

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VALEO, NORTH AMERICA, INC., VALEO S.A., VALEO GMBH,
VALEO SCHALTER UND SENSOREN GMBH, and
CONNAUGHT ELECTRONICS LTD.,
Petitioner,

v.

MAGNA ELECTRONICS, INC.,
Patent Owner.

Cases IPR2014-00227 and IPR2014-00228
Patent 7,877,175 B2

Before JAMESON LEE, PHILLIP J. KAUFFMAN, and
MATTHEW R. CLEMENTS, *Administrative Patent Judges*.

KAUFFMAN, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. BACKGROUND

A. *Procedural History*

In IPR2014-00227, Petitioner (Valeo North America, Inc., Valeo S.A., Valeo GmbH, Valeo Schalter und Sensoren GmbH, and Connaught Electronics Ltd.) filed a revised Petition (Paper 6, “Pet. ’227”) to institute an *inter partes* review of claims 1–12, 15–19, and 21 of U.S. Patent No. 7,877,175 B2 (Ex. 1001, “the ’175 patent”). In IPR2014-00228, Petitioner filed a revised Petition (Paper 7, “Pet. ’228”) to institute an *inter partes* review of claims 1, 8, 9, 12–16, 19, 20, and 22–27 of the ’175 patent. Patent Owner (Magna Electronics, Inc.) submitted a Preliminary Response to each petition (IPR2014-00227, Paper 12, “Prelim. Resp. ’227”; IPR2014-00228, Paper 13, “Prelim. Resp. ’228”).

In our Decision to Institute (Paper 13, “Dec.”), we consolidated IPR2014-00227 and IPR2014-00228.¹ We instituted an *inter partes* review as to claims 19 and 25–27 on the following grounds:

- 1) claim 19 based on anticipation by Hitachi,² and
- 2) claims 25–27 based on obviousness over Gutta³ and Nissan.⁴

Patent Owner filed a Patent Owner Response (Paper 20, “PO Resp.”), to which Petitioner filed a Reply (Paper 24, “Pet. Reply”).

Patent Owner did not file a motion to amend.

¹ Except where specified otherwise, all subsequent references to papers and exhibits are to the consolidated proceeding (i.e., IPR2014-00227).

² Hitachi, JP 2002-74339, March 15, 2002, Ex. 1002 (Japanese). Ex. 1003 (English translation).

³ Gutta, US 6,424,273 B1, July 23, 2002, Ex. 1006.

⁴ Nissan, JP 2004-1658, January 8, 2004, Ex. 1004 (Japanese). Ex. 1005 (English translation).

Patent Owner filed a Motion to Exclude certain evidence, which is discussed in Section II below.

Patent Owner filed a Motion to Terminate based on an assertion that Petition failed to provide the notice regarding real parties-in-interest required by 37 C.F.R. § 42.8(a)(3). Paper 31. Petitioner filed an opposition. Paper 36. Patent Owner filed a Reply. Paper 37. The Board denied the Motion to Terminate. Paper 41.

At the request of both parties, oral hearing was held on January 15, 2015. Papers 32, 33, 35. A transcript of the oral hearing is included in the record. Paper 50 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6(c). This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

For the reasons given below, we determine that Petitioner has shown by a preponderance of the evidence that claims 19 and 25–27 are unpatentable.

B. Related Proceedings

The ’175 patent is the subject of a district court case brought by Patent Owner against Petitioner, titled, *Magna Electronics, Inc. v. Valeo, Inc.*, No. 2:13-cv-11376 (E.D. Mich.) (filed Mar. 28, 2013). Pet. ’227, 4; Paper 8, 2.

The parties in this case are involved in three other *inter partes* reviews: IPR2014-00220 (challenging U.S. Patent No. 7,859,565 B2), IPR2014-00221 (challenging U.S. Patent No. 7,991,522 B2), and IPR2014-00222 (challenging U.S. Patent No. 8,386,114 B2).

The '175 patent was also the subject of IPR2014-01206 (institution of trial denied, Paper 13).

C. The '175 Patent

The '175 patent relates to an imaging system that includes a lane departure warning system, and is operable to determine if a vehicle or object of interest is adjacent, forward, or rearward of the vehicle to assist the driver in changing lanes or parking the vehicle. Ex. 1001, 1:15–22.

Figure 1 of the '175 patent is reproduced below:

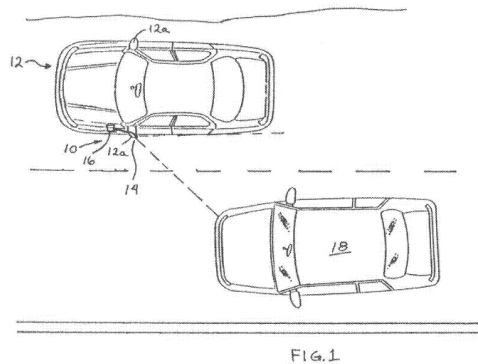


Figure 1 is a top plan view of a vehicle incorporating the object detection system of the '175 patent. *Id.* at 4:7–8.

The system includes an imaging array sensor and a control. *Id.* at 3:12–4. The imaging array sensor comprises a plurality of photo-sensing pixels. *Id.* at 3:14–16. The sensor is positioned with a field of view exteriorly of the vehicle, and is operable to capture an image of that view that comprises an image data set. *Id.* at 3:16–20.

