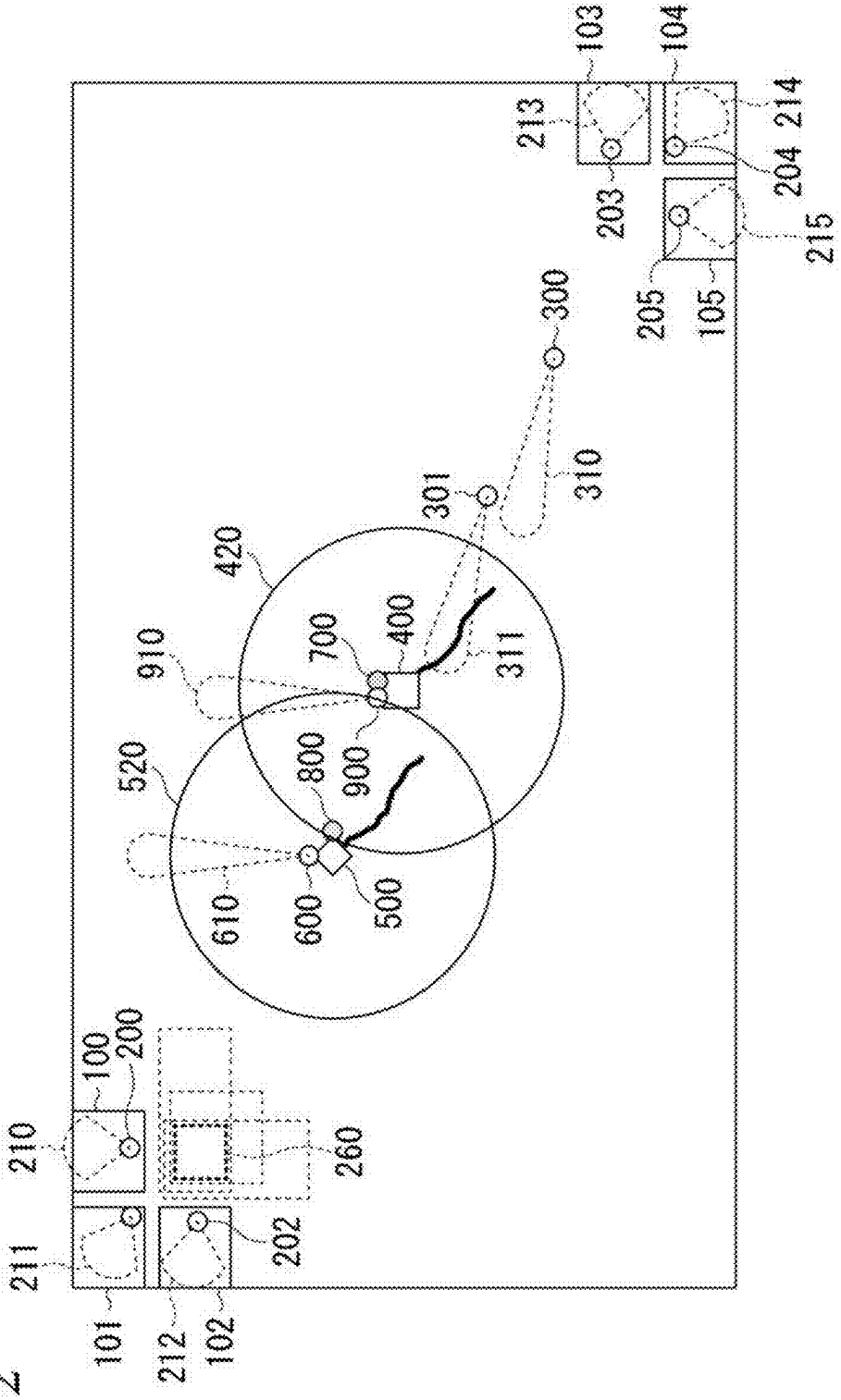

100
200
210
211
101
212
102
202
260
520
610
600
500
800
900
910
420
700
400
311
301
310
300
213
103
203
104
214
204
205
105
215

FIG. 12

FIG. 13

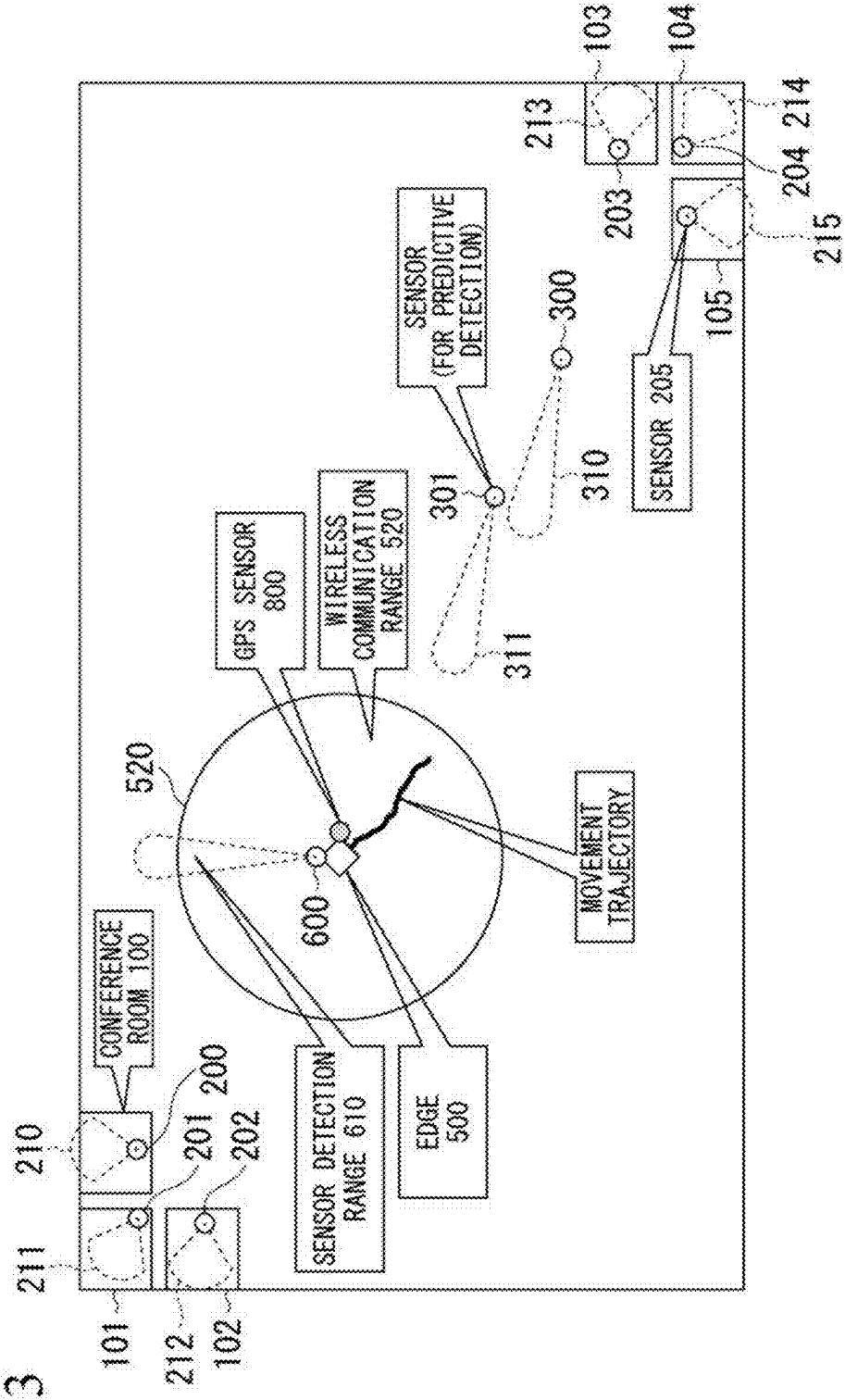

CONFERENCE ROOM 100
SENSOR DETECTION RANGE 610
EDGE 500
GPS SENSOR 800
WIRELESS COMMUNICATION RANGE 520
SENSOR (FOR PREDICTIVE DETECTION)
SENSOR 205
MOVEMENT TRAJECTORY
101
102
103
104
105
200
201
202
203
204
210
211
212
213
214
215
300
301
310
311
520
600

