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(54) **ON-BOARD APPARATUS AND TRAIN COMMUNICATION SYSTEM**

(57) On-board equipment and a train communication system are disclosed. The on-board equipment includes a wireless communication device, configured to receive a switching instruction from a ground responder; a time management device, configured to determine a wireless time-out time slice after the wireless communication device receives the switching instruction from the ground responder; a storage device, configured to store communication contents between the wireless communication device and the takeover ZC when the wireless communication device pauses communication with the takeover ZC; and a processing device, configured to determine a next movement authority according to the communication contents between the wireless communication device and the takeover ZC, determine whether the current movement authority is connected with the next movement authority, and perform zone switching if a determination result is yes.

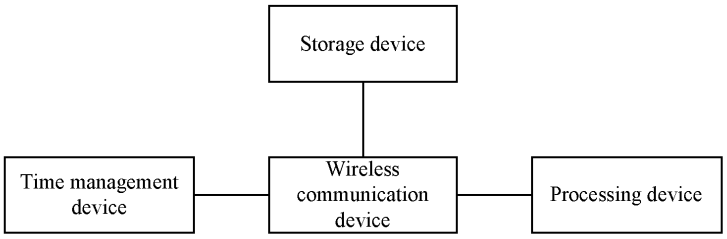

Fig. 1

EP 3 315 379 A1

Description

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the priority of Chinese patent application CN201510367587.4, entitled "On-board Equipment and Train Communication System" and filed on June 26, 2015, the entirety of which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present disclosure relates to the technical field of train control, and particularly to on-board equipment and a train communication system.

BACKGROUND OF THE INVENTION

[0003] With rapid development of urban railway transportation, Communication Based Train Control (CBTC) system is more and more widely used. A Zone Controller (ZC) is a core subsystem of the CBTC system. The ZC, based on an accurate position reported by a train in communication with the ZC and axle counter occupied/idle, turnout and signal state jointly reported therein, calculates a Movement Authority (MA) for the train and enables the train to operate safely.

[0004] A plurality of ZCs are generally arranged in a relatively long route. During driving of the train, two ZCs communicate train and lineside information and enable the train to pass through a border region between two zones at a high speed in a safe and seamless manner, and this process is called as zone switching. According to the present disclosure, a ZC from which the train is driving is called as a handover ZC, and a ZC to which the train is driving is called as a takeover ZC.

[0005] On-board equipment of the CBTC system in the prior art generally comprises two available wireless communication devices. The two wireless communication devices work at the same time in a hot-standby manner, one of which is responsible for communication with the handover ZC, and the other of which is responsible for communication with the takeover ZC. The on-board equipment enables the train to pass through the border region between two ZCs in a safe, effective, and seamless manner based on the MAs sent from the two ZCs.

[0006] In the case that only one wireless communication device in the CBTC system is available, the wireless communication device is always in communication with the handover ZC. The train stops when it enters into the border region between two zones, and turns to a manual driving mode. Thus, the train is driven by a driver to pass through the border region between two zones. Then, the CBTC drive mode is switched back according to operating procedure. Under such circumstance, an operating efficiency of the train passing through the border region is low, and a workload of the driver is increased, which affects an operating efficiency of a whole train, and even a whole line.

SUMMARY OF THE INVENTION

[0007] The present disclosure provides on-board equipment and a train communication system so as to solve the technical problem that an operating efficiency of a train is low when the train passes through a border region between two zones in a case that only one wireless communication device is available.

[0008] According to a first aspect, the present disclosure provides on-board equipment. The on-board equipment comprises:

a wireless communication device, configured to receive a switching instruction from a ground responder;

a time management device, configured to determine a wireless time-out time slice after the wireless communication device receives the switching instruction from the ground responder,

wherein the wireless communication device pauses communication with a handover ZC during a wireless time-out time slice and within a range of a current movement authority, establishes communication with a takeover ZC during a next wireless time-out time slice and reports a train position to the takeover ZC, and pauses communication with the takeover ZC when the next wireless time-out time slice comes to an end;

a storage device, configured to store communication contents between the wireless communication device and the takeover ZC when the wireless communication device pauses communication with the takeover ZC; and

a processing device, configured to determine a next movement authority according to the communication contents between the wireless communication device and the takeover ZC, determine whether the current movement authority is connected with the next movement authority, and perform zone switching if a determination result is yes.

