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Datasheet for the decision of 11 March 2013

Case Number: T 0752/10 - 3.2.07

Application Number: 05018406.8

Publication Number: 1640119

IPC: B25J 9/16

Language of the proceedings: EN

Title of invention:
Method, system and program for controlling moving body with error detection

Applicant:
Honda Motor Co., Ltd.

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step: yes"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0752/10 - 3.2.07

D E C I S I O N
of the Technical Board of Appeal 3.2.07
of 11 March 2013

Appellant: (Applicant)
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 12 November 2009 refusing European patent application No. 05018406.8 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: H. Meinders
Members: K. Poalas
E. Kossonakou

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal against the decision of the Examining Division refusing European patent application 05 018 406.8.

II. In its decision, the Examining Division held that the subject-matter of claims 1 and 5 according to the main request or one of the first to seventh auxiliary requests does not involve an inventive step (Article 56 EPC) over the teachings of D1 (JP 2003 211 379 A) and D2 (EP 1 424 171 A) together with the application of general technical knowledge.

III. Oral proceedings before the Board took place on 11 March 2013. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the following documents:

claims:	1 to 5 filed as main request in the oral proceedings;
description:	pages 1, 3 to 8, 10 to 16 and 38 to 39 filed as auxiliary request on 28 February 2013, pages 1a, 2 and 9 filed as main request in the oral proceedings, pages 17 to 37 as originally filed;
figures:	1 to 4 as originally filed.

IV. Independent claims 1 and 4 read as follows:

"1. A method of controlling a function of a legged mobile robot (200) after examining whether there is any error thereof in a starting period from starting the

power supply to a plurality of control units (100) until starting the motion of the robot (200) accompanying with the operation of an actuator (131), the robot (200) having a first function including a control function of a motion of the robot (200) accompanying with an operation of the actuator (131) through conditioning of electric power supplied to the actuator (131) via a drive system cable from a drive system power supply (141) with a first sub-control unit (121) out of the plurality of control units (100) operating by being supplied with power via control system cables from a control system power supply (142) and a second function including an alternate communications facility with the plurality of control units (100) and a measuring function of a state quantity through a sensor (132) of a second sub-control unit (122) out of the plurality of control units, wherein the drive and control system cables are closely spaced in joints of the legged robot,
the method comprising:
an error detection step (111, S11O, S120, S140, S210, S220, S230) of detecting the presence or absence of a first error likely to disturb the first and second functions, a second error likely to disturb the first function while unlikely to disturb the second function, and a third error unlikely to disturb the first and second functions during the starting period;
wherein the error detection step (111, S11O, S120, S140, S210, S220, S230) includes:
a first error detection step (S110, S120, S140) of detecting an error in a first state where the control unit (100) is powered via the control system cable from the control system power supply (142) while halting the power supply to the actuator (131) via the drive system

cable from the drive system power supply during the starting period of the robot (200); and
a second error detection step (S210, S220, S230) of detecting an error in a second state where the control unit (100) is powered via the control system cable from the control system power supply (142) and the actuator (131) is powered via the drive system cable from the drive system power supply (141) during the starting period of the robot (200) before starting the motion of the robot (200); and
a mode setting step (112; S300) of:
setting a first mode for halting the first and second functions at least after the end of the starting period if the first error is detected in the error detection step (111, S11O, S120, S140, S210, S220, S230);
setting a second mode for halting the first function at least after the end of the starting period and adjusting one or both of the control unit and the sensor using the second function during the starting period if the second error is detected in the error detection step (111, S11O, S120, S140, S210, S220, S230); and
setting a third mode for starting the motion of the robot (200) using the first and second functions after the end of the starting period if the third error is detected in the error detection step (111, S11O, S120, S140, S210, S220, S230); and
a step of controlling functions of the robot (200) according to the mode set in the mode setting step (112; S300)".

"4. A system for controlling a function of a legged mobile robot (200) after examining whether there is any error thereof in a starting period from starting the

power supply to a plurality of control units (100) until starting the motion of the robot (200) accompanying with the operation of an actuator (131), the robot (200) having a first function including a control function of a motion of the robot (200) accompanying with an operation of the actuator (131) through conditioning of electric power supplied to the actuator (131) via a drive system cable from a drive system power supply with a first sub-control unit (121) out of the plurality of control units (100) operating by being supplied with power via control system cables from a control system power supply (142) and a second function including an alternate communications facility with the plurality of control units (100) and a measuring function of a state quantity through a sensor (132) of a second sub-control unit (122) out of the plurality of control units, the system comprising:
error detection means (111, S110, S120, S140, S210, S220, S230) for detecting the presence or absence of a first error likely to disturb the first and second functions, a second error likely to disturb the first function while unlikely to disturb the second function, and a third error unlikely to disturb the first and second functions during the starting period; wherein the error detection means (111, S11O, S120, S140, S210, S220, S230) includes:
a first error detection means (S11O, S120, S140) of detecting an error in a first state where the control unit (100) is powered via the control system cable from the control system power supply (142) while halting the power supply to the actuator (131) via the drive system cable from the drive system power supply during the starting period of the robot (200); and
a second error detection means (S210, S220, S230) of