FIG. 14

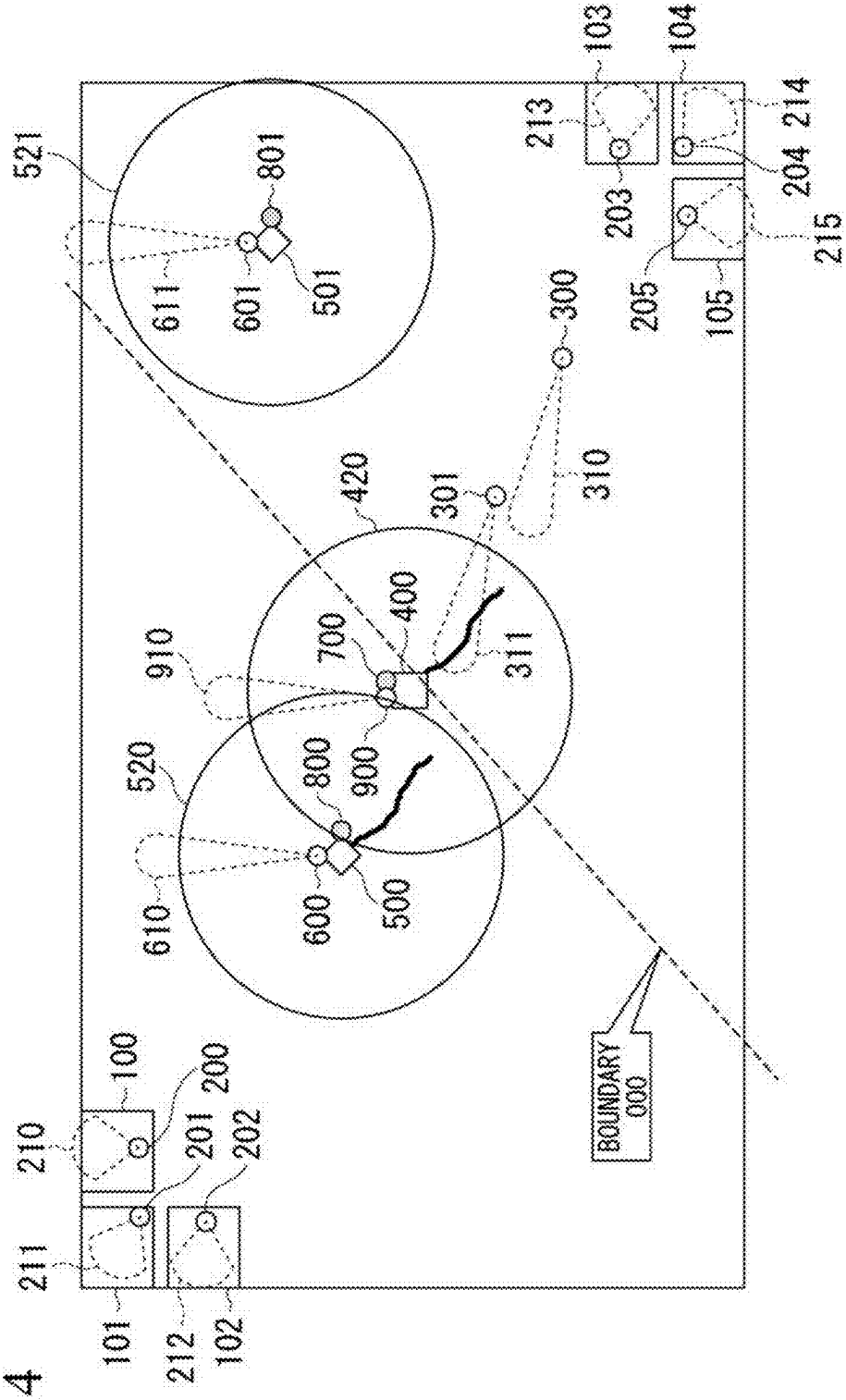

521
801
611
601
501
103
104
213
214
203
204
205
215
105
300
310
420
301
400
910
700
311
900
520
800
610
600
500
BOUNDARY
000
100
200
210
201
202
211
101
212
102

FIG. 15

HUMAN PRESENCE SENSOR ID	GROUP ID	ASSIGNED RANGE ID	READING RANGE x1	READING RANGE y1	READING RANGE x2	READING RANGE y2
200						
201						
202						
203						
204						
205						
300						
301						

FIG. 16

REPEATER ID	ASSIGNED RANGE ID	CURRENT POSITION LATITUDE	CURRENT POSITION LONGITUDE	MOVEMENT SPEED LATITUDE	MOVEMENT SPEED LONGITUDE

FIG. 17

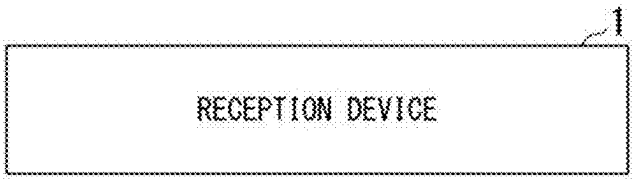
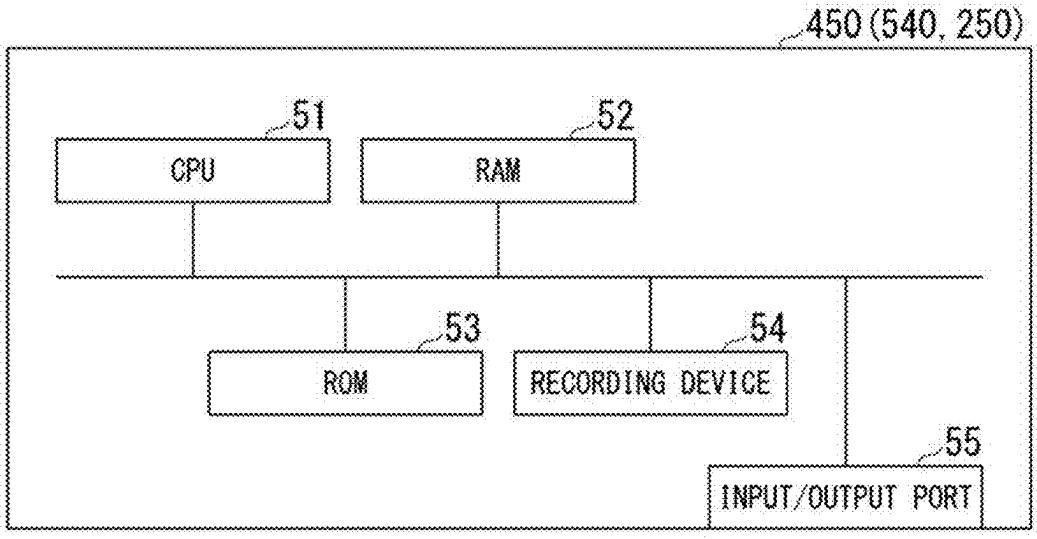

1
RECEPTION DEVICE

FIG. 18


450 (540, 250)
51
CPU
52
RAM
53
ROM
54
RECORDING DEVICE
55
INPUT/OUTPUT PORT

WIRELESS COMMUNICATION SYSTEM, WIRELESS COMMUNICATION METHOD, AND STORAGE MEDIUM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based upon and claims the benefit of priority from Japanese patent application No. 2024-030900, filed on Mar. 1, 2024, the disclosure of which is incorporated herein in its entirety by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to a wireless communication system, a wireless communication method, and a storage medium.

BACKGROUND ART

[0003] In recent years, the use of Internet of Things (IoT) systems has been increasing. In an IoT system, sensors that perform sensing are generally installed on-site, and the data collected by the sensors is aggregated at an edge, and then transmitted to the cloud. Here, an "edge" refers to a device that serves as a point that delivers the data collected by the sensors, to a line for transmission to a device that processes the data. Sensors include wired-type and wireless-type sensors. Wired-type sensors require wiring and placement, which makes installation cumbersome. On the other hand, wireless-type sensors also have disadvantages, such as a limited transmission and reception range, and the possibility of interference with other radio waves, which prevents a correct reading from being obtained. Therefore, wired-type and wireless-type sensors each have advantages and disadvantages. In addition, although equipment exists that transmits directly to the cloud from a sensor, the cost and functionality are generally high, which makes management complicated in cases where a large number of sensors are used.

[0004] Furthermore, in order to receive data from a sensor that is further away than a wireless communication range, a repeater that relays data from the sensor is arranged between the edge and the sensor. In cases where coverage cannot be achieved with a plurality of repeaters, a plurality of edges is installed. However, in configurations that use a repeater, many wireless communication standards only allow a single relay hop. As a result, an edge cannot receive data from sensors that are more than one hop away, and there is a problem that, in configurations in which a plurality of edges is arranged, the operational effort increases.

[0005] For example, Japanese Unexamined Patent Publication No. 2018-165099 (Patent Document 1) discloses a wireless communication system that acquires position information of a data collector, position information of a relay device, information relating to a communication status between the data collector and the relay device, and information relating to a communication status between the relay device and a ground unit corresponding to an edge, and based on such information, determines a line-of-sight state between the data collector and the relay device, and controls the position of the relay device such that line-of-sight between the data collector and the relay device is ensured.

SUMMARY

[0006] Furthermore, many sensors used in IoT have limited functionality. In such cases, the sensor may transmit data that has been sensed at a certain, specific timing.

[0007] In the wireless communication system described in Patent Document 1, in a case where the data that has been sensed by the sensor is transmitted at a certain, specific timing, because the transmission timing of the sensor is not taken into consideration, the data collector may not be able to receive the information that has been sensed in some cases.

[0008] An example object of the present disclosure is to provide a wireless communication system, a wireless communication method, and a program that solve the problem described above.

[0009] A wireless communication system according to an example aspect of the present disclosure includes: a receiver configured to be capable of self-propelled movement, perform movement control of the receiver based on a transmission timing of sensing information of a sensor, an installation position of the sensor, and a range in which reception is possible in a case where the sensing information is received from the sensor, and receive the sensing information of the sensor.

[0010] A wireless communication method according to an example aspect of the present disclosure is performed by a receiver included in a wireless communication system, the method including the step of: performing movement control of the receiver based on a transmission timing of sensing information of a sensor, an installation position of the sensor, and a range in which reception is possible in a case where the sensing information is received from the sensor, and receiving the sensing information of the sensor.

[0011] A non-transitory storage medium storing a program according to an example aspect of the present disclosure is a program for a receiver included in a wireless communication system, the program causing a computer to execute the step of: performing movement control of the receiver based on a transmission timing of sensing information of a sensor, an installation position of the sensor, and a range in which reception is possible in a case where the sensing information is received from the sensor, and receiving the sensing information of the sensor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. **1** is a diagram showing a system overview of a wireless communication system according to an example embodiment of the present disclosure.

[0013] FIG. **2**A is a functional block diagram showing a configuration of an edge.

[0014] FIG. **2**B is a functional block diagram showing a configuration of a repeater.

[0015] FIG. **2**C is a functional block diagram showing a configuration of a human presence sensor.

[0016] FIG. **3** is a flowchart relating to processing performed in the wireless communication system in a case where an edge receives data from a human presence sensor via a repeater.

[0017] FIG. **4** is a flowchart relating to processing performed in the wireless communication system in a case where an edge receives data from a human presence sensor via a repeater.

[0018] FIG. **5** is a flowchart relating to processing performed in the wireless communication system in a case where an edge receives data from a human presence sensor via a repeater.

