CLAIMS

1. A method of determining a new Position for a Node n, said Node having a distance measuring radio, said method comprising the steps of:

a) Starting with a previously determined previous Position P, said previous Position having a previously determined Confidence C, calculating a predicted Position pP, and an associated predicted Confidence pC, said calculations utilizing data from at least a 3-axis Inertial sensor,

b) Electronically measuring at least a first distance Dn1 to at least a first other Node n1, and at least a second distance Dn2 to at least a second other Node n2,

c) Obtaining the current Position Pn1 of at least said first other Node and Position Pn2 of at least said second other Node, said Position comprising at least X, Y, Z coordinates and a Confidence metric Cn1 and Cn2,

d) Geometrically projecting the distances Dn1 and Dn2 onto a common horizontal plane, to determine projected distances pDn1 and pDn2,

e) Calculating Circle-Circle Intersections of said projected distances to determine two candidate Positions cPa and cPb,

f) Determining a candidate Confidence cC as the lesser of Cn1 and Cn2, then adjusting said Confidence cC based on geometric conditions of the calculations in step e),

g) Determining the error distance eDa between pP and cPa, and error distance eDb between pP and cPb,

h) Choosing the candidate Position with the lesser error distance as the candidate Position cP,

i) If confidence cC is greater than pC, choosing candidate position cP as new position P and taking cC as the new confidence C, otherwise choosing predicted position pP as new position P and predicted confidence pC as new confidence C.

2. A method of determining a new Position for a Node n, said Node having a distance measuring radio, said method comprising the steps of:

a) Starting with a previously determined previous Position P, said previous Position having a previously determined Confidence C, calculating a predicted Position pP, and an associated predicted Confidence pC, said calculations utilizing data from at least a 3-axis Inertial sensor,

b) Electronically measuring at least a first distance Dn1 to at least a first other Node n1, at least a second distance Dn2 to at least a second other Node n2, and at least a third distance Dn3 to at least a second other Node n3,

c) Obtaining the current Position Pn1 of at said first other Node, Position Pn2 of said second other Node, and Position Pn3 of said third other Node, said Position comprising at least X, Y, Z coordinates and a Confidence metric Cn1, Cn2 and Cn3,

d) Using trilateration with positions Pn1, Pn2 and Pn3 and corresponding measured distances Dn1, Dn2 and Dn3 to determine at least a candidate Position cP,

e) Determining a candidate Confidence cC as the lesser of Cn1, Cn2 and Cn3, then adjusting said Confidence cC based on geometric conditions of the calculations in step d),

f) If confidence cC is greater than pC, choosing candidate position cP as new position P and taking cC as the new confidence C, otherwise choosing predicted position pP as new position P and predicted confidence pC as new confidence C.

3. A method of determining a new Position for a Node n, said Node having a distance measuring radio, said method comprising the steps of:

a) Starting with a previously determined previous Position P, said previous Position having a previously determined Confidence C, calculating a predicted Position pP, and an associated predicted Confidence pC, said calculations utilizing data from at least a 3-axis Inertial sensor,

b) Electronically measuring at least a first distance Dn1 to at least a first other Node n1, and at least a second distance Dn2 to at least a second other Node n2,

c) Obtaining the current Position Pn1 of at least said first other Node and Position Pn2 of at least said second other Node, said Position comprising at least X, Y, Z coordinates and a Confidence metric Cn1 and Cn2,

d) Geometrically projecting the distances Dn1 and Dn2 onto a common horizontal plane, to determine projected distances pDn1 and pDn2,

e) Calculating Circle-Circle Intersections of said projected distances to determine two candidate Positions cPa and cPb,

f) Determining a candidate Confidence cC as the lesser of Cn1 and Cn2, then adjusting said Confidence cC based on geometric conditions of the calculations in step e),

g) Determining the error distance eDa between pP and cPa, and error distance eDb between pP and cPb,

h) Choosing the candidate Position with the lesser error distance as the candidate Position cP and the corresponding error distance as the error distance eD,

i) Calculating new position P as a weighted interpolation between at least the predicted position pP and candidate position cP,

j) Calculating new confidence C as a weighted interpolation of predicted

~~confidence pC and candidate confidence cC.~~

~~4. A method of determining a new Position for a Node n, said Node having a distance measuring radio with an associated Precision, said method comprising the steps of:~~