The control algorithmically processes the image data set of the captured image into a reduced image data set, and the control processes the reduced data set to extract information. *Id.* at 3:20–24. The control is

operable to determine if the imaging array sensor is misaligned, calculate a degree of misalignment, and adjust the image data set or the image processing to account for such misalignment. *Id.* at 6:10–29, 54–55.

Additionally, the control may be operable to activate a warning indicator to alert the driver of the vehicle that another vehicle is present at the side of the driver's vehicle. *Id.* at 4:57–60, Fig. 1.

Of the challenged claims, claims 19 and 25 are independent. Claim 19 is illustrative and is reproduced below:

19. An imaging system for a vehicle comprising:

an imaging array sensor comprising a plurality of photosensing pixels, wherein said imaging array sensor is positioned at the vehicle and having a field of view exterior of the vehicle, and wherein said imaging array sensor is operable to capture images exterior of the vehicle;

a control for processing said captured image;

wherein said control is operable to determine that said imaging array sensor is not aligned within a desired tolerance when said imaging array sensor is positioned at the vehicle; and

wherein said control, responsive to a determination of a misalignment of said imaging array sensor when said imaging array sensor is positioned at the vehicle, is operable to adjust at least one of said captured images and said image processing to at least partially compensate for the determined misalignment of said imaging array sensor, and

wherein at least one of (a) said imaging system comprises an object detection system for detecting an object exterior of the vehicle, (b) said imaging system comprises a headlamp control system for detecting a headlamp of a vehicle in the field of view, and (c) said imaging system comprises a lane departure warning system.

Ex. 1001, 19:11–35.

II. CLAIM INTERPRETATION

The Board interprets claims using the broadest reasonable construction. *See* 37 C.F.R. § 42.100(b); Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,766 (Aug. 14, 2012); *see also In re Cuozzo Speed Techs LLC*, 778 F.3d 1271, 1281 (Fed. Cir. 2015) (“We conclude that Congress implicitly adopted the broadest reasonable interpretation standard in enacting the AIA.”).

A. *Operable to adjust (claims 19 and 25)*

The Decision to Institute provided an explicit construction for the limitation that the control is ““operable to adjust at least one of [1] said image data set and [2] said image processing to at least partially compensate for the determined misalignment of said imaging array sensor”” as recited by independent claim 1. Dec. 9–12 (numbering inserted). The Decision stated that independent claims 19 and 25 contained similar limitations. *Id.* Patent Owner utilized the claim construction of the Decision to Institute. *See* PO Resp. 2. Petitioner did not further address this claim construction. Pet. Reply, *passim*. The language of claim 19 differs slightly from that of claim 1, and for that reason we provide a construction of claim 19.

Independent claim 19 is directed to an imaging system for a vehicle that includes an imaging array sensor and a control. The imaging array sensor is operable to capture an image of a scene exterior of the vehicle, and the control processes the captured image. According to claim 19, the control is operable to determine that the imaging array sensor is not aligned within a desired tolerance, and responsive to that determination, the control “is

operable to adjust at least one of [1] said captured images and [2] said image processing to at least partially compensate for the determined misalignment of said imaging array sensor.” Ex. 1001, 19:25–29 (numbering added).

The claim terms “said captured image” and “said image processing” each have antecedent basis in the claim. Specifically, claim 19 recites that the imaging array sensor is operable to “capture images,” and the system includes “a control for processing said captured image.” Ex. 1001, 19:11–18. Consequently, claim 19 requires that the control is operable to adjust at least one of (1) the captured images and (2) the image processing of the captured image.

Consistent with this interpretation, the Specification describes that during camera calibration, the control determines that the camera is misaligned, and the control may “adjust the image and/or image processing” to account for such misalignment. *Id.* at 6:10–24. The Specification goes on to describe that, “[f]or example, the degree of misalignment may be calculated, and the image processing may be adjusted or shifted and/or rotated to position the reference structure at the appropriate location in the captured images.” *Id.* at 6:25–29.

In light of this, claim 19 requires that the control is operable to adjust the captured image or the image processing of the captured image. Independent claim 25 is similar with regard to this limitation.

Consequently, independent claims 19 and 25 require that the control is operable to determine that the imaging array sensor is not aligned within a desired tolerance, and responsive to that determination, is operable to adjust

at least one of (1) the captured image and (2) the image processing of the captured image.

B. Remaining Claim Terms or Phrases

All remaining claim terms or phrases need not be construed expressly.

III. MOTION TO EXCLUDE

A. Analysis of Motion

The exhibit at issue is Exhibit 1015, an article by Dr. Matthew A. Turk, et al., titled, “VITS - A Vision System for Autonomous Land Vehicle Navigation” (the “VITS article”).⁵

Prior to filing its Motion to Exclude Evidence, Patent Owner objected to Exhibit 1015 within the required five business days.⁶ Petitioner did not respond to the objections. Patent Owner preserved the objections by filing a Motion to Exclude Evidence. The Board expunged this motion (and the associated Opposition, Paper 38, and Response, Paper 39) because it failed to comply with an earlier order stating that a Motion to Exclude Evidence should not include arguments alleging that a reply exceeds the scope of a proper reply. Paper 44 (referring to earlier order at Paper 15). Patent Owner requested rehearing of that order. Paper 46. The Board granted the request for rehearing to permit filing of a revised Motion to Exclude with

⁵ IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, Vol. 10, No. 3, May 1988.

