CLAIMS

1. An operation control method for a high-speed train, wherein the operation control method is performed based on a train network control system and an ATO system installed on the high-speed train, the operation control method comprising:

communicating, by the train network control system, with the ATO system via a communication interface;

negotiating, by the train network control system with the ATO system, to activate an automatic operation mode;

receiving, by the train network control system, a train operation control signal sent by the ATO system, and determining, by the train network control system, whether communication between the train network control system and the ATO system is performed normally; and

sending, if the communication between the train network control system and the ATO system is performed normally, the train operation control signal to a hardware system of the high-speed train to control the hardware system to perform an operation based on the train operation control signal,

wherein the train operation control signal comprises a fresh air control signal, and

the sending the train operation control signal to a hardware system of the high-speed train to control the hardware system to perform an operation based on the train operation control signal comprises:

acquiring information about a distance between the high-speed train and a tunnel entrance from the fresh air control signal;

determining whether the distance between the high-speed train and the tunnel entrance is not greater than a preset distance threshold; and

sending, if the distance between the high-speed train and the tunnel entrance is not greater than the preset distance threshold, a fresh air damper closing command to an air conditioning system of the high-speed train to control the air conditioning system of the high-speed train to close a fresh air damper .

2. The method according to claim 1, wherein the negotiating, by the train network

control system with the ATO system, to activate an automatic operation mode comprises:

activating, by the ATO system, the automatic operation mode if the ATO system operates normally and receives a signal sent by the train network control system for indicating that the high-speed train is allowed to operate in the automatic operation mode;

determining, by the train network control system, whether the ATO system activates the automatic operation mode; and

sending, if the ATO system activates the automatic operation mode, a prompt information for indicating that the ATO system activates the automatic operation mode, and activating, if an automatic operation mode activating signal inputted by a driver is detected, the automatic operation mode.

3. The method according to claim 2, wherein the signal for indicating that the high-speed train is allowed to operate in the automatic operation mode is sent by:

determining, by the train network control system, whether each of conditions in a condition group is not met, wherein the condition group comprises the following conditions:

tractions to a preset number or more of units of the high-speed train are removed,

an air brake of at least one of the units of the high-speed train is unavailable,

speed limiting protection is performed for the high-speed train,

the high-speed train automatically applies service braking,

the high-speed train applies emergency braking,

the high-speed train maintains braking isolation, and

the high-speed train detects an ineffective communication state of the ATO system; and

sending, if each of the conditions in the condition group is not met, the signal for indicating that the high-speed train is allowed to operate in the automatic operation mode to the ATO system.

4. The method according to claim 1, wherein the determining whether communication between the train network control system and the ATO system is operated normally comprises:

determining whether a life signal of a control port of the ATO system and a life signal of a state port of the ATO system are continuously updated.

~~5. The method according to claim 1, wherein~~

~~the train operation control signal comprises a fresh air control signal, and~~

~~the sending the train operation control signal to a hardware system of the high-speed train to control the hardware system to perform an operation based on the train operation control signal comprises:~~

~~acquiring information about a distance between the high-speed train and a tunnel entrance from the fresh air control signal;~~

~~determining whether the distance between the high-speed train and the tunnel entrance is not greater than than a preset distance threshold; and~~

~~sending, if the distance between the high-speed train and the tunnel entrance is not greater than the preset distance threshold, a fresh air damper closing command to an air conditioning system of the high-speed train to control the air conditioning system of the high-speed train to close a fresh air damper.~~

~~6~~5. The method according to claim 1, wherein

the train operation control signal comprises a traction and braking control signal,

the sending the train operation control signal to a hardware system of the high-speed train to control the hardware system to perform an operation based on the train operation control signal comprises:

sending the traction and braking control signal to a traction and braking system of the high-speed train to control the traction and braking system to perform traction and braking, and wherein

the method further comprises:

sending, by the train network control system, a traction and braking percentage of the traction and braking system to a display system of the high-speed train, to display the traction and braking percentage of the traction and braking system by the display system.

~~7~~6. The method according to claim 1, before the sending the train operation control

signal to a hardware system of the high-speed train to control the hardware system to perform an operation based on the train operation control signal, the method further comprises:

determining whether the high-speed train is allowed to operate in the automatic operation mode, wherein

if the high-speed train is allowed to operate in the automatic operation mode, the train operation control signal is sent to the hardware system of the high-speed train to control the hardware system to perform the operation based on the train operation control signal; and

if the high-speed train is not allowed to operate in the automatic operation mode, no train operation control signal is sent to the hardware system of the high-speed train.

