CLAIMS

1. A failure detection sub-system operatively connectable to an autonomous vehicle that comprises an autonomous control sub-system; the autonomous control sub-system is configured to process real-time sensory data and generate, based on sensory data processing output, commands for controlling the autonomous vehicle; ~~the failure detection sub-system comprises at least one processing circuitry configured to:~~

the failure detection sub-system comprising or being otherwise operatively connected to at least one scanning device on-board the autonomous vehicle configured to scan an environment near the vehicle and obtain real-time sensory data;

the failure detection sub-system further comprising at least one processing circuitry configured to:

process the real-time sensory data, including scanned data output, and generate real-time mapping data, the real-time mapping data comprising information with respect to obstacles within a scanned area; receive real-time behavioral-data that includes real-time driving parameters;

adapt~~determine~~ at least one safety rule value of at least one safety rule according to the real-time behavioral-data; wherein the real-time driving parameters include real-time yaw rate and speed of the autonomous vehicle and the at least one safety rule includes information defining a region of interest within the scanned area;

wherein the at least one processing circuitry is configured for adapting the at least one safety rule value to: adapt the shape of the region of interest to create an offset toward a left size of the vehicle or right size of the vehicle according to the yaw rate to thereby reduce the area of the region of interest in a direction opposite from a direction of turning;

determine, based on the real-time behavioral-data and the real-time mapping data, whether a violation of the at least one safety rule is occurring; and

generate one or more vehicle control commands for controlling at least one driving sub-system in case a violation of the safety rules is detected~~;~~ to thereby avoid the occurrence of an unwanted event resulting from the violation.

~~wherein processing done by failure detection sub-system is less computationally intensive as compared to processing done by the autonomous control~~

~~sub-system~~

2. The failure detection sub-system of claim 1, wherein the at least one ~~safety rule includes information on a region of interest within the scanned area, and wherein the~~ processing circuitry is configured ~~for determining~~, while the autonomous vehicle is making a turn, to create the offset in the direction of the ~~at least one safety rule value,~~turn to ~~change~~thereby reduce the ~~size and/or shape~~areas of the region of interest opposite from a turning direction and increase the areas of the region of interest ~~according to the real-time behavioral data~~in the direction of the turn.

3. The failure detection sub-system of claim 1 or 2, wherein the region of interest is characterized by ~~a distinctive shape~~any one of the following:~~.~~

(i) a parallelogram shape and wherein the at least one processing circuitry is configured for adapting the at least one safety rule, to change the angles of the parallelogram shape according to the yaw rate of the autonomous vehicle and changing length of the parallelogram shape in the direction of travel according to the speed of the autonomous vehicle, to thereby decrease the area of the region of interest opposite from the direction of travel; or

ii) a double arc shape and wherein the at least one processing circuitry is configured for adapting the at least one safety rule, to adapt the double arc shape according to the yaw rate of the autonomous vehicle, to thereby decrease the area of the region of interest opposite from the direction of travel.

~~4. The failure detection sub-system of any one of claims 2 and 3, wherein the driving parameters include one or more of: speed of the autonomous vehicle; acceleration of the autonomous vehicle; heading of the autonomous vehicle; and yaw rate of the autonomous vehicle.~~

~~5. The failure detection sub-system of claim 2, wherein the region of interest is characterized by a rectangular shape and wherein the processing circuitry is configured for determining the at least one safety rule, to change the length of the rectangular shape in the direction of travel according to the speed of the autonomous vehicle and/or the heading of the autonomous vehicle.~~

~~6. The failure detection sub-system of claim 2, wherein the region of interest is characterized by a parallelogram shape and wherein the processing circuitry is configured for determining the at least one safety rule, to change the angles of the~~

~~parallelogram shape according to the yaw rate of the autonomous vehicle.~~

~~7. The failure detection sub-system of claim 6, wherein the processing circuitry is configured to change the length of the parallelogram shape in the direction of travel according to the speed of the autonomous vehicle.~~

~~8. The failure detection sub-system of claim 2, wherein the region of interest is characterized by a double arc shape and wherein the processing circuitry is configured for determining the at least one safety rule, to adapt the double arc shape according to the yaw rate of the autonomous vehicle.~~

~~9.~~4. The failure detection sub-system of any one of claims 1 to 3~~8~~, wherein the region of interest is defined as an intersection between a~~the~~ double arc shape and a parallelogram shape, wherein while the vehicle is making a turn, the region of interest is defined by the double arc shape at an~~the~~ external side of the turn, and by the parallelogram at an~~the~~ internal side of the turn.

