

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE, INC., SAMSUNG ELECTRONICS AMERICA, INC.,
HTC CORP., HTC AMERICA, INC., and LG ELECTRONICS, INC.,
Petitioner,

v.

UNILOC 2017 LLC,
Patent Owner.

Case IPR2018-00424¹
Patent 7,881,902 B1

Before SALLY C. MEDLEY, JOHN F. HORVATH, and
SEAN P. O'HANLON, *Administrative Patent Judges*.

HORVATH, *Administrative Patent Judge*.

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

¹ HTC Corp., HTC America, Inc., and LG Electronics, Inc., who collectively filed a petition in IPR2018-01631, and Samsung Electronics America, Inc., who filed a petition in IPR2018-01653, have been joined to this proceeding.

I. INTRODUCTION

A. Background

Apple Inc. filed a Petition requesting *inter partes* review of claims 1–6, 9, and 10 (“the challenged claims”) of U.S. Patent No. 7,881,902 B1 (Ex. 1001, “the ’902 patent”). Paper 2 (“Pet.”). Uniloc Luxembourg S.A., a predecessor-in-interest of the ’902 patent, filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). Upon consideration of the Petition and Preliminary Response, we instituted *inter partes* review of all challenged claims on all grounds raised in the Petition. Paper 7 (“Dec. Inst.”).

Subsequent to our Institution Decision, Uniloc Luxembourg S.A. assigned the ’902 patent to Uniloc 2017 LLC (“Patent Owner”), and we granted motions for Samsung Electronics America, Inc., HTC Corp., HTC America, Inc., and LG Electronics, Inc. to join Apple, Inc. as Petitioner in this proceeding. See Papers 10, 13, and 14.²

Patent Owner filed a Response to the Petition (Paper 11, “PO Resp.”), Petitioner filed a Reply (Paper 12, “Pet. Reply”), and Patent Owner filed a Sur-Reply (Paper 15, “PO Sur-Reply”). We held a consolidated oral hearing for this case and related cases involving the same parties and related patents on April 2, 2019, and the hearing transcript is included in the record. See Paper 20 (“Tr.”).

² Apple identifies itself as the real party-in-interest. Uniloc 2017 LLC identifies itself, Uniloc USA, Inc., and Uniloc Licensing USA LLC as real parties-in-interest. Paper 10, (1). Samsung Electronics America, Inc. identifies itself and Samsung Electronics Co., Ltd. as real parties-in-interest. Paper 13, 2 n.1. HTC Corp., HTC America, Inc., and LG Electronics, Inc. identify themselves, LG Electronics U.S.A., Inc., and LG Electronics MobileComm USA, Inc. as real parties-in-interest. Paper 14, 2 n.1.

We have jurisdiction under 35 U.S.C. § 6(b). This is a Final Written Decision under 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons set forth below, we find Petitioner has shown by a preponderance of evidence that claims 1–6 and 10 of the '902 patent are unpatentable, but has failed to show by a preponderance of evidence that claim 9 is unpatentable.

B. Related Matters

Petitioner and Patent Owner identify numerous district court matters that could affect, or be affected by, a decision in this proceeding. Pet. 1–2; Paper 3, (2). In addition, our Institution Decision identifies numerous *inter partes* reviews challenging claims of the '902 patent and related U.S. Patent Nos. 7,653,508 B1 and 8,712,723 B1 that could affect, or be affected by, this proceeding. Dec. Inst. 2–3.

*C. Evidence Relied Upon*³

Reference		Effective Date ⁴	Exhibit
Pasolini	US 7,463,997 B2	Oct. 2, 2006	1005
Fabio	US 7,698,097 B2	Oct. 2, 2006	1006
Mitchnick	US 2006/0084848 A1	Oct. 14, 2004	1007
Tanenhaus	US 6,469,639 B2	Oct. 22, 2002	1008
Sheldon	US 5,957,957	Sept. 28, 1999	1009

³ Petitioner also relies upon the Declaration of Joseph A. Paradiso, Ph.D. (Ex. 1003).

⁴ Petitioner relies on the filing dates of Pasolini, Fabio, and Mitchnick as the effective date for determining their availability as prior art.

D. Instituted Grounds of Unpatentability

Reference(s)	Basis	Claim(s) Challenged
Mitchnick	§ 103(a)	1 and 2
Mitchnick and Sheldon	§ 103(a)	3
Mitchnick, Sheldon, and Tanenhaus	§ 103(a)	4
Fabio and Pasolini	§ 103(a)	5, 6, 9, and 10

II. ANALYSIS

A. The '902 Patent

The '902 patent relates to “a method of . . . counting periodic human motions such as steps.” Ex. 1001, 1:9–11. The method involves the use of a “portable electronic device that includes one or more inertial sensors” that “measure accelerations along a single axis or multiple axes.” *Id.* at 2:24–28.

Figure 1 of the '902 patent is reproduced below.

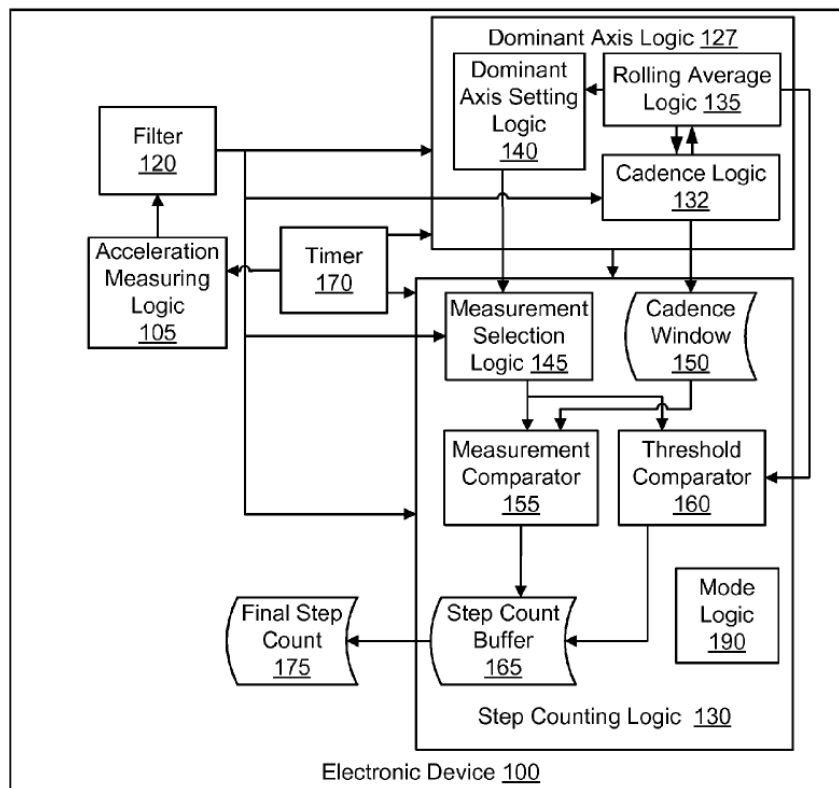


Figure 1 of the '902 patent is a block diagram illustrating electronic device 100. *Id.* at 1:47–48. Device 100 includes acceleration measuring logic 105 (e.g., inertial sensors), dominant axis logic 127, and step counting logic 130. *Id.* at 2:19–24, 2:38–43, Fig. 1. Device 100 “may be used to count steps or other periodic human motions,” where a “step” is “any user activity having a periodic set of repeated movements.” *Id.* at 2:29–30, 3:34–38. According to the '902 patent, device 100 accurately counts steps “regardless of the placement and/or orientation of the device on a user,” and regardless of whether the device “maintains a fixed orientation or changes orientation during operation.” *Id.* at 2:31–35.

Dominant axis logic 127 includes cadence logic 132 and rolling average logic 135. *Id.* at 2:66–3:2, Fig. 1. Inertial sensors 105 measure acceleration data, and cadence logic 132 analyzes this data to detect “a period and/or cadence of a motion cycle,” which may be based on user activity such as running or walking. *Id.* at 2:38–40, 3:14–18, 3:46–51. Cadence logic 132 determines “a cadence window 150 to be used by the step counting logic 130.” *Id.* at 3:11–14. Cadence window 150 is “a window of time since a last step was counted that is looked at to detect a new step.” *Id.* at 3:65–4:1. Cadence window 150 is initially set to a default value, and can be dynamically updated to reflect the cadence or period of detected steps once a minimum number of steps have been detected. *Id.* at 3:57–61, 4:22–28, 4:61–5:6. The cadence or stepping period can be determined as a “rolling average of the stepping periods over previous steps.” *Id.* at 3:61–62.

Cadence logic 132 also determines “one or more sample periods to be used by the rolling average logic 135.” *Id.* at 3:11–14, 5:31–34. The sample periods can be set to “the length of, or longer than, the stepping period,”

including a “multiple of the stepping period.” *Id.* at 5:34–37. Rolling average logic 135 “creates one or more rolling averages of accelerations . . . measured by the inertial sensor(s) over the sample period(s) set by the cadence logic 132.” *Id.* at 5:39–41. These rolling averages are used to determine an orientation of the electronic device and a threshold against which acceleration measurements are compared. *Id.* at 5:41–45.

Dominant axis logic 127 includes dominant axis setting logic 140, which determines an orientation of device 100 or of the inertial sensor(s) within device 100. *Id.* at 6:8–10. This may be done “based upon the rolling averages of accelerations created by the rolling average logic 135.” *Id.* at 6:10–12. In particular, “[t]he axis with the largest absolute rolling average” over a given sampling period, which can be the “axis most influenced by gravity,” is designated the dominant axis. *Id.* at 6:14–18, 6:23–25. The ’902 patent explains that because device orientation may change over time, the rolling average acceleration may change and “a new dominant axis may be assigned when the orientation of the electronic device 100 and/or the inertial sensor(s) attached to or embedded in the electronic device 100 changes.” *Id.* at 6:16–22. Dominant axis setting logic 140 can also set the dominant axis to be a virtual “axis that is defined as approximately aligned to gravity,” and that is found from “trigonometric calculations on the actual axes based on the gravitation influence” on those axes. *Id.* at 6:25–34.

Step counting logic 130 includes measurement selection logic 145, measurement comparator 155, and threshold comparator 160. *Id.* at 6:38–41. Measurement selection logic 145 “monitor[s] accelerations relative to the dominant axis, and select[s] only those measurements with specific relations to the dominant axis.” *Id.* at 6:44–47. “Selected measurements

[are] forwarded to the measurement comparator 155 and the threshold comparator 160 to determine whether a step has occurred.” *Id.* at 6:57–59.

A method for determining whether a step has occurred is disclosed in Figure 8 of the '902 patent, which is reproduced below.

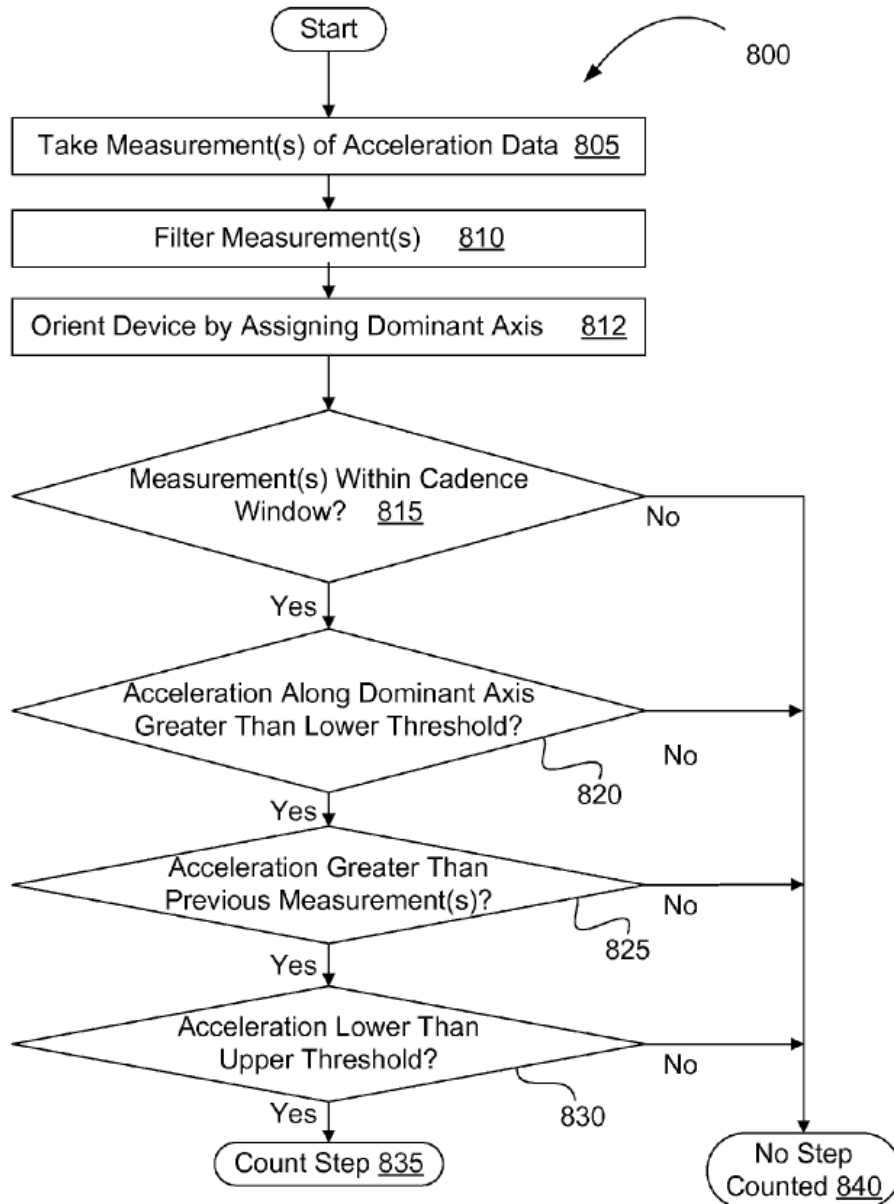


Figure 8 is a flow diagram of a method for recognizing that a step has occurred. *Id.* at 2:1–4, 12:25–27. Acceleration measurement data is received and filtered to remove low and high frequency components. *Id.* at 12:31–38, Fig. 8 (steps 805 and 810). A dominant axis is assigned as described above. *Id.* at 12:40–44, Fig. 8 (step 812). If the acceleration measurement falls outside the cadence window, it is discarded. *Id.* at 12:45–48, Fig. 8 (steps 815, 840). If the acceleration measurement falls within the cadence window, three additional tests are performed to determine whether a step is counted. First, the acceleration along the dominant axis must be greater than a lower threshold, such as the rolling average acceleration along the dominant axis. *Id.* at 7:9–12, 12:51–55, 12:64–65, Fig. 8 (step 820). Second, the acceleration along the dominant axis must be greater than previous measured accelerations along the dominant axis. *Id.* at 7:9–12, 13:34–38, 13:53–56, Fig. 8 (step 825). Third, the acceleration along the dominant axis must be lower than an upper threshold, which “prevent[s] sudden accelerations such as taps from being counted as steps.” *Id.* at 13:66–14:3, 7:9–12, 13:59–62, Fig. 8 (step 830).

