

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC., LG ELECTRONICS, INC., HTC CORPORATION, and HTC
AMERICA, INC.,
Petitioner,

v.

UNILOC 2017 LLC,
Patent Owner.

Case IPR2018-00389^{1,2}
Patent 8,712,723 B1

Before SALLY C. MEDLEY, MIRIAM L. QUINN, and
SEAN P. O'HANLON, *Administrative Patent Judges*.

O'HANLON, *Administrative Patent Judge*.

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

¹ LG Electronics, Inc., HTC Corporation, and HTC America, Inc., who filed a Petition in IPR2018-01458, have been joined to petitioner in this proceeding.

² At the time the Petition was filed, Uniloc Luxembourg S.A. was the patent owner.

I. INTRODUCTION

A. Background

Apple Inc. (“Petitioner”) filed a Petition for *inter partes* review of claims 1–3, 5–7, and 10–18 (“the challenged claims”) of U.S. Patent No. 8,712,723 B1 (Ex. 1001, “the ’723 patent”). Paper 2 (“Pet.”), 1. Uniloc Luxembourg S.A., a predecessor in interest to Uniloc 2017 LLC (“Patent Owner”), filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). On June 27, 2018, we instituted an *inter partes* review of the challenged claims on all grounds raised in the Petition. Paper 7 (“Decision” or “Dec.”), 25.

Subsequent to institution, Patent Owner filed a Patent Owner Response (Paper 11 (“PO Resp.”)) and Petitioner filed a Reply to the Patent Owner Response (Paper 12 (“Pet. Reply”)). Patent Owner subsequently filed a Sur-Reply to Petitioner’s Reply. Paper 14 (“PO Sur-Reply”). An oral hearing was held on April 2, 2019. A transcript of the hearing has been entered into the record. Paper 19 (“Tr.”).³

In our Scheduling Order, we notified the parties that “any arguments for patentability not raised in the [Patent Owner] response will be deemed waived.”⁴ Nonetheless, Petitioner bears the burden to show, by a preponderance of the evidence, that the challenged claims are unpatentable. 35 U.S.C. § 316(e). For the reasons that follow, we conclude that Petitioner

³ The oral hearing included related proceedings IPR2018-00387, IPR2018-00424, and IPR2018-01028. Paper 17.

⁴ See Paper 8, 3; see also Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,766 (Aug. 14, 2012) (“The patent owner response . . . should identify all the involved claims that are believed to be patentable and state the basis for that belief.”).

has proven by a preponderance of the evidence that claims 1–3, 5–7, and 10–18 of the ’723 patent are unpatentable.

B. Related Matters

The parties indicated that the ’723 patent is the subject of the following litigation:

Uniloc USA, Inc. v. Apple Inc., No. 2-17-cv-00522 (E.D. Tex. filed June 30, 2017),

Uniloc USA, Inc. v. Samsung Electronics America, Inc., No. 2-17-cv-00650 (E.D. Tex. filed Sept. 15, 2017),

Uniloc USA, Inc. v. LG Electronics USA, Inc., No. 4-12-cv-00832 (N.D. Tex. filed Oct. 13, 2017),

Uniloc USA, Inc. v. HTC America, Inc., No. 2-17-cv-01629 (W.D. Wash. filed Nov. 1, 2017),

Uniloc USA, Inc. v. Huawei Devices USA, Inc., No. 2-17-cv-00737 (E.D. Tex. filed Nov. 9, 2017),

Uniloc USA, Inc. v. Apple Inc., No. 4-18-cv-00364 (N.D. Cal. filed Jan. 17, 2018), and

Uniloc USA, Inc. v. LG Electronics USA, Inc., No. 4-18-cv-02918 (N.D. Cal. filed May 17, 2018).

Pet. 2; PO Resp. 2–3.

We note that in IPR2018-01027, Petitioner sought *inter partes* review of claims 4 and 19 of the ’723 patent. We declined to institute review. IPR2018-01027, Paper 8. The ’723 patent was also subject to a petition for *inter partes* review in IPR2018-01757, which we did not institute. IPR2018-01757, Paper 7.

C. Real Parties-in-Interest

The statute governing *inter partes* review proceedings sets forth certain requirements for a petition for *inter partes* review, including that “the petition identif[y] all real parties in interest.” 35 U.S.C. § 312(a)(2); *see also* 37 C.F.R. § 42.8(b)(1) (requiring identification of real parties-in-interest in mandatory notices). The Petition identifies “Apple Inc.” as the real party-in-interest. Pet. 1. The joinder petitioners identify LG Electronics, Inc., LG Electronics U.S.A., Inc., LG Electronics MobileComm USA, Inc., HTC Corporation, and HTC America, Inc. as real parties-in-interest. IPR2018-01458, Paper 1, 2. Patent Owner states that its real parties-in-interest are “Uniloc 2017 LLC,” “Uniloc USA, Inc.,” and “Uniloc Licensing USA LLC.” Paper 9, 2.

D. The Challenged Patent

The ’723 patent relates to monitoring and counting periodic human motions, such as steps. Ex. 1001, 1:12–14. The ’723 patent states that inertial sensors (e.g., accelerometers) are used in step counting devices, allowing an individual to track the number of daily steps. *Id.* at 1:18–29. One problem recognized in the ’723 patent is the limitations of these step counting devices concerning the orientation of the device during use. *Id.* at 1:29–34. Further, motion noise often confuses these devices, resulting in missed steps or counting false steps, with a particular problem of inaccurate step measurements for slow walkers. *Id.* at 1:35–43.

The ’723 patent provides for accurate counting of steps regardless of the orientation of the step counting device, even if that orientation changes during operation. *Id.* at 2:33–38. In particular, the ’723 patent describes

assigning a dominant axis after determining an orientation of the inertial sensor, where the orientation of the inertial sensor is continuously determined. *Id.* at 2:15–19. In one embodiment, the '723 patent method determines rolling averages of the accelerations of each axis monitored by the inertial sensor in the device. *Id.* at 6:15–21. The largest absolute rolling average indicates the axis most influenced by gravity, which may change over time, as the device's orientation changes because of rotation. *Id.* at 6:20–26.

With regard to the embodiment shown in Figure 8, reproduced below, the '723 patent describes the method for measuring the acceleration along the assigned dominant axis to detect and count steps. *See id.* at 12:30–35.

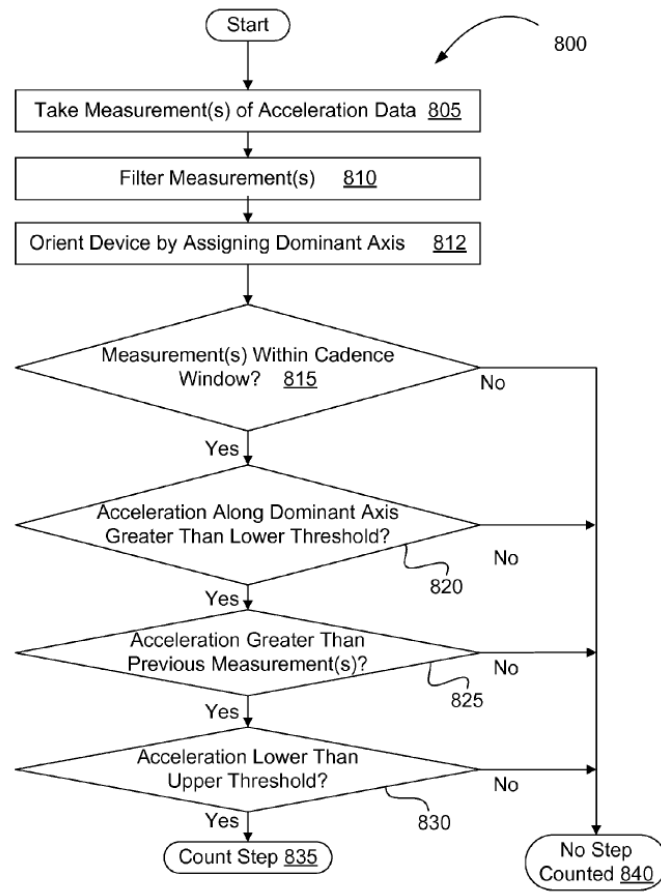


Figure 8

Figure 8 illustrates a diagram for a method of recognizing a step. *Id.* at 2:4–7. After taking measurements of acceleration data (step 805) and filtering those measurements (step 810), the method evaluates the orientation of the device and assigns a dominant axis (step 812). *Id.* at 12:36–49. A processing logic determines whether a measurement is within a cadence window (step 815). *Id.* at 12:50–57. The cadence window is the allowable time window for steps to occur. *Id.* at 3:65–66. In one embodiment, the cadence window is determined based on the actual stepping period or actual motion cycle, but default limits or other determiners may be used to set the cadence window. *Id.* at 4:7–27. After each step is counted, the minimum and/or maximum of the cadence window, or window length, may be adjusted based on actual cadence changes. *Id.* Therefore, the cadence window is dynamic so that it continuously updates. *Id.* at 4:31–33.