[0019] FIG. **6** is a diagram showing an example of a sensor definition table.

[0020] FIG. **7**A is a diagram showing an example of a transmission state table.

[0021] FIG. **7**B is a diagram showing an example of a transmission state table.

[0022] FIG. **7**C is a diagram showing an example of a transmission state table.

[0023] FIG. **8** is a diagram showing an example of a reception history table.

[0024] FIG. **9**A is a diagram showing an example of a sensor state table.

[0025] FIG. **9**B is a diagram showing an example of a sensor state table.

[0026] FIG. **9**C is a diagram showing an example of a sensor state table.

[0027] FIG. **10** is a diagram showing an example of a group reading range table.

[0028] FIG. **11** is a diagram showing an example showing a state after an edge and a repeater have moved in order to receive data from each human presence sensor in group A.

[0029] FIG. **12** is a diagram showing the concept of superimposing rectangular areas that satisfy an RSSI threshold of the human presence sensors belonging to group A, and setting an overlapping section as the optimal reading range of group A.

[0030] FIG. **13** is a diagram showing an overview of a wireless communication system in a case where a repeater is not used.

[0031] FIG. **14** is a diagram showing an overview of a wireless communication system in a case where two repeaters are used.

[0032] FIG. **15** is a diagram showing an example of a sensor state table.

[0033] FIG. **16** is a diagram showing an example of a repeater management table.

[0034] FIG. **17** is a diagram showing a configuration of a wireless communication system according to an example embodiment of the present disclosure.

[0035] FIG. **18** is a diagram showing an example of a hardware configuration of a control unit, such as an edge.

EXAMPLE EMBODIMENT

[0036] Hereinafter, an example embodiment according to the present disclosure will be described using the drawings. In each of the drawings, the same or corresponding components are assigned the same reference symbols, and common descriptions are omitted. FIG. **1** is a diagram showing a system overview of a wireless communication system according to an example embodiment of the present disclosure. The wireless communication system includes an edge **400** that serves as a receiving device, and a repeater **500**. Furthermore, the wireless communication system may include predictive detection human presence sensors **300** and **301**. Here, FIG. **1** shows an example in which two predictive detection human presence sensors are shown, but the number of sensors may be one or more.

[0037] In FIG. **1**, an example of a wireless communication system is shown in which a human presence sensor is installed inside each of a plurality of conference rooms on an office floor in a building of a company or the like, and data from each of the sensors on the large floor is collected using an edge **400** and a repeater **500**, which are capable of moving. In the example of FIG. **1**, the floor includes conference rooms **100** to **105**, and the conference rooms have the respective human presence sensors **200** to **205** installed therein. The human presence sensors have the respective detection ranges **210** to **215**. In addition, it is assumed that the repeater **500** is only permitted to perform a single relay hop.

[0038] Here, the edge **400** is a device that is capable of self-propelled movement, performs self-propelled movement based on the transmission timing of data, which is sensing information from the human presence sensors **200** to **205**, the installation positions of the human presence sensors **200** to **205**, and the range in which reception is possible in a case where the sensing information is received from the human presence sensors **200** to **205**, and receives the sensing information from the human presence sensors **200** to **205** via the repeater **500**. Moreover, the edge **400** is provided with a function that delivers the received sensing information to a line for transmission to a device that processes the sensing information. The edge **400** further includes a Global Positioning System (GPS) **700** and a human presence sensor **900**. As a result of the human presence sensor **900** of the edge **400** having a detection range **910**, the edge **400** has a wireless communication range **420**.

[0039] The repeater **500** is equipment that is capable of self-propelled movement under the control of the edge **400**, receives the sensing information from the human presence sensors **200** and **205**, and relays the received sensing information to the edge **400**. The repeater **500** further includes a GPS **800** and a human presence sensor **600**. The human presence sensor **600** of the repeater **500** has a detection range **610**, and the repeater **500** also has a wireless communication range **520**.

[0040] The predictive detection human presence sensors **300** and **301** are human presence sensors that are installed in a stationary fashion to the floor on which the conference rooms **100** to **105** are located. The predictive detection human presence sensors **300** and **301** respectively have the detection ranges **310** and **311**.

[0041] In an example such as that shown in FIG. **1**, the edge **400** and the repeater **500** move around the floor while grasping the position information obtained by the respective GPSs **700** and **800**, and receive sensing information, which is data from the human presence sensors **200** to **205** installed in the conference rooms **100** to **105**. FIG. **1** also shows an example of the movement trajectories in a case where the edge **400** and the repeater **500** move in order to receive data from the human presence sensors **200** to **205** installed in the conference rooms **100** to **105**.

[0042] FIG. **2**A to FIG. **2**C are functional block diagrams showing the configuration of each of the edge **400**, the repeater **500**, the human presence sensors **200** to **205**, and the predictive detection human presence sensors **300** and **301**.

[0043] As shown in FIG. **2**A, the edge **400** includes, in addition to the GPS **700** and the human presence sensor **900**, a wireless transmission and reception unit **410**, a network (NW) transmission unit **415**, a self-propelled movement unit **430**, a storage unit **440**, and a control unit **450**. The wireless transmission and reception unit **410** is provided with the functions of receiving data from the human presence sensors

200 to **205** and the predictive detection human presence sensors **300** and **301** via the repeater **500**, and transmitting and receiving information for controlling the movement of the repeater **500** and the like from the edge **400**. The NW transmission unit **415** is provided with the function of delivering received data to a line for transmitting the received data to a device that processes the data from the human presence sensors **200** to **205**. The self-propelled movement unit **430** is provided with the function of performing self-propelled movement around a floor under the control of the control unit **450**, using position information from the GPS **700**. The control unit **450**, in addition to controlling each device and each unit constituting the edge **400**, in order to receive data from the human presence sensors **200** to **205**, refers to information provided in the storage unit **440** and the like, and determines the movement position of the edge **400**, the movement position of the repeater **500**, the time points of the movement to the movement positions, and the like.

[0044] The storage unit **440** stores a sensor definition table **431**, a transmission state table **432**, a reception history table **433**, a sensor state table **434**, and a group reading range table **435**. The sensor definition table **431** is a table for managing the human presence sensors **200** to **205** and the predictive detection human presence sensors **300** and **301**, and includes information such as an installation position, an installation location, an installation height, and a data transmission interval of each sensor. The transmission state table **432** is a table for managing the transmission state from the human presence sensors **200** to **205** and the predictive detection human presence sensors **300** and **301**, and is used to manage a previous transmission time point of the human presence sensor, a detection result indicating whether or not a person has been detected by the human presence sensor, a predicted next time point of the human presence sensor, and the like. The reception history table **433** is a table for managing the reception status from the human presence sensors, and includes items such as a signal strength at the time of reception from the human presence sensor. The sensor state table **434** is used for management in a case where the human presence sensors are grouped, and for management of the range in which reception of the data is possible from each human presence sensor. The group reading range table **435** is used to manage, with respect to the grouped human presence sensors, the range in which it is possible to simultaneously receive data from all of the human presence sensors included in a group.

[0045] As shown in FIG. **2**B, the repeater **500** includes, in addition to the GPS **600** and the human presence sensor **800**, a wireless transmission and reception unit **510**, a self-propelled movement unit **530**, and a control unit **540**. The wireless transmission and reception unit **510** is provided with the function of receiving data from the human presence sensors, and transmitting the received data to the edge **400**. Furthermore, the wireless transmission and reception unit **510** is provided with the function of transmitting and receiving information relating to the movement position and the like with respect to the edge **400** in a case where the repeater **500** moves in order to receive data from the human presence sensors. The self-propelled movement unit **530** is provided with the function of performing self-propelled movement around a floor using control information from the edge **400** and under the control of the control unit **540**, and using position information from the GPS **600**. The control unit **540** controls the devices and each unit constituting the repeater **500** in order to receive and relay data from the human presence sensors. In addition, the control unit **540** controls the movement of the own device so that the own device stays within a range in which communication is possible with the edge **400**.

[0046] As shown in FIG. **2**C, the human presence sensors **200** to **205** and the predictive detection human presence sensors **300** and **301** include a sensor **230**, a wireless transmission and reception unit **240**, and a control unit **250**. The sensor **230** is an infrared sensor that reacts to the heat and movements of a person, senses a change in temperature in a case where a person passes near the sensor, and outputs a detection result of a person by an on/off signal or the like. The wireless transmission and reception unit **240** is provided with the function of transmitting the sensing information from the sensor **230** as data. In addition, the wireless transmission and reception unit **240** is also provided with the function of receiving control information for the human presence sensor. The control unit **250** controls the devices and each unit constituting the human presence sensor in order to transmit the sensing information from the sensor **230** and the like.

[0047] Next, the processing performed by the wireless communication system for receiving data from the human presence sensors will be described. FIG. **3** to FIG. **5** are flowcharts relating to processing performed in the wireless communication system in a case where the edge **400** receives data from the human presence sensors via the repeater **500**. The determination processing in the edge **400** and the repeater **500** is performed by the respective control units **450** and **540**. However, in the description using FIG. **3** to FIG. **5**, in order to simplify the description below, the entity performing the processing will be simply referred to the "edge **400**" in a case where referring to the "control unit **450** of the edge **400**", and the "repeater **500**" in a case where referring to the "control unit **540** of the repeater **500**".

[0048] In FIG. **3**, the following operation starts in a case where the edge **400** and the repeater **500** are started.

[0049] First, the edge **400** requests the repeater **500** to acquire the GPS coordinates of the repeater **500** (step S**1**). The edge **400**, as a result of obtaining a response that includes the GPS coordinates of the repeater **500** (in step S**2**: Yes), confirms that the repeater **500** is inside the wireless communication range **420**. If there is no response from the repeater (in step S**2**: No), the edge **400** terminates the processing relating to data reception from the human presence sensors via the repeater **500**.

