



EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:
12.02.2020 Bulletin 2020/07

(51) Int Cl.:
B61L 27/00 ^(2006.01)

(21) Application number: **18876592.9**

(86) International application number:
PCT/CN2018/085944

(22) Date of filing: **08.05.2018**

(87) International publication number:
WO 2019/091063 (16.05.2019 Gazette 2019/20)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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(30) Priority: **13.11.2017 CN 201711113188**

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(54) **RAIL STATION TRANSPORTATION DISPATCH METHOD AND SYSTEM**

(57) The present disclosure discloses a station transportation dispatching method, comprising: receiving, by a plan processing module, station plan issued from a station plan management module; by the plan processing module, parsing the station plan into train route plan and issuing the train route plan to a route processing module; issuing, by the route processing module, the train route

plan to a train arrival departure control module for processing; issuing, by the station plan management module, the station plan to a storage query module for storing. The present disclosure realizes the timely and effective delivery of the station plan, and realizes the convenient dispatching of the station transport. And a station transport dispatching system is also disclosed.

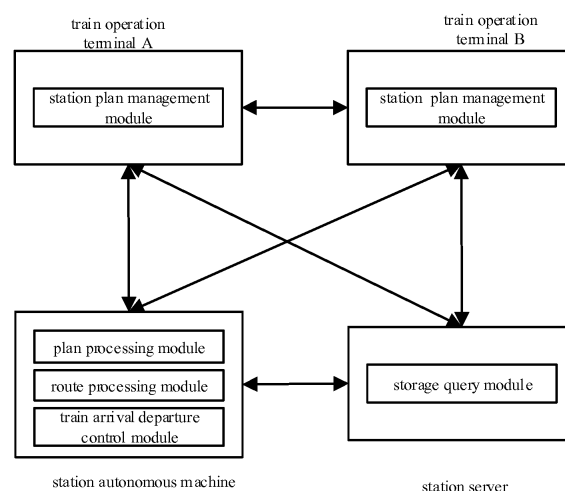


FIG. 2

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority of the Chinese Patent Application No. 201711113188.0 filed on November 13, 2017, the entire disclosure of which is hereby incorporated in full text by reference as part of the present application.

TECHNICAL FIELD

[0002] The present disclosure relates to the field of automatic control technology, especially to a station transport dispatching method and system.

BACKGROUND

[0003] Chinese high-speed railway signal system mainly includes subsystems like Chinese Train Control System (CTCS), Computer Based Interlocking system (CBI), Central Traffic Control (CTC), as well as some signal auxiliary systems, such as Centralized Signaling Monitoring (CSM), dispatching command wireless transmission system, power supply system, etc.

[0004] The train dispatchers are required to use the CTC system to carry out jobs like the formulation and delivery of train movement plan, the train route setting, the shunting operation, the release of dispatching command, the centralized control of signaling equipment, the equipment maintenance dispatching, the emergency traffic commanding, the arrival and departure operation during abnormality, etc. In addition, the dispatchers need to monitor the situation of train operation and signaling equipment such as train tracking, train position and speed, signal status, train route, and section block and so on through the screen wall and display of the CTC system.

[0005] The CTC system is technical equipment with which the dispatching center (dispatcher) centrally controls the signaling equipment in a certain section and directly directs, manages the train operation. The CTC system is a highly automated dispatching and commanding system combined with computer technology, network communication technology and modernization controlling technology, which applies the design principle of intelligent decentralized self-discipline. It centers on the train operation adjustment plan control and takes the train operation and shunting operation into account.

[0006] The CTC system consists of three parts: the dispatch center subsystem, the station subsystem, and the network subsystem among stations, as shown in FIG. 1.

[0007] The dispatch center subsystem is the core of the CTC system, and is mainly composed of server equipment and the terminal equipment in each dispatch station. The server equipment includes: a database server, an application server, a communication server, an inter-

face server, an external information service server, and an external time server. The dispatch station user terminal equipment includes: a dispatcher workstation, an assistant dispatcher workstation, a comprehensive maintenance workstation, a station display workstation, a comprehensive query workstation, a shift supervisor workstation, a planner workstation, a dispatch maintenance workstation, and the like.

[0008] The station autonomous machine is the key equipment of the CTC system and should meet the following functional requirements: it should be able to receive the train operation adjustment plan, direct operation commands from the dispatch center and direct operation commands from the station operator, and send them to the station interlocking system at the appropriate time to be executed after inspection with no conflicts; it should be able to receive the station signaling equipment status information in real time, track the train number, collect the actual train running data, and upload it to the dispatch center; it should be able to get the status of execution of the route commands by the station interlocking system, and make necessary adjustments to the relevant routes according to feedback information; it should be able to receive train time report and equipment status information from every two adjacent stations.

SUMMARY

[0009] The present disclosure provides a station transport dispatching method and system to solve the problem that the existing CTC system cannot meet the transport commanding needs.