Device 100 is battery operated and has multiple operating modes to preserve battery life, including sleep mode 305, entry mode 315, stepping mode 325, and exit mode 335. *Id.* at 8:16–18. The power level of device 100 is linked to these modes. *Id.* at 8:18–19. The different modes and the relationships between them are shown in Figure 3 of the '902 patent, which is reproduced below.

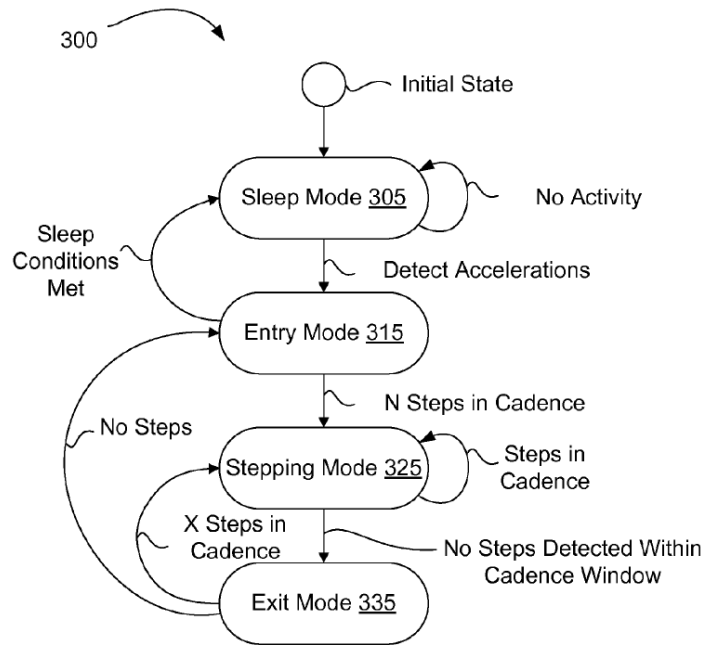


Figure 3 of the '902 patent is a state diagram showing the different modes of electronic device 100. *Id.* at 1:52–54. When no acceleration data is measured, device 100 is in sleep mode 305. *Id.* at 8:20–22. When acceleration data is detected, device 100 enters entry mode 315 to search for steps in the acceleration data. *Id.* at 8:22–25. If a predetermined number (N) of steps are detected in a sampling period, device 100 enters stepping mode 325; otherwise it reverts to sleep mode 305. *Id.* at 8:25–28. In stepping mode 325, steps are detected and counted as described above until no steps are detected within the cadence window, at which point device 100 enters exit mode 335. *Id.* at 8:30–37. In exit mode 335, device 100 determines whether a predetermined number (X) of steps are detected at a particular cadence. *Id.* at 8:38–40. If so, device 100 reverts to stepping mode 325; if not, device 100 reverts to entry mode 315. *Id.* at 8:41–44.

The method by which device 100 transitions from entry mode 315 to stepping mode 325 is shown in Figure 5, which is reproduced below.

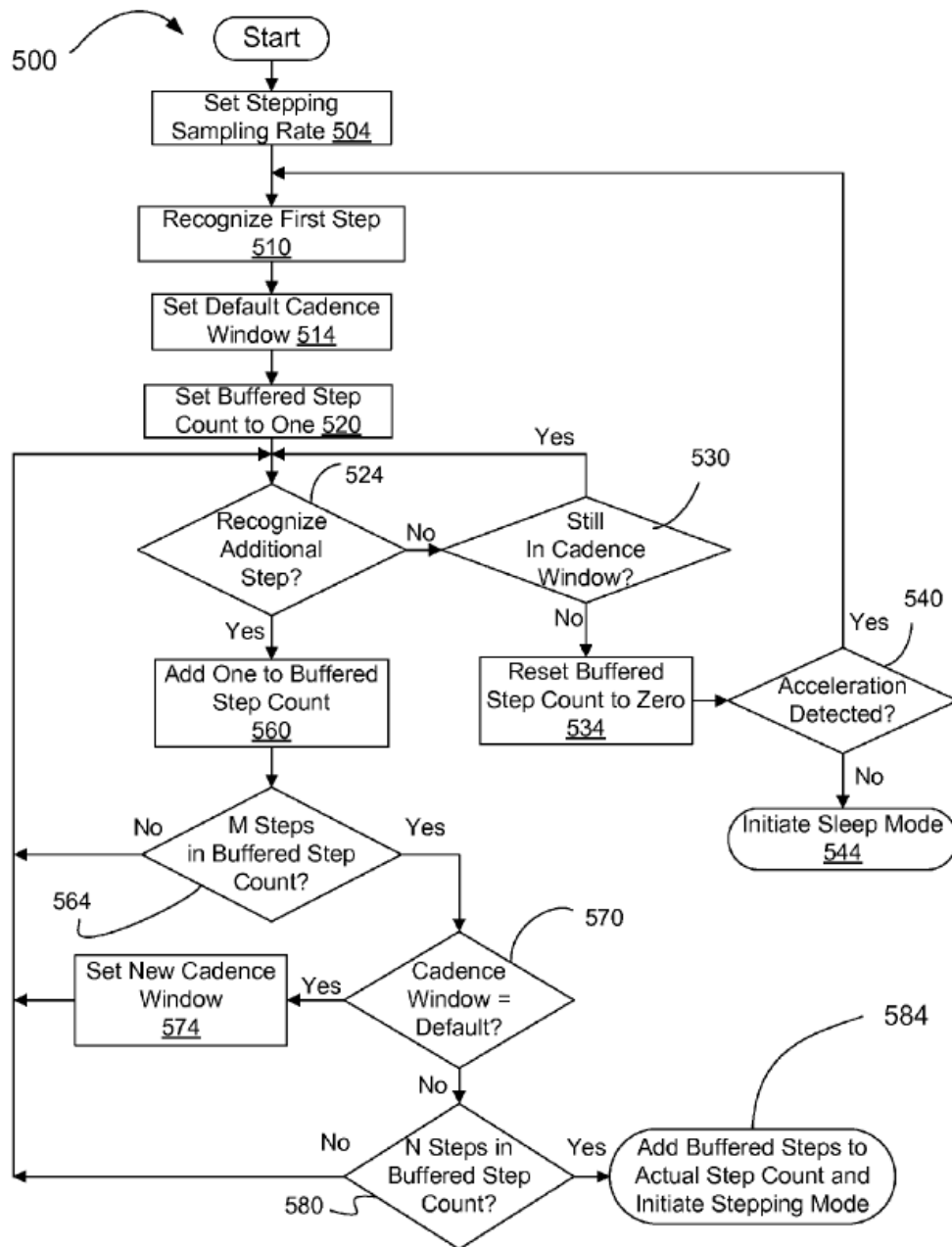


Figure 5 of the '902 patent is a flow chart of entry mode 315. *Id.* at 1:58–60. After setting a sampling rate (504), a first step is detected in the acceleration data (510), a default cadence window is set (514), and a temporary or buffered step count is set to one (520). *Id.* at 9:55–10:8, 10:25. Next, additional steps are searched for in the acceleration data (524) using the

criteria discussed above, including whether the acceleration data falls within the default cadence window. *Id.* at 10:25–30, 12:45–46, Fig. 8.

When additional steps are detected (524), they are added to the buffered step count (560). *Id.* at 10:46–47. If the buffered step count is less than a predetermined number M (564), additional steps are looked for in the acceleration data (524). *Id.* at 10:47–52. If the buffered step count is equal to M (564) and the cadence window is the default cadence window (570), a new cadence window is determined based on the cadence of the M steps (574). *Id.* at 10:53–57. The new cadence window is used to look for additional steps in the acceleration data (524) until a predetermined number of N steps is counted in the buffered step count (580). *Id.* at 10:57–67. When the buffered step count reaches N steps, the N steps are added to an actual step count (584), and device 100 enters stepping mode 325. *Id.* at 10:67–11:3. In stepping mode 325, the cadence window is dynamically updated based on the rolling average of previously measured stepping periods. *Id.* at 11:13–17.

As discussed above, measured acceleration data is only counted as a step when it falls within the cadence window. *Id.* at 10:25–30, 12:45–46, Fig. 8. If the measured acceleration data falls outside the cadence window (530), the buffered step count is reset to zero (534). *Id.* at 10:36–37. If acceleration data is subsequently detected (540), the process begins again to look for a first step (510). *Id.* at 10:42–44. Otherwise, the device enters sleep mode (544). *Id.* at 10:41–42.

B. Illustrative Claims

Of the challenged claims, claims 1 and 5 of the '902 patent are independent. Each of the other challenged claims depends directly from either claim 1 or claim 5. Claim 1 is reproduced below.

1. A method comprising:

detecting motion by an inertial sensor included in a mobile device;

determining, by the mobile device, whether the motion has a motion signature indicative of a user activity that the mobile device is configured to monitor;

when the motion does not have a motion signature of a user activity that the mobile device is configured to monitor, entering a sleep mode.

Ex. 1001, 15:10–18. Claim 5 is reproduced below.

5. A method for a mobile device comprising:

receiving acceleration data that meets stepping criteria from an accelerometer included in the mobile device;

incrementing a step count in a step count buffer;

when at least one of a) the step count is below a step count threshold, or b) a current user cadence fails to match a step cadence of a user profile, using a default step cadence window to identify a time frame within which to monitor for a next step; and

when the step count is at or above the step count threshold, determining a dynamic step cadence window and using the dynamic step cadence

window to identify the time frame within which to monitor for the next step.

Ex. 1001, 15:46–16:6.

C. Claim Construction

This Petition was filed on January 5, 2018. Pet. 72. For Petitions filed before November 13, 2018, claim terms of an unexpired patent are given their broadest reasonable interpretation in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b) (2017).⁵ Under the broadest reasonable interpretation standard, claim terms are generally given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art, in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Only claim terms that are in controversy need to be construed and only to the extent necessary to resolve the controversy. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

Petitioner proposes constructions for the terms “dominant axis” and “cadence window.” Pet. 6–7. In our Institution Decision, we adopted Petitioner’s proposed construction of “dominant axis,” declined to expressly construe “cadence window,” and *sua sponte* construed “periodically sampling acceleration data at a predetermined sampling rate, wherein each sample includes acceleration data measured by the inertial sensor over a predetermined time period” (the “periodically sampling” limitation). Dec. Inst. 13–16. Patent Owner disputes our constructions of the “dominant axis”

⁵ See Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent and Trial Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018).

and “periodic sampling” limitations. PO Resp. 6–13. Patent Owner does not dispute our finding that express construction of “cadence window” is not necessary, but argues that its “meaning is ignored by the Petitioner.” *Id.* at 11–12. We revisit our constructions of these claim terms below.

1. *dominant axis*

Petitioner argues “the term ‘dominant axis’ as used in the claims includes ‘the axis most influenced by gravity.’” Pet. 6 (citing Ex. 1003 ¶¶ 33–34) (emphasis added). As noted above, we adopted Petitioner’s proposed construction in our Institution Decision. *See* Dec. Inst. 13–15.

Patent Owner argues this construction “violates the well-established rule against reading limitations from the specification into the claim language.” PO Resp. 6. In particular, Patent Owner argues “Petitioner seeks to limit the claim term . . . to mean ‘the axis most influenced by gravity.’ . . . However, the teachings of the specification cited by Petitioner clearly state that they are only *example* embodiments and are not meant to be limiting.” *Id.* (citing Pet. 6). Patent Owner cites various portions of the Specification that allegedly illustrate that assigning a “dominant axis” as “the axis most influenced by gravity” is only one of many embodiments of the invention. *Id.* at 6–11 (citing Ex. 1002, 6:7–37). Despite disagreeing with Petitioner’s proposed construction of “dominant axis,” Patent Owner does not offer an alternative construction. Rather, Patent Owner argues “Petitioner has not and cannot establish *prima facie* obviousness through application of an incorrect construction.” *Id.* at 11.

We are not persuaded by Patent Owner’s arguments. In particular, we disagree that Petitioner seeks to *limit* the meaning of the term “dominant axis” to “the axis most influenced by gravity.” *Id.* at 6. As noted above,

Petitioner's proposed construction is that "the term 'dominant axis' as used in the claims *includes* 'the axis most influenced by gravity.'" Pet. 6 (emphasis added). Thus, Petitioner does not contend the term is *limited* to "the axis most influenced by gravity," but rather that the term, as used in the claims, *includes* "the axis most influenced by gravity." *Id.*

Petitioner's proposed construction is supported by claim 10 of the '902 patent, the only claim that includes the term "dominant axis." Claim 10 requires "determining an orientation of [a] mobile device with respect to gravity," and "assigning a dominant axis based on the orientation." Ex. 1001, 16:40–42. Thus, the "dominant axis" of claim 10 is an axis assigned based on the "orientation of the mobile device with respect to gravity." This claim limitation is fully supported by the Specification of the '902 patent, which discloses an embodiment in which "[d]etermining the orientation of the electronic device 100 may include identifying a gravitational influence," and in which "once the orientation is determined, a dominant axis is assigned based upon the orientation." *Id.* at 6:13–16

Accordingly, we agree with and continue to adopt Petitioner's proposed construction that the term "dominant axis includes the axis most influenced by gravity." See *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1248 (Fed. Cir. 1998) ("[T]he claim construction inquiry . . . begins and ends in all cases with the actual words of the claim."); *id.* at 1250 ("[T]he interpretation to be given a term can only be determined and confirmed with a full understanding of what the inventors actually invented and intended to envelop with the claim."); *id.* ("The construction that stays true to the claim language and most naturally aligns with the patent's description of the invention will be, in the end, the correct construction.");

see also Brookhill-Wilk 1, LLC v. Intuitive Surgical, Inc., 334 F.3d. 1294, 1300 (Fed. Cir. 2003) (“[I]n determining the ordinary and customary meaning . . . of disputed claim terms, the correct meaning of a word or phrase is informed only by considering the surrounding text.”).

