Motive Technologies Inc.

Patent Owner

May 27, 2026

IPR2025-00574

U.S. Patent No. 11,875,580

Institution Should be Withdrawn

INCONSISTENT CLAIM CONSTRUCTIONS

D. Claim Construction

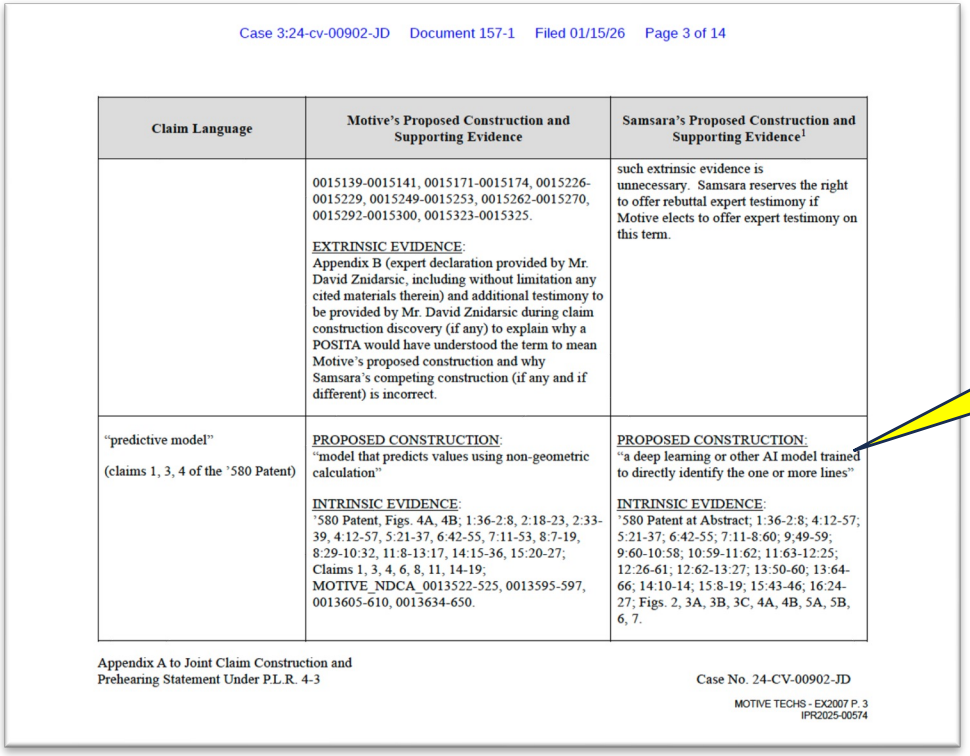
Samsara has construed the terms according to their ordinary and customary meanings as understood by a POSA in view of the specification. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2005). No term needs an explicit construction to resolve the controversy between the parties. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

Pet. at 8

PO Sur Reply at 1 and 4

INCONSISTENT CLAIM CONSTRUCTIONS

Predictive Model



Case 3:24-cv-00902-JD Document 157-1 Filed 01/15/26 Page 3 of 14

Claim Language	Motive's Proposed Construction and Supporting Evidence	Samsara's Proposed Construction and Supporting Evidence[1]
	0015139-0015141, 0015171-0015174, 0015226-0015229, 0015249-0015253, 0015262-0015270, 0015292-0015300, 0015323-0015325. EXTRINSIC EVIDENCE: Appendix B (expert declaration provided by Mr. David Znidarsic, including without limitation any cited materials therein) and additional testimony to be provided by Mr. David Znidarsic during claim construction discovery (if any) to explain why a POSITA would have understood the term to mean Motive's proposed construction and why Samsara's competing construction (if any and if different) is incorrect.	such extrinsic evidence is unnecessary. Samsara reserves the right to offer rebuttal expert testimony if Motive elects to offer expert testimony on this term.
"predictive model" (claims 1, 3, 4 of the '580 Patent)	PROPOSED CONSTRUCTION: "model that predicts values using non-geometric calculation" INTRINSIC EVIDENCE: '580 Patent, Figs. 4A, 4B; 1:36-2:8, 2:18-23, 2:33-39, 4:12-57, 5:21-37, 6:42-55, 7:11-53, 8:7-19, 8:29-10:32, 11:8-13:17, 14:15-36, 15:20-27; Claims 1, 3, 4, 6, 8, 11, 14-19; MOTIVE_NDCA_0013522-525, 0013595-597, 0013605-610, 0013634-650.	PROPOSED CONSTRUCTION: "a deep learning or other AI model trained to directly identify the one or more lines" INTRINSIC EVIDENCE: '580 Patent at Abstract; 1:36-2:8; 4:12-57; 5:21-37; 6:42-55; 7:11-8:60; 9;49-59; 9:60-10:58; 10:59-11:62; 11:63-12:25; 12:26-61; 12:62-13:27; 13:50-60; 13:64-66; 14:10-14; 15:8-19; 15:43-46; 16:24-27; Figs. 2, 3A, 3B, 3C, 4A, 4B, 5A, 5B, 6, 7.

Appendix A to Joint Claim Construction and Prehearing Statement Under P.L.R. 4-3

Case No. 24-CV-00902-JD

MOTIVE TECHS - EX2007 P. 3
IPR2025-00574

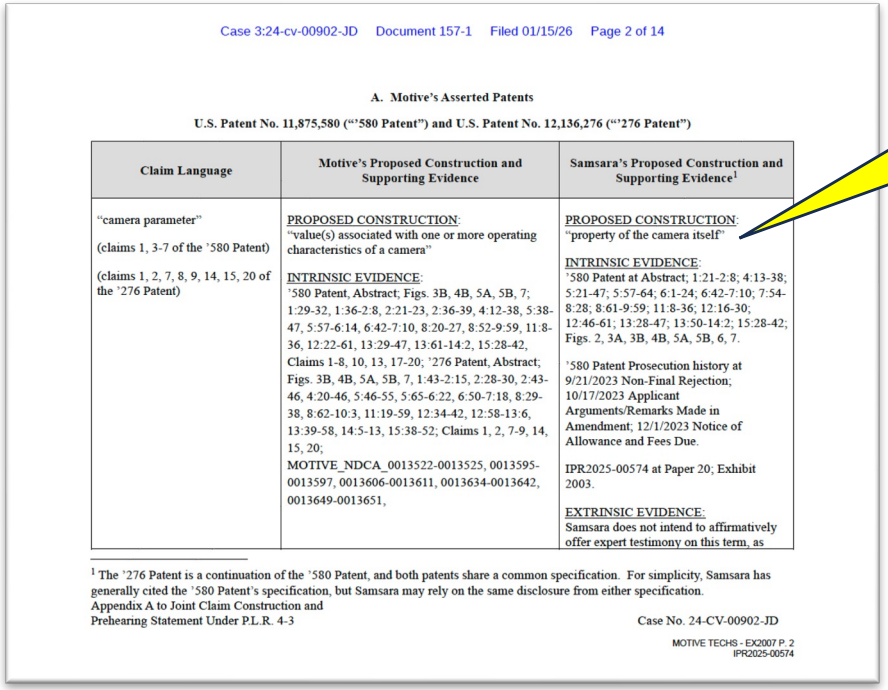
PROPOSED CONSTRUCTION:
"a deep learning or other AI model trained to directly identify the one or more lines"

EX 2007, p. 3

PO Sur Reply at 1, 4 and 12

INCONSISTENT CLAIM CONSTRUCTIONS

Camera Parameter



Case 3:24-cv-00902-JD Document 157-1 Filed 01/15/26 Page 2 of 14

A. Motive's Asserted Patents

U.S. Patent No. 11,875,580 ("'580 Patent") and U.S. Patent No. 12,136,276 ("'276 Patent")

Claim Language	Motive's Proposed Construction and Supporting Evidence	Samsara's Proposed Construction and Supporting Evidence[1]
"camera parameter" (claims 1, 3-7 of the '580 Patent) (claims 1, 2, 7, 8, 9, 14, 15, 20 of the '276 Patent)	PROPOSED CONSTRUCTION: "value(s) associated with one or more operating characteristics of a camera" INTRINSIC EVIDENCE: '580 Patent, Abstract; Figs. 3B, 4B, 5A, 5B, 7; 1:29-32, 1:36-2:8, 2:21-23, 2:36-39, 4:12-38, 5:38-47, 5:57-6:14, 6:42-7:10, 8:20-27, 8:52-9:59, 11:8-36, 12:22-61, 13:29-47, 13:61-14:2, 15:28-42, Claims 1-8, 10, 13, 17-20; '276 Patent, Abstract; Figs. 3B, 4B, 5A, 5B, 7, 1:43-2:15, 2:28-30, 2:43-46, 4:20-46, 5:46-55, 5:65-6:22, 6:50-7:18, 8:29-38, 8:62-10:3, 11:19-59, 12:34-42, 12:58-13:6, 13:39-58, 14:5-13, 15:38-52; Claims 1, 2, 7-9, 14, 15, 20; MOTIVE_NDCA_0013522-0013525, 0013595-0013597, 0013606-0013611, 0013634-0013642, 0013649-0013651,	PROPOSED CONSTRUCTION: "property of the camera itself" INTRINSIC EVIDENCE: '580 Patent at Abstract; 1:21-2:8; 4:13-38; 5:21-47; 5:57-64; 6:1-24; 6:42-7:10; 7:54-8:28; 8:61-9:59; 11:8-36; 12:16-30; 12:46-61; 13:28-47; 13:50-14:2; 15:28-42; Figs. 2, 3A, 3B, 4B, 5A, 5B, 6, 7. '580 Patent Prosecution history at 9/21/2023 Non-Final Rejection; 10/17/2023 Applicant Arguments/Remarks Made in Amendment; 12/1/2023 Notice of Allowance and Fees Due. IPR2025-00574 at Paper 20; Exhibit 2003. EXTRINSIC EVIDENCE: Samsara does not intend to affirmatively offer expert testimony on this term, as

[1] The '276 Patent is a continuation of the '580 Patent, and both patents share a common specification. For simplicity, Samsara has generally cited the '580 Patent's specification, but Samsara may rely on the same disclosure from either specification.

Appendix A to Joint Claim Construction and Prehearing Statement Under P.L.R. 4-3

Case No. 24-CV-00902-JD

MOTIVE TECHS - EX2007 P. 2
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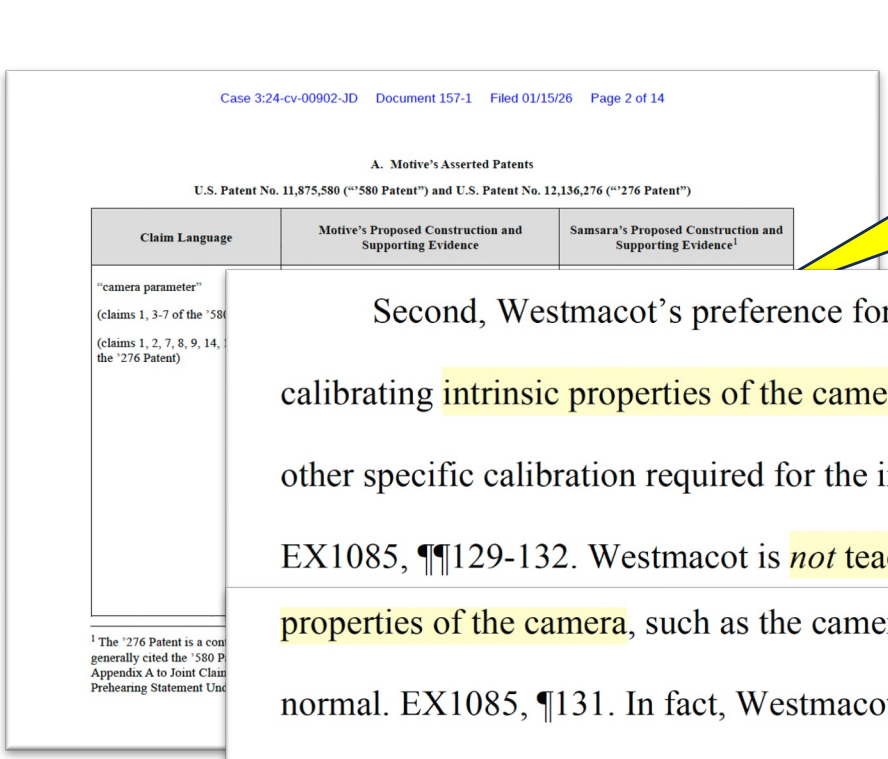
PROPOSED CONSTRUCTION:
"property of the camera itself"

EX 2007, p. 2

PO Sur Reply at 4, 9, and 23-24

INCONSISTENT CLAIM CONSTRUCTIONS

Camera Parameter


Case 3:24-cv-00902-JD Document 157-1 Filed 01/15/26 Page 2 of 14

A. Motive's Asserted Patents

U.S. Patent No. 11,875,580 ("'580 Patent") and U.S. Patent No. 12,136,276 ("'276 Patent")

Claim Language	Motive's Proposed Construction and Supporting Evidence	Samsara's Proposed Construction and Supporting Evidence[1]
"camera parameter" (claims 1, 3-7 of the '58 (claims 1, 2, 7, 8, 9, 14, the '276 Patent)		

[1] The '276 Patent is a con generally cited the '580 P Appendix A to Joint Clai Prehearing Statement Unc

PROPOSED CONSTRUCTION:
"property of the camera itself"

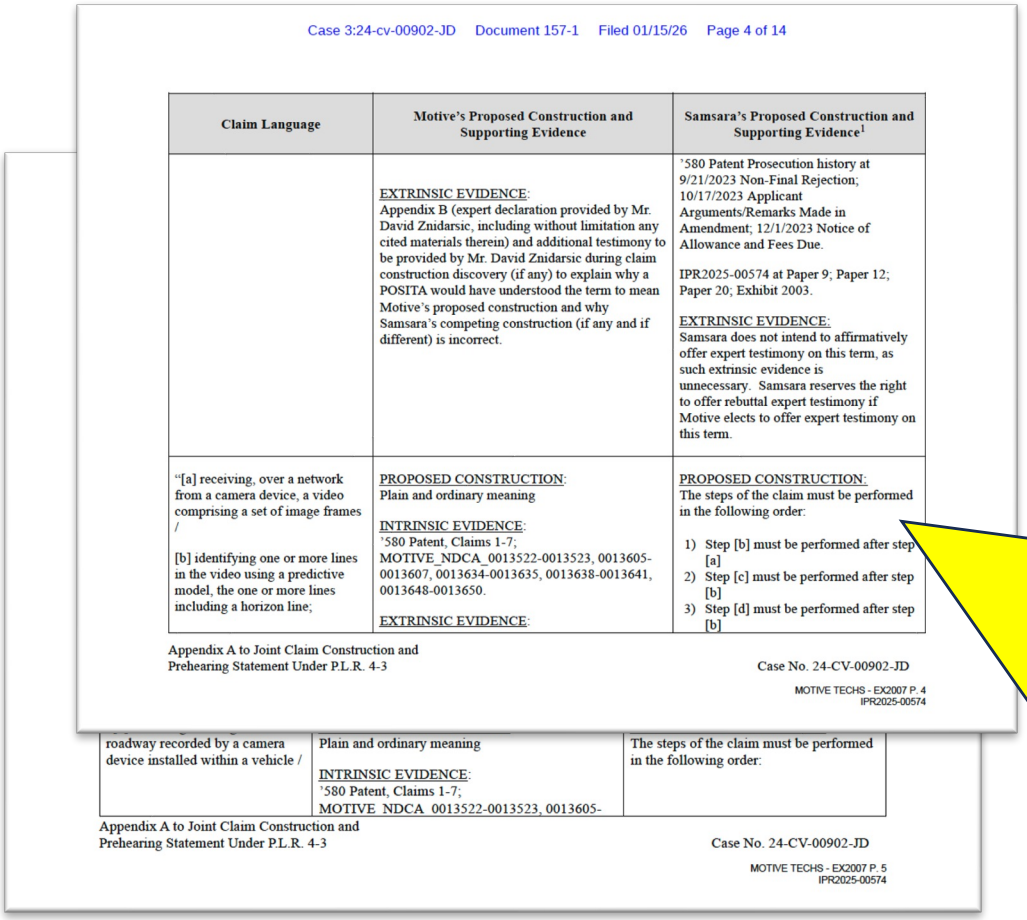
Second, Westmacot's preference for not requiring calibration is specific to calibrating intrinsic properties of the camera, such as the camera's focal length and other specific calibration required for the internal characteristics of a camera. EX1085, ¶¶129-132. Westmacot is *not* teaching away from calibrating extrinsic properties of the camera, such as the camera's pose relative to the road plane normal. EX1085, ¶131. In fact, Westmacot explicitly states systems should "measur[e] a relative rotational orientation of an image capture device within a vehicle." EX1010, 9:4-5.

Reply at 30-31

PO Sur Reply at 4, 9, and 23-24

INCONSISTENT CLAIM CONSTRUCTIONS

Order of the Steps



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Claim Language	Motive's Proposed Construction and Supporting Evidence	Samsara's Proposed Construction and Supporting Evidence[1]
	EXTRINSIC EVIDENCE: Appendix B (expert declaration provided by Mr. David Znidarsic, including without limitation any cited materials therein) and additional testimony to be provided by Mr. David Znidarsic during claim construction discovery (if any) to explain why a POSITA would have understood the term to mean Motive's proposed construction and why Samsara's competing construction (if any and if different) is incorrect.	'580 Patent Prosecution history at 9/21/2023 Non-Final Rejection; 10/17/2023 Applicant Arguments/Remarks Made in Amendment; 12/1/2023 Notice of Allowance and Fees Due. IPR2025-00574 at Paper 9; Paper 12; Paper 20; Exhibit 2003. EXTRINSIC EVIDENCE: Samsara does not intend to affirmatively offer expert testimony on this term, as such extrinsic evidence is unnecessary. Samsara reserves the right to offer rebuttal expert testimony if Motive elects to offer expert testimony on this term.
"[a] receiving, over a network from a camera device, a video comprising a set of image frames / [b] identifying one or more lines in the video using a predictive model, the one or more lines including a horizon line;	PROPOSED CONSTRUCTION: Plain and ordinary meaning INTRINSIC EVIDENCE: '580 Patent, Claims 1-7; MOTIVE_NDCA_0013522-0013523, 0013605-0013607, 0013634-0013635, 0013638-0013641, 0013648-0013650. EXTRINSIC EVIDENCE:	PROPOSED CONSTRUCTION: The steps of the claim must be performed in the following order: 1) Step [b] must be performed after step [a] 2) Step [c] must be performed after step [b] 3) Step [d] must be performed after step [b]

Appendix A to Joint Claim Construction and Prehearing Statement Under P.L.R. 4-3

Case No. 24-CV-00902-JD

MOTIVE TECHS - EX2007 P. 4
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roadway recorded by a camera device installed within a vehicle /	Plain and ordinary meaning INTRINSIC EVIDENCE: '580 Patent, Claims 1-7; MOTIVE_NDCA_0013522-0013523, 0013605-	The steps of the claim must be performed in the following order:

Appendix A to Joint Claim Construction and Prehearing Statement Under P.L.R. 4-3

Case No. 24-CV-00902-JD

MOTIVE TECHS - EX2007 P. 5
IPR2025-00574

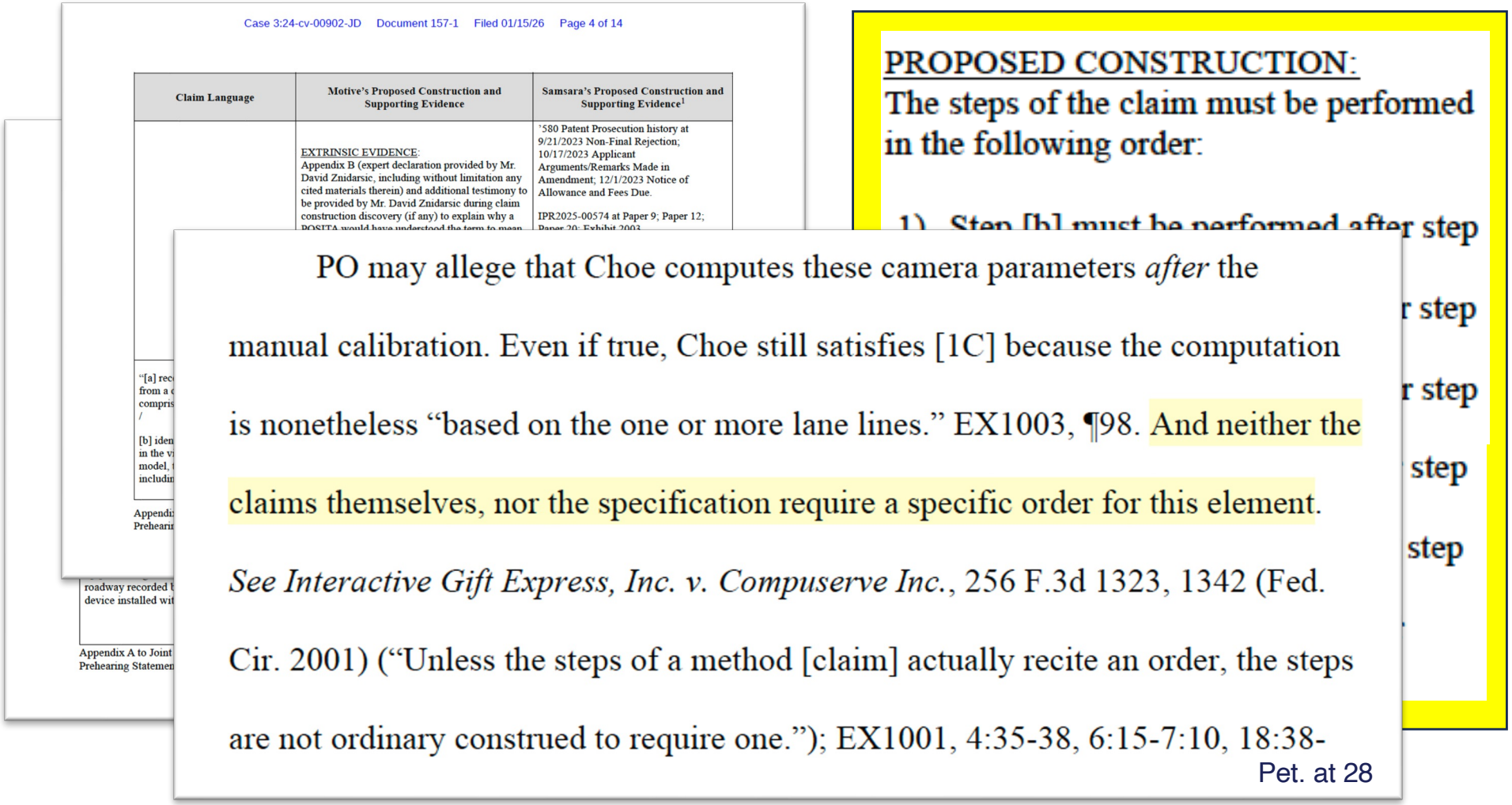
PROPOSED CONSTRUCTION:
The steps of the claim must be performed in the following order:

1) Step [b] must be performed after step [a]
2) Step [c] must be performed after step [b]
3) Step [d] must be performed after step [b]
4) Step [e] must be performed after step [d]
5) Step [f] must be performed after step [e]
6) Step [g] must be performed after steps [c] and [f]

EX 2007, p. 4-5

PO Sur Reply at 5

INCONSISTENT CLAIM CONSTRUCTIONS



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Claim Language	Motive's Proposed Construction and Supporting Evidence	Samsara's Proposed Construction and Supporting Evidence[1]
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PROPOSED CONSTRUCTION:
The steps of the claim must be performed in the following order:

1) Step [b] must be performed after step

r step

r step

step

step

PO may allege that Choe computes these camera parameters *after* the manual calibration. Even if true, Choe still satisfies [1C] because the computation is nonetheless "based on the one or more lane lines." EX1003, ¶98. And neither the claims themselves, nor the specification require a specific order for this element. *See Interactive Gift Express, Inc. v. Compuserve Inc.*, 256 F.3d 1323, 1342 (Fed. Cir. 2001) ("Unless the steps of a method [claim] actually recite an order, the steps are not ordinary construed to require one."); EX1001, 4:35-38, 6:15-7:10, 18:38-

Pet. at 28

PO Sur Reply at 4-5

SAMSARA HAS FAILED TO PROVIDE EXPLANATION

Although the Board's rules "do not necessarily prohibit petitioners from taking inconsistent claim construction positions before the Board and a district court," Cambridge Mobile, IPR2024-00942, Paper 12 at 8–9, when a petitioner advances different positions before the Board and a district court, that ***petitioner is required to explain why*** *those different positions are warranted. Revvo Techs., Inc. v. Cerebrum Sensor Techs., Inc., IPR2025- 00632, Paper 20 at 3–5 (Director Nov. 3, 2025) (precedential) (explaining the Office's approach to addressing a petitioner's different claim construction positions in two forums).*

Tesla, Inc. v. Intellectual Ventures II LLC, IPR2025-00340, Paper 18, p. 3

PO Sur Reply at 5

INSTITUTION SHOULD BE WITHDRAWN

Allowing a petitioner to advance a claim construction before the Board when that petitioner has made inconsistent indefiniteness arguments in district court fails to further, but instead detracts from, the Office's goal of "providing greater predictability and certainty in the patent system." Revvo Techs., IPR2025-00632, Paper 20 at 4–5 (quoting 83 Fed. Reg. at 51,342–43). Thus, denial of institution is appropriate in this case.

Tesla, Inc. v. Intellectual Ventures II LLC, IPR2025-00340, Paper 18, p. 4

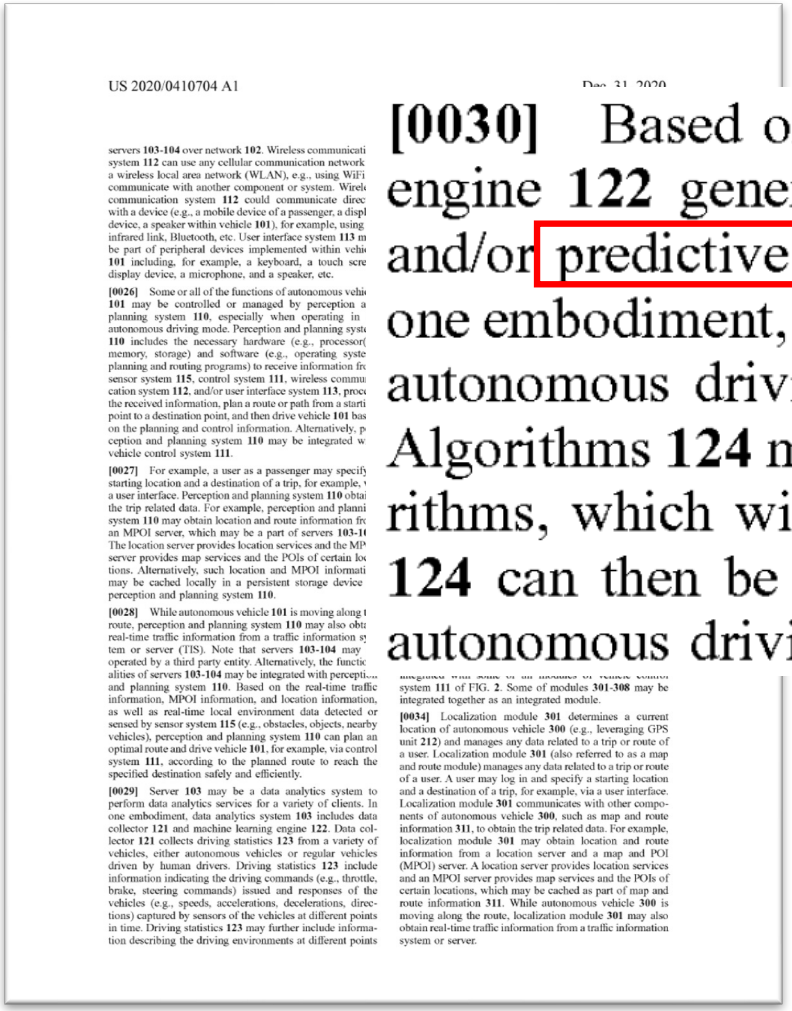
PO Sur Reply at 1 and 5

Instituted Grounds Should be Denied

ALL GROUNDS FAIL

- No horizon line determination with a predictive model in Choe or Khan/Ali
- No transmission or generation of overlaid video
- No motivation to combine Choe

CHOE'S PREDICTIVE MODEL DOES NOT PREDICT HORIZON LINES



US 2020/0410704 A1

[0030] Based on driving statistics **123**, machine learning engine **122** generates or trains a set of rules, algorithms, and/or predictive models **124** for a variety of purposes. In one embodiment, algorithms **124** may include algorithms for autonomous driving a vehicle as described further below. Algorithms **124** may further include sensor calibration algorithms, which will be described further below. Algorithms **124** can then be uploaded on ADVs to be utilized during autonomous driving in real-time.

Ex. 1005 at 13 and POR at 13.

CHOE'S PREDICTIVE MODEL DOES NOT PREDICT HORIZON LINES

90. Choe then explains how the "set of rules" are used. For example, "Decision module 304 may make such decisions according to a set of rules such as traffic rules or driving rules 312, which may be stored in persistent storage device 352." EX 1004 at [0038]. It also explains how "algorithms" are used for "autonomous driving a vehicle," for "sensor calibration," and how they can be uploaded and "utilized during autonomous driving in real-time." *Id.* at [0030]. Choe does not actually describe how "predictive models" are used for any purpose, how they may be trained, or provide any specifics about them. More importantly, nothing in Choe teaches or suggests the use of a predictive model to identify a horizon line.

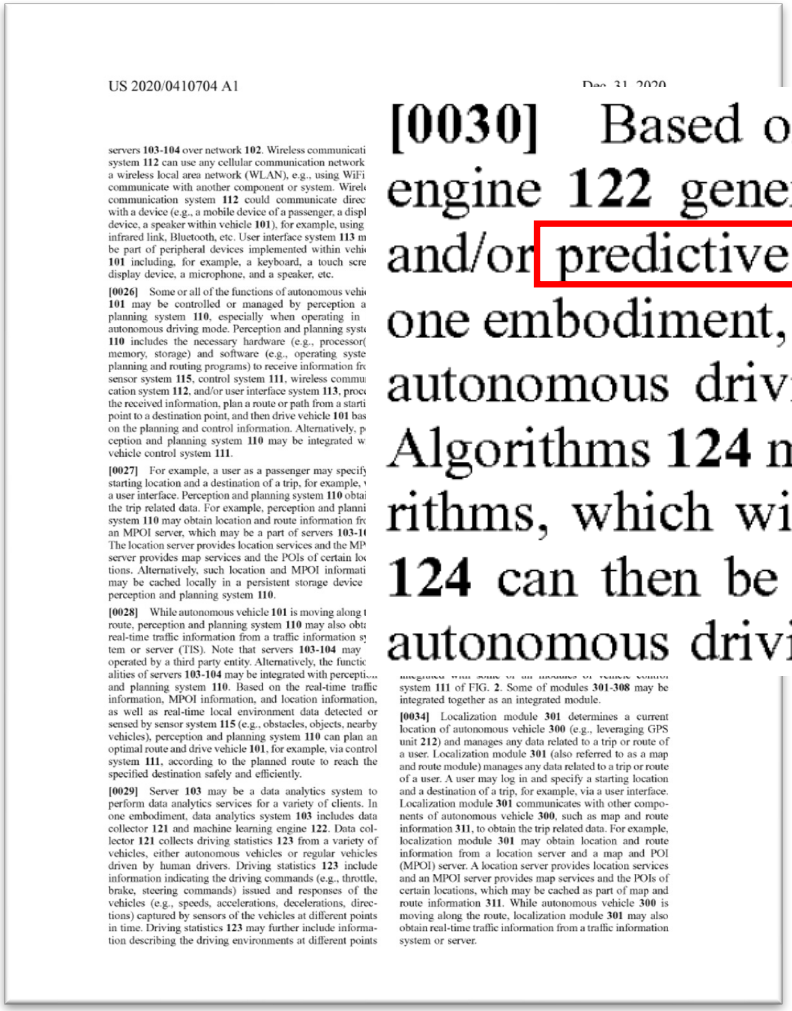
Ex. 2003 (revised) at ¶90 and POR at 13.

CHOE'S PREDICTIVE MODEL DOES NOT PREDICT HORIZON LINES

[0044] According to one embodiment, sensor calibration module or system **308** is configured to calibrate, using sensor calibration algorithms **313**, a sensor based on an image or point cloud captured by the sensor to determine a set of calibration parameters. The calibration parameters can be utilized by the software to compensate the hardware settings of the sensors during a perception process. Sensor

Ex. 1005 at 15, Ex. 2003 (revised) at ¶ 91 and POR at 13-14.

CHOE'S PREDICTIVE MODEL DOES NOT PREDICT HORIZON LINES



US 2020/0410704 A1

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Mr. Alexander: "Nothing in Choe teaches or suggests any predictive model trained to identify lines in video."

Ex. 1005 at 13, Ex 2003 (revised) at ¶ 53 and POR at 15.

CHOE'S HORIZON LINE IS NOT DETERMINED BY A PREDICTIVE MODEL

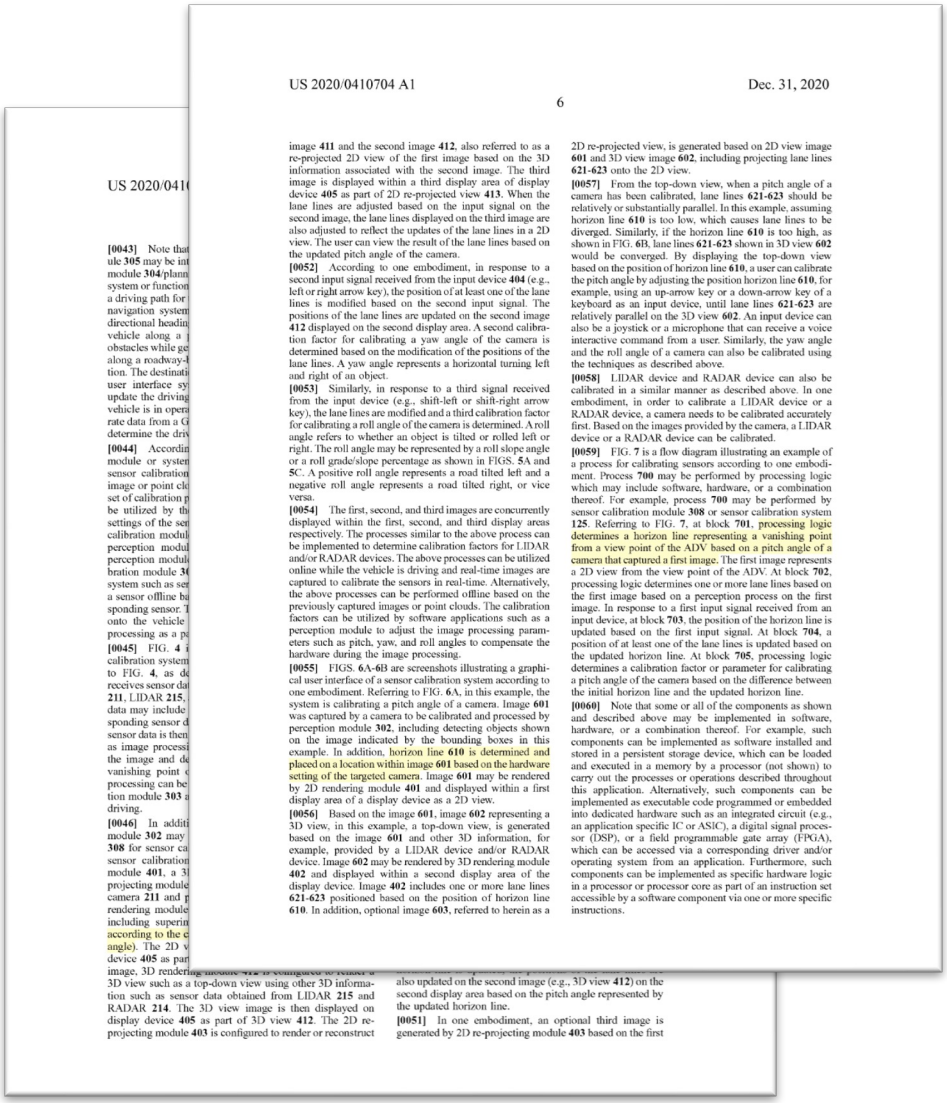

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image **411** and the second image **412**, also referred to as a re-projected 2D view of the first image based on the 3D information associated with the second image. The third image is displayed within a third display area of display device **405** as part of 2D re-projected view **413**. When the lane lines are adjusted based on the input signal on the second image, the lane lines displayed on the third image are also adjusted to reflect the updates of the lane lines in a 2D view. The user can view the result of the lane lines based on the updated pitch angle of the camera.

[0052] According to one embodiment, in response to a second input signal received from the input device **404** (e.g., left or right arrow key), the position of at least one of the lane lines is modified based on the second input signal. The positions of the lane lines are updated on the second image **412** displayed on the second display area. A second calibration factor for calibrating a yaw angle of the camera is determined based on the modification of the positions of the lane lines. A yaw angle represents a horizontal turning left and right of an object.

[0053] Similarly, in response to a third signal received from the input device (e.g., shift-left or shift-right arrow key), the lane lines are modified and a third calibration factor for calibrating a roll angle of the camera is determined. A roll angle refers to whether an object is tilted or rolled left or right. The roll angle may be represented by a roll slope angle or a roll grade/slope percentage as shown in FIGS. **5**A and **5**C. A positive roll angle represents a road tilted left and a negative roll angle represents a road tilted right, or vice versa.

[0054] The first, second, and third images are concurrently displayed within the first, second, and third display areas respectively. The processes similar to the above process can be implemented to determine calibration factors for LIDAR and/or RADAR devices. The above processes can be utilized online while the vehicle is driving and real-time images are captured to calibrate the sensors in real-time. Alternatively, the above processes can be performed offline based on the previously captured images or point clouds. The calibration factors can be utilized by software applications such as a perception module to adjust the image processing parameters such as pitch, yaw, and roll angles to compensate the hardware during the image processing.

[0055] FIGS. **6**A-**6**B are screenshots illustrating a graphical user interface of a sensor calibration system according to one embodiment. Referring to FIG. **6**A, in this example, the system is calibrating a pitch angle of a camera. Image **601** was captured by a camera to be calibrated and processed by perception module **302**, including detecting objects shown on the image indicated by the bounding boxes in this example. In addition, horizon line **610** is determined and placed on a location within image **601** based on the hardware setting of the targeted camera. Image **601** may be rendered by 2D rendering module **401** and displayed within a first display area of a display device as a 2D view.

[0056] Based on the image **601**, image **602** representing a 3D view, in this example, a top-down view, is generated based on the image **601** and other 3D information, for example, provided by a LIDAR device and/or RADAR device. Image **602** may be rendered by 3D rendering module **402** and displayed within a second display area of the display device. Image **402** includes one or more lane lines **621**-**623** positioned based on the position of horizon line **610**. In addition, optional image **603**, referred to herein as a 2D re-projected view, is generated based on 2D view image **601** and 3D view image **602**, including projecting lane lines **621**-**623** onto the 2D view.

[0057] 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. **6**B, 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**. An input device can also be a joystick or a microphone that can receive a voice interactive command from a user. Similarly, the yaw angle and the roll angle of a camera can also be calibrated using the techniques as described above.

[0058] LIDAR device and RADAR device can also be calibrated in a similar manner as described above. In one embodiment, in order to calibrate a LIDAR device or a RADAR device, a camera needs to be calibrated accurately first. Based on the images provided by the camera, a LIDAR device or a RADAR device can be calibrated.

[0059] FIG. **7** is a flow diagram illustrating an example of a process for calibrating sensors according to one embodiment. Process **700** may be performed by processing logic which may include software, hardware, or a combination thereof. For example, process **700** may be performed by sensor calibration module **308** or sensor calibration system **125**. Referring to FIG. **7**, at 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.

[0060] Note that some or all of the components as shown and described above may be implemented in software, hardware, or a combination thereof. For example, such components can be implemented as software installed and stored in a persistent storage device, which can be loaded and executed in a memory by a processor (not shown) to carry out the processes or operations described throughout this application. Alternatively, such components can be implemented as executable code programmed or embedded into dedicated hardware such as an integrated circuit (e.g., an application specific IC or ASIC), a digital signal processor (DSP), or a field programmable gate array (FPGA), which can be accessed via a corresponding driver and/or operating system from an application. Furthermore, such components can be implemented as specific hardware logic in a processor or processor core as part of an instruction set accessible by a software component via one or more specific instructions.

including superimposing a horizon line onto the image according to the camera setting (e.g., hardware preset pitch angle). The 2D view image is then displayed on display

Ex 1005 at [0046]

[0048] According to one embodiment, in response to a first image captured by a camera of an ADV, perception module **302** determines a horizon line based on the camera's hardware settings. The horizon line represents a vanishing

Ex 1005 at [0048]

example. In addition, horizon line **610** is determined and placed on a location within image **601** based on the hardware setting of the targeted camera. Image **601** may be rendered

Ex 1005 at [0055]

125. Referring to FIG. **7**, at 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

Ex 1005 at [0059]

Ex 2003 (revised) at ¶ *41* and POR at 12-13.

CHOE DOES NOT DESCRIBE RECEIVING, GENERATING, OR TRANSMITTING VIDEO

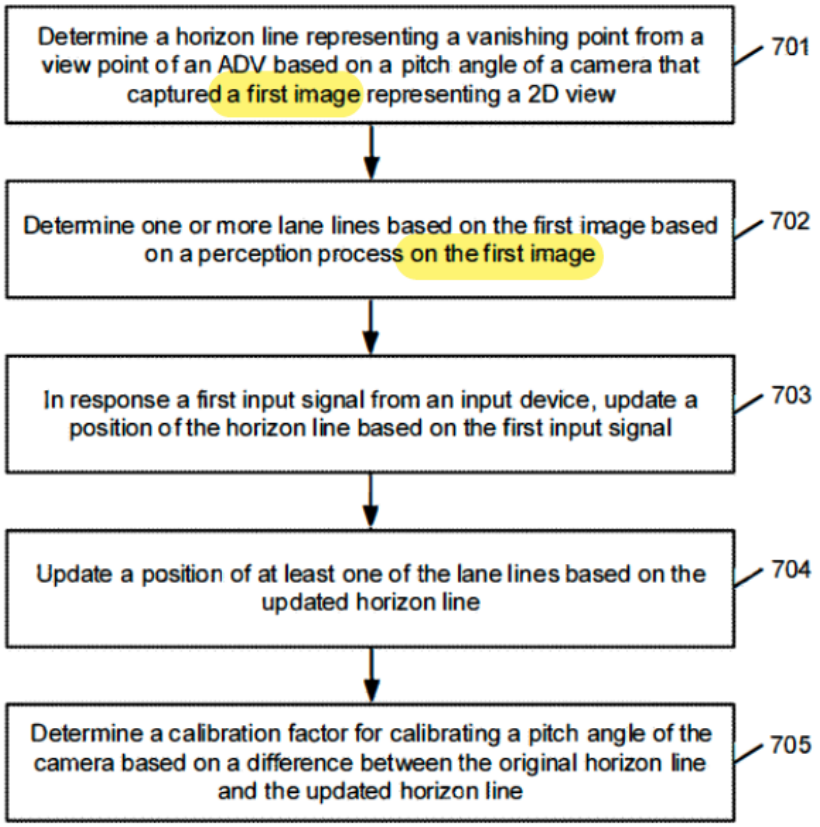


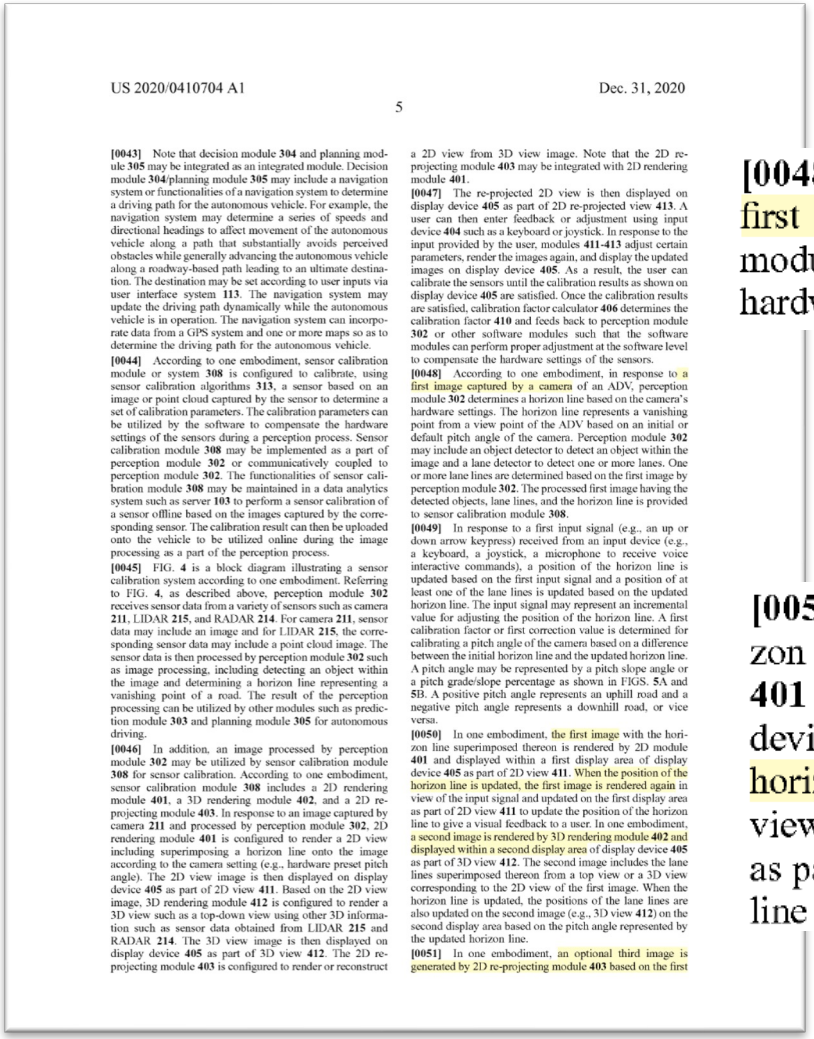
FIG. 7

Ex. 1005, Fig. 7. The initial steps of the process, 701 and 702, refer to a/the "first

Mr. Andrews: *"Choe shows its operation is based on single frames. For example, FIG. 7 shows this operation … The initial steps of the process, 701 and 702, refer to a/the 'first image.'"*

Ex 2003 (revised) at ¶ *86* and POR at 16-19.

CHOE DOES NOT DESCRIBE RECEIVING, GENERATING, OR TRANSMITTING VIDEO



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[0043] Note that decision module **304** and planning module **305** may be integrated as an integrated module. Decision module **304**/planning module **305** may include a navigation system or functionalities of a navigation system to determine a driving path for the autonomous vehicle. For example, the navigation system may determine a series of speeds and directional headings to affect movement of the autonomous vehicle along a path that substantially avoids perceived obstacles while generally advancing the autonomous vehicle along a roadway-based path leading to an ultimate destination. The destination may be set according to user inputs via user interface system **113**. The navigation system may update the driving path dynamically while the autonomous vehicle is in operation. The navigation system can incorporate data from a GPS system and one or more maps so as to determine the driving path for the autonomous vehicle.

[0044] According to one embodiment, sensor calibration module or system **308** is configured to calibrate, using sensor calibration algorithms **313**, a sensor based on an image or point cloud captured by the sensor to determine a set of calibration parameters. The calibration parameters can be utilized by the software to compensate the hardware settings of the sensors during a perception process. Sensor calibration module **308** may be implemented as a part of perception module **302** or communicatively coupled to perception module **302**. The functionalities of sensor calibration module **308** may be maintained in a data analytics system such as server **103** to perform a sensor calibration of a sensor offline based on the images captured by the corresponding sensor. The calibration result can then be uploaded onto the vehicle to be utilized online during the image processing as a part of the perception process.

[0045] FIG. **4** is a block diagram illustrating a sensor calibration system according to one embodiment. Referring to FIG. **4**, as described above, perception module **302** receives sensor data from a variety of sensors such as camera **211**, LIDAR **215**, and RADAR **214**. For camera **211**, sensor data may include an image and for LIDAR **215**, the corresponding sensor data may include a point cloud image. The sensor data is then processed by perception module **302** such as image processing, including detecting an object within the image and determining a horizon line representing a vanishing point of a road. The result of the perception processing can be utilized by other modules such as prediction module **303** and planning module **305** for autonomous driving.

[0046] In addition, an image processed by perception module **302** may be utilized by sensor calibration module **308** for sensor calibration. According to one embodiment, sensor calibration module **308** includes a 2D rendering module **401**, a 3D rendering module **402**, and a 2D re-projecting module **403**. In response to an image captured by camera **211** and processed by perception module **302**, 2D rendering module **401** is configured to render a 2D view including superimposing a horizon line onto the image according to the camera setting (e.g., hardware preset pitch angle). The 2D view image is then displayed on display device **405** as part of 2D view **411**. Based on the 2D view image, 3D rendering module **412** is configured to render a 3D view such as a top-down view using other 3D information such as sensor data obtained from LIDAR **215** and RADAR **214**. The 3D view image is then displayed on display device **405** as part of 3D view **412**. The 2D re-projecting module **403** is configured to render or reconstruct a 2D view from 3D view image. Note that the 2D re-projecting module **403** may be integrated with 2D rendering module **401**.

[0047] The re-projected 2D view is then displayed on display device **405** as part of 2D re-projected view **413**. A user can then enter feedback or adjustment using input device **404** such as a keyboard or joystick. In 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**. As a result, the user can calibrate the sensors until the calibration results as shown on display device **405** are satisfied. Once the calibration results are satisfied, calibration factor calculator **406** determines the calibration factor **410** and feeds back to perception module **302** or other software modules such that the software modules can perform proper adjustment at the software level to compensate the hardware settings of the sensors.

[0048] According to one embodiment, in response to a first image captured by a camera of an ADV, perception module **302** determines a horizon line 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. Perception module **302** may include an object detector to detect an object within the image and a lane detector to detect one or more lanes. One or more lane lines are determined based on the first image by perception module **302**. The processed first image having the detected objects, lane lines, and the horizon line is provided to sensor calibration module **308**.

[0049] In response to a first input signal (e.g., an up or down arrow keypress) received from an input device (e.g., a keyboard, a joystick, a microphone to receive voice interactive commands), 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 value 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. A pitch angle may be represented by a pitch slope angle or a pitch grade/slope percentage as shown in FIGS. **5A** and **5B**. A positive pitch angle represents an uphill road and a negative pitch angle represents a downhill road, or vice versa.

[0050] In one embodiment, the first image with the horizon line superimposed thereon is rendered by 2D module **401** and displayed within a first display area of display device **405** as part of 2D view **411**. When 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. In one embodiment, a second image is rendered by 3D rendering module **402** and displayed within a second display area of display device **405** as part of 3D view **412**. The second image includes the lane lines superimposed thereon from a top view or a 3D view corresponding to the 2D view of the first image. When the horizon line is updated, the positions of the lane lines are also updated on the second image (e.g., 3D view **412**) on the second display area based on the pitch angle represented by the updated horizon line.

[0051] In one embodiment, an optional third image is generated by 2D re-projecting module **403** based on the first

[0048] According to one embodiment, in response to a first image captured by a camera of an ADV, perception module **302** determines a horizon line based on the camera's hardware settings. The horizon line represents a vanishing

[0050] In one embodiment, the first image with the horizon line superimposed thereon is rendered by 2D module **401** and displayed within a first display area of display device **405** as part of 2D view **411**. When 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. In one embodiment,

Ex. 1005 at. 15

Ex 2003 (revised) at ¶ 86 , POR at 19-20, and PO Sur Reply at 7-10.

QUALCOMM PREVENTS USE OF EXPERT TESTIMONY TO SUPPLY MISSING VIDEO DISCLOSURE

> The PO may allege Choe does not explicitly disclose an overlaid "video." Even if not explicit, a POSA would have found it obvious that a collection of video frames having the horizon line superimposed thereon is an overlaid "video." EX1003, ¶103.
>
> Pet. at 29

"*As a practical matter, enforcement of Rule 104(b)(4) means that applicant admitted prior art (AAPA),* ***expert testimony****, common sense, and other evidence that is not 'prior art consisting of patents or printed publications' (collectively, 'general knowledge')* ***may not be used to supply a missing claim limitation***."

July 31, 2025 Memorandum from Acting Director

POR at 10, 16-17, 19, 21.

ALL GROUNDS FAIL DUE TO THE LACK OF "OVERLAID VIDEO" DISCLOSURE IN CHOE

Ground	Basis	Reference(s)	Claims
1	§103	Choe (Publication + Patent Center Figures)	1-4
2	§103	Choe, Khan, and Ali	1-5
3	§103	Choe and Workman	1-4
4	§103	Choe and Westmacot	5-7
5	§103	Choe, Westmacot, Khan, and Ali	1-7
6	§103	Choe, Westmacot, and Workman	1-7

Pet. at 10

POR at 16, 18-20, 31, 49-51, 53, and 58-59

KHAN AND ALI DO NOT TEACH USE OF PREDICTIVE MODEL TO IDENTIFY HORIZON LINE

Khan in view of Ali "identif[ies] one or more lines in the video using a predictive model, the one or more lines including a horizon line" as recited in [1B]. EX1003, ¶133. In Khan, the predictive model used to identify lane and horizon lines is called a "Mask-RCNN." EX1007, 1825; EX1003, ¶133. As known by a POSA, a Mask-RCNN is the same predictive model used in the '580 patent. EX1003, ¶133 (Mask-RCNN uses a backbone network and a network head).

Pet. at 41

[3] Motive points out Khan/Ali "take motivation from keypoint detection in Mask-RCNN." EX1007, 1825. Although Khan/Ali does not use the identical Mask-RCNN previously known in the literature, it nonetheless "uses" a CNN (a predictive model) to identify lane and horizon lines. EX1085, ¶¶72-93.

Reply at 18

Samsara admits that, contrary to what it argued in the Petition, in Khan, "Mask-RCNN" is not a predictive model used to identify lane and horizon lines.

POR at 24 and PO Sur Reply at 11

KHAN AND ALI DO NOT TEACH USE OF PREDICTIVE MODEL TO IDENTIFY HORIZON LINE

Khan in view of Ali uses this predictive model to identify lane lines and horizon lines. EX1003, ¶134. Specifically, the Mask-RCNN predicts lane boundary markers and then fit lines to the predicted keypoints. EX1007, 1825-26 ("We fit lines to predicted keypoints…."), 1828 (Algorithm 1). After lane lines are fit to the detected markers, Khan uses RANSAC (a predictive model) to predict the horizon line. EX1007, 1826-27. This predictive model for the horizon is described more fully in Ali. EX1008, 1104; *see also* EX1007, 1827 (citing EX1008).

Pet. at 41

3.2.1 Horizon Estimation

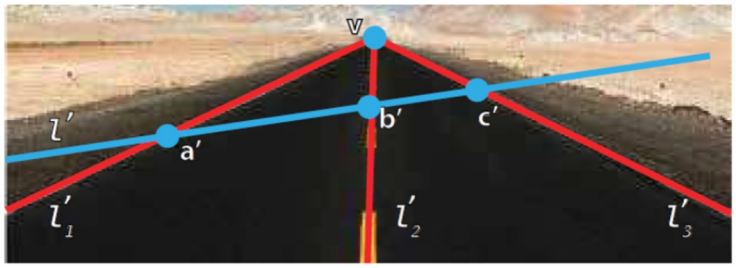
The estimation of IPM assumes a planar road scene having no elevation and more than one lanes (3 or more lane boundaries), such as a typical highway scenario. We start by fitting lines to the detected markers. A best fit line must have a minimum number of inlier markers (i.e., 25% of total number of markers for each lane boundary). Inlier markers are those having horizontal distance of under 8 pixels to the best 1st degree line fit through RANSAC [8].

Ex. 1007 at 1826 and Ex. 2003 at ¶65

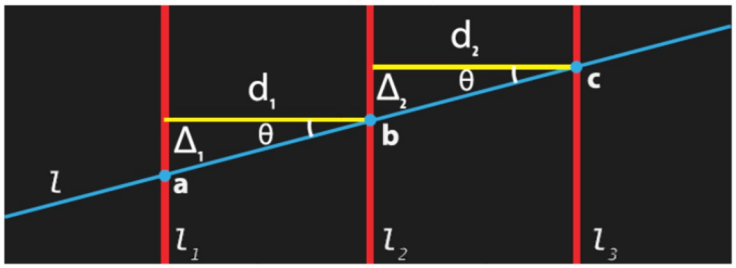
Khan uses RANSAC to define "inline markers" not to predict a horizon line

POR at 24-25 and PO Sur Reply at 11

UNDISPUTED THAT KHAN AND ALI USE GEOMETRIC APPROACH FOR HORIZON LINE



(a)



(b)

Figure 5. (a) Perspective view of road plane. Lane lines (l'_1, l'_2, and l'_3) are shown in red and an arbitrary line l' (blue) cuts all lane lines at points a', b', and c'. Forward vanishing point (V) is obtained by the cross product of any two lane lines (b) Real world top-down view of the road plane. d1and d2 are the distances between lane lines l_1, l_2 and l_2, l_3 respectively. Since all lane lines are parallel Δ_1 and Δ_2 are similar triangles which implies $\frac{ab}{bc} = \frac{d1}{d2}$

Ex. 1008 at 1104, Ex. 2003 at ¶60, POR at 25-27 and PO Sur Reply at 11

KHAN AND ALI DO NOT TEACH USE OF PREDICTIVE MODEL TO IDENTIFY HORIZON LINE

> EX1061, 34:12-21.[3] When Khan/Ali performs initialization, the output of the CNN is input into the horizon estimation step to identify the horizon line. EX1085, ¶¶88-92; EX1061, 40:8-41:15, 43:18-44:1, 46:21-25; EX1008, 1104 (Algorithm 1, "Input: Detected markers by lane detector").

Reply at 18-19

PO Sur Reply at 11-13

KHAN AND ALI DO NOT TEACH USE OF PREDICTIVE MODEL TO IDENTIFY HORIZON LINE

> First, the Applicant argued that Kwant1 did not predict a horizon line but instead predicted *lane lines* and then used a geometric approach to identify the horizon line. EX1002, 0145. In contrast, the Grounds identify the horizon *directly* with a predictive model. EX1003, ¶228. Khan and Ali identify the horizon line using RANSAC, a predictive model. EX1008, 1104; EX1007, 1826-27. Workman

Pet. at 76

The Ali/Kahn combination does not disclose anything more than KWANT1, using predictive models to predict lane lines, and their "horizon line estimation algorithm" cannot be a "predictive model" because it is a geometric approach like the one disclosed in KWANT1 and distinguished by the inventors.

PO Sur Reply at 11-13 and POR at 30

NO MOTIVATION TO COMBINE CHOE WITH OTHER REFERENCES

Consequent Legal Question:

Would an automotive sensor system designer of ordinary skill starting with Choe's camera-hardware-based approach to determine horizon lines find it obvious to replace that with Khan/Ali's geometric algorithms or Workman's image-trained predictive models to identify a horizon line?

See KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 424 (2007).

POR at 32 and 39

NO MOTIVATION TO CHANGE CHOE'S HORIZON LINE APPROACH

PO may allege that Choe does not explicitly disclose which predictive models it uses. A POSA 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. at 36

for its sensor calibration algorithms. EX1005, ¶[0030]. However, if PO alleges that Choe does not explicitly disclose which predictive models it uses or whether it uses predictive models to identify the horizon line, a POSA would have searched for references that use predictive models and how such models were used. EX1003, ¶146. This would have led to Workman, which discloses predictive models to identify the horizon line. EX1003, ¶146.

Pet. at 47

POR at 32 and 39 and PO Sur Reply at 14 and 18

NO MOTIVATION TO CHANGE CHOE'S HORIZON LINE APPROACH

Choe consistently describes that "a horizon line is determined based on the camera's hardware settings."

Ex_1005 at [0015]; Ex_2003 ¶47.

"Choe does not actually describe how 'predictive models' are used for any purpose."

Ex_2003, ¶90

"The only teaching regarding predictive models in Choe is that they are 'based on driving statistics' and 'generated or trained' by 'machine learning engine 122.'"

Ex_2003, ¶53.

Simply disclosing driving-statistics-based predictive models does not motivate a POSITA to look for any kind of predictive models to identify horizon lines.

Ex_2003, ¶74.

POR at 32 and 39 and PO Sur Reply at 14.

NO MOTIVATION TO CHANGE CHOE'S HORIZON LINE APPROACH

"There is simply nothing in Choe to motivate a POSITA to look for other references discussing the use of image-trained predictive models, much less for the different purpose of identifying a horizon line."

Ex_2003, ¶74

*"Choe does not identify any **shortcomings** with its camera-hardware based approach to determining the horizon line or the need for using predictive models for this purpose."*

Ex_2003, ¶74

Intel Corp. v. Qualcomm Inc. (the "the feedthrough problem");
PAR Pharm., Inc. v. TWI Pharms., (the "known high viscosity and high interpatient variability of Megace OS" problem);
KSR Int'l Co., ("the known wire chafing problems")

POR at 33-34 and PO Sur Reply at 18-19

SAMSARA'S COMBINATIONS ARE BASED ON IMPERMISSIBLE HINDSIGHT

Simply "being known" and "being compatible" does not suffice as a motivation to combine; "[u]nder the correct analysis, any need or problem known in the field and addressed by the patent can provide a reason for combining the elements ***in the manner claimed****."*

KSR Int'l, 550 U.S. at 420

It is apparent that "Petitioner's proposed combination of teachings plainly takes into account knowledge gleaned only from applicant's disclosure, i.e., impermissible hindsight."

See IPR2023-00656, Paper No. 33 at 52

POR at 35 and 49 and PO Sur Reply at 15