(in other words, since the second reflecting plane H2 is horizontal), the reference distance h_{ref1} is equal to the reference distance h_{ref2}.

[0038] Subsequently, when the EV bus 1 has further advanced into the charging area A and the second distance measuring instrument K2 is located over the first reflecting plane H1, the first distance measuring instrument K1 measures the vertical distance h1 to a point in the second reflecting plane H2, and the second distance measuring instrument K2 measures the vertical distance h2 to a point in the first reflecting plane H1. As a result, the vertical distance h2 measured by the second distance measuring instrument K2 is smaller than the vertical distance h1 measured by the first distance measuring instrument K1. Thereafter, when the EV bus 1 has further advanced into the charging area A and the first and second distance measuring instruments K1 and K2 are located over the first reflecting plane H1, the first and second distance measuring instruments K1 and K2 together measure the vertical distances h1 and h2 to points in the first reflecting plane H1.

[0039] When the vertical distance h1 measured by the first distance measuring instrument K1 has decreased to be smaller than the reference distance h_{ref1}, or when the vertical distance h2 measured by the second distance measuring instrument K2 has decreased to be smaller than the reference distance h_{ref2}, the positional deviation detecting unit 105 obtains at least either one of a difference h1y between the vertical distance h1 and the reference distance h_{ref1} and a difference h2y between the vertical distance h2 and the reference distance h_{ref2}. In other words, the positional deviation detecting unit 105 obtains the difference h1y between the reference distance

h_{ref1} and the vertical distance h1 to a point in the first reflecting plane H1 having the same position in the orthogonal direction D2 as the position in the second reflecting plane H2 where the reference distance h_{ref1} has been measured. Otherwise, the positional deviation detecting unit 105 obtains the difference h2y between the reference distance h_{ref2} and the vertical distance h2 to a point in the first reflecting plane H1 having the same position in the orthogonal direction D2 as the position in the second reflecting plane H2 where the reference distance h_{ref2} has been measured.

[0040] Subsequently, the positional deviation detecting unit 105 calculates a positional deviation $\Delta y1$ (hereinafter, called a right-left deviation) of the EV bus 1 with respect to the lateral direction of the charging area A based on the difference h1y, a value hp of the difference h1y (hereinafter, called a reference value) in the case where the EV bus 1 has stopped in the charging area A (in the case where the EV bus 1 has been precisely docked in the charging area A), and the first angle $\theta 1$. Specifically, the positional deviation detecting unit 105 obtains the right-left deviation $\Delta y1$ using Expression (4) below.

$$\Delta y1 = (hp - h1y)/\tan \theta 1 \quad (4)$$

[0041] The positional deviation detecting unit 105 calculates a right-left deviation $\Delta y2$ of the EV bus 1 with respect to the lateral direction of the charging area A based on the difference h2y, the reference value hp, and the first angle $\theta 1$. Specifically, the positional deviation detecting unit 105 obtains the right-left deviation $\Delta y2$ using Expression (5) below.

$$\Delta y2 = (hp - h2y)/\tan \theta 1 \quad (5)$$

[0042] If at least either one of the detected right-left

first reflecting plane H1. The positional deviation detecting unit 105 stores therein the vertical distance measured by the second distance measuring instrument K2 as the reference vertical distance. Thereafter, when the EV bus 1 has further advanced into the charging area A, the vertical distance measured by the first distance measuring instrument K1 changes to the vertical distance to a point in the first reflecting plane H1. The positional deviation detecting unit 105 stores therein the vertical distance measured by the first distance measuring instrument K1 as the reference vertical distance.

[0052] The positional deviation detecting unit 105 waits until the EV bus 1 further advances into the charging area A to change the vertical distance measured by the second distance measuring instrument K2. If the difference upper limit hq is reached by the difference between the reference vertical distance measured by the second distance measuring instrument K2 and the vertical distance measured by the second distance measuring instrument K2 after the reference vertical distance has been measured, the positional deviation detecting unit 105 detects that the difference between the position of the EV bus 1 with respect to the longitudinal direction of the charging area A and the position (hereinafter, called a precise docking position) where the charging unit 102 can perform the charging in the charging area A is equal to or smaller than a predetermined threshold. At that time, the positional deviation detecting unit 105 displays information indicating that the position of the EV bus 1 with respect to the longitudinal direction of the charging area A has come close to the precise docking position as the positional deviation information on the display unit 106.

passed through the precise docking position. In this manner, an overrun of the EV bus 1 with respect to the charging area A can be detected. At that time, the positional deviation detecting unit 105 displays information indicating that the position of the EV bus 1 has overrun the charging area A on the display unit 106.

