CLAIMS

I/We Claim:

**1.** A system (102) for determining an instantaneous absolute position and absolute orientation of an entity in a navigation space, the system comprising:

a plurality of sensors (104) comprising a first set of sensors disposed on a first plurality of locations on the entity (200), wherein the first set of sensors are part of a cartesian coordinate system provided by a local positioning system formed using a technology selected from a group consisting of UWB, Bluetooth, Zig-bee, Ultrasound, and a second set of diversified sensors disposed on a second plurality of locations on the entity (200);

a coarse absolute position and orientation estimation unit (106) configured to determine any one of: a coarse absolute position and a coarse absolute orientation, of the entity (200) with respect to the predetermined path (304) based on a position data captured in a two-dimensional cartesian plane of the cartesian coordinate system at a predetermined frequency/interval by the first set of sensors (202A -202H);

a relative position and orientation estimation unit (108) configured to determine any one of: a relative position and a relative orientation, of the entity (200) with respect to the predetermined path (304) based on a set of data captured at a predetermined frequency/interval from the second set of diversified sensors (302A-302C) wherein the data captured represent one of a relative deviation and a relative inclination of the entity with respect to one of the predetermined physical features in the navigation space;

a navigation guidance unit (110) configured to generate a navigation map that provides unique attributes based on a desired navigable layout identified in the indoor navigation space and to update one or more of the attributes of the navigation map dynamically as a learning/feedback based

on a historical navigation data wherein the navigation guidance unit (110) is positioned inside the entity (200) or outside the entity; and

an analytics unit (112) configured to determine any one of a refined absolute position and a refined absolute orientation of the entity (200) at a predetermined frequency/interval by fine tuning: the coarse absolute position and the coarse absolute orientation based on 1) one or more of the plurality of inputs provided by the relative position and orientation estimation unit (108), 2) coarse absolute position of the entity and 3) the unique attributes provided by the navigation guidance unit (110);

wherein the entity (200) comprises a stationary object or a mobile object;

**characterized in that**:

wherein the analytics unit (112) is configured to seamlessly select the relative position and the relative orientation from among a plurality of inputs from the relative position and orientation estimation unit while navigating through a plurality of mutually different sections of a navigation layout involving either a plurality of line segments or a single line segment with mutually different physical attributes, and wherein the selection is guided by the navigation map based on the coarse absolute position of the entity (200), and wherein the navigation map provides the physical attributes associated with each such line segment wherein the physical attribute is a wall adjacent to the navigation path along with its side, or a presence of lane marking.

**2.** The system (102) as claimed in claim 1, wherein the analytics unit (112) is configured to:

transform the predetermined path (304) by rotating a navigation plane associated with the predetermined path (304) by a rotation angle so as

to align the predetermined path (304) parallel to one of X-axis or Y-axis of the two-dimensional cartesian plane and to generate a transformed navigation plane (404) wherein the coarse absolute position undergoes same rotation to become transformed coarse absolute position of the entity;

apply a refinement to the transformed coarse absolute position based on one or more of the plurality of inputs from the relative position and orientation estimation unit to obtain a transformed refined absolute position of the entity (200) on the transformed navigation plane (404), wherein the refinement is a simple substitution of a combination of a transformed ideal coordinate value of interest and one or more of the plurality of deviations from the predetermined path obtained from among the plurality of inputs from the relative position and orientation estimation unit (108), to either X or Y value of the transformed coarse absolute position coordinates of the entity (200) depending up on the rotation applied during transformation of the plane, and wherein the transformed ideal coordinate value of interest is equal to one of the transformed ideal starting point coordinate values selected based on the transformation applied, and wherein, the transformed ideal coordinate value of interest is equal to X coordinate value for a transformed predetermined path aligned parallel to the Y-axis of the cartesian plane and vice versa, and wherein the ideal starting point is the theoretical coordinates for the starting node in the line segment obtained from the navigation map; and

obtaining a refined absolute position of the entity (200) by rotating the transformed navigation plane (404) in the reverse direction by same quantity which is equal to the rotation angle back to the original orientation of the navigation plane (402), and wherein the transformed refined absolute position is rotated by the same angle to provide the refined absolute position of the entity (200).

