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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte FUMINORI TAKEDA and TAKU TAKAHAMA

Appeal 2014-005410
Application 13/053,684
Technology Center 3600

Before JENNIFER D. BAHR, EDWARD A. BROWN, and
JILL D. HILL, *Administrative Patent Judges*.

BROWN, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Fuminori Takeda and Taku Takahama (Appellants) appeal under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 1, 3–6, and 10–14.[1] Appeal Br. 3. We heard oral argument on October 13, 2016. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

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[1] Claim 2 has been cancelled, and claims 7–9 have been withdrawn. Appeal Br. 3.

CLAIMED SUBJECT MATTER

Claims 1, 10, and 11 are independent claims. Claim 1, reproduced below, illustrates the claimed subject matter:

> 1. A vehicle environment recognizing apparatus comprising:
>
> an image capturing device configured to capture an image of a road on which a vehicle is traveling;
>
> a road shape calculating section configured to calculate approximation lines that approximate a shape of the road in at least two regions that are located at different distances in front of the vehicle based on image data captured by the image capturing device;
>
> a straight road determining section configured to determine whether the road on which the vehicle is traveling is straight based on a degree to which the approximation lines of the regions calculated by the road shape calculating section match one another;
>
> a parallel travel determining section configured to determine whether the vehicle is traveling parallel to the road based on a detection result determined from the image data captured by the image capturing device and the approximation lines calculated by the road shape calculating section;
>
> an imaginary vanishing point calculating section configured to calculate an imaginary vanishing point using an intersection point between a left approximation line and a right approximation line of the approximation lines upon determining that the road on which the vehicle is traveling is straight and that the vehicle is traveling parallel to the road; and
>
> an optical axis direction revising section configured to estimate an estimated optical axis direction of the image capturing device based on a calculation result of the imaginary vanishing point calculating section and revise a preset value of an optical axis direction.

Appeal Br. 19 (Claims App.).

REJECTIONS

1. Claims 1, 3, 4, 10, and 11 are rejected under 35 U.S.C. § 103(a) as unpatentable over Nakayama (US 5,359,666, iss. Oct. 25, 1994) and Tsuji (JP 2002-259995, pub. Sept. 13, 2002).

2. Claims 5 and 6 are rejected under 35 U.S.C. § 103(a) as unpatentable over Nakayama, Tsuji, and Iwasaka (US 2005/0096826 A1, pub. May 5, 2005).

3. Claims 12–14 are rejected under 35 U.S.C. § 103(a) as unpatentable over Nakayama, Tsuji, and Nilsson (US 2010/0191421 A1, pub. July 29, 2010).

ANALYSIS

Rejection 1—Claims 1, 3, 4, 10, and 11

As to claim 1, the Examiner finds that Nakayama fails to disclose a parallel travel determining section, an imaginary vanishing point calculating section, or an optical axis direction revising section, as claimed. Final Act. 2–3. The Examiner finds that Tsuji discloses determining whether a vehicle is traveling in the center of a straight lane based on image data, calculating an imaginary vanishing point using an intersection point between left and right approximation lines upon determining the vehicle is traveling in the center of a straight lane, and estimating and revising an optical axis direction of the image capturing device based on a calculation result of the imaginary vanishing point calculating section. *Id.* at 3 (citing Tsuji ¶¶ 7, 19, 44–46; Fig. 3). The Examiner explains, however, that "Tsuji indeed *does not disclose first determining whether the vehicle is traveling parallel to the straight lane* before calculating the vanishing point, instead performing this calculation and the subsequent estimation and revision of the optical axis

direction *by compensating for the detected yaw angle*" (emphasis added). *Id.* at 7 (citing Tsuji ¶¶ 44–46).

Based on these findings, the Examiner concludes that it would have been obvious "to simplify the process, and modify Tsuji by removing this compensation for instances *where the yaw is known to be zero; when the vehicle is traveling parallel to a straight road.*" Final Act. 3 (emphasis added), *see also id.* at 7. The Examiner also concludes that it would have been obvious to modify Nakayama

> to calculate an imaginary vanishing point of a road based on an intersection point between the left and right approximation lines and estimate and revise an optical axis of the image capturing device based on the vanishing point, *only executing these steps after detecting that the vehicle is traveling parallel to a straight road with the image data* to avoid compensation and simplify the calculation, for the advantage of more accurately detecting the position of road image elements (pars. 2 and 4).