~~a) Starting with a previously determined previous Position P, said previous Position having a previously determined Confidence C, calculating a predicted Position pP, and an associated predicted Confidence pC, said calculations utilizing data from at least a 3-axis Inertial sensor,~~

~~b) Electronically measuring at least a first distance Dn1 to at least a first other Node n1, at least a second distance Dn2 to at least a second other Node n2, and at least a third distance Dn3 to at least a second other Node n3,~~

~~c) Obtaining the current Position Pn1 of at said first other Node, Position Pn2 of said second other Node, and Position Pn3 of said third other Node, said Position comprising at least X, Y, Z coordinates and a Confidence metric Cn1, Cn2 and Cn3,~~

~~d) Using trilateration with positions Pn1, Pn2 and Pn3 and corresponding measured distances Dn1, Dn2 and Dn3 to determine at least a candidate Position cP,~~

~~e) Determining a candidate Confidence cC as the lesser of Cn1, Cn2 and Cn3, then adjusting said Confidence cC based on geometric conditions of the calculations in step d),~~

~~f) Calculating new position P as a weighted interpolation between at least the predicted position pP and candidate position cP,~~

~~g) Calculating new confidence C as a weighted interpolation of predicted confidence pC and candidate confidence cC.~~

~~5. The method of Claim 1 wherein said nodes n1 and n2 are chosen from among a plurality of available nodes based at least on corresponding Confidence.~~

~~6. The method of Claim 2 wherein said nodes n1 and n2 are chosen from among a plurality of available nodes based at least on corresponding Confidence.~~

~~7. The method of Claim 3 wherein said nodes n1, n2 and n3 are chosen from among a plurality of available nodes based at least on corresponding Confidence.~~

~~8. The method of Claim 4 wherein said nodes n1, n2 and n3 are chosen from among a plurality of available nodes based at least on corresponding Confidence.~~

~~9. The method of Claim 1 wherein said nodes n1 and n2 are chosen from among a plurality of available nodes based at least on the geometry of their~~

~~corresponding positions relative to previous position P of said node n.~~

~~10. The method of Claim 2 wherein said nodes n1 and n2 are chosen from among a plurality of available nodes based at least on the geometry of their corresponding positions relative to previous position P of said node n.~~

~~11. The method of Claim 3 wherein said nodes n1, n2 and n3 are chosen from among a plurality of available nodes based at least on the geometry of their corresponding positions relative to previous position P of said node n.~~

~~12. The method of Claim 4 wherein said nodes n1, n2 and n3 are chosen from among a plurality of available nodes based at least on the geometry of their corresponding positions relative to previous position P of said node n.~~

1. A method of determining a new position for a node, the node having a distance measuring radio, the method comprising:

a) starting with a previously determined position having a previously determined confidence C, and calculating a predicted position and an associated predicted confidence utilizing data from at least a 3-axis inertial sensor;

b) electronically measuring a first distance to a first other node and a second distance to a second other node;

c) obtaining a first current position of the first other node comprising at least X, Y, Z coordinates and a first confidence metric, and obtaining a second current position of the second other node comprising at least X, Y, Z coordinates and a second confidence metric;

d) geometrically projecting the first distance and the second distance onto a common horizontal plane, to respectively determine a first projected distance and a second projected distance;

e) calculating circle-circle intersections of the first projected distance and the second projected distance to respectively determine a first candidate position and a second candidate position;

f) determining a candidate confidence as the lesser of the first confidence metric and the second confidence metric, then adjusting the candidate confidence based on geometric conditions of the calculations in step e);

g) determining a first error distance between the predicted position and the first candidate position, and determining a second error distance between the predicted position and the second candidate position;

h) comparing the first error distance of the first candidate position and the second error distance of the second candidate position, and selecting one with a lower error distance as a candidate position; and

i) if the candidate confidence of the candidate position is greater than the predicted confidence, then the candidate position is selected as the new position and the candidate confidence is selected as a new confidence, otherwise the predicted position is selected as the new position and the predicted confidence is selected as the new confidence.

2. The method of claim 1, wherein the first other node and the second other node are selected from among a plurality of available nodes based at least on a corresponding confidence.

3. The method of claim 1, wherein the first other node and the second other node are selected from among a plurality of available nodes based at least on a geometry of their corresponding positions relative to a previous position of the node.