If the measurement of acceleration along the dominant axis is within the cadence window, is greater than previous measurements, and is within the range of acceleration thresholds (steps 820, 825, 830), the motion is determined to be a step and is counted (step 835). *Id.* at 12:53–62, 13:37–14:6. Otherwise, the step is not counted (step 840) and the method continues to evaluate subsequent measurements. *Id.* at 12:51–53.

E. The Challenged Claims

Petitioner challenges claims 1–3, 5–7, and 10–18 of the '723 patent. Claims 1, 5, 10, and 14 are independent. Claim 1 is illustrative of the challenged claims and is reproduced below:

1. A method of monitoring human activity using an inertial sensor, comprising:

assigning a dominant axis with respect to gravity based on an orientation of the inertial sensor;
detecting a change in the orientation of the inertial sensor and updating the dominant axis based on the change; and
counting periodic human motions by monitoring accelerations relative to the dominant axis by counting the periodic human motions when accelerations showing a motion cycle that meets motion criteria is detected within a cadence window; and
updating the cadence window as actual cadence changes.

Ex. 1001, 15:13–24.

F. The Prior Art and Instituted Ground of Unpatentability

Petitioner relies on the following prior art references:

- 1) Fabio: U.S. Patent No. 7,698,097 B2, filed in the record as Exhibit 1006; and
- 2) Pasolini: U.S. Patent No. 7,463,997 B2, filed in the record as Exhibit 1005.⁵

We instituted trial based on all challenged claims and the single ground of unpatentability asserted in the Petition: obviousness of all challenged claims (claims 1–3, 5–7, and 10–18) over Fabio and Pasolini. Dec. 25. Petitioner submits a declaration of Joseph A. Paradiso, PhD (Ex. 1003) in support of its contentions in the instituted challenges.

⁵ We note that the first named inventor of both Pasolini and Fabio is “Fabio Pasolini,” and we adopt the naming protocol used by the parties.

II. ANALYSIS

A. Principles of Law

To prevail in its challenge to Patent Owner’s claims, Petitioner must demonstrate by a preponderance of the evidence that the claims are unpatentable. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). A claim is unpatentable under 35 U.S.C. § 103(a)⁶ if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time of the invention to a person having ordinary skill in the art. *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) when in evidence, objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

Citing its declarant, Petitioner contends that a person having ordinary skill in the art at the time of the invention (“POSITA”) would have had “a Bachelor’s degree in Electrical Engineering, Computer Engineering, and/or Computer Science, or equivalent training,” and “approximately two years of experience working in hardware and/or software design and development

⁶ The ’723 patent was filed on January 31, 2001, prior to the date when the Leahy-Smith America Invents Act (“AIA”) took effect.

related to MEMS (micro-electro-mechanical) devices and body motion sensing systems.” Pet. 7–8 (citing Ex. 1003, 8).

Patent Owner notes that its declarant, Dr. William C. Easttom II,⁷ disagrees with the experience level set forth by Petitioner, contending instead that a person having ordinary skill in the art at the time of the invention would have had “two years of experience ‘related to accelerometers or similar devices.’” PO Resp. 3 (citing Ex. 2001 ¶ 13). Patent Owner acknowledges, however, that Dr. Easttom “recognizes that the difference is inconsequential to the dispute here.” *Id.* at 4.

Although the definitions proposed by the parties vary slightly, any differences do not alter the obviousness analysis for purposes of rendering this decision. We find Petitioner’s definition reasonable, and, because it is consistent with the problems and solutions in the ’723 patent and cited references, we adopt it as our own. *See, e.g.*, Ex. 1001, 1:19–26 (discussing MEMS technology); Ex. 1005, 1:34–39 (same); Ex. 1006, 2:49–52 (same); *see also In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (“In determining this skill level, the court may consider various factors including type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” (citations and internal quotations omitted)).

⁷ It is our understanding that since the time of submitting his declaration, Dr. Easttom has obtained his doctorate. *See* IPR2017-02148, Paper 79, 51.

C. Claim Construction

In an *inter partes* review, a claim in an unexpired patent shall be given its broadest reasonable construction in light of the specification of the patent in which it appears.⁸ 37 C.F.R. § 42.100(b) (2017); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) (upholding the use of the broadest reasonable interpretation standard). Consistent with the broadest reasonable construction, claim terms are presumed to have their ordinary and customary meaning as understood by a person of ordinary skill in the art in the context of the entire patent disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). The presumption may be overcome by providing a definition of the term in the specification with reasonable clarity, deliberateness, and precision. *See In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). In the absence of such a definition, limitations are not to be read from the specification into the claims. *See In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993). Only those terms that are in controversy need be construed, and only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999); *see also Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (applying *Vivid Techs.* in the context of an *inter partes* review).

⁸ This Petition was filed before the effective date of the amendment to 37 C.F.R. § 42.100 that changed the claim construction standard applied in *inter partes* reviews. Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (amending 37 C.F.R. § 42.100(b) effective November 13, 2018). Thus, we use the broadest reasonable interpretation claim construction standard in this proceeding.

When a claim term does not include the word “means,” a rebuttable presumption that the term is not drafted in means-plus-function language can be overcome “if the challenger demonstrates that the claim term fails to recite sufficiently definite structure or else recites function without reciting sufficient structure for performing that function.” *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1349 (Fed. Cir. 2015) (en banc in relevant part) (quotation marks and internal citations omitted). If the presumption is overcome, “[a]pplication of § 112, ¶ 6 requires identification of the structure in the specification which performs the recited function,” but does not permit “incorporation of structure from the written description beyond that necessary to perform the claimed function.” *Micro Chem., Inc., v. Great Plains Chem. Co.*, 194 F.3d 1250, 1257–58 (Fed. Cir. 1999).

Petitioner proposes constructions for five claim terms, asserting that its “claim constructions . . . are based on the broadest reasonable construction.” Pet. 8–15. Patent Owner disagrees with Petitioner’s proposed constructions. PO Resp. 4–9. We address each of the disputed terms below.

1. “logic” terms

We first address the “logic” terms recited in claim 10: “a dominant axis logic,” “a counting logic,” and “a cadence logic.” Pet. 10–15. Petitioner contends that these terms would have been understood to include “hardware, software, or both” to perform the functions recited. *See id.* at 10, 12, 13 (citing Ex. 1003, 19, 21, 22). Petitioner also contends that “to the extent that Patent Owner overcomes the presumption against construction under 35 U.S.C. § 112, sixth paragraph, a POSITA would have understood” certain structures to be associated with the recited functions. *Id.* at 11, 12,

13. More particularly, Petitioner contends that these terms “under the narrower *Phillips* standard,” which does not apply in this *inter partes* review, are directed to “logic” that invokes § 112 ¶ 6 but fails to meet the definiteness requirement of § 112 ¶ 2. Pet. 14. Patent Owner notes that “[t]he Institution Decision determined that ‘the presumption against application of § 112 ¶ 6 has not been overcome, and that no construction is necessary.’” PO Resp. 9 (citing Dec. 8).

We determine that the presumption against application of § 112 ¶ 6 has not been overcome, and that no construction is necessary. None of these “logic” terms recite the word “means,” and, therefore, there is a presumption that the term is not drafted in means-plus-function format. *Williamson*, 792 F.3d at 1349. Additionally, Petitioner, although preserving for district court litigation its position that the claims are drafted in means-plus-function format, affirmatively argues here, and supports with testimonial evidence, the contention that a person of ordinary skill in the art would interpret each of these “logic” terms to include “hardware, software, or both.” See Ex. 1003 ¶¶ 40, 43, 46.

Therefore, under *Williamson*, neither party has challenged the rebuttable presumption that § 112 ¶ 6 does not apply to these terms, which do not use the word “means.” Petitioner’s alternative position that these claim terms are indefinite appears to give “notice” of its claim construction position in district court, but is not a position that Petitioner is affirmatively asserting in this proceeding. Pet. 14 (stating that “regardless of whether the recited ‘logic’ is a nonce word requiring the disclosure of an algorithm, the Board may still find that the claims are obvious in view of the software and hardware disclosed in the prior art cited in this Petition”). More importantly,

there is no record evidence, proposed by either party, to support the construction of these “logic” terms as nonce words under § 112 ¶ 6, and, therefore, the presumption against application of § 112 ¶ 6 is unrebutted. *See Zeroclick LLC v. Apple Inc.*, 891 F.3d 1003, 1007–08 (Fed. Cir. 2018).