⁶ Exhibit 1015 was filed on October 31, 2014, and Patent Owner’s objections to Exhibit 1015 were filed on November 7, 2014. Mot. 2; Ex. 2012, 1, 2, 4; Pet. Reply, iii.

inappropriate argument removed. Paper 47. In a follow-up conference call, we clarified that arguments alleging that Petitioner's Reply was beyond the scope of a proper reply were to be marked in strikethrough. Paper 48, 2. We also asked that Patent Owner consider whether other arguments, such as those related to the weight of evidence rather than admissibility, were appropriate in a motion to exclude evidence. *Id.* at 2–3. Patent Owner's revised Motion to Exclude Evidence, seeks to exclude Exhibit 1015.⁷ Paper 49.

On this record, it is not necessary that we assess Patent Owner's Motion to Exclude Evidence because our analysis does not rely upon Exhibit 1015 (except as material relied upon by Dr.-Ing. Frahm). Consequently, Patent Owner's Motion to Exclude Evidence is *dismissed* as moot.

B. Related Issues

We note that the VITS article is referenced by Dr.-Ing. Frahm in Exhibit 1014. *See* Ex. 1014 ¶ 27. Patent Owner does not contest the admissibility of Exhibit 1014. Indeed, an expert may base an opinion on facts or data that the expert has been made aware of or personally observed. *See* Fed. R. Evid. 703; 37 C.F.R. § 42.62(a).

Patent Owner argued that certain evidence submitted with Petitioner's reply was improperly introduced. Paper 28. Specifically, Patent Owner alleged the following evidence was introduced improperly: (1) paragraphs 6, 8, 10–18 of Dr.-Ing. Frahm's Reply Declaration (Ex. 1014); (2) VITS

⁷ Patent Owner limited the Motion to the admissibility of Exhibit 1015 and no longer seeks to exclude other exhibits.

article (Ex. 1015); (3) Bertozzi/Broggi Article (Ex. 1016); (4) Broggi II article (Ex. 1017); (5) Gold article (Ex. 1018); and the portions of Petitioner's Reply (Paper 24) relying on that evidence (pp. 5, 9, and 10). Paper 28

A Petitioner's reply may only respond to arguments raised in Patent Owner's response. See 37 C.F.R. § 42.23(b). Therefore, the question raised by Patent Owner is whether the arguments on pages 5, 9, and 10 of Petitioner's Reply that rely upon the identified exhibits (1014-1018) are in response to arguments raised in Patent Owner's Response. We need not reach this issue because we do not rely, in this Final Written Decision, on any of the disputed evidence or disputed portions of the Petitioner's Reply.

IV. PATENTABILITY

A. *Anticipation by Hitachi - Claim 19*

Petitioner contends that claim 19 is unpatentable under 35 U.S.C. § 102 as anticipated by Hitachi. Pet. '227, 19–34. For the reasons that follow, we find that the preponderance of the evidence weighs in favor of unpatentability.

1. *Overview of Hitachi (Ex. 1003)*

Hitachi discloses an automotive image capture apparatus for recognizing a vehicle driving environment that is capable of detecting changes in either field angle or image rotation through reference to two photographic subjects (marks 3) disposed on the vehicle (automobile M) in the image capture viewing field. Ex. 1003 ¶¶ 1, 10, 19, Fig. 2.

Figure 2 is reproduced below:

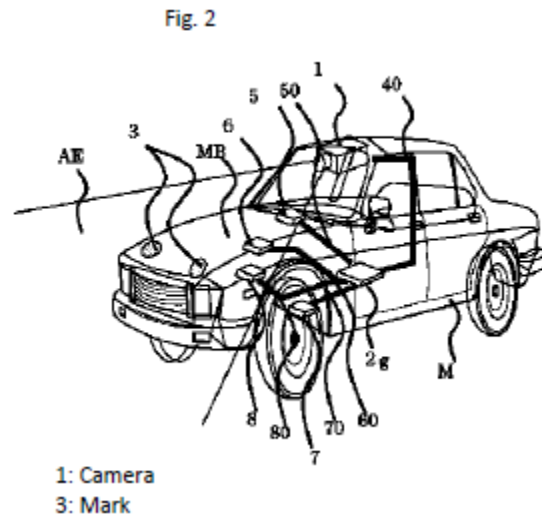


Figure 2 shows an embodiment of Hitachi's automotive image capture apparatus being used as a driving environment recognition apparatus. *Id.* ¶ 18.

Hitachi's camera includes image capture device 11 having an optoelectric conversion surface made up of a plurality of optoelectric conversion elements known as pixels. *Id.* ¶¶ 3, 15–17. Rather than capturing image data on the entire optoelectric surface of the camera (capture-capable image area A0), the camera captures image data on a portion (used image area A1) of that entire surface. *Id.* ¶ 15, Fig. 1. By selecting the pixels that will acquire image data (the used image area A1), the field angle can be altered and image rotation can be obtained without actually moving the optoelectrical conversion surface (capture-capable image area A0) of the image capture device 11. *Id.* ¶ 17. Thus, misalignment may be detected and corrected without moving the camera by

selecting the pixels that acquire image data to alter the field angle and/or rotate the image. *Id.* ¶¶ 43–46.

