

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HTC CORPORATION and HTC AMERICA, INC.

Petitioners,

v.

UNILOC LUXEMBOURG S.A.,
Patent Owner

PETITION FOR *INTER PARTES* REVIEW OF

U.S. PATENT NO. 7,653,508

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PETITIONER'S EXHIBIT LIST

August 23, 2018

Ex. 1001	U.S. Patent No. 7,653,508
Ex. 1002	Prosecution History of U.S. Patent No. 7,653,508
Ex. 1003	Declaration of Joe Paradiso, Ph.D, under 37 C.F.R. § 1.68
Ex. 1004	Curriculum Vitae of Joe Paradiso.
Ex. 1005	U.S. Patent No. 7,463,997 to Fabio Pasolini et al. ("Pasolini")
Ex. 1006	U.S. Patent No. 7,698,097 to Fabio Pasolini et al. ("Fabio").

I. INTRODUCTION

U.S. Patent No. 7,653,508 (“the ’508 patent,” Ex. 1001) is generally directed to “monitoring human activity, and more particularly to counting periodic human motions.” Ex. 1001, 1:5-6. The claims of the ’508 patent are directed to two separate concepts. The first concept is a well-known technique for determining which of three axes in a tri-axial accelerometer is directed to a “dominant axis” and counting a user’s steps along that axis. The second concept is a well-known technique for counting periodic human motions using two different operating modes. In the first mode, periodic human motions are detected but not added to the total count until validated. In the second mode, detected periodic human motions are counted and added to the total count. As shown below, these concepts were already taught in the prior art before the priority date of the ’508 patent.

Accordingly, this petition and the cited evidence demonstrate that claims 1-4, 6-8, 11-16, 19, and 20 of the ’508 patent are unpatentable under (pre-AIA) 35 U.S.C. § 103(a). HTC Corporation and HTC America, Inc. (together “Petitioner”) therefore respectfully request that these claims be held unpatentable and cancelled.

This Petition is substantively the same as IPR2018-00387, which was instituted on July 23, 2018, but includes an additional challenge to claim 20. Because claim 20 is substantially similar to claims 3 and 13, which have been

instituted, no new grounds or arguments are being presented. This Petition is being filed concurrently with a motion for joinder with respect to IPR2018-00387.

II. MANDATORY NOTICES

A. Real Party-in-Interest

The real parties-in-interest are HTC Corporation and HTC America, Inc.

B. Related Matters

As of the filing date of this petition, the '508 patent has been asserted in the following cases:

Heading	Number	Court	Filed
<i>Uniloc USA, Inc. v. Huawei Devices USA, Inc.</i>	2:17-cv-00737	E.D. Tex.	Nov. 9, 2017
<i>Uniloc USA, Inc. v. HTC Am., Inc.</i>	2:17-cv-01629	W.D. Wash.	Nov. 1, 2017
<i>Uniloc USA, Inc. v. LG Elecs. USA, Inc.</i>	4:12-cv-00832	N.D. Tex.	Oct. 13, 2017
<i>Uniloc USA, Inc. v. LG Elecs. USA, Inc.</i>	4:18-cv-02918	N.D. Cal.	May 17, 2018
<i>Uniloc USA, Inc. v. Samsung Elecs. Am., Inc.</i>	2:17-cv-00650	E.D. Tex.	Sep. 15, 2017
<i>Uniloc USA, Inc. v. Apple Inc.</i>	2:17-cv-00522	E.D. Tex.	Jun. 30, 2017
<i>Uniloc USA, Inc. v. Apple Inc.</i>	4:18-cv-00364	N.D. Cal.	Jan. 17, 2018

Additionally, the '508 patent is the subject of two pending requests for *inter partes* review: IPR2018-00387 filed by Apple Inc. on December 22, 2017 (instituted

on July 23, 2018), and IPR2018-01026 filed by Apple Inc. on May 4, 2018. The real parties-in-interest herein are not parties to the above listed petitions and were not involved in the preparation of those petitions.

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III. GROUNDS FOR STANDING

Petitioner certifies that the '508 patent is eligible for *inter partes* review and that Petitioner is not barred or estopped from requesting *inter partes* review challenging the patent claims on the grounds identified in this petition. Petitioner was served with a complaint asserting infringement of the '508 patent on November

1, 2017, which is not more than one year before the filing of this Petition. Petitioner has not filed a civil action challenging the validity of any claim of the '508 patent.

IV. NOTE REGARDING PAGE CITATIONS AND EMPHASIS

Petitioner's citation to Ex. 1002 uses the page numbers added for compliance with 37 C.F.R. § 42.63(d)(2)(ii). Petitioner's citations to the remaining exhibits use the page numbers in their original publication. Unless otherwise noted, all **bold underline** emphasis in any quoted material has been added.

V. THE '508 PATENT

A. Summary of the '508 patent

The '508 patent is directed to “a method of monitoring human activity, and more particularly, to counting periodic human motions such as steps.” Ex. 1001, 1:5-7. As admitted by the Applicant, “inertial sensors (e.g., accelerometers)” are commonly used in commercial electronic devices. *Id.*, 1:13-18. “Step counting devices are used to monitor an individual's daily activity by keeping track of the number of steps that he or she takes.” *Id.*, 1:19-21. These devices, however, “are often confused by motion noise experienced by the device throughout a user's daily routine. This noise causes false steps to be measured and actual steps to be missed in conventional step counting devices.” *Id.*, 1:27-31.

The claims are directed to two separate concepts. The first concept (associated with independent claims 1 and 11) relates to determining and assigning a “dominant axis,” and counting steps along that axis. *See id.*, claim 1. In the '508

patent, the dominant axis is the axis “with the largest absolute rolling average . . . most influenced by gravity, which may change over time (e.g. as the electronic device is rotated). Therefore, a new dominant axis may be assigned when the orientation of the electronic device . . . changes.” *Id.*, 6:16-21.

The second concept (associated with independent claims 6 and 15) relates to counting steps in two different modes—a non-active mode and an active mode. In the non-active mode, steps are detected but not yet added to the total step count. Instead, steps are buffered until the device switches to the active mode, which occurs when a certain number of steps have been detected and validated. Steps are determined to be valid if they fall within a cadence window. The cadence window is based on a user’s motion cycle or stepping period. Once in the active mode, the detected steps are added to the total step count as they are detected.

The concepts described and claimed in the ’508 patent were not new at the time the ’508 patent was filed. Before the ’508 Patent was filed, Fabio Pasolini was actively working on pedometer devices that included the concepts described and claimed in the ’508 patent. Mr. Pasolini filed two patent applications (issued as U.S. Patent No. 7,698,097 (“Fabio”) and U.S. Patent No. 7,463,997 (“Pasolini”)) before the ’508 patent was filed. The Pasolini reference describes a pedometer updating the vertical axis with each acquisition of an acceleration sample to take into account variations of the orientation of the pedometer device during use. Ex. 1005, 8:20-24.