[0009] When the wireless communication device pauses communication with the handover ZC, the storage device stores a communication state and communication contents between the wireless communication device and the handover ZC.

[0010] The storage device further stores a communication state between the wireless communication device and the takeover ZC when it stores the communication contents between the wireless communication device and the takeover ZC.

[0011] When the processing device determines that the current movement authority is disconnected with the

next movement authority,

during the wireless time-out time slice: the wireless communication device resumes communication with the handover ZC according to the communication state and the communication contents between the wireless communication device and the handover ZC stored in the storage device, and reports a train position to the handover ZC; the processing device updates a current movement authority according to current communication contents between the wireless communication device and the handover ZC; the wireless communication device pauses communication with the handover ZC when the wireless time-out time slice comes to an end; and the storage device stores a communication state and the communication contents between the wireless communication device and the handover ZC; and

during the next wireless time-out time slice: the wireless communication device resumes communication with the takeover ZC according to the communication state and the communication contents between the wireless communication device and the takeover ZC stored in the storage device, and reports a train position to the takeover ZC; the processing device updates a next movement authority according to current communication contents between the wireless communication device and the takeover ZC; the wireless communication device pauses communication with the takeover ZC when the next wireless time-out time slice comes to an end; and the storage device stores a communication state and communication contents between the wireless communication device and the takeover ZC; and

the processing device performs zone switching when it determines that an updated current movement authority is connected with an updated next movement authority.

[0012] The wireless communication device stops communication with the handover ZC after entering into a zone corresponding to the takeover ZC.

[0013] The wireless time-out time slice is equal to a smaller one of a duration of the current movement authority and a longest communication duration of wireless communication between the wireless communication device and the ground responder.

[0014] A safety margin duration is set by the time management device, and the wireless time-out time slice is determined according to the safety margin duration.

[0015] The wireless time-out time slice is equal to a difference between a smaller one of a duration of the current movement authority and a longest communication duration of wireless communication between the wireless communication device and the ground responder and the safety margin duration.

[0016] According to a second aspect, the present disclosure provides a train communication system, which comprises the aforesaid on-board equipment.

[0017] The following beneficial effects can be brought about by the present disclosure. The present disclosure provides on-board equipment, which comprises only one available wireless communication device. The wireless communication device of the on-board equipment is in time-sharing communication with the handover ZC and the takeover ZC. The processing device of the on-board equipment obtains a current MA and a next MA respectively from two ZCs, and performs zone switching when it determines that the current MA is connected with the next MA. In a case that only one wireless communication device is provided in the on-board equipment, automatic driving of a train can be realized in a CBTC mode, whereby an operating efficiency of the train when it passes through a border region between two zones can be improved, and an operating efficiency of a whole train, and even a whole line can be ensured.

[0018] Other features and advantages of the present disclosure will be further explained in the following description, and partially become self-evident therefrom, or be understood through the embodiments of the present disclosure. The objectives and advantages of the present disclosure will be achieved through the structure specifically pointed out in the description, claims, and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The accompanying drawings provide further understandings of the present disclosure and constitute one part of the description. The drawings are used for interpreting the present disclosure together with the embodiments, not for limiting the present disclosure. In the drawings:

Fig. 1 schematically shows a structure of on-board equipment provided by one embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0020] The present disclosure will be illustrated in detail hereinafter in combination with the accompanying drawings to enable the purpose, technical solutions, and advantages of the present disclosure more clear.

[0021] The embodiment of the present disclosure provides on-board equipment. As shown in Fig. 1, the on-board equipment is provided with only one wireless communication device which is in communication with a ZC, which means that the on-board equipment can communicate with one ZC only, while cannot communicate with two ZCs at the same time. In this case, the wireless communication device according to the present embodiment is in communication with two ZCs in a time-sharing communication method. Moreover, the on-board equipment further comprises a time management device, a storage device, and a processing device, and the devices cooperate with each other to realize time-sharing communi-

cation function of the wireless communication device.

