

CLAIMS:

1. A system, comprising:
 - a mounting structure configured to mount on a vehicle; and
 - a control module attached on the mounting structure, including at least one storage medium storing a set of instructions, an output port, and, a microchip in connection with the at least one storage medium, wherein during operation, the microchip executing the set of instructions to:
 - obtain vehicle status information;
 - determine a reference path based on the vehicle status information;
 - determine a loss function incorporating the reference path, vehicle status information, and a candidate path;
 - obtain an optimized candidate path by optimizing the loss function;
 - send an electronic signal encoding the optimized candidate path to the output port.
2. The system of claim 1, further comprising:
 - a Gateway Module (GWM) electronically connected the control module to a Control Area Network (CAN);
 - the CAN electrically connected the GWM to at least one of:
 - an Engine Management System (EMS),
 - an Electric Power System (EPS),
 - an Electric Stability Control (ESC), and
 - a Steering Column Module (SCM).
3. The system of claim 1, wherein the reference path includes a reference sample; the candidate path includes a candidate sample; the loss function includes a first

indicator; and,

the control module is further directed to:

determine the first indicator based on a difference between a reference location of the reference sample and a candidate location of the candidate sample.

4. The system of claim 1, wherein the reference path includes a reference sample; the candidate path includes a candidate sample; the loss function includes a second indicator; and,

the control module is further directed to:

determine the second indicator based on a difference between a reference velocity of the reference sample and a candidate velocity of the candidate sample.

5. The system of claim 1, wherein the reference path includes a reference sample; the candidate path includes a candidate sample; the loss function includes a third indicator; and,

the control module is further directed to:

determine the third indicator based on a difference between a reference acceleration of the reference sample and a candidate acceleration of the candidate sample.

6. The system of claim 1, wherein the loss function includes a fourth indicator; and,

the control module is further directed to:

obtain profile data of the vehicle;

obtain one or more locations of one or more obstacles around the vehicle;

determine one or more obstacle distances between the vehicle and the one or more obstacles;

determine the fourth indicator based on the one or more obstacle distances.

7. The system of claim 6, wherein value of the fourth indicator is inversely proportional to the one or more obstacle distances.

8. The system of claim 7, wherein the fourth indicator is expressed as:

$$\sum_{k=1}^M \frac{1}{d_k + E}$$

wherein the d_k denotes the one or more obstacle distance, M denotes number of the one or more obstacles, and E denotes the profile data.

9. The system of claim 1, wherein the vehicle status information includes at least one of:

a driving direction of the vehicle, a velocity of the vehicle, an acceleration of the vehicle, or environment information around the vehicle.

10. The system of claim 1, wherein the loss function is optimized by gradient descent method.

11. A method, implemented on a control module, having a microchip, a storage medium, and an output, attached on a mounting structure of a vehicle, the method comprising:

obtaining, by the microchip, vehicle status information;

determining, by the microchip, a reference path based on the vehicle status information;

determining, by the microchip, a loss function incorporating the reference path, vehicle status information, and a candidate path;

obtaining, by the microchip, an optimized candidate path by optimizing the loss function;

sending, by the microchip, an electronic signal encoding the optimized candidate path to the output port.

12. The method of claim 11, wherein the reference path includes a reference sample; the candidate path includes a candidate sample; the loss function includes a first indicator; and,

the method further comprises:

determine the first indicator based on a difference between a reference location of the reference sample and a candidate location of the candidate sample.

13. The method of claim 11, wherein the reference path includes a reference sample; the candidate path includes a candidate sample; the loss function includes a second indicator; and,

the control module is further directed to:

determine the second indicator based on a difference between a reference velocity of the reference sample and a candidate velocity of the candidate sample.

14. The method of claim 11, wherein the reference path includes a reference sample; the candidate path includes a candidate sample; the loss function includes a third indicator; and,

the control module is further directed to:

determining, by the microchip, the third indicator based on a difference between a reference acceleration of the reference sample and a candidate acceleration of the candidate sample.

15. The method of claim 11, wherein the loss function includes a fourth indicator; and,

the method further comprises:

obtaining, by the microchip, profile data of the vehicle;

obtaining, by the microchip, one or more locations of one or more obstacles around the vehicle;

determining, by the microchip, one or more obstacle distances between the vehicle and the one or more obstacles;

determining, by the microchip, the fourth indicator based on the one or more obstacle distances.

16. The method of claim 15, wherein value of the fourth indicator is inversely proportional to the one or more obstacle distances.

17. The method of claim 16, wherein the fourth indicator is expressed as:

$$\sum_{k=1}^M \frac{1}{d_k + E}$$

wherein the d_k denote the one or more obstacle distance, M denote number of the one or more obstacles, and E denote the profile data.

18. The method of claim 11, wherein the vehicle status information includes at least one of:

a driving direction of the vehicle, a velocity of the vehicle, an acceleration of the vehicle, or environment information around the vehicle.

19. The method of claim 11, wherein the loss function is optimized by gradient descent method.

20. A non-transitory computer readable medium, comprising at least one set of

instructions for determining a path for a vehicle, wherein when executed by at least one processor of an electronic terminal, the at least one set of instructions directs the at least one processor to perform acts of:

- obtaining vehicle status information;

- determining a reference path based on vehicle status information;

- determining a loss function incorporating the reference path, vehicle status information, and a candidate path;

- obtaining an optimized candidate path by optimizing the loss function;

- sending an electronic signal encoding the optimized candidate path to the output port.