

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.

Case IPR2014-00222
Patent 8,386,114 B2

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

CLEMENTS, *Administrative Patent Judge*.

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

I. INTRODUCTION

Valeo North America, Inc., Valeo S.A., Valeo GmbH, Valeo Schalter und Sensoren GmbH, and Connaught Electronics Ltd. (collectively, “Petitioner”) filed a Corrected Petition requesting *inter partes* review of claims 1–3, 6, 8–29, 31–41, 44–50, 52–55, and 59 of U.S. Patent No. 8,386,114 B2 (Ex. 1001, “the ’114 patent”). Paper 6 (“Pet.”). Magna Electronics, Inc. (“Patent Owner”) filed a Preliminary Response. Paper 12 (“Prelim. Resp.”). On May 29, 2014, we instituted an *inter partes* review of claims 1, 3, 6, 8–11, 14–16, 18–29, 31, 32, 34, 35–41, 44, 46, and 47–50 (“the instituted claims”) of the ’114 patent on certain grounds of unpatentability alleged in the Petition. Paper 13 (“Dec. to Inst.”).

After institution of trial, Patent Owner filed a Patent Owner Response (Paper 22, “PO Resp.”) to which Petitioner filed a Reply (Paper 26, “Pet. Reply”). Patent Owner filed a Motion to Exclude (Paper 51), which Petitioner opposed (Paper 53). Patent Owner filed a Reply to Petitioner’s Opposition to its Motion to Exclude. Paper 54.

Oral hearing was held on January 14, 2015.¹

The Board has 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.

Petitioner has shown, by a preponderance of the evidence, that the instituted claims of the ’114 patent are unpatentable. Patent Owner’s Motion to Exclude is denied.

¹ A transcript of the oral hearing is included in the record as Paper 50 (“Tr.”).

A. Related Proceedings

Petitioner and Patent Owner indicate that the '114 patent is involved in *Magna Elecs., Inc. v. Valeo, Inc.*, No. 2:13-cv-11376 (E.D. Mich.), filed March 28, 2013. Pet. 5; Paper 8, 2. Petitioner also has filed five petitions for *inter partes* review of other related patents of Patent Owner: IPR2014-00220 (U.S. Patent No. 7,859,565 B2), IPR2014-00221 (U.S. Patent No. 7,991,522 B2), IPR2014-00223 (U.S. Patent No. 8,386,114 B2), IPR2014-00227 (U.S. Patent No. 7,877,175 B2), and IPR2014-00228 (U.S. Patent No. 7,877,175 B2).

The '114 is also the subject of IPR2014-01204.

B. The '114 Patent

The '114 patent relates generally to vision or imaging systems for vehicles and, more particularly, to imaging systems that are operable to determine if a vehicle or object of interest is adjacent to, forward of, or rearward of the subject vehicle to assist the driver in changing lanes or parking the vehicle. Ex. 1001, 1:23–28. The prior art included many lane change aid/side object detection/lane departure warning devices or systems, and the like, that are operable to detect a vehicle or other object that is present next to, ahead of, or rearward of the equipped vehicle or in a lane adjacent to the equipped vehicle. *Id.* at 1:34–38. Such known systems statistically analyzed all of the pixels in a pixelated image. *Id.* at 1:53–56. However, because such systems continuously analyze every pixel for every frame captured, they require expensive processing controls and computationally expensive software to continuously handle and process substantially all of the data. *Id.* at 1:65–2:5. In addition, prior art warning systems may result in many intended maneuvers causing a warning. *Id.* at

2:24–29. As a result, the driver may begin to ignore the warnings. *Id.* at 2:30–31.

To address these issues, the '114 patent discloses an object detection system operable to detect and/or identify a vehicle or other object of interest at the side, front, or rear of the vehicle equipped with the object detection system. *Id.* at 2:40–49. The system uses an edge detection algorithm to detect edges of objects in the captured images. *Id.* at 2:49–56. The system processes a subset of image data that is representative of a target zone or area of interest within the field of view where a vehicle or object is likely to be present. *Id.* at 2:56–60. The system processes the detected edges within the subset of image data to determine whether they are part of a vehicle. *Id.* at 2:60–64. The system utilizes various filtering mechanisms to substantially eliminate or substantially ignore edges or pixels that are not or cannot be indicative of a vehicle or significant object to reduce the processing requirements and to reduce the possibility of false positive signals. *Id.* at 2:65–3:3.

Figure 1 is reproduced below.

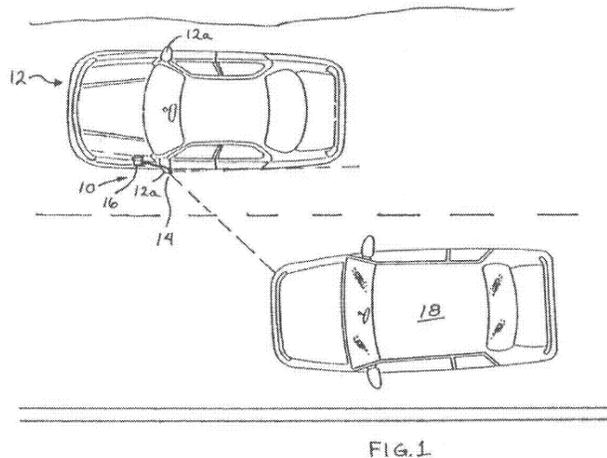


Figure 1 depicts an overhead view of a vehicle incorporating the object detection system of the invention described in the '114 patent. *Id.* at 4:10–

11. Lane change assist or aid system 10 is positioned at vehicle 12 (such as at exterior rearview mirror 12a) and is operable to capture an image of a scene occurring sidewardly and rearwardly at or along one or both sides of vehicle 12. *Id.* at 4:50–54. Lane change assist system 10 comprises image capture device or sensor or camera 14, which captures an image of the scene occurring toward a respective side of the vehicle 12, and control 16, which processes the captured image to determine whether another vehicle 18 is present at the side of vehicle 12. *Id.* at 4:54–60. Control 16 further may be operable to activate a warning indicator or display or signal device to alert the driver of vehicle 12 that another vehicle is present at the side of vehicle 12. *Id.* at 4:60–63.

Side object detection works based on the edges detected. *Id.* at 9:16. Horizontal edges are used to detect and track vehicles. *Id.* at 9:17. Vertical edges are used to detect vehicles close to the camera and passing vehicles. *Id.* at 9:22–24. Vehicle identification may be based on the shadow created by a vehicle. *Id.* at 9:25–26. The shadow of the subject or “host” vehicle may be detected as a target vehicle if the host shadow is extended in the zone of area of interest alongside the host vehicle, as may happen in the morning or evening. *Id.* at 10:43–47.

Figure 14 is reproduced below.

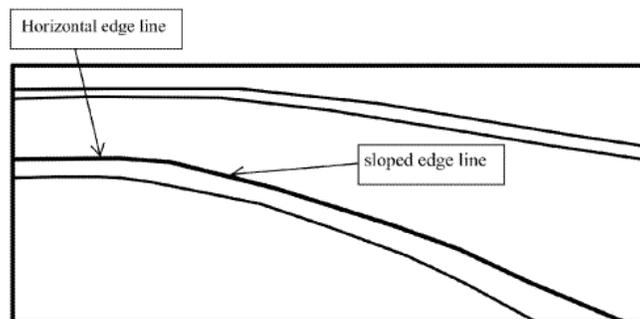


FIG. 14

Figure 14 is a representation of a captured image showing the shadow of the vehicle in the area adjacent to the vehicle. *Id.* at 4:37–38. The host shadow consists of a straight horizontal edge and an edge line with some slope. *Id.* at 10:47–49. The '114 patent discloses a series of steps to process the image to remove or ignore the host shadow. *Id.* at 10:50–67. The '114 patent further discloses a bicycle detection process. *Id.* at 11:10–12:33, Fig. 15. The '114 patent further discloses a headlight detection process. *Id.* at 14:4–55, Figs. 16–20.

