

CLAIMS

1. A method of controlling a vehicle, the method comprising:

generating, by a primary computing system, a fall back trajectory from a location for the vehicle in order to safely stop the vehicle, the fall back trajectory being generated based on information received by the primary computing system from a perception system of the vehicle, wherein the fall back trajectory is identical to a nominal trajectory to a destination location between the location and a divergent point where the fall back trajectory and the nominal trajectory diverge;

sending, by the primary computing system, the fall back trajectory to a secondary computing system;

receiving, by the secondary computing system, the fall back trajectory at a first point in time;

controlling, by the secondary computing system, the vehicle according to the fall back trajectory;

waiting, by the secondary computing system, for an updated trajectory while controlling the vehicle according to the fall back trajectory; and

when a predetermined threshold period of time from the first point in time has passed and the updated trajectory has not been received by the secondary computing system, continuing to control the vehicle, by the secondary computing system, according to the fall back trajectory in order to safely stop the vehicle.

2. The method of claim 1, further comprising, when the updated trajectory is received after the predetermined threshold period of time from the time when the fall back trajectory was received by the secondary computing system has passed, ignoring, by the secondary computing system, the updated trajectory.

3. The method of claim 1, further comprising:

receiving, by the secondary computing system, after the predetermined threshold period of time from the time when the fall back trajectory was received by the secondary computing system has passed, data from a sensor indicating that an object is detected by the sensor; and

in response to receiving the data from the sensor, applying, by the secondary computing system, brakes of the vehicle in order to stop the vehicle immediately.

4. The method of claim 3, wherein the sensor is not part of the perception system and is a dedicated sensor of the secondary computing system.

5. The method of claim 1, wherein the divergent point corresponds to a time along the fall back trajectory during which the primary computing system sends the updated trajectory during normal operation of the primary computing system.

6. The method of claim 1, further comprising:

prior to receiving the fall back trajectory, receiving, by the secondary computing system from the primary computing system, a first fall back trajectory having a first divergent location where the first fall back trajectory diverges from a first nominal trajectory generated by the primary computing system;

controlling, by the secondary computing system, the vehicle according to the first fall back trajectory; and

prior to reaching the first divergent location, receiving, by the secondary computing system the fall back trajectory as the updated trajectory.

7. The method of claim 6, further comprising replacing, by the secondary computing system, the nominal trajectory with the updated trajectory in order to control the vehicle according to the fall back trajectory.

8. The method of claim 1, further comprising determining the predetermined threshold period of time based on a current steering angle of the vehicle.

9. The method of claim 1, further comprising determining the predetermined threshold period of time based on a speed of the vehicle.

10. The method of claim 1, wherein the predetermined threshold period of time from the time when the fall back trajectory was received by the secondary computing system corresponds to a point of divergence between the nominal trajectory and the fall back trajectory.

11. A system for controlling a vehicle, the system comprising:

a primary computing system having one or more processors configured to:

generate a fall back trajectory from a location for the vehicle in order to safely stop the vehicle, the fall back trajectory begin generated based on information received by the primary computing system from a perception system of the vehicle, wherein the fall back trajectory is identical to a nominal trajectory to a destination location between the location and a divergent location where the fall back trajectory and the nominal trajectory diverge, and

sending the fall back trajectory to a secondary computing system; and

the secondary computing system having one or more processors configured to:

receive the fall back trajectory at a first point in time;

control the vehicle according to the fall back trajectory;

wait for an updated trajectory from the primary computing system while controlling the vehicle; and

when a predetermined threshold period of time from the first point in time has passed and the updated trajectory has not been received by the secondary computing system, continue to control the vehicle according to the fall back trajectory in order to safely stop the vehicle.

12. The system of claim 11, wherein the one or more processors of the secondary computing system are further configured to, when the updated trajectory is received after the predetermined threshold period of time from the time when the fall back trajectory was received by the secondary computing system has passed, ignore the updated trajectory.

13. The system of claim 11, wherein the one or more processors of the secondary computing system are further configured to:

receiving after the predetermined threshold period of time from the time when the fall back trajectory was received by the secondary computing system has passed, data from a sensor indicating that an object is detected by the sensor; and

in response to receiving the data from the sensor, applying brakes of the vehicle in order to stop the vehicle immediately.

14. The system of claim 13, further comprising the sensor and wherein the sensor is not part of the perception system and is a dedicated sensor of the secondary computing system.

15. The system of claim 11, wherein the divergent location corresponds to a time along the fall back trajectory during which the primary computing system is configured to send the updated trajectory during normal operation of the primary computing system.

16. The system of claim 11, wherein the one or more processors of the secondary computing system are further configured to:

prior to receiving the fall back trajectory, receive, from the primary computing system, a first fall back trajectory having a first divergent location where the first fall back trajectory diverges from a first nominal trajectory generated by the primary computing system;

control the vehicle according to the first fall back trajectory; and

prior to reaching the first divergent location, receive the fall back trajectory as the updated trajectory.

17. The system of claim 16, wherein the one or more processors of the secondary computing system are further configured to replace the nominal trajectory with the updated trajectory in order to control the vehicle according to the fall back trajectory.

18. The system of claim 11, further comprising the vehicle and the perception system.

19. The system of claim 11, wherein the one or more processors are further configured to determine the predetermined threshold period of time based on a current steering angle of the vehicle.

20. The system of claim 11, wherein the one or more processors are further configured to determine the predetermined threshold period of time based on a speed of the vehicle.