[0010] The present disclosure provides a station transport dispatching method, comprising:

receiving, by a plan processing module, station plan issued from a station plan management module;
by the plan processing module, parsing the station plan into train route plan and issuing the train route plan to a route processing module;
issuing, by the route processing module, the train route plan to a train arrival departure control module for processing;
issuing, by the station plan management module, the station plan to a storage query module for storing.

[0011] Some beneficial effects of the embodiments of the present disclosure may include that the station operator sends the station plan to the plan processing module through the station plan management module, and the plan processing module automatically parses the station plan into a corresponding operation route and sends it to the route processing module and the train arrival departure control module, which realizes the timely and effective delivery of the station plan, and realizes the convenient dispatching of the station transport.

[0012] In one embodiment, the method further comprises:

at startup of the station plan management module, sending a request to the storage query module to load station plan and train graph stage plan in a database;

by the station plan management module, receiving station plan information and train graph stage plan information issued from the storage query module and updating interface display information according to the station plan information and the train graph stage plan information.

[0013] In this embodiment, the initialization process of the station plan management module is added, the station plan management module sends a request for loading the station plan information in the database to the storage query module and requests stage plan from the storage query module.

[0014] In one embodiment, the method further comprising:

sending, by a station plan management module of standby machine, request to load station plan in database to the storage query module during an hot/standby switchover;

by the station plan management module of standby machine, receiving station plan request receipt returned from the storage query module and sending information to the station plan management module that the local machine is to be upgraded as the hot machine;

upgrading the station plan management module of standby machine as new station plan management module of hot machine, and degrading the station plan management module of hot machine to new station plan management module of standby machine;

by the new station plan management module of hot machine, sending a request for the train graph stage plan to the storage query module, receiving the train graph stage plan information issued from the storage query module, and updating the interface display information according to the train graph stage plan information.

[0015] Receiving, by the original station plan management module of standby machine, a station plan request receipt returned from the storage query module specifically comprises:

if the receipt result is that the station plan request has been successfully loaded, updating, by the original station plan management module of standby machine, the interface display information according to the station plan information;

if the receipt result is that the station plan request fails to load, sending, by the original station plan management module of standby machine, a request to load the entire station plan information to the orig-

inal station plan management module of hot machine;

receiving, by the original station plan management module of standby machine, the entire station plan information sent from the original station plan management module of hot machine.

[0016] In this embodiment, the processing procedure of hot/standby switchover by the station plan management module is added, which ensures secure operation of the station transport dispatching system, and improves disaster tolerance performance of the station transport dispatching system.

[0017] The present application provides a station transport dispatching system, comprising: a plan processing module, a station plan management module, a route processing module, a storage query module, and a train arrival departure control module:

the plan processing module is configured to receive station plan issued from a station plan management module, parse the station plan into train route plan, and issue the train route plan to the route processing module;

the route processing module is configured to issue the train route plan to the train arrival departure control module for processing;

the station plan management module is configured to issue the station plan to the plan processing module for processing, and issue the plan station to the storage query module for storing; receive station plan information and train graph stage plan information issued from the storage query module and update interface display information according to the station plan information and the train graph stage plan information.

[0018] In the station transport dispatching system of this embodiment, the station operator sends the station plan to the plan processing module through the station plan management module, the plan processing module automatically parses the station plan into corresponding operation routes and sends them to the route processing module and the train arrival departure control module, which realizes the timely and effective delivery of the station plan, and realizes the convenient dispatching of the station transport.

[0019] In one embodiment, the system further comprises a storage query module:

the station plan management module is configured to send request to load station plan and a train graph stage plan in a database to the storage query module;

receive the station plan information and the train graph stage plan information issued from the storage query module and update interface display information according to the station plan information and the

train graph stage plan information;
the storage query module is configured to receive the station plan and store it in a database, receive request for the station plan and request for the stage plan sent from the station plan management module, and send station plan request receipt and stage plan request receipt to the station plan management module.

[0020] In this embodiment, the initialization process of the station plan management module is added, the station plan management module sends a request for loading the station plan information in the database to the storage query module and requests a stage plan from the storage query module.

[0021] In one embodiment, the system further comprises a station plan management module of standby machine and a station plan management module of hot machine:

the station plan management module of standby machine is configured to send a request to load station plan in a database to the storage query module during an hot/standby switchover, and receive a station plan request receipt returned from the storage query module; after being upgraded to the new station plan management module of hot machine, send a request for train graph stage plan to the storage query module, and receive the train graph stage plan information sent from the storage query module, and update the interface display information according to the train graph stage plan information;
the station plan management module of hot machine is configured to receive information sent from the station plan management module of standby machine that the local machine is upgraded as the hot one during the hot/standby switchover.

[0022] The station plan management module of standby machine is specifically configured to: if a receipt result is that the station plan request has been successfully loaded, update the interface display information according to the station plan information;
if the station plan request receipt result returned from the storage query module is that the station plan request fails to load, send a request to load the entire station plan information to the station plan management module of hot machine;
the station plan management module of hot machine is configured to send the entire station plan information to the station plan management module of standby machine.