~~8~~7. An operation control system for a high-speed train, comprising a train network control system and an ATO system that are installed on the high-speed train, wherein

the train network control system is configured to:

communicate with the ATO system via a communication interface;

negotiate with the ATO system to activate an automatic operation mode;

receive a train operation control signal sent by the ATO system;

determine whether communication between the train network control system and the ATO system is performed normally; and

send, if the communication between the train network control system and the ATO system is performed normally, the train operation control signal to a hardware system of the high-speed train to control the hardware system to perform an operation based on the train operation control signal,

wherein the train operation control signal comprises a fresh air control signal, and

for sending the train operation control signal to the hardware system of the high-speed train to control the hardware system to perform the operation based on the train operation control signal, the train network control system is further configured to:

acquire information about a distance between the high-speed train and a tunnel entrance from the fresh air control signal;

determine whether the distance between the high-speed train and the tunnel entrance

is not greater than a preset distance threshold; and

send, if the distance between the high-speed train and the tunnel entrance is not greater than the preset distance threshold, a fresh air damper closing command to an air conditioning system of the high-speed train to control the air conditioning system of the high-speed train to close a fresh air damper .

~~9~~8. The operation control system for a high-speed train according to claim ~~8~~7, wherein for negotiating with each other to activate the automatic operation mode,

the ATO system is configured to activate the automatic operation mode if the ATO system operates normally and receives a signal sent by the train network control system for indicating that the high-speed train is allowed to operate in the automatic operation mode, and

the train network control system is further configured to:

determine whether the ATO system activates the automatic operation mode; and

send, if the ATO system activates the automatic operation mode, a prompt information for indicating that the ATO system activates the automatic operation mode, and activate, if an automatic operation mode activating signal inputted by a driver is detected, the automatic operation mode.

~~10~~9. The operation control system for a high-speed train according to claim ~~9~~8, wherein for sending the signal for indicating that the high-speed train is allowed to operate in the automatic operation mode, the train network control system is further configured to:

determine whether each of conditions in a condition group is not met, wherein the condition group comprises the following conditions:

tractions to a preset number or more of units of the high-speed train are removed,

an air brake of at least one of the units of the high-speed train is unavailable,

speed limiting protection is performed for the high-speed train,

the high-speed train automatically applies service braking,

the high-speed train applies emergency braking,

the high-speed train maintains braking isolation, and

the high-speed train detects an ineffective communication state of the ATO system;

and

send, if each of the conditions in the condition group is not met, the signal for indicating that the high-speed train is allowed to operate in the automatic operation mode to the ATO system.

~~11~~10. The operation control system for a high-speed train according to claim ~~8~~7, wherein for determining whether communication between the train network control system and the ATO system is operated normally, the train network control system is further configured to:

determine whether a life signal of a control port of the ATO system and a life signal of a state port of the ATO system are continuously updated.

~~12. The operation control system for a high-speed train according to claim 8, wherein~~

~~the train operation control signal comprises a fresh air control signal, and~~

~~for sending the train operation control signal to the hardware system of the high-speed train to control the hardware system to perform the operation based on the train operation control signal, the train network control system is further configured to:~~

~~acquire information about a distance between the high-speed train and a tunnel entrance from the fresh air control signal;~~

~~determine whether the distance between the high-speed train and the tunnel entrance is not greater than a preset distance threshold; and~~

~~send, if the distance between the high-speed train and the tunnel entrance is not greater than the preset distance threshold, a fresh air damper closing command to an air conditioning system of the high-speed train to control the air conditioning system of the high-speed train to close a fresh air damper.~~

~~13~~11. The operation control system for a high-speed train according to claim ~~8~~7, wherein

the train operation control signal comprises a traction and braking control signal, and

for sending the train operation control signal to the hardware system of the high-speed train to control the hardware system to perform an operation based on the train operation control signal, the train network control system is further configured to:

send the traction and braking control signal to a traction and braking system of the

high-speed train to control the traction and braking system to perform traction and braking, and wherein

the train network control system is further configured to send a traction and braking percentage of the traction and braking system to a display system of the high-speed train, to display the traction and braking percentage of the traction and braking system by the display system.

~~14~~12. The operation control system for a high-speed train according to claim ~~8~~7, wherein

before sending the train operation control signal to the hardware system of the high-speed train to control the hardware system to perform the operation based on the train operation control signal, the train network control system is further configured to:

determine whether the high-speed train is allowed to operate in the automatic operation mode, wherein

if the high-speed train is allowed to operate in the automatic operation mode, the train network control system sends the train operation control signal to the hardware system of the high-speed train to control the hardware system to perform the operation based on the train operation control signal; and

if the high-speed train is not allowed to operate in the automatic operation mode, the train network control system sends no train operation control signal to the hardware system of the high-speed train.