2. *cadence window*

Petitioner argues the Specification defines the term “cadence window” to mean “a window of time since a last step was counted that is looked at to detect a new step.” Pet. 7 (quoting Ex. 1001, 3:66–4:1). In our Institution Decision, we preliminarily determined that this claim term did not require express construction. *See* Dec. Inst. 15.

Neither party appears to dispute our preliminary determination that express construction of “cadence window” is not needed to resolve any dispute between the parties. Instead, Patent Owner argues the plain and ordinary meaning of the term “is ignored by the Petitioner.” PO Resp. 11–12. And Petitioner argues, “[w]hether under Petitioner’s construction or the plain and ordinary meaning, . . . the combination of Pasolini and Fabio renders the claimed ‘cadence window’ obvious.” Pet. Reply 6.

Accordingly, we maintain our decision declining to expressly construe the term “cadence window.”

3. *periodically sampling acceleration data at a predetermined sampling rate, wherein each sample includes acceleration data measured by the inertial sensor over a predetermined period of time*

In our Institution Decision, we *sua sponte* construed this limitation based on a potential lack of clarity as to whether “*each sample*” in the “*wherein*” clause refers to all of the many acceleration data points that are measured over each sampling period, or instead refers to each one of those

acceleration data points. *See* Dec. Inst. 15–16. Patent Owner argues that “the claim language is clear and no construction is necessary.” PO Resp. 12–13. Nonetheless, Patent Owner offers a modification of our preliminary construction in the event we construe this term. *Id.* at 13. Petitioner agrees with Patent Owner that “no construction is required,” because “regardless of any construction of this term, Patent Owner does not separately argue the patentability of claim 3 under any construction.” Pet. Reply 7.

Upon consideration of the arguments presented by Petitioner and Patent Owner, we agree with both parties that express construction of this term is not required, because it is not needed to resolve any dispute between the parties. *See Nidec Motor*, 868 F.3d at 1017.

D. Level of Ordinary Skill in the Art

Petitioner contends a person of ordinary skill in the art would have had a Bachelor of Science degree or equivalent training in electrical engineering, computer engineering, or computer science, and approximately two years of hardware or software design and development experience related to micro-electro-mechanical (MEM) devices and body motion sensing systems. Pet. 5 (citing Ex. 1003 ¶ 16).⁶

Patent Owner disagrees with the experiential component of Petitioner’s definition (i.e., experience with MEMS and body motion sensing systems), and contends that a person skilled in the art would instead have two years of experience “related to accelerometers or similar devices.” PO Resp. 3 (quoting Ex. 2001 ¶ 12). Nonetheless, Patent Owner admits that

⁶ Petitioner cites to the page number of Exhibit 1003. We cite here to the paragraph number of Dr. Paradiso’s Declaration.

this “difference is inconsequential to the dispute here.” *Id.*

For purposes of this Decision, we find Petitioner’s description of a person skilled in the art to be reasonable, and adopt it as our own, because it is consistent with the problems and solutions disclosed in the patent and prior art of record. *See, e.g., In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). Although Patent Owner’s description is slightly different, we agree with Patent Owner that that difference is inconsequential to the analysis that follows.

E. Overview of the Prior Art

1. Mitchnick

Mitchnick discloses “a device for participant monitoring . . . that automatically collects monitoring data with little or no participant attention.” Ex. 1007 ¶ 1. The device “includes sensors for, at least, detecting and storing the occurrences of sexual activity . . . by observing characteristic patterns of participant motion as sensed by an acceleration.” *Id.* ¶ 12. Mitchnick’s preferred embodiment is a vaginally implanted device; however, Mitchnick discloses alternative embodiments that can reside “elsewhere in or on the body [for] detecting other parameters of medical/clinical interest.” *Id.* ¶ 43.

Figure 1 of Mitchnick is reproduced below.

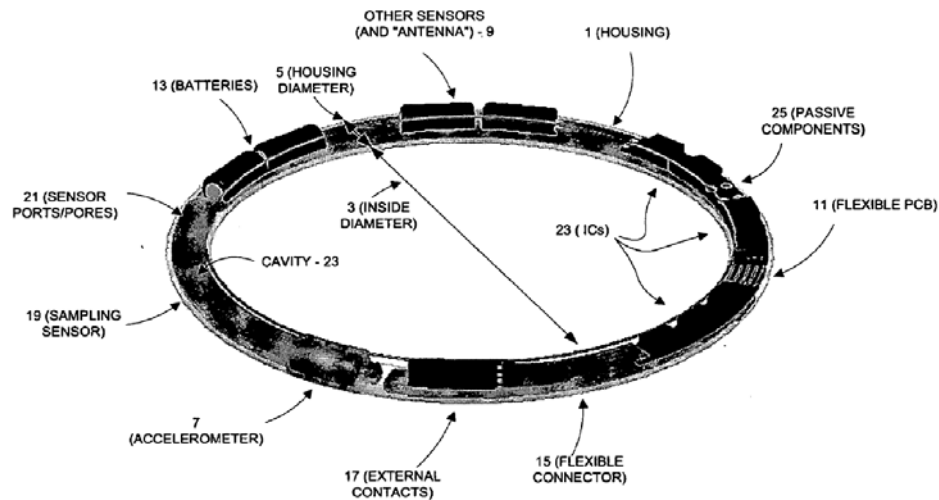


Figure 1 of Mitchnick is a schematic illustration of an activity monitoring device. *Id.* ¶ 49. The device includes housing 1, batteries 13, and accelerometer 7 “mounted so that its acceleration measurements are correctly oriented with respect to the housing.” *Id.* The device is controlled by a microprocessor that “implements general-purpose and power management instructions,” including processing analog sensor signals from the accelerometer. *Id.* ¶¶ 50, 66, Fig. 2. The device may also include a radio-frequency transceiver for communicating with external devices. *Id.* ¶ 49.

The microprocessor’s power management instructions allow the device to operate in either “a very low power . . . sleep mode,” an optional “low power mode,” or a “normal operational mode.” *Id.* ¶¶ 50, 67. At least some of these modes are shown in Figure 3 of Mitchnick, which is reproduced below.

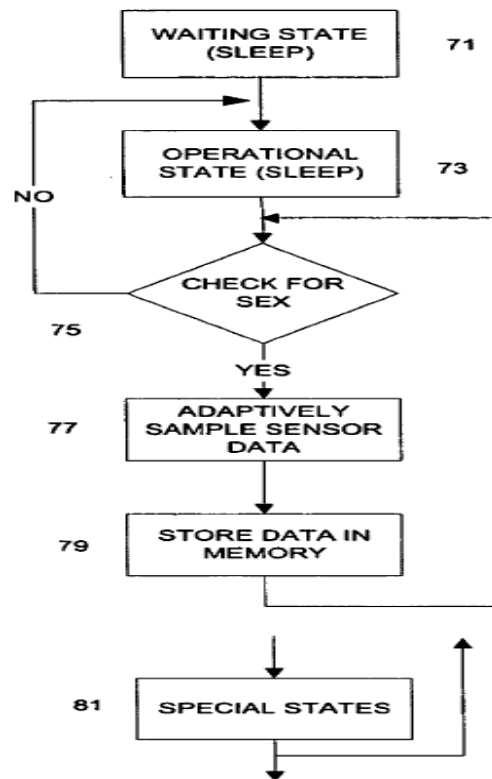


Figure 3 of Mitchnick is a flow chart showing the operating states of Mitchnick's device and transitions between those operating states. *Id.* ¶ 67, Fig. 3. The device is in wait/sleep state 71 when it is initially powered on or after the microprocessor receives and executes a SLEEP instruction. *Id.* ¶ 68. The device transitions from wait/sleep state 71 to operational/sleep state 73 when the microprocessor receives an interrupt signal generated by either an internal timer or a wake-up circuit responding to an external event. *Id.* ¶¶ 68, 72. Mitchnick discloses:

Because sexual activity is intermittent, power and memory can be advantageously *further conserved*, and device life *further extended*, by only intermittently sampling 75 for sexual activity and by storing sensor detail data only if sexual activity is observed. If sexual activity is not detected, the device *remains* in a low-power sleep state.

Id. ¶ 69 (emphases added). The timer can periodically wake up the device (e.g., every 10 minutes), placing it in operational/sleep state 73, to search for sexual activity. *Id.*

When in operational/sleep state 73, the device samples accelerometer data at a predetermined sampling rate and checks for sexual activity over a sampling period that is sufficient to achieve a desired accuracy. *Id.* ¶¶ 69, 72, 73, Fig. 3 (step 75). For example, the sampling period can be chosen so that the device has a 10% duty cycle and a 10 Hz sampling rate. *Id.* ¶¶ 69, 73. Thus, if the device enters operational state 73 every 10 minutes, it will sample the accelerometer data for a period of 1 minute (10% duty cycle), and in the course of that minute, it will obtain 600 acceleration data samples (10 Hz sampling rate).

The device identifies sexual activity by matching characteristics of the sampled accelerometer data to templates containing characteristics indicative of sexual activity, such as peaks in the accelerometer data and time intervals between the peaks. *Id.* ¶ 70. If the device identifies sexual activity in the accelerometer data, it continuously samples and records the accelerometer data, and checks for additional sexual activity. *Id.* ¶ 72, Fig. 3 (steps 75, 77, 79). However, if the device fails to detect sexual activity, it reverts to or remains in a sleep state. *Id.* ¶¶ 69, 72.

2. *Sheldon*

Sheldon discloses “a rate responsive pacemaker employing a body position sensor to distinguish stair climbing from other activities.”

Ex. 1009, 4:19–24. The pacemaker includes an accelerometer that “can be used to derive the level of patient activity from the number of changes in signal levels exceeding a certain threshold occurring in a given sampling

time period.” *Id.* at 5:14–17. The patient’s posture can also be determined by aligning the accelerometer’s sensitive axis “with the pacemaker case and the patient’s anterior-posterior (A-P) body axis.” *Id.* at 4:52–56. The accelerometer’s output can be sampled at 200 Hz over a 2 second sampling period, the DC component of the sampled output (i.e., the accelerometer’s “tilt”) can be used to determine the patient’s posture, and the AC component of the sampled output (i.e., the accelerometer’s “activity count”) can be used to determine the patient’s activity level. *Id.* at 11:64–12:3.

3. *Tanenhaus*

Tanenhaus discloses a low power monitoring device that includes a plurality of MEMS sensors, including at least an accelerometer and a wake-up circuit. Ex. 1008, 4:15–20, 4:29, 4:36–38. The wake-up circuit senses an activity, such as a movement, and sends a wake-up signal to a data acquisition processing circuit. *Id.* at 4:38–41. The wake-up circuit consists of a buffer and absolute value circuit, and a threshold detecting circuit. *Id.* at 4:53–56, 4:62–66. The buffer and absolute value circuit stores an absolute value of the sampled MEMS output, and the threshold detecting circuit determines whether that stored value exceeds a predetermined threshold. *Id.* When it does, a switching circuit connected to the threshold detecting circuit switches the data acquisition processing circuit from a sleep-type low power condition to a wake-up high power condition. *Id.* at 5:9–14.

4. *Fabio*

Fabio discloses a method for “controlling a pedometer based on the use of inertial sensors.” Ex. 1006, 1:10–11. The pedometer can be “integrated within a portable electronic device, such as a cell phone.” *Id.* at 2:34–36. The method involves:

generating a signal correlated to movements of a user of the pedometer; detecting steps of the user based on the signal; checking whether sequences of the detected steps satisfy pre-determined conditions of regularity; updating a total number of valid steps if the conditions of regularity are satisfied; and preventing updating of the total number of valid steps if the conditions of regularity are not satisfied.

Id. at 1:62–2:3. Fabio detects user steps from the sampled acceleration data A_Z of its inertial sensor according to a method illustrated in Figures 5 and 6, which are reproduced below.

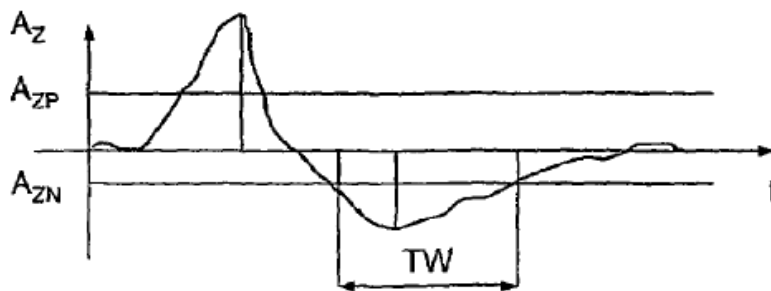


Fig.5

Figure 5 of Fabio is a graph illustrating quantities used to detect user steps from acceleration data. *Id.* at 2:22–23. A step is recognized when a positive peak of acceleration signal A_Z is greater than threshold A_{ZP} , and a negative peak is less than threshold A_{ZN} and falls within fixed time window TW from the positive peak. *Id.* at 4:15–21.

A recognized step is validated as a step when it falls within a variable time interval TV , which is illustrated in Figure 6, reproduced below.