2. dominant axis

Petitioner proposes that this term is properly construed as including “the axis most influenced by gravity.” Pet. 9 (citing Ex. 1003, 18). Patent Owner challenges this construction as importing limitations from the Specification because the “dominant axis” is not limited to just gravitational influence. PO Resp. 5–6. Petitioner’s proposal, although taken directly from the Specification (Ex. 1001, 6:23–26), is not as objectionable as Patent Owner argues because the claims of the ’723 patent recite that the “dominant axis” is assigned “with respect *to gravity*” based on an orientation of the inertial sensor. Ex. 1001, 15:15–16, 15:62–63, 16:27–28 (emphasis added) (language of independent claims 1, 10, 14). Although the word “dominant” in and of itself may be sufficient to identify the recited axis, the surrounding claim language makes clear that gravity influences which axis is dominant. *Id.*

The Specification supports Petitioner’s proposal (*id.* at 6:23–26) and also explains that “[i]n alternative embodiments, the dominant axis does not correspond to one of the actual axes of the inertial sensor(s) in a current orientation, but rather to an axis that is defined as approximately aligned to gravity” (*id.* at 6:32–35). Therefore, we are persuaded that the Specification is consistent in explaining that a dominant axis, whether a virtual axis or otherwise, is assigned on the basis of gravity: “most influenced by gravity”

(*id.* at 6:23–25) and “approximately aligned to gravity” (*id.* at 6:32–35). Further, as discussed above, the claim language expressly requires the assignment of the dominant axis based on gravity. Patent Owner’s characterization of the Specification as describing embodiments that exclude the gravitational influence are unpersuasive. Accordingly, we adopt Petitioner’s proposed construction and determine that the plain and ordinary meaning of “dominant axis” includes “the axis most influenced by gravity.” No further construction is necessary to resolve the issues in this proceeding. *Vivid Techs.*, 200 F.3d at 803; *Nidec Motor Corp.*, 868 F.3d at 1017.

3. *cadence window*

Petitioner proposes that the term “cadence window” includes “a window of time since a last step was counted that is looked at to detect a new step.” Pet. 9–10 (citing Ex. 1001, 4:4–5; Ex. 1003, 18–19). Patent Owner argues that “a ‘cadence window’ corresponds to the time allowable for a particular motion to occur.” PO Resp. 11 (citing, *inter alia*, Ex. 1001, 3:65–66). Petitioner replies that “Patent Owner . . . has not explained why this definition is meaningfully different than Petitioner’s definition.” Pet. Reply 8.

Both Petitioner and Patent Owner rely on language from the Specification of the ’723 patent. Petitioner relies on the statement that “[a] cadence window is a window of time since a last step was counted that is looked at to detect a new step” (Ex. 1001, 4:5–7), and Patent Owner relies on the statement “cadence window (the allowable time window for steps to occur)” (*id.* at 3:65–66). The proposed definitions proffered by the parties are similar in that they are both lengths of time during which a step can be detected, with Petitioner’s definition being narrower due to the requirement

that the cadence window occurs “since a last step was counted.” During the hearing, Petitioner explained that it relied on the narrower definition due to its inclusion of the first instance of the word *is*. Tr. 19:2–12. We understand Petitioner to interpret “[a] cadence window *is* a window of time since a last step was counted that is looked at to detect a new step” (Ex. 1001, 4:5–7 (emphasis added)) to indicate that a definition is provided.

We agree with Petitioner’s reasoning regarding “is,” adopt Petitioner’s proposed construction, and determine that a “cadence window” is a window of time since a last step was counted that is looked at to detect a new step.

D. Overview of the Prior Art

1. Fabio

Fabio is directed to controlling a pedometer based on the use of inertial sensors. Ex. 1006, 1:10–11, Abstract, Title. Fabio describes that pedometer reliability depends in part on “recognizing and ignoring events not correlated to the gait, which, however, cause perturbations resembling those produced by a step.” *Id.* at 1:22–27. Pedometers that use inertial sensors detect accelerations along a substantially vertical axis and recognize a step when the pedometer detects a positive acceleration peak followed by a negative acceleration peak, both of these peaks within certain thresholds. *Id.* at 1:32–38. Random events, however, can interfere with step recognition, causing “false positives” (i.e., steps are recognized when they are not steps). *Id.* at 1:38–44. Rest periods also produce events that are detected by the pedometer, and “isolated” steps or brief sequences of steps are irrelevant to assessment of activity for which a pedometer is used. *Id.* at 1:44–52.

Fabio overcomes the above-described problems by detecting whether sequences of detected steps satisfy predetermined conditions of regularity. *Id.* at 1:63–2:3. If the condition of regularity is satisfied, the valid step count is updated; if the condition of regularity is not satisfied, the number of valid steps is not updated. *Id.* In particular, Fabio describes a method that involves two counting procedures, as shown in Figure 3, reproduced below.

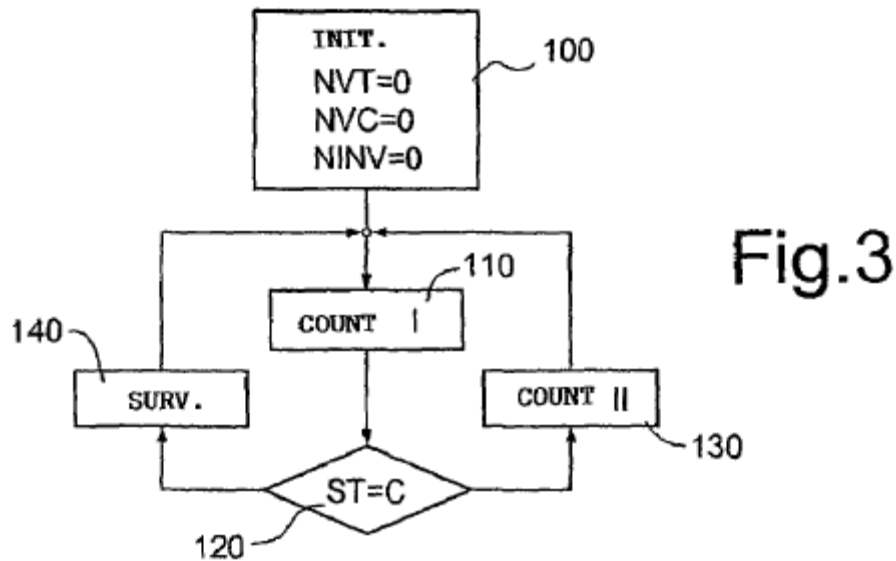


Figure 3 depicts a flowchart of a control method executed by a control unit of a pedometer. Ex. 1006, 2:17–19, 3:11–12. In particular, upon switching on the pedometer, an initialization step 100 sets to zero the counters for valid steps (N_{VT}), valid control steps (N_{VC}), and invalid steps (N_{INV}). *Id.* at 3:13–18. Then, during the first counting procedure (COUNT I, step 110), the acceleration signal output by the accelerometer of the pedometer is sampled and evaluated to recognize sequences of steps that are “close to one another, which satisfy [the] pre-determined conditions of regularity.” *Id.* at 3:19–27. In particular, for each step that is validated during this first counting procedure, the number of valid control steps is

increased until the number of valid control steps matches a predetermined threshold. *Id.* at 5:40–45 (describing that regularity is sufficient when N_{VC} reaches a threshold N_{T2}). The first counting procedure terminates after updating the valid steps counter, N_{VT} , to equal the number of “regular” steps just detected. *Id.* at Fig. 4, step 265 ($N_{VT}=N_{VT}+N_{T2}$).

Fabio describes this first counting procedure as enabling the pedometer to wait for a sequence of events that satisfies regularity and to detect events that are irregular (or a wait time between steps that is too long) so the counter for valid control steps N_{VC} is decreased or reset to zero accordingly. *Id.* at 5:40–49. Fabio states that programming thresholds for the first counting procedure, such as N_{T2} described above, enables modification of the sensitivity of the pedometer. *Id.* at 5:62–6:11. The user can program lower values of the threshold number of steps when regularity of gait is not possible, such as when in an office, enabling the pedometer to validate and count shorter sequences of steps as “regular” steps. *Id.* On the other hand, by programming higher values for the thresholds for intense activity, such as running, short step sequences can be ignored. *Id.*

When the first counting procedure passes control to the second counting procedure, the user is considered to be moving and the second counting procedure counts valid steps N_{VT} . *Id.* at 3:41–44. The second counting procedure also checks for continued regularity of the sequences of steps by counting the number of valid control steps N_{VC} and the number of invalid steps N_{INV} . *Id.* at 6:40–62. If the number of invalid steps N_{INV} is lower than a threshold, the method assumes regularity of steps and continues counting validated steps. *Id.* at 7:7–13. Validation of steps in both counting

procedures is described more particularly with respect to Figure 6, reproduced below.

