CLAIMS

1. A computer implemented method of autonomously maneuvering a vehicle during a point-turn, the method comprising:

operating a scanning device from onboard the vehicle for scanning an area around the vehicle in a plurality of directions and generating real-time scanning output data;

operating at least one processing circuitry operatively connected to the scanning device, for:

generating, based on the real-time scanning output data, a range map including K set(s) of real-time range values, wherein K≥1; each set comprising a plurality of real-time range values, each range value in the set is determined from a given rotation-point of the vehicle towards a certain direction; each set of real-time range values having a corresponding set comprising a plurality of vehicle-contour range values; each vehicle-contour range value in the corresponding set is determined from the given rotation-point to a perimeter of the vehicle in a respective direction;

for each set of the K sets:

determining differences between real-time range values in the set and corresponding vehicle-contour range values in a corresponding set;

determining, based on the differences, conditions for executing a point-turn that avoids collision with nearby objects; and

generating a point-turn command for causing the vehicle to execute a point-turn according to the point-turn conditions.

2. The method of claim 1, further comprising executing the point-turn command and causing the vehicle to turn accordingly.

3. The method of claim 1, wherein K=1 and the rotation-point are located at the center of a driving symmetry axis of the vehicle.

4. The method of claim 1, wherein K>1, and determining conditions for executing a point-turn further comprises:

determining a selected rotation-point from a plurality (*K*) of possible rotation points along a driving symmetry axis of the vehicle.

5. The method of claim 4, wherein the point-turn command includes data indicating a first velocity of a first driving element on a first side of the vehicle, and a second velocity of a second driving element on a second side of the vehicle during the point-turn; the method further comprising:

determining the first velocity and the second velocity according to the selected rotation point and its distance from the first driving element and the second driving element.

6. The method of claim 1, wherein the conditions include a point-turn direction and range.

7. The method of claim 1, wherein each set of real-time range values, and its corresponding set of vehicle-contour range values, include range values corresponding to the same angles.

8. The method of claim 1, wherein each of the K sets of real-time range values and their corresponding sets of vehicle-contour range values are plotted in a first histogram and a second histogram, respectively; and wherein determining differences between real-time range values in the set and corresponding vehicle-contour range values in a corresponding set, is executed by shifting between relative positions of the first histogram and second histogram and comparing values in the first histogram and second histogram, in different relative positions.

9. The method of claim 1, further comprising:

while the vehicle is travelling, updating the vehicle-contour range values.

10. The method of claim 1, further comprising: implementing filtering on the real-time range values, and ignoring real-time range values which are greater than a certain threshold value.

11. A system mountable on an unmanned vehicle, comprising:

at least one processing circuitry operatively connected to a scanning device;

the scanning device is configured to scan an area around the vehicle in a plurality of directions and generate real-time scanning output data;

the at least one processing circuitry is configured to:

generate, based on the real-time scanning output data, a range map including K sets of real-time range values, wherein K≥1; each set comprising a plurality of real-time range values, each range value in the set is determined from a given rotation-point of the vehicle towards a certain direction; each set of real-time range values having a corresponding set comprising a plurality of vehicle-contour range values; each vehicle-contour range value in the corresponding set is a distance measured from the given rotation-point to a perimeter of the vehicle in a respective direction;

for each set of the K sets:

determine differences between real-time range values in the set and corresponding vehicle-contour range values in a corresponding set;

determine, based on the differences, conditions for executing a point-turn that avoids collision with nearby objects;

generate a point-turn command for causing the vehicle to execute a point-turn according to the point-turn conditions; and

transmit the point-turn command to a vehicle control sub-system where the command is executed.

12. The system of claim 11, wherein K=1 and the rotation point is located at the center of a driving symmetry axis of the vehicle.

13. The system of claim 11, wherein K>1, wherein the at least one processer is configured for determining conditions for executing a point-turn to:

determine a selected rotation point from a plurality (*K*) of possible rotation points along a driving symmetry axis of the vehicle.

14. The system of claim 11, wherein the point-turn command includes data indicating a first velocity of a first driving element on a first side of the vehicle and a second velocity of a second driving element on a second side of the vehicle during the point-turn; the at least one processing circuitry is further configured to:

determine the first velocity and the second velocity according to the selected rotation point.

15. The system of claim 11, wherein the conditions include a point-turn direction and range.

16. The system of claim 11, wherein each set of real-time range values and its corresponding set of vehicle-contour range values include range values corresponding to overlapping directions.