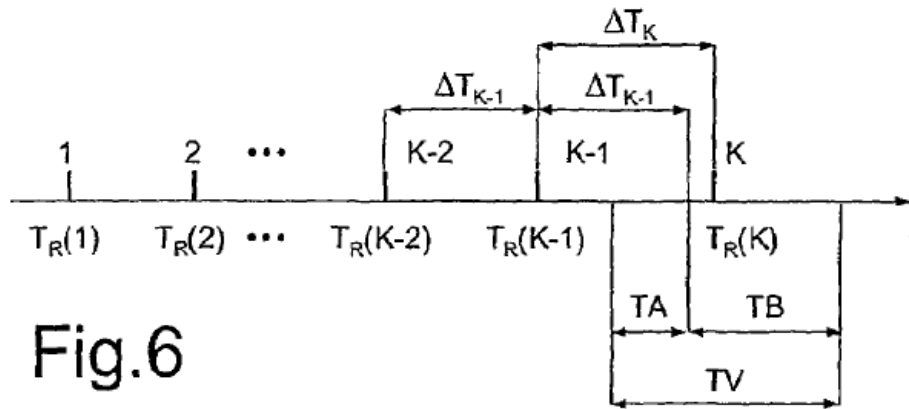


Figure 6 of Fabio is a graph illustrating quantities used to validate user steps detected from acceleration data. *Id.* at 2:24–25. Figure 6 illustrates a sequence of user steps recognized at times $T_R(1)$, $T_R(2) \dots T_R(K-2)$, $T_R(K-1)$, and $T_R(K)$ according to the method disclosed in Figure 5. The time between steps recognized at times $T_R(K-1)$ and $T_R(K-2)$ is ΔT_{K-1} ; the time between steps recognized at times $T_R(K)$ and $T_R(K-1)$ is ΔT_K . *Id.* at 4:28–35. For the step recognized at time $T_R(K)$ to be validated as a step, it must fall within variable time window TV; i.e., $T_R(K)$ must be greater than $T_R(K-1) + \frac{1}{2} (\Delta T_{K-1})$ and less than $T_R(K-1) + 2 (\Delta T_{K-1})$. *Id.* at 4:35–52. Although TV is described as having a variable width of $\frac{3}{2} \Delta T_{K-1}$ that depends on the variable time between previous steps, Fabio discloses TV can “have a different amplitude” (i.e., width). *Id.* at 4:52–53. Fabio further discloses that TV is used to ensure “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.” *Id.* at 4:28–31.

When counting steps, Fabio discloses that isolated “or very brief sequences of steps are far from significant and should preferably be ignored because they are, in effect, irrelevant.” *Id.* at 1:47–50. To ignore such steps,

Fabio discloses a two-stage counting procedure, illustrated in Figure 3, which is reproduced below.

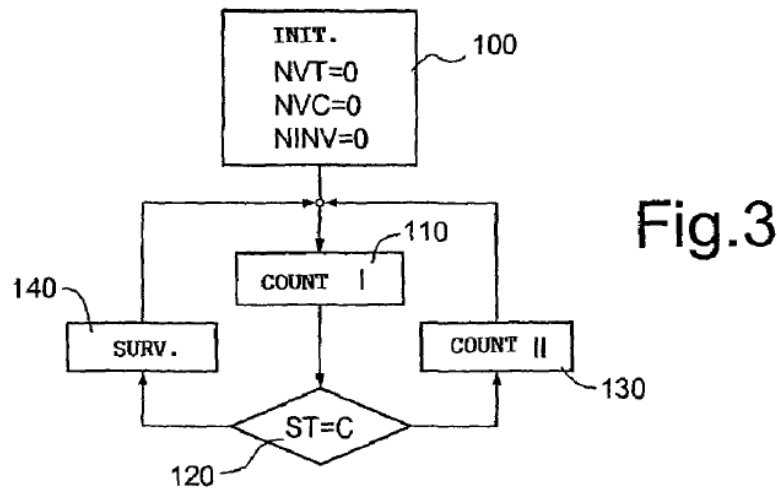


Figure 3 of Fabio is a flow chart depicting a two-stage counting procedure. *Id.* at 2:17–19. Initially, valid step counter N_{VT} , valid control step counter N_{VC} , and invalid step counter N_{INV} are set to zero (100). *Id.* at 3:13–18. Next, first counting procedure 110 counts steps by sampling acceleration data A_Z at a predetermined frequency. *Id.* at 3:19–21. First counting procedure 110 terminates and sets a state flag to C when “a regular gait of the user is recognized,” or terminates and sets the state flag to PD when “a time interval . . . that has elapsed from the last step recognized is longer than a first time threshold.” *Id.* at 3:27–36. If the state flag is set to C, second counting procedure 130 executes; otherwise surveying procedure 140 executes and the pedometer is placed in a wait or power down state. *Id.* at 3:37–41, 3:50–53.

Fabio illustrates first counting procedure 110 in Figure 4, which is reproduced below.

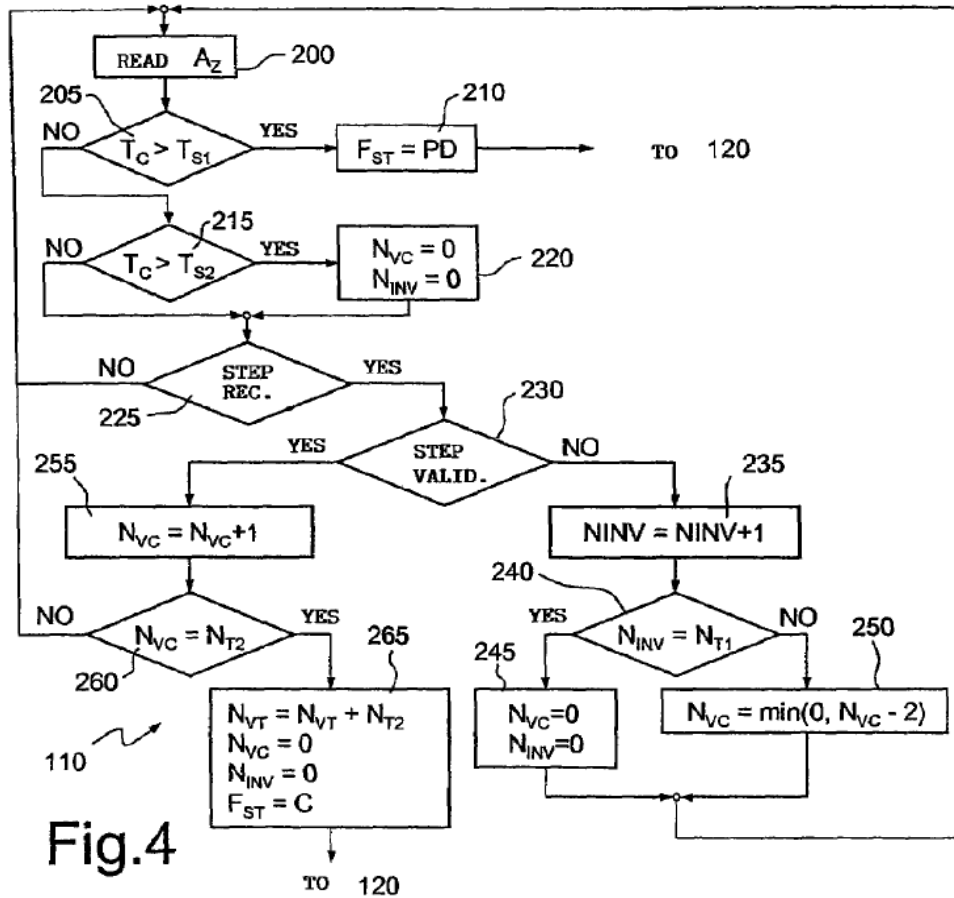


Figure 4 of Fabio is a flowchart illustrating first counting procedure 110. *Id.* at 2:20–21, 3:58–59. Sampled acceleration data A_Z is read (200), and if the time T_c between the sample time and the time of the last detected step is greater than a first threshold T_{S1} (205), state flag F_{ST} is set to PD (210) and survey procedure 140 is called. *Id.* at 3:60–4:2; *see also id.* at Fig. 3. Otherwise, the sample is checked to see if it is both recognized as a step (225) according to the procedure disclosed in Figure 5, and validated as a step (230) according to the procedure disclosed in Figure 6. *Id.* at 4:2–55. As discussed above, to be validated, a step must fall within time interval T_V .

If the sample is recognized (225) and validated (230) as a step, the number of valid control steps N_{VC} is incremented (255) and compared to a

threshold N_{T2} (260). *Id.* at 5:10–22. If N_{VC} is less than N_{T2} , another acceleration data sample is read (200) and the process continues. *Id.* at 5:22–27. However, if N_{VC} is equal to N_{T2} (260), the number of valid control steps N_{T2} is added to the number of valid steps N_{VT} , state flag F_{ST} is set to the count value C (i.e., N_{VT}), and second counting procedure 130 is called (265). *Id.* at 5:30–39; *see also id.* at Fig. 3. If the acceleration sample is recognized (225), but not validated (230) as a step because it falls outside of time interval T_V , an invalid step count N_{INV} is incremented (235), a new acceleration data sample is read (step 200), and the process is repeated.

Fabio's second counting procedure 130 is illustrated in Figure 7, which is reproduced below.

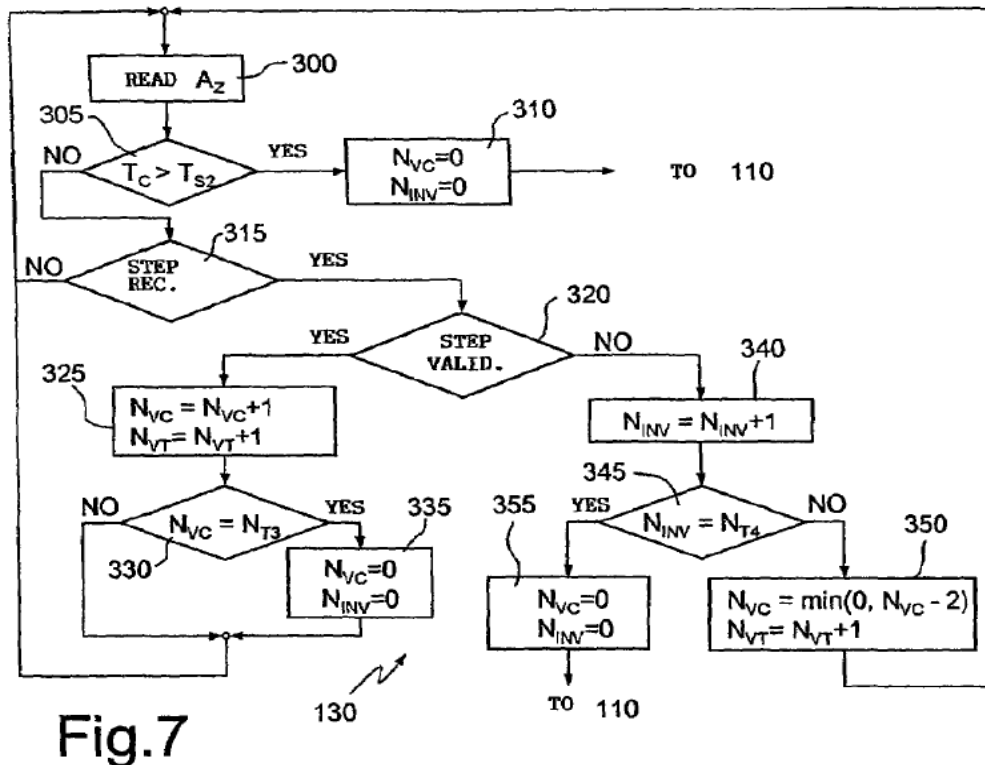


Figure 7 of Fabio is a flowchart illustrating second counting procedure 130. *Id.* at 6:12–13. Sampled acceleration data A_z is read (300), and if the time

T_c between the sample time and the time of the last detected step is greater than threshold T_{S2} (305), second counting procedure 130 is terminated. *Id.* at 6:14–20; *see also id.* at Fig. 3. Otherwise, the sample is checked to see if it is both recognized as a step (315) according to the procedure disclosed in Figure 5, and validated as a step (320) according to the procedure disclosed in Figure 6. *Id.* at 6:21–39. If the sample is recognized and validated as a step, the number of valid steps N_{VT} is incremented (325), another acceleration data sample is read (300), and the process continues searching for valid steps to count. *Id.* at 6:40–53. Second counting procedure 130 continues until either (a) the time T_c between an acceleration data sample and the time of the last detected step is greater than threshold T_{S2} (305), or (b) a sample is not validated as a step (320) and the incremented number of invalid steps N_{INV} (340) reaches threshold N_{T4} (345). *Id.* at 6:14–20, 6:54–7:6. When second counting procedure 130 terminates, first counting procedure 110 is executed. *Id.* at Fig. 3.

In addition to disclosing a two-stage counting procedure as described above, Fabio discloses that when the pedometer's inertial sensor contains two or more detection axes, step recognition is “performed by selecting the acceleration signal corresponding to the detection axis nearest to the vertical.” *Id.* at 8:21–25. The nearest-to-vertical 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. This allows steps to be counted “independently of how [the pedometer] is oriented.” *Id.* at 8:32–33.

Fabio uses survey procedure 140 to identify the nearest-to-vertical detection axis. *See id.* at 7:21–59, Fig. 3. Survey procedure 140 executes

whenever first counting procedure 110 terminates for failure to detect a step within a time T_{S1} from a previously detected step. *Id.* at 3:29–32, 3:50–53, Fig. 3. It initially determines and stores mean value A_{ZM} of the DC component of acceleration signal A_Z in non-volatile memory. *Id.* at 7:27–31. Mean value A_{ZM} represents the inertial sensor's acceleration due to gravity along its detection axis, and indicates the pedometer's orientation. *Id.* at 7:30–37. The pedometer then enters a sleep state, and periodically wakes up (e.g., every 10 seconds) to determine an updated mean value A_{ZM}' of the DC component of acceleration signal A_Z . *Id.* at 7:46–48. If A_{ZM}' is substantially the same as A_{ZM} , the pedometer goes back to sleep. *Id.* at 7:54–59. Otherwise, first counting procedure 110 is executed. *Id.* at 7:51–54.

5. *Pasolini*

Pasolini discloses a pedometer having a “step detection method using an algorithm for self-adaptive computation of acceleration thresholds.” Ex. 1005, 1:10–12. The pedometer can be housed inside a portable device, such as a mobile phone, and includes an accelerometer having multiple detection axes. *Id.* at 2:60–63, 8:11–13, 8:31–34. The pedometer's step detection algorithm “identif[ies] 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),” and does so “at each acquisition of a new acceleration sample . . . to take into account variations in the orientation of the pedometer device 1 and consequently of the accelerometer 2 arranged inside it.” *Id.* at 8:16–24.