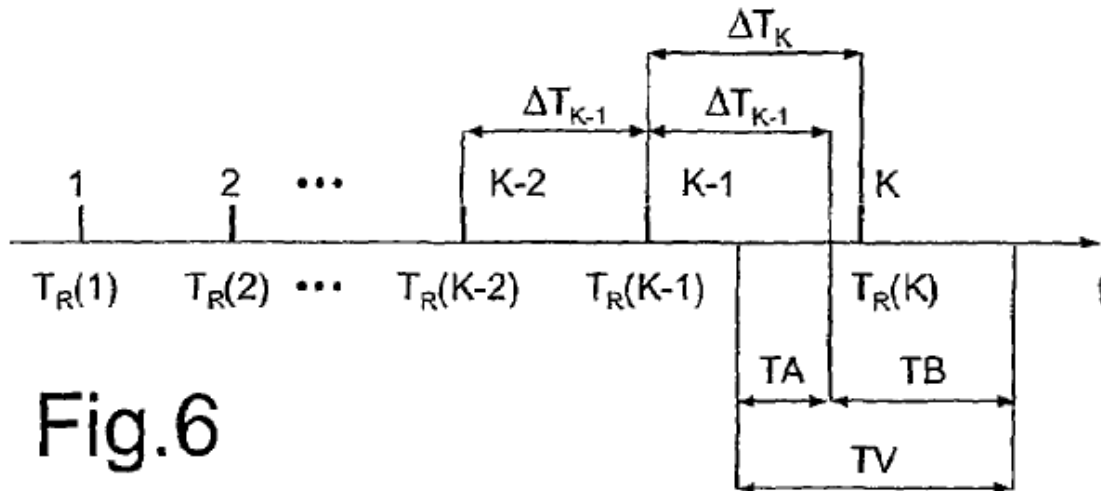


Fig.6

Figure 6 is a graph plotting the time of recognition T_R of a sequence of steps (1, 2, . . . K-2, K-1, K). *Id.* at Fig. 6. Fabio validates a step when the duration of a current step K (ΔT_K) is “substantially homogeneous with respect to the duration . . . of an immediately preceding step K-1 [(ΔT_{K-1})].” *Id.* at 4:28–35. In particular, “the last step recognized is validated if the instant of recognition of the current step $T_R(K)$ falls within a validation interval TV, defined with respect to the instant of recognition of the immediately preceding step $T_R(K+1)$,” according to a specific equation. *Id.* at 4:35–42. Fabio describes that the validation interval TV has an “amplitude” equal to “ $3\Delta T_{K-1}/2$ ” but could have a different “amplitude.” *Id.* at 4:50–53.

2. Pasolini

Pasolini is also directed to a pedometer for detecting and counting steps. Ex. 1005, Abstract. Specifically, Pasolini describes using an

accelerometer that detects an acceleration component along axis Z of the vertical acceleration generated during a step. *Id.* at 3:16–19. Pasolini applies positive and negative thresholds S^+ and S^- to the acceleration signal for identifying the positive phase and the negative phase of a step. *Id.* at 3:35–41. The values of these thresholds are modified at each acquisition of a new sample. *Id.* at 3:42–54. In particular, Pasolini utilizes an algorithm for determining positive and negative envelope values E^+ and E^- using the acceleration datum for each sampled acceleration signal, and adjusting the thresholds S^+ and S^- as a function of the envelope values E^+ and E^- . *Id.* at 5:42–54. In this manner, the pedometer adapts to variations in the detection conditions due, for example, to a different type of terrain, or to an increase in the speed of the gait. *Id.* at 3:54–59.

Pasolini's accelerometer can be a three-axis accelerometer, in which case:

[T]he algorithm implemented by the processing unit **3** [of the pedometer] envisages identifying the main vertical axis to be used for step detection as the axis of detection that has the highest mean acceleration value $Accm$ (on account of gravity). For example, the main vertical axis can be identified at each acquisition of a new acceleration sample, block **30** of FIG. **4**, so as to take into account variations in the orientation of the pedometer device **1**, and consequently of the accelerometer **2** arranged inside it.

Id. at 8:11–24.

E. Prosecution History

Patent Owner notes that Pasolini was cited during prosecution of the '723 patent, pointing out that Applicants argued that Pasolini does not teach

or suggest the use of cadence windows. PO Resp. 9–10 (reproducing a portion of Ex. 1002, 142). Patent Owner characterizes Fabio and Pasolini as having “overlapping applications” and argues that “[t]he interest of finality weighs against revisiting the deficiencies of Pasolini and whether the cumulative disclosure in Fabio renders obvious what Pasolini admittedly fails to disclose.” PO Sur-Reply 2.

It is not clear what relief, if any, Patent Owner seeks in advancing these arguments. We note that Petitioner relies on Fabio, not Pasolini, to disclose a cadence window. *See, e.g.*, Pet. 33–36. Moreover, as correctly noted by Petitioner (*see* Pet. Reply 10), the *combination* of Pasolini and Fabio was not considered during prosecution of the ’723 patent. To the extent Patent Owner requests denial of Petitioner’s challenge due to its reliance on Pasolini, such request is *denied*.

F. The Challenge

Petitioner asserts that the combination of Fabio and Pasolini describes all elements of claims 1–3, 5–7, and 10–18, and that it would have been obvious to combine Fabio and Pasolini. Pet. 26–66.

1. Independent Claims 1, 5, 10, and 14

We are satisfied that Petitioner has demonstrated how the combination of Fabio and Pasolini teaches the limitations of the independent claims. We focus on the language of claim 1 to address the similarly recited limitations of claims 1, 5, 10, and 14. Claim 5 recites limitations not recited in claims 1, 10, and 14, and, thus, those limitations are reviewed separately. Claim 10 recites certain logic limitations not recited in claims 1, 5, and 14, and, thus, those limitations are reviewed separately. Claim 14 recites a non-transitory

machine readable medium containing executable computer program instructions that is not recited in claims 1, 5, and 10, and, thus, that limitation is reviewed separately.

a. A method of monitoring human activity using an inertial sensor

For the preamble of claim 1, Petitioner relies on Fabio's disclosure of controlling a pedometer, comprising an inertial sensor, to detect the steps of the user. Pet. 26–28. Patent Owner does not challenge this aspect of the Petition.

Fabio discloses a pedometer comprising, *inter alia*, an inertial sensor and a control unit. Ex. 1006, 2:36–40. Fabio discloses controlling the pedometer to detect and count the user's steps. *Id.* at 1:62–2:3. As used in the '723 patent, steps are a form of human activity. See Ex. 1001, 1:12–14. We are persuaded by Petitioner's showing and agree that Fabio discloses “[a] method of monitoring human activity using an inertial sensor.”

b. assigning a dominant axis with respect to gravity based on an orientation of the inertial sensor (the “assigning limitation”)

Petitioner relies on Fabio's selection of the acceleration signal corresponding to the detection axis nearest to vertical to teach the assigning limitation. Pet. 28 (citing Ex. 1006, 8:21–33). In the portion cited by Petitioner, Fabio states that “[t]he *detection axis* is selected on the basis of the value of the DC component of the respective acceleration signal, which is correlated to the contribution of the *acceleration of gravity*.” Ex. 1006, 8:27–30 (emphases added). Fabio states further that “[t]he pedometer can then be used independently of how it is *oriented*.” *Id.* at 8:32–33 (emphasis

added). Accordingly, we are persuaded by Petitioner’s showing and find that Fabio discloses the assigning limitation.

Petitioner alternatively relies on Pasolini as teaching the assigning limitation because Pasolini describes taking into account the orientation of the accelerometer and pedometer device enclosing it. Pet. 29 (citing Ex. 1003, 38; Ex. 1005, 8:20–24). Petitioner argues that it would have been obvious to a person of ordinary skill in the art to combine the teachings of Fabio and Pasolini because “the combination is merely a use of a known technique to improve a similar device, method, or product in the same way.” *Id.* at 23 (citing Ex. 1003, 31). Petitioner further argues that incorporating Pasolini’s teachings into Fabio’s device would provide improved step detection and reduced susceptibility to errors, resulting in more accurate step recognition and a more precise step count. *Id.* at 22–26, 29 (citing Ex. 1003, 31–34, 39). We note that Fabio supports this rationale by disclosing, through the first regularity test, that the second counting procedure is engaged—and the valid steps counted in the first counting procedure added to the total number of valid steps—only when a predetermined number of valid steps are recognized. Ex. 1006, 5:10–39. In this manner, “[i]solated events and sequence of steps that are in any case too short are thus advantageously ignored.” *Id.* at 5:56–57.

Patent Owner argues that “Petitioner acknowledges, and tacitly admits that *Fabio* does not disclose ‘assigning a dominant axis with respect to gravity based on an orientation of the inertial sensor’, because *Fabio* . . . can only ‘select[] the acceleration signal corresponding to the detection axis nearest to the vertical.’” PO Resp. 16 (second modification in original). Patent Owner argues that Fabio “discloses only that the *device* may be used

independently of how it is oriented. *Fabio* . . . is silent as to the orientation of the *inertial sensor*, and *Fabio* . . . does not disclose assigning a dominant axis *based on an orientation of the inertial sensor*, as required by the claim language.” *Id.* at 17 (citing Ex. 1006, 8:30–33). Similarly, Patent Owner argues that Pasolini does not “assign[] a dominant axis *based on an orientation of the inertial sensor* as required by the claim language.” *Id.*; see also *id.* at 17–18 (“[T]he proposed combination fails because neither *Fabio* . . . [n]or *Pasolini* . . . discloses ‘assigning a dominant axis with respect to gravity based on an orientation of the inertial sensor.’”).