C. Illustrative Claim

Of the instituted claims, claims 1, 27, and 39 are independent. Claim 1 is reproduced below:

1. An imaging system for detecting objects exterior of a vehicle, said imaging system comprising:
 - an imaging device comprising a CMOS array of photo-sensing pixels, wherein said imaging device is part of an exterior rearview mirror assembly that attaches at a side of a vehicle equipped with said imaging system, and wherein said imaging device captures image data;
 - wherein, with said exterior rearview mirror assembly attached at the side of the equipped vehicle, said imaging device has a field of view at least one of rearward of said exterior rearview mirror assembly in a direction towards the rear of the equipped vehicle and sideward of said exterior rearview mirror assembly in a direction away from the side of the equipped vehicle at which said exterior rearview mirror assembly is attached;
 - a control for processing image data captured by said imaging device;
 - wherein said control utilizes edge detection in processing captured image data;

wherein, responsive at least in part to said processing of captured image data by said control, said control determines objects of interest present in the field of view of said imaging device;

wherein objects of interest determined to be present in the field of view of said imaging device comprise at least one of (i) a vehicle that is at least one of rearward of the equipped vehicle and sideward of the equipped vehicle, (ii) a headlight of a vehicle that is at least one of rearward of the equipped vehicle and sideward of the equipped vehicle, (iii) a bicycle that is at least one of rearward of the equipped vehicle and sideward of the equipped vehicle, and (iv) a bicycle rider that is at least one of rearward of the equipped vehicle and sideward of the equipped vehicle;

wherein, responsive at least in part to said processing of captured image data by said control, a driver of the equipped vehicle is alerted to a hazardous condition; and

wherein, in determining objects of interest present in the field of view of said imaging device, edges that are not indicative of objects of interest are substantially ignored in order to at least one of (a) reduce processing requirements and (b) reduce false signals.

D. Prior Art Supporting Instituted Challenges

Petitioner relies upon the following references:

Gutta et al.	U.S. 6,424,273 B1	July 23, 2002	Ex. 1002
Saito (“Nissan”) ²	JP 2004-1658	Jan. 8, 2004	Ex. 1003
Broggi et al., <i>Multi-Resolution Vehicle Detection Using Artificial Vision</i> , 2004 IEEE INTELLIGENT VEHICLE SYMP. 310 (June 14-17, 2004) (“Broggi”)			Ex. 1005

² Nissan is a Japanese language document. Ex. 1003. Unless indicated otherwise, all citations to Nissan in this decision will refer to its certified English language translation. Ex. 1004.

Achler et al., *Vehicle Wheel Detector Using 2D Filter Banks*, Ex. 1006
2004 IEEE INTELLIGENT VEHICLES SYMP. 25 (June 14–17, 2004)
 (“Achler”)

V. Kastrinaki et al., *A Survey of Video Processing Techniques
for Traffic Applications*, 21 IMAGE & VISION COMPUTING 359 Ex. 1009
(Apr. 2003) (“Kastrinaki”)

Broggi et al., AUTOMATIC VEHICLE GUIDANCE: THE EXPERIENCE OF THE ARGO AUTONOMOUS VEHICLE (1999) (“Broggi II”) Ex. 1012

E. The Instituted Grounds of Unpatentability

We instituted *inter partes* review on the following grounds:

References	Basis	Claims Challenged
Gutta, Nissan, and Broggi	§ 103	1, 3, 6, 8, 9, 18–29, 31, 32, 35–41, 44, and 47–50
Gutta, Nissan, Broggi, and Achler	§ 103	10, 11, 32, and 44
Gutta, Nissan, Broggi, and Kastrinaki	§ 103	14 and 15
Gutta, Nissan, Broggi, Kastrinaki, and Broggi II	§ 103	16, 34, and 46

II. MOTION TO EXCLUDE

Patent Owner seeks to exclude Broggi (Exhibit 1005). Paper 51, 3–5. As movant, Patent Owner has the burden of proof to establish that it is entitled to the requested relief. *See* 37 C.F.R. § 42.20(c). For the reasons stated below, Patent Owner’s Motion to Exclude is denied.

Prior to filing its Motion to Exclude, Patent Owner objected to Exhibit 1005 within the required five business days. Paper 51, 2. Patent Owner preserved the objections by filing a Motion to Exclude Evidence. Paper 33 (now expunged). The Board expunged this motion 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 45 (referring to earlier order at Paper 15). Patent Owner

requested rehearing of that order. Paper 47. The Board granted the request for rehearing to permit filing of a revised Motion to Exclude with inappropriate argument removed. Paper 48. Specifically, 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 49, 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 1005. Paper 51.

Patent Owner argues that Broggi should be excluded because Petitioner “fails to demonstrate, as required by 35 U.S.C. § 102(a), that Broggi was published or made publicly accessible prior to the December 23, 2004 priority date of the '114 patent.” Paper 51, 4. According to Patent Owner, “Broggi only lists the date of the 2004 IEEE Intelligent Vehicles Symposium in Parma, Italy (June 14-17), which provides no evidence to support that the paper was published at or prior to the conference.” *Id.* Patent Owner also argues that the testimony in the Declaration of Dr.-Ing. Jan-Michael Frahm (Ex. 1013) as to Broggi's public accessibility lacks personal knowledge. *Id.*

Petitioner argues that Broggi is a “self-authenticating periodical[] under FRE 902(6) that require[s] no extrinsic evidence of authenticity in order to be admitted under FRE 902(6).” Paper 53, 4 (citing *Liberty Mutual Insur. Co. v. Progressive Casualty Insur. Co.*, Case CBM2012-00010, slip op. at 37 (PTAB Feb. 24, 2014) (Paper 59)). Specifically, Petitioner argues that Broggi “purport[s] to be [a] periodical[] (which Patent Owner, notably,

does not dispute) and, therefore, require[s] no extrinsic evidence of authenticity in order to be admitted under FRE 902(6).” *Id.* at 5. Petitioner submits a declaration from the IEEE custodian of records, Mr. Gerald P. Grenier, to corroborate that Broggi was published and presented at the 2004 IEEE Intelligent Vehicle Symposium that occurred on June 14–17, 2004. *Id.* at 5–6 (citing Ex. 1021; Ex. 1022). Petitioner also argues that Patent Owner’s argument is unsupported by evidence, and that there is no requirement that an expert have personal knowledge of the publication date of a document in order to rely on it as prior art. *Id.* at 8–9 (citing *EMC Corp. v. PersonalWeb Techs.*, Case IPR2013-00082, slip op. at 60 (PTAB May 15, 2014) (Paper 83)). Finally, Petitioner argues that “[t]he publication dates and Copyright notice dates on [Broggi] clearly establish [its] prior art date[.]” *Id.* at 9 (citing *FLIR Systems, Inc. v. Leak Surveys, Inc.*, Case IPR2014-00411, slip op at 18–19 (PTAB Sept. 5, 2014) (Paper 9)).