[0022] The wireless communication device of the on-board equipment receives a switching instruction from a ground responder. The ground responder is a point apparatus through which ground transmits information to a train, and comprises a fixed (passive) responder and a variable (active) responder. When the train passes through a location of the ground responder, the ground responder receives electromagnetic energy sent by a point information receiving antenna of the on-board equipment of the train, transfers the electromagnetic energy into a work power supply to turn on an electronic circuit, and sends a transmission message prestored therein or sent by a Lineside Electronic Unit (LEU) in a circulating manner until the electromagnetic energy disappears, i.e., until the train departs from the ground responder.

[0023] According to the present embodiment, a ZC from which the train is driving is called as a handover ZC, and a ZC to which the train is driving is called as a takeover ZC. The transmission message sent by the ground responder comprises a switching instruction which means that the train is driving to a control zone of the takeover ZC, and the wireless communication device of the on-board equipment learns which takeover ZC should be in communication with according to this switching instruction.

[0024] After the wireless communication device of the on-board equipment receives the switching instruction from the ground responder, the time management device of the on-board equipment determines a wireless time-out time slice involved in a wireless communication process. The wireless time-out time slice prescribes a longest time period of pause communication on a premise that the wireless communication device keeps communication with the ZC. As long as a time period during which the communication between the wireless communication device and the ZC pauses is less than or equal to the wireless time-out time slice, the wireless communication device can, at any time, resume a communication state and communication contents with the ZC before communication pause, and continue communication with the ZC.

[0025] When the train drives in a zone of the handover ZC, the wireless communication device always keeps communication with the handover ZC, and reports a train position and other related information to the handover ZC. The handover ZC calculates a Movement Authority (MA) for the train based on the train position, barrier information along the line, and comprehensive condition thereof. According to the embodiment of the present disclosure, the MA calculated by the handover ZC is called as a current MA. MA is a formal authority according to which the train can drive to a next parking position safely, and thus safe distance control between trains can be realized. A safe distance between two trains is calculated according to maximum allowable speed, present parking position, route and other information, and the information is refreshed in a dynamic and circulating manner.

[0026] According to the present embodiment, in order to ensure that the train can operate for a period of time after the wireless communication device pauses communication with the handover ZC, combining a definition on the wireless time-out time slice hereinabove, the wireless time-out time slice should be smaller than or equal to a duration of the current Movement Authority. Therefore, according to the present embodiment, the wireless time-out time slice is equal to a smaller one of the duration of the current movement authority and a longest communication duration of wireless communication between the wireless communication device and the ground responder. On this premise, the wireless communication device pauses communication with the handover ZC. In order to ensure that the wireless communication device can resume and continue communication with the handover ZC after communication pause, the storage device stores a communication state and communication contents between the wireless communication device and the handover ZC when the wireless communication device pauses communication with the handover ZC. The wireless communication device can establish time-sharing communication with the handover ZC and the takeover ZC based on the wireless time-out time slice, so that the train can pass through a border between two zones in an effective, seamless, and safe manner when only one wireless communication device is available.

[0027] The wireless communication device, after pauses communication with the handover ZC, immediately establishes communication with the takeover ZC. At this time, timing of a next wireless time-out time slice begins.

[0028] When the wireless communication device is in communication with the takeover ZC, it also reports a train position and other related information to the takeover ZC. Similar to the handover ZC, the takeover ZC calculates a Movement Authority (MA) for the train based on the train position, barrier information along the line, and comprehensive condition thereof. According to the embodiment of the present disclosure, the MA calculated by the takeover ZC is called as a next MA.

[0029] When the next wireless time-out time slice comes to an end, the wireless communication device pauses communication with the takeover ZC, and the storage device stores communication contents between the wireless communication device and the takeover ZC. In order to ensure that the wireless communication device can resume and continue communication with the takeover ZC after communication pause, the storage device stores a communication state and communication contents between the wireless communication device and the takeover ZC when the wireless communication device pauses communication with the takeover ZC.

[0030] The on-board equipment of the train determines the next MA corresponding to the takeover ZC based on the communication contents with the takeover ZC stored therein.