[0050] The edge **400** acquires an own position using the GPS **700** (step S**3**). Furthermore, the edge **400** refers the transmission state table **432**, and confirms that the reception information of none of the sensors has been entered in the initial state (step S**4**). FIG. **7**A is a diagram showing an example of the initial state of the transmission state table **432**. As shown in the diagram, the transmission state table **432** includes, as items, a human presence sensor ID, a previous transmission time point, a detection result, a predicted next transmission time point, and an enabled/disabled state. The "human presence sensor ID" is an ID that uniquely specifies a human presence sensor that is installed on a floor. Here, a specific ID is set as the "human presence sensor ID" to the human presence sensors **200** to **205** and the predictive detection human presence sensors **300** and **301** that are installed on the floor. The "previous transmission time

point" indicates the time point at which the target human presence sensor last transmitted data. The "detection result" indicates a result of whether or not a person has been detected by the human presence sensor. The "predicted next transmission time point" represents the predicted time point of the next transmission by the human presence sensor, which is obtained from the previous transmission time point using the sensor definition table **413** described separately in a case where data is received. The "enabled/disabled state" indicates whether the target human presence sensor is enabled or disabled.

[0051] Then, the edge **400** uses the sensor definition table **431** to group the human presence sensors whose installation positions are close to each other (steps S**5** to S**8**). FIG. **6** is a diagram showing an example of the sensor definition table **431**. The sensor definition table **431** includes, as items, a human presence sensor ID, a manufacturer name, a model number, a transmission interval upon detection, a pre-detection transmission interval, an installation conference room ID, an installation position latitude, an installation position longitude, and an installation height. The "human presence sensor ID" is an ID that uniquely specifies a human presence sensor that is installed on a floor. The "manufacturer name" and the "model number" represent the manufacturer name and model number of the target human presence sensor. The "transmission interval upon detection" represents the length of the interval before the next data transmission is transmitted after the target human presence sensor detects a person and data relating to the detection result has been transmitted. The "pre-detection transmission interval" represents the length of the interval before the next data transmission is transmitted after data relating to a detection result indicating that the target human presence sensor has not detected a person, has been transmitted. The "installation conference room ID" is an ID that uniquely specifies the conference room in which the target human presence sensor has been installed. The "installation position latitude", the "installation position longitude", and the "installation height" represent the latitude and longitude indicating the location where the target human presence sensor has been installed, and the height of the installation position from the floor.

[0052] In order to group the human presence sensors, the edge **400** confirms whether or not an ID is set in the "group ID" in the sensor state table **434** for the human presence sensor that is targeted for processing, being a human presence sensor in the sensor definition table **431** (step S**5**). If an ID is not set (in step S**5**: No), the edge **400** confirms the position of the target human presence sensor, calculates the distance from the target human presence sensor to the other human presence sensors (step S**6**), and creates a group with the human presence sensors in which the distance is shorter than a threshold (steps S**7** and S**8**).

[0053] FIG. **9**A is a diagram showing an example of the sensor state table **434**. The sensor state table **434** includes, as items, a human presence sensor ID, a group ID, a reading range x1, a reading range y1, a reading range x2, and a reading range y2. The "human presence sensor ID" is an ID that uniquely specifies a human presence sensor that is installed on a floor. The "group ID" represents an ID that uniquely specifies a group in a case where the target human presence sensor has been grouped. The "reading range x1", the "reading range y1", the "reading range x2", and the "reading range y2" represent the positions at which data transmitted from the target human presence sensor can be read, that is to say, the range where wireless reception is possible, and is represented by a rectangular area in two-dimensional orthogonal coordinates.

[0054] Returning to FIG. **3**, for example, in a case where the target human presence sensor is the human presence sensor **200**, the distances between the installation position of the human presence sensor **200** and the other sensors are calculated. Then, if the distance is less than or equal to a predetermined value, the same group, such as "group A", is written to the item "group ID" of the sensor state table **434**. In a case where the human presence sensor **203** serves as the target, which is a human presence sensor that is not grouped, the distances to the installation positions of the other sensors that are not grouped are calculated. Then, if the distance is less than or equal to a predetermined value, the same group, such as "group B", is written to the item "group ID" of the sensor state table **434**. The edge **400** does not subject the predictive detection human presence sensors **300** and **301** to grouping. In the example of FIG. **1**, two groups are defined, namely the human presence sensors **200** to **202** as group A, and the human presence sensors **203** to **205** as group B, and then the group IDs are entered in the sensor state table **434**. The sensor state table **434** at this time is shown in FIG. **9**B.

[0055] The edge **400** determines the movement order into the group that has been grouped (steps S**9** to S**11**). The edge **400** refers the sensor definition table **431** and the sensor state table **434**, and calculates an intermediate coordinate position from the positions of the human presence sensors belonging to the same group (step S**10**). The edge **400** performs the processing (step S**10**) with respect to all of the groups defined in the sensor state table **434** (steps S**9** and S**10**). The edge **400** determines the order of groups starting with the group that is closest to the edge **400**, based on the calculated intermediate coordinate position of each group and the current position of the edge **400** (step S**11**). In the example of FIG. **1**, it is assumed that it is calculated that group A is the closest, and group B is the next closest.

[0056] The edge **400** uses the sensor state table **434** and the sensor definition table **431** to confirm the location of group A, which is the closest group from the current position of the edge **400**, and moves close enough to group A to receive data (step S**12**). At this time, the edge **400** issues a movement instruction to the repeater **500**, and in a case where data is simultaneously received from the human presence sensors in group A, causes the repeater **500** to move inside the wireless communication range **420**, in which the edge **400** can receive signals via the repeater **500**, to a position between the human presence sensors in group A and the edge **400**, such that the movement distance of the edge **400** is minimized (step S**13**). In the processing (step S**12**) and the processing (step S**13**), if there are no obstacles on the floor, the edge **400** calculates the movement position of the repeater **500**, and further, the movement position of the edge **400** on a direct line or in the vicinity of a direct line that connects the current position of the edge **400** that has been calculated in the processing (step S**10**) and the intermediate coordinate position of group A. The movement position of the repeater **500** is a position that can cover the transmission range of all of the human presence sensors belonging to group A. It is assumed that the transmission range of each human presence sensor in group A is set to an initial value that enables reception by the repeater **500**. Furthermore, the movement position of the edge **400** is a range that enables the edge **400** to perform transmission and

reception with respect to the repeater **500**. FIG. **11** is a diagram showing an example showing a state after the edge **400** and the repeater **500** have moved in order to receive data from each human presence sensor in group A. If there is an obstacle on the floor, the edge **400** determines the movement positions of the edge **400** and the repeater **500** after taking the position of the obstacle into account.

[0057] After the edge **400** and the repeater **500** have moved to the movement positions, the edge **400** issues an instruction by a network communication that sets the enabled or disabled state of each sensor in group A. That is to say, the edge **400** transmits, to each sensor in group A via the repeater **500**, an instruction that temporarily disables and then re-enables the human presence sensor that is the reception target (step S**14**). As a result, in a case where the sensors in group A have performed a detection operation, in the initial stage, it becomes possible to receive data from each sensor via the repeater **500** with the same timing (step S**15**). As a result of such an operation, it subsequently becomes possible for the human presence sensors **200** to **202** belonging to group A to transmit data in such a cycle. Although an example has been shown here where the setting of the human presence sensors to enabled or disabled is performed with an instruction issued by a wireless communication, it is not limited to this. For example, a direct mechanism may be implemented in which the repeater **500** presses a switch to switch the human presence sensor **200** to enabled or disabled in response to an instruction from the edge **400**.

[0058] In a case where the edge **400** receives a packet containing data relating to sensing information from the human presence sensor that includes whether or not a person has been detected, the edge **400** inputs, as each of the previous transmission time points, the detection result, and the enabled/disabled state in the rows of the transmission state table **432** containing the sensor IDs **200**, **201**, and **202**, and values corresponding to the current time point, whether or not detection has occurred, and been enabled. At this time, if the value indicating whether or not detection has occurred in the packet that has been received from the human presence sensor is "yes", the edge **400** inputs, as the predicted next transmission time point, a time point obtained by adding the value of the transmission interval upon detection to the previous transmission time point (step S**16**). If the value indicating whether or not detection has occurred is "no", the edge **400** inputs, as the predicted next transmission time point, the value obtained by adding the pre-detection transmission interval to the current time point (step S**16**). For example, in the transmission state table **432** shown in FIG. **7**B, in a case where a person has been detected by the human presence sensors **200** and **201**, a time point obtained by adding 2 minutes, which corresponds to the "transmission interval upon detection" of the human presence sensors **200** and **201** shown in the sensor definition table **431**, to the previous transmission time point "2023/12/1 12:00", is recorded as the predicted next transmission time point "2023/12/1 12:02" of the human presence sensors **200** and **201** in the transmission state table **432**. Similarly, in a case where a person has not been detected by the human presence sensor **202**, a time point obtained by adding 30 minutes, which corresponds to the "pre-detection transmission interval" of the human presence sensor **202** shown in the sensor definition table **431**, to the previous transmission time point "2023/12/1 12:00", is recorded as the predicted next transmission time point "2023/12/1 12:30" of the human presence sensor **202** in the transmission state table **432**.

[0059] In addition, new rows are added to the reception history table **433**, and in each item, namely the human presence sensor ID, the reception time point, the detection result, the signal strength, the reception latitude, and the reception longitude, the values of **200** (or **201** or **202**), the time point at which reception occurred, whether or not detection has occurred, the signal strength value, and the latitude and longitude of the repeater at the time of reception, are stored (step S**17**). FIG. **8** is a diagram showing the reception history table **433** at this time. As shown in FIG. **8**, the reception history table **433** includes, as items, a human presence sensor ID, a reception time point, a detection result, a signal strength, a reception latitude, and a reception longitude. The "human presence sensor ID" is an ID that uniquely specifies a human presence sensor that is installed on a floor, and is the ID of the human presence sensor in a case where data is received from the target human presence sensor. The "detection result" indicates whether or not a person has been detected by the target human presence sensor. The "signal strength" indicates the signal strength in a case where the repeater **500** receives data from the target human presence sensor. The "reception latitude" and the "reception longitude" indicate the latitude and longitude of the position of the repeater **500** in a case where data is received from the target human presence sensor.