Initially, we do not see any admission on the part of Petitioner as asserted by Patent Owner. Nor do we see a distinction between the orientation of *Fabio*’s device versus the orientation of the inertial sensor within the device. *Fabio* discloses that “[t]he pedometer **1** comprises an inertial sensor **3**, a control unit **5**, equipped with a nonvolatile-memory module (not illustrated herein), a display **6**, and a communication interface **8**, all housed on a card **9**, which is, in turn, fixed within a casing **10** of the cell phone **2**.” Ex. 1006, 2:36–40. As the pedometer—including its inertial sensor—is housed on a card that is fixed to the device (cell phone), any change in orientation of the device will result in an identical change in orientation of the inertial sensor.

Moreover, we disagree with Patent Owner’s characterization of *Fabio*’s disclosure, as *Fabio* discloses that the *pedometer*, not the device, can be used irrespective of its orientation. *Id.* at 8:32–33 (“The pedometer can then be used independently of how it is oriented.”). *Fabio* discloses that its “inertial sensor can be of the type with . . . three axes of detection,” in which case “step recognition can advantageously be performed by selecting the

acceleration signal corresponding to the detection axis nearest to the vertical.” *Id.* at 8:21–25. Fabio uses the detection axis nearest to vertical because “[t]he nearer the detection axis used is to the vertical, . . . the greater the amplitude of the signal useful for step recognition.” *Id.* at 8:25–27. “The detection axis is selected on the basis of the value of the DC component of the respective acceleration signal, which is correlated to the contribution of the acceleration of gravity.” *Id.* at 8:27–30. Thus, Fabio determines which of the three detection axes is most aligned with vertical, thereby determining the orientation of the inertial sensor, and selects that detection axis for use in measuring acceleration samples, thereby assigning a dominant axis based on the orientation of the inertial sensor.

Turning to Petitioner’s alternative argument that Pasolini teaches the assigning limitation, we disagree with Patent Owner’s characterization of Pasolini’s disclosure. Like Fabio, Pasolini discloses that its “accelerometer 2 could be equipped with . . . three mutually orthogonal axes of measurement,” in which case “the algorithm implemented by the processing unit 3 envisages identifying the main vertical axis to be used for step detection as the axis of detection that has the highest mean acceleration value *Accm* (on account of gravity).” Ex. 1005, 8:11–20. “[T]he main vertical axis can be identified at each acquisition of a new acceleration sample . . . so as to take into account variations in the orientation of the pedometer device 1, and consequently of the accelerometer 2 arranged inside it.” *Id.* at 8:20–24. Thus, each time an acceleration sample is acquired, Pasolini identifies which of the three axes is most aligned with gravity, thereby determining the orientation of the accelerometer (inertial sensor), and selects that axis for use in measuring acceleration samples, thereby

assigning a dominant axis based on the orientation of the inertial sensor. Accordingly, we are persuaded by Petitioner’s showing and find that Pasolini discloses the assigning limitation.

Patent Owner next argues that “the claim language requires ‘assigning a dominant axis with respect to gravity’, which allows for any direction and axis to become dominant.” PO Resp. 18 (citing Ex. 2001 ¶¶ 18–19). This argument is unpersuasive because the claims do not require allowing *any* direction or axis to become dominant because, as we stated with regard to claim construction (section II.C.2 above), the claim requires the assignment of the dominant axis *with respect to gravity*. Thus, Patent Owner’s argument is not commensurate with the scope of the challenged claims. Moreover, Patent Owner’s argument fails to explain why the axis nearest to vertical relied upon by Petitioner and used in both Fabio and Pasolini would not qualify as a dominant axis as Patent Owner broadly defines that term.

Patent Owner next argues that Petitioner has merely relied on conclusory statements and speculation through its declarant that it would have been obvious to combine Pasolini and Fabio. PO Resp. 18–22 (citing, *inter alia*, Pet. 29). Patent Owner argues that Fabio is not concerned with a lack of accuracy because it provides the solution of a two- or three-axis accelerometer, so there is no need to modify Fabio to provide a more accurate and precise step count. *Id.* at 20–21 (citing Ex. 1006, 8:21–27). Patent Owner argues that Petitioner’s assertion that combining Fabio and Pasolini “would have been a relatively simple and obvious solution” lacks requisite analysis or explanation. *Id.* at 21–22 (quoting Pet. 25; citing Dec. 23).

Petitioner relies on Pasolini's teaching of detecting the main vertical axis at each data acquisition, and argues that including this teaching with Fabio's device would result in a more precise step count. Pet. 25, 29. Petitioner argues that the "combination is merely the use of Pasolini's known technique to improve Fabio's similar pedometer device in the same way." *Id.* at 29 (citing Ex. 1003, 39). Although in our Institution Decision we stated that merely saying a modification is "relatively simple" and "obvious" fails to satisfy Petitioner's burden to prove unpatentability, our Institution Decision also stated that another rationale advanced by Petitioner ("providing more accurate step recognition, which would result in a more precise step count") appeared to be factually supported. Dec. 22–24. As explained above, Fabio supports this rationale, which we find to provide rational underpinning as to why a person having ordinary skill in the art would have combined the teachings of Pasolini and Fabio.

Regarding Patent Owner's arguments that Fabio "does not express any concern about a lack of accuracy" (see PO Resp. 21), such piecemeal arguments attacking Fabio individually are unpersuasive of error in the challenge based on the combined teachings of Fabio and Pasolini as set forth in the Petition. *See In re Keller*, 642 F.2d 413, 426 (CCPA 1981) ("[O]ne cannot show non-obviousness by attacking references individually where, as here, the rejections are based on combinations of references."). Moreover, as noted above, Petitioner relies on Pasolini to teach "identifying the vertical detection axis *[at] each acquisition of a new acceleration signal* to take into account changes in the device's orientation." Pet. 29 (citing Ex. 1003, 39) (emphasis added); *see also* Ex. 1005, 8:15–24. As noted in our Institution Decision (see Dec. 22–23), Fabio supports this rationale by disclosing that

“[t]he nearer the detection axis used is to the vertical, in fact, the greater the amplitude of the signal useful for step recognition.” Ex. 1006, 8:25–27.

Thus, the combined teachings of Fabio and Pasolini result in a pedometer that detects the axis nearest to vertical each time an acceleration sample is acquired so that the sampled signal has the greatest amplitude useful for step recognition.

Regarding Patent Owner’s attacks on the declaration testimony of Petitioner’s expert witness (*see, e.g.*, PO Resp. 18–19), we note that experts are required to provide supporting facts or data for their opinions. *See* 37 C.F.R. § 42.65(a). Here, however, Petitioner’s declarant does not offer mere conclusory statements. Instead, Petitioner’s declarant cites to specific disclosures of Fabio and Pasolini and explains how a person of ordinary skill would have interpreted such teachings. *See, e.g.*, Ex. 1003 ¶¶ 63–69, page 39 (citing to “the reasons to combine” section of the declaration (that is, ¶¶ 63–69)); *see also* Pet. 29 (citing Ex. 1003, page 39). Similarly, the Petition does not provide mere conclusory statements; rather, Petitioner cites to the disclosures of Fabio and Pasolini in addition to its declarant’s declaration testimony. *See, e.g.*, Pet. 28–29.

c. detecting a change in the orientation of the inertial sensor and updating the dominant axis based on the change (the “updating dominant axis limitation”)

Petitioner contends that Fabio in combination with Pasolini teaches the updating dominant axis limitation. Pet. 29–31. In particular, Petitioner relies on Pasolini’s disclosure of identifying the main vertical axis at each acquisition of a new acceleration sample. *Id.* at 30 (citing Ex. 1005, 8:20–22). According to Petitioner, a person of ordinary skill in the art

would have understood that Pasolini detects a change in orientation of the inertial sensor based on the acceleration samples because Pasolini *takes into account variations in the orientation* of the pedometer when identifying the main vertical axis. *Id.* (citing Ex. 1003, 40; Ex. 1005, 8:22–24).

Patent Owner argues that “*Pasolini* . . . does not disclose ‘detecting a change in the orientation of the inertial sensor.’” PO Resp. 23. According to Patent Owner, “*Pasolini* . . . does not **detect a change in the orientation of the inertial sensor** and then in response, act upon that change.” *Id.* Patent Owner argues that the claims require detecting a change in sensor orientation and, in response to such detection, updating the dominant axis. *Id.* Patent Owner argues that Petitioner merely relies on “conclusory speculation through its declarant,” which amounts to a “conce[ssion] that *Pasolini* does not perform the required action (or any action) ‘**based on the change** [in the orientation of the inertial sensor].’” *Id.* at 24 (second alteration in original).