~~10.~~5. The failure detection sub-system of any one of the preceding claims, further comprising or being other operatively connected to a sensing device configured to generate auxiliary sensory data, the auxiliary sensory data being equivalent to main sensory data generated by a sensing device used by the autonomous control sub-system; wherein the at least one processing circuitry is configured to compare the auxiliary sensory data with the main sensory data and determine validity of the sensory data in view of the real-time mapping data.

~~11. The failure detection sub-system of any one of the preceding claims comprising, or being otherwise operatively connected to at least one scanning device on-board the autonomous vehicle configured to scan the environment in the vicinity of the vehicle and to obtain the sensory data.~~

~~12.~~6. The failure detection sub-system of any one of the preceding claims, further comprising a control unit connected over a control link to one or more driving sub-systems; the control unit is configured, in the event of violation of the ~~updated~~ safety rule, to generate the one or more vehicle control commands and transmit the one or more vehicle control commands to the one or more driving sub-systems.

~~13.~~7. The failure detection sub-system of any one of the preceding claims, wherein the at least one processing circuitry is configured to generate the real-time mapping data, ~~output~~ independently of data generated by the autonomous control sub-

system.

~~14.~~8. A method of detection of a failure of an autonomous control sub-system operating for controlling an autonomous vehicle; the autonomous control sub-system is configured to process real-time sensory data and generate, based on sensory data processing output, commands for controlling the autonomous vehicle;

the method comprising:

operating at least one scanning device on-board the autonomous vehicle for scanning an environment near the vehicle and obtaining therefrom real-time sensory data; utilizing ~~a~~ processing circuitry separated from the control sub-system, for:

processing the real-time sensory data, including scanned data output, and generating real-time mapping data, the real-time mapping data comprising information with respect to obstacles within a scanned area; ~~receiving real-time behavioral-data that includes real-time driving parameters;~~

receiving real-time behavioral-data that includes real-time driving parameters;

adapting~~determining~~ at least one safety rule value of at least one safety rule according to the real-time behavioral-data; wherein the real-time driving parameters include real-time yaw rate and speed of the autonomous vehicle and the at least one safety rule includes information on a region of interest within the scanned area;

wherein adapting the at least one safety rule value comprises: adapting the shape of the region of interest to create an offset toward a left side of the vehicle or a right side of the vehicle according to the yaw rate to thereby reduce the area of the region of interest in a direction opposite from a direction of turning;

determining, based on the real-time behavioral-data and the real-time mapping data, whether a violation of the at least one safety rule is occurring; and

generating one or more vehicle control commands for controlling at least one driving sub-system in case a violation of the safety rules is detected~~;~~, to thereby avoid the occurrence of an unwanted event resulting from the violation.

~~wherein processing of real-time sensory data done by failure detection sub-system is less computationally intensive as compared to processing of real-time sensory data done by an autonomous control sub-system.~~

~~15.~~9. The method of claim 8~~14~~, wherein ~~the at least one safety rule includes~~

~~information on a~~while the autonomous vehicle is making a turn, the offset is created in the direction of the turn to thereby reduce the areas of the region of interest ~~within the scanned area, wherein determining the at least one safety rule value comprises: changing the size~~opposite from a turning direction and~~/or shape~~ increase the areas of the region of interest in the direction of the turn~~according to the real-time behavioral data~~.

~~16. The method of claim 15, wherein the region of interest is characterized by a distinctive shape.~~

~~17.~~10. The method of ~~any one of~~ claim~~s~~ 8 or 9~~15 and 16~~, wherein the driving parameters further include one or more of: ~~speed of the autonomous vehicle;~~ acceleration of the autonomous vehicle; and heading of the autonomous vehicle~~; and yaw rate of the autonomous vehicle~~.

~~18.~~11. The method of claim 9~~15~~, wherein the region of interest is characterized by a rectangular shape and wherein determining the at least one safety rule comprises: changing a~~the~~ length of the rectangular shape in the direction of travel according to the speed of the autonomous vehicle and/or ~~the~~ heading of the autonomous vehicle.

~~19.~~12. The method of claim 9~~15~~, wherein the region of interest is characterized by a parallelogram shape and wherein adapting~~determining~~ the at least one safety rule comprises: changing the angles of the parallelogram shape according to the yaw rate of the autonomous vehicle, to thereby decrease the area of the region of interest opposite from the direction of travel.