[0058] The following describes, using FIGS. 13 and 14, a detection flow of the positional deviation of the EV bus 1 in the charging system according to the present embodiment. FIG. 14 is a diagram for explaining an example of the detection flow of the positional deviation of the EV bus in the charging system according to the seventh embodiment. In the present embodiment, as illustrated in FIG. 13, the EV bus 1 includes, on the roof of the EV bus 1, the second reflecting plane H2, the first reflecting plane H1, the third reflecting plane H3, and the fourth reflecting plane H4, in this order from the front side in the traveling direction D1.

[0059] As illustrated in FIG. 14, the first and second distance measuring instruments K1 and K2 measure vertical distances to the ground surface until the EV bus 1 comes close to the charging area A. After the EV bus 1 passes through the entrance of the charging area A, the second distance measuring instrument K2 measures the vertical distance to a point in the second reflecting plane H2 provided on the roof of the EV bus 1. When the EV bus 1 has further advanced into the charging area A, the first and second distance measuring instruments K1 and K2 together measure vertical distances to points in the second reflecting plane H2. The positional deviation detecting unit 105 stores therein the vertical distance to the second reflecting plane H2 measured by the first distance measuring instrument K1 (reference distance h_{ref1}) and the

vertical distance to the second reflecting plane H2 measured by the second distance measuring instrument K2 (reference distance h_{ref2}) (Step S1).

[0060] Subsequently, when the EV bus 1 has further advanced into the charging area A and the second distance measuring instrument K2 is located over the first reflecting plane H1, the positional deviation detecting unit 105 obtains the difference h2y between the vertical distance h2 measured by the second distance measuring instrument K2 and the reference distance h_{ref2}. The positional deviation detecting unit 105 detects the deviation (right-left deviation) of the EV bus 1 with respect to the lateral direction of the charging area A based on the difference h2y, the reference value hp, and the first angle $\theta 1$ (Step S2). The positional deviation detecting unit 105 displays the positional deviation information indicating the detected right-left deviation on the display unit 106. This display allows the driver D of the EV bus 1 to check the positional deviation information displayed on the display unit 106 and correct the right-left deviation of the EV bus 1.

[0061] Subsequently, when the EV bus 1 has further advanced into the charging area A and the first and second distance measuring instruments K1 and K2 are located over the first reflecting plane H1, the positional deviation detecting unit 105 detects the inclination angle β (rotational deviation) of the EV bus 1 with respect to the longitudinal direction of the charging area A based on the difference between the vertical distance h1 to the point P1 in the first reflecting plane H1 measured by the first distance measuring instrument K1 and the vertical distance h2 to the point P2 in the first reflecting plane H1 measured by the second distance measuring instrument K2,

the distance L between the point P1 and the point P2, and the first angle θ1 (Step S3). At that time, the positional deviation detecting unit 105 obtains the difference h1y between the vertical distance h1 measured by the first distance measuring instrument K1 and the reference distance h_{ref1}. The positional deviation detecting unit 105 may detect the deviation (right-left deviation) of the EV bus 1 with respect to the lateral direction of the charging area A based on the difference h1y, the reference value hp, and the first angle θ1 (Step S3). The positional deviation detecting unit 105 displays the positional deviation information indicating the rotational deviation and the right-left deviation thus detected on the display unit 106. This display allows the driver D of the EV bus 1 to check the information displayed on the display unit 106 and correct the rotational deviation and the right-left deviation of the EV bus 1.

[0062] When the EV bus 1 has further advanced into the charging area A and the second distance measuring instrument K2 is located over the third reflecting plane H3 to change the vertical distance measured by the second distance measuring instrument K2, the positional deviation detecting unit 105 determines whether the difference upper limit hq is reached by the difference between the vertical distance (reference vertical distance) to the point in the first reflecting plane H1 measured by the second distance measuring instrument K2 and the vertical distance measured by the second distance measuring instrument K2 after the reference vertical distance has been measured. If the difference upper limit hq is reached by the difference between the reference vertical distance measured by the second distance measuring instrument K2 and the vertical distance (vertical distance to the point in the third

detection flow of the positional deviation of the EV bus 1 in the charging system according to the present embodiment. FIG. 16 is a diagram for explaining an example of the detection flow of the positional deviation of the EV bus in the charging system according to the eighth embodiment.