Patent Owner replies that Broggi is not a self-authenticating periodical because its “range of dates is associated with a conference, and there is no evidence of publication at that conference.” Paper 54, 1. Patent Owner also argues that Petitioner’s declarant, Mr. Grenier, “admitted at his deposition that he did not know when the Broggi article was published, and that his records did not identify a date of publication.” *Id.* at 1–2 (citing Ex. 2011, 12–13). Finally, Patent Owner distinguishes *EMC Corp.* on the grounds that “the other factors that served to authenticate the Langer reference in *EMC Corp.* are not present here,” and argues that Broggi’s copyright date—“© 2004 IEEE”—relates to creation, and cannot be assumed to be a publication date. *Id.* at 3.

In large part, Patent Owner argues that Petitioner has not established that Broggi is prior art. *See* Paper 51, 3–5; Ex. 2007, 1–3 (objections). Such arguments go to the weight and sufficiency of the evidence and not to admissibility. A motion to exclude deals with admissibility of evidence, not the sufficiency of evidence. *See* Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,767 (August 14, 2012) (A motion to exclude may not be used to challenge the sufficiency of the evidence to prove a particular fact.). Patent Owner’s preliminary response and response were opportunities to challenge whether Petitioner has sufficiently demonstrated that Broggi is prior art under 35 U.S.C. § 102(b). Patent Owner elected not to make such a challenge.

Patent Owner’s sole argument regarding admissibility is that Dr.-Ing. Frahm’s statement in Exhibit 1013 cannot serve to authenticate Broggi. *See* Ex. 2007, 2–3; Paper 51, 4. We do not rely upon the Frahm Declaration to authenticate Broggi.

Federal Rule of Evidence 901 requires that the proponent produce evidence sufficient to support a finding that an item is what the proponent claims it is. The Grenier Declaration indicates that Mr. Grenier is the Senior Director of Publishing Technologies for the Institute of Electrical and Electronics Engineers (IEEE), and a neutral third party to this proceeding.³ Ex. 1021 ¶¶ 1, 4, 5. Having reviewed IEEE records related to Broggi, Mr. Grenier certifies that Broggi is a true and correct copy of a record kept in the ordinary course of business, and this article was presented at an IEEE

³ Although the Grenier Declaration is filed as an exhibit, it is supplemental evidence and may only be considered with regard to the admissibility of Broggi (Ex. 1005). *See* 37 C.F.R. § 42.64(b)(2).

symposium which occurred June 14–17, 2004. Ex. 1021 ¶¶ 3, 7–9. The Grenier Declaration establishes sufficiently that Broggi is what Petitioner claims it to be.

We determine that Patent Owner has not met its burden of proof to establish that Broggi is inadmissible under a Federal Rule of Evidence. *See* 37 C.F.R. §§ 42.20(c), 42.62(a). Accordingly, Patent Owner’s Motion to Exclude is denied.

III. ANALYSIS

A. Claim Construction

In an inter partes review, claim terms in an unexpired patent are interpreted according to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *see also In re Cuozzo Speed Techs., LLC*, 778 F.3d 1271, 1281–82 (Fed. Cir. 2015) (“Congress implicitly adopted the broadest reasonable interpretation standard in enacting the AIA,” and “the standard was properly adopted by PTO regulation.”). Under the broadest reasonable interpretation, claim terms are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

In the Decision on Institution, we interpreted various claim terms of the ’114 patent as follows:

Claim Term (Claims)	Interpretation
“edge detection” (1, 8, 27, 32, 39, 44, 52, and 54)	an image segmentation technique in which edge pixels are identified by examining their neighborhoods

Claim Term (Claims)	Interpretation
“adjusts said processing of captured image data” (2)	excludes physically adjusting the camera

See Dec. on Inst. 9–10. The parties do not dispute these interpretations in their Patent Owner Response and Reply. We adopt the above claim constructions based on our previous analysis, and see no reason to deviate from those constructions, based on the complete record now before us.

B. Claims 1, 3, 6, 8, 9, 18–29, 31, 32, 35–41, 44, and 47–50 – Obvious over Gutta, Nissan, and Broggi

Petitioner contends that claims 1, 3, 6, 8, 9, 18–29, 31, 32, 35–41, 44, and 47–50 are unpatentable under 35 U.S.C. § 103(a) as obvious over Gutta, Nissan, and Broggi. Pet. 21–44. In support of this ground of unpatentability, Petitioner explains how each claim limitation is taught by Gutta, Nissan, or Broggi, and relies upon the Declaration of Dr.-Ing. Frahm. *Id.* (citing Ex. 1013 ¶¶ 153–67, 169–73, 178–88, 219, 224, 225, 234–38).

Patent Owner argues that (1) the Petition fails to provide a detailed explanation of Broggi; (2) the Petition fails to articulate a reason with rational underpinnings to combine Gutta, Nissan, and Broggi; and (3) Broggi does not disclose that “said control determines shadows present in the field of view of said imaging device and discerns shadows from objects present in the field of view of said imaging device,” as recited in claim 3. PO Resp. 3–13.

Upon consideration of the parties’ contentions and supporting evidence, we determine that Petitioner has established, by a preponderance of the evidence, that claims 1, 3, 6, 8, 9, 18–29, 31, 32, 35–41, 44, and 47–50 are unpatentable as obvious over Gutta, Nissan, and Broggi.

1. Gutta (Exhibit 1002)

Gutta describes a vehicular vision system to aid a driver of a vehicle to determine whether it is safe to change lanes. Ex. 1002, Abstract.

Figure 2 is reproduced below.

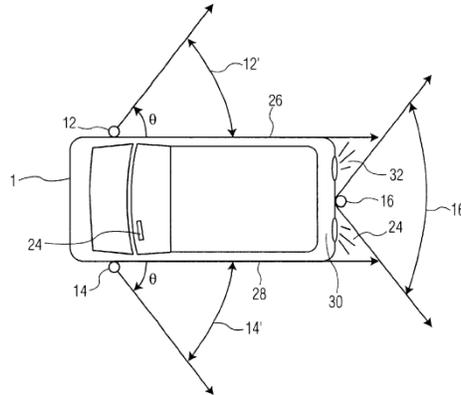


FIG. 2

Figure 2 depicts an overhead view of cameras on a vehicle having the vehicular vision system of Gutta. *Id.* at 2:20–22. Vehicular system 10 includes first and second side image cameras 12 and 14, rear image camera 16, distance determiner 18, and object identifier 20. *Id.* at 2:29–32. First and second side image cameras 12 and 14 are placed preferably on, e.g., passenger side and driver side front portions of the vehicle, respectively, such that rearward and sideward fields of view 12' and 14' are obtained for both sides of vehicle 1. *Id.* at 2:55–60. Rear image camera 16 is placed preferably on rear portion 30 of vehicle 1 with its field of view oriented such that a rearward view from vehicle 1 is obtained. *Id.* at 3:1–3. Rear image camera 16 preferably has a field of view that results in only very small areas 32 and 34 behind the vehicle not being visible to either rear image camera 16 or first and second side image cameras 12 and 14. *Id.* at 3:3–7. Images generated by cameras 12, 14, and 16 are provided to image processor 22, which processes the image signals generated by the cameras and provides

processed image signals to display 24 for viewing by the driver, to distance determiner 18, and to object identifier 20. *Id.* at 3:14–19, 23–27. Object identifier 20 identifies the type of objects observed by the camera, preferably by the well-known methods of extraction and classification. *Id.* at 3:34–40, 51–56. The identification may be as simple as saying that the object is a car, bus, motorcycle, sport utility, minivan, or truck. *Id.* at 3:56–58.

Figure 3 is reproduced below.