[0023] In this embodiment, the processing flows of hot/standby switchover by the station plan management modules is added, which ensures secure operation of the station transport dispatching system, and improves disaster tolerance performance of the station transport dispatching system.

[0024] Other features and advantages of the present disclosure will be set forth in the description which follows, parts of them will be apparent from the description, or may be learned by implementing the present disclosure. The objectives and other advantages of the present disclosure can be realized and obtained by the description, claims and structure particularly specified in the drawings attached thereto.

[0025] The technical solutions of the present disclosure will be further described in detail below through the accompanying drawings and embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] The drawings are to provide a further understanding of the present disclosure, and they constitute a part of the specification, the drawings together with the description of the specification are intended to explain principles of the present disclosure, rather than to limit the present disclosure. In the drawings:

FIG. 1 is a structural schematic view of the CTC system in the prior art;

FIG. 2 is a schematic diagram of a station transport dispatching system in one embodiment of the present disclosure;

FIG. 3 is a flowchart of Embodiment 1 of a station transport dispatching method according to the embodiments of the present disclosure;

FIG. 4 is a flowchart of Embodiment 2 of a station transport dispatching method according to the embodiments of the present disclosure;

FIG. 5 is a flowchart of Embodiment 3 of a station transport dispatching method according to the embodiments of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0027] The preferred embodiments of the present disclosure will be described below with reference to the accompanying drawings. It should be understood that, the preferred embodiments described herein are used to illustrate and explain the present disclosure only, not to limit the present disclosure.

[0028] FIG. 3 is a flowchart of a station transport dispatching method according to the embodiments of the present disclosure. As shown in FIG. 3, the method comprises the following steps S301 to S308.

[0029] Step 301, a station plan management module receives command inputted by user to issue station plan
[0030] Step 302, the station plan management module issues the station plan to a plan processing module.

[0031] Step 303, the plan processing module returns receipt of the station plan to the station plan management module.

[0032] Step 304, the plan processing module parses the station plan into train route plan.

[0033] Step 305, the plan processing module issues

the parsed station route plan to a route processing module.

[0034] Step 306, the route processing module forwards the received station route plan to a train arrival departure control module.

[0035] Step 307, the station plan management module issues the station plan information to a storage query module for storing.

[0036] Step 308, the storage query module returns storage receipt of the station plan information to the station plan management module.

[0037] In the station transport dispatching method in this embodiment, the station operator sends the station plan to the plan processing module through the station plan management module, the plan processing module automatically parses the station plan into corresponding operation routes and sends them to the route processing module and the train arrival departure control module, which realizes the timely and effective delivery of the station plan, and realizes the convenient dispatching of the station transport.

[0038] FIG. 4 is a flowchart of Embodiment 2 of a station transport dispatching method according to the embodiments of the present disclosure. As shown in FIG. 4, this embodiment comprises the following steps.

[0039] Step 401, start programs of the station plan management module.

[0040] Step 402, the station plan management module loads configurations and the system starts to run.

[0041] Step 403, the station plan management module sends a request for loading station plan in the database to the storage query module.

[0042] Step 404, the station plan management module sends a request for loading a train graph stage plan in the database to the storage query module.

[0043] Step 405, the storage query module sends station plan information to the station plan management module.

[0044] Step 406, the station plan management module updates interface display information according to the station plan information.

[0045] Step 407, the storage query module sends train graph stage plan information to the station plan management module.

[0046] Step 408, the station plan management module updates interface display information according to the train graph stage plan information.

[0047] For the station transport dispatching method in this embodiment, the initialization process of the station plan management module is added based on the embodiment in FIG. 3, the station plan management module sends a request for loading the station plan information in the database to the storage query module and requests a stage plan from the storage query module, receives the request receipt sent from the storage query module and updates the interface display information.

[0048] FIG. 5 is a flowchart of Embodiment 3 of a station transport dispatching method according to the em-

bodiments of the present disclosure. As shown in FIG. 5, the station plan management module A (the station plan management module of the original standby machine) in this embodiment is the station plan management module of standby machine, and the station plan management module B (the station plan management module of the original hot machine) is the station plan management module of hot machine, this embodiment includes the following steps.

[0049] Step 501, starts programs of the station plan management module A.

[0050] Step 502, the station plan management module A sends a request for loading station plan in the database to the storage query module.

[0051] Step 503, the storage query module returns receipt of the station plan request to the station plan management module A.

[0052] Step 504, if a receipt result is that the station plan request has been successfully loaded, the station plan management module A updates the interface display information according to the station plan information.

[0053] Step 505, if the receipt result is that the station plan request fails to load, the station plan management module A sends a request to load the entire station plan information to the station plan management module B.

[0054] Step 506, the station plan management module B sends the entire station plan information to the station plan management module A.

[0055] Step 507, upgrade the station plan management module A as the hot one and sends information that the local machine is upgraded as the hot one to the station plan management module B.

[0056] Step 508, degrades the station plan management module B is as the standby machine, and clears the cache.

[0057] Step 509, the station plan management module A sends a request for train graph stage plan to the storage query module.

[0058] Step 510, the storage query module sends a train graph stage plan to the station plan management module A.