Hitachi discloses an embodiment having marks 3 disposed on the left and right of hood MB of the automobile M. *Id.* ¶ 18, Fig. 2. When the initial mark position X of mark 3 is not identical to the current mark position Y (steps S4, S5) and correction is within the correctable range (step S9), a correction is calculated (step S10), and image data is corrected (step S11). *Id.* ¶¶ 0032–0048, Figs. 4, 5.

Figure 4 of Hitachi follows:

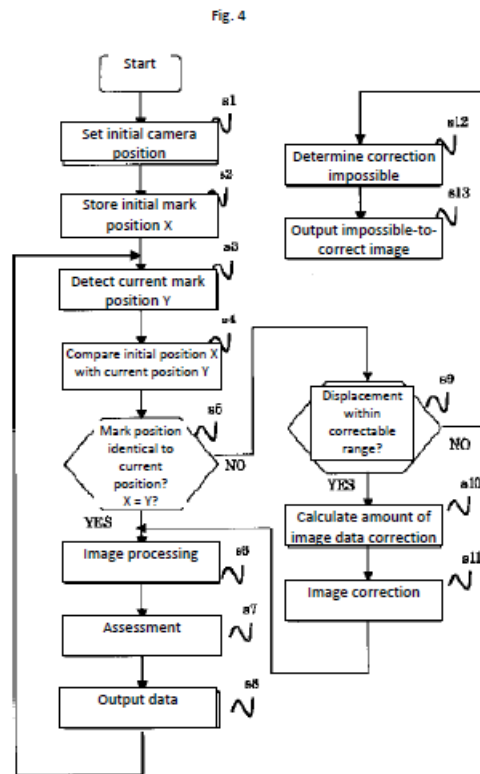


Figure 4 is a process flowchart. *Id.* ¶ 0032.

Hitachi's forward vehicle recognition unit 151 detects objects, such as a forward vehicle, and danger avoidance decision unit 17 and warning

issuance decision unit 172 determines when the driven vehicle is abnormally close to that object, and warns the driver via display unit 5. *Id.* ¶¶ 25–29, Fig. 3. Hitachi’s same-vehicle lane positional relationship calculation unit 154, in conjunction with danger avoidance decision unit 17 and warning issuance decision unit 172, detects when the driven vehicle is about to deviate from its lane and warns the driver via display 5. *Id.*

2. Analysis

Petitioner explains how each claim limitation is disclosed by Hitachi. Pet. ’227, 32–34 (incorporating support from claim 1 at Pet. ’227, 19–22). For example, Petitioner identifies Hitachi’s camera 1 as an imaging array sensor, and Hitachi’s image operation unit 1B as a control for processing the captured image. *Id.* at 19–20, 32; Ex. 1003 ¶ 22, Fig. 3. Petitioner explains that Hitachi’s system detects camera misalignment and corrects by adjusting the captured image. Pet. ’227, 33; Ex. 1003 ¶¶ 32, 39–41. Further, Petitioner explains that Hitachi’s system includes an object detection system (image processing unit 15 includes a forward vehicle recognition unit 151) and a lane departure warning system (same-vehicle lane positional relationship calculation unit 154 in conjunction with warning issuance decision unit 172). Pet. ’227, 33–34; Ex. 1003 ¶¶ 25, 29.

Patent Owner argues that Petitioner has not demonstrated the unpatentability of claim 19 by a preponderance of the evidence. Prelim. Resp. 3–7. Specifically, Patent Owner contends that the Petition only provides a series of unexplained quotes and, therefore, fails to satisfy Petitioner’s burden of providing a detailed explanation of the significance of the evidence. *Id.* at 3–4 (citing 37 C.F.R. §§ 42.22(a)(2); 42.104(b)(4)). As

a consequence, according to Patent Owner, it cannot be determined from Petitioner's showing whether the image date of Hitachi is image data of an already captured image. *Id.* at 5 (citing Pet. '227, 33). Patent Owner contends that the circumstances at hand are exactly like those in *Google*. *Id.* at 6 (citing *Google Inc. v. EveryMD.com LLC*, Case IPR2014-00347, slip op. at 17-18 (PTAB May 22, 2014) (Paper 9)).

As explained above, claim 19 requires that the control is operable to determine that the imaging array sensor is not aligned within a desired tolerance, and responsive to that determination, the control is operable to adjust at least one of (1) the captured image and (2) the image processing of the captured image.

In *Google*, the information in the Petition did not specify sufficiently how the construed claim is unpatentable, nor where each element of the claimed subject matter was found. *Google*, Paper 9 at 17-18. For the reasons that follow, such is not the case here.

Petitioner contends that Hitachi's Image Operation Unit 1B corresponds to a control as claimed. Pet. '227, 20 (citing Fig. 3), 32.⁸ Petitioner contends that Hitachi's system includes functionality to detect camera misalignment. Pet. '227, 20–21 (citing and quoting from Ex. 1003 ¶¶ 24, 39, Fig. 3.), 32. Petitioner contends that Hitachi discloses correction of the detected misalignment by adjusting the image data set using an image correction algorithm. Pet. '227, 21–22 (citing and quoting from Ex. 1003 ¶¶ 40–41).

