CLAIMS

[Claim 1] A positioning system to perform positioning of a communication device that wirelessly communicates with each base station of a plurality of base stations, the positioning system comprising:

a relative angle acquisition unit to acquire a relative angle between each base station of the plurality of base stations and the communication device from each base station of the plurality of base stations;

a provisional position calculation unit to calculate a position of the communication device as a provisional position of the communication device, using the relative angle between each base station of the plurality of base stations and the communication device and a position of each base station of the plurality of base stations;

a weight calculation unit to calculate a distance between each base station of the plurality of base stations and the provisional position of the communication device, using the position of each base station of the plurality of base stations and the provisional position of the communication device, and calculate, for each of the plurality of base stations, a respective weighting coefficient for correcting the provisional position, based on the distance between each base station of the plurality of base stations and the provisional position of the communication device, wherein the weighting coefficients are functions that monotonically decrease as the respective distance increases; and

a device position calculation unit to calculate the position of the communication device as a device position, using the relative angle between each base station of the plurality of base stations and the communication device, the position of each base station of the plurality of base stations, and the weighting coefficients for each base station of the plurality of base stations,

wherein the provisional position calculation unit is arranged to calculate the provisional position by performing a least-squares method, the provisional position being given as a solution to a minimum value of a sum of squares of errors obtained based on the relative angle between each base station of the plurality of base stations and the communication device and the position of each base station of the plurality of base stations, said errors being associated with measurement noise of the position of the communication device, and

wherein the device position calculation unit is arranged to calculate the device position by multiplying each of the obtained errors by the corresponding weighting coefficient to obtain a weighted error and executing a weighted least-squares method, the

device position being given as a solution to a minimum value of a sum of squares of weighted errors.

[Claim 2] The positioning system according to claim 1,

wherein the weight calculation unit calculates the weighting coefficient that makes an influence of each error in the least-squares method smaller as the distance is greater.

[Claim 3] The positioning system according to claim 1 or claim 2,

wherein the communication device is one base station included in the plurality of base stations, and

wherein the one base station wirelessly communicates with another base station of the plurality of base stations.

[Claim 4] A positioning method of a positioning system to perform positioning of a communication device that wirelessly communicates with each base station of a plurality of base stations, the positioning method comprising:

acquiring a relative angle between each base station of the plurality of base stations and the communication device from each base station of the plurality of base stations, by a relative angle acquisition unit;

calculating a position of the communication device as a provisional position of the communication device, using the relative angle between each base station of the plurality of base stations and the communication device and a position of each base station of the plurality of base stations, by a provisional position calculation unit;

calculating a distance between each base station of the plurality of base stations and the provisional position of the communication device, using the position of each base station of the plurality of base stations and the provisional position of the communication device, and calculating, for each of the plurality of base stations, a respective weighting coefficient for correcting the provisional position of the communication device, based on the distance between each base station of the plurality of base stations and the provisional position of the communication device, by a weight calculation unit, wherein the weighting coefficients are functions that monotonically decrease as the respective distance increases; and

calculating the position of the communication device as a device position, using the relative angle between each base station of the plurality of base stations and the

communication device, the position of each base station of the plurality of base stations, and the weighting coefficients for each base station of the plurality of base stations, by a device position calculation unit,

wherein the provisional position calculation unit calculates the provisional position by performing a least-squares method, the provisional position being given as a solution to a minimum value of a sum of squares of errors obtained based on the relative angle between each base station of the plurality of base stations and the communication device and the position of each base station of the plurality of base stations, said errors being associated with measurement noise of the position of the communication device, and

wherein the device position calculation unit calculates the device position by multiplying each error of the obtained errors by the corresponding weighting coefficient to obtain a weighted error and executing a weighted least-squares method, the device position being given as a solution to a minimum value of a sum of squares of weighted errors.

[Claim 5] A positioning program of a positioning system to perform positioning of a communication device that wirelessly communicates with each base station of a plurality of base stations, the positioning program causing a computer to execute:

a relative angle acquisition process of acquiring a relative angle between each base station of the plurality of base stations and the communication device from each base station of the plurality of base stations;

a provisional position calculation process of calculating a position of the communication device as a provisional position of the communication device, using the relative angle between each base station of the plurality of base stations and the communication device and a position of each base station of the plurality of base stations;

a weight calculation process of calculating a distance between each base station of the plurality of base stations and the provisional position of the communication device, using the position of each base station of the plurality of base stations and the provisional position of the communication device, and calculating, for each of the plurality of base stations, a respective weighting coefficient for correcting the provisional position of the communication device, based on the distance between each base station of the plurality of base stations and the provisional position of the communication device, wherein the weighting coefficients are functions that monotonically decrease as the respective distance increases; and

a device position calculation process of calculating the position of the communication device as a device position, using the relative angle between each base station of the plurality of base stations and the communication device, the position of each base station of the plurality of base stations, and the weighting coefficients for each base station of the plurality of base stations,

wherein the provisional position calculation process is arranged to calculate the provisional position by performing a least-squares method, the provisional position being given as a solution to a minimum value of a sum of squares of errors obtained based on the relative angle between each base station of the plurality of base stations and the communication device and the position of each base station of the plurality of base stations, said errors being associated with measurement noise of the position of the communication device, and

wherein the device position calculation process is arranged to calculate the device position by multiplying each error of the obtained errors by the corresponding weighting coefficient to obtain a weighted error and executing a weighted least-squares method, the device position being given as a solution to a minimum value of a sum of squares of weighted errors.