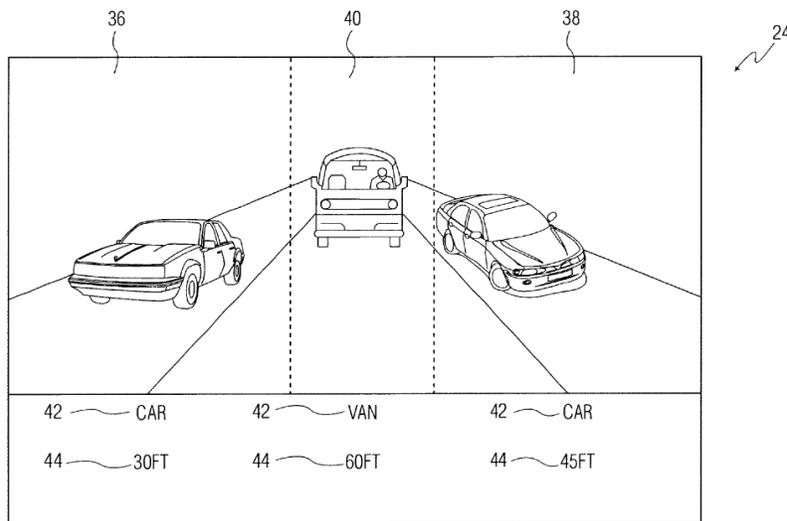


FIG. 3

Figure 3 is an exemplary display according to Gutta. *Id.* at 2:23–24. As depicted in Figure 3, display device 24 displays a composite image that includes: (1) visual representations 36, 38, and 40 of the fields of view 12', 14', and 16' of cameras 12, 14, and 16, respectively; (2) notations 42 as to each type of object identified; and (3) indications 44 of the distance between the object and vehicle 1. *Id.* at 4:24–32. Based on the information provided by the cameras, object identifier, and distance determiner, the system can provide the driver with an indication that it is now safe to change lanes to the left or right in response to the driver activating the turn signal. *Id.* at 5:22–27.

2. *Nissan (Exhibit 1004)*

Nissan describes a vehicle-mounted camera optical axis misalignment detection device that detects optical axis misalignment in a vehicle-mounted camera that is mounted on a vehicle and captures images of an area around the vehicle. Ex. 1004 ¶ 1. Vehicle-mounted system 30 includes vehicle-mounted camera 2 that is built in to a left hand door mirror of the vehicle. *Id.* ¶ 32. Vehicle-mounted camera 2 captures an image of a position that is a blind spot for the driver at the front left of the car near the left fender. *Id.* Specifically, 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.* Vehicle-mounted system 30 displays this image to display 3, thereby providing the driver with driving support when, for example, making a left turn. *Id.*

3. *Broggi (Exhibit 1005)*

Broggi describes a vehicle detection system using a single camera. Ex. 1005, Abstract. The system is based on the search for areas with high vertical symmetry in multi-resolution images. *Id.* Symmetry is computed using different sized boxes centered on all the columns of the interest areas. *Id.* All the columns with high symmetry are analyzed to get the width of detected objects. *Id.* Horizontal edges are examined to find the base of the vehicle in the individuated area. *Id.* The aim is to find horizontal lines located below an area with sufficient amount of edges. *Id.* The algorithm deletes all the bounding boxes which are too large, too small, or too far from the camera in order to decrease the number of false positives. *Id.* All the results found in different interest areas are mixed together and the

overlapping bounding boxes are localized and managed in order to delete false positives. *Id.*

An interesting column is defined as having a high symmetry in:
(i) the image that contains the result of Sobel binarization; or (ii) the image that contains the AND between symmetry of horizontal and vertical edges. *Id.* at 3. A columnwise histogram is then used to locate candidate columns. *Id.* In correspondence to these columns the vertical edges symmetry is checked to obtain the expected vehicle width. *Id.* More specifically, if a high value of symmetry is present for small widths too, it means that the algorithm has detected a small object; in this case the column is discarded. *Id.*

Figure 5 is reproduced below:



Fig. 5. Vertical edges symmetry: the horizontal axis represents the position of symmetry axis while the vertical axis represents the width of the symmetry box (small on the top and large on the bottom of the image).

Figure 5 shows an example of discarding a column in which the leftmost peak is discarded because it presents a high symmetry value also for small widths. *Id.* In contrast, the rightmost peak presents an appreciable symmetry value only for widths above a certain size. *Id.*

4. Analysis

We are persuaded that the record supports a finding that the limitations of independent claim 1 listed in the first column of the following table are taught by the corresponding disclosure of Gutta identified in the second column of the table:

<i>Independent Claim 1</i>	<i>Gutta</i>
an imaging device comprising a CMOS array of photo-sensing pixels	first and second side image cameras 12 and 14, and rear image camera 16, which may be CMOS imaging arrays
wherein said imaging device captures image data	a CMOS imaging array captures image data
wherein, with said exterior rearview mirror assembly attached at the side of the equipped vehicle, said imaging device has a field of view at least one of rearward of said exterior rearview mirror assembly in a direction towards the rear of the equipped vehicle and sideward of said exterior rearview mirror assembly in a direction away from the side of the equipped vehicle at which said exterior rearview mirror assembly is attached	“The first and second side image cameras 12, 14 are preferably placed on a portion of the vehicle (e.g., a passenger side and driver side front portions of the vehicle, respectively) such that a rearward and sideward field of view 12’, 14’ is obtained for both sides of the vehicle.” Ex. 1002, 2:55–60, Fig. 2.
a control for processing image data captured by said imaging device	image processor 22 and object identifier 20
wherein, responsive at least in part to said processing of captured image data by said control, said control determines objects of interest present in the field of view of said imaging device	object identifier 20 “analyzes the images generated by the cameras 12, 14, 16 and identifies the type of objects observed by the camera. . . . [T]he identification occurs by extraction and classification. The extraction of objects from the field of view is accomplished in accordance with any of a number of well-known methods.” Ex. 1002, 3:34–40.

<i>Independent Claim 1</i>	<i>Gutta</i>
<p>wherein objects of interest determined to be present in the field of view of said imaging device comprise at least one of (i) a vehicle that is at least one of rearward of the equipped vehicle and sideward of the equipped vehicle, (ii) a headlight of a vehicle that is at least one of rearward of the equipped vehicle and sideward of the equipped vehicle, (iii) a bicycle that is at least one of rearward of the equipped vehicle and sideward of the equipped vehicle, and (iv) a bicycle rider that is at least one of rearward of the equipped vehicle and sideward of the equipped vehicle</p>	<p>“The identification may be as simple as saying that the object is a car, bus, motorcycle, sport utility, minivan or truck. These methods are known to persons skilled in the art.” Ex. 1002, 3:56–59.</p>
<p>wherein, responsive at least in part to said processing of captured image data by said control, a driver of the equipped vehicle is alerted to a hazardous condition</p>	<p>“Thereafter, objects in the field of view of the cameras are identified by the object identifier, and the relative distance of each object from the vehicle is determined. This information is then provided to the display 24 for viewing by the driver.” Ex. 1002, 3:28–31; <i>see also id.</i> at Fig. 3.</p> <p>The “system can provide the driver with an indication that it is now safe to change lanes to the left or the right in response to the driver activating the turning signal, . . . [and] can have the capability to automatically disable the turning signal, in addition to providing an indication to the driver on the display, . . . to advise the driver that it is unsafe to change lanes.” Ex. 1002, 5:22–31.</p>

Independent claim 1 also recites “wherein said imaging device is part of an exterior rearview mirror assembly that attaches at a side of a vehicle equipped with said imaging system.” Petitioner cites Nissan for teaching that “vehicle-mounted camera 2 is built in to a left-hand door mirror of the car.” Pet. 22–23 (quoting Ex. 1004 ¶ 32). We are persuaded that Nissan, as cited by Petitioner, supports Petitioner’s contention.