**3.** The system (102) as claimed in claim 1, wherein the analytics unit (112) is configured to:

derive the refined absolute orientation of the entity based on 1) the relative orientation of the entity obtained from the relative position and orientation estimation unit (108) and 2) the coarse absolute orientation obtained from the coarse absolute position and orientation estimation unit (104);

wherein the relative orientation of the entity with respect to the predetermined path (304) provided by the relative position and orientation estimation unit (108) along with its sign of orientation is added to the orientation of the predetermined path in the transformed navigation plane 404 to obtain the transformed absolute orientation of the entity in the transformed navigation plane 404;

wherein the orientation of the predetermined path in the transformed plane 404 is either the same as X-axis or Y-axis based on the transformation applied;

wherein by rotating the plane 404, in the reverse direction by same quantity as the rotation angle, back to the original orientation of the navigation plane 402, the transformed absolute orientation angle undergoes similar rotation and provides an interim representation of the absolute orientation of the entity (200).

wherein the refined absolute orientation of the entity (200) is obtained as a weighted combination of the coarse absolute orientation and the interim representation of the absolute orientation of the entity.

**4.** The system (102) as claimed in claim 1, wherein the analytics unit (112) is configured to select and use one or more of the relative positions and the relative orientation from the relative position and orientation estimation unit from among a plurality of inputs, and wherein such plurality of inputs to the analytics unit is derived by the relative position and orientation unit using the diversified set of sensors among the second set of sensors, and wherein the choice of the specific input to be used is guided by the navigation map based on the coarse absolute position of the entity (200).

**5.** The system (102) as claimed in claim 1, wherein the first plurality of locations on the entity (200) comprises a front end and a rear end of the entity (200), and wherein the second plurality of locations selected from a group consisting of a left side of the entity (200), a right side of the entity (200), a front end of the entity (200) and a back end of the entity (200).

**6.** The apparatus (102) as claimed in claim 1, wherein the second plurality of sensors comprises proximity sensing devices, and image capture devices, and wherein upon using such diversified set of sensors, the relative position and orientation estimation unit (108) provides a plurality of inputs to the analytics unit (112) representing a relative position and an relative orientation of the entity (200) relative to the predetermined path (304) derived based on a set of data captured at a predetermined frequency/interval from the second set of diversified sensors, and wherein the data captured represent one of a relative deviation and a relative inclination of the entity with respect to certain known fixed physical features in the navigation space and wherein the relative position and orientation estimation unit (108) derives a plurality of such relative position and relative orientation based on the diversified set of data captured from the second set of diversified sensors

**7.** A method to provide one of a refined absolute position and a refined absolute orientation of an entity at predefined frequency/interval to facilitate navigation of the entity along a predetermined path in a navigation space, the process comprising steps of:

a) initiating (502) navigation of the entity along the predetermined path in the space;

b) determining (504) one of: a coarse absolute position and a coarse absolute orientation of the entity based on a set of position data captured by a first set of sensors from among a plurality of sensors, disposed on a first plurality of locations on the entity;

c) determining (506) one of: a plurality of relative position and relative orientation, of the entity with respect to the predetermined path based on a set of data captured from a second set of diversified sensors from among the plurality of sensors, disposed on a second plurality of locations on the entity;

d) selecting (508) one of: a relative position and relative orientation of the entity with respect to the predetermined path from among the plurality of relative position and relative orientation based on the coarse absolute position and a navigation map

e) determining (510) a refined absolute position and a refined absolute orientation of the entity by fine tuning: the coarse absolute position based on selected relative position, and the coarse absolute orientation based on selected relative orientation, using a navigation map, wherein the navigation map is generated and updated based on a map data and a machine learning model based on a historical navigation data;

f) verifying (512) if the destination is reached; and

g) performing any one of:

i) repeating steps b) to f) upon the destination not being reached; and

ii) stopping (514) navigation of the entity upon destination being reached;

**characterized in that:**

seamlessly selecting and using the relative position and the relative orientation from a plurality of inputs from the relative position and orientation estimation unit while navigating through different sections of a navigation layout comprising a plurality of line segments or a single line segment with mutually different physical attributes, and wherein the selection is guided by the navigation map based on the coarse absolute position of the entity, and wherein the navigation map provides the physical

attributes associated with each such line segment, and wherein the physical attribute is selected from a group consisting of a wall adjacent to the navigation path along with its side, and a presence of lane marking.

**8.** The method as claimed in claim 7, comprises selecting the relative position and the relative orientation from among a plurality of inputs from the relative position and orientation estimation unit, and wherein the plurality of inputs is derived by the relative position and orientation unit using the diversified set of sensors among the second set of sensors, and wherein the specific input to be used is selected by the navigation map based on the coarse absolute position of the entity.