⁸ The ground of unpatentability for claim 19 incorporates the analysis of claim 1. See Pet. '227, 32.

From these explanations and citations, a person of ordinary skill in the art would discern that Hitachi's control (Image Operation Unit 1B) is operable to determine that the imaging array sensor (camera 1) is not aligned within a desired tolerance (camera position change unit 16 of Image Operation Unit 1B determines when a disparity exists between initial mark 3A and current mark 3B). Ex. 1003 ¶¶ 24, 39, Figs. 3, 4⁹, 5(a)–5(c).¹⁰ Responsive to that determination, the control (Image Operation Unit 1B) is operable to adjust the captured image (when the disparity between the initial mark and the current mark is within a correctable range, then the correction required is calculated at step S10, and image data correction unit 14 of Image Operation Unit 1B corrects the image data at step S11). Ex. 1003 ¶¶ 39–41, Figs. 3, 4, 5(a)–5(c).

Accordingly, it can be determined from Petitioner's showing that Hitachi's system compares the initial mark to the current mark via an image of the current mark, and it is this captured image that is adjusted by image data correction unit 14 of Image Operation Unit 1B. *Contra* Prelim. Resp. 5 (contending that it cannot be determined if Hitachi compares using a captured image).

⁹ We note that paragraphs 39 and 40–41 are described in relation to Figures 4 and 5. See Ex. 1003 ¶ 32.

¹⁰ The Petition quotes from Exhibit 1003 paragraph 39 that cites to Figures 5(b) and 5(c). See Pet. '227, 21. Figure 5(c) utilizes the labels "3A" and "3B" and omits the description that 3A is an initial mark and 3B is a current mark.

Upon review of the Petition, Patent Owner's response and Petitioner's reply, we determine that Petitioner has shown by a preponderance of the evidence that Hitachi anticipates independent claim 19.

*B. Obviousness over Gutta and Nissan - Claims 25–27*¹¹

Petitioner contends that claims 25–27 are unpatentable under 35 U.S.C. § 103 as obvious over Gutta and Nissan. Pet. '228, 43–48.

We begin with an overview of the references.

1. Gutta (Ex. 1006)

Gutta discloses a vehicular vision system which provides the vehicle operator with information to utilize when making a determination as to whether to change lanes while driving. Ex. 1006, 1:6–10.

Gutta's vehicular vision system 10 includes three cameras (side image cameras 12, 14, and rear image camera 16), distance determiner 18, object identifier 20, image processor 22, and display 24. *Id.* at 2:28–36, Figs. 1, 2. The cameras are connected to image processor 22 that synthesizes a composite image output signal for viewing on a display 24. *Id.* at 2:32–40, 3:14–19, 4:24–32, Figs. 1–3. Distance determiner 18 and object identifier 20 process image signals from image processor 22 to identify objects in the field of view and their relative distance. *Id.* at 2:40–42, 3:23–31. This information is displayed with the composite image. *Id.* at 2:25–33, 3:30–31, 4:24–32, Fig. 3.

¹¹ This ground of unpatentability was presented in the '228 Petition. Pet. '228, 43–48.

Gutta discloses that although the preferred system has three cameras, it may have: one (“a single camera with a very large field of view and properly positioned on the vehicle”), two (“specifically positioned”), or more than three cameras (additional cameras providing a more panoramic view). *Id.* at 4:63–5:4, 5:20–22.

Gutta is silent regarding calibration of the cameras. Gutta, *passim*.

2. *Nissan (Ex. 1005)*

Nissan describes a vehicle-mounted camera optical axis misalignment detection system. Ex. 1005, Title. Vehicle-mounted system 30 of the second embodiment captures an image of a position which is a blind spot for the driver at the front left of the car (near the left fender) with vehicle-mounted camera 2, in response to an instruction input by the passenger of the car, and displays this image to display 3, providing the driver with driving support when, for example, making a left turn. *Id.* ¶ 32. Vehicle-mounted camera 2 is built in to a left-hand door mirror of the car. *Id.* Vehicle-mounted camera 2 is mounted on the car such that a left turn signal provided to the side of the car is visible, so as to capture images including the left turn signal. *Id.* Data ROM 8 stores an image showing where the turn signal ought to be observed in images captured by vehicle-mounted camera 2 when vehicle-mounted camera 2 is in an ideal state, mounted in a correct position and with no optical axis misalignment occurring. *Id.* ¶ 34. CPU 6 of control unit 5 executes an optical axis misalignment detection program to determine periodically whether or not optical axis misalignment has occurred in vehicle-mounted camera 2. *Id.* ¶ 41. Turn signal position detection unit 33 performs a process to detect the position where the turn

signal is displayed in the actual image of the left front of the car. *Id.* ¶ 44. Turn signal misalignment evaluation unit 34 compares the position where the left turn signal ought to be observed as shown in the template image stored in data ROM 8 against the position of the left turn signal in the actual image as detected by turn signal position detection unit 33, and judges, based on the degree of misalignment, whether or not optical axis misalignment has occurred in vehicle-mounted camera 2. *Id.* ¶ 45.