[0059] Step 511, the station plan management module A updates the cache.

[0060] Step 512, the operator clicks on the "Update" button.

[0061] Step 513, the station plan management module A updates the interface.

[0062] For the station transport dispatching method in this embodiment, the processing flows of hot/standby switchover by the station plan management module is added based on the embodiment in FIG. 3, which ensures secure operation of the station transport dispatching system, and improves disaster tolerance performance of the station transport dispatching system.

[0063] FIG. 2 is a schematic diagram of a station transport dispatching system in one embodiment of the present disclosure, as shown in FIG. 2, the station transport dispatching system in this embodiment comprises:

a plan processing module, station plan management modules, a route processing module, a storage query module, and a train arrival departure control module. The station plan management modules are set in train operation terminal A/train operation terminal B; the train arrival departure control module, the plan processing module and the route processing module are set in the station autonomous machine; and the storage query module is set in the station server:

the plan processing module is configured to receive station plan issued from the station plan management module, parse the station plan into train route plan, and issue the train route plan to the route processing module;
the route processing module is configured to issue the train route plan to the train arrival departure control module for processing;
the station plan management module is configured to issue the plan station to the storage query module for storing.

[0064] In the station transport dispatching system of this embodiment, the operator sends the station plan to the plan processing module through the station plan management module, the plan processing module automatically parses the station plan into corresponding operation routes and sends them to the route processing module and the train arrival departure control module, which realizes the timely and effective delivery of the station plan, and realizes the convenient dispatching of the station transport.

[0065] Wherein the station transport dispatching system further comprises a storage query module:

the station plan management module is configured to send a request to load station plan and train graph stage plan in the database to the storage query module;
receive the station plan information and the train graph stage plan information issued from the storage query module and update interface display information according to the station plan information and the train graph stage plan information.

[0066] For the station transport dispatching system of this embodiment, the initialization process of the station plan management module is added based on the embodiment in FIG. 2, the station plan management module sends a request for loading the station plan information in the database to the storage query module and requests a stage plan from the storage query module.

[0067] Wherein the station transport dispatching system further comprises a station plan management module of standby machine and a station plan management module of hot machine:

the station plan management module of standby ma-

chine is configured to : send a request to load station plan in the database to the storage query module during an hot/standby switchover, and receive station plan request receipt returned from the storage query module; after being upgraded as the new station plan management module of hot machine, send a request for train graph stage plan to the storage query module, and receive the train graph stage plan information sent from the storage query module, and update the interface display information according to the train graph stage plan information;
the station plan management module of hot machine is configured to receive information sent from the station plan management module of standby machine that the local machine is to be upgraded as the hot one during the hot/standby switchover.

[0068] The station plan management module of standby machine is specifically configured to: if a receipt result is that the station plan request has been successfully loaded, update the interface display information according to the station plan information;

if the station plan request receipt result returned from the storage query module is that the station plan request fails to load, send a request to load the entire station plan information to the station plan management module of hot machine;

the station plan management module of hot machine is configured to send the entire station plan information to the station plan management module of standby machine.

[0069] For the station transport dispatching system in this embodiment, the processing flows of hot/standby switchover by the station plan management module is added based on the embodiment in FIG. 2, which ensures secure operation of the station transport dispatching system, and improves disaster tolerance performance of the station transport dispatching system.

[0070] Those skilled in the art should understand that, the embodiments of the present application can be provided as methods, systems or computer program products. Therefore, the present application can adopt the form of full hardware embodiments, full software embodiments, or embodiments combining software and hardware aspects. And the present application can adopt the form of computer program products implemented on one or more storage mediums with program codes usable for computer (including, but not limited to, magnetic disk storage, CD-ROM, optical memory, or the like).

[0071] Obviously, those skilled in the art can make various modifications and variations to the present disclosure without departing from the spirit and scope thereof. Thus, if these modifications and variations of the present disclosure are within the scope of the claims of the disclosure as well as their equivalents, the present disclosure is also intended to include these modifications and variations.

Claims**1.** A station transport dispatching method, comprising:

receiving, by a plan processing module, station
plan issued from a station plan management
module; 5
by the plan processing module, parsing the sta-
tion plan into train route plan and issuing the
train route plan to a route processing module; 10
issuing, by the route processing module, the
train route plan to a train arrival departure control
module for processing;
issuing, by the station plan management mod- 15
ule, the station plan to a storage query module
for storing.

2. The method of claim 1, wherein the method further comprises:

sending, by the station plan management mod- 20
ule at startup, a request to load station plan and
train graph stage plan in the database, to the
storage query module;
by the station plan management module, receiv- 25
ing station plan information and train graph
stage plan information issued from the storage
query module, and updating interface display in-
formation according to the station plan informa- 30
tion and the train graph stage plan information.