[0071] As illustrated in FIG. 16, during a period until the EV bus 1 comes close to the charging area A, the vertical distances measured by the first and second distance measuring instruments K1 and K2 provided on the roof of the EV bus 1 are infinite. After the EV bus 1 passes through the entrance of the charging area A, the first distance measuring instrument K1 measures the vertical distance to a point in the second reflecting plane H2 provided on the roof R covering the charging area A. When the EV bus 1 has further advanced into the charging area A, the first and second distance measuring instruments K1 and K2 together measure vertical distances to points in the second reflecting plane H2. The positional deviation detecting unit 105 stores therein the vertical distance to the second reflecting plane H2 measured by the first distance measuring instrument K1 (reference distance h_{ref1}) and the vertical distance to the second reflecting plane H2 measured by the second distance measuring instrument K2 (reference distance h_{ref2}) (Step S11).

[0072] Subsequently, when the EV bus 1 has further advanced into the charging area A and the first distance measuring instrument K1 is located under the first reflecting plane H1, the positional deviation detecting unit 105 obtains the difference h1y between the vertical distance h1 measured by the first distance measuring instrument K1 and the reference distance h_{ref1}. The positional deviation detecting unit 105 detects the deviation (right-left deviation) of the EV bus 1 with

respect to the lateral direction of the charging area A based on the difference h1y, the reference value hp, and the first angle θ1 (Step S12). The positional deviation detecting unit 105 displays the positional deviation information indicating the detected right-left deviation on the display unit 106. This display allows the driver D of the EV bus 1 to check the positional deviation information displayed on the display unit 106 and correct the right-left deviation of the EV bus 1.

[0073] Subsequently, when the EV bus 1 has further advanced into the charging area A and the second distance measuring instrument K2 is located under the first reflecting plane H1, the positional deviation detecting unit 105 detects the inclination angle β (rotational deviation) of the EV bus 1 with respect to the longitudinal direction of the charging area A based on the difference between the vertical distance h1 to the point P1 in the first reflecting plane H1 measured by the first distance measuring instrument K1 and the vertical distance h2 to the point P2 in the first reflecting plane H1 measured by the second distance measuring instrument K2, the distance L between the point P1 and the point P2, and the first angle θ1 (Step S13). At that time, the positional deviation detecting unit 105 obtains the difference h2y between the vertical distance h2 measured by the second distance measuring instrument K2 and the reference distance h_{ref2}. The positional deviation detecting unit 105 may detect the deviation (right-left deviation) of the EV bus 1 with respect to the lateral direction of the charging area A based on the difference h2y, the reference value hp, and the first angle θ1 (Step S13). The positional deviation detecting unit 105 displays the positional deviation

6. The charging device according to any one of claims 1 to 5, wherein the detecting unit is configured to detect the positional deviation of the vehicle with respect to the predefined area when the detected inclination of the vehicle exceeds a predetermined angle.

7. The charging device according to claim 5, wherein the detecting unit is configured to transmit information on the angle of inclination of the vehicle with respect to the longitudinal direction of the predefined area, the positional deviation of the vehicle with respect to the lateral direction of the predefined area, and the positional deviation of the vehicle with respect to the longitudinal direction of the predefined area, to a display unit of the vehicle through wireless communication.

8. The charging device according to claim 5, wherein

the first position is provided with the second plane, the first plane, the third plane, the fourth plane, and a fifth plane, in this order from a front side of the vehicle along the traveling direction, and

the fifth plane is provided closer than the fourth plane to an exit side of the predefined area in the longitudinal direction of the predefined area, and has no gradient with respect to the horizontal plane.

9. A charging device comprising:

a charging unit configured to charge a power storage functional unit provided in a vehicle stopping in a rectangular predefined area;

a measuring unit that is provided on a roof of the vehicle, and that is configured to measure a vertical distance to a point in a first plane that is provided above

the vehicle stopping in the predefined area, and that has a gradient of a first angle with respect to a horizontal plane toward a lateral direction of the predefined area; and

a detecting unit configured to detect an angle of inclination of the vehicle with respect to a longitudinal direction of the predefined area based on a first difference, a distance, and the first angle, the first difference being a difference between a first vertical distance to a first point in the first plane and a second vertical distance to a second point in the first plane having a position in the longitudinal direction of the predefined area different from that of the first point, the distance being a distance between the first point and the second point.

10. A positional deviation detection method comprising:

measuring a vertical distance to a point in a first plane that is provided in a first position serving as a roof or a bottom of a vehicle stopping in a rectangular predefined area and being charged, and that has a gradient of a first angle with respect to a horizontal plane toward an orthogonal direction orthogonal to a traveling direction of the vehicle; and

detecting an angle of inclination of the vehicle with respect to a longitudinal direction based on a first difference, a distance, and the first angle, the first difference being a difference between a first vertical distance to a first point in the first plane and a second vertical distance to a second point in the first plane having a position in the traveling direction different from