[0031] Since each MA corresponds to a certain length of route, in order to ensure that the train can perform

zone switching in an effective, seamless, and safe manner, the processing device of the on-board equipment should ensure that the current MA corresponding to the handover ZC is connected with the next MA corresponding to the takeover ZC, i.e., the route corresponding to the current MA and the route corresponding to the next MA are partially overlapped with each other or exactly connected with each other seamlessly. If the current MA is connected to the next MA, the processing device of the train can form a new MA spanning the zone of the handover ZC and the zone of the takeover ZC, so that the train can pass a boundary of the handover ZC and enter into the zone of the takeover ZC in a smooth, safe, and effective manner according to the new MA.

[0032] When the processing device determines that the train has a condition to perform zone switching in an effective, seamless, and safe manner, the processing device forms a new MA spanning a border region of two zones according to the MAs send to the on-board equipment by the handover ZC and the takeover ZC respectively so as to perform ZC switching in a safe, effective, and seamless manner. After the train enters into the zone corresponding to the takeover ZC, the wireless communication device stops communication with the handover ZC, and keeps communication with the takeover ZC only. At this time, the takeover ZC serves as a main control ZC. In the zone corresponding to the takeover ZC, the wireless communication device keeps communication with the takeover ZC until next zone switching.

[0033] When the processing device determines that the current movement authority is disconnected with the next movement authority, the wireless communication device resumes communication with the handover ZC and the takeover ZC, and the processing device updates the current MA corresponding to the handover ZC and the next MA corresponding to the takeover ZC.

[0034] Specifically, during the wireless time-out time slice: the wireless communication device resumes communication with the handover ZC according to the communication state and the communication contents between the wireless communication device and the handover ZC stored in the storage device, and reports a train position to the handover ZC; the processing device updates a current movement authority according to current communication contents between the wireless communication device and the handover ZC; the wireless communication device pauses communication with the handover ZC when the wireless time-out time slice comes to an end; and the storage device stores the communication state and the communication contents between the wireless communication device and the handover ZC.

[0035] During the next wireless time-out time slice: the wireless communication device resumes communication with the takeover ZC according to the communication state and the communication contents between the wireless communication device and the takeover ZC stored in the storage device, and reports a train position to the takeover ZC; the processing device updates a next movement authority according to current communication contents between the wireless communication device and the takeover ZC; the wireless communication device pauses communication with the takeover ZC when the next wireless time-out time slice comes to an end; and the storage device stores a communication state and communication contents between the wireless communication device and the takeover ZC.

[0036] After the current MA and the next MA are updated, the processing device determines whether an updated current MA is connected with an updated next MA. If a determination result is yes, the processing device performs zone switching; and if a determination result is no, the processing device updates the current MA and the next MA once again until it determines that a further updated current MA is connected with a further updated next MA.

[0037] The ZC of the CBTC system can transmit information to the on-board equipment through wireless communication, ground cross induction loop, waveguide, or other medium. In order to ensure that the communication between the wireless communication device and the ZC is not affected by external conditions, and avoid accidental interruption caused thereby, according to the present embodiment, the time management device sets a safety margin duration before determines the wireless time-out time slice. In this case, the wireless time-out time slice is equal to a difference between a smaller one of a duration of the current movement authority and a longest communication duration of wireless communication between the wireless communication device and the ground responder and the safety margin duration. The safety margin duration is determined by communication medium, communication mode between the ZC and the wireless communication device and other factors.

[0038] The present embodiment provides on-board equipment, which comprises only one available wireless communication device. The wireless communication device of the on-board equipment is in time-sharing communication with the handover ZC and the takeover ZC. The processing device of the on-board equipment obtains a current MA and a next MA respectively from two ZCs, and performs zone switching when it determines that the current MA is connected with the next MA. In a case that only one wireless communication device is provided in the on-board equipment, automatic driving of a train can be realized in a CBTC mode, whereby an operating efficiency of the train when it passes through a border region between two zones can be improved, and an operating efficiency of a whole train, and even a whole line can be ensured.

[0039] The present embodiment further provides a train communication system, which comprises the aforesaid on-board equipment.

[0040] The above embodiments are described only for better understanding, rather than restricting, the present disclosure. Any person skilled in the art can make amend-

ments to the implementing forms or details without departing from the spirit and scope of the present disclosure. The protection scope of the present disclosure shall be determined by the scope as defined in the claims.