Pasolini's step detection algorithm “compares the value of the [measured] acceleration signal A . . . with a positive reference threshold S^+

and with a negative reference threshold S^- , for identifying, respectively, the positive phase (positive acceleration peak) and the negative phase (negative acceleration peak) of the step.” *Id.* at 3:35–41. Once a positive acceleration phase is identified, a negative acceleration phase is searched for “within a certain time interval Mask.” *Id.* at 4:47–50. If a negative step phase is found within the Mask interval, a step is counted, and the length (LPS) of the step is estimated as $LPS = LP \times f(S_{\max}^+)$, where LP is a standard length corresponding to 0.4 to 0.5 times the height of the user, and $f(S_{\max}^+)$ is “a function of the maximum value $S_{\max}^+$ reached by the positive reference threshold S^+ during the positive phase of the step.” *Id.* at 4:66–5:24. Function $f(S_{\max}^+)$ can be tabulated and stored in memory on the basis of experimental tests. *Id.* at 5:24–29.

F. Patentability of Claims 1 and 2 over Mitchnick

Petitioner argues claims 1 and 2 are unpatentable under 35 U.S.C. § 103(a) as obvious over Mitchnick. Pet. 8–17. For the reasons discussed below, we determine Petitioner has demonstrated by a preponderance of evidence that claims 1 and 2 are unpatentable over Mitchnick.

1. Claim 1

Claim 1 recites a method comprising detecting motion by an inertial sensor included in a mobile device. Ex. 1001, 15:10–12. Petitioner argues Mitchnick teaches this limitation by disclosing an intra-vaginal device that includes an accelerometer 7 (i.e., an inertial sensor) that detects “patterns of participant motion.” Pet. 12 (citing Ex. 1007 ¶¶ 12, 49, Fig. 1). Petitioner argues Mitchnick’s device is mobile because it is small in size, includes a battery, is easily transported and does not restrict the movements of the

patient, and communicates wirelessly. *Id.* at 13 (citing Ex. 1007 ¶ 15, Figs. 1, 5B; Ex. 1003, 22–24).

Petitioner also argues that Mitchnick’s device is a mobile device because Mitchnick “teaches that its internal embodiment can be ‘entirely dispensed with, and all data sensed from an external unit on . . . the participant.’” *Id.* (citing Ex. 1007 ¶ 15). Relying on the testimony of Dr. Paradiso, Petitioner argues a person skilled in the art would have found it obvious to implement Mitchnick’s device as an externally worn device for several reasons, including allowing a patient to wear or remove the device rather than having it medically implanted, allowing the device to be distributed and worn by both male and female patients, and using the device to detect “other parameters of medical/clinical interest,” such as walking or running following a heart attack or knee surgery. *Id.* at 10–11 (citing Ex. 1003, 18–19).

Patent Owner argues that Mitchnick’s device is not a “mobile device” because it is “designed to be affixed to or reside in a cavity of, a participant.” PO Resp. 22. In rebuttal, Petitioner argues “[t]he claims of the ’902 patent . . . provide no language that specifically excludes an implantable device,” and the ’902 patent’s only disclosure regarding device mobility, i.e., that the device “*may* be carried in a backpack, pocket, purse, hand, *or elsewhere*,” also does not exclude an implantable device. Pet. Reply 18 (quoting Ex. 1001, 2:35–36) (emphases added).

We agree with Petitioner that the term “mobile device,” as recited in the claims of the ’902 patent, does not exclude implantable devices. The ’902 patent does not define the term “mobile device,” and does not use the term other than in the claims. Moreover, Petitioner sets forth persuasive and

unrebutted testimonial evidence that Mitchnick’s device—whether internally or externally worn—is a “mobile device” because it is small, battery powered, easily transported by the patient, and communicates wirelessly. *See* Pet. 13; *see also* Ex. 1007 ¶ 15, Figs. 1, 5B; Ex. 1003, 22–24. In addition, we note that Petitioner does not rely solely on Mitchnick’s intra-vaginal device to challenge claim 1; Petitioner also relies on implementing that device as a device that is worn “on” a patient’s body. *See* Pet. 13 (citing Ex. 1007 ¶ 15).

Patent Owner next argues that Petitioner fails to show Mitchnick’s internal and external embodiments are combinable because Mitchnick’s preferred embodiment is “an ‘intra-vaginal device used during trials of pharmaceuticals, especially microbicides, for preventing or limiting STD (e.g., HIV) transmission.’” PO Resp. 22 (quoting Ex. 1007 ¶ 11). Patent Owner argues wearing Mitchnick’s device externally “completely moots *Mitchnick*’s stated data gathering purposes,” and that Mitchnick provides “no suggestion or teaching how such a device could somehow be ‘mobile’ and yet retain its ‘medical/clinical’ measuring capabilities.” *Id.* at 23.

We are not persuaded by Patent Owner’s arguments, which fail to fully address the ground raised in the Petition. Specifically, Petitioner’s argument is that Mitchnick’s device—whether internally or externally worn—is a “mobile device” because it is small, battery powered, easily transported by the patient, and communicates wirelessly. *See* Pet. 13. Thus, even if we were to agree with Patent Owner that Mitchnick’s externally worn device cannot be combined with Mitchnick’s internally worn device, Petitioner has persuasively shown that Mitchnick’s internally worn device is itself a “mobile device.”

Moreover, we agree with Petitioner that Mitchnick’s internal and external embodiments are combinable, and that Patent Owner’s non-combinability argument is unpersuasive because it ignores “Mitchnick’s explicit teaching that [its] device can reside ‘on the body’ and still retain its medical/clinical measuring capabilities.” Pet. Reply 20–21 (quoting Ex. 1007 ¶ 43). Indeed, although Mitchnick teaches its intra-vaginal device includes sensors for detecting sexual activity, and *preferably* also “include[s] sensors for other aspects of the vaginal environment and for detecting . . . topical pharmaceuticals,” Mitchnick also teaches its device may include other types of sensors to measure other clinically interesting data, such as temperature, pH, heart rate, and oxygen level. Ex. 1007 ¶ 12. Mitchnick further teaches its “intra-vaginal unit may be entirely dispensed with, and all data sensed from an external unit on or near the participant.” *Id.* ¶ 15. That is, Mitchnick expressly teaches its device can be externally worn, include motion sensors for detecting sexual activity, and include other sensors for detecting other medical/clinical data of interest. *Id.* ¶ 12; *see also id.* ¶ 43 (expressly teaching “embodiments . . . in or on the body and detecting other parameters of medical/clinical interest”).

Finally, Patent Owner argues Petitioner fails to explain why a person skilled in the art would modify Mitchnick’s device to be externally worn, or how it would be so modified. PO Resp. 25. Although Patent Owner acknowledges the many reasons Petitioner provided for implementing Mitchnick’s device as an externally worn device, Patent Owner characterizes those reasons as conclusory, and argues “Petitioner cannot merely speculate through its declarant, outside the four corners of the reference, to carry its burden.” *Id.* at 26–28.

We are not persuaded by Patent Owner’s argument. Again, Petitioner’s argument is that Mitchnick’s internal and external embodiments are both “mobile devices.” See Pet. 13. Moreover, Petitioner’s contention that Mitchnick’s device can be externally worn “does not rely on Dr. Paradiso’s declaration alone. Rather, . . . [it] rel[ies] on explicit statements from Mitchnick describing that the device can reside elsewhere ‘on the body’ in order to detect ‘other parameters of medical/clinical interest.’” Pet. Reply 23 (quoting Ex. 1007 ¶ 43).⁷ Thus, Petitioner not only provides adequate reasoning with rational underpinnings to implement Mitchnick’s device as an externally wearable device (e.g., the ability to easily wear, remove, and distribute the device to both men and women), but identifies an *express teaching* in Mitchnick that the device can be externally worn. See Pet. 10–11, 13. Given that, we do not find it was incumbent upon Petitioner to explain what, if any, modifications would have been needed to implement Mitchnick’s externally worn device. Petitioner’s proposal is not to modify the *device itself*, but *how the device is worn*. Mitchnick expressly teaches that the device can be worn either “in” or “on” the body. See Ex. 1007 ¶¶ 15, 43.

Accordingly, for the reasons explained above, we find Petitioner has sufficiently demonstrated that Mitchnick teaches a mobile device having an inertial sensor to detect motion.

⁷ Petitioner incorrectly cites to paragraph 11 of Mitchnick. We correct the citation to reference paragraph 43, where the quoted material can be found, and which Petitioner correctly quoted earlier in its Reply. See, e.g., Pet. Reply 21; see also Ex. 1007 ¶ 43 (disclosing “embodiments for residing elsewhere in or *on the body* and detecting *other parameters of medical/clinical interest*” (emphases added)).

Claim 1 further requires the mobile device to determine whether the motion has a signature indicative of a user activity that the mobile device is configured to monitor. Ex. 1001, 15:13–15. Petitioner argues Mitchnick teaches this limitation by disclosing its device “extracts characteristics from an observed accelerometer signal, compares observed characteristics to a template indicating ranges of characteristics likely to indicate sexual activity, and indicates sexual activity is likely if the observed characteristics match the template.” Pet. 14 (quoting Ex. 1007 ¶ 70) (emphasis omitted). Petitioner contends the accelerometer signal characteristics used to detect sexual activity in Mitchnick’s device include accelerometer signal peaks and times between peaks. *Id.*

Patent Owner disputes that Mitchnick’s device detects motion, arguing instead that the device “only performs **intermittent sampling** for data.” PO Resp. 29 (citing Ex. 1007 ¶ 69). We disagree, and are persuaded by Petitioner’s argument that Mitchnick’s device detects motion “‘by observing characteristic patterns of participant motion as sensed by an acceleration’ during sexual activity.” Pet. Reply 25 (citing Ex. 1007 ¶ 12); *see also* Pet. 12. Although we agree with Patent Owner that Mitchnick’s device periodically samples accelerometer data, it does so in order to detect motion, as does the device described in the ’902 patent. *See, e.g.*, Ex. 1001, 9:56–59 (teaching detecting motion (i.e., steps) by setting an accelerometer “sampling rate . . . to facilitate accurate measurements of steps”).

Patent Owner next argues that Mitchnick’s device does not determine whether accelerometer motion has a signature indicative of user activity the device is configured to monitor. PO Resp. 30–31. First, Patent Owner argues Mitchnick’s device “is not *focused* on detecting . . . sexual activity

via accelerometers, but rather gathering data” such as temperature, pH, heart rate, and oxygen level. *Id.* at 30 (citing Ex. 1007 ¶¶ 12, 20) (emphasis added). Next, Patent Owner argues that Mitchnick’s device only “happens upon motion by coincidence, not by detecting” it, because it “periodically wakes up to perform intermittent sampling, which may or may not just happen to be during activity.” *Id.* at 31.

We are not persuaded by Patent Owner’s arguments. Petitioner demonstrates how Mitchnick’s device detects a motion signature indicative of sexual activity regardless of whether the device *focuses* on detecting such activity. See Pet. 14–15; see also Ex. 1007 ¶ 70. Moreover, Mitchnick teaches measuring and recording clinical/sensor data only *after* detecting such a motion signature. See Ex. 1007 ¶ 72 (disclosing that when a sexual activity check succeeds, “the device proceeds to repetitively retrieve sensor data”). Finally, Mitchnick’s device doesn’t just “happen[] upon motion by coincidence,” as Patent Owner contends. PO Resp. 31. Rather, it is designed to detect motion by “periodically wak[ing] up and sampl[ing] for sexual activity approximately every 5 min[utes],” i.e., frequently enough to detect sexual activity by more than mere happenstance. Ex. 1007 ¶ 69. Thus, Petitioner has shown that Mitchnick teaches that its mobile device determines “whether the motion has a signature indicative of a user activity that the mobile device is configured to monitor,” as recited in claim 1.

Claim 1 further requires entering a sleep mode when the motion does not have a motion signature of a user activity that the mobile device is configured to monitor. Ex. 1001, 15:16–18. Petitioner demonstrates how Mitchnick teaches this limitation because its device enters a low power state when it does not find data indicative of continuing sexual activity while

sampling and recording accelerometer data in normal operating mode. Pet. 15–16 (citing Ex. 1007 ¶¶ 50, 70, 72, Fig. 3; Ex. 1003, 26–27). Patent Owner does not dispute this. See PO Resp. 21–31.

For the reasons discussed above, having considered the evidence and arguments presented by Petitioner and Patent Owner, we find Petitioner has demonstrated by a preponderance of evidence that Mitchnick teaches or suggests—via its internally or externally worn device—all the limitations of claim 1, and that claim 1 is unpatentable over Mitchnick.

2. Claim 2

Claim 2 depends from claim 1, and requires monitoring for future motions having the motion signature when the detected motion has a motion signature of a user activity that the mobile device is configured to monitor. Ex. 1001, 15:19–23. Petitioner demonstrates how Mitchnick teaches this limitation by periodically sampling accelerometer data, checking to determine whether the data is indicative of sexual activity, and when it is, “proceed[ing] to repetitively retrieve sensor data” and “checking ‘that sexual activity is continuing.’” Pet. 16–17 (quoting Ex. 1007 ¶ 72; citing Ex. 1003, 27–29). Patent Owner argues claim 2 fails for the same reasons as claim 1. PO Resp. 31–32. We are not persuaded by Patent Owner’s arguments for the reasons discussed in § II.F.1, *supra*.

Accordingly, for the reasons discussed above, having considered the evidence and arguments presented by Petitioner and Patent Owner, we find Petitioner has demonstrated by a preponderance of evidence that Mitchnick teaches or suggests—via its internally or externally worn device—all the limitations of claim 2, and that claim 2 is unpatentable over Mitchnick.

G. Patentability of Claim 3 over Mitchnick and Sheldon

Petitioner argues claim 3 is unpatentable under 35 U.S.C. § 103(a) as obvious over Mitchnick and Sheldon. Pet. 17–27. For the reasons discussed below, we determine Petitioner has demonstrated by a preponderance of evidence that claim 3 is unpatentable over Mitchnick and Sheldon.

1. Claim 3

Claim 3 depends from claim 1, and further requires the mobile device to periodically sample acceleration data at a predetermined sampling rate when in sleep mode, wherein each sample includes acceleration data measured by the inertial sensor over a predetermined period of time. Ex. 1001, 15:24–29.

