CLAIMS

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

controlling, by one or more control computing devices, the vehicle in an autonomous driving mode by generating first commands for acceleration control and sending the first commands to an acceleration actuator of an acceleration system of the vehicle in order to cause the vehicle to accelerate;

monitoring acceleration of the vehicle while the vehicle is being operated in the autonomous driving mode;

comparing the monitored acceleration with the first commands;

determining that there is an error with the acceleration system based on the comparison; and

when the error is determined, controlling, by the one or more control computing devices, the vehicle in the autonomous driving mode by generating second commands according to a plurality of rules and which do not require any acceleration by the acceleration system; wherein the first commands are not generated according to the plurality of rules and at least one of the plurality of rules is that the vehicle cannot change lanes, except to move off a roadway.

2. The method of claim 1, wherein the monitoring and determining are performed by a monitor computing device, and wherein the method further comprises:

using the comparison to generate a signal indicating the error; and

sending the signal to the one or more control computing devices.

3. The method of claim 2, wherein the signal indicates that there is too much acceleration.

4. The method of claim 3, further comprising:

receiving, by the one or more control computing devices, the signal; and

in response to receiving the signal, turning off an ignition of the vehicle.

5. The method of claim 4, further comprising:

receiving, by the one or more control computing devices, the signal; and

in response to receiving the signal, moving a gear control to a neutral state thereby disengaging a transmission of the vehicle.

6. The method of claim 2, wherein the signal indicates that there is not enough acceleration.

7. The method of claim 1, further comprising:

determining a first trajectory for maneuvering the vehicle by a planning system of the vehicle, wherein generating the first commands is based on the trajectory; and

when the error is detected, changing a planning behavior of the planning system.

8. The method of claim 7, further comprising after changing the planning behavior of the planning system, determining a second trajectory for maneuvering the vehicle according to the changed planning behavior, and wherein the second commands are generated based on the second trajectory.

9. The method of claim 1, wherein at least one of the plurality of rules is that the vehicle must avoid intersections or crossing railroad tracks.

10. A method of stopping a vehicle, the method comprising:

controlling, by one or more control computing devices, the vehicle in an autonomous driving mode by generating first commands for steering control and sending the first commands to a steering actuator of a steering system of the vehicle in order to cause the vehicle to change orientation;

monitoring orientation of the vehicle while the vehicle is being operated in the autonomous driving mode;

comparing the monitored orientation with the first commands;

determining that there is an error with the steering system based on the comparison; and

when the error is determined, controlling, by the one or more control computing devices, the vehicle in the autonomous driving mode by generating second commands according to a plurality of rules and which do not require any change in the vehicle's orientation by the steering system; wherein the first commands are not generated according to the plurality of rules and at least one of the plurality of rules is that the vehicle is able to be accelerated and slowed down.

11. The method of claim 10, wherein the monitoring and determining are performed by a monitor computing device, and wherein the method further comprises:

using the comparison to generate a signal indicating the error; and

sending the signal to the one or more control computing devices.

12. The method of claim 10, further comprising:

determining a first trajectory for maneuvering the vehicle by a planning system of the vehicle, wherein generating the commands is based on the trajectory; and

when the error is detected, changing a planning behavior of the planning system.

13. The method of claim 12, further comprising after changing the planning behavior of the planning system, determining a second trajectory for maneuvering the vehicle according to the changed planning behavior, and wherein the second commands are generated based on the second trajectory.

14. The method of claim 10, wherein at least one of the plurality of rules is that the vehicle must avoid intersections or crossing railroad tracks.

15. A system for stopping a vehicle, the system comprising:

one or more control computing devices configured to control the vehicle in an autonomous driving mode by generating first commands for acceleration control and sending the first commands to an acceleration actuator of an acceleration system of the vehicle in order to cause the vehicle to accelerate; and

a monitoring computing device configured to:

monitor acceleration of the vehicle while the vehicle is being operated in the autonomous driving mode,

compare the monitored acceleration with the first commands, and

determine that there is an error with the acceleration system based on the comparison; and

wherein the one or more control computing devices are further configured to, when the error is determined, control the vehicle in the autonomous driving mode by generating second commands according to a plurality of rules and which do not require any acceleration by the acceleration system; wherein the first commands are not generated according to the plurality of rules and at least one of the plurality of rules is that the vehicle cannot change lanes, except to move off a roadway.

16. The system of claim 15, wherein the monitoring computing device is further configured to:

use the comparison to generate a signal indicating the error; and

send the signal to the one or more control computing devices.

17. The system of claim 16, wherein the signal indicates that there is too much acceleration.

18. The system of claim 17, wherein the one or more control computing devices are further configured to:

receive the signal; and

in response to receiving the signal, turn off an ignition of the vehicle.

19. The system of claim 17, wherein the one or more control computing devices are further configured to:

receive the signal; and

in response to receiving the signal, move a gear control to a neutral state thereby disengaging a transmission of the vehicle.

20. The system of claim 16, wherein the signal indicates that there is not enough acceleration.

21. The system of claim 15, wherein the one or more control computing devices are further configured to:

determine a first trajectory for maneuvering the vehicle, wherein generating the first commands is based on the trajectory;

when the error is detected, change a planning behavior of the planning system; and

after changing the planning behavior of the planning system, determine a second trajectory for maneuvering the vehicle according to the changed planning behavior, and wherein the second commands are generated based on the second trajectory.

22. The system of claim 15, further comprising the vehicle.