Id. at 3–4 (emphasis added). The Examiner also states:

> *[I]n the straight road context of Tsuji, a yaw angle of zero would necessarily indicate that the vehicle is traveling parallel to the road.* Consequently, Examiner maintains that it would have been obvious to modify Tsuji and Nakayama to first determine that the vehicle is traveling parallel to the straight road, to simplify the subsequent calculations by avoiding the need to compensate for the non-zero yaw angle.

Id. at 7 (emphasis added).

Appellants contend that Tsuji does not determine the claimed "parallel travel," but "merely teaches determining whether the road is straight and whether the vehicle is traveling close to the center of the lane." Appeal Br. 11 (citing Tsuji ¶ 44). Appellants also contend that

> the fact that the yaw ***angle*** of a vehicle is zero does ***not*** necessarily mean that the vehicle is traveling parallel to the road.

> The yaw angle is defined as the angle between the heading direction of the vehicle and the velocity direction of the vehicle. As can be understood from that definition, ***the yaw angle is unrelated to the road.*** In other words, the yaw angle does not represent a relationship between the vehicle and the road. Thus, the yaw angle by itself says ***nothing*** about whether or not the vehicle is traveling parallel to the road.

Id. at 11–12.

In response, the Examiner states that:

> *Appellants are of course correct that, considered independently of any other factors, the yaw angle of a vehicle is unrelated to the road it is traveling on*, and therefore the yaw angle in itself cannot suggest anything about the vehicle's orientation to the road without further information. However, *in the context of the present application and cited references, the parallel travel determination always takes place on a straight road. For a vehicle traveling on a straight road, if the yaw angle of the vehicle is determined to be zero, the vehicle is traveling straight on the straight road, and is therefore necessarily traveling parallel to the straight road.* Consequently, Examiner maintains that *Tsuji does teach determining parallel travel by teaching a determination of zero yaw when traveling on a straight road.*

Ans. 2–3 (emphasis added).

Appellants' contentions regarding Tsuji are persuasive. Tsuji's description that "a road is a straight line and it is judged whether self-vehicles are near the center of the slow lane" (Tsuji ¶ 44) is insufficient to establish that the self-vehicles are necessarily "traveling parallel to the road," as claimed. In addition, the Examiner has not established with evidence that, even if a road is straight, a measurement of zero yaw would indicate that a vehicle must be traveling parallel to the road. Tsuji further describes that "*[t]his computes the coordinates of the vanishing point which took into consideration a present yaw angle* and pitch angle, for example,

and learns this data by doing the addition operation of the past data and the present data at a fixed ratio." *Id.* at ¶ 45 (emphasis added). This description does not teach using a determination of "zero yaw" in "determining parallel travel." Accordingly, Tsuji also does not disclose calculating an imaginary vanishing point "upon determining that the road on which the vehicle is traveling is straight *and that the vehicle is traveling parallel to the road*," as required by claim 1. Appeal Br. 19 (Claims App.) (emphasis added).

Appellants contend that Tsuji's determination that the yaw angle is zero also is not "based on a detection result determined from the image data captured by the image capturing device and the approximation lines calculated by the road shape calculating section," as claimed. Appeal Br. 12. Accordingly, Appellants contend, "***even if*** it were assumed that a zero yaw angle might indicate parallel travel in Tsuji, this so-called 'determination' of parallel travel is ***not based on*** the image data and approximation lines as required by independent claims 1, 10 and 11." *Id.*

The Examiner responds that:

> Appellants are correct that [in Tsuji] the yaw angle determination in the second part is not based on images or calculated lines. However, Tsuji describes that the determination of a straight road, in manner very similar to the claimed invention, is based on captured image data *and calculated approximation lines* (16, FIG 3; FIG 4; paragraphs [0018], [0019], and [0044]). *Since one part of the parallel travel determination is based upon captured image data and calculated approximation lines*, Examiner maintains that the ultimate parallel travel determination in Tsuji is thus also *"based on"* captured image data and calculated approximation lines, teaching a broadest reasonable interpretation of the claimed invention.

Ans. 3–4.