Independent claim 1 also recites “wherein said control utilizes edge detection in processing captured image data.” Petitioner cites Gutta for teaching that “[t]he extraction of objects from the field of view is accomplished in accordance with any of a number of well-known methods,” (Ex. 1002, 3:38–40), and cites Broggi for teaching the use of edge detection to find areas of an image with the high vertical symmetry that is characteristic of most vehicles (Ex. 1005, Abstract, 1–3). Pet. 23. We are persuaded that Gutta and Broggi, as cited by Petitioner, support Petitioner’s contention.

Independent claim 1 also recites “wherein, in determining objects of interest present in the field of view of said imaging device, edges that are not indicative of objects of interest are substantially ignored in order to at least one of (a) reduce processing requirements and (b) reduce false signals.” Petitioner cites Broggi for teaching that “the vertical edges symmetry is checked to obtain the expected vehicle width. . . . [I]f a high value of symmetry is present for small widths too, it means that the algorithm has detected a small object; in this case the column is discarded.” Pet. 25–26 (quoting Ex. 1005, 3); *see also* Ex. 1005, 3 (“Unfortunately not all the detected boxes are correct: some false positives caused by road signs or other objects in the scene can be present as well. Two filters are used in

order to discard some false positives.”). We are persuaded that Broggi, as cited by Petitioner, supports Petitioner’s contention.

We also are persuaded that Petitioner’s arguments and evidence with respect to claim 6, 8, 9, 18–28, 31, 32, 35–40, 44, and 47–50 (Pet. 27–44) support Petitioner’s contentions.

Patent Owner argues that the (1) the Petition fails to provide a detailed explanation of Broggi; (2) the Petition fails to articulate a reason with rational underpinnings to combine Gutta, Nissan, and Broggi; and (3) Broggi does not disclose that “said control determines shadows present in the field of view of said imaging device and discerns shadows from objects present in the field of view of said imaging device,” as recited in claim 3. PO Resp. 3–13. We analyze these arguments in turn.

a. Sufficiency of Petitioner’s Explanation

Patent Owner argues that the Petition fails to provide a detailed explanation of Broggi (citing 37 C.F.R. §§ 42.22(a)(2), 42.104(b)(4)). PO Resp. 3–4. Specifically, Patent Owner argues that “Petitioners merely provided a brief summary of Broggi and claim charts containing unexplained cut-and-pasted quotations” that “do not contain language identical to the claim language and lack any explanation to bridge the gap between the quoted portions of Broggi and the claim elements,” and cites to claim 3 as an example. *Id.* at 4. According to Patent Owner, Dr.-Ing. Frahm’s Declaration “does not add any support.” *Id.* at 5. Patent Owner contends that the circumstances “are identical to those in *Google*.” *Id.* at 6 (citing *Google Inc. v. EveryMD.com LLC*, Case IPR2014-00347 (PTAB May 22, 2014) (Paper 9)).

Petitioner counters that (1) Patent Owner’s reliance on *Google* is misplaced because, unlike in *Google*, the Petition at hand included a concise summary of the argument, detailed claim charts, and arguments supported by an expert declaration; and (2) the one example given by Patent Owner—claim 3—“illustrates how Patent Owner is wrong.” Pet. Reply 2–4.

We are persuaded by Petitioner’s arguments. With respect to claim 3, for example, Patent Owner’s assertion that “[t]he quotes do not contain language identical to the claim language,” is not correct. The claim term “shadow” is used in the cited disclosure of Broggi. Pet. 27 (citing Ex. 1005, 312 (“[t]he shadow under the car is searched for in order to find the box base.)). Similarly, Patent Owner asserts that the cited passage of Broggi “cannot be said to disclose determining a shadow, as required by claim 3,” but the cited portion of Broggi clearly states that “[t]he shadow under the car is searched for.” PO Resp. 5. Searching for a shadow under a car necessarily entails a control “determin[ing] shadows present in the field of view,” and “discern[ing] shadows from objects present in the field of view,” as recited in claim 3. Even if the disclosure of Broggi was ambiguous, which it is not, the Petition cites ¶ 187 of Dr.-Ing. Frahm’s Declaration (Pet. 27), in which he relates the disclosure of Broggi (i.e., “[t]he shadow under the car is searched for”) to the claim limitations. Ex. 1013 ¶ 187. Accordingly, we are persuaded that Petitioner’s explanation of the cited portions of Broggi is sufficiently clear.

b. Reason to Combine

Patent Owner argues that Petitioner failed to articulate a reason to combine Gutta, Nissan, and Broggi because (1) it “provided only vague and unsupported rationale as to why a [person of ordinary skill in the art] would

have been motivated to combine” (PO Resp. 11); (2) “Petitioners and Dr.[Ing.] Frahm only analyze the combinations of two references at a time, and fail to provide analysis for the combination of Nissan, Gutta, *and* Broggi as required” (*id.*) (emphasis original); (3) Petitioner “do[es] not explain why the object identification system of Gutta would benefit from shadow detection” (*id.* at 12); and (4) there is no explanation or evidence of the alleged well-known design choices and well-known method in the arts that, in Dr.-Ing. Frahm’s opinion, would have rendered obvious the claimed invention (*id.*).

Petitioner counters that Patent Owner’s argument “assumes the [person of ordinary skill in the art] would lack basic common sense.” Pet. Reply 6. According to Petitioner, even aside from the discussion of motivation to combine in the Petition and Dr.-Ing. Frahm’s Declaration, “the motivation to combine these references is a matter of common sense because of the particular teachings within Nissan and Broggi as compared to Gutta.” *Id.* at 8. Specifically, “[i]t would have been a matter of common sense and an obvious design choice to modify Gutta to employ (1) a camera in the side rearview mirror and (2) edge detection.” *Id.*

We are persuaded by Petitioner’s arguments. Petitioner argues that:

A person of ordinary skill in the relevant art would have been motivated to combine the teachings of Gutta, Nissan, and Broggi given that the references are all in the area of vehicle vision systems and relate to capturing images of a vehicle’s surroundings to aid a driver with various vehicle-related functions. A person of ordinary skill in the art would recognize Gutta’s commentary regarding the number of cameras that could be employed and the general placement of such cameras in the vision system of Gutta to use side door mirror mounted cameras for object detection. Ex. 1013 at ¶¶153-162. Such

camera placement would have been entirely predictable and a well-known design choice to one of ordinary skill in the art prior to December 2004. *Id.* Further, a person of ordinary skill in the art would recognize Gutta’s commentary regarding the use of well-known methods in the art for identifying and classifying objects from images captured by cameras mounted on a vehicle would be fully applicable to edge-based recognition algorithms, using the edge detection as disclosed in Broggi. Ex. 1013 at ¶¶163-167.

Pet. 21–22 (citing Ex. 1013 ¶¶153–67). At the cited portions of his declaration, Dr.-Ing. Frahm addresses Gutta and Nissan (Ex. 1013 ¶¶ 153–62), and Gutta and Broggi (*Id.* ¶¶ 163–67). Although Dr.-Ing. Frahm does not provide specifically a motivation to make a three-way combination of Gutta, Broggi, *and* Nissan, he sufficiently articulates a reason why a person of ordinary skill in the art would have modified Gutta in view of Nissan (to place image cameras 14, 16 in the exterior rear view mirrors) and would have looked to Broggi for the details of Gutta’s “well-known methods” (Ex. 1002, 3:40, 52) of object extraction and classification. Patent Owner points us to no legal authority for its proposition that a reason to combine three references cannot be established by discussing the references in separate pairs. Accordingly, we are persuaded that Petitioner has articulated a reason to combine Gutta, Broggi, and Nissan with rational underpinnings.

c. Claims 3, 29, and 41

Claim 3 recites “said control determines shadows present in the field of view of said imaging device and discerns shadows from objects present in the field of view of said imaging device.” Claims 29 and 41 recite “at least one of . . . (b) said control determines shadows present in the field of view of said imaging device and discerns shadows from objects present in the field of view of said imaging device.” Petitioner cites Broggi for teaching that

“[t]he shadow under the car is searched for,” and that “the algorithm looks for a high concentration of edges above the horizontal edge” to discern car shadows from, e.g., bridge shadows. Ex. 1005, 3.