Figure 8 is reproduced below:

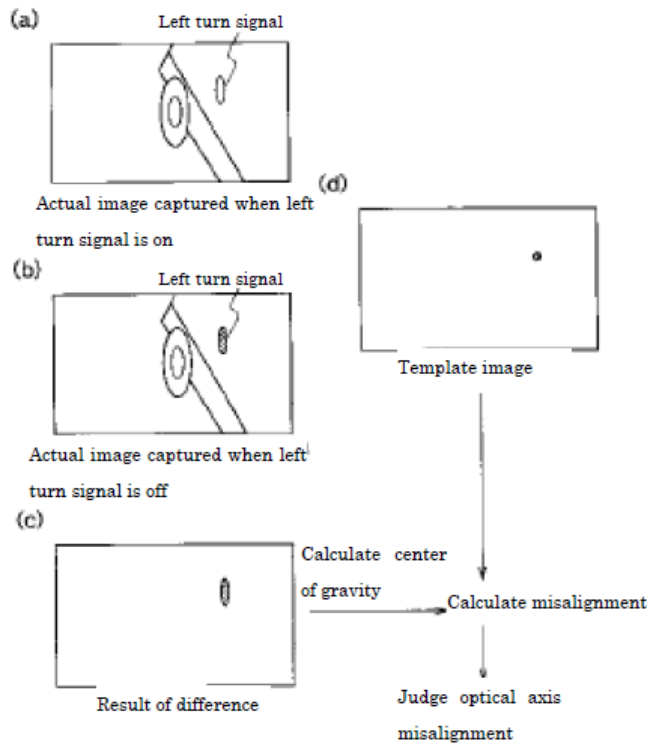


Figure 8 is a view for describing a method for detecting positional misalignment between a position of a left turn signal in an actual image and a position of the left turn signal in a template image in a vehicle-mounted system of the first embodiment.

As depicted in Figure 8, (a) shows the image captured when the left turn signal is on, (b) shows the image captured when the left turn signal is off, (c) shows the difference between the two captured images, and (d) shows an image indicating where the left turn signal ought to be observed. Ex. 1005, 18, Brief Description of the Drawings.

When optical axis misalignment is detected in vehicle-mounted camera 2, control unit 5 drives an actuator (camera position adjusting means capable of adjusting the direction of the optical axis of vehicle mounted camera 2) according to the detected amount of optical axis misalignment in vehicle-mounted camera 2. *Id.* ¶ 52. Specifically, control unit 5 continuously monitors scores D1 and D2, which represent the degree of misalignment, and drives the actuator such that both of these scores are substantially zero. *Id.*

3. *Claim 25*

Petitioner contends that it would have been obvious to modify Gutta's vehicular vision system in three respects to reach the claimed subject matter. *Id.* at 43–44, 46. First, Petitioner reasons that it would have been obvious in light of the teachings of Nissan and Gutta to modify the position and number of Gutta's cameras to have a camera positioned in the driver and passenger side exterior rearview mirrors. *Id.* at 43–44 (explaining and citing Ex. 1011 ¶¶ 150–154, 156). Second, Petitioner reasons that it would have been obvious to modify Gutta's system to detect and correct camera misalignment as taught by Nissan in order to capture accurate images. *Id.* at 43. Third, Petitioner reasons that instead of physically adjusting the camera as taught by Nissan, it would have been obvious to adjust the data image set or the

image processing, because such operation is cheaper and more reliable than Nissan's mechanical method of adjustment. *Id.* at 46.

Regarding the first and second modification, Petitioner asserts that Gutta discloses three cameras, including one placed on the passenger side of the vehicle and one placed on the driver side of the vehicle, both of which have a rearward and sideward field of view, and that Nissan discloses camera placement in the driver and passenger side exterior rearview mirrors. Pet. '228, 43–45 (citing Ex. 1006, 2:52–60, Fig. 2; Ex. 1005 ¶ 32). Further, Dr.-Ing. Frahm asserts that Gutta discloses the use of other numbers of cameras (e.g., one or two cameras). *Id.* at 43 (citing Ex. 1011 ¶ 150). In light of this, Petitioner's reasoning that the first two modifications would ensure capturing accurate images and achieve a field of view covering areas behind the car has a rational underpinning. *Id.* at 43–44 (citing Ex. 1011 ¶¶ 150–154, 156).

As explained above, Petitioner reasons that instead of physically adjusting the camera to compensate for misalignment as taught by Nissan, it would have been obvious to adjust the image data set or the image processing, because such operation is cheaper and more reliable than Nissan's mechanical method of adjustment. *Id.* at 46 (citing Ex. 1011 ¶¶ 204–208¹²).

¹² As Patent Owner has acknowledged, it appears the Petition intended to refer to paragraphs 206–210, titled, “Image Processing is Obvious in View of Nissan.” See Ex. 1011, 76; Ex. 2003, 16 n.5.

We state the limitation involved before turning to Patent Owner's arguments:

wherein said control, responsive to a determination of a misalignment . . . is operable to adjust at least one of said captured images and said image processing to at least partially compensate for the determined misalignment

Ex. 1001, Claim 19.

Patent Owner presents three arguments against Petitioner's contention. First, Patent Owner contends that Dr.-Ing. Frahm's testimony regarding the state of the art of image processing at the time of the claimed invention should not be given any weight because the underlying facts or data on which this opinion is based are not disclosed. PO Resp. 8–10 (citing 37 C.F.R. § 42.65(a)). Second, Patent Owner contends that Petitioner's proffered rationale is the result of impermissible hindsight. *Id.* at 10–12. Third, Patent Owner contends that Dr.-Ing. Frahm's vague testimony does not establish a prima facie case of obviousness. *Id.* at 13–14. We analyze these arguments in turn.