Petitioner demonstrates how Mitchnick’s device is in sleep mode when its micro-controller (MC) and wake-up circuit are powered on and all other components are powered down. Pet. 20 (citing Ex. 1007 ¶¶ 53, 68; Ex. 1003, 32–34). Petitioner further demonstrates how Mitchnick’s device checks for sexual activity in sleep mode because “[i]f sexual activity is not detected, the device *remains* in [a] low-power state.” *Id.* at 20–21 (quoting Ex. 1007 ¶ 69; citing Ex. 1003, 32–34). Finally, Petitioner demonstrates how Mitchnick’s device periodically checks for sexual activity by sampling acceleration data (e.g., every 5 minutes) at a predetermined sampling rate (e.g., 10 Hz) over a predetermined period of time sufficient to achieve desired accuracy. Pet. 21–24 (citing Ex. 1007 ¶¶ 69, 73; Ex. 1003, 34–39).

Petitioner illustrates these contentions with an annotated version of Mitchnick’s Figure 3, which is reproduced below.

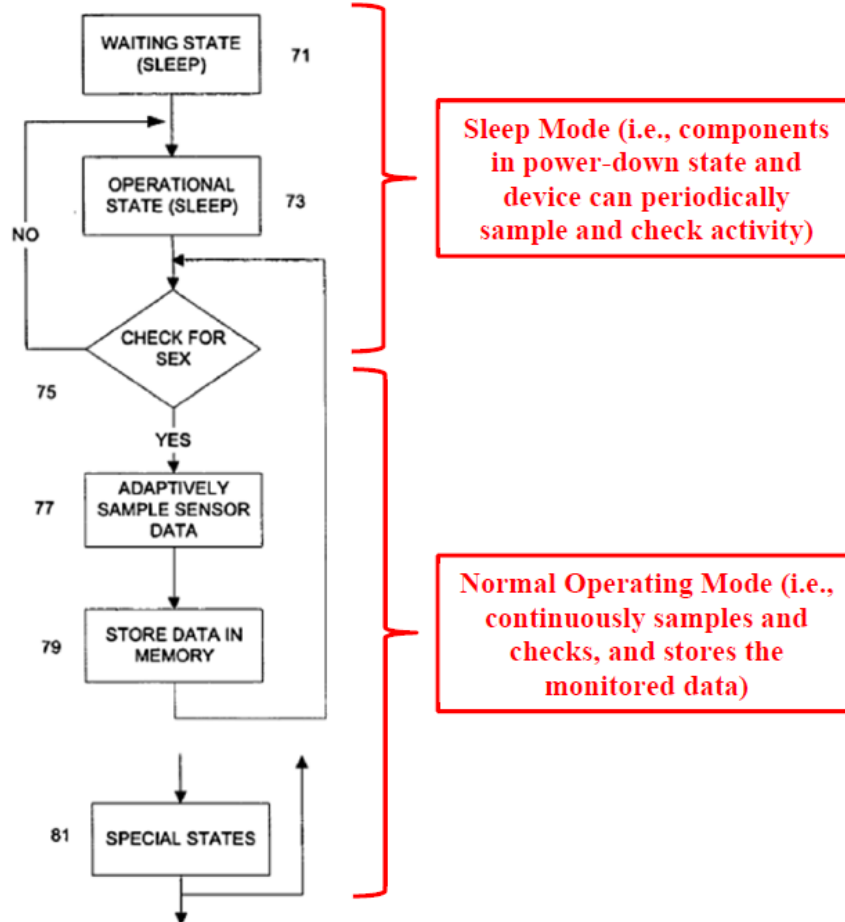


FIG. 3

Figure 3 of Mitchnick, as annotated by Petitioner (*see* Pet. 23), demonstrates Petitioner's contention that Mitchnick's device samples acceleration data and checks for sexual activity in sleep mode (operational sleep state 73) rather than in normal operating mode (sample sensor 77, store data 79, or other special states 81). Moreover, Mitchnick teaches its device can sample data every 5 minutes for a period of time "sufficient for necessary accuracy, but such that the overall device duty cycle is less than approximately 20%," i.e., the device samples data for a period of 1 minute every 5 minutes. Ex. 1007 ¶¶ 69, 72.

Petitioner further demonstrates that the combination of Mitchnick and Sheldon teaches sampling acceleration data over a predetermined period of time to the extent Mitchnick does not. *See* Pet. 25–26. In particular, Petitioner demonstrates how Sheldon teaches “us[ing] an accelerometer to determine patient activity ‘from the number of changes in signal levels exceeding a certain threshold occurring in a given sampling time period.’” *Id.* at 25 (quoting Ex. 1009, 5:14–17).

Petitioner contends a person skilled in the art would have modified Mitchnick to sample acceleration data over a predetermined period of time, as taught by Sheldon, to avoid insufficiently sampling acceleration data in sleep mode, which would waste power. *Id.* (citing Ex. 1007 ¶ 69; Ex. 1003, 40). Petitioner further argues that modifying Mitchnick in view of Sheldon would have “contribute[d] to Mitchnick’s overall goal for managing [the] device’s ‘power use for longer battery life.’” *Id.* at 25–26 (quoting Ex. 1007 ¶ 13; citing Ex. 1003, 40). We agree with this reasoning, which Patent Owner does not contest, and adopt it as our own.

Claim 3 also requires exiting the sleep mode “when acceleration data having a motion signature indicative of a user activity that the mobile device [is] configured to monitor is detected within the predetermined time period.” Ex. 1001, 15:30–33. Petitioner demonstrates how the combination of Mitchnick and Sheldon teaches this limitation because Mitchnick teaches that when its device successfully identifies sexual activity during the data sampling period of operational sleep state 73, it enters a normal operating mode in which “the device proceeds to repetitively retrieve sensor data 77 and store retrieved data in memory.” Pet. 26–27 (quoting Ex. 1007 ¶ 72; Ex. 1003, 40–42).

Patent Owner argues claim 3 fails for the same reasons as claim 1. PO Resp. 31–32. We are not persuaded by these arguments for the reasons discussed in § II.F.1, *supra*.

Accordingly, having considered the evidence and arguments presented by Petitioner and Patent Owner, we find Petitioner has demonstrated by a preponderance of evidence that the combination of Mitchnick and Sheldon teaches or suggests all the limitations of claim 3, and that claim 3 is unpatentable over Mitchnick and Sheldon.

H. Patentability of Claim 4 over Mitchnick, Sheldon, and Tanenhaus

Petitioner argues claim 4 is unpatentable under 35 U.S.C. § 103(a) as obvious over Mitchnick, Sheldon, and Tanenhaus. Pet. 28–34. For the reasons discussed below, we determine Petitioner has demonstrated by a preponderance of evidence that claim 4 is unpatentable over this combination of references.

1. Claim 4

Claim 4 depends from claim 1, and requires the mobile device’s inertial sensor to have inertial wakeup functionality. Ex. 1001, 15:34–35. Petitioner demonstrates how the combination of Mitchnick, Sheldon, and Tanenhaus teaches this limitation because Mitchnick’s device can “wake up from sleep state 73 upon the occurrence of selected external events,” and Tanenhaus teaches a wake-up sensing circuit that switches a device “from a sleep-type low power condition to a wake-up higher power condition” when an accelerometer signal “reaches or passes a predetermined threshold value.” Pet. 31–32 (quoting Ex. 1007 ¶ 72; Ex. 1008, 4:65–66, 5:13–14; citing *id.* at 4:29, 4:36–40, 4:43–47; Ex. 1003, 47–49).

Petitioner further provides reasoning with rational underpinnings to explain why a person skilled in the art would have found it obvious to modify Mitchnick's device to include Tanenhaus's wake-up sensing circuit. *Id.* at 29–31. First, to avoid missing user activity at times when Mitchnick's device is in sleep-mode and not actively checking for such activity (i.e., during the “off” portion of the device's sleep-mode duty cycle). *Id.* at 30, 32 (citing Ex. 1003, 45, 49). Second, to preserve battery life by waking up only when the sensing circuit detects user activity rather than periodically waking up to check for user activity that may not be occurring. *Id.* at 30–31 (citing Ex. 1007 ¶ 72; Ex. 1008, 7:48–49; Ex. 1003, 46).

Claim 4 further requires the mobile device to detect, while in sleep mode, a motion sufficient to trigger the inertial wakeup and to sample acceleration data for a predetermined period of time. Ex. 1001, 15:36–39. Petitioner demonstrates, via the analysis discussed immediately above, that the combination of Mitchnick and Tanenhaus teaches these limitations. Pet. 33; *see also id.* at 20–21. In particular, Petitioner demonstrates that Mitchnick's device exits sleep mode “upon internal timer or *external interrupts*,” Tanenhaus teaches a sensing circuit capable of generating an interrupt to wake up a device “from a sleep-type low[er] power condition to a wake-up higher power condition” upon detecting “a vibration or movement” that exceeds a threshold, and the combination of Mitchnick and Sheldon teaches sampling acceleration data for a predetermined period of time as discussed in § II.G.1, *supra*. *Id.* at 33–34 (quoting Ex. 1007 ¶ 50; Ex. 1008, 4:37, 4:65–66, 5:11–14) (emphasis added).

Claim 4 further requires the mobile device to determine whether the acceleration data includes a motion signature indicative of a user activity the

mobile device is configured to monitor, and to exit sleep mode when such activity is detected. Ex. 1001, 15:40–45. Petitioner demonstrates how Mitchnick teaches these limitations for the reasons discussed in §§ II.F.1 and II.G.1, *supra*. Pet. 34; *see also id.* at 14–15, 26–27.

Patent Owner argues claim 4 fails for the same reasons as claim 1. PO Resp. 31–32. We are not persuaded by these arguments for the reasons discussed in § II.F.1, *supra*.

Accordingly, having considered the evidence and arguments presented by Petitioner and Patent Owner, we find Petitioner has demonstrated by a preponderance of evidence that the combination of Mitchnick, Sheldon, and Tanenhaus teaches or suggests all the limitations of claim 4, and that claim 4 is unpatentable over Mitchnick, Sheldon, and Tanenhaus.

I. Patentability of Claims 5, 6, 9, and 10 over Fabio and Pasolini

Petitioner argues claims 5, 6, 9, and 10 are unpatentable under 35 U.S.C. § 103(a) as obvious over Fabio and Pasolini. Pet. 34–72. For the reasons discussed below, we determine Petitioner has demonstrated by a preponderance of evidence that claims 5, 6, and 10 are unpatentable over Fabio and Pasolini, but has failed to demonstrate by a preponderance of evidence that claim 9 is unpatentable over Fabio and Pasolini.

1. Claim 5

Claim 5 is an independent claim reciting a method performed by a mobile device, and requires receiving acceleration data that meets stepping criteria from an accelerometer included in the mobile device. Ex. 1001, 15:46–48. Petitioner demonstrates how Fabio teaches this limitation by disclosing a mobile pedometer that receives acceleration data A_Z and determines whether that data satisfies stepping criteria A_{ZP} and A_{ZN} . Pet.

45–47 (citing Ex. 1006, 1:58–59, 2:23–26, 2:34–36, 2:49–64, Figs. 1, 5). In particular, Fabio’s pedometer determines whether the acceleration data has a positive peak greater than A_{ZP} followed by a negative peak less than A_{ZN} within a time window TW. See Ex. 1006, 4:12–21, Fig. 5. Patent Owner does not dispute these contentions. See PO Resp. 13–21; PO Sur-Reply 1–10.

Claim 5 further requires incrementing a step count in a step count buffer. Ex. 1001, 15:49. Petitioner demonstrates how Fabio teaches this limitation by temporarily counting a number of valid control steps in first counting procedure 110 until “the number of valid control steps N_{VC} reaches the second threshold number N_{T2} .” Pet. 47–49 (citing Ex. 1006, 4:24–26, 5:10–11, 5:43–45, Fig. 4). Relying on the testimony of Dr. Paradiso, Petitioner demonstrates that N_{VC} is a step count buffer because it temporarily stores step counts until a regularity condition is reached, at which time N_{VC} is added to total step count N_{VT} . *Id.* at 48–49 (citing Ex. 1003, 69–70). Patent Owner does not dispute these contentions. See PO Resp. 13–21; PO Sur-Reply 1–10.

Claim 5 further requires using a default step cadence window to identify a time frame within which to monitor for a next step when at least one of (a) the step count is below a step count threshold, *or* (b) a current user cadence fails to match a step cadence of a user profile. Ex. 1001, 15:50–16:2.

Petitioner demonstrates how the combination of Fabio and Pasolini teaches or suggests using a default cadence window to monitor for a next step when a step count is below a step count threshold (i.e., under condition (a) above), which is sufficient to demonstrate that the combination meets

this limitation. Pet. 49–55. In particular, notwithstanding Patent Owner’s arguments to the contrary, Petitioner demonstrates how Fabio’s first counting procedure 110 counts steps using a default cadence window when step count N_{VC} is below threshold N_{T2} . *Id.* at 49–55 (citing Ex. 1006, 5:24–32, Fig. 4; Ex. 1003, 70–71). Petitioner identifies the default cadence window as either Fabio’s validation interval TV modified to have a fixed width or Fabio’s timing threshold T_{S1} . *Id.* at 50–55.

First, Petitioner argues that it would have been obvious to modify Fabio’s validation interval TV to have a default width because Fabio expressly teaches TV can have a different amplitude (i.e., width) than the variable width shown in Figure 6, and further teaches that TV is used to verify that the timing of a current step is compatible with the frequency of previously counted steps. *Id.* at 53–54 (quoting Ex. 1006, 4:52–55; citing Ex. 1003, 75). Dr. Paradiso testifies that these teachings would have suggested to a person skilled in the art the benefit of “modify[ing] the cadence window [TV] to a default value in order to increase compatibility with [a] user’s previous step as the user is beginning a new activity such as walking or running.” Ex. 1003, 75. Petitioner further argues that it would have been obvious to modify TV to have a default width because Pasolini teaches “establishing a default step length value (LP) that is used to determine the distance that a user travels.” Pet. 54 (citing Ex. 1003, 75–76; Ex. 1005, 5:21–22). Dr. Paradiso testifies that this teaching would have further motivated a person skilled in the art to modify TV to have a default width because “establish[ing] a default cadence window based on [a] user’s physical attributes would increase the likelihood that the first few steps are recognized as being compatible.” Ex. 1003, 75–76.