Patent Owner argues that “Broggi does not determine whether or not a detected object is a shadow, but instead determines the location of the box base of a vehicle.” PO Resp. 8 (citing Ex. 2001 (Turk Decl.) ¶ 24).

Specifically, Patent Owner argues that “Broggi merely assumes a shadow is present beneath the vehicle and . . . determine[s] if a detected horizontal edge is indicative of a vehicle.” *Id.* Patent Owner emphasizes Broggi’s disclosure that “[t]he shadow under the car is searched for *in order to find the box base*,” and faults Petitioner for providing “no evidence to show that ‘determining a shadow’ is necessarily performed as part of ‘determining a box base’ of a vehicle,” and argues that it is not inherent. *Id.* at 9 (emphasis original).

Petitioner counters that “Broggi describes searching for a shadow underneath a car.” Pet. Reply 5.

We determine that Petitioner’s arguments are persuasive. Broggi states explicitly that “[t]he shadow under the car is searched for.” Ex. 1005, 3. It is irrelevant why the shadow under the car is searched for—to find a box base or otherwise—because the claims do not require a purpose; they require only that “said control determines shadows . . . and discerns shadows from objects.” Patent Owner asserts that, “Broggi merely assumes a shadow is present beneath a vehicle” (PO Resp. 8), but that cannot be reconciled with Broggi’s explicit disclosure that “[t]he shadow under the car is searched for.” Broggi also states explicitly that when looking for car, “the algorithm looks for a high concentration of edges above the horizontal edge,” “since

other shadows, like bridges' ones, could be present on the road as well.”
Ex. 1005, 3. Thus, Broggi's algorithm not only detects shadows from cars and bridges, it looks for a high concentration of edges above the horizontal edge in order to discern whether the shadow is from a car or a bridge. Accordingly, we are persuaded that Broggi teaches the limitation recited in claims 3, 29, and 41.

5. Conclusion

Petitioner has demonstrated, by a preponderance of the evidence, that claims 1, 3, 6, 8, 9, 18–29, 31, 32, 35–41, 44, and 47–50 are unpatentable as obvious over Gutta, Nissan, and Broggi.

C. Claims 10, 11, 32, and 44 – Obvious over Gutta, Nissan, Broggi, and Achler

Petitioner contends that claims 10, 11, 32, and 44 are unpatentable under 35 U.S.C. § 103(a) as obvious over Gutta, Nissan, Broggi, and Achler. Pet. 44–47. In support of this ground of unpatentability, Petitioner explains how each claim limitation is taught by Gutta, Nissan, Broggi, or Achler, and relies upon the Declaration of Dr.-Ing. Frahm. *Id.* (citing Ex. 1013 ¶¶ 198–209).

Patent Owner argues that the Petition does not sufficiently articulate a reason to combine Gutta, Nissan, Broggi, and Achler because Petitioner provides a motivation to combine only Gutta and Achler. PO Resp. 13–14.

Upon consideration of the parties' contentions and supporting evidence, we determine that Petitioner has established, by a preponderance of the evidence, that claims 10, 11, 32, and 44 are unpatentable as obvious over Gutta, Nissan, Broggi, and Achler.

1. Achler (Ex. 1006)

Achler describes a vehicle wheel detector using 2D filter banks. Ex. 1006, 1. Views from an omnidirectional camera are used to generate side view images. *Id.* These images are processed using a difference of Gaussian filterbank. *Id.* The responses from the filterbank are applied to a precomputed set of principle components. *Id.* The principle component responses are compared against a Gaussian mixture model of wheels and Gaussian model roadbed. *Id.* Wheel candidates are chosen and tracked. *Id.*

2. Analysis

Claim 10 recites “wherein said control determines that an object of interest determined to be present in the field of view of said imaging device is a wheel of a vehicle.” Petitioner cites Achler for teaching a wheel detector that determines when wheels are present in the field of view of an imaging device. Pet. 45–46 (citing Ex. 1006, Abstract). We are persuaded that Achler, as cited by Petitioner, supports Petitioner’s contention.

Claim 11 recites “wherein said control determines the presence of a wheel of a vehicle by processing image data and determining generally vertical edges of objects present in the field of view of said imaging device.” Petitioner cites Achler for teaching detecting the presence of a wheel by processing image data, and cites Broggi for teaching detecting vertical edges. Pet. 46 (citing Ex. 1006, Abstract; Ex. 1005, Fig. 5, Abstract, 3). We are persuaded that Achler and Broggi, as cited by Petitioner, support Petitioner’s contention.

Claims 32 and 44 recite “wherein at least one of . . . (b) [the limitation recited in claim 10], and (c) [the limitation recited in claim 11].” Patent Owner does not argue separately claims 32 and 44. For the reasons

discussed above with respect to claims 10 and 11, we are persuaded that Achler, as cited by Petitioner, supports Petitioner's contention.

We are not persuaded by Patent Owner's argument that Petitioner failed to articulate a reason to combine Gutta, Nissan, and Broggi with Achler. PO Resp. 13–14. Patent Owner contends that "Petitioner[] must explain why one of skill in the art would have been motivated to combine the wheel detector of Achler with the edge detection methodology allegedly described in Broggi." *Id.* at 14. As Petitioner correctly points out, the Petition proposes to modify Gutta to include wheel detection, as taught by Achler, and to use edge detection, as taught by Broggi, to detect those wheels. Pet. Reply 9 (quoting Pet. 45). The Petition cites the following testimony from Dr.-Ing. Frahm as to why a person of ordinary skill in the art would combine Gutta, Broggi, and Achler:

A person of ordinary skill in the art would have been inclined to look at Broggi's teachings for available vehicle detection given that it also exploits edges. Moreover, as Achler states "[u]sing a combination of these primitive filters yields a response that is representative of edges and angles of edges." Pet. Ex. 1006 at §1.1. It would have been a simple and obvious variation to a person of ordinary skill in the art to use the Difference of Gaussian filters of Achler to extract the edge features exploited in the edge-based detection scheme of Broggi instead of the Sobel filter.

Ex. 1013 ¶ 206; Pet. 45. As a result, we are not persuaded by Patent Owner's contention that the Petition provides no analysis of why a person of ordinary skill in the art would have combined Achler and Broggi.

3. *Conclusion*

Petitioner has demonstrated, by a preponderance of the evidence, claims 10, 11, 32, and 44 are unpatentable as obvious over Gutta, Nissan, Broggi, and Achler.

*D. Claims 14 and 15 –
Obvious over Gutta, Nissan, Broggi, and Kastrinaki*

Petitioner contends that claims 14 and 15 are unpatentable under 35 U.S.C. § 103(a) as obvious over Gutta, Nissan, Broggi, and Kastrinaki. Pet. 48–51. In support of this ground of unpatentability, Petitioner explains how each claim limitation is taught by Gutta, Nissan, Broggi, or Kastrinaki, and relies upon the Declaration of Dr.-Ing. Frahm. *Id.* (citing Ex. 1013 ¶¶ 210–216).