3. The method of any of claims 1 to 2, further compris-
ing:

during hot/standby switchover, sending, by a 35
station plan management module of standby
machine, a request to load a station plan in the
database, to the storage query module;
by the station plan management module of 40
standby machine, receiving a station plan re-
quest receipt returned from the storage query
module, and sending to the station plan man-
agement module of hot machine the information
that the local machine is upgraded to be a hot 45
machine,;
upgrading the station plan management module
of standby machine to be a station plan man-
agement module of a new hot machine, and de-
grading the station plan management module of 50
hot machine to be a station plan management
module of a new standby machine;
by the station plan management module of the
new hot machine, sending a request for the train
graph stage plan to the storage query module,
receiving the train graph stage plan information 55
issued from the storage query module, and up-
dating the interface display information accord-
ing to the train graph stage plan information.

4. The method of any of claims 1 to 3, comprising:

receiving, by the station plan management mod-
ule of the original standby machine, a station
plan request receipt returned from the storage
query module,
and specifically comprising:

if the receipt result is that the station plan
request has been successfully loaded, up-
dating, by the station plan management
module of the original standby machine, the
interface display information according to
the station plan information;
if the receipt result is that the station plan
request fails to load, sending, by the station
plan management module of the original
standby machine, a request to load the en-
tire station plan information, to the station
plan management module of the original hot
machine;
receiving, by the station plan management
module of the original standby machine, the
entire station plan information sent from the
station plan management module of the
original hot machine.

5. A station transport dispatching system, comprising:
a plan processing module, a station plan manage-
ment module, a route processing module, a storage
query module, and a train arrival departure control
module:

the plan processing module is configured to re-
ceive a station plan issued from a station plan
management module, parse the station plan into
a train route plan, and issue the train route plan
to the route processing module;
the route processing module is configured to is-
sue the train route plan to the train arrival de-
parture control module for processing;
the station plan management module is config-
ured to issue the station plan to the plan process-
ing module for processing, and issue the plan
station to the storage query module for storing;
receive station plan information and train graph
stage plan information issued from the storage
query module, and update interface display in-
formation according to the station plan informa-
tion and the train graph stage plan information.

6. The system of claim 5, further comprising a storage
query module:

the station plan management module is config-
ured to send a request to load station plan and
train graph stage plan in the database to the
storage query module;

receive the station plan information and the train graph stage plan information issued from the storage query module, and update interface display information according to the station plan information and the train graph stage plan information; 5

the storage query module is configured to receive the station plan and store it in the database, receive the request for the station plan and the request for the stage plan sent from the station plan management module, and send a station plan request receipt and stage plan request receipt to the station plan management module. 10

7. The system of any of claims 5 to 6, further comprising a station plan management module of standby machine and a station plan management module of hot machine: 15

the station plan management module of standby machine is configured to send a request to load station plan in the database to the storage query module during hot/standby switchover, and receive the station plan request receipt returned from the storage query module; after have been upgraded to be a station plan management module of a new hot machine, send a request for train graph stage plan to the storage query module, and receive the train graph stage plan information sent from the storage query module, and update the interface display information according to the train graph stage plan information; 20

during the hot/standby switchover, the station plan management module of hot machine is configured to receive information sent from the station plan management module of standby machine that the local machine is upgraded to be the hot one. 25

8. The system of any of claims 5 to 7, wherein the station plan management module of standby machine is specifically configured to: if a receipt result is that the station plan request has been successfully loaded, update the interface display information according to the station plan information; 30
- if the station plan request receipt result returned from the storage query module is that the station plan request fails to load, send to the station plan management module of hot machine a request to load the entire station plan information; 35
- the station plan management module of hot machine is configured to send the entire station plan information to the station plan management module of standby machine. 40