~~20. The method of claim 19 further comprising changing the length of the parallelogram shape in the direction of travel according to the speed of the autonomous vehicle.~~

~~21.~~13. The method of claim 9~~15~~, wherein the region of interest is characterized by a double arc shape and wherein ~~the processing circuitry is configured for determining~~adapting the at least one safety rule~~, to adapt~~ comprises: adapting the double arc shape according to the yaw rate of the autonomous vehicle, to thereby decrease the area of the region of interest opposite from the direction of travel.

~~22.~~14. The method of claim 13~~21~~, wherein the region of interest is defined as an intersection between the double arc shape and a parallelogram shape,

wherein, while the vehicle is making a turn, the region of interest is defined by the double arc shape at anthe external side of the turn, and by the parallelogram at anthe internal side of the turn.

~~23. The method of any one of claims 14 to 22 comprising: operating at least one scanning device on-board the autonomous vehicle for scanning the environment in the vicinity of the vehicle and obtaining therefrom the real-time sensory data.~~

~~24.~~15. The method of ~~any one of~~ claims ~~8~~14 to ~~23~~, wherein the generating of the real-time mapping data output is executed independently of data generated by the autonomous control sub-system.

~~25.~~16. An autonomous vehicle comprising a system for controlling ~~an autonomous~~the vehicle, the system comprising:

a failure detection sub-system operatively connectable to an autonomous vehicle that comprises an autonomous control sub-system; the autonomous control sub-system is configured to process real-time sensory data, and generate, based on sensory data processing output, commands for controlling the autonomous vehicle; the failure detection sub-system comprises or being otherwise operatively connected to at least one scanning device on-board the autonomous vehicle ~~processing circuitry~~ configured to scan an environment near the vehicle and obtain sensory data;

the failure detection sub-system further comprising at least one processing circuitry configured to:

process the real-time sensory data, including scanned data output, and generate real-time mapping data, the real-time mapping data comprising information with respect to obstacles within a scanned area; receive real-time behavioral-data that includes real-time driving parameters;

adapt~~determine~~ at least one safety rule value of at least one safety rule according to the real-time behavioral-data; wherein the real-time driving parameters include real-time yaw rate and speed of the autonomous vehicle and the at least one safety rule includes information defining a region of interest within the scanned area;

wherein the at least one processing circuitry is configured for adapting the at least one safety rule value to: adapt the shape of the region of interest while turning to create an offset toward a left side of the vehicle or a right side of the vehicle according

to the yaw rate to thereby reduce the area of the region of interest in a direction opposite from a direction of turning;

determine, based on the real-time behavioral-data and the real-time mapping data, whether a violation of the at least one safety rule is occurring; and

generate one or more vehicle control commands for controlling at least one driving sub-system in case a violation of the safety rules is detected~~;~~ to thereby avoid the occurrence of an unwanted event resulting from the violation.

~~wherein processing of real-time sensory data done by failure detection sub-system is less computationally intensive as compared to processing of real-time sensory data done by an autonomous control sub-system.~~

~~26. An autonomous vehicle comprising the system according to claim 25.~~

~~27.~~17. A computer-readable non-transitory memory device tangibly embodying a program of instructions executable by ~~the computer for performing the method of claim 14~~a computer for performing a method of detection of a failure of an autonomous control sub-system operating for controlling an autonomous vehicle; the autonomous control sub-system is configured to process real-time sensory data and generate, based on sensory data processing output, commands for controlling the autonomous vehicle~~.~~;

the method comprising:

processing real-time sensory data, including scanned data output, and generating real-time mapping data, the real-time mapping data comprising information with respect to obstacles within a scanned area;

receiving real-time behavioral-data that includes real-time driving parameters;

adapting at least one safety rule value of at least one safety rule according to the real-time behavioral-data; wherein the real-time driving parameters include real-time yaw rate and speed of the autonomous vehicle and the at least one safety rule includes information on a region of interest within the scanned area;

wherein adapting the at least one safety rule value comprises: adapting the shape of the region of interest to create an offset toward a left side of the vehicle or a right side of the vehicle according to the yaw rate to thereby

reduce the area of the region of interest in a direction opposite from a direction of turning;

determining, based on the real-time behavioral-data and the real-time mapping data, whether a violation of the at least one safety rule is occurring; and

generating one or more vehicle control commands for controlling at least one driving sub-system in case a violation of the safety rules is detected, to thereby avoid the occurrence of an unwanted event resulting from the violation.