Patent Owner argues that (1) Kastrinaki does not disclose that the “reduced data set is representative of a target zone that is encompassed by the field of view of said imaging device and that is not inclusive of a portion of the equipped vehicle,” as recited in claim 15; and (2) Petitioner fails to articulate a reason to combine Kastrinaki with Gutta, Nissan, and Broggi. PO Resp. 15–19.

Upon consideration of the parties’ contentions and supporting evidence, we determine that Petitioner has established, by a preponderance of the evidence, that claims 14 and 15 are unpatentable as obvious over Gutta, Nissan, Broggi, and Kastrinaki.

1. *Kastrinaki (Ex. 1009)*

Kastrinaki describes various video processing techniques for traffic applications known as of 2003. Ex. 1009, 359. Kastrinaki classifies image-processing methods used in traffic applications, discusses advantages and

disadvantages of these algorithms, and discusses shortcomings and general needs in this field of active research. *Id.* at Abstract. Kastrinaki discloses techniques related to automatic lane finding and object detection. *Id.* at 360–72.

2. *Analysis*

Claim 14 recites “wherein said control reduces captured image data to a reduced data set of said image data, said control processing said reduced data set to extract information from said reduced data set.” Petitioner cites Kastrinaki for teaching the use of a “region of interest (ROI) within each frame and process[ing] only relevant features within this ROI instead of the entire image.” Pet. 49 (quoting Ex. 1009, 365). Section 3.2 of Kastrinaki then describes several techniques for predicting the ROI from previously processed frames. Ex. 1009, 365. We are persuaded that Kastrinaki, as cited by Petitioner, supports Petitioner’s contention.

Claim 15 depends from claim 14 and further recites “wherein said reduced data set is representative of a target zone that is encompassed by the field of view of said imaging device and that is not inclusive of a portion of the equipped vehicle.” The Petition states that “Petitioner incorporates all support cited with respect to claim 14, herein. *See also* claim 21 above,” and also states as follows:

Regarding claim 15, one of ordinary skill in the art would have found it obvious to remove the portion of the equipped vehicle captured by any camera system from the target zone, as part of the equipped vehicle is not an object of interest in the vision system of Gutta. Ex. 1013 at ¶¶224-226.

Pet. 50–51.

Patent Owner argues that (1) Kastrinaki does not disclose that the “reduced data set is representative of a target zone that is encompassed by the field of view of said imaging device and that is not inclusive of a portion of the equipped vehicle,” as recited in claim 15; and (2) Petitioner fails to articulate a reason to combine Kastrinaki with Gutta, Nissan, and Broggi. PO Resp. 15–19. We analyze these arguments in turn.

a. “not inclusive of a portion of the equipped vehicle”

Patent Owner argues that “claims 14 and 21 do not reflect the features recited by claim 15,” specifically “a target zone . . . that is not inclusive of a portion of the equipped vehicle.” PO Resp. 15–16. According to Patent Owner, Kastrinaki does not teach excluding a portion of the equipped vehicle because, in Kastrinaki, “the equipped vehicle would be included in the [region of interest], it just would not be processed if it was not a relevant feature.” *Id.* at 17. Patent Owner continues that Dr.-Ing. Frahm’s testimony should be discounted because it is conclusory and unsupported, and “does not explain why a [person of ordinary skill in the art] would need to improve the system disclosed in Kastrinaki.” *Id.* at 17–18.

Petitioner counters that it is not relying solely on Kastrinaki for teaching that recited “target zone . . . is not inclusive of a portion of the equipped vehicle.” Pet. Reply 11. According to Petitioner, Dr.-Ing. Frahm’s testimony regarding claim 14 makes clear that Kastrinaki’s region of interest teaches the “target zone,” and his testimony regarding claim 21 “confirms that Gutta does not consider a portion of the equipped vehicle to be an object of interest.” *Id.* (citing Ex. 1013 ¶¶ 219, 221). Thus, Kastrinaki teaches the “target zone” while Gutta teaches excluding the portion of the equipped vehicle. *Id.* Moreover, Petitioner argues, it would have been obvious to a

person of ordinary skill in the art to exclude the portion of the equipped vehicle from the target zone. *Id.* (citing Ex. 1013 ¶ 226; Ex. 1014 ¶¶ 18–23).

We are persuaded by Petitioner’s arguments. Contrary to Patent Owner’s contentions, Petitioner does not rely solely on Kastrinaki to teach that the “target zone . . . is not inclusive of a portion of the equipped vehicle.” With respect to this limitation, we credit the testimony of Dr.-Ing. Frahm, who states that “Gutta does not include any portion of the equipped vehicle within any region of interest in the captured image data” (Ex. 1013 ¶ 219) and that “it would have been obvious to a person of ordinary skill in the art to reduce the chance of false positives by eliminating portions of the equipped vehicle from within the designated target zone for the reduced data set” (*id.* ¶ 224). Patent Owner takes issue with the support for this testimony, but does not allege that it is incorrect.

b. Reason to Combine

Patent Owner also argues that Petitioner failed to articulate a reason to combine Kastrinaki with Gutta, Nissan, and Broggi. PO Resp. 18–19. Specifically, Patent Owner argues that “simply being in the same field does not inherently mean that the references are combinable” (*id.* at 18) and faults Petitioner for discussing only Gutta and Kastrinaki and, separately, Broggi and Kastrinaki, but not all four references together (*id.* at 18–19). Patent Owner also argues that Dr.-Ing. Frahm’s testimony does not support a *prima facie* case of obviousness because it is conclusory. *Id.* at 19.

Petitioner counters that “the Petition unequivocally provides the motivation to combine the prior art references.” Pet. Reply 12–13 (citing Pet. 48–49)). Petitioner also argues that “the motivation to combine Gutta and Kastrinaki would have been obvious to the PHOSITA based on the

disclosures within the references themselves.” *Id.* at 13. Finally, Petitioner argues that “it would have been a matter of common sense to add Kastrinaki to the combination of Gutta, Nissan, and Broggi.” *Id.* (citing Ex. 1014 (Reply Declaration of Dr.-Ing. Frahm) ¶¶ 24–25).

We are persuaded by Petitioner’s arguments. The Petition states as follows:

A person of ordinary skill in the relevant art would have been motivated to combine the teachings of Gutta, Nissan, Broggi, and Kastrinaki given that the references are all in the area of vehicle vision systems and relate to capturing images of a vehicle’s surroundings to aid a driver with various vehicle-related functions. In addition to the reasons given above with respect to the combination of Gutta, Nissan, and Broggi, a person of ordinary skill in the art would recognize Gutta’s commentary with regard to object identification occurring by extraction and classification, both of which may be performed in accordance with “any number of well-known methods,” (Ex. 1002 at 3:36-40) would be fully applicable to any of the video processing and object identification methods mentioned in the overview of processing techniques in traffic applications that are disclosed in Kastrinaki. One of ordinary skill in the art would also readily recognize the compatibility of Broggi and Kastrinaki, which both provide for edge detection as a method for object detection and provide for efficient processing of edges. In an effort to make the vision system of Gutta as robust as possible, and given that Kastrinaki provides many of the relevant processing techniques that were known prior to 2003, it would have been entirely predictable to make the vision system of Gutta adaptable to changing conditions. Ex. 1013 at ¶¶210-216.

Pet. 48–49. With respect to claims 14 and 15, the Petition further states as follows:

With respect to claim 14, it also would have been obvious to one skilled in the art to combine Gutta and Kastrinaki to

incorporate the image data reduction of Kastrinaki in the system of Gutta. Ex. 1013 at ¶¶218-223. Regarding claim 15, one of ordinary skill in the art would have found it obvious to remove the portion of the equipped vehicle captured by any camera system from the target zone, as part of the equipped vehicle is not an object of interest in the vision system of Gutta. Ex. 1013 at ¶¶224-226.

Id. at 50–51. Thus, contrary to Patent Owner’s contentions, Petitioner is not relying solely on the assertion that these references are in the same field. Moreover, the Petition discusses Kastrinaki in the context of the other references. Specifically, it is sufficiently clear that Petitioner is relying on Kastrinaki as teaching the details of one of the “number of well-known methods” for object identification alluded to in Gutta. The Petition does not provide a separate reason for combining Kastrinaki with Nissan. As Petitioner correctly points out, though (albeit in rebuttal to a different argument), the Petition “relie[s] on Nissan for a disjoint element of the system claims of the ’114 patent (*i.e.*, the camera placement in the side rearview mirror).” Pet. Reply 10. As a result, the proposed modification to Gutta in view of Kastrinaki does not implicate the teachings of Nissan. Patent Owner points us to no legal authority for the proposition that a reason to combine must be provided for every possible pair of a four reference combination. We are, therefore, persuaded that the reason to combine articulated by Petitioner is sufficient.

3. Conclusion

Petitioner has demonstrated, by a preponderance of the evidence, that claims 14 and 15 are unpatentable as obvious over Gutta, Nissan, Broggi, and Kastrinaki.

*E. Claims 16, 34, and 46 –
Obvious over Gutta, Nissan, Broggi, Kastrinaki, and Broggi II*

Petitioner contends that claims 16, 34, and 46 are unpatentable under 35 U.S.C. § 103(a) as obvious over Gutta, Nissan, Broggi, Kastrinaki, and Broggi II. Pet. 51–53. In support of this ground of unpatentability, Petitioner explains how each claim limitation is taught by Gutta, Nissan, Broggi, Kastrinaki, or Broggi II, and relies upon the Declaration of Dr.-Ing. Frahm. *Id.* (citing Ex. 1013 ¶¶ 230–33).

Patent Owner argues that Petitioner fails to articulate a reason to combine Gutta, Nissan, Kastrinaki, and Broggi II. PO Resp. 19–22.

Upon consideration of the parties’ contentions and supporting evidence, we determine that Petitioner has established, by a preponderance of the evidence, that claims 16, 34, and 46 are unpatentable as obvious over Gutta, Nissan, Broggi, Kastrinaki, and Broggi II.

1. Broggi II (Ex. 1012)

Broggi II describes a windowing technique for quickly and dynamically reducing an area of interest (“where the obstacle is supposed to be”) in a captured image. Ex. 1012, 80. The region of interest is determined by taking the smaller bounding box including all the obstacles. *Id.* Information on vehicle motion and the steering wheel angle can be used to update the window of attention in a more accurate fashion. *Id.* Periodically, or when no obstacles are found, the entire image is analyzed in order to avoid the risk of missing new obstacles. *Id.*

2. Analysis

In light of the arguments and evidence, Petitioner has demonstrated, by a preponderance of the evidence, that claims 16, 34, and 46 are

unpatentable as obvious over Gutta, Nissan, Broggi, Kastrinaki, and Broggi II.

Claim 16 recites “wherein said control adjusts said target zone responsive to a steering angle of the wheels of the equipped vehicle.” Petitioner cites Broggi II for teaching adjusting a region of interest using steering wheel angle. Pet. 52 (citing Ex. 1012, 80). We are persuaded that Broggi II, as cited by Petitioner, supports Petitioner’s contention.

Claims 34 and 46 recite “[limitation recited in claim 14], and [limitation recited in claim 15], and [limitation recited in claim 16].” Petitioner incorporates by reference the support cited for claims 14, 15, and 16. Pet. 52–53. For the same reasons discussed above with respect to claims 14, 15, and 16, we are persuaded that Broggi II, as cited by Petitioner, support’s Petitioner’s contention.

Patent Owner argues that Petitioner failed to articulate a reason to combine Gutta, Nissan, Kastrinaki, and Broggi II. PO Resp. 19–22. Specifically, Patent Owner argues that Petitioner “only discuss[es] an alleged motivation to combine Broggi II with Gutta,” and “ignore[s] the requirement that the motivation to combine must address why one of skill in the art would have been motivated to combine Nissan, Gutta, Broggi, Kastrinaki, *and* Broggi II.” *Id.* at 20. Patent Owner also argues that “the [proffered] rationale [to combine Gutta with Broggi II] is conclusory and based on impermissible hindsight,” (*id.* at 20) because “there is no explanation how Broggi II would lead to fewer false positives,” and “there is no reasoning why a [person of ordinary skill in the art] would have been motivated to specifically combine the features of Broggi II to improve the accuracy of Gutta” (*id.* at 21).

Petitioner counters that Dr.-Ing. Frahm’s testimony regarding the motivation to combine Broggi II and Gutta is unrebutted. Pet. Reply 14 (citing Ex. 1013 ¶ 232). Petitioner states that “Broggi II specifically addresses narrowing the window of attention based on characteristics of the vehicle, such as the steering angle.” *Id.* at 15. According to Petitioner, “[i]t would have been obvious to a [person of ordinary skill in the art] that a more focused or better directed region of interest, or ‘window of attention’ as Broggi II calls it, would reduce false positives” because “a more focused window within which objects are searched for, which is adjustable based on the steering angle of the equipped vehicle, would not lead to determining objects in a direction that is not the direction in which the equipped vehicle is directed.” *Id.* at 14–15 (citing Ex. 1014 ¶¶ 26–28).

We are persuaded by Petitioner’s arguments. The Petition does not ignore the reason to combine Gutta, Nissan, Broggi, Kastrinaki, *and* Broggi II. *See, e.g.*, Pet. 51 (“A person of ordinary skill in the relevant art would have been motivated to combine the teachings of Gutta, Nissan, Broggi, Kastrinaki, and Broggi II”); *id.* (“In addition to the reasons given above with respect to the combination of Gutta, Nissan, [] Broggi, and Kastrinaki,”). Although the Petition does not separately address combining Broggi II with, for example, Nissan, that is because the Petition relies on Nissan for a disjoint element (i.e., camera placement in the side rearview mirror) and the proposed modification to Gutta in view of Broggi II does not implicate the teachings of Nissan. The Petitioner provides a reason to combine Gutta with each of Nissan, Broggi, Kastrinaki, and Broggi II. Patent Owner points us to no legal authority for the proposition that a reason to combine must be provided for every possible pair of a five reference combination. We are,

therefore, persuaded that the reason to combine articulated by Petitioner is sufficient.

3. Conclusion

Petitioner has demonstrated, by a preponderance of the evidence, that claims 16, 34, and 46 are unpatentable as obvious over Gutta, Nissan, Broggi, Kastrinaki, and Broggi II.

IV. CONCLUSION

Petitioner has shown, by a preponderance of the evidence, that the instituted claims of the '114 patent are unpatentable under 35 U.S.C. § 103.

V. ORDER

Accordingly, it is

ORDERED that claims 1, 3, 6, 8–11, 14–16, 18–29, 31, 32, 34, 36–41, 44, 46, and 48–50 of the '114 patent are held unpatentable;

FURTHER ORDERED that Patent Owner's Motion to Exclude is *denied*; and

FURTHER ORDERED that, because this is a Final Written Decision, the 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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Patent 8,386,114 B2

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