As we explained in section II.F.1.b above, each time an acceleration sample is acquired, Pasolini identifies which of its three axes is most aligned with gravity, thereby determining the orientation of the accelerometer (inertial sensor), and selects that axis for use in measuring acceleration samples, thereby assigning/updating a dominant axis based on the orientation of the inertial sensor. In other words, if the orientation of the inertial sensor has changed since the last acceleration sample was acquired, this change will be detected when the subsequent acceleration sample is acquired by determining anew which of the axes is most aligned with gravity. If the change in orientation warrants the selection of a different axis than was used with the preceding sample acquisition, Pasolini updates the

axis used to acquire the sample based on the orientational change. As we stated in our Institution Decision, Pasolini’s identification of the main vertical axis occurs, at each acquisition of a new sample of the acceleration data, precisely because the orientation (e.g., rotation) may change, thus changing which axis is considered the *main* vertical axis. *See* Dec. 19 (citing Ex. 1005, 8:17–24). Accordingly, we are persuaded by Petitioner’s showing and find that Pasolini discloses the updating dominant axis limitation. We note that Petitioner sets forth reasoning with rational underpinning as to why a person having ordinary skill in the art would have combined the teachings of Pasolini and Fabio. *See* section II.F.1.b above.

Furthermore, Patent Owner’s argument that the claims require a cause and effect relationship such that detecting a change in sensor orientation must be wholly independent from assigning or updating the dominant axis is inconsistent with the Specification of the ’723 patent, which states that “in one embodiment the inertial sensor *is oriented* by assigning a dominant axis.” Ex. 1001, 12:45–47 (emphasis added); *see also Google LLC v. Personal Audio, LLC*, 743 Fed. App’x 978, 985 (Fed. Cir. 2018) (recognizing “the principle that in . . . obviousness analysis, a single element, feature, or mechanism can ordinarily satisfy multiple claim limitations, including by performing multiple claimed functions”).

d. counting periodic human motions by monitoring accelerations relative to the dominant axis by counting the periodic human motions when accelerations showing a motion cycle that meets motion criteria is detected within a cadence window (the “counting limitation”)

Petitioner contends that Fabio teaches the counting limitation. Pet. 31–36. In particular, Petitioner relies on Fabio’s evaluation of the acceleration signal A_z to identify and count a total number of valid steps

N_{VT}. *Id.* at 32 (citing Ex. 1006, 2:56–64, Fig. 7). According to Petitioner, Fabio’s acceleration signal A_z is correlated to the accelerations undergone by the inertial sensor along the detection axis Z, which, as stated above with regard to the assigning limitation, Petitioner defines as the dominant axis. *Id.* at 33 (citing Ex. 1006, 2:56–59). Furthermore, Petitioner demonstrates how Fabio recognizes a step by evaluating the motion cycle of positive and negative peaks in the acceleration signal. *Id.* at 33–34 (citing Ex. 1006, 4:16–21, 6:21–26, Fig. 5). More importantly, Petitioner points to Fabio’s disclosure of a validation interval TV, during which Fabio validates a recognized step. *Id.* at 34–35 (citing Ex. 1003, 48; Ex. 1006, 4:35–39, 6:40–44, Fig. 6). Petitioner equates the validation interval TV with the recited “cadence window.” *Id.* Notwithstanding Patent Owner’s arguments, which we discuss below, we are persuaded by Petitioner’s showing and agree that Fabio describes the counting limitation.

Patent Owner argues that Fabio’s validation interval TV is not a cadence window, but, rather, is part of a validation logic that validates whether “the prior (but not the current step)” is “within a 50% variance of an immediately preceding period.” PO Resp. 11–15 (arguing also that the prior, but not the current step is validated and counted). Patent Owner notes that Fabio describes ignoring steps that are too short, and argues that “[t]he problem with this approach is that a legitimate regular step is invalidated.” *Id.* at 14. According to Patent Owner, “[n]one of the counting in *Fabio* . . . is with respect to a step *within* the validation interval TV. Rather, the counted steps occur *before* the validation interval TV being examined.” *Id.* at 14–15.

We are not persuaded by Patent Owner's arguments, which are premised on the contention that Fabio is retrospective in that its validation interval TV is used to validate a prior step ($K-1$), not to validate the current step (K). See PO Resp. 12; Tr. 66:13–20. Fabio discloses that once analysis of an acceleration sample indicates that a step has been recognized, “the control unit 5 executes a first validation test, corresponding to the regularity *of the individual step*.” Ex. 1006, 4:24–27 (emphasis added). Continuing, Fabio discloses that “validation occurs when the duration ΔT_K of *a current step K* is substantially homogeneous with respect to the duration ΔT_{K-1} of *an immediately preceding step K-1*.” *Id.* at 4:28–31 (emphases added). “[T]he duration of a generic step is determined by the time that has elapsed between an instant of recognition of the step of which the duration is evaluated and an instant of recognition of the step that immediately precedes it.” *Id.* at 4:31–35 (emphasis added). Additionally, both Figure 4 (illustrating a flowchart of the first counting procedure) and Figure 7 (illustrating a flowchart of the second counting procedure) indicate that an acceleration datum is subjected to the validation test immediately after it has been recognized as a step. Thus, it is the currently recognized step (K) that is being validated, not the preceding step ($K-1$).

We understand Patent Owner's interpretation to be based on Fabio's reference to the “last step recognized”—interpreting the “last step recognized” as the last or preceding step. In fact, the relevant disclosure in Fabio refers to the “last step recognized,” the “current step,” and the “immediately preceding step”:

More precisely, the last step recognized is validated if the instant of recognition of the current step $T_R(K)$ falls within a validation interval TV , defined with respect to the instant of

recognition of the immediately preceding step $T_R(K-1)$, in the following way:

$$TV=[T_R(K-1)+\Delta T_{K-1}-TA, T_R(K-1)+\Delta T_{K-1}+TB]$$

where TA and TB are complementary portions of the validation interval TV.

Id. at 4:35–43. Patent Owner contends that “last step recognized” refers to the immediately preceding step (K–1). We disagree. First, the language quoted above indicates that the current step has been recognized (“instant of recognition of the current step”), and the current step (K) necessarily occurred more recently than the immediately preceding step (K–1). *See id.* at Fig. 6 (illustrating a timeline of steps 1, 2, . . . , K–2, K–1, K). Second, only recognized steps are subjected to the validation test. *Id.* at 4:22–27 (“If . . . the step-recognition test is passed (output YES from block **225**), the control unit **5** executes a first validation test, corresponding to the regularity of the individual step (block **230**).”), 6:27–32 (discussing the second counting procedure and stating “The second validation test is altogether similar to the first validation test carried out in block **230** of FIG. [4].”), Figs. 4, 7.

Accordingly, we find that “last step recognized” refers to the current step (K) because both (K) and (K–1) are recognized steps, and between them, (K) was the last step that was recognized. This understanding is further supported by several of Fabio’s claims, which discuss validation of the “current detected step.” For example, claim 5 of Fabio recites “executing a first validation test of a current detected step,” and claim 6 recites “executing said first validation test of said current detected step comprises evaluating whether a duration of said current detected step is homogeneous with respect to a duration of an immediately preceding

detected step.” *Id.* at 9:13, 9:20–24. Fabio’s claim 7, which depends from claim 6, applies the formula quoted above to the recited first validation test of the current detected step. *Id.* at 9:25–35. We note that all of this claim language appeared in the Fabio application as originally filed on October 2, 2006. See Fabio patent file history, Specification 16 (filed October 2, 2006) (Ex. 3001).

In addition to being consistent with Fabio’s disclosure, Petitioner’s contentions that the current detected step (K) is the step being validated are supported by reference to the testimony of its declarant. See Pet. 31–36 (citing, in relevant part, Ex. 1003, 48–49). We credit this testimony as it is unrebutted, factually supported, and more consistent with Fabio’s disclosure as we have described above. Consequently, we view Petitioner’s evidence as more persuasive (and probative) than Patent Owner’s reading of Fabio.

e. updating the cadence window as actual cadence changes (the “updating cadence limitation”)

The Petition relies on Fabio’s disclosures of the validation interval TV as teaching that the cadence window is updated as actual cadence changes. Pet. 36–37. For instance, Petitioner quotes Fabio’s disclosure of validation occurring when the duration of a current step (K) is substantially homogeneous with respect to the duration of an immediately preceding step (K–1). *Id.* at 36 (citing Ex. 1006, 4:28–31). Notwithstanding Patent Owner’s arguments, which we discuss below, we are persuaded by Petitioner’s showing and agree that Fabio describes the updating cadence limitation.

Patent Owner argues that Fabio’s validation interval is not updated because it “considers only an immediately preceding step and time period

and cannot account, for example, for a rolling average of previous detected cycles.” PO Resp. 15; *see also* PO Sur-Reply 4 (discussing rolling average of previous detected cycles).

Patent Owner’s “retrospective” argument is unpersuasive for the reasons as set forth in section II.F.1.d above regarding the counting limitation. Regarding Patent Owner’s assertion that “the specification [of the ’723 patent] describes the cadence window as a rolling average of previous detected cycles” (PO Sur-Reply 4), we note that the portion of the ’723 patent cited by Patent Owner states, in relevant part, “*In one embodiment*, the period is updated after each step. The current stepping period *may* be a rolling average of the stepping periods over previous steps” Ex. 1001, 3:66–4:1 (emphases added). Thus, the citation relied upon by Patent Owner describes optional attributes and implicitly suggests that in other embodiments the stepping period is *not* updated after each step or based on a rolling average of previous stepping periods. Moreover, we note that there is no requirement in the challenged claims that the cadence window be defined by a rolling average of previous detected cycles. Thus, Patent Owner’s arguments are not commensurate with the scope of the challenged claims.