[0060] The edge **400** performs the processing of steps S**12** to S**17** in order to receive data from the human presence sensor of group B, which has the next closest distance after group A. Thereafter, the same processing is repeated with respect to other groups. However, the processing of steps S**12** to S**17** is not performed with respect to the sensors for predictive detection. This is because information relating to the timing at which detection occurs in the sensors for predictive detection is utilized, and therefore, if the timing is controlled by the edge **400**, the sensors for predictive detection cannot be used as intended.

[0061] Then, the repeater **500** and the edge **400** confirm the predicted next transmission time point for each group using the transmission state table **432**, move to the group targeted for data reception in a case where the predicted next transmission time point approaches, and read the data from the human presence sensors belonging to the group. The operation performed at the time of reading is the same as steps S**16** and S**17**.

[0062] As the edge **400** repeatedly moves to the group that is the data reception target, and simultaneously reads data from the human presence sensors belonging to the group, it becomes increasingly difficult to efficiently read the data all at once due to variations in the predicted next transmission time point of the sensors in the group, depending on whether or not a person has been detected by the sensors belonging to the group. In such a case, the edge **400** executes the adjustment of the transmission timing (step S**14**) again. The criteria for determining that variation exist may be, for example, (1) in a case where three or more patterns exist in the predicted next transmission time points of the sensors in the group, or (2) in a case where data reception from the sensors belonging to a different group creates a temporal conflict in a case where the movement of the repeater **500** and the edge **400** is considered, leading to a status in which reception is not possible.

[0063] The repeater **500** and the edge **400** successively determine the order of the groups based on the distance from the edge **400** and the predicted next transmission time points of the human presence sensors belonging to the group, and repeatedly execute steps S**12**, S**13**, S**15** to S**17**, and S**14** as necessary, while also circulating the floor in a case where idle. At this time, if the human presence sensor **900** or **600** attached to the edge **400** or the repeater **500** detects a moving person, or if data is received from the predictive detection human presence sensors **300** and **301**, which indicates that a moving person has been detected, the edge **400** estimates the direction in which the person is moving, and performs processing that receives data from the human presence sensors **200** to **205** that are in the estimated direction. That is to say, if there is a sensor in a pre-detection state and an enabled state, which is in the direction that a person is moving that can be estimated from **1**) the installation positions and detection times of the predictive detection human presence sensors **300** and **301**, and/or **2**) the position and detection time of the edge **400** and/or repeater **500** in a case where the human presence sensor **900** or **600** attached to the edge **400** and/or repeater **500** detects a person, and there is time until the data reception timing from each group, the repeater **500** and the edge **400** move in the movement direction of the person, and the edge **400** confirms whether or not the sensors in the pre-detection state switch to the detection state, that is to say, whether or not to receive detection data. The processing according to steps S**16** and S**17** is performed if data is received. FIG. **4** is a diagram showing the processing performed to estimate the movement direction of a person as described above, and to receive data from the human presence sensors **200** to **205** in the movement direction. For example, as shown in the transmission state table **432** in FIG. **7**, an example will be described of a case where the predictive detection human presence sensors **300** and **301** have detected a person.

[0064] The edge **400** acquires/receives human detection data from the predictive detection human presence sensors **300** and **301** and/or the human presence sensors **900** and **600** attached to the edge **400** and/or the repeater **500** (step S**21**).

[0065] The edge **400** refers to the transmission state table **432** and the sensor state table **434**, and for each group, if the most recent detection result of any of the human presence sensors belonging to the group is "yes", that is to say, if the conference room in which the human presence sensor is installed is not empty, detects the nearest time point among the "predicted next transmission time points" of the sensors belonging to the group (steps S**22** and S**23**).

[0066] If the difference between the nearest time point among the "predicted next transmission time point" determined for each group and the current time point is not greater than or equal to a predetermined value (in step S**24**: No), the edge **400** terminates the movement processing of the edge **400** and the repeater **500** based on the movement prediction of a person.

[0067] On the other hand, if the difference between the nearest time point among the "predicted next transmission time point" determined for each group and the current time point is greater than or equal to the predetermined value (in step S**24**: Yes), the edge **400** predicts the movement direction of the detected person from the position and time of the edge **400** and the repeater **500** in a case where the edge **400** acquires/receives human detection data from the predictive detection human presence sensors **300** and **301** and/or the human presence sensors **900** and **600** attached to the edge **400** and/or the repeater **500** (step S**25**). In the example of the transmission state table **432** in FIG. **7**C, because the predictive detection human presence sensor **301** detects the person after the predictive detection human presence sensor **300** detects the person, the edge **400** predicts that the person is moving from the installation position of the predictive detection human presence sensor **300** toward the reporting by the predictive detection human presence sensor **301**.

[0068] The edge **400** refers to the sensor definition table **431** and the sensor state table **434**, and determines whether or not there is a human presence sensor group in the predicted direction. If there is no group (in step S**26**: No), the edge **400** terminates the movement processing of the edge **400** and the repeater **500** based on the movement prediction of a person.

[0069] On the other hand, if there is a group in the predicted direction (in step S**26**: Yes), the edge **400** further refers to the transmission state table **432**, and confirms whether or not the most recent detection result of any of the human presence sensors belonging to the group is "no", that is to say, whether or not there is an available conference room (step S**27**). If there are no available conference rooms (in step S**27**: No), the edge **400** determines that the person moving in the predicted direction is not moving for the purpose of using an available conference room, and terminates the movement processing of the edge **400** and the repeater **500** based on the movement prediction of a person.

[0070] On the other hand, if there is an available conference room (in step S**27**: Yes), the edge **400** and the repeater **500** move in order to receive data from the human presence sensors in the group that is in the predicted direction (steps S**28** and S**29**), and receive the data (step S**30**). The processing (steps S**28** to S**30**) is the same as the processing of each of the processing (steps S**12**, S**13**, and S**15**) in FIG. **3**. If any of the human presence sensors belonging to the group detect the person (in step S**30**: Yes), the edge **400** performs the same processing as each of the processing (step S**16** and S**17**) in FIG. **3**. If none of the human presence sensors belonging to the group detect the person (in step S**30**: No), the edge **400** terminates the movement processing of the edge **400** and the repeater **500** based on the movement prediction of a person.

[0071] In a case where the movement processing of the edge **400** and the repeater **500** due to the movement prediction of a person is terminated, the edge **400** repeats the simultaneous reading of data from the human presence sensors belonging to the group described in FIG. **3**. In this way, the edge **400** performs movement processing of the edge **400** and the repeater **500** based on the movement prediction of a person.

[0072] In addition, the edge **400** may adjust the range in which data can be received from the human presence sensors belonging to a group by utilizing the radio wave strength in a case where the repeater **500** receives data from the human presence sensors. As a premise of the processing, in a case where the edge **400** receives data from the human presence sensors in step S**15** of FIG. **3** or step S**30** of FIG. **4**, it is assumed that a radio wave strength (RSSI: Received Signal Strength Indicator) value in a case where the repeater **500** receives the data, and the latitude and longitude of the repeater **500** at the time of reception are successively recorded in the reception history table **433**. FIG. **8** is a diagram showing an example of the reception history table

433. In the table, the item "signal strength" indicates the value of the radio wave strength (RSSI) in a case where the repeater **500** receives the data. From the records in the reception history table **433**, the edge **400** determines and updates the range in which the edge **400** can receive data via the repeater **500** from each sensor, and therefore, from each group, as needed.

[0073] FIG. **5** is a diagram showing the processing performed in a case where the edge **400** uses the radio wave strength to adjust the range in which data can be simultaneously received from the human presence sensors belonging to a group. If the target human presence sensor is not empty in the reception history table **433** (in step S**41**: No), the edge **400** maps, for each human presence sensor, the latitude and longitude of the repeater **500** at the time of reception from the human presence sensor, and the RSSI value at the time (step S**42**). The edge **400** calculates a range that satisfies a predetermined RSSI threshold for the mapping result (step S**43**), and adds the result to the sensor state table **434** (step S**44**). FIG. **9**C shows an example in which the range satisfying the conditions for each human presence sensor is represented by a rectangular area using the latitude and longitude in the sensor state table **434**.

[0074] The edge **400** superimposes the results of each group (step S**45**), determines the range of the common sections as the optimal reading range of the group (step S**46**), and inputs the range into the group reading range table **435** (step S**47**). FIG. **10** is a diagram showing an example of the group reading range table **435**. In FIG. **10**, an example is shown in which the range in which the repeater **500** can reliably simultaneously receive data from all the human presence sensors belonging to group A is defined as a rectangular area using a latitude and longitude. FIG. **12** is a diagram showing an image in a case where rectangular areas that satisfy an RSSI threshold of the human presence sensors **200** to **202** belonging to group A are superimposed and define a common section **260** as the optimal reading range of group A.

[0075] In a case where the edge **400** and the repeater **500** receive data from the sensors in each group, the repeater **500** refers to the group reading range table **435**, moves inside the optimal read range indicated in the group reading range table **435**, and receives the data. Furthermore, the edge **400** updates the optimal read range as appropriate. The calculation of the optimal read range is approximated as a rectangular area as an example, but it is not limited to this.

[0076] The edge **400** updates the group reading range table **435** as described above.