Claims

1. On-board equipment, comprising:

   a wireless communication device, configured to receive a switching instruction from a ground responder;
   a time management device, configured to determine a wireless time-out time slice after the wireless communication device receives the switching instruction from the ground responder,

      wherein the wireless communication device pauses communication with a handover ZC during a wireless time-out time slice and within a range of a current movement authority, establishes communication with a takeover ZC during a next wireless time-out time slice and reports a train position to the takeover ZC, and pauses communication with the takeover ZC when the next wireless time-out time slice comes to an end;

   a storage device, configured to store communication contents between the wireless communication device and the takeover ZC when the wireless communication device pauses communication with the takeover ZC; and
   a processing device, configured to determine a next movement authority according to the communication contents between the wireless communication device and the takeover ZC, determine whether the current movement authority is connected with the next movement authority, and perform zone switching if a determination result is yes.

2. The on-board equipment according to claim 1, wherein, when the wireless communication device pauses communication with the handover ZC, the storage device stores a communication state and communication contents between the wireless communication device and the handover ZC.

3. The on-board equipment according to claim 2, wherein the storage device further stores a communication state between the wireless communication device and the takeover ZC when it stores the communication contents between the wireless communication device and the takeover ZC.

4. The on-board equipment according to claim 3, wherein when the processing device determines that the current movement authority is disconnected with the next movement authority,

   during the wireless time-out time slice: the wireless communication device resumes communication with the handover ZC according to the communication state and the communication contents between the wireless communication device and the handover ZC stored in the storage device, and reports a train position to the handover ZC; the processing device updates a current movement authority according to current communication contents between the wireless communication device and the handover ZC; the wireless communication device pauses communication with the handover ZC when the wireless time-out time slice comes to an end; and the storage device stores a communication state and the communication contents between the wireless communication device and the handover ZC; and
   during the next wireless time-out time slice: the wireless communication device resumes communication with the takeover ZC according to the communication state and the communication contents between the wireless communication device and the takeover ZC stored in the storage device, and reports a train position to the takeover ZC; the processing device updates a next movement authority according to current communication contents between the wireless communication device and the takeover ZC; the wireless communication device pauses communication with the takeover ZC when the next wireless time-out time slice comes to an end; and the storage device stores a communication state and communication contents between the wireless communication device and the takeover ZC; and

   wherein the processing device performs zone switching when it determines that an updated current movement authority is connected with an updated next movement authority.

5. The on-board equipment according to claim 4, wherein the wireless communication device stops communication with the handover ZC after entering into a zone corresponding to the takeover ZC.

6. The on-board equipment according to claim 5, wherein the wireless time-out time slice is equal to a smaller one of a duration of the current movement authority and a longest communication duration of wireless communication between the wireless communication device and the ground responder.

7. The on-board equipment according to claim 5, wherein a safety margin duration is set by the time management device, and the wireless time-out time slice is determined according to the safety margin duration.

8. The on-board equipment according to claim 7, wherein the wireless time-out time slice is equal to a difference between a smaller one of a duration of the current movement authority and a longest communication duration of wireless communication between the wireless communication device and the ground responder and the safety margin duration.

9. A train communication system, comprising on-board equipment, which comprises:

a wireless communication device, configured to receive a switching instruction from a ground responder;
a time management device, configured to determine a wireless time-out time slice after the wireless communication device receives the switching instruction from the ground responder,

wherein the wireless communication device pauses communication with a handover ZC during a wireless time-out time slice and within a range of a current movement authority, establishes communication with a takeover ZC during a next wireless time-out time slice and reports a train position to the takeover ZC, and pauses communication with the takeover ZC when the next wireless time-out time slice comes to an end;

a storage device, configured to store communication contents between the wireless communication device and the takeover ZC when the wireless communication device pauses communication with the takeover ZC; and
a processing device, configured to determine a next movement authority according to the communication contents between the wireless communication device and the takeover ZC, determine whether the current movement authority is connected with the next movement authority, and perform zone switching if a determination result is yes.

10. The train communication system according to claim 9, wherein, when the wireless communication device pauses communication with the handover ZC, the storage device stores a communication state and communication contents between the wireless communication device and the handover ZC.

11. The train communication system according to claim 10, wherein the storage device further stores a communication state between the wireless communication device and the takeover ZC when it stores the communication contents between the wireless communication device and the takeover ZC.

