(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
29 November 2012 (29.11.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/162360 A3

(51) International Patent Classification:
H04L 12/28 (2006.01) *H04L 12/24* (2006.01)

(21) International Application Number:
PCT/US2012/039085

(22) International Filing Date:
23 May 2012 (23.05.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/488,871 23 May 2011 (23.05.2011) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

[Continued on next page]

(54) **Title**: SIMULATION BASED FAULT DIAGNOSIS USING EXTENDED HEAT FLOW MODELS

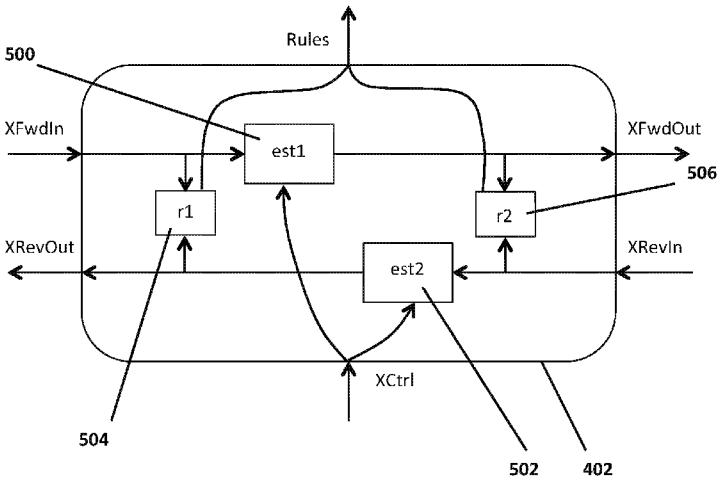


FIG 5

(57) **Abstract**: In order to reduce computation time and cost involved with detecting and diagnosing a fault in a system, simplified representations of components of the system are used to estimate valid intervals for state variables at the components. Generic failure rules are configured to compare the estimated valid intervals to related intervals for the same state variables, from either observations or propagations, for overlap. Failure output vectors are generated based on the comparison, and the failure output vectors are compared to diagnostic matrices to determine a source of the fault.

WO 2012/162360 A3

(88) Date of publication of the international search report:
17 January 2013

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/039085

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L12/28 H04L12/24
ADD.

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)
H04L

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2007/008879 A1 (WALLENIUS EERO [FI]) 11 January 2007 (2007-01-11)	1-7, 11-13, 16,18-20
A	figures 1,3A,3B paragraph [0013] paragraph [0042] paragraphs [0062] - [0066]	8-10,14, 15,17
Y	US 2008/209030 A1 (GOLDSZMIDT MOISES [US] ET AL) 28 August 2008 (2008-08-28) figure 1 paragraph [0038] paragraph [0047]	1-7,11, 18-20

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[X] Further documents are listed in the continuation of Box C.

[X] 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

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"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
12 November 2012	21/11/2012

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/039085

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	OUM-EL-KHEIR AKTOUF ET AL: "Dependability of embedded networks â A case study with system diagnosis of CAN protocol", INTELLIGENT TRANSPORT SYSTEMS TELECOMMUNICATIONS,(ITST),2009 9TH INTERNATIONAL CONFERENCE ON, IEEE, PISCATAWAY, NJ, USA, 20 October 2009 (2009-10-20), pages 552-556, XP031619126, ISBN: 978-1-4244-5346-7 page 553	12,13,16
A	US 2002/029575 A1 (OKAMOTO TAKEHISA [JP]) 14 March 2002 (2002-03-14) figures 4,8 paragraphs [0060], [0063]	1-11, 18-20
A	US 6 073 089 A (BAKER MICHELLE [US] ET AL) 6 June 2000 (2000-06-06) figures 1,3 column 6, line 53 - column 8, line 7	1-11, 18-20

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/039085

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/039085

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007008879 A1	11-01-2007	CN 101199162 A	11-06-2008
		EP 1897275 A2	12-03-2008
		US 2007008879 A1	11-01-2007
		WO 2006134204 A2	21-12-2006
US 2008209030 A1	28-08-2008	NONE	
US 2002029575 A1	14-03-2002	CN 1343862 A	10-04-2002
		KR 20020020831 A	16-03-2002
		TW 593950 B	21-06-2004
		US 2002029575 A1	14-03-2002
US 6073089 A	06-06-2000	AU 1106799 A	10-05-1999
		CA 2309034 A1	29-04-1999
		EP 1032841 A1	06-09-2000
		JP 2001521210 A	06-11-2001
		US 6073089 A	06-06-2000
		WO 9921017 A1	29-04-1999

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-11, 18-20

   Method (claim 1) and system (claim 18) with determination of a failure value

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2. claims: 12-17

   Computer readable storage medium that stores executable instructions (claim 12) for comparing for each component of at least two components the second interval to the valid first interval

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