We agree with Petitioner’s reasoning that a person skilled in the art would have been motivated to modify Fabio’s validation interval TV to have a default width in order to determine the compatibility of the first few steps of user activity. Fabio teaches the importance of using TV to determine the compatibility of timing between steps, and the timing compatibility of the first few steps can only be determined with a default time interval rather than the time interval of (non-existing) previous steps. *See* Ex. 1006, 4:28–55.

Patent Owner does not dispute Petitioner’s contention that it would have been obvious to modify Fabio’s validation interval TV to have a default width in order to increase the likelihood of recognizing the timing compatibility of a user’s first few steps. *See* PO Resp. 13–21; PO Sur-Reply 1–10. Rather, Patent Owner argues that validation interval TV is not a *cadence window at all* because TV “is used to determine whether a last step is counted (or not) – not as a ‘window of time *since* a last step was counted.’” *Id.* at 14.

In particular, Patent Owner argues:

Fabio’s TV is *retrospective* at least in that it is used to validate only the immediately ***preceding*** step (shown in Fig. 6 as K-1), as opposed to the ***current*** step detected (shown in Fig. 6 as K): “[m]ore 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[.]” Unless and until the last step is validated by the current step in the manner disclosed, the last step is not counted.

Id. at 14–15 (internal citation omitted). That is, Patent Owner argues that TV validates preceding step K–1 rather than current step K because “*the last*

step recognized is validated,” and, according to Patent Owner, “*the last step recognized*” is previous step K-1. Ex. 1006, 4:35–39 (emphases added).

We are not persuaded by this argument. Rather, we agree with Petitioner that Fabio “recognizes, validates, and either buffers or counts a step within a single step cycle,” where a step cycle “refers to Fabio’s iterative process of recognizing (e.g., 225), validating (e.g., 230) and buffering/counting (235) a step upon acquisition of an acceleration sample.” Pet. Reply 9–10 & n.1 (citing Ex. 1006, Figs. 4, 7).

Figure 4 of Fabio is reproduced below.

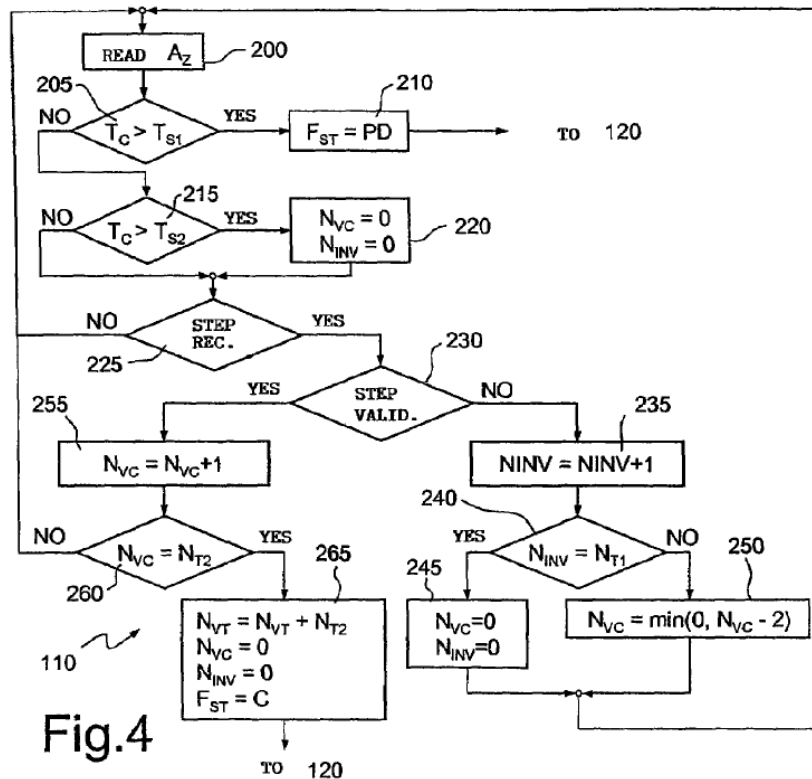


Figure 4 is a flowchart illustrating Fabio’s first counting procedure. See Ex. 1006, 3:58–59. A current acceleration data sample (e.g., K) is obtained (200). *Id.* at 3:60–61. Sample K is rejected (205/210) if “the time interval

T_C that has elapsed from the last step recognized [i.e., $K-1$]⁸ is higher than the first time threshold T_{S1} .” *Id.* at 3:61–4:2. Otherwise, sample K is tested to see if it includes a recognizable step (225).⁹ *Id.* at 4:2–11. If sample K contains a recognizable step, that step is immediately tested to see if it is also a valid step (230). *Id.* at 4:24–27.

Step validation test (230) is illustrated in Figure 6 of Fabio, which is reproduced below.

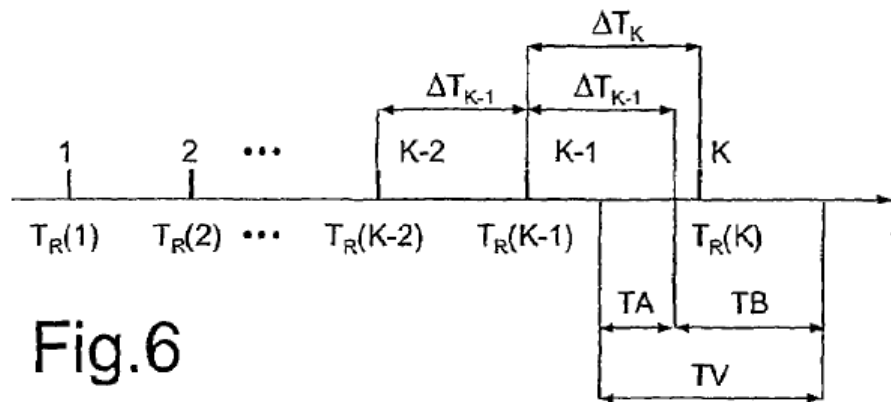


Fig.6

Figure 6 illustrates a sequence of steps recognized at times $T_R(1)$, $T_R(2)$. . . $T_R(K-2)$, $T_R(K-1)$, and $T_R(K)$. *Id.* at Fig. 6. The step recognized in sample K at $T_R(K)$ is validated as a step “when the duration ΔT_K of [the] *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, Fig. 6 (emphasis added). That is, “the last step recognized [i.e., K] is validated if the *instant of*

⁸ We note that when time interval T_C is evaluated in decision block 205, *the last step recognized* is $K-1$ because sample K has not yet been tested in step recognition test 225 to determine whether it contains a recognizable step.

⁹ We note that once sample K passes step recognition test 225, it becomes *the last step recognized*, and step $K-1$ becomes the *next to last step recognized*.

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 $T_R(K-1)$.” *Id.* at 4:35–39 (emphases added). Notably, as shown in Figure 4, steps K and $K-1$ are both recognized steps during step validation test (230) because both have passed step recognition test (225). Thus, step K is the last recognized step with an *instant of recognition* $T_R(K)$, and step $K-1$ is the next to last recognized step with an *instant of recognition* $T_R(K-1)$. Consequently, when Fabio teaches “the *last step recognized is validated*” (*id.* (emphasis added)), Fabio is teaching validating step K , not step $K-1$ as Patent Owner contends, because step K is the last step recognized at $T_R(K)$.

Petitioner also argues that Fabio’s threshold time T_{S1} is a default cadence window because the “first counting procedure ‘terminates when a time interval T , that has elapsed from the last step recognized is longer than a first time threshold T_{S1} .’” Pet. 53 (citing Ex. 1006, 3:30–32). Patent Owner argues T_{S1} is not a default cadence window for the same reason TV is not a default cadence window, i.e., because T_{S1} is used to “determine[] whether to count the *previous* step,” and therefore cannot be used to “monitor for a *next* step.” PO Resp. 16–17 (emphasis added). We addressed this argument above, and reject it for the reasons explained there.

We agree with Petitioner that T_{S1} is also a default cadence window. Fabio teaches reading (200) acceleration sample K at a time T_C *after* previous step $K-1$ has been read, validated, and counted, but only tests whether sample K includes a recognizable (225) and valid (230) step if T_C is less than threshold time T_{S1} (205). See Ex. 1006, 3:60–4:27, Fig. 4. Thus, T_{S1} is “a window of time since a last step [$K-1$] was counted that is looked at

to detect a new step [K],” i.e., T_{S1} is a default cadence window. As Petitioner persuasively argues, “ T_{S1} is a default cadence window because it is the maximum time, such as 10 seconds, within which samples of the acceleration data A_Z (read in step 200) can be tested to recognize (step 225) and validate (step 230) steps.” Pet. Reply 13 (citing Ex. 1006, 3:60–4:11, Fig. 4).

For the reasons explained above, we find Petitioner has demonstrated that the combination of Fabio and Pasolini teaches or suggests first counting procedure 110 uses a default cadence window (T_{S1} or modified TV) to monitor for a next step when buffered step count N_{VC} is below step count threshold N_{T2} , and has demonstrated reasoning with rational underpinnings to modify TV to have a default width.

Lastly, claim 5 requires when the step count is at or above the step count threshold, determining a dynamic step cadence window and using the dynamic step cadence window to identify the time frame within which to monitor for the next step. Ex. 1001, 16:3–6.

Petitioner demonstrates, notwithstanding Patent Owner’s arguments to the contrary, how the combination of Fabio and Pasolini teaches or suggests using (unmodified) validation interval TV to monitor for and count next steps in second step counting procedure 130 when step count N_{VC} exceeds threshold N_{T2} . Pet. 55 (citing Ex. 1006, 5:22–32, 5:37–39, Fig. 4; Ex. 1003, 76–78). Petitioner further demonstrates how validation interval TV is a dynamic cadence window because it is “defined with respect to the instant of recognition of the immediately preceding step,” and a person skilled in the art would understand this to mean that it “compensates for changes in each

step” and “would also change from step to step.” *Id.* at 56–57 (citing Ex. 1003, 79–80; Ex. 1006, 4:37–39).

Patent Owner argues Fabio’s validation interval TV is neither a cadence window nor a *dynamic* cadence window. PO Resp. 17–20. First, Patent Owner argues validation interval TV is not a cadence window for the reasons discussed above. *Id.* at 18, 20. We do not find this argument persuasive for the reasons explained above. Next, Patent Owner argues “even if *Fabio*’s validation interval TV was a cadence window . . . *Fabio* does not disclose ‘a dynamic step cadence window’ as required,” because Fabio teaches TV is used to verify “that the last step recognized is compatible with the frequency of the last steps made previously.” *Id.* at 18–19 (quoting Ex. 1006, 4:54–55) (emphases omitted). Therefore, Patent Owner argues, “the last recognized step in *Fabio* comes at the same frequency as steps made previously.” *Id.* at 19.

We disagree. Fabio does not teach second counting procedure 130 uses TV to validate the last step recognized when it arrives at *the same frequency* as previously counted steps. Rather, it teaches second counting procedure 130 uses TV to verify that “the last step recognized is *compatible* with the frequency of the last steps previously made.” Ex. 1006, 6:27–39, Fig. 7 (emphasis added). In particular, Fabio teaches second counting procedure 130 validates step K “if the instant of recognition of the current step $T_C(K)$ falls within the validation interval TV defined above” for first counting procedure 110. *Id.* at 6:34–37. As discussed in § II.E.4, *supra*, TV for step K is defined as the time between $T_R(K-1) + \frac{1}{2} (\Delta T_{K-1})$ and $T_R(K-1) + 2 (\Delta T_{K-1})$, having a width of $\frac{3}{2} (\Delta T_{K-1})$, where ΔT_{K-1} is the time interval between steps K-1 and K-2. *Id.* at 4:28–52. Thus, the width of TV for step

K depends on the time difference between steps K-1 and K-2. Similarly, the width of TV for step K+1 will depend on the time difference between steps K and K-1, and the width of TV for step K+2 will depend on the time difference between steps K+1 and K. Therefore, because the width of TV changes from step to step, and is used to monitor for and validate the next step, TV is a *dynamic* cadence window.

Upon considering all of the evidence and arguments presented by Petitioner and Patent Owner, and for the reasons explained above, we find Petitioner has demonstrated by a preponderance of evidence that the combination of Fabio and Pasolini teaches or suggests all the limitations of claim 5, and that claim 5 is unpatentable as obvious over Fabio and Pasolini.

2. Claim 6

Claim 6 depends from claim 5, and requires the step count buffer to represent probable steps, and requires emptying the step count buffer and acknowledging the step counts from the step count buffer as actual steps when the step count buffer reaches the step count threshold. Ex. 1001, 16:7–11. Petitioner demonstrates how Fabio teaches this limitation because valid control step counter N_{VC} is a step count buffer that represents probable steps, and when N_{VC} reaches threshold N_{T2} , first counting procedure 110 adds probable steps N_{VC} to actual valid step counter N_{VT} , and resets N_{VC} to zero. Pet. 57–60 (citing Ex. 1006, 5:10–39, Fig. 4; Ex. 1003, 80–83).

Claim 6 further requires entering a stepping mode upon emptying the step count buffer. Ex. 1001, 16:13–14. Petitioner demonstrates how Fabio teaches this limitation because when N_{VC} reaches threshold N_{T2} , first counting procedure 110 sets N_{VC} to zero, and calls second counting

procedure 130. Pet. 61 (citing Ex. 1006, 5:32–39, 7:13–15; Ex. 1003, 84–85).

Patent Owner argues claim 6 is patentable for the same reasons as claim 5. PO Resp. 21. We are not persuaded by Patent Owner’s arguments for the reasons discussed in § II.I.1, *supra*.

Accordingly, having considered the evidence and arguments presented by Petitioner and Patent Owner, and for the reasons discussed above, we find Petitioner has demonstrated by a preponderance of evidence that the combination of Fabio and Pasolini teaches or suggests all the limitations of claim 6, and that claim 6 is unpatentable as obvious over Fabio and Pasolini.

3. Claim 9

Claim 9 depends from claim 5, and sets forth three stepping criteria that must be satisfied by a current acceleration measurement in order for that measurement to be counted as a potential step in a step count buffer. *See* Ex. 1001, 15:47–49, 16:28–38. The first criterion is that the current acceleration measurement have a greater magnitude than a previous measurement. *Id.* at 16:28–32. The second is that the current acceleration measurement have a greater magnitude than a lower threshold. *Id.* at 16:33–35. The third is that the current acceleration measurement have a lesser magnitude than an upper threshold. *Id.* at 16:36–38.