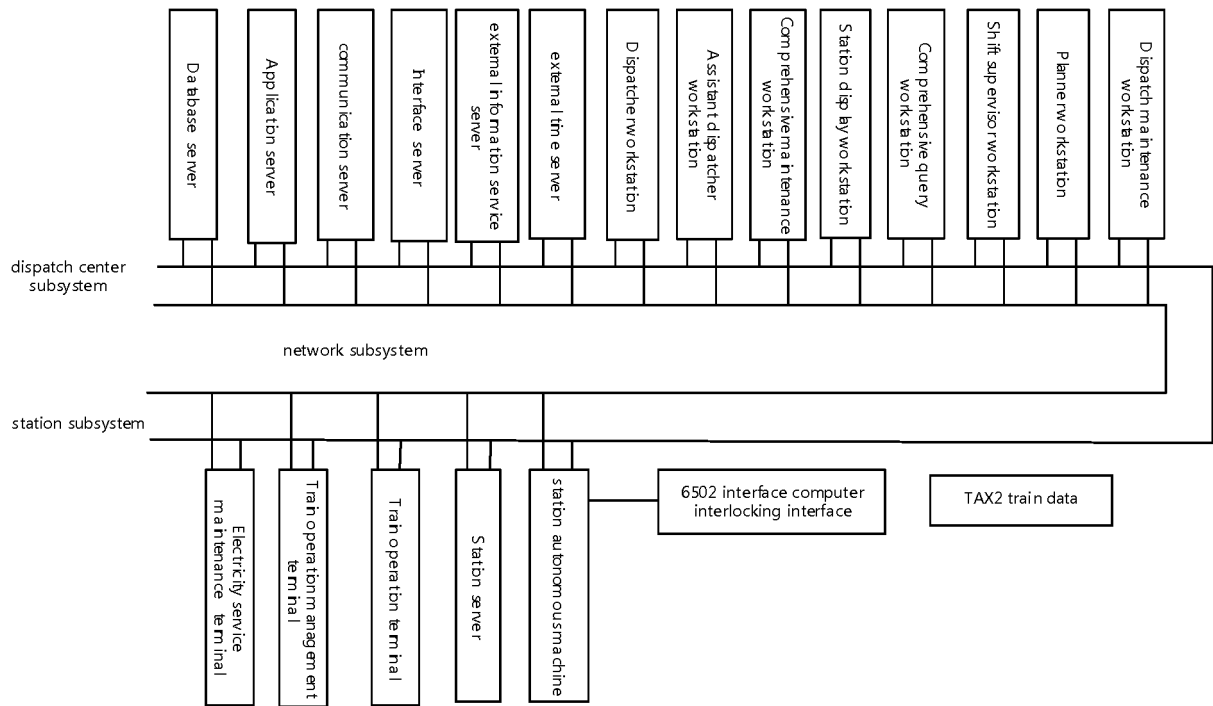


FIG. 1

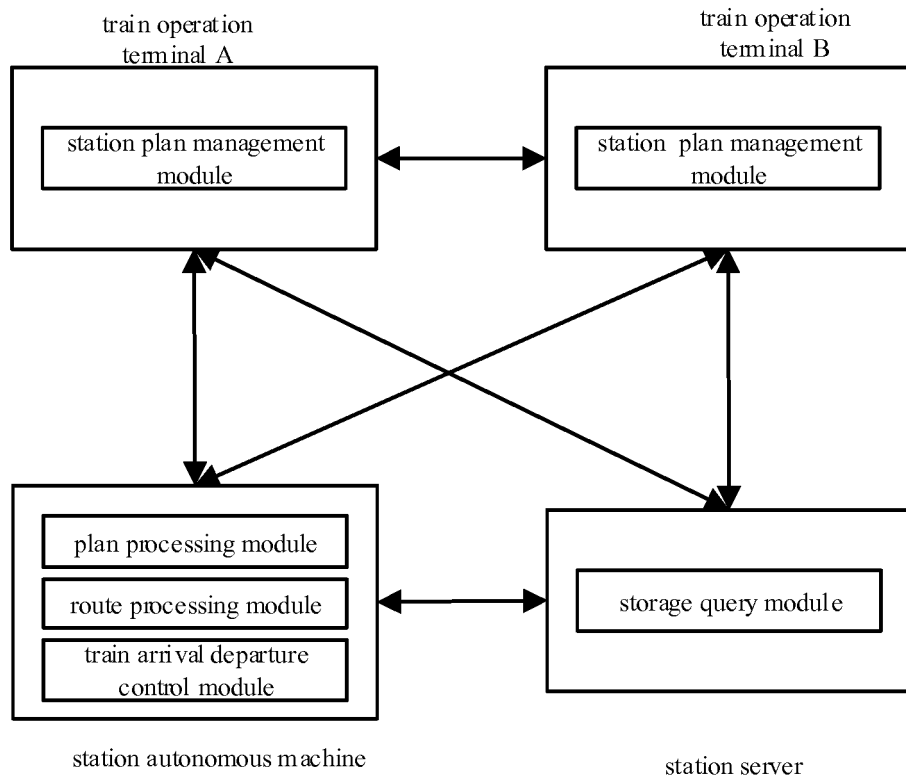


FIG. 2

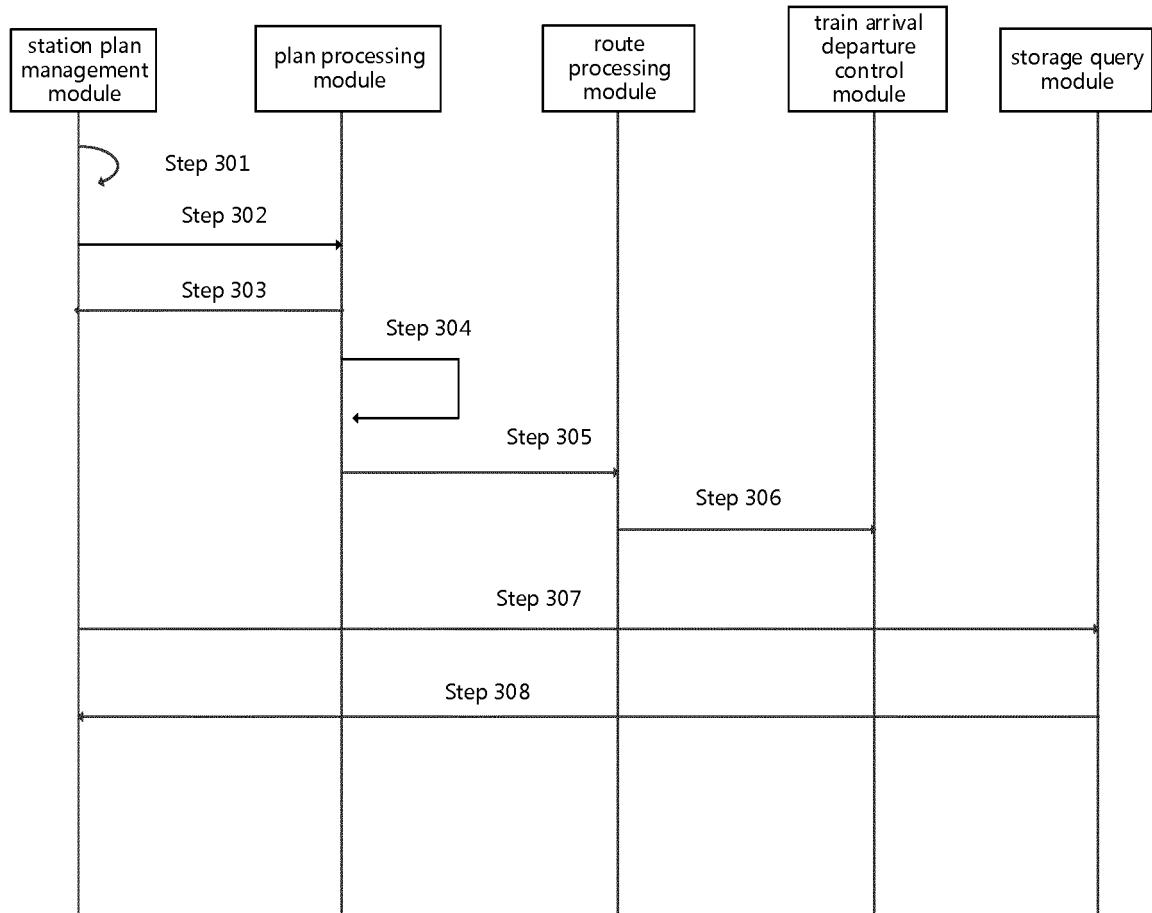


FIG. 3

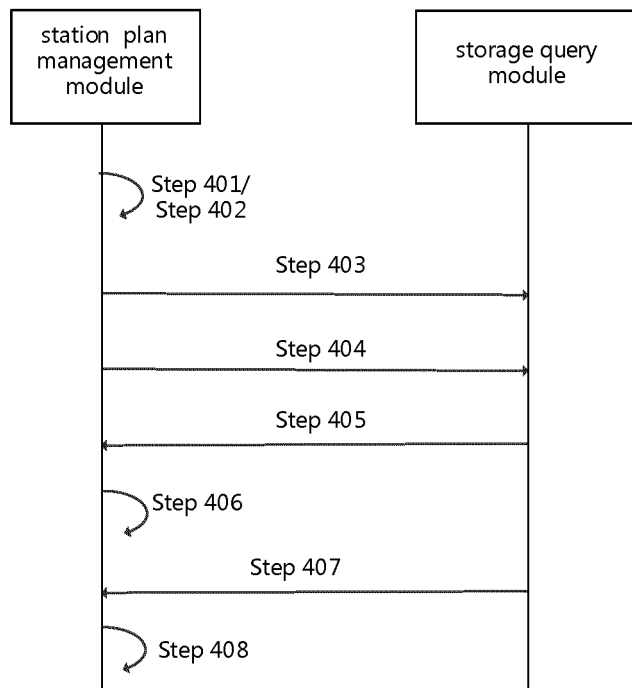


FIG. 4

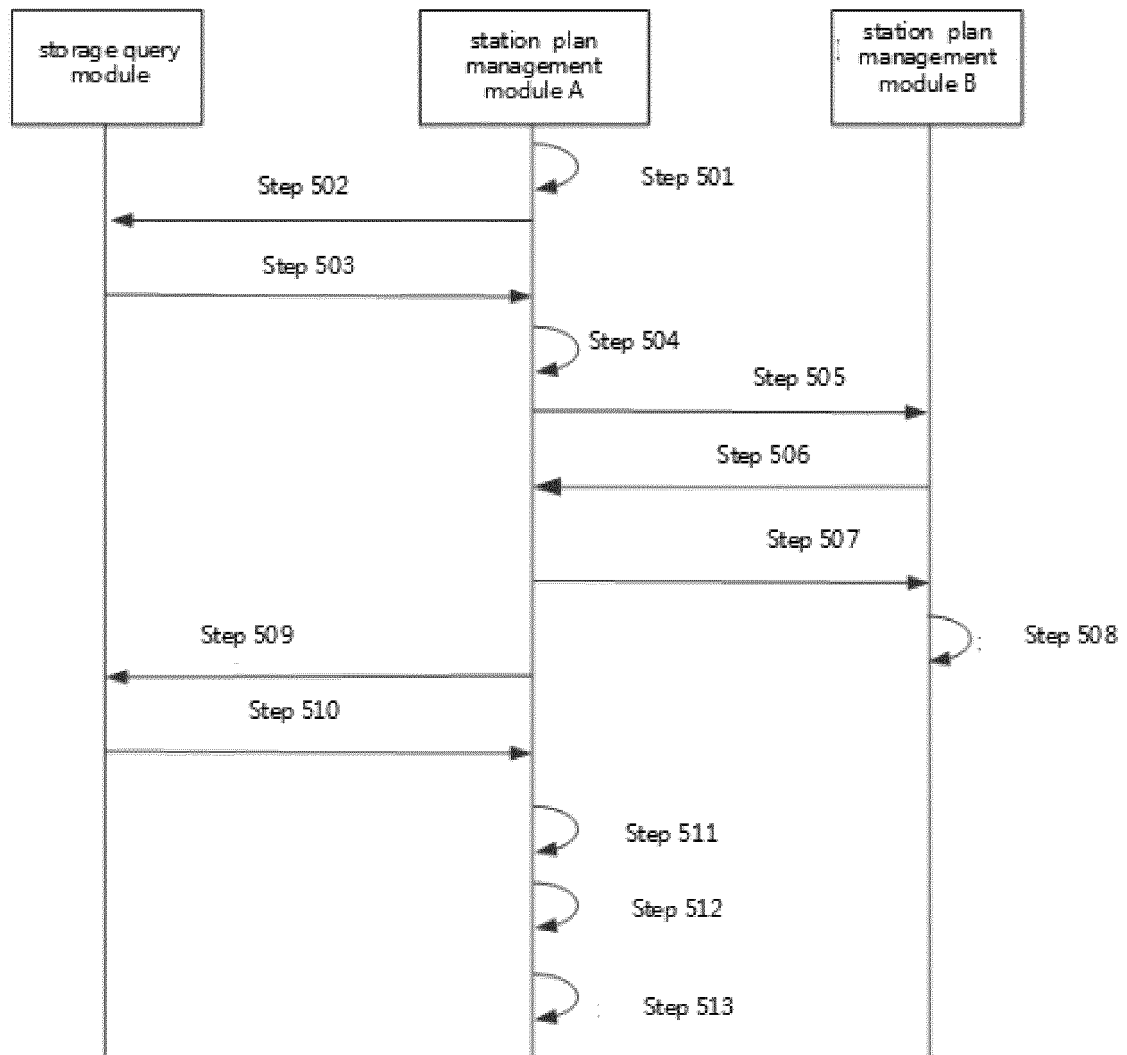


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2018/085944

A. CLASSIFICATION OF SUBJECT MATTER B61L 27/00(2006.01)i According to International Patent Classification (IPC) or to both national classification and IPC															
B. FIELDS SEARCHED															
Minimum documentation searched (classification system followed by classification symbols) B61L															
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched															
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPI; EPODOC; CNPAT; CNKI; IEEE: 车站, 列车, 运输, 调度, 解析, 计划, 下发, 控制, 存储, station, train, transportation, scheduling, realize, control, memory															