detecting an error in a second state where the control unit (100) is powered via the control system cable from the control system power supply (142) and the actuator (131) is powered via the drive system cable from the drive system power supply (141) during the starting period of the robot (200) before starting the motion of the robot (200);
mode setting means (112) for:
setting a first mode for halting the first and second functions at least after the end of the starting period if the first error is detected by the error detection means (1ll, S11O, S120, S140, S210, S220, S230);
setting a second mode for halting the first function at least after the end of the starting period and adjusting one or both of the control unit and the sensor using the second function during the starting period if the second error is detected by the error detection means (111, S11O, S12O, S140, S210, S220, S230); and
setting a third mode for starting the motion of the robot (200) using the first and second functions after the end of the starting period if the third error detected by the error detection means (1ll, S11O, S120, S140, S210, S220, S230); and means for controlling functions of the robot (200) according to the mode set by the mode setting means".

V. The appellant argued essentially as follows:

Amendments - Article 123(2) EPC

Independent claim 1 is based on a combination of original filed claims 1 and 2, and independent claim 4 is based on a combination of original claims 5 and 2.

Further, in both claims, the moving body is defined as "legged mobile robot" in accordance with page 1, line 9 to page 2, line 10 and page 16, lines 6 to 9 of the originally filed description, and the second error detection step is defined to be during the starting period of the moving body before putting it into motion, as disclosed in the paragraph bridging original filed pages 29 and 30. In independent claim 1 it is further defined that the drive and the control system cables are closely spaced in joints of the legged robot, as disclosed on page 21, lines 2 to 21 and on page 32, lines 6 to 11 of the originally filed description.

Claims 1 and 4 - Inventive step, Article 56 EPC

D1 concerns error detection in a legged mobile robot after the starting period. Thus, D1 cannot be considered the proper starting point for assessing inventive step, since it is not related to the essential purpose of the method of claim 1 and of the system of claim 4.

In D2, after an initial self check during a starting period, power is supplied to the sub-control units of a legged mobile robot to allow communication between the main control unit and the sub-control units, while power supply to the actuators is blocked.

None of the above-mentioned documents discloses or suggests performing any error detection step by supplying power not only to the control unit but also to the actuator without moving the robot, allowing thereby to determine whether any error in the communication lines results from powering the control

unit and the actuator separately. The legged mobile robot can be thus reliably prevented from an unexpected motion even when the system check is done while powering the actuator.

The subject-matter of claims 1 and 4 involves therefore an inventive step.

Reasons for the decision

1. *Amendments - Article 123(2) EPC*

1.1 Claim 1 is based on originally filed claims 1 and 2, whereby the expression "moving body" has been replaced by the expression "legged mobile robot", see page 1, line 9 to page 2, line 10 and page 16, lines 6 to 9 of the originally filed description. It is further defined in claim 1 that the "drive and control system cables are closely spaced in joints of the legged robot". For its basis, see page 21, lines 2 to 21 and page 32, lines 6 to 11 of the originally filed description. Further, the claim mentions that in the second error detection step the actuator is powered via the drive system cable from the drive system power supply during the starting period of the robot before starting the motion of the robot; for its basis, see page 26, lines 12 to 22 and page 29, line 26 to page 30, line 3 of the originally filed description.

1.2 Claim 4 is based on originally filed claims 5 and 2, whereby the expression "moving body" has been replaced by the expression "legged mobile robot"; for its basis, see page 1, line 9 to page 2, line 10 and page 16,

lines 6 to 9 of the originally filed description. It is further defined in claim 4 that the second error detection means detect an error in a second state where the actuator is powered via the drive system cable from the drive system power supply during the starting period of the robot before starting the motion of the robot; for its basis, see page 26, lines 12 to 22 and page 29, line 26 to page 30, line 3 of the originally filed description.

1.3 Claims 2, 3 and 5 are based on the originally filed claims 3, 4 and 6.

1.4 The Board considers therefore that the claims 1 to 5 filed as main request during the oral proceedings meet the requirements of Article 123(2) EPC.

The same applies to the amendments in the description, which deal with the reference to the prior art D1 and D2 and the adaptation to the wording of claims 1, 4 and 5.