Petitioner argues Fabio teaches satisfying the first criterion by entering first counting procedure 110 “*when the updated mean value A_{ZM}' determined from the samples of acceleration signal A_Z exceeds the current mean value A_{ZM} .*” Pet. 62 (citing Ex. 1006, 7:46–50; Ex. 1003, 86–87). Relying on the testimony of Dr. Paradiso, Petitioner identifies the samples of acceleration signal A_Z needed to determine A_{ZM}' as the current acceleration

measurement, and the samples needed to determine A_{ZM} as the previous acceleration measurement. *Id.* at 62–63 (citing Ex. 1006, 7:46–50, 7:54–56; Ex. 1003, 87).

We are not persuaded that Petitioner has demonstrated that Fabio teaches satisfying the first stepping criterion by determining mean value A_{ZM}' exceeds mean value A_{ZM} . As discussed above, the first stepping criterion of claim 9 is only one of three criteria that must be satisfied to recognize a potential step in the *current acceleration measurement*. Ex. 1001, 15:47–49, 16:28–38. Petitioner relies on Fabio’s step recognition criteria, shown in Figure 5, for meeting the second and third criteria. Pet. 64, 66. These criteria are evaluated in step recognition test (225) in first counting procedure 110 as shown in Figure 4. Ex. 1006, 3:58–59, 4:12–21, Fig. 4.

Fabio determines and compares mean values A_{ZM} and A_{ZM}' from samples of acceleration signal A_Z obtained during surveying procedure 140. See Ex. 1006, 7:24–59, Fig. 3. When A_{ZM}' exceeds A_{ZM} , the “surveying procedure is interrupted, and the first counting procedure indicated in block 110 of FIG. 3 is executed.” *Id.* at 7:51–54. However, first counting procedure 110 begins by reading a new sample of acceleration signal A_Z (200), and testing that new sample to see if a potential step is recognized (225) and validated (230). Ex. 1006, 3:60–61, 7:45–53, Fig. 3. Fabio does not disclose that the acceleration data used to determine A_{ZM}' during surveying procedure 140 (i.e., *the current acceleration measurement identified by Petitioner*) are the same acceleration data used to recognize (225) and validate (230) steps in first counting procedure 110, which is required by claim 9.

Claim 9 further requires satisfying a second criterion when the current acceleration measurement has a greater magnitude than a lower threshold. Ex. 1001, 16:33–35. Petitioner argues Fabio’s first counting procedure 110 teaches this limitation by requiring acceleration signal A_Z to have a positive peak greater than threshold A_{ZP} , which Petitioner identifies as a lower threshold. Pet. 63–65 (citing Ex. 1006, 4:14–20, Fig. 5; Ex. 1003, 88–90). For example, Petitioner argues Figure 5 of Fabio illustrates “the second criterion is satisfied by the positive acceleration peak exceeding a positive acceleration threshold A_{ZP} .” *Id.* at 64.

We are not persuaded that Petitioner has demonstrated how Fabio teaches satisfying the second criterion. As discussed above, claim 9 requires the same “current acceleration measurement” to satisfy the first and second criteria, and Petitioner identifies samples of acceleration signal A_Z obtained in surveying procedure 140 as the current acceleration measurement that satisfies the first criterion and samples of acceleration signal A_Z obtained in first counting procedure 110 as the current acceleration measurement that satisfies the second criterion. *See* Pet. 62–65. However, surveying procedure 140 uses the current measured acceleration to determine A_{ZM}' , and terminates when A_{ZM}' exceeds A_{ZM} . *See* Ex. 1006, 8:45–54, Figs. 3, 4. At that point, first counting procedure 110 begins, and reads a new sample of acceleration signal A_Z (200). *Id.* at 3:60–61, 8:51–54, Figs. 3, 4. Thus, Petitioner fails to demonstrate a single acceleration measurement that satisfies both the first and second criteria.

Lastly, claim 9 requires satisfying a third criterion when the current acceleration measurement has a lesser magnitude than an upper threshold. Ex. 1001, 16:36–38. Petitioner argues Fabio’s first counting procedure 110

teaches this limitation by requiring acceleration signal A_Z to have a negative peak less than threshold A_{ZN} , which Petitioner identifies as the upper threshold. Pet. 65–66 (citing Ex. 1006, 4:15–18, Fig. 5; Ex. 1003, 90–92). For example, Petitioner argues Figure 5 of Fabio illustrates “the third criterion is satisfied by the negative acceleration peak exceeding a negative acceleration threshold A_{ZN} .” *Id.* at 66.

We are not persuaded Petitioner has demonstrated how Fabio teaches satisfying the third criterion for several reasons. First, as discussed above, claim 9 requires the same “current acceleration measurement” to satisfy the first and third criteria, and Petitioner identifies samples of acceleration signal A_Z obtained in surveying procedure 140 as the current acceleration measurement that satisfies the first criterion and samples of acceleration signal A_Z obtained in first counting procedure 110 as the current acceleration measurement that satisfies the third criterion. *See* Pet. 62–63, 65–66. However, surveying procedure 140 uses the current measured acceleration to determine A_{ZM}' , and terminates when A_{ZM}' exceeds A_{ZM} . *See* Ex. 1006, 8:45–54, Figs. 3, 4. At that point, first counting procedure 110 begins, and reads a new sample of acceleration signal A_Z (200). *Id.* at 3:60–61, 8:51–54, Figs. 3, 4. Thus, Petitioner fails to demonstrate a single acceleration measurement that satisfies both the first and third criteria.

Second, Petitioner identifies threshold A_{ZP} in Figure 5 of Fabio as the second criterion’s lower threshold, and A_{ZN} as the third criterion’s upper threshold. *See* Pet. 64, 66. Figure 5 of Fabio is reproduced below.

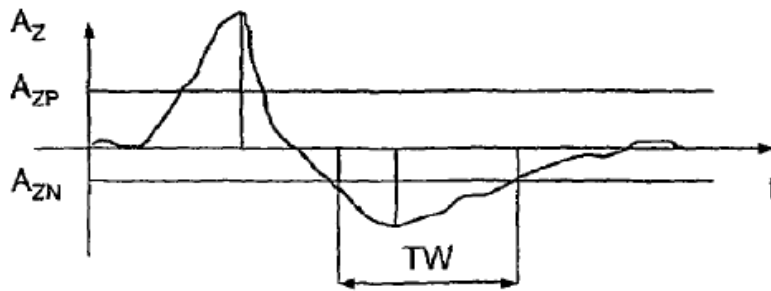


Fig.5

Figure 5 of Fabio is a plot of acceleration signal A_Z as a function of time. Figure 5 illustrates how a step is recognized in acceleration signal A_Z when the signal has a positive peak greater than threshold A_{ZP} and a negative peak less than threshold A_{ZN} . Ex. 1006, 4:12–21. As shown in Figure 5, threshold A_{ZP} is greater than threshold A_{ZN} . Thus, Petitioner has failed to demonstrate that threshold A_{ZN} is the *upper* threshold required by claim 9.

Third, even assuming Fabio's first counting procedure 110 and surveying procedure 140 use the same samples of acceleration signal A_Z (i.e., the same "current acceleration measurement") and that threshold A_{ZN} is an *upper* threshold, Petitioner fails to demonstrate that the *magnitude* of acceleration signal A_Z is less than threshold A_{ZN} . As shown in Figure 5, acceleration signal A_Z has an amplitude and a phase. The amplitude represents the displacement of the signal from the x-axis, and the phase represents the cycle of the signal (i.e., whether it has a positive or negative amplitude).

Claim 9 requires the current acceleration measurement to have a lesser *magnitude* than an upper threshold. Ex. 1001, 16:36–38. Thus, it requires the absolute value of the amplitude of the current acceleration measurement to be less than the upper threshold. In Fabio's step recognition test, shown in Figure 5, the negative peak of acceleration signal A_Z must be *less* than

negative threshold A_{ZN} . Mathematically, this means the *magnitude* or absolute value of the negative peak is *greater* than either A_{ZN} or the absolute value of A_{ZN} . Thus, Petitioner has failed to demonstrate how Fabio's negative peak threshold test teaches or suggests a third criterion that is satisfied when the current acceleration measurement has a lesser magnitude than an upper threshold.

Accordingly, for the reasons discussed above, we find Petitioner has failed to demonstrate by a preponderance of evidence that the combination of Fabio and Pasolini teaches or suggests all the limitations of claim 9, and that claim 9 is unpatentable over the combination of Fabio and Pasolini.

4. Claim 10

Claim 10 depends from claim 5, and requires determining an orientation of the mobile device with respect to gravity, and assigning a dominant axis based on the orientation. Ex. 1001, 16:39–42.

Notwithstanding Patent Owner's arguments to the contrary, Petitioner demonstrates how the combination of Fabio and Pasolini teaches these limitations. Pet. 66–70. Petitioner first demonstrates how Fabio teaches identifying steps using a multi-axis accelerometer by detecting and selecting the axis nearest to vertical based on the DC component of its acceleration signal, which is correlated to the acceleration due to gravity. *Id.* at 67, 69 (citing Ex. 1006, 8:21–32; Ex. 1003, 93–94, 96–97).

Petitioner further demonstrates how Pasolini also teaches identifying steps using a multi-axis accelerometer by detecting and selecting the vertical axis having the highest mean acceleration due to gravity. *Id.* at 67–69 (citing Ex. 1005, 8:11–24). Relying on the testimony of Dr. Paradiso, Petitioner also demonstrates why—to the extent Fabio does not disclose

these limitations—a person skilled in the art would have included Pasolini’s teachings into Fabio’s step counting method, namely, “because it would ensure that the axis most influenced by gravity is used as each acceleration sample is taken.” *Id.* at 68–70 (citing Ex. 1003, 95–98).

Patent Owner argues claim 10 is patentable for the same reasons as claim 5. PO Resp. 21. We are not persuaded by this argument for the reasons discussed in § II.I.1, *supra*.

Patent Owner further argues the combination of Fabio and Pasolini fails to teach assigning a dominant axis because “[n]either *Fabio* nor *Pasolini* are interested in . . . a ‘dominant axis’ as claimed. Rather, both *Fabio* and *Pasolini* are interested in a vertical axis with respect to gravity.” PO Resp. 20–21 (emphasis omitted). We are not persuaded by this argument. First, Fabio teaches “[t]he detection axis nearest to the vertical is the axis along which the contribution of the acceleration of gravity is greater,” and selecting this axis allows the pedometer to be used “independently of how it is oriented.” Ex. 1006, 8:30–33. Thus, Fabio teaches determining an orientation of a device with respect to gravity, and assigning a dominant axis based on that orientation. Next, as Petitioner persuasively argues, “Pasolini teaches ‘identifying the main vertical axis’ on account of gravity ‘at each acquisition of a new acceleration sample,’” which “functionally assigns a dominant axis because it accounts for changes in gravity^[10] as the orientation of the device, and the accelerometer inside the device, changes.” Pet. Reply 17 (quoting Ex. 1005, 8:15–22; citing Ex.

¹⁰ We interpret Petitioner’s argument to mean assigning the dominant axis accounts for changes in the component of gravity measured by each axis of the device as the device orientation changes.

1003, 97). Thus, Petitioner demonstrates how the combination of Fabio and Pasolini teaches determining an orientation of the mobile device with respect to gravity, and assigning a dominant axis based on the orientation.

Claim 10 further requires comparing only acceleration data for the dominant axis to the stepping criteria to make a determination that the acceleration data meets the stepping criteria. Ex. 1001, 16:43–45.

Petitioner demonstrates how the combination of Fabio and Pasolini teaches this limitation. See Pet. 70–72. As discussed above, Petitioner first demonstrates how Fabio teaches this limitation by identifying steps based on the acceleration signal of the accelerometer's axis that has been selected because it is nearest to the vertical or Z-axis. *Id.* at 70–71 (citing Ex. 1006, 2:56–59). Relying on the testimony of Dr. Paradiso, Petitioner explains why a person skilled in the art would understand the Z-axis to be the vertical axis, or the dominant axis that is most influenced by gravity. *Id.* at 71 (citing Ex. 1003, 98). Petitioner further demonstrates that Pasolini also teaches this limitation by identifying steps using only acceleration data obtained from the accelerometer's selected vertical or z-axis. *Id.* (citing Ex. 1005, 3:13–19, 3:35–41).

Accordingly, having considered the evidence and arguments presented by Petitioner and Patent Owner, and for the reasons discussed above, we find Petitioner has demonstrated by a preponderance of evidence that the combination of Fabio and Pasolini teaches or suggests all the limitations of claim 10, and that claim 10 is unpatentable as obvious over Fabio and Pasolini.

III. CONCLUSION

We have reviewed the Petition, Patent Owner's Response, Petitioner's Reply, and Patent Owner's Sur-Reply. We have considered all of the evidence and arguments presented by Petitioner and Patent Owner, and have weighed and assessed the entirety of this evidence as a whole.

We determine, on this record, that Petitioner has demonstrated by a preponderance of evidence that claims 1 and 2 of the '902 patent are unpatentable over Mitchnick, claim 3 is unpatentable over the combination of Mitchnick and Sheldon, claim 4 is unpatentable over the combination of Mitchnick, Sheldon, and Tanenhaus, and claims 5, 6, and 10 are unpatentable over the combination of Fabio and Pasolini. Petitioner, however, has failed to demonstrate by a preponderance of evidence that claim 9 is unpatentable over the combination of Fabio and Pasolini.

IV. ORDER

It is hereby:

ORDERED that claims 1 and 2 of the '902 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Mitchnick;

FURTHER ORDERED that claim 3 of the '902 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over Mitchnick and Sheldon;

FURTHER ORDERED that claim 4 of the '902 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over Mitchnick, Sheldon, and Tanenhaus;

FURTHER ORDERED that claims 5, 6, and 10 of the '902 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Fabio and Pasolini;

FURTHER ORDERED that Petitioner has failed to demonstrate by a preponderance of evidence that claim 9 of the '902 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over Fabio and Pasolini; and

FURTHER ORDERED that this Decision is final, and a party to this proceeding seeking judicial review of the Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2018-00424
Patent 7,881,902 B1

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