

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSARA INC.,
Petitioner,

v.

MOTIVE TECHNOLOGIES, INC.,
Patent Owner.

IPR2025-00574
Patent 11,875,580 B2

Before JUSTIN T. ARBES, MICHELLE N. WORMMEESTER, and
DANIEL J. GALLIGAN, *Administrative Patent Judges*.

GALLIGAN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining No Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

In this *inter partes* review, Samsara Inc. (“Petitioner”) challenges the patentability of claims 1–7 of U.S. Patent No. 11,875,580 B2 (Ex. 1001, “the ’580 patent”), which is assigned to Motive Technologies, Inc. (“Patent Owner”).

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision, issued pursuant to 35 U.S.C. § 318(a), addresses issues and arguments raised during the trial in this *inter partes* review. For the reasons discussed below, we determine that Petitioner has not proven by a preponderance of the evidence that claims 1–7 of the ’580 patent are unpatentable. *See* 35 U.S.C. § 316(e) (“In an inter partes review instituted under this chapter, the petitioner shall have the burden of proving a proposition of unpatentability by a preponderance of the evidence.”).

A. Procedural History

Petitioner filed a Petition (Paper 2, “Pet.”) challenging claims 1–7 of the ’580 patent on the following grounds:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–4	103 ¹	Choe ²
1–5	103	Choe, Khan, ³ Ali ⁴
1–4	103	Choe, Workman ⁵

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. § 103 effective March 16, 2013, which is before the ’580 patent’s filing date. Thus, we apply the AIA version of § 103.

² US 2020/0410704 A1, published Dec. 31, 2020 (Ex. 1005, “Choe”).

³ Khan *et al.*, “Lane Detection Using Lane Boundary Marker Network with Road Geometry Constraints” (2020) (Ex. 1007, “Khan”).

⁴ Ali *et al.*, “Real-Time Vehicle Distance Estimation using Single View Geometry” (2020) (Ex. 1008, “Ali”).

⁵ Workman *et al.*, “Horizon Lines in the Wild” (2016) (Ex. 1011, “Workman”).

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
5–7	103	Choe, Westmacot ⁶
1–7	103	Choe, Westmacot, Khan, Ali
1–7	103	Choe, Westmacot, Workman

Pet. 10. Patent Owner filed a Preliminary Response. Paper 9. As authorized, Petitioner filed a preliminary reply (Paper 10), and Patent Owner filed a preliminary sur-reply (Paper 11). Trial was instituted on the asserted grounds of unpatentability. Paper 12 (“Inst. Dec.”).

During the trial, Patent Owner filed a Response (Paper 20, “PO Resp.”), Petitioner filed a Reply (Paper 23, “Pet. Reply”), and Patent Owner filed a Sur-reply (Paper 24, “PO Sur-reply”).

An oral hearing was held on May 27, 2026, a transcript of which appears in the record. Paper 33 (“Tr.”).

Petitioner relies on testimony from Trevor J. Darrell, Ph.D. Exs. 1003 (Declaration), 1085 (Reply Declaration). Patent Owner relies on testimony from Scott Andrews. Exs. 2003, 2003 (Revised).⁷ Petitioner took the deposition of Mr. Andrews and entered the deposition transcript in the record. Ex. 1061. Patent Owner did not take Dr. Darrell’s deposition.

⁶ WO 2019/175286 A1, published Sept. 19, 2019 (Ex. 1010, “Westmacot”).

⁷ Patent Owner submitted a declaration from Mr. Andrews with its Preliminary Response as Exhibit 2003 and then submitted another declaration from Mr. Andrews with its Response as Exhibit 2003 (Revised). Patent Owner did not affirmatively withdraw Mr. Andrews’s earlier declaration, so both are evidence in this proceeding. *See* Trial Practice Guide § II.C (“If a trial is instituted, a patent owner may choose not to rely on testimony submitted with the preliminary response. In that case, the patent owner should advise the Board of its decision, which can be done by affirmatively withdrawing the testimony in the patent owner response.”), available at <https://www.uspto.gov/patents/ptab/trial-practice-guide>. Unless otherwise noted, this Decision’s references to Exhibit 2003 are to the revised declaration submitted with the Patent Owner Response.

B. Real Parties in Interest

The parties identify themselves as the real parties in interest. Pet. 78; Paper 17 (Patent Owner's Updated Mandatory Notices), 1.

C. Related Matters

As required by 37 C.F.R. § 42.8(b)(2), the parties identify *Motive Technologies, Inc. v. Samsara, Inc.*, Case No. 3:24-cv-00902 (N.D. Cal.) as a related matter. Pet. 78; Paper 17, 2.

D. Challenged Claims

Independent claim 1 and dependent claims 2–7 are the challenged claims. Claim 1 is reproduced below with Petitioner's identifiers for the claim limitations in brackets (*see* Pet. 24–33).

1. [1Pre] A method comprising:

[1A] receiving, over a network from a camera device, a video comprising a set of image frames;

[1B] identifying one or more lines in the video using a predictive model, the one or more lines including a horizon line;

[1C] computing at least one camera parameter based on the one or more lines;

[1D] overlaying the one or more lines on the video to generate an overlaid video;

[1E] transmitting the overlaid video to an annotator device for manual review;

[1F] receiving a confirmation from the annotator device, the confirmation indicating that the one or more lines are accurate; and

[1G] transmitting data representing the at least one camera parameter to the camera device.

II. ANALYSIS

A. Principles of Law

A patent claim is unpatentable “if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.” 35 U.S.C. § 103; *see also KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) any secondary considerations, if in evidence. *Graham v. John Deere Co. of Kan. City*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill in the art “would have had a Bachelor’s in Computer Science with a focus on computer/machine vision, and at least two years of experience with each of: (1) machine learning (including neural network) methods as applied to machine/computer vision and (2) classical machine/computer vision algorithms (e.g., edge detection, line identification, computation of camera parameters from horizon line, etc.)” and that “[a]dditional education could serve as a substitute for the experience requirement.” Pet. 7–8 (citing Ex. 1003 ¶ 77).

Patent Owner criticizes Petitioner’s proposed level of ordinary skill for not requiring “any training or experience in ‘automotive systems,’ precisely what the ’580 [p]atent relates to.” PO Resp. 7. According to Patent Owner, a person of ordinary skill in the art would have had “a

bachelor's degree in engineering or computer science with one- or two-years training and/or experience in design of software for camera/sensor systems in the automotive industry.” PO Resp. 8–9 (citing Ex. 2003 ¶ 35).

Petitioner contends that any differences in the parties' proposed levels of ordinary skill would not have any impact on this case because the levels are generally similar:

[Patent Owner's proposed level of ordinary skill in the art] does not differ much because two-years of training/experience designing software for cameras/sensors in the automotive industry is similar [to] two-years with machine learning and machine/computer vision algorithms because the automotive industry, and software designers for automotive camera/sensor systems, would have been heavily involved in machine learning and machine/computer vision applications for autonomous vehicles.

Pet. Reply 2.

The parties' proposed definitions do not differ in any way that affects our analysis. Given Petitioner's statement that Patent Owner's level of ordinary skill “has no impact” (Reply Br. 2 (formatting changed)), we adopt Patent Owner's level of ordinary skill in the art, which is consistent with the teachings of the '580 patent and the asserted prior art, but note that our conclusions herein would not change if we adopted Petitioner's level.

C. Claim Construction

We need not construe expressly any claim terms to decide the issues before us. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

*D. Obviousness over Choe
(Claims 1–4)*

Petitioner asserts that claims 1–4 would have been obvious over the teachings of Choe. Pet. 24–35; Pet. Reply 5–15. Patent Owner argues that the claims are not unpatentable. PO Resp. 10–23; PO Sur-reply 6–10. For the reasons discussed below, we determine that Petitioner’s contentions do not show that claims 1–4 are unpatentable.

Our analysis focuses on Petitioner’s contentions with respect to the “video” limitations of claim 1, which are dispositive. Claim 1 recites “receiving, over a network from a camera device, a video comprising a set of image frames” (limitation 1A), “identifying one or more lines in the video using a predictive model, the one or more lines including a horizon line” (limitation 1B), “overlaying the one or more lines on the video to generate an overlaid video” (limitation 1D), and “transmitting the overlaid video to an annotator device for manual review” (limitation 1E).

Petitioner contends that Choe discloses using still or video cameras to capture images. Pet. 25–26 (citing Ex. 1005 ¶¶ 18, 20–22, 31, Figs. 1, 2, 6A, 6B; Ex. 1003 ¶¶ 84–89). For example, Choe discloses a sensor system that includes cameras, which “maybe still cameras and/or video cameras.” Choe ¶ 22. Petitioner contends that Choe teaches identifying lane lines and a horizon line in video frames that are captured. Pet. 26–28 (citing Ex. 1005 ¶¶ 15, 30, 45, 48, 55, 56, 59, Figs. 1, 6A, 6B, 7; Ex. 1003 ¶¶ 90–97). Choe discloses the following:

[I]n response to a first image captured by a camera of an [autonomous driving vehicle (ADV)], a horizon line is determined based on the camera’s hardware settings. The horizon line represents a vanishing point from a view point of the ADV based on an initial or default pitch angle of the camera.

One or more lane lines are determined based on the first image via a perception process performed on the first image.

Choe ¶ 15; *see* Pet. 27 (partially quoting this disclosure).

Petitioner contends that “the images used to identify the horizon and lane lines are video frames because, as explained for [1A], Choe captures video.” Pet. 27 (citing Ex. 1005, Figs. 6A, 6B). Petitioner also argues that “Choe’s Figures 6A and 6B show the video frames used in its process,” noting that Figure 6A “shows ‘frame id: 1110’” while “Figure 6B shows the prior frame, ‘frame id: 1109.’” Pet. 25.

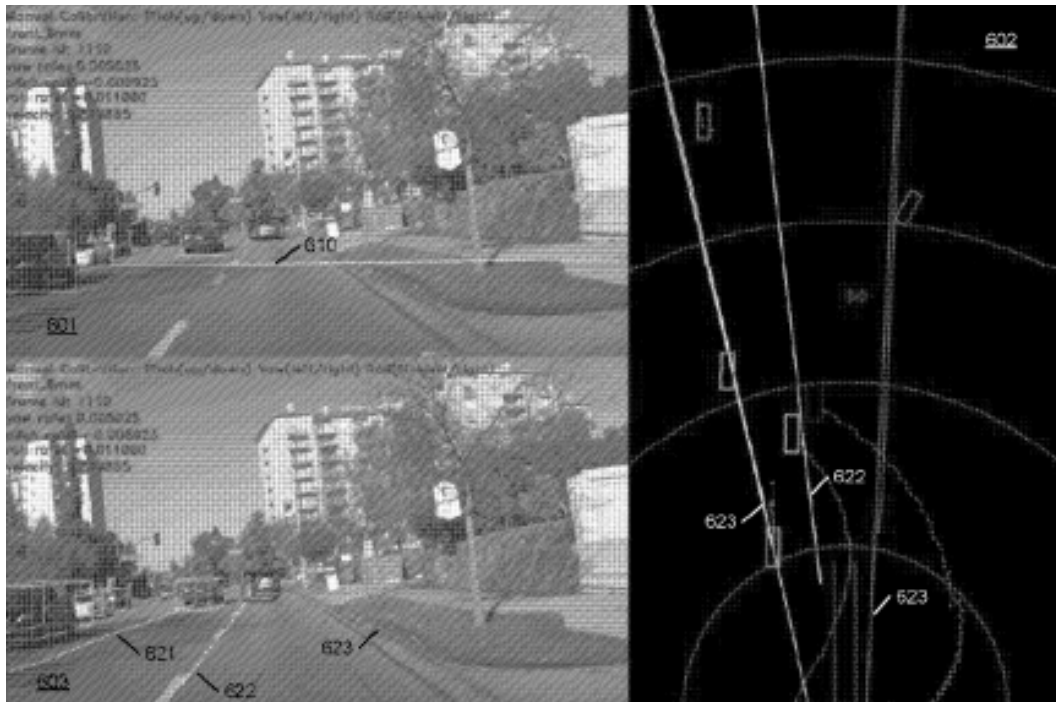
For limitations 1D (“overlaying the one or more lines on the video to generate an overlaid video”) and 1E (“transmitting the overlaid video to an annotator device for manual review”), Petitioner asserts that Choe discloses overlaying the horizon line on a video and transmitting the overlaid video to an annotator’s graphical user interface (GUI), as shown in Figures 4, 6A, and 6B. Pet. 29–31 (citing Ex. 1005 ¶¶ 10, 15–17, 45–58, Figs. 6A, 6B; Ex. 1003 ¶¶ 99–107); Pet. Reply 12–13.

Patent Owner argues that Choe discloses performing single frame analysis, even if the frame is extracted from video. PO Resp. 16, 18–19. According to Patent Owner, “Figure 6A, reproduced in the Petition (p. 30), clearly shows operation of a single frame from the camera along with corresponding ‘3D information’ from other sensors (LIDAR/RADAR); a video is not used for the manual calibration process.” PO Resp. 20 (citing Ex. 2003 ¶ 86). Patent Owner argues, therefore, that Petitioner’s contentions fail because claim 1 requires “overlaying the one or more lines on the video to generate an overlaid video,” which is comprised of “a set of image frames,” not merely a single frame, and that “Choe does not actually

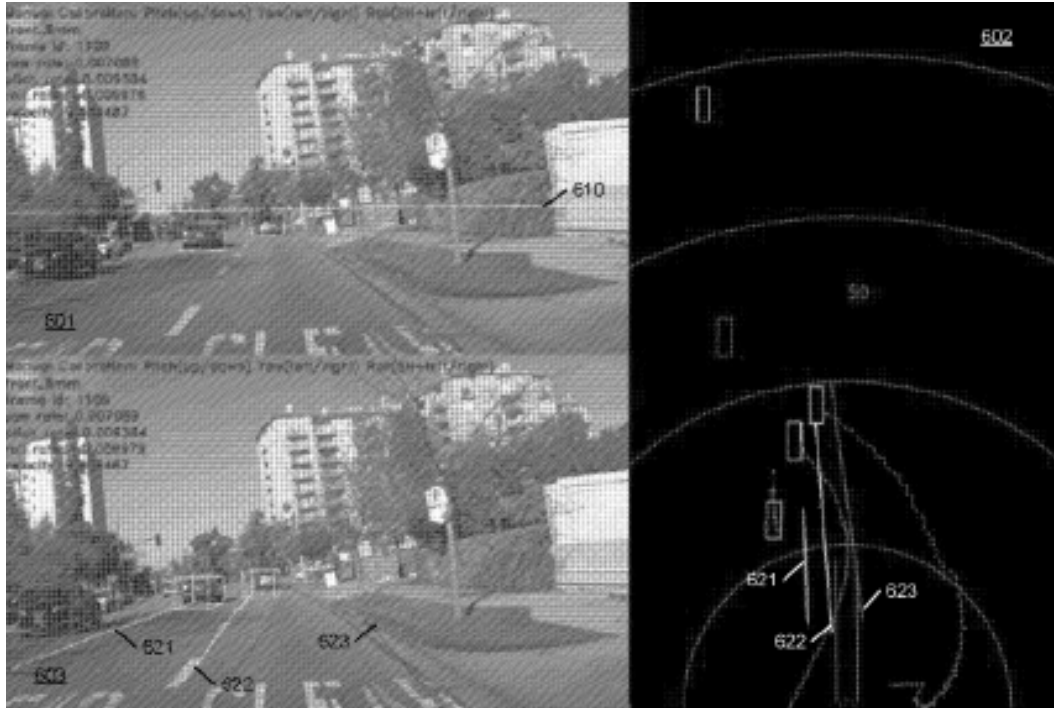
mention any transmission of a video, much less an overlaid video.” PO Resp. 18–19.

We agree with Patent Owner that Petitioner has not shown that Choe teaches, suggests, or renders obvious the subject matter of limitations 1D and 1E. As detailed below, the evidence shows that Choe’s manual annotation system works on individual images or frames rather than the recited video comprising a set of image frames.

Petitioner’s contentions rely on Figures 6A and 6B to show overlaid video frames. Pet. 25, 29; Pet. Reply 12–13. Choe’s Figures 6A and 6B are below.⁸



⁸ Petitioner uses Figures 6A and 6B that were originally filed with the Patent Office for clarity. Pet. 8; Ex. 1006. These are clearer than the versions of the same figures in the published application, so we use them as well.



Choe’s Figures 6A (above top) and 6B (above bottom) “are screenshots illustrating a graphical user interface of a sensor calibration system.”

Ex. 1005 ¶ 55. Each of the figures has image 601 in the upper left, image 603 in the bottom left, and image 602 on the right spanning both images 601 and 603. Ex. 1005 ¶¶ 55–56. “Image 601 was captured by a camera to be calibrated and processed by perception module 302,” and “horizon line 610 is determined and placed on a location within image 601 based on the hardware setting of the targeted camera.” Ex. 1005 ¶ 55. Image 602 on the right is a 3D, top-down view “generated based on the image 601 and other 3D information, for example, provided by a LIDAR device and/or RADAR device.” Ex. 1005 ¶ 56. Image 602 has “lane lines 621-623 positioned based on the position of horizon line 610.” Ex. 1005 ¶ 56.⁹ Choe explains

⁹ Choe states that “[i]mage 402 includes one or more lane lines 621-623 positioned based on the position of horizon line 610.” Ex. 1005 ¶ 56. There is no image 402, and in context, we understand this to refer to image 602.

that “[i]mage 601 may be rendered by 2D rendering module 401 and displayed within a first display area of a display device as a 2D view” and that “[i]mage 602 may be rendered by 3D rendering module 402 and displayed within a second display area of the display device.” Ex. 1005 ¶¶ 55–56. In the bottom left of Figure 6A is “optional image 603, referred to herein as a 2D re-projected view, [which] is generated based on 2D view image 601 and 3D view image 602, including projecting lane lines 621-623 onto the 2D view.” Ex. 1005 ¶ 56.

With respect to the horizon lines in each image, Choe explains the following:

From the top-down view, when a pitch angle of a camera has been calibrated, lane lines 621-623 should be relatively or substantially parallel. In this *example*, assuming horizon line 610 is too low, which causes lane lines to be diverged. Similarly, if the horizon line 610 is too high, as shown in FIG. 6B, lane lines 621-623 shown in 3D view 602 would be converged. By displaying the top-down view based on the position of horizon line 610, a user can calibrate the pitch angle by adjusting the position horizon line 610, for example, using an up-arrow key or a down-arrow key of a keyboard as an input device, until lane lines 621-623 are relatively parallel on the 3D view 602.

Choe ¶ 57 (emphasis added). Thus, Figures 6A and 6B represent examples of horizon lines at different positions.

Below are excerpted and annotated images from Figures 6A and 6B, provided by Petitioner, that show the frame IDs more clearly. *See* Pet. Reply 12–13.



The figures above are images 601 from Figures 6A (top) and 6B (bottom), and Petitioner has added a red box in each to note the frame ID, which is 1110 for Figure 6A and 1109 for Figure 6B. Pet. Reply 12–13.

Figures 6A and 6B show two frames, which alone may suffice to show “a set of image frames,” i.e., a video as recited in claim 1. Claim 1, however, recites “overlaying the one or more lines on the video to generate an overlaid video” and “transmitting the overlaid video to an annotator device for manual review.” Further, the recited “one or more lines” include “a horizon line” (limitation 1B). Figures 6A and 6B show examples of different horizon lines, one that is too low and the other that is too high, to

explain how a user manually adjusts the line in each situation. Choe ¶ 57. A horizon line that is too low, as shown in Figure 6A, causes the lane lines to diverge, as shown in image 602 at the right of Figure 6A. Choe ¶ 57. Conversely, a horizon line that is too high, as shown in Figure 6B, causes the lane lines to converge. Choe ¶ 57.

Even though Choe discloses that cameras that capture images “may be still cameras and/or video cameras” (Choe ¶ 22), we find that Choe discloses that the horizon line overlay and adjustment operation is on a single frame.

The testimony of Petitioner’s technical declarant, Dr. Darrell, is consistent with this finding. Dr. Darrell testifies that, “[i]n Choe, the horizon line is superimposed on the video frame. As a [person of ordinary skill in the art] would have understood, superimposing a line on a video frame ‘overlay[s]’ the line on the video frame. Choe states that the initial horizon line is superimposed on the video frame” Ex. 1003 ¶ 100 (third alteration in original; citing Ex. 1005 ¶¶ 16, 46, 55–57, Figs. 6A, 6B). Dr. Darrell quotes the following disclosure from Choe in support:

In one embodiment, the first image with the horizon line superimposed thereon is displayed within a first display area of a display device. When the position of the horizon line is updated, the first image is updated on the first display area to update the position of the horizon line to give a visual feedback to a user.

Ex. 1005 ¶ 16, *quoted in* Ex. 1003 ¶ 100. Dr. Darrell further testifies that “[a] video having the horizon line superimposed thereon (even if the overlay is on a single frame) is ‘an overlaid video.’” Ex. 1003 ¶ 102. This testimony shows that Choe discloses overlaying the horizon line on a single frame, not on a set of image frames, which the claim requires for the recited video.

Petitioner argues that, even if “Choe does not explicitly disclose an overlaid ‘video,’” a person of ordinary skill in the art “would have found it obvious that a collection of video frames having the horizon line superimposed thereon is an overlaid ‘video.’” Pet. 29 (citing Ex. 1003 ¶ 103). The problem with this argument is that Choe does not disclose *the* horizon line superimposed on multiple video frames. As discussed above, Figures 6A and 6B show two different examples of horizon lines, not the same horizon line on two frames.

At oral argument, Petitioner’s counsel explained, with respect to Figures 6A and 6B, that “the horizon line on the multiple image frames is the same horizon line because in paragraph 49, the annotator is moving that horizon line with respect to those images, uses the up and down arrow keys.” Tr. 49:1–8; *see also* Tr. 49:15–21 (APJ Question: “[A]re you saying that line started the same and those two images show what the manual adjuster did?”; Counsel’s Answer: “That’s correct, because it shows the change of the horizon line on those images.”).¹⁰

¹⁰ Petitioner’s counsel also indicated that requiring the same horizon line to be overlaid on the video was a new argument by Patent Owner at the hearing. *See* Tr. 49:1–3 (“And with respect to this argument about having -- needing the same horizon line on both image frames, I’m not sure that that argument has been preserved in the briefing.”). Petitioner’s contentions, however, consistently identify a single horizon line as teaching the claimed subject matter. *See, e.g.,* Pet. 27 (“These sensor calibration algorithms/models predict the initial horizon line before manual calibration.”), 29 (“In Choe, the initial horizon line is superimposed on the image Even if not explicit, a [person of ordinary skill in the art] would have found it obvious that a collection of video frames having *the* horizon line superimposed thereon is an overlaid ‘video.’” (emphasis added)). Patent Owner was entitled to rely on the Petition’s presentation of evidence and arguments. *See Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3))

We do not agree with Petitioner that Figures 6A and 6B show the result of the manual adjustment such that there was only one horizon line overlaid. Choe describes that, “[i]n response to the input provided by the user, modules 411-413 adjust certain parameters, *render the images again*, and display the updated images on display device 405.” Ex. 1005 ¶ 47 (emphasis added). It further discloses that, “[w]hen the position of the horizon line is updated, *the first image is rendered again* in view of the input signal and updated on the first display area as part of 2D view 411 to update the position of the horizon line to give a visual feedback to a user.” Ex. 1005 ¶ 50 (emphasis added). If the “first image” were rendered again, then it would be the same frame with the horizon line at a different position. Instead, Figures 6A and 6B show different frames, which means they are not the same image rendered again with an updated horizon line, as Petitioner suggested at oral argument.

The following disclosure in Choe’s paragraphs 15–16 confirms this understanding:

According to one embodiment, in response to a first image captured by a camera of an ADV, a horizon line is determined based on the camera’s hardware settings. The horizon line represents a vanishing point from a view point of the ADV based on an initial or default pitch angle of the camera. One or more lane lines are determined based on the first image via a perception process performed on the first image. *In response to a first input signal (e.g., an up or down arrow key) received from an input device (e.g., keyboard, joystick, voice interactive*

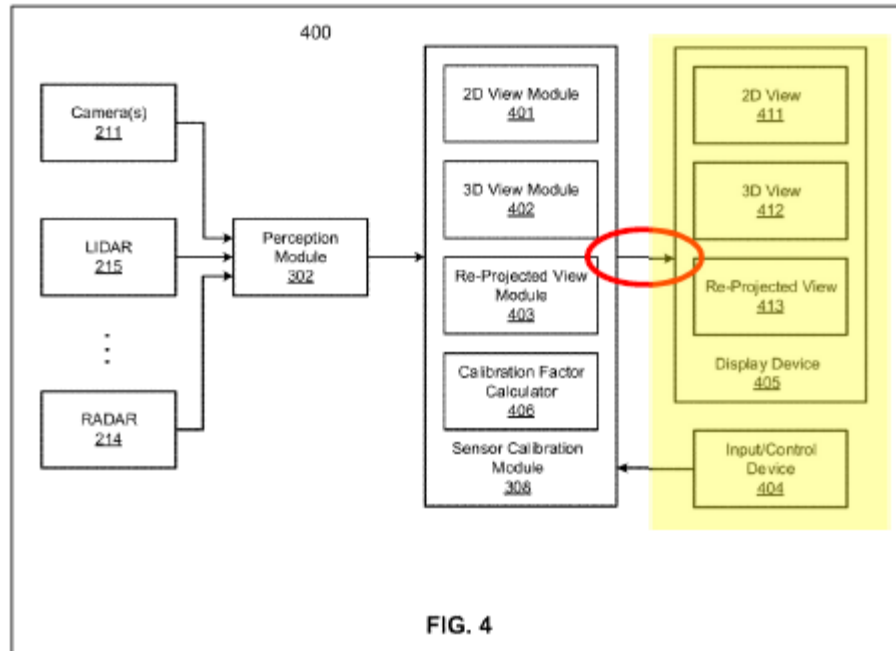
(“It is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the initial petition identify ‘with particularity’ the ‘evidence that supports the grounds for the challenge to each claim.’”).

command), *a position of the horizon line is updated* based on the first input signal and a position of at least one of the lane lines is updated based on the updated horizon line. The input signal may represent an incremental adjustment for adjusting the position of the horizon line. A first calibration factor or first correction value is determined for calibrating a pitch angle of the camera based on a difference between the initial horizon line and the updated horizon line.

In one embodiment, the first image with the horizon line superimposed thereon is displayed within a first display area of a display device. When the position of the horizon line is updated, *the first image is updated* on the first display area to update the position of the horizon line to give a visual feedback to a user.

Ex. 1005 ¶¶ 15–16 (emphasis added); *see* Ex. 1003 ¶ 100 (citing Ex. 1005 ¶ 16). This passage discloses that updating the horizon line in response to user input involves updating the image, not rendering the updated horizon line on a new image or frame of the video.

Furthermore, even if the overlaid frame is part of a video such that the overlaying of the line on only one frame “generate[s] an overlaid video” (*see* Ex. 1003 ¶ 102), Petitioner has not shown that Choe discloses “transmitting the overlaid video to an annotator device for manual review” (limitation 1E). For limitation 1E, Petitioner refers to the annotated version of Choe’s Figure 4 below.



Pet. 31. Choe’s Figure 4 above, as annotated by Petitioner, illustrates a sensor calibration system showing an arrow going from sensor calibration module 308 to display device 405. Ex. 1005 ¶ 45. Petitioner includes a red oval around the arrow and argues that “the captured video with the initial overlaid horizon and lane lines is first transmitted to the sensor calibration module 308” and “then transmitted (shown . . . with the red arrow) to the annotator device, e.g., elements 404, 405, 411, 412, and/or 413 (highlighted . . . in yellow).” Pet. 31 (citing Ex. 1005 ¶¶ 45–54, Fig. 4; Ex. 1003 ¶ 105). Dr. Darrell provides the same explanation. Ex. 1003 ¶ 105.

Choe’s Figures 6A and 6B are screenshots of the user interface on display device 405, i.e., the results of transmissions to the annotator device. See Pet. 30 (“Figure 6A and related text show the GUI on display 405 instructs the user how to perform manual calibration with a keyboard: ‘Manual Calibration: Pitch (up/down) Yaw (left/right) Roll (SH+left/right).’”). As discussed above, Figures 6A and 6B show single frame analysis, not multiple frames of an overlaid video. Thus, the alleged

transmitting represented by the arrow involves a single overlaid frame, not multiple frames with the horizon line overlaid.

At oral argument, Petitioner's counsel further explained Petitioner's position as follows:

[T]he horizon line of where it has been initially predicted or identified, that's going to be in all the image frames. And then when the annotator is adjusting with respect to one frame, it's going to move them all. I think that's consistent with what Choe explains with respect to the overlaying happening before it reaches the annotation device.

Tr. 50:10–15. Even assuming, however, that Choe overlays a determined horizon line on all images in a video, which we do not find disclosed in Choe, we still find no disclosure in Choe of transmitting multiple frames of the video, with that horizon line overlaid, to the annotator device.¹¹ As discussed above, the manual annotation process is performed on a single image. The purpose of the manual annotation process is to generate calibration information for the sensors, as Petitioner asserts: “In Choe, after the manual calibration, the data representing at least one camera parameter (e.g., calibration factors or parameters for calibrating the pitch, yaw, and roll of camera 211) is transmitted to the camera 211.” Pet. 33 (citing Ex. 1003 ¶¶ 111–112; Ex. 1005 ¶¶ 31, 44, 47). Petitioner does not direct us to disclosure in Choe that teaches the manual adjustment happening on a video stream of multiple frames, as opposed to a single frame as disclosed in each of Figures 6A and 6B.

¹¹ At oral argument, Petitioner's counsel confirmed that Petitioner never argued that a video in the claim could be a set of one image frame. Tr. 10:26–11:5.

Choe's Figure 7, below, is further evidence that the manual calibration process operates on an image, rather than on a video, i.e., multiple frames.

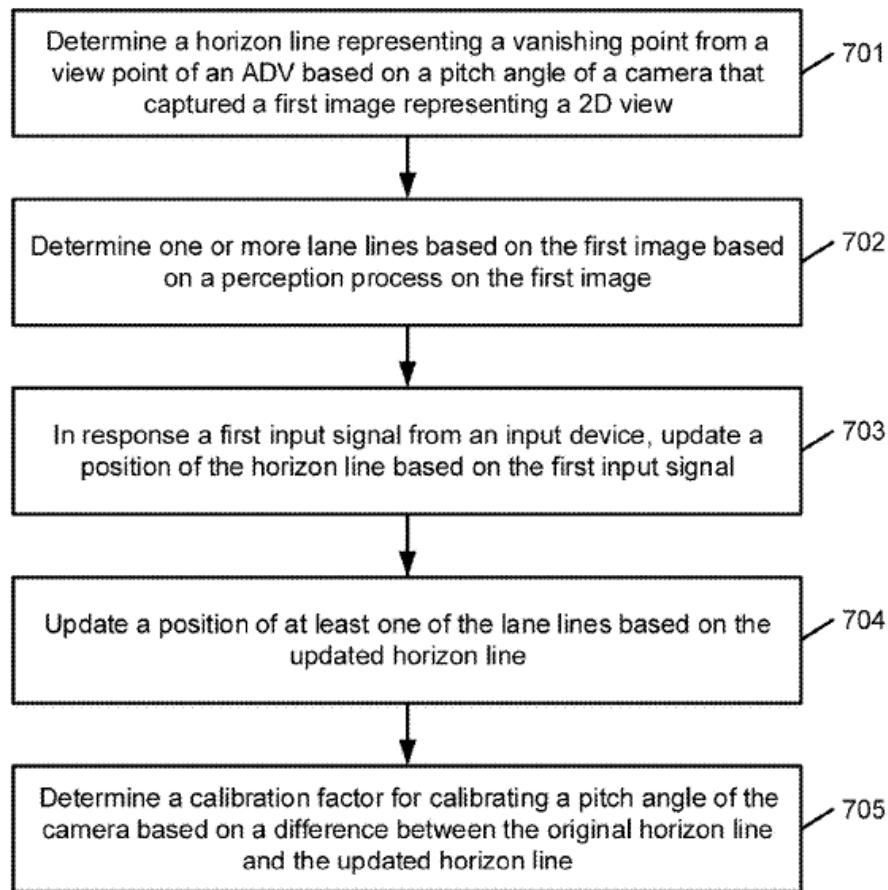


FIG. 7

Figure 7 above is a flow diagram illustrating a process for calibrating sensors. Ex. 1005 ¶ 59.

[A]t block 701, processing logic determines a horizon line representing a vanishing point from a view point of the ADV based on a pitch angle of a camera that captured a first image. The first image represents a 2D view from the view point of the ADV. At block 702, processing logic determines one or more lane lines based on the first image based on a perception process on the first image. In response to a first input signal received from an input device, at block 703, the position of the horizon line is updated based on the first input signal. At block 704, a

position of at least one of the lane lines is updated based on the updated horizon line. At block 705, processing logic determines a calibration factor or parameter for calibrating a pitch angle of the camera based on the difference between the initial horizon line and the updated horizon line.

Ex. 1005 ¶ 59. The calibration factor for the camera is based on the difference between the initial horizontal line and the updated horizontal line in the image reviewed. Even if the updated horizontal line were subsequently placed on multiple frames, as alleged by Petitioner (Tr. 50:10–15), it is not readily apparent why such video would be transmitted to the annotator device once the calibration process is finished.

We note that claim 6 recites “receiving, over the network from the camera device, a second video comprising a second set of images” and “transmitting the second video to the annotator device for manual review.” Petitioner argues (in its asserted ground based on Choe and Westmacot) that “Choe performs its process multiple times because the camera must be ‘periodically’ calibrated.” Pet. 63–64 (citing Ex. 1005 ¶ 3 (“such sensors require periodically calibrated to make sure the accuracy of the sensors”)). Petitioner refers back to its contentions for claim 1 and argues that “Choe performs the same step with ‘the second video’ because it calibrates the camera multiple times.” Pet. 64 (citing Ex. 1003 ¶ 187). These arguments are consistent with the understanding that the calibration process, such as shown in Figure 7, is run again with a new image when calibration is needed, obviating the need for transmitting to the annotator device a video with the corrected horizon line after the calibration process has ended.

For the reasons explained above, the evidence before us shows that Choe’s calibration process involves the transmission of a single overlaid image to an annotator device each time the calibration process is performed.

Petitioner also argues that, “[i]n the event [Patent Owner] argues that ‘video’ or ‘overlaid video’ is not explicit in Choe, these features are at least obvious in view of Choe’s teachings about predicting the horizon and lane lines on video ‘frames’ / ‘images.’” Pet. 24 (citing Ex. 1003 ¶ 79). In support of this proposition, Dr. Darrell testifies as follows: “Choe discloses every element in claims 1-4. However, if Choe does not explicitly disclose ‘video’ and ‘overlaid video,’ these features would have been at least obvious in view of Choe’s teachings about processing ‘frames’ (e.g., Figures 6A and 6B, disclosing frame ids 1109 and 1110).” Ex. 1003 ¶ 79. Similarly, Dr. Darrell states, without support or further explanation, that “to the extent a collection of overlaid video frames is not an overlaid video, it would have been obvious to combine the frames to form an overlaid video.” Ex. 1003 ¶ 103. Petitioner’s contentions and Dr. Darrell’s testimony are not sufficiently developed to persuade us of the obviousness of limitations 1D and 1E in light of Choe’s disclosure of single image analysis discussed above. As the discussion above shows, there is no apparent reason in Choe to transmit to the annotator device a video with the corrected horizon line after the calibration process has ended.

Based on the foregoing, we are not persuaded that Petitioner has shown that Choe teaches, suggests, or otherwise renders obvious limitations 1D and 1E. Petitioner’s challenges to dependent claims 2–4 do not cure the deficiencies noted with respect to independent claim 1. Therefore, Petitioner

has not demonstrated unpatentability of claims 1–4 by a preponderance of the evidence.

*E. Obviousness over Choe, Khan, and Ali
(Claims 1–5)*

Petitioner asserts that claims 1–5 would have been obvious over the combined teachings of Choe, Khan, and Ali. Pet. 35–46; Pet. Reply 15–25. Petitioner introduces this ground as follows:

[Patent Owner] may allege that Choe does not explicitly disclose which predictive models it uses. A [person of ordinary skill in the art] would have therefore searched for references that use predictive models for horizon and lane detection. EX1003, ¶121. This would have led to Khan and Ali, which disclose predictive models for horizon and lane detection. EX1003, ¶121. Pet. 36. Petitioner further argues that, “[a]s Ground 1 explains, Choe discloses (or at least suggests) every element of claims 1-4. However, if [Patent Owner] alleges that Choe fails to explicitly describe its ‘predictive models,’ Khan in view of Ali provide this teaching.” Pet. 41 (citing Ex. 1003 ¶ 132).

Patent Owner argues that this ground relies exclusively on Choe to teach certain limitations of claim 1, including limitations 1D and 1E, and, therefore, this ground does not cure the deficiencies of the ground based on Choe alone. PO Resp. 31.

Petitioner, however, argues that, for this ground, it “relied on Choe-Khan/Ali for every limitation because, under obviousness, grounds of unpatentability are based on combinations—not references in isolation.” Pet. Reply 20–21 (citing *In re Keller*, 642 F.2d 413 (CCPA 1981); Pet. 36–46). According to Petitioner, “Choe-Khan/Ali would receive a video over a network and then use a predictive model to identify a horizon line in the video because Khan/Ali—like Choe—performs its process on a

video,” and “Choe-Khan/Ali would compute a camera parameter based on the identified lines because Khan/Ali computes camera parameters using the same equations as the ’580 patent.” Pet. Reply 21.

We agree with Patent Owner that Petitioner’s contentions in this ground do not cure the issues for limitations 1D and 1E. Petitioner’s contentions in this ground involve combining Khan and Ali’s teachings of identifying a horizon line and lane lines with Choe. For example, Petitioner argues that “[u]sing predictive models for Choe’s lane and horizon prediction would have combined known elements according to known methods to yield predictable results” and that “[i]mplementing these known mathematical models in Choe’s calibration system, according to their known functions, would have yielded predictable results.” Pet. 39. Petitioner further argues that “[u]sing predictive models for Choe’s lane and horizon prediction would have used a known technique (predictive models) to improve similar devices in the same way” and that “[u]sing predictive models for Choe’s lane and horizon prediction would have also applied a known technique (predictive models) to a known device (a manual annotator device) ready for improvement.” Pet. 40.

Petitioner’s proposed combination, therefore, still relies on Choe’s teachings of transmitting an overlaid image to an annotator device. We note that Petitioner asserts that, “[o]nce Khan in view of Ali identifies the horizon and lane lines, it overlays the horizon line and/or lane lines on the video, as shown in the screenshots below.” Pet. 41–42. Although Petitioner mentions Khan and Ali’s teachings with respect to video here, Petitioner does not adequately explain how the teaching of an overlaid video would be combined with Choe’s single image annotator teachings. As discussed above, Choe discloses transmitting a single overlaid image to the annotator

device for manual manipulation, and Petitioner's contentions in this ground focus on "using the predictive models in Khan in view of Ali for Choe's camera calibration system" (Pet. 44), not on modifying Choe's single image analysis system to be a multi-frame video annotator.

Thus, Petitioner has not provided sufficient evidence and argument to explain how the additional teachings of Khan and Ali teach limitations 1D and 1E in combination with Choe. Petitioner, therefore, has not demonstrated unpatentability of claims 1–5 by a preponderance of the evidence.

*F. Obviousness over Choe and Workman
(Claims 1–4)*

Petitioner asserts that claims 1–4 would have been obvious over the combined teachings of Choe and Workman. Pet. 47–52; Pet. Reply 26–30. Petitioner asserts that, "if [Patent Owner] alleges that Choe does not explicitly disclose which predictive models it uses or whether it uses predictive models to identify the horizon line, a [person of ordinary skill in the art] would have searched for references that use predictive models and how such models were used," which "would have led to Workman, which discloses predictive models to identify the horizon line." Pet. 47. According to Petitioner, "[u]sing Workman's predictive model to identify the horizon line would also have merely been combining known elements ([convolutional neural networks (CNNs)] and annotation for camera calibration) according to known methods to yield predictable results and used known techniques (CNNs) to improve similar devices in the same way." Pet. 48–49. Thus, Petitioner relies on Workman to teach a predictive model to identify a horizon line. *See* Pet. 47–49.

Petitioner's contentions in this ground do not cure the deficiency of Choe with respect to limitations 1D and 1E. Indeed, Workman involves horizon line estimation in single images. *See* Ex. 1011, 10 (§ 5) (“We introduced *Horizon Lines in the Wild* (HLW), a new dataset for single image horizon line estimation, to address the limitations of existing horizon line detection datasets.”). Petitioner, therefore, has not demonstrated unpatentability of claims 1–4 by a preponderance of the evidence.

*G. Obviousness over Choe and Westmacot
(Claims 5–7)*

Petitioner asserts that claims 5–7 would have been obvious over the combined teachings of Choe and Westmacot. Pet. 51–73; Pet. Reply 30–32. Petitioner does not rely on Westmacot for any subject matter in claim 1. *See* Pet. 61–73 (analyzing claims 5–7). For the limitation of claim 6 reciting “transmitting the second video to the annotator device for manual review,” Petitioner relies on Choe, referring to its contentions for limitation 1E (“transmitting the overlaid video to an annotator device for manual review”). Pet. 64 (citing Pet. § V.A.6 (addressing limitation 1E)). Therefore, Westmacot does not cure the deficiencies noted with respect to claim 1. Thus, Petitioner has not demonstrated unpatentability of claims 5–7 by a preponderance of the evidence.

*H. Additional Obviousness Combinations with Westmacot
(Claims 1–7)*

Petitioner asserts that claims 1–7 would have been obvious over the combined teachings of Choe, Westmacot, Khan, and Ali and over the combined teachings of Choe, Westmacot, and Workman. Pet. 73–75. These grounds are combinations of the Choe obviousness ground with other grounds and do not cure the deficiencies of Petitioner's contentions with

respect to limitations 1D and 1E. *See* Pet. 73 (“[T]o the extent [Patent Owner] argues that Choe-Westmacot does not explicitly disclose the predictive models, Khan and Ali provide this teaching.”), 74–75 (“To the extent the Choe-Westmacot combination does not explicitly disclose which predictive models it uses, a [person of ordinary skill in the art] would have searched for references that use predictive models for horizon and lane detection.”). Petitioner, therefore, has not demonstrated unpatentability of claims 1–7 by a preponderance of the evidence.

III. CONCLUSION

For the reasons discussed above, we determine that Petitioner has not proven, by a preponderance of the evidence, that claims 1–7 of the ’580 patent are unpatentable, as summarized in the following table:

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
1–4	103	Choe		1–4
1–5	103	Choe, Khan, Ali		1–5
1–4	103	Choe, Workman		1–4
5–7	103	Choe, Westmacot		5–7
1–7	103	Choe, Westmacot, Khan, Ali		1–7
1–7	103	Choe, Westmacot, Workman		1–7
Overall Outcome				1–7

IV. ORDER

Accordingly, it is

ORDERED that claims 1–7 of the ’580 patent have not been shown to be unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, 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.

IPR2025-00574
Patent 11,875,580 B2

FOR PETITIONER:

Jason Eisenberg
Tyler Dutton
Jean Selep
STERNE, KESSLER, GOLDSTEIN & FOX PLLC
jasone-ptab@sternekessler.com
tdutton-ptab@sternekessler.com
jselep-ptab@sternekessler.com

FOR PATENT OWNER:

Hector Ribera
Chien-Ju Chuang
Carolyn Chang
Ryan Marton
MARTON RIBERA SCHUMANN & CHANG LLP
hector@martonribera.com
cjalice@martonribera.com
carolyn@martonribera.com
ryan@martonribera.com