2. *Claim 1 - Inventive step, Article 56 EPC*

2.1 Closest prior art

2.1.1 Claim 1 relates to a method of controlling a function of a legged mobile robot after examining whether there is any error thereof, during a **starting period** from starting the power supply to a plurality of control units **until starting the motion of the robot**, which is accompanied by the operation of an actuator.

2.1.2 In contrast, D1 discloses a method of controlling a function of a legged mobile robot, whereby the error detection and the mode setting steps are executed **during movement of the robot** or during the period in which **the robot has already started moving**, see feature d) of claim 1 of D1.

2.1.3 Given the fact that D1 concerns error detection at a later stage of the robot's operation cycle and not at a stage before any first movement of the robot, the Board, following the appellant's arguments, considers that D1 cannot be considered the proper starting point for assessing inventive step, since it is not related to the essential purpose of the method of claim 1.

2.1.4 In the third and fourth paragraphs of point 2.3 of its grounds for the decision the Examining Division considers that since the checking and reaction/recovery procedure according to the flow chart of figure 6 of D1 is executed every 2.5 msec., said procedure takes place a number of times within the interpolation tact needed to plan the motion of the robot. This would mean, that this procedure would take place during a planning phase before any movement of the robot, with the "consequence" that any unexpected or wrong motion caused by error influences would be prevented. However, no basis can be found in D1 supporting this final conclusion. The Board follows thus the appellant's argument that the whole disclosure of Dl concerns error detection steps **after the robot has started its motion**.

2.1.5 On the other hand, D2 discloses a method of controlling a function of a legged mobile robot in a **starting period** from starting the power supply to a plurality of

(sub)control units **until starting the motion of the robot** accompanied by the operation of an actuator, whereby after an initial self check during said starting period, power is supplied to the subcontrol units to allow communication between the main control unit and the subcontrol units, while power supply to the actuators is blocked, see paragraphs [0039] and [0043] of D2. Since D2 concerns an error detection state **during a starting period** similar with the one claimed in claim 1, the Board considers that D2 represents the prior art best suited as starting point for the discussion of inventive step.

2.2 Differentiating features

2.2.1 The method according to claim 1 differs from the method known from D2 *inter alia* in that an error is detected in a second state where the control system power supply supplies power to the control unit via the control system cable and the **drive system power supply** supplies **power to the actuator** via the drive system cable during the starting period of the robot **before starting the motion of the robot.**

2.3 Effect

2.3.1 The above-mentioned error detection at a state where the actuator(s) of the legged mobile robot is/are supplied with power via the drive system cable and at the same time it/they is/are not allowed to move/turn allows an appropriate control of functions of the legged mobile robot. The Board follows the appellant's argument that this kind of error detection allows to determine whether any error in the communication lines

results from powering the control unit and the actuator separately. The legged mobile robot can be thereby reliably prevented from an unexpected motion even when the system check is done while powering the actuator, see paragraph bridging pages 8 and 9 of the originally filed application.

2.4 Inventiveness

2.4.1 The documents in the file are silent as far as the detection of whether any error in the communication lines results from powering the control unit and the actuator separately is concerned. They are also silent concerning the provision of an error detection step according to point 2.2.1 above. Due to the absence of any kind of hint in the available prior art towards such an error detection step the Board considers that the skilled person would not arrive at such an error detection step and thus at the subject-matter of claim 1, unless he would exercise inventive skills.

2.5 Accordingly, the subject-matter of claim 1 involves an inventive step (Article 56 EPC).

3. *Claim 4 - Inventive step, Article 56 EPC*

3.1 The arguments presented under point 2 above concerning the method of controlling a function of a legged mobile robot according to claim 1 apply mutatis mutandis to the system for controlling a function of a legged mobile robot according to claim 4.

3.2 Accordingly, the subject-matter of claim 4 also involves an inventive step (Article 56 EPC).

4. *Claims 2, 3 and 5 - Inventive step, Article 56 EPC*

4.1 Dependent claims 2 and 3 relating to preferred embodiments of the method of claim 1 and also claim 5 concerning a computer program adapted to perform all steps of the method of claim 1, as a consequence of the conclusion under point 2 above, involve as well an inventive step (Article 56 EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent on the basis of the following documents:

claims:	1 to 5 filed as main request in the oral proceedings;
description:	pages 1, 3 to 8, 10 to 16 and 38 to 39 filed as auxiliary request on 28 February 2013, pages 1a, 2 and 9 filed as main request in the oral proceedings, pages 17 to 37 as originally filed;
figures:	1 to 4 as originally filed.

The Registrar: The Chairman:

G. Nachtigall H. Meinders