Patent Owner advances additional arguments in its Sur-Reply. Specifically, Patent Owner contends that Petitioner’s interpretation of “cadence window,” as set forth in the Petition, “ignores the term ‘cadence.’” PO Sur-Reply 3–4. Patent Owner also argues that “cadence window,” by definition, means considering multiple motion cycles rather than a single cycle. *Id.* at 4. Patent Owner also characterizes the recited cadence changes as “the rhythmic pattern changes.” *Id.* at 6. According to Patent Owner,

“Petitioner is reading the term ‘cadence’ out of the claim to ignore any [rhythmical] component.” *Id.* at 6–7.

Initially, we note that these arguments appear to be procedurally improper. *See* Trial Practice Guide Update, 14–15 (Aug. 2018),⁹ (discussing sur-replies and stating that “[g]enerally, a . . . sur-reply may only respond to arguments raised in the preceding brief”). These new arguments are also unpersuasive on their merits. As correctly noted by Petitioner (*see* Pet. 36–37), Fabio discloses that the amplitude (duration) of validation interval TV is based on the amplitude of the immediately preceding step and is determined anew each time a step is recognized. Ex. 1006, 4:28–55. Thus, as the cadence or rhythm of a user’s steps changes, the validation interval TV will also change in corresponding fashion.

f. Distinct Claim 5 Limitations

In addition to recitations substantially similar to the counting and updating cadence limitations discussed above, independent claim 5 also recites “buffering a plurality of periodic human motions, each periodic human motion comprising a motion cycle.” Ex. 1001, 15:35–44. For this limitation, Petitioner identifies Figure 4 as disclosing how Fabio performs “buffering” of steps (step 255, Fig. 4) that are not added to the valid steps counter until the regularity condition is met (step 265, Fig. 4). Pet. 41–43 (citing Ex. 1006, Fig. 4). Petitioner also relies on the teachings identified with regard to the independent claims, discussed above, where Fabio counts the steps during walking or running (i.e., periodic human activity) and updates the valid steps counter N_{VT} accordingly. *Id.* at 44 (citing Ex. 1006,

⁹ The Trial Practice Guide Update is available at <https://go.usa.gov/xU7GP>.

1:14–17, 6:40–42). Petitioner also reiterates for this claim that Fabio teaches updating the cadence window as the cadence of the motion cycle changes for the same reasons discussed above. *Id.* at 45–46. With the exception of the cadence window update, addressed in section II.F.1.e above, Patent Owner does not challenge Petitioner’s arguments and evidence concerning the claim 5 limitations.

Fabio discloses that, in operation, its control unit initially implements a first counting procedure in which acceleration data is sampled at a predetermined frequency. Ex. 1006, 3:13–21, Figs. 3–4. The user is considered to be at rest, and the control unit executes the first counting procedure to analyze acceleration data for an indication that the user is engaged in activity with a regular gait. *Id.* at 3:22–27. During the first counting procedure, the number of recognized and validated steps is tallied in a valid control steps counter N_{VC} . *Id.* at 3:15–16, 5:10–11. If a regular gait is detected, the number of valid control steps N_{VC} is added to the number of total valid steps N_{VT} and the control unit executes a second counting procedure according to which each detected valid step is added to the number of total steps; if no regular gait is detected within a certain amount of time, the pedometer is set in a low power consumption state and the control unit executes a surveying procedure until the pedometer is moved. *Id.* at 3:27–56, 5:30–36, Figs. 4, 7, 8. We note that the ’723 patent operates in substantially the same manner. *See, e.g.*, Ex. 1001, 11:1–8.

We are persuaded by Petitioner’s showing and agree that Fabio discloses “buffering a plurality of periodic human motions, each periodic human motion comprising a motion cycle.”

g. Distinct Claim 10 Limitations

Independent claim 10 recites “a dominant axis logic,” “a counting logic,” and “a cadence logic,” each performing functions recited in claim 1. Ex. 1001, 15:61–16:5. Petitioner argues that “Fabio discloses ‘dominant axis logic’ to perform the claimed functionality because its ‘control unit 5 receives and processes the acceleration signal A_z ’ and ‘performs control functions of the pedometer 1.’” Pet. 50 (citing Ex. 1003, 73–74; Ex. 1006, 2:34–48, 2:56–64). Petitioner also relies on Fabio’s control unit to disclose the counting logic (*id.* at 53–54) and the cadence logic (*id.* at 55). Patent Owner does not make any arguments with respect to these limitations.

Fabio discloses that its control unit is configured to execute the first counting procedure, second counting procedure, and surveying procedure. *See, e.g.*, Ex. 1006, 3:11–12 (“The control unit 5 is configured for executing a control procedure, as illustrated with reference to FIGS. 3-8.”). We are persuaded by Petitioner’s showing, which we adopt, that Fabio discloses the recited dominant axis logic, counting logic, and a cadence logic.

h. Distinct Claim 14 Limitations

Independent claim 14 recites “[a] non-transitory machine readable medium containing executable computer program instructions which, when executed by a processing system, cause said system to perform” the method steps recited in claim 1. Ex. 1001, 16:23–36. Petitioner argues that “Fabio discloses a non-transitory machine readable medium containing executable computer program instructions since the pedometer (1) includes ‘**a control unit 5 equipped with a nonvolatile-memory module**’ and (2) ‘the control unit 5 performs control functions of the pedometer 1.’” Pet. 61 (citing Ex. 1006, 2:36–42). Petitioner argues that it would have been obvious to a

person having ordinary skill that “Fabio’s control unit would execute computer program instructions to perform the various functions of the pedometer” and “to store the instructions in the control unit’s nonvolatile-memory module for execution by the control unit.” *Id.* (citing Ex. 1003, 84).

Petitioner also notes that “Pasolini similarly teaches ‘processing unit 3, comprising a microprocessor circuit (for example, a microcontroller or DSP)’ that ‘executes appropriate processing operations for counting the number of steps and measuring the distance traveled,’” and argues that it would have been obvious to a person having ordinary skill “to execute computer program instructions for counting steps by a processing system.” *Id.* at 62 (citing Ex. 1003, 84; Ex. 1005, 3:30–35). Petitioner reasons that:

Fabio’s control unit equipped with a nonvolatile memory that performs a step counting method, in view of Pasolini’s processing unit that executes processing operations to perform a step counting method, renders obvious “a non-transitory machine readable medium containing executable computer program instructions which, when executed by a processing system, cause said system to perform a method.”

Id. (citing Ex. 1003, 85). Patent Owner does not make any arguments with respect to these limitations.

We are persuaded by Petitioner’s showing, which we adopt, that Fabio and Pasolini render obvious a non-transitory machine readable medium containing executable computer program instructions to cause Fabio’s control unit to perform the recited functions.

i. Conclusion

For the reasons provide above, we are persuaded by Petitioner’s showing, which we adopt as our own, that independent claims 1, 5, 10, and 14 would have been obvious in view of Fabio and Pasolini.

2. Dependent Claims 2, 3, 6, 7, 11–13, and 15–18

We have reviewed the Petition, Patent Owner Response, Petitioner Reply, Patent Owner Sur-Reply, and evidence of record and determine that Petitioner has shown, by a preponderance of the evidence, that dependent claims 2, 3, 6, 7, 11–13, and 15–18 would have been obvious in view of Fabio and Pasolini. Patent Owner does not make any arguments with respect to these claims apart from arguments directed to the independent claims from which they depend, which we have addressed above. PO Resp. 25; *see also* PO Sur-Reply 17.

Claim 2 depends from claim 1 and further recites “using acceleration measurements along only the dominant axis to count steps.” Ex. 1001, 15:25–27. Claim 11, depending from claim 10, and claim 15, depending from claim 14, contain substantially similar recitations as claim 2. *Id.* at 16:6–8, 16:37–42. Petitioner relies on Fabio and Pasolini to disclose these limitations. Regarding Fabio, Petitioner argues that, “[b]ecause Fabio discloses that the detection axis is detection axis Z, a POSITA would have understood Fabio’s processing the acceleration signal of the Z axis (A_z) to count steps is using only the acceleration measurements from Fabio’s dominant axis[] (i.e., the detection axis).” Pet. 38 (citing Ex. 1003, 51–52; Ex. 1006, 2:56–59); *see also id.* at 56 (regarding claim 11), 63–64 (regarding claim 15). Regarding Pasolini, Petitioner notes that Pasolini detects the acceleration component along the detection axis Z of the vertical acceleration generated during a step, and Petitioner argues that “[a] POSITA would have understood this to teach using only the dominant axis since Pasolini describes that ‘the dc. component of said acceleration value (due substantially to the acceleration of gravity) is eliminated’ to determine the

acceleration value to use subsequently in the algorithm.” *Id.* at 38–39 (citing Ex. 1003, 52–53; Ex. 1005, 3:13–19, 3:35–41, 5:57–61). We note that Petitioner relies on Fabio and Pasolini in a similar manner as with its challenge to claim 1. We are persuaded by Petitioner’s showing, which we adopt, that claims 2, 11, and 15 would have been obvious in view of Fabio and Pasolini.