The Fabio reference, on the other hand, describes applying a regularity condition to the detected step data so that a step is counted when it occurs within a “validation interval.” The disclosures provided in the Fabio and Pasolini references render obvious each and every element of the challenged claims.

B. Prosecution History of the '508 Patent

The '508 patent issued on January 26, 2010 from U.S. Patent Application No. 11/644,455 filed on December 22, 2006.

The first Office Action issued on August 31, 2009, and included no prior art rejections. *See* Ex. 1002, p. 70. The Action did, however, include multiple objections to the drawings and other informalities. On October 9, 2009, the Applicant filed a response to replace drawings and amended the specification to address the other objections. *See id.*, p. 54. A Notice of Allowance then issued on November 30, 2009. *See id.*, p. 16. In the Allowance, the Examiner did not provide any specific reason but instead quoted the independent claims and merely stated that a few cited references did not teach the limitations of the claims. *See id.*, p. 22.

The prior art presented in this petition was not cited or applied by the Examiner during prosecution.

VI. LEVEL OF ORDINARY SKILL IN THE ART

The level of ordinary skill in the art may be reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). Here, a person of

ordinary skill in the art (“POSITA”) would include someone who had, at the priority date of the ’508 Patent (i) a Bachelor’s degree in Electrical Engineering, Computer Engineering, and/or Computer Science, or equivalent training, and (ii) approximately two years of experience working in hardware and/or software design and development related to MEMS (micro-electro-mechanical) devices and body motion sensing systems. Ex. 1003, p. 10. Lack of work experience can be remedied by additional education, and vice versa. *Id.*

VII. CLAIM CONSTRUCTION

This petition presents claim analysis in a manner that is consistent with the broadest reasonable construction in light of the specification. *See* 37 C.F.R. § 42.100(b). Under the broadest reasonable construction, claim terms are given their ordinary and accustomed meaning as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *Cuozzo Speed Techs., LLC v. Lee*, 579 U.S. ___, slip op. at 17 (2016). Also, because the claim constructions proposed herein are based on the broadest reasonable construction, they do not necessarily apply to other proceedings that use different claim construction standards. *See Samsung Elecs. Co. v. Virginia Innovation Sci., Inc.*, IPR2013-00569, Paper 9 at 2 (PTAB 2013). For terms not addressed below, Petitioner submits that no specific construction is necessary for this proceeding.¹

¹ Petitioner does not concede that any term not construed herein meets the statutory requirements of 35 U.S.C. § 112.

A. “dominant axis”

This term appears in at least claims 1 and 11. In the specification of the ’508 patent, the dominant axis is determined based on the accelerometer’s alignment with gravity. Ex. 1003, p. 17. For example, the specification states that “[i]n one embodiment, the dominant axis is assigned after identifying a gravitational influence. The gravitational influence may be identified by calculating total acceleration based upon the acceleration on each axis.” Ex. 1001, 14:34-38. The specification also states that “[i]n one embodiment, once the orientation is determined, a dominant axis is assigned based upon the orientation. Determining an orientation of the electronic device 100 may include identifying a gravitational influence.” *Id.*, 6:12-15. In other words, the dominant axis is “the axis most influenced by gravity, which may change over time (e.g., as the electronic device is rotated).” *Id.*, 6:16-18.

Thus, for the purposes of this proceeding, the term “dominant axis” as used in the claims includes “the axis most influenced by gravity.” Ex. 1003, p. 18.

B. “cadence window”

This term appears in at least claims 3, 6, 7, 10, 13, 15, 16, 19, and 20. The specification specifically defines this term as “a window of time since a last step was counted that is looked at to detect a new step.” Ex. 1001, 3:64-65.

Thus, for the purposes of this proceeding, the term “cadence window” as used in the claims includes “a window of time since a last step was counted that is looked at to detect a new step.” Ex. 1003, p. 18.

C. “a dominant axis logic to continuously determine an orientation of a device, to assign a dominant axis, and to update the dominant axis as the orientation of the device changes”

This term appears in at least claim 11. The specification describes that “dominant axis logic 127 is used to determine an orientation of the electronic device 100 and/or an inertial sensor within the electronics device 100.” *See* Ex. 1001, 3:4-8. “At processing block 812, in one embodiment the inertial sensor is oriented by assigning a dominant axis. Assigning a dominant axis may include calculating rolling averages of acceleration and assigning the dominant axis based on the rolling averages of acceleration.” *Id.*, 12:42-43. The specification further describes that the present invention may be performed by hardware, software, or a combination of both. *See id.*, 14:50-56.

Accordingly, a POSITA would have understood the broadest reasonable interpretation of this claim term to include “hardware, software, or both to continuously determine an orientation of a device, to assign a dominant axis, and to update the dominant axis as the orientation of the device changes.”

However, to the extent that Patent Owner overcomes the presumption against construction under 35 U.S.C. § 112, sixth paragraph, a POSITA would have understood the claim itself and the specification to provide:

Function: continuously determine an orientation of a device, to assign a dominant axis, and to update the dominant axis as the orientation of the device changes;

Structure: software, hardware, or combination thereof to perform actions in block 812. *See* Ex. 1001, 12:42-43, 14:50-56; Ex. 1003, pp. 18-19.

D. “a counting logic to count periodic human motions by monitoring accelerations relative to the dominant axis”

This term appears in at least claim 11. The specification describes “step counting logic 130” that is used “to determine if a step has occurred” and indicate if “a step may be counted” Ex. 1001, 6:40-45, 7:2. In one example, at block 615, “measurement data is checked to determine whether an additional step is recognized.” *Id.*, 11:19-21. At block 620, “[i]f an additional step is recognized, then it is added to the final or actual step count.” *Id.*, 11:21-22. The specification further describes that the present invention may be performed by hardware, software, or a combination of both. *See id.*, 14:50-56.

Accordingly, a POSITA would have understood the broadest reasonable interpretation of this claim term to include “hardware, software, or both to count

periodic human motions by monitoring accelerations relative to the dominant axis, or identify and count periodic human motions.”

However, to the extent that Patent Owner overcomes the presumption against construction under 35 U.S.C. § 112, sixth paragraph, a POSITA would have understood the claim itself and the specification to provide:

Function: count periodic human motions by monitoring accelerations relative to the dominant axis;

Structure: software, hardware, or combination thereof to perform actions in blocks 615 and 620. *See* Ex. 1001, 7:46-60, 14:50-56; Ex. 1003, pp. 20-21.

E. “a counting logic to identify and count periodic human motions”

This term appears in at least claim 15. The specification describes “step counting logic 130” that is used “to determine if a step has occurred” and indicate if “a step may be counted” Ex. 1001, 6:40-45, 7:2. In one example, at block 615, “measurement data is checked to determine whether an additional step is recognized.” *Id.*, 11:19-21. At block 620, “[i]f an additional step is recognized, then it is added to the final or actual step count.” *Id.*, 11:21-22. The specification further describes that the present invention may be performed by hardware, software, or a combination of both. *See id.*, 14:50-56.

Accordingly, a POSITA would have understood the broadest reasonable interpretation of this claim term to include “hardware, software, or both to count

periodic human motions by monitoring accelerations relative to the dominant axis, or identify and count periodic human motions.”

However, to the extent that Patent Owner overcomes the presumption against construction under 35 U.S.C. § 112, sixth paragraph, a POSITA would have understood the claim itself and the specification to provide:

Function: identify and count periodic human motions;

Structure: software, hardware, or combination thereof to perform actions in blocks 615 and 620. *See* Ex. 1001, 7:46-60, 14:50-56; Ex. 1003, pp. 21-22.

F. “a cadence logic to continuously update a dynamic cadence window”

This term appears in at least claim 13. The specification describes “cadence logic 132 [that] detects a period and/or cadence of a motion cycle. The period and/or cadence of a motion cycle may be based upon user activity (e.g. rollerblading, biking, running, walking, etc.).” Ex. 1001, 3:9-16. In one example, at block 574 “a new cadence window is set (block 574) based on a stepping cadence of the M steps measured.” *Id.*, 10:56-57. The specification further describes that the present invention may be performed by hardware, software, or a combination of both. *See id.*, 14:50-56.

Accordingly, a POSITA would have understood the broadest reasonable interpretation of this claim term to include “hardware, software, or both to continuously update a dynamic cadence window.”

However, to the extent that Patent Owner overcomes the presumption against construction under 35 U.S.C. § 112, sixth paragraph, a POSITA would have understood the claim itself and the specification to provide:

Function: continuously update a dynamic cadence window;

Structure: software, hardware, or combination thereof to perform actions in block 574. *See* Ex. 1001, 10:56-57, 14:50-56; Ex. 1003, p. 22.

G. “a mode logic, to switch the device from a non-active mode to an active mode after a number of periodic human motions are detected within appropriate cadence windows by the counting logic”

This term appears in at least claim 15. The specification describes mode logic 190 that determines the “operating mode that the electronic device is in.” Ex. 1001, 7:23-24. In one example, block 580 describes logic to check “whether there are N steps in the buffered step count.” *Id.*, 10:63-64. At block 584, “a stepping [active] mode is entered into.” *Id.*, 11:2-3. The specification further describes that the present invention may be performed by hardware, software, or a combination of both. *See id.*, 14:50-56.

Accordingly, a POSITA would have understood the broadest reasonable interpretation of this claim term to include “hardware, software, or both to switch the device from a non-active mode to an active mode after a number of periodic human motions are detected within appropriate cadence windows by the counting logic.”

However, to the extent that Patent Owner overcomes the presumption against construction under 35 U.S.C. § 112, sixth paragraph, a POSITA would have understood the claim itself and the specification to provide:

Function: switch the device from a non-active mode to an active mode after a number of periodic human motions are detected within appropriate cadence windows by the counting logic;

Structure: software, hardware, or combination thereof to perform actions in blocks 580 and 584. *See* Ex. 1001, 10:63-11:3, 14:50-56; Ex. 1003, pp. 23-24.

H. Note Regarding the Claim Terms directed to “Logic”

Petitioner may assert in this same district court litigation that, under the narrower *Phillips* standard, the claim limitations directed to “logic” invoke § 112 ¶6 but fail to meet the definiteness requirement of § 112 ¶2. As of the filing of this petition, the district court has not yet issued a claim construction order.

Petitioner recognizes that *inter partes* review proceedings cannot be used to challenge definiteness under § 112. *See* 35 U.S.C. § 311(b). However, for purposes of this proceeding, the broadest reasonable interpretation of these claim terms encompasses software, hardware, or a combination thereof for performing the recited function, as explained by the ’508 patent.

Additionally, regardless of whether the recited “logic” is a nonce word requiring the disclosure of an algorithm, the Board may still find that the claims are obvious in view of the software and hardware disclosed in the prior art cited in this petition. *See, e.g., Vibrant Media, Inc. v. Gen’l Elec. Co.*, IPR2013-00172, Paper 50, at 10-11 (PTAB July 28, 2014) (“[A]n indefiniteness determination in this proceeding would not have prevented us from deciding whether the claims would have been obvious over the cited prior art.”); *Microsoft Corp. v. Enfish*, IPR2013-00560, Paper 14, at 9-10 (PTAB Mar. 4, 2014) (instituting review and directing patent owner to identify structure in its Patent Owner Response). As detailed herein, the prior art teaches software, hardware, or a combination thereof performing the claimed function. Therefore, any indefiniteness determination would not prevent the Board from deciding that these claims are obvious in light of the provided prior art.

VIII. RELIEF REQUESTED AND THE REASONS FOR THE REQUESTED RELIEF

Petitioner asks that the Board review the accompanying prior art and analysis, institute a trial for *inter partes* review of claims 1-4, 6-8, 11-16, 19, and 20 of the ’508 patent, and cancel those claims as invalid.

As explained below and in the declaration of Petitioner’s expert, Dr. Joe Paradiso, the concepts described and claimed in the ’508 patent were not new. This petition explains where each element of claims 1-4, 6-8, 11-16, 19, and 20 is found

in the prior art and why the claims would have been obvious to a person of ordinary skill in the art (“POSITA”) before the earliest claimed priority date of the ’508 patent.

IX. IDENTIFICATION OF HOW THE CLAIMS ARE UNPATENTABLE

A. Challenged Claims

Claims 1-4, 6-8, 11-16, 19, and 20 of the ’508 patent are challenged in this petition.

B. Statutory Grounds for Challenges

Challenge	Claims	Ground
Challenge #1	1-2 and 11-12	Obvious under 35 U.S.C. § 103(a) over U.S. Patent No. 7,463,997 to Fabio Pasolini et al. (“Pasolini”).
Challenge #2	6-8, 15-16, and 19	Obvious under 35 U.S.C. § 103(a) over U.S. Patent No. 7,698,097 to Fabio Pasolini et al. (“Fabio”).
Challenge #3	3-4, 13-14, and 20	Obvious under 35 U.S.C. § 103(a) over Pasolini in view of Fabio.

Both Pasolini and Fabio were filed on October 2, 2006, which is before the December 22, 2006 filing date of the earliest filed application upon which the ’508 Patent claims priority. Accordingly, Pasolini and Fabio are each at least pre-AIA 35 U.S.C. § 102(e) prior art based on their filing dates.

C. State of the art at the time of the ’508 Patent

By the time the ’508 Patent was filed on December 22, 2006, others were actively working on pedometer devices that monitored a user’s steps. One such

developer was Fabio Pasolini, who designed motion detection systems using MEMS that could be implemented in phones or other portable electronic devices. *See* Ex. 1006, 2:33-36; Ex. 1005, 8:31-34. The Fabio and Pasolini references disclose pedometer devices that use an inertial sensor, such an accelerometer, to count steps of the user while the user is carrying the device. Ex. 1006, 1:10-11, 2:49-64; Ex. 1005, 3:30-35.

To detect and identify the user's steps, Mr. Pasolini's devices analyze positive and negative acceleration peaks provided by the accelerometer. Ex. 1006, 4:12-21; Ex. 1005, 3:35-41. In this way, Mr. Pasolini's devices provide features that help avoid "false positives" with respect to the step recognition. Ex. 1006, 7:16-19; Ex. 1005, 1:61-2:3. These step-recognition features are described in two of Mr. Pasolini's issued patents—U.S. Patent No. 7,698,097 ("Fabio") and U.S. Patent No. 7,463,997 ("Pasolini")—that were both filed on October 2, 2006.

Both of Mr. Pasolini's patents describe a number of features in common with the pedometer devices. This includes, for example, an accelerometer with multiple axes of detection, so that step recognition is advantageously performed using the accelerations measured by the axis that is most aligned with gravity. Ex. 1006, 8:20-32; Ex. 1005, 8:15-24.

The references differ in that the Pasolini reference provides additional detail regarding step detection using linear and multi-axes accelerometers, including

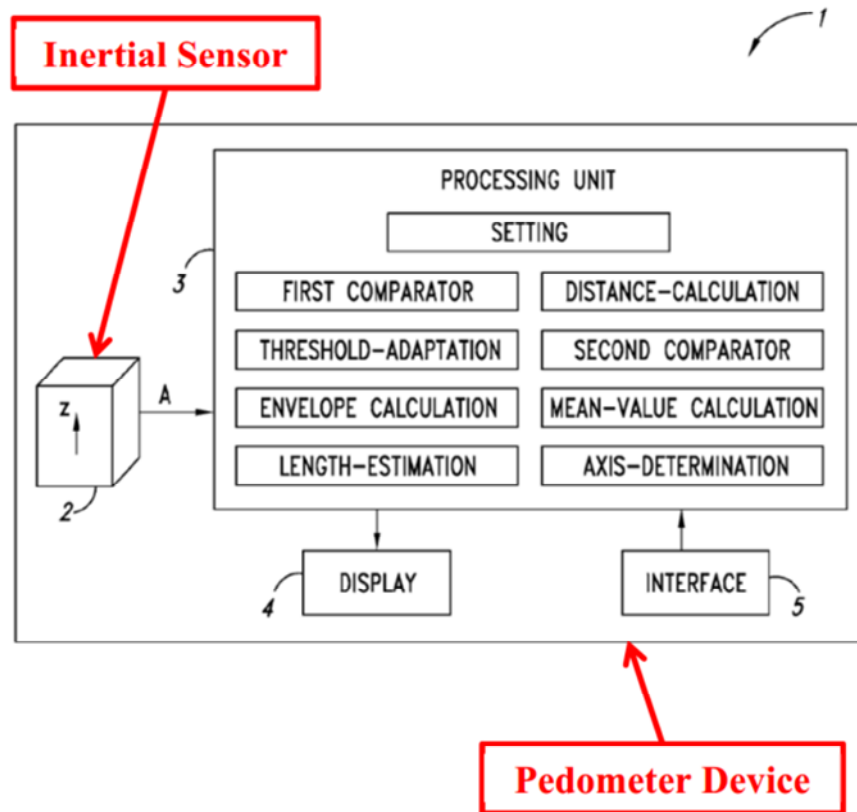
describing that the pedometer updates the vertical axis with each acquisition of an acceleration sample to take into account variations of the orientation of the pedometer device during use. Ex. 1005, 8:20-24. The Fabio reference, on the other hand, describes applying a regularity condition to the detected step data so that a step is counted when it occurs within a “validation interval,” which is identified as a window of time since a previous step was counted. Ex. 1006, 4:35-39, 7:16-19, FIG. 6.

As described in more detail below, the disclosures provided in the Fabio and Pasolini references render obvious each and every element of the challenged claims.

1. Summary of Pasolini

Pasolini is directed to “a pedometer device and to a step detection method using an algorithm for self-adaptive computation of acceleration thresholds.” Ex. 1005, 1:10-12. In one embodiment, Pasolini describes a pedometer device having an “accelerometer 2 [that] detects the component along the **detection axis z of the vertical acceleration** generated **during the step**, and produces a corresponding acceleration signal A.” *Id.*, 3:13-19. The processing unit in the pedometer device “acquires at pre-set intervals samples of the **acceleration signal A** generated by the accelerometer 2, and executes appropriate processing operations

for counting the number of steps.” *Id.*, 3:30-41. An example of Pasolini’s pedometer device is reproduced below:



Ex. 1005, Fig. 1 (annotated); Ex. 1003, p. 27.

Pasolini also teaches an embodiment where the accelerometer 2 may be a tri-axial accelerometer rather than a linear accelerometer: “The accelerometer 2 could be equipped with a number of axes of measurement, for example three mutually orthogonal axes of measurement.” Ex. 1005, 8:11-13. When using the three axes of measurement, the axis most aligned with gravity is used for step detection. Ex. 1003, p. 27.

Pasolini further teaches that the axis identified as the one most aligned with gravity changes as the device rotates. *Id.* Specifically, Pasolini states that the “processing unit 3 envisages identifying the **main vertical axis** to be used for **step detection** as the axis of detection that has the highest mean acceleration value Accm (on account of gravity). For example, the **main vertical axis** can be identified at **each acquisition of a new acceleration sample**, block 30 of FIG. 4, so as to take into account **variations in the orientation** of the pedometer device 1.” Ex. 1005, 8:18-24.

Thus, the various embodiments described in Pasolini teach a pedometer using a tri-axial accelerometer to continuously determine which axis is the one most aligned with gravity, and uses that axis to count steps. Ex. 1003, p. 28.

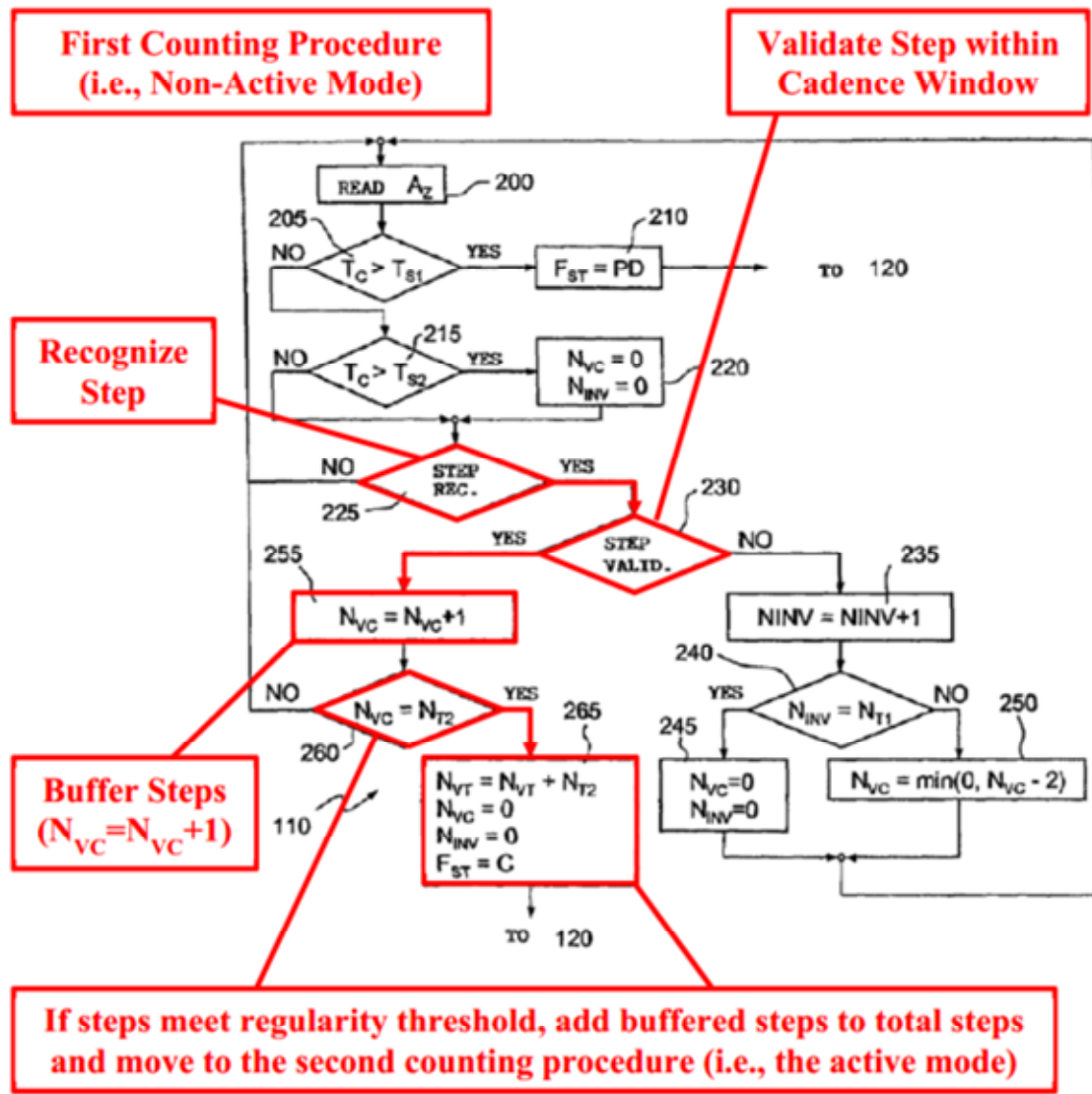
2. Summary of Fabio

Fabio is directed to “controlling a pedometer based on the use of inertial sensors.” Ex. 1006, 1:10-11. Fabio notes that “there are many random events that can interfere with correct recognition of the step. Impact or other external vibrations and given movements of the user can, in fact, give rise to so-called ‘false positives.’” *Id.*, 1:38-41. Consequently, Fabio describes a pedometer having various features to overcome such challenges.

Fabio’s device uses two separate counting procedures. In the first counting procedure, steps are detected and counted but not added to the “total number of valid

steps N_{VT} .” *Id.*, 3:43. Instead, **“the number of valid control steps N_{VC} is incremented by one** (block 255), and then the control unit 5 executes a first test on regularity of the sequence of steps recognized (block 260).” *Id.*, 5:10-13. In other words, the valid control steps value N_{VC} is incremented rather than the total step count N_{VT} . After the number of valid control steps N_{VC} reaches a threshold N_{T2} , the value of N_{T2} (the same as N_{VC}) is added to the total step count N_{VT} : “Otherwise (output YES from block 260), a sequence of steps is recognized that satisfies the first condition of regularity, and the first regularity test is passed . . . the total number of valid steps N_{VT} is updated and incremented by a value equal to the second threshold number N_{T2} (block 265).” *Id.*, 5:10-39. “[W]hen the first regularity test (block 260) is passed, **the total number of valid steps N_{VT} is immediately updated so as to take into account the valid steps** (equal to N_{T2}) that make up the sequence considered as being regular.” *Id.*, 5:52-56.

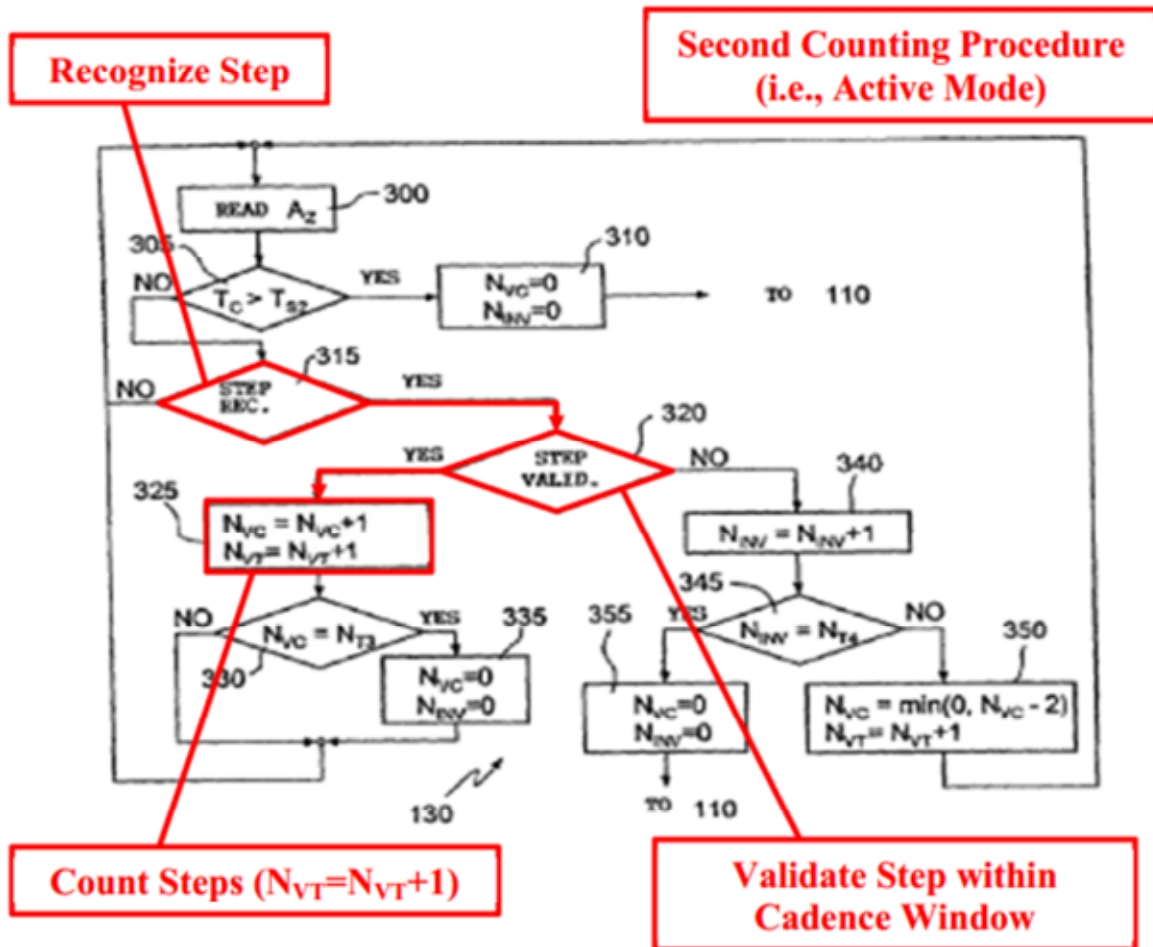
A flowchart for Fabio’s first counting procedure is shown below.



Ex. 1006, Fig. 4 (annotated); Ex. 1003, p. 30.

After a certain number of validated steps have been detected, Fabio's device enters a second counting procedure. In the second counting procedure, detected steps are added to the step count. Specifically, Fabio teaches **"If the check yields a positive result (output YES from block 320), the control unit 5 updates the total number of valid steps N_{VT} ."** Ex. 1006, 6:27-53. Additionally, Fabio teaches that

“[t]he user is considered to be moving, and a first counter, hereinafter referred to as total number of valid steps N_{VT} , is incremented whenever an event corresponding to a step is recognized.” *Id.*, 3:37-49. A flowchart of the second counting procedure from Fig. 7 is reproduced below:



Id., Fig. 7 (annotated); Ex. 1003, p. 31.

Using these counting procedures, Fabio’s device is able to more accurately count steps and adapt to changes in the user’s pace. Ex. 1003, p. 31. Specifically, Fabio teaches:

Possible isolated irregularities are ignored and do not interrupt or suspend updating of the count, which is, instead, interrupted when prolonged pauses occur or in the presence of significant discontinuities in locomotion. However, if the gait becomes regular again, even with a different rhythm, also the count promptly resumes, because the first counting procedure is once again executed. This prevents a significant number of steps from being neglected.

Ex. 1006, 7:16-23.

D. Challenge #1: Claims 1-2 and 11-12 are obvious under 35 U.S.C. § 103(a) over Pasolini.

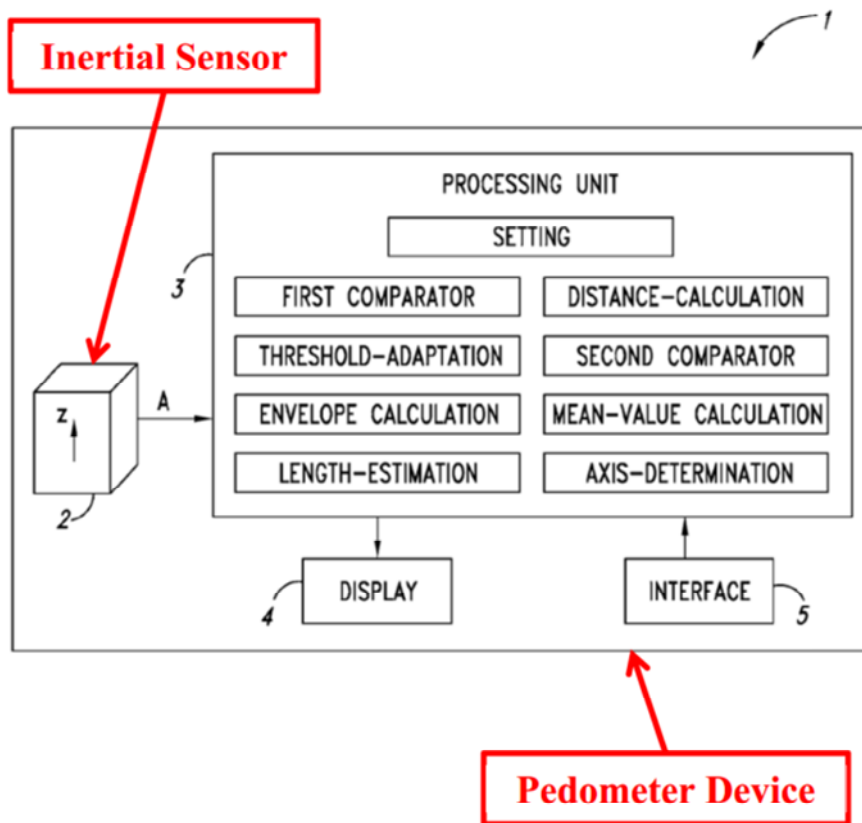
The following analysis describes how Pasolini renders obvious each and every element of at least claims 1-2 and 11-12 of the '508 patent. A corresponding claim chart is contained in Dr. Paradiso's expert declaration. *See* Ex. 1003, pp. 32-46.

1. Claim 1

[1.0] A method of monitoring human activity using an inertial sensor, comprising:

Pasolini discloses this limitation because it teaches that “[o]ne embodiment of the invention is a **step detection method** for **detecting steps in the gait of a user.**” Ex. 1005, 2:22-28. Accordingly, Pasolini teaches a method for monitoring human activity (e.g., detecting the gait of a user (steps)). To detect the user's stepping activity, Pasolini teaches using “a **pedometer device and a method for detecting**

and counting steps.” *Id.*, 2:6-9. To detect stepping motions, the pedometer employs an accelerometer, as illustrated in Fig. 1, below:



Id., Fig. 1 (annotated); Ex. 1003, p. 33.

In Pasolini’s pedometer, “[T]he **accelerometer 2** detects the component along the detection axis z of the vertical acceleration generated **during the step**, and produces a corresponding acceleration signal A.” Ex. 1005, 3:13-19. According to Pasolini, accelerometer 2 is an example of an inertial sensor. Ex. 1003, pp. 33-34; *see also* Ex. 1001, 1:13.

Pasolini states that its pedometer and method can be included, for example, in a mobile device: “as shown in FIG. 8, the pedometer device 1, due to its reduced

dimensions, may advantageously be housed inside a portable device, in particular a mobile phone 50 (or else an MP3 reader, a camera, a PDA, a game console, etc.).” Ex. 1005, 8:31-34. An example of the mobile device in Fig. 8 with the pedometer (and the inertial sensor) is shown below:

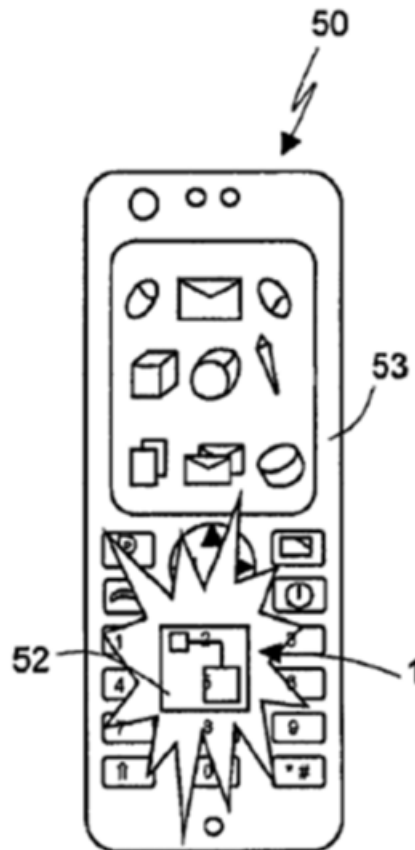


Fig.8

Thus, Pasolini’s method for detecting steps with a pedometer device that includes an accelerometer teaches “[a] method of monitoring human activity using an inertial sensor” as recited in the claim. Ex. 1003, p. 35.

[1.1] continuously determining an orientation of the inertial sensor;

Pasolini renders this limitation obvious. Pasolini teaches a three-axis accelerometer that determines which of three axes is the main vertical axis as the device's orientation changes:

The accelerometer 2 could be equipped with a number of axes of measurement, for example three mutually orthogonal axes of measurement In this case, according to one embodiment of the present invention, the algorithm implemented by the processing unit 3 envisages **identifying the main vertical axis to be used for step detection as the axis of detection that has the highest mean acceleration value Accm (on account of gravity)**. For example, **the main vertical axis can be identified at each acquisition of a new acceleration sample**, block 30 of FIG. 4, so as to take into account **variations in the orientation of the pedometer device 1**, and consequently of the accelerometer 2 arranged inside it.

Ex. 1005, 8:11-24.

By determining which axis is the main vertical axis as the device's orientation changes, Pasolini teaches that "an orientation" is being determined based on alignment of the accelerometer with gravity. Ex. 1003, p. 36. For example, if the X-axis is determined to be the main vertical axis, then it is determined that the device is oriented such that the X-axis is most aligned with gravity. *Id.* Alternatively, if the Y-axis is the main vertical axis, then it is determined that the device is oriented such that the Y-axis is most aligned with gravity. *Id.*

Further, Pasolini's determining of the main vertical axis is performed *continuously* because it is done "at each acquisition of a new acceleration sample." Ex. 1005, 8:20-22. In Pasolini, the device "acquires at pre-set intervals samples of the acceleration signal A generated by the accelerometer 2." *Id.*, 3:31-33. By acquiring acceleration samples at pre-set intervals and determining the device's orientation as each acquisition, a POSITA would thus recognize that Pasolini's device is determining device orientation continuously, at a pre-set interval. Ex. 1003, p. 36.

Thus, Pasolini's pedometer that determines the main vertical axis (and thus an orientation) at each new acceleration sample teaches "continuously determining an orientation of the inertial sensor" as recited in the claim. *Id.*, p. 37.

[1.2] assigning a dominant axis;

Pasolini discloses this limitation because it teaches identifying a main vertical axis (i.e., the dominant axis) of the accelerometer to be used in step detection: "the algorithm implemented by the processing unit 3 envisages identifying the main vertical axis to be used for step detection as the axis of detection that has the highest mean acceleration value Accm (on account of gravity)." Ex. 1005, 8:11-24). A POSITA would understand the main vertical axis to be a *dominant* axis because, in Pasolini, the main vertical axis is the axis most aligned with gravity (i.e.,

has the highest mean acceleration value Accm on account of gravity). Ex. 1003, p. 37.

Thus, Pasolini's identification of a main vertical axis as the axis most aligned with gravity teaches "assigning a dominant axis" as recited in the claim. *Id.*, pp. 37-38.

[1.3] updating the dominant axis as the orientation of the inertial sensor changes; and

First, as discussed in sections [1.1] and [1.2], Pasolini's embodiments teach determining the orientation of the accelerometer (i.e., an inertial sensor) by identifying the axis most aligned with gravity (i.e., assigning the dominant axis).

Second, Pasolini teaches in its second embodiment that "**the main vertical axis can be identified at each acquisition of a new acceleration sample**, block 30 of FIG. 4, so as **to take into account variations in the orientation of the pedometer device 1, and consequently of the accelerometer 2 arranged inside it.**" Ex. 1005, 8:11-24. Along with identifying the main vertical axis with each new acceleration sample, Pasolini also "executes appropriate processing operations for **counting the number of steps** and measuring the distance traveled." *Id.*, 3:33-35. Based on these disclosures, a POSITA would have thus recognized that as the pedometer (and by extension the accelerometer inside it) is rotated, a new acceleration sample is acquired to both identify the main vertical axis (i.e., the dominant axis) and count the steps that occur along this axis. Ex. 1003, p. 39.

Accordingly, Pasolini teaches that the axis identified as the dominant axis is “updated” at the acquisition of each acceleration sample to count steps along that axis. *Id.*

Thus, Pasolini’s pedometer that regularly (i.e., at each acquisition of a new acceleration sample) updates the axis which is the main vertical axis to account for various orientations teaches “updating the dominant axis as the orientation of the inertial sensor changes” as recited in the claim. *Id.*

[1.4] counting periodic human motions by monitoring accelerations relative to the dominant axis.

First, Pasolini teaches that “the algorithm implemented by the processing unit 3 envisages identifying the main vertical axis to be used for step detection.” Ex. 1005, 8:15-20. As discussed above, in [1.2] and [1.3], Pasolini’s main vertical axis is the dominant axis because it is updated at each acceleration sample to be the axis most aligned with gravity. Ex. 1003, p. 39.

Second, Pasolini teaches that the pedometer device is “for detecting and counting the steps of a user.” Ex. 1005, 2:10-21. To count the user’s steps the device includes an “accelerometer 2 [that] detects the component along the detection axis z of the vertical acceleration generated during the step, and produces a corresponding acceleration signal A.” *Id.*, 3:13-19. A POSITA would have understood that detection along the z-axis would be the main vertical axis when the pedometer is oriented such that detection along the z-axis has the highest mean

acceleration value Accm as discussed in section [1.3]. Ex. 1003, p. 40. Accordingly, a POSITA would have understood that the z-axis is the dominant axis. *Id.*

Accordingly, a POSITA would have found it obvious to apply the step counting techniques of the Z-axis to the main vertical axis to count steps.

Thus, Pasolini's identifying the main vertical axis at each acceleration sample in combination with the teachings of counting steps relative to the z-axis renders obvious "counting periodic human motions by monitoring accelerations relative to the dominant axis" as recited in the claim. *Id.*, pp. 40-41.

2. Claim 2

[2.0-2.1] The method of claim 1, further comprising: using acceleration measurements along only the dominant axis to count steps.

Pasolini renders this limitation obvious because it teaches a triaxial embodiment that uses the "main *vertical* axis" to detect and count steps. Pasolini further teaches that "In use, the accelerometer 2 detects the component along the detection axis z of the vertical acceleration generated during the step, and produces a corresponding acceleration signal A." Ex. 1005, 3:16-19. In other words, Pasolini teaches that the process used to determine the step only takes into account the acceleration along the main vertical axis. Ex. 1003, p. 41.

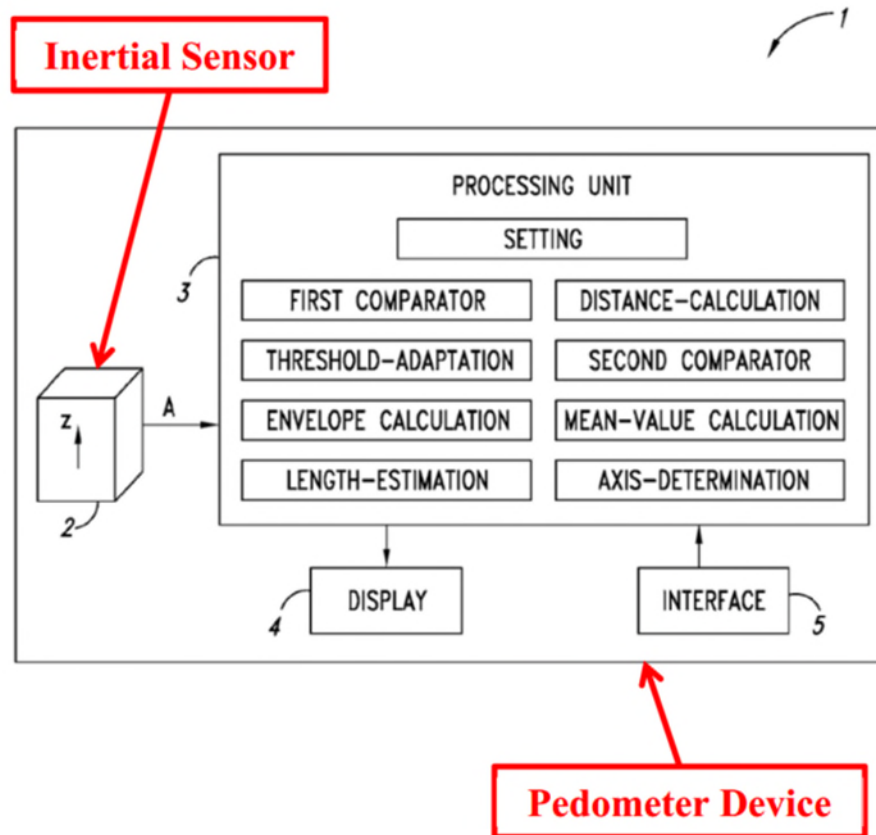
Thus, Pasolini's teachings of processing the acceleration signal correlated to the accelerations undergone along only the main vertical detection axis to count steps

renders obvious “using acceleration measurements along only the dominant axis to count steps.” *Id.*, pp. 41-42.

3. *Claim 11*

[11.0] An inertial sensor based device, comprising:

Pasolini discloses this limitation because it teaches “**a pedometer device** and a method **for detecting and counting steps.**” Ex. 1005, 2:6-9. To detect and count steps, Pasolini’s pedometer device includes an accelerometer (i.e., inertial sensor): “FIG. 1 is a schematic illustration of a **pedometer device 1**, comprising an **accelerometer 2**.” *Id.*, 2:60-66. An example diagram of Pasolini’s pedometer is illustrated in Fig. 1, provided below:



Id., Fig. 1 (annotated); Ex. 1003, p. 43.

Thus, Pasolini's pedometer, including the accelerometer, which counts a user's steps teaches "[a]n inertial sensor based device," as recited in the claim.

Ex. 1003, p. 43.

[11.1] a dominant axis logic to continuously determine an orientation of a device, to assign a dominant axis, and to update the dominant axis as the orientation of the device changes,

Pasolini renders this limitation obvious because the combination of its embodiments teaches a processing unit that continuously determines which of three axes is the one most aligned with gravity. *Id.*

First, Pasolini teaches “logic” that performs the functions recited in the claim because it states that the various accelerometer related functions are done through “**digital implementation** of the pedometer device 1.” Ex. 1005, 8:53-58. Pasolini also regularly refers to processing steps being performed by the processing unit, which executes processing operations (i.e., “logic”). For example, Pasolini states that “[t]he processing unit 3, comprising a microprocessor circuit (for example, a microcontroller or DSP), acquires at pre-set intervals samples of the acceleration signal A generated by the accelerometer 2, and **executes appropriate processing operations** for counting the number of steps and measuring the distance traveled.” *Id.*, 3:30-41. Accordingly, Pasolini teaches hardware (e.g., processing unit 3) and software (e.g., processing operations).

Second, consistent with the analysis at [1.1], Pasolini discloses that one of the functions of the processing unit and processing operations is determining the main vertical axis (and thus an orientation) at each new acceleration sample. Ex. 1003, p. 44. Thus, Pasolini teaches “a dominant axis logic, to continuously determine an orientation of a device,” as recited in the claim. *Id.*

Third, