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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte FREDERIC GARCIA, FREDERIC GRANDIDIER,
BRUNO MIRBACH, ROBERTO ORSELLO,
and THOMAS SOLIGNAC

Appeal 2019-004920
Application 13/058,962¹
Technology Center 2400

Before ERIC S. FRAHM, NATHAN A. ENGELS, and
JOHN D. HAMANN, *Administrative Patent Judges*.

FRAHM, *Administrative Patent Judge*.

DECISION ON APPEAL

¹ The instant application on appeal was the subject of a prior appeal, Appeal No. 2015-002051, decided December 9, 2016. In the prior appeal, the Board affirmed the Examiner's obviousness rejections of claims 16–20, 22–25, 27, 28, and 30–39 under 35 U.S.C. § 103(a) over the combination of Rafii et al. (US 7,741,961 B1; issued June 22, 2010 and filed Sept. 28, 2007) (hereinafter, "Rafii") and Palm (US 5,699,444; issued Dec. 16, 1997) (*see* Decision 2–3, 6).

Pursuant to 35 U.S.C. § 134(a), Appellant² appeals from the Examiner’s decision to reject claims 16–20, 22–25, 27, 28, and 30–39, which constitute all the claims pending in this application. Claims 1–15, 21, 26, and 29 have been canceled (*see* Appeal Br. 8, 27, 28, 29, 30). We have jurisdiction under 35 U.S.C. § 6(b).

We reverse.

STATEMENT OF THE CASE

Disclosed Invention and Exemplary Claim

Appellant’s disclosed invention relates to three-dimensional (3D) computer vision, and particularly “to a position/orientation calibration method for a 3D time-of-flight [(TOF)] camera system” (Spec. ¶ 1; Title; *see also* claim 16; Fig. 3) used in the automotive field (*see* Spec. ¶ 3). Because the inventors recognized that “position and orientation calibration of 3D TOF cameras currently requires the person installing the camera to go through relatively complicated procedures, which might hinder the success of such cameras on the market place” (Spec. ¶ 4), and “requires the knowledge of [a] transformation matrix” (Spec. ¶ 5) and the space and time-consuming installation of calibration tools, Appellant discloses and claims a camera system (claims 24 and 32) and position and orientation calibration method (*see* claims 16, 35, and 39) for a 3D time-of-flight camera system

² We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. “The word ‘applicant’ when used in this title refers to the inventor or all of the joint inventors, or to the person applying for a patent as provided in §§ 1.43, 1.45, or 1.46.” 37 C.F.R. § 1.42(a). Appellant identifies the real party in interest as IEE International Electronics & Engineering S.A. (Appeal Br. 2).

that “facilitates installation, in particular position and orientation calibration, of a 3D TOF camera” (Spec. ¶ 6). Exemplary independent claim 16 under appeal, with *emphases* and bracketed lettering added to key portions of the claim at issue, reads as follows:

16. Position and orientation calibration method for a camera system including a 3D time-of-flight camera, said method comprising:

acquiring a camera-perspective range image of a scene using said 3D time-of-flight camera, [A] *wherein the range image includes 3D data points representing surface elements within the scene;*

[B] detecting one or more planes within said range image [C] *without using predefined reference points from the 3D data;*

[D] selecting a reference plane among said one or more planes detected, said selecting of said reference plane comprising presenting said one or more detected planes using a user interface and fixing said reference plane based upon user interaction; and

[E] *calibrating said 3D time-of-flight camera with respect to a position and orientation of said 3D time-of-flight camera* by computing, using said reference plane, position and orientation parameters of said 3D time-of-flight camera with respect to said reference plane and a coordinate transformation matrix that transforms camera-perspective range images of said scene into Cartesian representations of said scene, in which coordinates are defined with respect to said reference plane.

Appeal Br. 27, Claims Appendix (emphases and bracketed lettering added). Remaining independent claims 24, 32, 35, and 39 recite camera systems and methods having limitations commensurate in scope with limitations A–E of claim 1. Limitations A through E in claim 16 above are similar to the disputed limitations in the prior appeal of this application decided by the

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Board on December 9, 2016 (affirmed for obviousness over Rafii and Palm), with the difference being that limitations A and C were added by Appellant's amendment filed May 23, 2017 (*see* p. 2), and limitation E was amended, by Appellant's amendments filed February 9, 2017 (*see* p. 2) and December 13, 2017 (*see* p. 2). As discussed below, limitations A and C will be dispositive of the instant application on appeal.

The Examiner's Rejection

Claims 16–20, 22–25, 27, 28, and 30–39 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Rafii, Palm, Lea et al. (US 2009/0086014 A1; published April 2, 2009) (hereinafter, “Lea”), and Jorge Lobo et al., *Vision and Inertial Sensor Cooperation Using Gravity as a Vertical Reference*, IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, Vol. 25, No. 12, pp. 1597–1608 (2003) (hereinafter, “Lobo”). Final Act. 17–32; Ans. 3–17.

Appellant's Contentions

Appellant primarily contends that the Examiner erred in rejecting claims 16–20, 22–25, 27, 28, and 30–39 under 35 U.S.C. § 103(a) based on the failure of the applied references to teach or suggest various limitation of claim 16 (*see* Appeal Br. 14–22; Reply Br. 2–6), and based on a failure by the Examiner to articulate a reason to modify Rafii (*see* Appeal Br. 22–23). More particularly, Appellant argues that the applied references, taken individually or in combination, fail to teach or suggest limitations A and C recited in claim 16, and as commensurately recited in claims 24, 32, 35, and 39.

Principal Issue on Appeal

Based on Appellant's arguments in the Appeal Brief (Appeal Br. 4–10) and Reply Brief (Reply Br. 2–5), the following dispositive issue is presented on appeal:

Has Appellant shown that the Examiner erred in rejecting claims 16–20, 22–25, 27, 28, and 30–39 under 35 U.S.C. § 103(a) because Lobo, and thus the combination of Rafii, Palm, Lea, and Lobo, fails to teach or suggest detecting one or more planes within a range image including 3D data points representing surface elements within a scene without using predefined reference points from the 3D data as recited in claim 16 (*see* claim 16, limitations A and C), and as commensurately recited in remaining independent claims 24, 32, 35, and 39?

ANALYSIS

We have reviewed Appellant's arguments in the Briefs (Appeal Br. 8–26; Reply Br. 2–54), the Examiner's rejection (Final Act. 17–32; Ans. 3–17), and the Examiner's response (Ans. 17–53) to Appellant's arguments in the Appeal Brief. We are persuaded by Appellant's contentions that the Examiner has not sufficiently shown that Lobo, and thus the combination of applied references, teaches or suggests the subject matter recited in limitations A and C of claim 16, and the commensurate limitations found in remaining independent claims 24, 32, 35, and 39. Our reasoning follows.

The USPTO “must examine the relevant data and articulate a satisfactory explanation for its action including a rational connection between the facts found and the choice made.” *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983) (internal

quotation marks and citation omitted); *see Synopsys, Inc. v. Mentor Graphics Corp.*, 814 F.3d 1309, 1322 (Fed. Cir. 2016) (stating that, as an administrative agency, the PTAB “must articulate logical and rational reasons for [its] decisions” (internal quotation marks and citation omitted)). We will not resort to speculation or assumptions to cure the deficiencies in the Examiner’s fact finding. *See In re Warner*, 379 F.2d 1011, 1017 (CCPA 1967).

In this light, and in view of the Examiner’s explanations as to the basis for the rejection of claim 16 (*see* Final Act. 18–24; Ans. 3–9), it is not completely clear which of the four applied references the Examiner mapped to each claim limitation, because the Examiner maps multiple references to individual limitations.

For example, as to limitation E of claim 16, the calibrating step, the Examiner cites to all four of the applied references: (i) Rafii (*see* Final Act. 18–21; Ans. 4–5); (ii) Palm (*see* Final Act. 21; Ans. 6); (iii) Lea (*see* Final Act. 21–22; Ans. 7); and (iv) Lobo (*see* Final Act. 22–23; 8).

With regard to limitation A of claim 16 (“the range image includes 3D data points representing surface elements within the scene”), the Examiner cites to (i) Rafii (*see* Final Act. 18; Ans. 3); and (ii) Lobo (*see* Final Act. 22; Ans. 7). And, as to limitation C (“without using predefined reference points from the 3D data”), the Examiner cites to (i) Rafii (*see* Final Act. 18; Ans. 4); and (ii) Lobo (*see* Final Act. 22; Ans. 7–8), and then finds that “Rafii, Palm, and Lea fail to explicitly disclose that the calibration of the imaging system can occur *without predefined reference points from the imaged data*” (Final Act. 22; Ans. 7) (emphases added).

In view of (i) the foregoing; and (ii) the Examiner's 43 page response to Appellant's arguments as to claim 16 (*see* Ans. 3–46), we find Appellant's statements made in the Reply Brief to have merit and bear repeating:

The content of an Examiner's Answer is prescribed in MPEP 1207.02, which sets forth that the Examiner's Answer should include a "Response to Argument" heading that includes a statement of whether the Examiner disagrees with each of the arguments presented in Appellant's Brief, and an explanation of the reasons for disagreement with any such argument. MPEP 1207.02 further states that:

In the event that the final rejection fully addresses the arguments in the appeal brief, the examiner should complete an examiner's answer with a typical "Grounds of Rejection to be Reviewed on Appeal" section and a *simplified* "Response to Arguments" section that *simply* refers to the appropriate portion of the final rejection. (Emphasis added.)

The Examiner's Answer in this case is 54 pages in length. Pages 3-17 of the Answer replicate the rejections set forth in the Final Office Action dated August 23, 2018, and the "Response to Arguments" section, which begins on page 17 of the Answer, spans the remaining 37 pages. But for a handful of sentences, the Response to Arguments section replicates the rejections in the Final Office Action, which themselves are little more than cut and pasted excerpts from the cited art references that lack analysis and reasoned explanation. Indeed, *there are portions of the Lobo reference in particular that are replicated more than a dozen times*. Appellant respectfully submits that *the repetitive nature of the Examiner's Answer is confusing, counterproductive, and contrary to the guidelines set forth in the MPEP*. Moreover, as detailed below, despite the 54 pages, the Examiner has failed to fully address the substance of each rebuttal argument set forth in the Appeal Brief.

Reply Br. 2 (italicized emphases added, underlining in original).

The Examiner makes the following findings as to Lobo and limitations A and C of claim 16:

Rafii, Palm, and Lea fail to explicitly disclose that the calibration of the imaging system can occur without predefined reference points from the imaged data.

Lobo discloses acquiring a camera-perspective range image of a scene using said ~~time-of-flight~~ camera (**[Fig. 5 and 6, Pages 1601-1602] first orientation**), wherein the range image includes 3D data points representing surface elements within the scene (**[Section 7.2 and Fig. 10] detecting ground points in images**);

detecting one or more planes within said range image (**[Fig. 5 and 6, Pages 1601-1602 and 1604] algorithm 6.2**) without using predefined reference points from the 3D data (**[Section 7.2 and Fig. 10] ground plane detection through mapping an identified ground patch onto the 3D scene**);

Final Act. 22; Ans. 7–8 (strike through and bold emphasis in original).

Regarding limitation A in claim 16, Lobo only teaches an artificial vision system including a camera for an autonomous robot that uses an inertial sensor and ground plane detection (*see* Lobo Abstract; Fig. 1), and not a *3D time-of-flight* camera capable of acquiring a camera-perspective *range image* of a scene that “includes 3D data points representing surface elements within the scene” as set forth in limitation A of claim 16.

Furthermore, Appellant describes a “range image” in the following manner (Spec. ¶ 21):

Range images acquired with a 3D TOF camera correspond to matrices of distance values d , which *indicate the distances from the camera to the imaged surface elements*.

Spec. ¶ 21 (emphases added).

The Examiner makes insufficient findings as to how/why Lobo's Section 7.2 and Figures 5, 6, and 10 describe and show acquiring *range images* with a 3D TOF camera, where the *range images* "correspond to matrices of distance values d " and "indicate the distances from the camera to the imaged surface elements" as described in paragraph 21 of the Specification. As a result, the Examiner leaves us to speculate how (i) Lobo's Figures 5 and 6 (showing a frame of reference and a ground plane with a fixed ground plane point) disclose, teach, or suggest acquiring a camera-perspective *range image* of a scene using a camera; and (ii) Lobo's Section 7.2 and Figure 10 (describing and showing ground plane/patch detection) disclose, teach, or suggest limitation A ("the *range image* includes 3D data points representing surface elements within the scene").

At best, the Examiner's proposed combination leaves us to speculate as to how or why one of ordinary skill in the art would modify Lobo to meet limitation A recited in claim 16, and commensurately recited in claims 24, 32, 35, and 39. *See In re Warner*, 379 F.2d at 1017; *Ex parte Braeken*, 54 USPQ2d 1110, 1112 (BPAI 1999) (unpublished) ("The review authorized by 35 U.S.C. [§] 134 is not a process whereby the examiner . . . invite[s] the [B]oard to examine the application and resolve patentability in the first instance.").

Regarding limitation C in claim 16, the Examiner (Final Act. 22; Ans. 7–8, 24–32) relies on Section 7.2 and Figure 10 of Lobo as teaching detecting one or more planes within a range image including 3D data points representing surface elements within a scene *without using predefined reference points from the 3D data*, as recited in claim 16. In response to

Appellant's arguments (*see* Appeal Br. 17–18) that these cited portions fail to teach or suggest limitation C, the Examiner further explains:³

Lobo discloses the known frames of reference such as Camera {C}, IMU {I}, mobile system {N}, and world fixed {W} can be found for the entire system [See Lobo, Fig. 5 and 1601]. The system detects the ground plane points from the set of initial points in the image and the ground patch is identified [See Lobo, Fig.10]. The points are obtained with a corner detector and then the points of interest are parsed [See Lobo, Section 7.2 and Fig.10]. Lobo discloses that the results show that the method works, but is very dependent on texture so that feature points can be detected [See Lobo, Section 7.2]. The corner detection is using features in the actual image data itself. The detection relies on texture which is known in the art as feature data from the actual image data. Thus, the identified points are not predetermined reference points. The ground plane detection is done through the mapping of the identified ground patch onto the 3D scene [See Lobo, Section 7.2 and Fig.10]. Thus, the ground plane ("one or more planes") can be detected from the original image of the area [See Lobo, Fig. 10].

Ans. 31–32.

Lobo discloses “[u]sing just one vanishing point and the vertical” (i.e., “the vertical reference provided by the inertial sensors”) to find a horizon line to detect planes and thus “segment and reconstruct vertical features and leveled planar patches” (Abstract). Lobo uses inertial sensors to “provide important cues about the observed scene structure, such as vertical and horizontal references” (p. 1597, Section 1), and uses “the vertical reference provided by the inertial sensors” to determine the “image horizon line” (p.

³ Notably, similar responses, almost word for word, are made by the Examiner (*see* Ans. 24, 26, 27–28, 29, 30) regarding Appellant's arguments (Appeal Br. 16–17) that Lobo's Figures 5 and 6 and their accompanying description also fail to teach or suggest limitation C.