[0077] As described above, the edge **400** and the repeater **500** are not installed in a fixed manner, but are capable of moving by being mounted on, for example, a drone, an Automated Guided Vehicle (AGV), an Autonomous Mobile Robot (AMR), or the like. In a case where the timing approaches for a human presence sensor that is installed far away to transmit data, the edge (or the repeater) moves toward the human presence sensor, and returns to the original position after receiving the data. At this time, the edge **400** transmits the data to the cloud using a wireless network line such as a carrier line. The repeater **500** relays communication between the human presence sensors and the edge **400**, and the human presence sensors periodically transmit data. In addition, the edge **400** and the repeater **500** are each able to learn the position of the other using a GPS, and are capable of exchanging information inside the wireless communication range. As a result, the edge **400** controls the repeater **500**, and moves the repeater **500** to a position where data can be relayed for the collection of data from the human presence sensors.

[0078] At this time, the edge **400** performs the following as a mechanism of knowing the timing at which the human presence sensors transmit data.

[0079] The edge **400** or the repeater **500** manages the data transmission period and status of the human presence sensors in a list, and predicts the timing at which data is next transmitted based on the operation specifications of the human presence sensors. Furthermore, as the number of sensors increases and the arrangement becomes dispersed, a state may arise in which sensors at a plurality of distant locations each transmit data simultaneously. In order to prevent such a state, the edge **400** or the repeater **500** controls the data transmission timing to be as close as possible to that of other nearby sensors inside the same communication area, such as by temporarily turning off the power supply connected to the sensors, or by temporarily rotating the sensors toward a wall to disable sensing, even if the sensors would normally be in a state to perform detection and transmit data. This is achieved by the edge **400** performing a control using wireless communication, or by the repeater **500** physically operating the sensors. As a result, the edge **400** or the repeater **500** is able to receive data from a plurality of sensors that are locally concentrated at the same timing, and enables data to be received evenly from a plurality of sensors that are arranged in a dispersed manner in distant locations while locally shifting the timing.

[0080] In addition, the boundaries of the range in which the data transmitted by each human presence sensor can be efficiently received are calculated based on statistical values of the radio wave strength included in the data received from each human presence sensor, and the distance that the edge **400** or the repeater **500** moves in order to receive the data is minimized, which makes the movement more efficient.

[0081] Also, another predictive detection human presence sensor is placed closer to the edge **400** and the repeater **500**, than the more distant target human presence sensor, and data from the predictive detection human presence sensor is collected to determine whether or not the more distant human presence sensor is likely to transmit data. For example, if the predictive detection human presence sensor installed in front of the human presence sensor that is targeted for data acquisition responds, the focus can be narrowed in that there is a possibility that a person will approach the target position. Further, in a case where a plurality of predictive detection human presence sensors are used, the movement of a person can be predicted with even greater accuracy by utilizing a time lapse of the detection by the predictive detection human presence sensors. Alternatively, a human presence sensor can be attached to the body of the edge **400** or repeater **500**, and the detection content can be monitored while moving around to predict whether or not the target human presence sensor will transmit data. As an example, if a human presence sensor is attached to the edge **400** or the repeater **500**, and a person is detected near the target sensor while moving, it is estimated that there is a possibility that the target sensor will detect the person.

[0082] Therefore, in a wireless communication system in which the edge **400** receives data transmitted by human presence sensors via wireless communication, even in a case where the human presence sensors are located at distances

where wireless communication is normally unreachable, reception is possible by moving the edge **400**. As a result, the range covered by the wireless communication system can be expanded without being restricted by the wireless communication range. In addition, data from the human presence sensors can be efficiently received.

[0083] An example embodiment of the present disclosure has a configuration in which the edge **400** is the center of processing, and performs processing such as predicting the timing of data transmission from the time sensors and adjusting the timing, and the repeater **500** moves significantly in order to support the data reception from the sensors. In another example embodiment, the repeater **500** may not be used, and a single edge **400** may perform all of the various processing up to receiving data from the sensors. FIG. **13** is a diagram showing an overview of a wireless communication system in a case where a repeater **500** is not used. FIG. **13** differs from FIG. **1** only in that the repeater **500** is not present. The operation of the edge **400** at this time differs only in that the repeater **500** does not relay data from the human presence sensors, and the edge **400** moves in a manner equivalent to that of the repeater **500**. In this case, although the repeater **500** is not required, the distance that the edge **400** must travel is increased due to the absence of the repeater **500**. Therefore, there is a possibility that the applicable range may be relatively smaller than that of the example embodiment.

[0084] Furthermore, in the example embodiment of the present disclosure, a single repeater **500** and single edge **400** are used. However, as another example embodiment, a configuration is possible in which two or more repeaters are used. FIG. **14** is a diagram showing an overview of a wireless communication system in a case where two repeaters are used. As the number of repeaters increases, the present disclosure can be implemented over a wider area.

[0085] A case where a plurality of repeaters are used will be described. The area in which the example embodiment described above is applied is logically divided by the number of repeaters, where a repeater is assigned to each area, and the repeater manages data reception from the sensors in the assigned area. For example, in a configuration using two repeaters **500** and **501** as in FIG. **14**, the target area in which the example embodiment described above is applied is divided into two, and the repeaters **500** and **501** are each assigned to the right side and the left side. Each repeater moves to the sensors arranged inside the assigned area, and relays the data such that the edge **400** is capable of receiving data from distant sensors with only a small movement. The example of FIG. **14** shows an example where the repeater **500** is assigned to the human presence sensors **200** to **202**, and the repeater **501** is assigned to the human presence sensors **203** to **205**.

[0086] Some wireless communication protocols do not allow multiple relays. Alternatively, there is a possibility that the repeaters may continue to repeatedly relay data between each other, causing congestion. Therefore, in a case where the edge **400** moves each of the repeaters within the assigned area, the edge **400** controls the repeaters to not come closer to each other than the radius of the wireless communication range. Specifically, at the timing of grouping the human presence sensors described in the processing of S**5** to S**8** of FIG. **3**, the edge **400** calculates the distance between the groups from the coordinates of the groups, and draws a boundary line as a divided block for a set of groups where the distance is less than or equal to a threshold value. Also, in a case where adjusting the transmission timing of the human presence sensors, the edge **400** performs a control that offsets the time such that the repeaters do not gather at groups having nearby coordinates at a near time point, but in a different allocated area. Also, the edge **400** performs distance calculations and path control to ensure that, in a case where the repeaters are circulating or moving, the repeaters do not get closer to each other than the radius of the wireless communication range. Each edge **400** uses the sensor state table and the repeater management table in a case where performing such processing. FIG. **15** and FIG. **16** are diagrams respectively showing a sensor state table and a repeater management table. In the sensor state table shown in FIG. **15**, compared to the sensor state table **434** shown in FIG. **9**A to **9**C, an "allocation area ID" is added as an item. The item "allocation area ID" indicates the result of summarizing the groups according to the distance between the groups, and serves as an ID that indirectly specifies the repeater that receives data from a target human presence sensor. The repeater management table shown in FIG. **16** includes, as items, a repeater ID, an allocation area ID, a current position latitude, a current location longitude, a movement speed latitude, and a movement speed longitude. Here, the "current position latitude" and the "current speed longitude" are items that indicate the current position of the target repeater using a latitude and longitude. The "movement speed latitude" and the "movement speed longitude" indicate, using a latitude and longitude, the position to which the target repeater is scheduled to move from the "current location latitude" and the "current location longitude" after a predetermined time unit. The edge **400** updates the sensor state table and the repeater management table described above, while also performing a control that offsets the time such that repeaters do not gather at a group having nearby coordinates at a near time point, but a different allocated area, and also performs distance calculations and path control to ensure that, in a case where the repeaters are circulating or moving, the repeaters do not get closer to each other than the radius of the wireless communication range.

[0087] In the example embodiment of the present disclosure, a human presence sensor is used as an example of data collection in IoT. However, the present disclosure is not limited to this. Another type of IoT sensor may be used.

[0088] Furthermore, in the example embodiment of the present disclosure, the edge **400** executes various processing. However, the repeater **500** may be provided with such a function.

[0089] The wireless communication system of the present disclosure can be used in cases where a large number of inexpensive sensors are installed over a vast area. In addition to visualizing the usage status of conference rooms as described in the example embodiment of the present disclosure, application is also possible in cases where IoT is utilized in offices or factories, for example, in remote maintenance of equipment, and management of facilities. Furthermore, the present disclosure can also be applied to improve the efficiency of work utilizing IoT at large-scale construction sites such as building sites and mining sites, that is to say, visualizing the state of workers, grasping the status of machines and robots, and performing maintenance. Also, the wireless communication system of the present disclosure can also be applied to collecting status data using

IoT over a vast area, such as for environmental conservation of forests, living things, and rivers.

[0090] FIG. **17** is a diagram showing a configuration example of a wireless communication system according to an example embodiment of the present disclosure. The wireless communication system includes: a reception device that is capable of self-propelled movement, performs movement control of an own device based on a transmission timing of sensing information of a sensor, an installation position of the sensor, and a range in which reception is possible in a case where the sensing information is received from the sensor, and then receives the sensing information of the sensor.

[0091] FIG. **18** is a block diagram showing an example of a hardware configuration of the control units **450**, **540** and **250** of the edge **400**, the repeater **500**, and the human presence sensor. Here, the hardware configuration of the control unit includes a CPU **51**, a Random Access Memory (RAM) **52**, a Read Only Memory (ROM) **53**, a recording device **54**, and the like. The ROM **53** and the recording device **54** store programs and information that realize the functions of the control unit. The RAM **52** is used as a work area that temporarily stores the data used during operation of the CPU **51** and the like. Furthermore, the control unit also includes an input/output port **55** that serves as an interface for connecting to other devices, the edge **400**, the repeater **500**, and devices that constitute the human presence sensor. The ROM **53** may be configured by an Electrically Erasable Programmable Read-Only Memory (EEPROM) or the like. In addition, the recording device **54** may be configured by a hard disk, an SSD, or the like. The computer program for realizing the functions of the control unit may be updated in the ROM **53** or the recording device **54**. In some cases, only the ROM **53** is provided in the control unit **250** of the human presence sensor, and the recording device **54** is omitted.

[0092] The present disclosure has been described above with reference to the example embodiments. However, the present disclosure is not limited to the example embodiments described above. Various changes to the configuration and details of the present disclosure that can be understood by those skilled in the art can be made within the scope of the present disclosure. In addition, each of the example embodiments may be combined as appropriate with other example embodiments.

[0093] According to an example aspect described above, even in a case where information that has been sensed by a sensor is transmitted with a certain, specific timing, it is possible to receive the information that has been sensed.

[0094] While preferred example embodiments of the disclosure have been described and illustrated above, it should be understood that these are exemplary of the disclosure and are not to be considered as limiting. Additions, omissions, substitutions, and other modifications can be made without departing from the scope of the present disclosure. Accordingly, the disclosure is not to be considered as being limited by the foregoing description, and is only limited by the scope of the appended claims.

[0095] A part or all of the example embodiment described above can be written as in the supplementary notes below, but is not limited thereto.

(Supplementary Note 1)

[0096] A wireless communication system including:

[0097] a reception device that is capable of self-propelled movement, performs movement control of an own device based on a transmission timing of sensing information of a sensor, an installation position of the sensor, and a range in which reception is possible in a case where the sensing information is received from the sensor, and then receives the sensing information of the sensor.

(Supplementary Note 2)

[0098] The wireless communication system according to supplementary note 1, wherein

[0099] the wireless communication system further includes a repeater that is capable of self-propelled movement, that receives the sensing information from the sensor, and relays the received sensing information to the reception device,

[0100] the reception device being a device that is capable of transferring the received sensing information to a data processing system, and

[0101] the reception device

[0102] further performs movement control of the repeater based on a transmission timing of the sensing information of the sensor, the installation position of the sensor, and a range in which reception is possible in a case where the repeater receives the sensing information from the sensor, and

[0103] receives the sensing information of the sensor via the repeater.

(Supplementary Note 3)

[0104] The wireless communication system according to supplementary note 2, wherein

[0105] the reception device performs movement control of the repeater such that an own movement distance is minimized in a position where transmission and reception is possible with respect to the repeater, and in a case where the sensing information is received from the sensor via the repeater.

(Supplementary Note 4)

[0106] The wireless communication system according to supplementary note 2 or 3, wherein

[0107] the reception device

[0108] performs grouping in a case where there are a plurality of sensors, where the plurality of sensors are grouped in a group that causes a distance between each sensor from an installation position of each sensor to be less than or equal to a predetermined value, and

[0109] performs movement control of the repeater such that the repeater can receive the sensing information at a predetermined time point from all of the sensors included in the group.

(Supplementary Note 5)

[0110] The wireless communication system according to supplementary note 4, wherein the reception device

[0111] predicts, for each sensor, a time point at which the sensor next transmits the sensing information based on a reception time of the last received sensing information, and

[0112] in a case where it is determined that, based on the predicted next time point at which the sensing information is transmitted, it is not possible to receive the sensing information from all of the sensors included in the group at a predetermined time point, performs a control that causes all of the sensors included in the group to be temporarily disabled, and then enabled.

(Supplementary Note 6)

[0113] The wireless communication system according to supplementary note 4 or 5, wherein

[0114] the wireless communication system includes a plurality of repeaters, and

[0115] the reception device

[0116] performs further grouping of the group based on position information of the group and the number of repeaters, and then assigns a repeater to each group that has been further grouped, and

[0117] in a case where the sensing information is received from a sensor belonging to a predetermined group, performs movement control of a repeater that has been assigned to a group that has been further grouped, to which the predetermined group belongs, and receives the sensing information of the sensor that belongs to the predetermined group via the repeater with respect to which movement control has been performed.

(Supplementary Note 7)

[0118] The wireless communication system according to any one of supplementary notes 4 to 6, wherein

[0119] the reception device adjusts the range in which reception is possible in a case where the repeater receives the sensing information from all of the sensors belonging to the group based on a reception strength in a case where the repeater receives the sensing information from the sensor.

(Supplementary Note 8)

[0120] The wireless communication system according to any one of supplementary notes 2 to 7, wherein

[0121] the sensor is a human presence sensor,

[0122] the wireless communication system is provided with a plurality of predictive detection human presence sensors that are different from the sensor, and are installed in a fixed manner in order to perform movement detection prediction of a person, and/or

[0123] the repeater and the reception device are each provided with a human presence sensor,

[0124] the reception device

[0125] predicts a movement direction of a person based on a time point at which a person is detected by the predictive detection human presence sensor, and an installation position of the predictive detection human presence sensor, and/or based on a time point at which a person is detected by the repeater and the reception device, and

[0126] further performs movement control of the repeater such that the sensing information can be acquired from a sensor that is in a predicted movement direction of the person.

(Supplementary Note 11)

[0127] A wireless communication method performed by a reception device that constitutes a wireless communication system, the method including the step of:

[0128] performing movement control of an own device based on a transmission timing of sensing information of a sensor, an installation position of the sensor, and a range in which reception is possible in a case where the sensing information is received from the sensor, and then receiving the sensing information of the sensor.

(Supplementary Note 12)

[0129] The wireless communication method performed by a reception device according to supplementary note 11, wherein

[0130] the wireless communication system further includes a repeater that is capable of self-propelled movement, that receives the sensing information from the sensor, and relays the received sensing information to the reception device, and

[0131] the reception device, in a case where it is a device that is capable of transferring the received sensing information to a data processing system,

[0132] further performs movement control of the repeater based on a transmission timing of the sensing information of the sensor, the installation position of the sensor, and a range in which reception is possible in a case where the repeater receives the sensing information from the sensor, and

[0133] receives the sensing information of the sensor via the repeater.

(Supplementary Note 13)

[0134] The wireless communication method performed by a reception device according to claim **12**, wherein

[0135] movement control of the repeater is performed such that an own movement distance is minimized in a position where transmission and reception is possible with respect to the repeater, and in a case where the sensing information is received from the sensor via the repeater.

(Supplementary Note 14)

[0136] The wireless communication method performed by a reception device according to supplementary note 12 or 13, wherein

[0137] grouping is performed in a case where there are a plurality of sensors, where the plurality of sensors are grouped in a group that causes a distance between each sensor from an installation position of each sensor to be less than or equal to a predetermined value, and

[0138] movement control of the repeater is performed such that the repeater can receive the sensing information at a predetermined time point from all of the sensors included in the group.

(Supplementary Note 15)

[0139] The wireless communication method performed by a reception device according to supplementary note 14, wherein

[0140] for each sensor, a time point at which the sensor next transmits the sensing information is predicted based on a reception time of the last received sensing information, and

[0141] in a case where it is determined that, based on the predicted next time point at which the sensing information is transmitted, it is not possible to receive the sensing information from all of the sensors included in the group at a predetermined time point, a control is performed that causes all of the sensors included in the group to be temporarily disabled, and then enabled.

(Supplementary Note 16)

[0142] The wireless communication method performed by a reception device according to supplementary note 14 or 15, wherein

[0143] in a case where the wireless communication system includes a plurality of repeaters,

[0144] further grouping of the group is performed based on position information of the group and the number of repeaters, and then a repeater is assigned to each group that has been further grouped, and

[0145] in a case where the sensing information is received from a sensor belonging to a predetermined group, movement control is performed of a repeater that has been assigned to a group that has been further grouped, to which the predetermined group belongs, and the sensing information of the sensor that belongs to the predetermined group is received via the repeater with respect to which movement control has been performed.

(Supplementary Note 17)

[0146] The wireless communication method performed by a reception device according to any one of supplementary notes 14 to 16, wherein

[0147] the range in which reception is possible in a case where the repeater receives the sensing information from all of the sensors belonging to the group is adjusted based on a reception strength in a case where the repeater receives the sensing information from the sensor.

(Supplementary Note 18)

[0148] The wireless communication method performed by a reception device according to any one of supplementary notes 12 to 17, wherein

[0149] the sensor is a human presence sensor,

[0150] and in a case where the wireless communication system is provided with a plurality of predictive detection human presence sensors that are different from the sensor, and are installed in a fixed manner in order to perform movement detection prediction of a person, and/or

[0151] the repeater and the reception device are each provided with a human presence sensor,

[0152] a movement direction of a person is predicted based on a time point at which a person is detected by the predictive detection human presence sensor, and an installation position of the predictive detection human presence sensor, and/or based on a time point at which a person is detected by the repeater and the reception device, and

[0153] movement control of the repeater is further performed such that the sensing information can be acquired from a sensor that is in a predicted movement direction of the person.

(Supplementary Note 21)

[0154] A program for a reception device that constitutes a wireless communication system, the program causing a computer to execute the step of:

[0155] performing movement control of an own device based on a transmission timing of sensing information of a sensor, an installation position of the sensor, and a range in which reception is possible in a case where the sensing information is received from the sensor, and then receiving the sensing information of the sensor.

(Supplementary Note 22)

[0156] The program for a reception device according to supplementary note 21, wherein

[0157] the wireless communication system further includes a repeater that is capable of self-propelled movement, that receives the sensing information from the sensor, and relays the received sensing information to the reception device, and

[0158] the reception device, in a case where it is a device that is capable of transferring the received sensing information to a data processing system,

[0159] further performs movement control of the repeater based on a transmission timing of the sensing information of the sensor, the installation position of the sensor, and a range in which reception is possible in a case where the repeater receives the sensing information from the sensor, and

[0160] receives the sensing information of the sensor via the repeater.

(Supplementary Note 23)

[0161] The program for a reception device according to supplementary note 22, wherein

[0162] movement control of the repeater is performed such that an own movement distance is minimized in a position where transmission and reception is possible with respect to the repeater, and in a case where the sensing information is received from the sensor via the repeater.

(Supplementary note 24)

[0163] The program for a reception device according to supplementary note 22 or 23, wherein

[0164] grouping is performed in a case where there are a plurality of sensors, where the plurality of sensors are grouped in a group that causes a distance between each sensor from an installation position of each sensor to be less than or equal to a predetermined value, and

[0165] movement control of the repeater is performed such that the repeater can receive the sensing information at a predetermined time point from all of the sensors included in the group.

(Supplementary note 25)

[0166] The program for a reception device according to supplementary note 24, wherein

[0167] for each sensor, a time point at which the sensor next transmits the sensing information is predicted based on a reception time of the last received sensing information, and

[0168] in a case where it is determined that, based on the predicted next time point at which the sensing information is transmitted, it is not possible to receive the sensing information from all of the sensors included in the group at a predetermined time point, a control is performed that causes all of the sensors included in the group to be temporarily disabled, and then enabled.

(Supplementary Note 26)

[0169] The program for a reception device according to supplementary note 24 or 25, wherein

[0170] in a case where the wireless communication system includes a plurality of repeaters,

[0171] further grouping of the group is performed based on position information of the group and the number of repeaters, and then a repeater is assigned to each group that has been further grouped, and

[0172] in a case where the sensing information is received from a sensor belonging to a predetermined group, movement control is performed of a repeater that has been assigned to a group that has been further grouped, to which the predetermined group belongs, and the sensing information of the sensor that belongs to the predetermined group is received via the repeater with respect to which movement control has been performed.

(Supplementary Note 27)

[0173] The program for a reception device according to any one of supplementary notes 24 to 26, wherein

[0174] the range in which reception is possible in a case where the repeater receives the sensing information from all of the sensors belonging to the group is adjusted based on a reception strength in a case where the repeater receives the sensing information from the sensor.

(Supplementary Note 28)

[0175] The program for a reception device according to any one of supplementary notes 22 to 27, wherein

[0176] the sensor is a human presence sensor,

[0177] and in a case where the wireless communication system is provided with a plurality of predictive detection human presence sensors that are different from the sensor, and are installed in a fixed manner in order to perform movement detection prediction of a person, and/or

[0178] the repeater and the reception device are each provided with a human presence sensor,

[0179] a movement direction of a person is predicted based on a time point at which a person is detected by the predictive detection human presence sensor, and an installation position of the predictive detection human presence sensor, and/or based on a time point at which a person is detected by the repeater and the reception device, and

[0180] movement control of the repeater is further performed such that the sensing information can be acquired from a sensor that is in a predicted movement direction of the person.

What is claimed is:

1. A wireless communication system comprising:

a receiver configured to be capable of self-propelled movement, and including at least one first memory configured to store first instructions and at least one first processor configured to execute the first instructions to:

perform movement control of the receiver based on a transmission timing of sensing information of a sensor, an installation position of the sensor, and a range in which reception is possible in a case where the sensing information is received from the sensor; and

receive the sensing information of the sensor.

2. The wireless communication system according to claim **1** further comprising a repeater configured to be capable of self-propelled movement, and including at least one second memory configured to store second instructions and at least one second processor configured to execute the second instructions to:

receive the sensing information from the sensor; and

relay the received sensing information to the receiver,

wherein the receiver is capable of transferring the received sensing information to a data processing system, and wherein the at least one first processor is configured to execute the first instructions to:

perform movement control of the repeater based on a transmission timing of the sensing information of the sensor, the installation position of the sensor, and a range in which reception is possible in a case where the repeater receives the sensing information from the sensor; and

receive the sensing information of the sensor via the repeater.

3. The wireless communication system according to claim **2**, wherein the at least one first processor is configured to execute the first instructions to perform movement control of the repeater such that an own movement distance is minimized in a position where transmission and reception is possible with respect to the repeater, and in a case where the sensing information is received from the sensor via the repeater.

4. The wireless communication system according to claim **2**, wherein the at least one first processor is configured to execute the first instructions to:

perform grouping in a case where there are a plurality of sensors, where the plurality of sensors are grouped in a group that causes a distance between each sensor from an installation position of each sensor to be less than or equal to a predetermined value; and

perform movement control of the repeater such that the repeater can receive the sensing information at a predetermined time point from all of the sensors included in the group.

5. The wireless communication system according to claim **4**, wherein the at least one first processor is configured to execute the first instructions to:

predict, for each sensor, a time point at which the sensor next transmits the sensing information based on a reception time of the last received sensing information, and

in a case where it is determined that, based on the predicted next time point at which the sensing information is transmitted, it is not possible to receive the sensing information from all of the sensors included in the group at a predetermined time point, perform a control that causes all of the sensors included in the group to be temporarily disabled, and then enabled.

6. The wireless communication system according to claim **4**, wherein the repeater includes a plurality of repeaters, and the at least one first processor is configured to execute the first instructions to:

perform further grouping of the group based on position information of the group and the number of repeaters, and then assigns a repeater to each group that has been further grouped, and

in a case where the sensing information is received from a sensor belonging to a predetermined group, perform movement control of a repeater that has been assigned to a group that has been further grouped, to which the predetermined group belongs, and receive the sensing information of the sensor that belongs to the predetermined group via the repeater with respect to which movement control has been performed.

7. The wireless communication system according to claim **4**, wherein the at least one first processor is configured to execute the first instructions to adjust the range in which reception is possible in a case where the repeater receives the sensing information from all of the sensors belonging to the group based on a reception strength in a case where the repeater receives the sensing information from the sensor.

8. The wireless communication system according to claim **2**, wherein

the sensor is a human presence sensor,

the wireless communication system includes a plurality of predictive detection human presence sensors that are different from the sensor, and are installed in a fixed manner in order to perform movement detection prediction of a person, and/or

the repeater and the receiver each include a human presence sensor, and

wherein the at least one first processor is configured to execute the first instructions to:

predict a movement direction of a person based on a time point at which a person is detected by the predictive detection human presence sensor, and an installation position of the predictive detection human presence sensor, and/or based on a time point at which a person is detected by the repeater and the reception device, and

perform movement control of the repeater such that the sensing information can be acquired from a sensor that is in a predicted movement direction of the person.

9. A wireless communication method performed by a receiver included in a wireless communication system, the method comprising:

performing, by the receiver, movement control of the receiver based on a transmission timing of sensing information of a sensor, an installation position of the sensor, and a range in which reception is possible in a case where the sensing information is received from the sensor; and

receiving, by the receiver, the sensing information of the sensor.

10. The wireless communication method according to claim **9**, wherein the wireless communication system further includes a repeater configured to be capable of self-propelled movement, and wherein the method further comprises:

receiving, by the repeater, the sensing information from the sensor; and

relaying, by the repeater, the received sensing information to the receiver,

wherein the receiver is capable of transferring the received sensing information to a data processing system, and wherein the method further comprises:

performing, by the receiver, movement control of the repeater based on a transmission timing of the sensing information of the sensor, the installation position of the sensor, and a range in which reception is possible in a case where the repeater receives the sensing information from the sensor; and

receiving, by the receiver, the sensing information of the sensor via the repeater.

11. The wireless communication method according to claim **10** further comprising performing, by the receiver, movement control of the repeater such that an own movement distance is minimized in a position where transmission and reception is possible with respect to the repeater, and in a case where the sensing information is received from the sensor via the repeater.

12. The wireless communication method according to claim **10** further comprising:

performing, by the receiver, grouping in a case where there are a plurality of sensors, where the plurality of sensors are grouped in a group that causes a distance between each sensor from an installation position of each sensor to be less than or equal to a predetermined value; and

performing, by the receiver, movement control of the repeater such that the repeater can receive the sensing information at a predetermined time point from all of the sensors included in the group.

13. The wireless communication method according to claim **12** further comprising:

predicting, by the receiver, for each sensor, a time point at which the sensor next transmits the sensing information based on a reception time of the last received sensing information, and

in a case where it is determined that, based on the predicted next time point at which the sensing information is transmitted, it is not possible to receive the sensing information from all of the sensors included in the group at a predetermined time point, performing, by the receiver, a control that causes all of the sensors included in the group to be temporarily disabled, and then enabled.

14. The wireless communication method according to claim **12**, wherein the receiver includes a plurality of repeaters, and wherein the method further comprises:

performing, by the receiver, further grouping of the group based on position information of the group and the number of repeaters, and then assigns a repeater to each group that has been further grouped, and

in a case where the sensing information is received from a sensor belonging to a predetermined group, perform-

ing, by the receiver, movement control of a repeater that has been assigned to a group that has been further grouped, to which the predetermined group belongs, and receiving the sensing information of the sensor that belongs to the predetermined group via the repeater with respect to which movement control has been performed.

15. The wireless communication method according to claim **12** further comprising adjusting, by the receiver, the range in which reception is possible in a case where the repeater receives the sensing information from all of the sensors belonging to the group based on a reception strength in a case where the repeater receives the sensing information from the sensor.

16. The wireless communication method according to claim **10**, wherein

the sensor is a human presence sensor,

the wireless communication system includes a plurality of predictive detection human presence sensors that are different from the sensor, and are installed in a fixed manner in order to perform movement detection prediction of a person, and/or

the repeater and the receiver each include a human presence sensor, and

wherein the method further comprises:

predicting, by the receiver, a movement direction of a person based on a time point at which a person is detected by the predictive detection human presence sensor, and an installation position of the predictive detection human presence sensor, and/or based on a time point at which a person is detected by the repeater and the reception device, and

performing, by the receiver, movement control of the repeater such that the sensing information can be acquired from a sensor that is in a predicted movement direction of the person.

17. A non-transitory storage medium storing a program for a receiver included in a wireless communication system, the program causing a computer to execute:

performing movement control of the receiver based on a transmission timing of sensing information of a sensor, an installation position of the sensor, and a range in which reception is possible in a case where the sensing information is received from the sensor; and

receiving the sensing information of the sensor.

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