*a. Dr.-Ing. Frahm's Testimony*¹³

Patent Owner argues that Dr.-Ing. Frahm's testimony "should not be given any weight" because it fails to disclose the underlying facts or data for two conclusions in Dr.-Ing. Frahm's testimony regarding the state of the art.

¹³ Exhibits 1010, 1011, and 1014 are each the Declaration of Dr.-Ing. Frahm. Exhibit 1010 was filed with the '227 Petition and Exhibit 1014 was filed with Petitioner's reply. Exhibit 1011 was initially filed with the '228 Petition and then after consolidation was filed as Exhibit 1011 in IPR2014-00227. The ground of unpatentability based at issue here was presented in the '228 Petition and for that reason we consider Dr. Frahm's testimony that was submitted with that petition (i.e., Ex. 1011).

PO Resp. 8–10 (citing Ex. 2003 ¶¶ 34–35, 37–39, 42). First, Patent Owner argues that Dr.-Ing. Frahm’s testimony at paragraphs 70 and 71 “simply states that a transformation is applied to a captured image, without providing any details on what the transformation does of the underlying facts or data upon which the testimony is based.” *Id.* at 8–9 (citing Ex. 1011 ¶¶ 70–71; Ex. 2003 ¶ 42). Second, Patent Owner asserts that Dr.-Ing. Frahm fails to disclose how the function $C((x,y), m, I)$ operates to adjust captured image data as required by claim 25. PO Resp. at 9 (citing Ex. 1011 ¶ 70; Ex. 2003 ¶ 39).

Patent Owner treats paragraphs 70 and 71 of Dr.-Ing. Frahm’s Declaration as stand-alone paragraphs. These paragraphs must be considered in context. Dr.-Ing. Frahm explains that autonomous driving systems go back as far as 1979, and that the need to detect and correct misalignment was known prior to December 2004. Ex. 1011 ¶¶ 51 (citing Attach. A), 67 (citing Ex. 1003, 1005), 208 (citing state of the art section ¶¶ 49–74). Dr.-Ing. Frahm goes on to explain that camera pose deviation (misalignment) could be corrected by adjusting image data or image processing. *Id.* ¶ 68 (citing Ex. 1003); *see* Pet. ’228, 46.¹⁴ Indeed, as discussed in the analysis of the prior ground of unpatentability, Hitachi (Ex. 1003) discloses correction of the detected misalignment by adjusting the image data set using an image correction algorithm.

Further, contrary to Patent Owner’s assertion, Petitioner explains how the captured image is transformed. Specifically, Dr.-Ing. Frahm explains

¹⁴ As acknowledged by Patent Owner, Petitioner’s citation to paragraphs 204–208 of Exhibit 1011 likely intended to refer to paragraphs 206–210.

that the correction process determines the pixel value of every pixel in the corrected image as a function depending on the pixel's coordinates, the present misalignment, and the captured image. Ex. 1011 ¶ 70. The corrected image is then utilized in subsequent processing. *Id.* We note that claim 25 is not limited to any specific algorithm; rather, claim 25 requires only that the controller is operable to adjust at least one of (1) the image data set of the captured image and (2) the image processing of the captured image. Dr.-Ing. Frahm provides examples of such adjustment.

Dr.-Ing. Frahm does not provide a specific citation as a source for the function $C((x,y), m, I)$. See Ex. 1011 ¶¶ 70–72.

However, Dr.-Ing. Frahm's testimony regarding the function is a summary based upon his knowledge and experience and the references listed. See Ex. 1011 ¶ 2–12, 15, 49–74; App'x A (listing Exhibits 1001–1009, Attachments A–J); App'x B (Curriculum Vitae). This testimony would be entitled to greater weight had a source of the information been supplied with more specificity; however, the testimony remains entitled to some weight because the underlying facts and data on which the opinion is based are provided.

Petitioner has shown by a preponderance of the evidence that compensating for camera misalignment by either adjusting the image data set or by adjusting the image processing was known in the art.

b. Alleged Impermissible Hindsight

Patent Owner contends that Dr.-Ing. Frahm's testimony that a person of ordinary skill in the art would have realized that physical adjustment as disclosed by Nissan has higher production cost and greater potential for

mechanical failure than adjustment of image data or image processing is founded on unsupported assumptions. PO Resp. 11 (citing Ex. 1011 ¶ 208). Specifically, Patent Owner asserts that Nissan “was designed to solve the problem of camera physical realignment.” *Id.* at 11–12. Based on this, Patent Owner argues that Petitioner’s proffered rationale is the result of impermissible hindsight. *Id.* at 10–12.

As Petitioner correctly points out, Nissan describes the problem to be solved as accurate detection of optical axis misalignment in a vehicle mounted camera. Pet. Resp. 6; Ex. 1005, Abstract; *contra* PO Resp. 11. Nissan describes that an actuator may be used to adjust the direction of the vehicle mounted camera to correct for such detected misalignment. Ex. 1005 ¶ 52. Patent Owner characterizes Nissan’s solution (physical camera realignment) as the problem faced by Nissan in an attempt to make it appear that Nissan has no need of the improvement proposed by Petitioner.