1598, Section 1.2). Thus, the vertical (and horizontal) reference lines (which consist of a plurality of points) could be considered as predefined reference points that are used later to identify feature points. Although Lobo discloses determining vertical and horizontal reference lines using inertial sensors (Abstract; Section 1, 1.2), as well as detecting (i) corner features to find “points of interest” in an image (*see* Section 7.2), (ii) “ground points” in a ground plane (*see* Section 7.2), and (iii) “feature points” (*see* Lobo, Section 7.2; *see also* Fig. 10a), Lobo is silent as to detecting a plane in a *range image* including 3D data points representing surface elements within a scene *without using predefined reference points* from the 3D data.

In light of our careful review of Lobo, we conclude that the strength of Appellant’s contentions (Appeal Br. 17–18) that Lobo discloses using predefined reference points outweighs the strength of the Examiner’s findings and reasoning that Lobo, whether taken individually or in some combination with the other 3 applied references, teaches or suggests limitation C (i.e., *not* using predefined reference points). At best, the Examiner’s proposed combination leaves us to speculate as to how or why one of ordinary skill in the art would modify Rafii, Palm, and Lea to meet limitation C, which requires the range image acquired in limitation A, recited in claim 16, and commensurately recited in claims 24, 32, 35, and 39. *See In re Warner*, 379 F.2d at 1017; *Ex parte Braeken*, 54 USPQ2d at 1112. In view of the foregoing, we agree with Appellant’s contentions (Appeal Br. 15–18) that the Examiner has not adequately shown that Lobo, and thus the combination of Rafii, Palm, Lea, and Lobo, teaches or suggests limitations A and C of claim 16 (i.e., detecting one or more planes within a range image including 3D data points representing surface elements within a scene

without using predefined reference points from the 3D data), and the commensurate limitations recited in claims 24, 32, 35, and 39.

Based on the record before us, we find that the Examiner (i) incorrectly relies upon Lobo to teach or suggest limitations A and C in claim 16, and the commensurate limitations recited in claims 24, 32, 35, and 39; and thus, (ii) has not properly established factual determinations and articulated reasoning with a rational underpinning to support the legal conclusion of obviousness for claims 16, 24, 32, 35, and 39, resulting in a failure to establish a prima facie of obviousness. The Examiner has not sufficiently shown Lobo, and thus the combination, teaches or suggests detecting one or more planes within *a range image including 3D data points representing surface elements within a scene without using predefined reference points* from the 3D data as recited in claim 16, and as commensurately recited in claims 24, 32, 35, and 39.

As a result, based on the record before us, Appellant has shown the Examiner erred in rejecting independent claims 16, 24, 32, 35, and 39, and thus claims 17–20, 22, 23, 25, 27, 28, 30, 31, 33, 34, and 36–38 depending respectively therefrom, under 35 U.S.C. § 103(a), and we cannot sustain the Examiner’s obviousness rejection of claims 16–20, 22–25, 27, 28, and 30–39 over the combination of Rafii, Palm, Lea, and Lobo.⁴

⁴ We recognize that Appellant’s arguments concerning the obviousness rejection presents additional issues (*see, e.g.*, Appeal Br. 18–26; Reply Br. 2–6). Because we were persuaded of error by the issue regarding limitations A and C, as recited in claim 16 and similarly recited in claims 24, 32, 35, and 39, we do not reach the additional issues (*e.g.*, such as to limitations B, D, and E in claim 16, and the commensurate limitations recited in claims 24, 32, 35, and 39), as the issue as to limitations A and C is dispositive of the appeal.

CONCLUSION

For all of the reasons above, we hold as follows:

| Claims Rejected | 35 U.S.C. § | Reference(s)/Basis | Affirmed | Reversed |
|-----------------------------|--------------------|---------------------------|-----------------|-----------------------------|
| 16–20, 22–25, 27, 28, 30–39 | 103(a) | Rafii, Palm, Lea, Lobo | | 16–20, 22–25, 27, 28, 30–39 |

REVERSED