C. DOCUMENTS CONSIDERED TO BE RELEVANT															
<table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>CN 105278379 A (SIGNAL & COMMUNICATION RESEARCH INSTITUTE OF CARS ET AL.) 27 January 2016 (2016-01-27) description, paragraphs [0023]-[0133], and figures 1-2</td> <td>1-8</td> </tr> <tr> <td>A</td> <td>CN 102358337 A (BEIJING HOLLYSYS SYSTEM ENGINEERING CO., LTD.) 22 February 2012 (2012-02-22) entire document</td> <td>1-8</td> </tr> <tr> <td>A</td> <td>CN 101767590 A (SIGNAL & COMMUNICATION RESEARCH INSTITUTE OF CARS ET AL.) 07 July 2010 (2010-07-07) entire document</td> <td>1-8</td> </tr> <tr> <td>A</td> <td>US 5950966 A (WESTINGHOUSE AIRBRAKE COMPANY) 14 September 1999 (1999-09-14) entire document</td> <td>1-8</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	CN 105278379 A (SIGNAL & COMMUNICATION RESEARCH INSTITUTE OF CARS ET AL.) 27 January 2016 (2016-01-27) description, paragraphs [0023]-[0133], and figures 1-2	1-8	A	CN 102358337 A (BEIJING HOLLYSYS SYSTEM ENGINEERING CO., LTD.) 22 February 2012 (2012-02-22) entire document	1-8	A	CN 101767590 A (SIGNAL & COMMUNICATION RESEARCH INSTITUTE OF CARS ET AL.) 07 July 2010 (2010-07-07) entire document	1-8	A	US 5950966 A (WESTINGHOUSE AIRBRAKE COMPANY) 14 September 1999 (1999-09-14) entire document	1-8
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Information on patent family members

International application No.

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CN	105278379	A	27 January 2016	None	
CN	102358337	A	22 February 2012	None	
CN	101767590	A	07 July 2010	None	
US	5950966	A	14 September 1999	None	

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REFERENCES CITED IN THE DESCRIPTION

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