Appellants respond that the Examiner appears to be combining the claimed "straight road determining section" and "parallel travel determining section" into an operation for determining parallel travel. Reply Br. 2–3. Appellants explain that "*the 'parallel travelling determining section' does not need to use the determination made by the 'straight road determining section' to determine whether the road is straight before determining whether the vehicle is traveling parallel* [,]" whereas "by the Examiner's admission, the Tsuji system requires that the road is determined to be straight and then that the yaw angle is determined to be zero in order to conclude that the vehicle is travelling parallel to the road." *Id.* at 3.

Appellants' contentions are persuasive. Even assuming Tsuji teaches the determination of a straight road based on captured image data and calculated approximation lines, this does not establish that Tsuji additionally teaches the claimed parallel travel determining section. Accordingly, the Examiner has not established by a preponderance of the evidence that either Nakayama or Tsuji teaches the claimed parallel travel determining section, or, otherwise, provided a reason with a rational underpinning to modify Nakayama to include this claimed section. Thus, we do not sustain the rejection of claim 1 and dependent claims 3 and 4 as unpatentable over Nakayama and Tsuji.

Claim 10 recites a vehicle environment recognizing apparatus comprising, *inter alia*, "parallel travel determining means" having a claimed function similar to the parallel travel determining section of claim 1. Appeal Br. 21–22 (Claims App.). The Examiner's findings and reasoning for claim 10 are the same as for claim 1. Final Act. 2–4. Accordingly, we

do not sustain the rejection of claim 10 for reasons similar to those for claim 1.

As for claim 11, the Examiner has not established that the proposed combination of teachings of Nakayama and Tsuji would include the steps of "determining whether the road on which the vehicle is traveling is straight based on a calculated matching degree of the approximation lines of the at least two regions" *and* "determining whether the vehicle is *traveling parallel to the road based on a detection result determined from the image data captured and the approximation lines calculated*." Appeal Br. 22–23 (Claims App.) (emphasis added). In addition, the Examiner has not otherwise provided a reason with a rational underpinning to further modify Nakayama to include the second claimed "determining" step. Accordingly, we do not sustain the rejection of claim 11.

Rejection 2—Claims 5 and 6

Claim 5 depends from claim 1 and calls for "a yaw rate measuring section configured to measure a yaw rate of the vehicle. . . ." Appeal Br. 20 (Claims App.). Claim 6 depends from claim 1 and calls for "a lateral acceleration measuring section configured to measure a lateral acceleration of the vehicle. . . ." *Id.*

The Examiner finds that Iwasaka discloses detecting a turn of a vehicle based on measured yaw rate or lateral acceleration of the vehicle. Final Act. 4. The Examiner concludes that it would have been obvious to modify Nakayama to measure yaw rate or lateral acceleration of the vehicle, and to stop revising of the optical axis direction when either the yaw rate or lateral acceleration exceeds a preset threshold value. *Id.* at 5.

The Examiner's application of Iwasaka to the rejection of claims 5 and 6 fails to cure the deficiencies of the rejection of claim 1 discussed above. Accordingly, we do not sustain the rejection of claims 5 and 6 as unpatentable over Nakayama, Tsuji, and Iwasaka.

Rejection 3—Claims 12–14

Claim 12 depends from claim 1 and recites that "the parallel travel determining section is configured to determine that the vehicle is traveling parallel to the road when a lateral velocity of the vehicle with respect to the road is equal to or smaller than a set prescribed value." Appeal Br. 23 (Claims App.). Claims 13 and 14, which depend from claims 10 and 11, respectively, each recite a limitation similar to claim 12. *Id.*

The Examiner finds that Nilsson discloses "keeping a vehicle in the center of a straight lane with zero lateral velocity, by intervening if the vehicle deviates from zero lateral velocity." Final Act. 5. The Examiner states that "[t]raveling in the center of a straight lane with zero lateral velocity is equivalent to traveling parallel to a straight road." *Id.* The Examiner concludes that it would have been obvious to modify Nakayama in view of Nilsson "to have a section determine that the vehicle is traveling parallel to the road when a lateral velocity with respect to the road is equal to or smaller than a set prescribed value for the advantage of accurately detecting the maintenance of parallel travel." *Id.* at 5–6.

The Examiner's application of Nilsson to the rejection of claims 12–14 fails to cure the deficiencies of the rejection of claims 1, 10, and 11 discussed above. Accordingly, we do not sustain the rejection of claims 12–14 as unpatentable over Nakayama, Tsuji, and Nilsson.

DECISION

We reverse the Examiner's decision rejecting claims 1, 3–6, and 10–14.

REVERSED