Patent Owner asserts that a common symptom of hindsight is an insufficient rationale for combining the references, yet Patent Owner does not address cogently or directly the merits of the rationale proffered by Petitioner. PO Resp. 10. As stated above, Petitioner reasons that a person of ordinary skill in the art would have recognized that compensation for camera misalignment via physical adjustment as disclosed by Nissan has higher production cost and greater potential for mechanical failure than adjusting the image data set or image processing. Pet. ’228 46; Ex. 1011 ¶ 208. Patent Owner’s expert, Dr. Turk, essentially concedes that physical actuators add cost and present risk of mechanical failure, but reasons that actuators were a suitable tool for solving Nissan’s problem of camera physical

alignment. Ex. 2003 ¶ 46. Again, Nissan sought to solve the problem of accurately detecting camera misalignment, not camera physical misalignment. Petitioner has articulated a sufficient rational underpinning to support the legal conclusion of obviousness. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007).

c. Patent Owner Arguments Against Obviousness

Patent Owner argues that Dr.-Ing. Frahm's testimony does not establish the difference between Nissan and the claimed subject matter and does not establish that his testimony is drawn from analogous art. PO Resp. 13–14 (citing Ex. 1011 ¶ 70). With regard to the limitation at issue, Petitioner addressed adequately the differences between Nissan and the claimed subject matter. Specifically, Petitioner asserts that Nissan discloses detection of camera misalignment and correction of that misalignment using physical means (an actuator), and proposes to modify Nissan to correct by adjusting the captured image data set or the image processing. *See* Pet. '228, 43, 46–47; Ex. 1011 ¶¶ 155–156, 206–208. Therefore, the difference between Nissan and the claimed subject matter is that Nissan compensates for misalignment via physical movement of the camera rather than adjusting the image data set or the image processing.

Patent Owner's assertion that it cannot be determined if Dr.-Ing. Frahm's testimony is drawn from analogous art is also unpersuasive. *See* PO Resp. 13–14. As in an earlier argument, Patent Owner treats paragraph 70 of the Frahm Declaration as a stand-alone paragraph without consideration of context. In context, as detailed above, Dr.-Ing. Frahm testifies that the need to detect and correct misalignment in

vehicle imaging systems was known prior to December 2004, camera pose deviation (misalignment) could be corrected by adjusting image data or image processing as shown, for example, by Hitachi, and there were two primary alternatives for accounting for misalignment.

Consequently, the '175 patent, like the testimony of Dr.-Ing. Frahm, relates to the field of vision or imaging systems for vehicles. See Ex. 1001, 1:15–16. The problem faced by the '175 patent was to create an improved object detection system, and such system included correction for misalignment to improve accuracy. Ex. 1001, 2:25–28, 2:67–3:1. The techniques for compensating for camera misalignment identified by Dr.-Ing. Frahm logically would have commended themselves to an inventor's attention in considering this problem. See *Innovention Toys, LLC v. MGA Entm't, Inc.*, 637 F.3d 1314, 1321 (Fed. Cir. 2011).

Upon review of the Petition, Patent Owner's response and Petitioner's reply, we determine that Petitioner has shown by a preponderance of the evidence that claim 25 is unpatentable under 35 U.S.C. § 103 as obvious over Gutta and Nissan.

4. *Claims 26 and 27*

Patent Owner makes no further arguments with regard to claims 26 and 27.

Claim 26 depends from claim 25 and recites,

wherein at least one of (a) said imaging system comprises an object detection system for detecting an object exterior of the vehicle, (b) said imaging system comprises a headlamp control system for detecting a headlamp of a vehicle in the field of view, and (c) said imaging system comprises a lane departure warning system.

Ex. 1001, Claim 26.

Petitioner correctly identifies that Gutta's system discloses an object identifier 20 that identifies objects in the field of view of the cameras. Pet. '228, 47; Ex. 1006, 3:23–30.

Claim 27 depends from claim 25 and recites, “wherein said control is operable to alert the driver of the vehicle that an object is detected.” Petitioner correctly identifies that Gutta's system uses the information provided by the object identifier to determine if it is safe to change lanes and alerts the driver when it is not (e.g., when an object is in the driver's blind spot). Pet. '228, 47–48; Ex. 1006, 1:14–20, 38–44, 2:22–31.

Upon review of the Petition, Patent Owner's response and Petitioner's reply, we determine that Petitioner has shown by a preponderance of the evidence that claims 26 and 27 are unpatentable under 35 U.S.C. § 103 as obvious over Gutta and Nissan.

V. CONCLUSION

Petitioner has met its burden of proof by a preponderance of the evidence that (1) claim 19 is anticipated by Hitachi and (2) claims 25–27 would have been obvious over Gutta and Nissan.

VI. ORDER

In consideration of the foregoing, it is

ORDERED that claims 19 and 25–27 of U.S. Patent 7,877,175 B2 are determined by a preponderance of the evidence to be unpatentable;

FURTHER ORDERED that Patent Owner's Motion to Exclude Evidence is dismissed as moot; and

FURTHER ORDERED that because this is a final written decision of the Board under 35 U.S.C. § 318(a), parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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