17. The system of claim 11, wherein each of the K sets of real-time range values and their corresponding sets of vehicle-contour range values are plotted in a first histogram and a second histogram, respectively; and wherein determining differences between real-time range values in the set and corresponding vehicle-contour range values in a corresponding set is executed by shifting between relative positions of the first histogram and second histogram and comparing values in the first histogram and the second histogram in different relative positions.

18. The system of claim 11, wherein the at least one processing circuitry is further configured to update the vehicle-contour range values while the vehicle is travelling.

19. An unmanned vehicle, comprising:

a scanning device for scanning an area around the vehicle in a plurality of directions and generating real-time scanning output data;

a vehicle control sub-system configured to receive vehicle control instructions and control the vehicle in accordance with the instructions; and

at least one processing circuitry configured to:

generate, based on the real-time scanning output data, a range map including K sets of real-time range values, wherein K≥1; each set comprising a plurality of real-time range values, each range value in the set is determined from a given rotation-point of the vehicle towards a certain direction; each set of real-time range values having a corresponding set comprising a plurality of vehicle-contour range values; each vehicle-contour range value in the corresponding set is a distance measured from the given rotation-point to a perimeter of the vehicle in a respective direction;

for each set of the K sets:

determine differences between real-time range values in the set and corresponding vehicle-contour range values in a corresponding set;

determine, based on the differences, conditions for executing a point-turn that avoids collision with nearby objects;

generate a point-turn command for causing the vehicle to execute a point-turn according to the point-turn conditions; and

the vehicle control sub-system is configured to execute the point-turn command and control the vehicle to turn accordingly.

20. A non-transitory computer readable storage medium retaining program instructions, the program instructions when read by a processor, cause the processor to perform a method of autonomously maneuvering a vehicle during a point-turn, comprising:

receiving real-time scanning output data; the real-time scanning output data is generated by a scanning device from onboard the vehicle for scanning an area around the vehicle in a plurality of directions;

generating, based on the real-time scanning output data, a range map including K sets of real-time range values, wherein K≥1; each set comprising a plurality of real-time range values, each range value in the set is determined from a given rotation-point of the vehicle towards a certain direction; each set of real-time range values having a corresponding set comprising a plurality of vehicle-contour range values; each vehicle-contour range value in the corresponding set is a distance measured from the given rotation-point to a perimeter of the vehicle in a respective direction;

for each set of the K sets:

determining differences between real-time range values in the set and corresponding vehicle-contour range values in a corresponding set;

determining, based on the differences, conditions for executing a point-turn that avoids collision with nearby objects; and

generating a point-turn command for causing the vehicle to execute a point-turn according to the point-turn conditions.

21. A computer-implemented method of monitoring a point turn of a vehicle using a graphical user interface, the method comprising:

plotting a set of real-time range values and their corresponding set of vehicle-contour range values in a first histogram and a second histogram, respectively;

wherein each range value in the set of real-time range values is determined from a given rotation-point of the vehicle towards a certain direction and wherein each corresponding vehicle-contour range value in the corresponding set of vehicle-contour range values is determined from the given rotation-point to a perimeter of the vehicle in the certain direction;

displaying the first histogram and second histogram within a graphical user interface on a computer screen;

displaying shifting between relative positions of the first histogram and second histogram and comparing values in the two histograms, in different relative positions

to thereby determine differences between real-time range values in the set and corresponding vehicle-contour range values in a corresponding set;

and determining, based on the differences, conditions for executing a point-turn that avoids collision with nearby objects;

thereby enabling an operator to monitor and/or control the generation of a point-turn command for causing the vehicle to execute a point-turn according to the point-turn conditions.

22. The method of claim 21 further comprising displaying additional information including the outline of the vehicle and a detected obstacle.

23. A computer program product retained on a non-transitory computer medium, the computer program product executable by a processor to perform a method of monitoring a point turn of a vehicle using a graphical user interface, the method comprising:

plotting a set of real-time range values and their corresponding set of vehicle-contour range values in a first histogram and a second histogram, respectively;

wherein each range value in the set of real-time range values is determined from a given rotation-point of the vehicle towards a certain direction and wherein each corresponding vehicle-contour range value in the corresponding set of vehicle-contour range values is determined from the given rotation-point to a perimeter of the vehicle in the certain direction;

displaying the first histogram and second histogram within a graphical user interface on a computer screen;

displaying shifting between relative positions of the first histogram and second histogram and comparing values in the two histograms, in different relative positions to thereby determine differences between real-time range values in the set and corresponding vehicle-contour range values in a corresponding set; and determining, based on the differences, conditions for executing a point-turn that avoids collision with nearby objects;

thereby enabling an operator to monitor and/or control generation of a point-turn command for causing the vehicle to execute a point-turn according to the point-turn conditions.