12. The train communication system according to claim 11,
wherein when the processing device determines that the current movement authority is disconnected with the next movement authority,

during the wireless time-out time slice: the wireless communication device resumes communication with the handover ZC according to the communication state and the communication contents between the wireless communication device and the handover ZC stored in the storage device, and reports a train position to the handover ZC; the processing device updates a current movement authority according to current communication contents between the wireless communication device and the handover ZC; the wireless communication device pauses communication with the handover ZC when the wireless time-out time slice comes to an end; and the storage device stores a communication state and the communication contents between the wireless communication device and the handover ZC; and
during the next wireless time-out time slice: the wireless communication device resumes communication with the takeover ZC according to the communication state and the communication contents between the wireless communication device and the takeover ZC stored in the storage device, and reports a train position to the takeover ZC; the processing device updates a next movement authority according to current communication contents between the wireless communication device and the takeover ZC; the wireless communication device pauses communication with the takeover ZC when the next wireless time-out time slice comes to an end; and the storage device stores a communication state and communication contents between the wireless communication device and the takeover ZC; and

wherein the processing device performs zone switching when it determines that an updated current movement authority is connected with an updated next movement authority.

13. The train communication system according to claim 12, wherein the wireless communication device stops communication with the handover ZC after entering into a zone corresponding to the takeover ZC.

14. The train communication system according to claim 13, wherein the wireless time-out time slice is equal to a smaller one of a duration of the current movement authority and a longest communication duration of wireless communication between the wireless communication device and the ground responder.

15. The train communication system according to claim 13, wherein a safety margin duration is set by the time management device, and the wireless time-out time slice is determined according to the safety margin duration.

16. The train communication system according to claim 15, wherein the wireless time-out time slice is equal to a difference between a smaller one of a duration of the current movement authority and a longest communication duration of wireless communication between the wireless communication device and the ground responder and the safety margin duration.

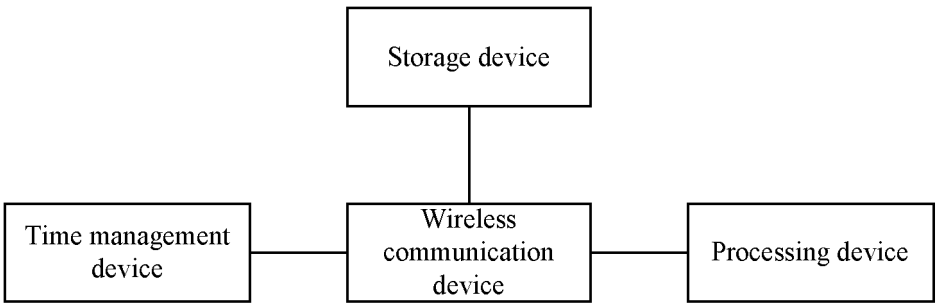
Storage device
Time management device
Wireless communication device
Processing device

Fig. 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2016/086682

A. CLASSIFICATION OF SUBJECT MATTER

B61L 23/14 (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; H04W

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)

CNABS, CNTXT, CNKI, VEN: RBC, time-sharing, authorization, switch, time, share, communication, movement, authority

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 105035126 A (ZHUZHOU CSR TIMES ELECTRIC CO., LTD.), 11 November 2015 (11.11.2015), description, paragraphs 0007-0049	1-16
A	LU, Zhitong et al., "RBC Handover in CTCS-3 Train Control System", SCIENCE & TECHNOLOGY, no. 4, 05 February 2009 (05.02.2009), pages 468 and 470	1-16
A	CN 101888676 A (HUAWEI TECHNOLOGIES CO., LTD.), 17 November 2010 (17.11.2010), description, paragraphs 0040-0062, and figures 2-9	1-16
A	CN 1350372 A (NEC CORPORATION), 22 May 2002 (22.05.2002), the whole document	1-16
A	CN 101820655 A (BEIJING JIAOTONG UNIVERSITY), 01 September 2010 (01.09.2010), the whole document	1-16
A	JP 2006245824 A (MITSUBISHI ELECTRIC CORP.), 14 September 2006 (14.09.2006), the whole document	1-16

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 July 2016 (15.07.2016)	**18 August 2016 (18.08.2016)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **RUAN, Wen** Telephone No.: (86-10) **62085735**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2016/086682

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