4. A method of determining a new position for a node, the node having a distance measuring radio, the method comprising:

a) starting with a previously determined previous position having a previously determined confidence, and calculating a predicted position and an associated predicted confidence utilizing data from at least a 3-axis inertial sensor;

b) electronically measuring a first distance to a first other node, a second distance to a second other node and a third distance to a third other node;

c) obtaining a first current position of the first other node comprising at least X, Y, Z coordinates and a first confidence metric, obtaining a second current position of the second other node comprising at least X, Y, Z coordinates and a second confidence metric, and obtaining a third current position of the third other node comprising at least X, Y, Z coordinates and a third confidence metric;

d) using trilateration with the first, second and third current positions and the corresponding first, second and third distances to determine at least a candidate position;

e) determining a candidate confidence as the lesser of the first confidence, the second confidence and the third confidence, then adjusting the confidence based on geometric conditions of the calculations in step d); and

f) if the candidate confidence is greater than the predicted confidence, then the candidate position is selected as the new position and the candidate confidence is selected as a new confidence, otherwise the predicted position is selected as the new position and the predicted confidence is selected as the new confidence C.

5. The method of claim 4, wherein the first other node and the second other node are selected from among a plurality of available nodes based at least on a corresponding confidence.

6. The method of claim 4, wherein the first other node and the second other node are selected from among a plurality of available nodes based at least on a geometry of their corresponding positions relative to a previous position of the node.

7. A method of determining a new position for a node, the node having a distance measuring radio, the method comprising:

a) starting with a previously determined previous position having a previously determined confidence, and calculating a predicted position and an associated predicted confidence utilizing data from at least a 3-axis inertial sensor;

b) electronically measuring a first distance to a first other node and a second distance o a second other node;

c) obtaining a first current position of the first other node comprising at least X, Y, Z coordinates and a first confidence metric, and a second current position of the second other node comprising at least X, Y, Z coordinates and a second confidence metric;

d) geometrically projecting the first distance and the second distance onto a common horizontal plane, to respectively determine a first projected distance and a second projected distance;

e) calculating circle-circle intersections of the first projected distance and the second projected distance to respectively determine a first candidate position and a second candidate position;

f) determining a candidate confidence as the lesser of the first confidence metric and the second confidence metric, then adjusting the candidate confidence based on geometric conditions of the calculations in step e);

g) determining a first error distance between the predicted position and the first candidate position, and determining a second error distance between the predicted position and the second candidate position;

h) comparing the first error distance of the first candidate position and the second error distance of the second candidate position, and selecting one with a lower error distance as a candidate position and the corresponding error distance as an error distance;

i) calculating the new position as a weighted interpolation between the predicted position and the candidate position; and

j) calculating a new confidence as a weighted interpolation of the predicted confidence and the candidate confidence.

8. The method of claim 7, wherein the first other node, the second other node and the third other node are selected from among a plurality of available nodes based at least on a corresponding confidence.

9. The method of claim 7, wherein the first other node, the second other node and third other node are chosen from among a plurality of available nodes based at least on a geometry of their corresponding positions relative to a previous position of the node.

10. A method of determining a new position for a node, the node having a distance measuring radio with an associated precision, the method comprising:

a) starting with a previously determined previous position having a previously determined confidence, calculating a predicted position and an associated predicted confidence utilizing data from at least a 3-axis inertial sensor;

b) electronically measuring a first distance to a first other node, a second distance to a second other node, and a third distance to a third other node;

c) obtaining a first current position of the first other node comprising at least X, Y, Z coordinates and a first confidence metric, a second current position of the second other node comprising at least X, Y, Z coordinates and a second confidence metric, and a third current position of the third other node comprising at least X, Y, Z coordinates and a third confidence metric;

d) using trilateration with the first, second and third positions and the corresponding first, second and third distances to determine at least a candidate position;

e) determining a candidate confidence as the lesser of the first confidence, the second confidence and the third confidence, then adjusting the confidence based on geometric conditions of the calculations in step d);

f) calculating the new position as a weighted interpolation between the predicted position and the candidate position; and

g) calculating a new confidence as a weighted interpolation of the predicted confidence and the candidate confidence.

11. The method of claim 10, wherein the first other node, the second other node and the third other node are selected from among a plurality of available nodes based at least on a corresponding confidence.

12. The method of claim 10, wherein the first other node, the second other node and third other node are chosen from among a plurality of available nodes based at least on a geometry of their corresponding positions relative to a previous position of the node.