Claim 3 depends from claim 1 and further recites “wherein at least one of the motion criteria is a dynamic motion criterion, the dynamic motion criterion updated to reflect current conditions.” Ex. 1001, 15:28–30. Claim 18 depends from claim 14, through claim 17, and contains substantially similar recitations as claim 3. *Id.* at 16:60–64. Petitioner relies on Fabio and Pasolini to disclose these limitations. Petitioner notes that Fabio discloses that a step is recognized when the acceleration signal shows a positive peak higher than a positive threshold (A_{ZP}) followed by a smaller, negative peak less than a negative threshold (A_{ZN}). Pet. 39 (citing Ex. 1006, 4:16–21, 6:21–26). Petitioner notes that Pasolini also compares the acceleration sample to positive (S^+) and negative (S^-) reference thresholds to determine positive and negative phases of a step, and argues that “Pasolini teaches that the positive and negative reference thresholds that make up the motion criteria are dynamic because they are calculated on-the-fly to be self-adaptive for the user.” *Id.* at 39–40 (citing Ex. 1005, 3:42–48). Petitioner argues that Pasolini’s “reference thresholds are also updated as each step occurs to adapt to variations in terrain or speed of the gait.” *Id.* at 40 (citing Ex. 1005, 3:48–59); *see also id.* at 41 (citing Ex. 1003, 57). Petitioner notes that Pasolini recognizes threshold levels that are either too high or too low are known problems in pedometer step recognition (*id.* at 22 (citing Ex.

1005, 1:61–2:3)), and argues that “[a] POSITA would have . . . understood that implementing Pasolini’s . . . teachings into Fabio’s device would result in a signal that is less susceptible to the type of errors that Fabio is concerned with preventing” (*id.* at 24). We are persuaded by Petitioner’s showing, which we adopt, that claims 3 and 18 would have been obvious in view of Fabio and Pasolini.

Claim 6 depends from claim 5 and further recites “switching the device from the active mode to the non-active mode when a number of expected periodic human motions are not identified in the appropriate cadence windows.” Ex. 1001, 15:45–49. Claim 16, depending from claim 14, contains substantially similar recitations as claim 6. *Id.* at 16:43–50. Petitioner relies on Fabio to disclose these limitations, arguing that Fabio “teaches switching its pedometer device from the second counting procedure (i.e., an active mode) to the first counting procedure (i.e., a non-active mode) when an interruption in locomotion occurs.” Pet. 46 (citing Ex. 1003, 65); *see also id.* at 64 (regarding claim 16). Petitioner notes that Fabio switches from its second counting procedure to its first counting procedure when a certain number of steps (N_{INV}) are not identified within their validation intervals (TV). *Id.* at 47 (citing Ex. 1003, 69–70; Ex. 1006, 3:37–49, 6:14–7:23). Fabio discloses that, when executing the second counting procedure, if an interruption in locomotion is detected, the control unit reverts to the first counting procedure. Ex. 1006, 3:44–49. In the second counting procedure, the number of recognized and invalid steps is tallied in an invalid step counter N_{INV} . *Id.* at 3:17–18, 6:54–56. If the number of invalid steps reaches a predetermined threshold number (N_{T4}), the second counting procedure is terminated and the first counting procedure is reinitiated. *Id.* at

7:1–6, Figs. 3, 7. We are persuaded by Petitioner’s showing, which we adopt, that claims 6 and 16 would have been obvious in view of Fabio and Pasolini.

Claim 7 depends from claim 5 and further recites “switching from a sleep mode to the non-active mode of operation when an acceleration is detected.” Ex. 1001, 15:50–52. Petitioner relies on Fabio to disclose this limitation, arguing that Fabio “teaches a surveying procedure (i.e., a sleep mode) in which the pedometer is placed in a low-power state that includes a lower sampling rate.” Pet. 48 (citing Ex. 1003, 70). Petitioner notes that, in the surveying mode, Fabio operates in a low-consumption state and samples acceleration data intermittently. *Id.* (citing Ex. 1006, 3:51–52, 7:43–45). Fabio discloses a low power consumption state in which the control unit executes a surveying procedure to reactivate the pedometer intermittently to acquire acceleration samples. Ex. 1006, 3:50–53, 7:24–50. If the acquired acceleration data indicates that the pedometer (and, therefore, the user) is in motion, the surveying procedure is terminated and the first counting procedure is re-initiated. *Id.* at 7:51–54. We are persuaded by Petitioner’s showing, which we adopt, that claim 7 would have been obvious in view of Fabio and Pasolini.

Claim 12 depends from claim 10 and further recites “the cadence logic to update a dynamic cadence window” and “the counting logic to count a periodic human motion when an acceleration measurement that meets motion criteria is taken within the cadence window.” Ex. 1001, 16:9–15. Petitioner relies on Fabio to disclose these limitations, arguing that Fabio’s “validation interval (i.e., the cadence window) is updated based on the timing and duration of the immediately preceding step.” Pet. 57 (citing

Ex. 1003, 79). According to Petitioner, “[b]ecause the validation interval is updated based on the timing and duration of the preceding step, a POSITA would have understood that the validation interval (i.e., the cadence window) changes upon each step and is therefore dynamic.” *Id.* (citing Ex. 1003, 79–80). Petitioner also presents arguments substantially similar to those discussed in section II.F.1.d above. *Id.* at 57–59. We are persuaded by Petitioner’s showing, which we adopt, that claim 12 would have been obvious in view of Fabio and Pasolini.

Claim 13 depends from claim 10 and further recites “a comparator, to compare measurements of acceleration to dynamic motion criteria, the dynamic motion criteria updated to reflect current conditions” and “the counting logic to count a periodic human motion when the measurements of acceleration satisfy the dynamic motion criteria.” Ex. 1001, 16:16–22. Petitioner argues that “Pasolini teaches comparing the acceleration signal (i.e., measurements of acceleration) to motion criteria consisting of positive and negative peak thresholds” S^+ and S^- , respectively. Pet. 59 (citing Ex. 1005, 3:36–41). Petitioner presents arguments substantially similar to those discussed above with respect to claim 3 in arguing that these thresholds are dynamic. *Id.* at 59–60 (citing Ex. 1003, 82; Ex. 1005, 3:48–51). Petitioner argues that a person having ordinary skill would have understood Pasolini’s processing unit to be a “comparator” because it performs comparisons, and would have understood Pasolini’s processing unit would execute machine readable instructions to perform the comparisons. *Id.* at 60 (citing Ex. 1003, 82). We are persuaded by Petitioner’s showing, which we adopt, that claim 13 would have been obvious in view of Fabio and Pasolini.

Claim 17 depends from claim 14 and further recites “maintaining a cadence window, wherein the cadence window is updated as an actual cadence changes” and “counting a periodic human motion when an acceleration measurement that meets motion criteria is within the cadence window.” Ex. 1001, 16:51–59. Petitioner presents arguments substantially similar to those discussed in sections II.F.1.d and II.F.1.e above regarding the counting and updating cadence limitations, and also argues that “[a] POSITA would have understood that the validation interval is updated, and thus maintained, at each step since it is defined with respect to the immediately preceding step.” Pet. 65 (citing Ex. 1003, 87–88). We are persuaded by Petitioner’s showing, which we adopt, that claim 17 would have been obvious in view of Fabio and Pasolini.

G. Patent Owner’s Polaris Argument

Patent Owner notes that an argument made in an appeal pending at the U.S. Court of Appeals for the Federal Circuit asserts that “the Board’s appointments of administrative patent judges violate the Appointments Clause of Article II” of the U.S. Constitution. PO Resp. 25. “Patent Owner . . . adopts this constitutional challenge . . . to ensure the issue is preserved pending the appeal.” *Id.*

The Board has previously “declin[ed] to consider . . . constitutional challenge[s] as, generally, ‘administrative agencies do not have jurisdiction to decide the constitutionality of congressional enactments.’” *Square, Inc. Unwired Planet LLC*, Case IPR2014-01165, slip op. at 25 (PTAB Oct. 30, 2015) (Paper 32) (quoting *Riggin v. Office of Senate Fair Emp’t Practices*,

61 F.3d 1563, 1569 (Fed. Cir. 1995)). We, likewise, decline to consider Patent Owner's constitutionality argument.

III. CONCLUSION

Based on the evidence and arguments, Petitioner has demonstrated by a preponderance of the evidence that claims 1–3, 5–7, and 10–18 of the '723 patent are unpatentable.

IV. ORDER

Accordingly, it is:

ORDERED that claims 1–3, 5–7, and 10–18 of the '723 patent are determined 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.

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Patent 8,712,723 B1

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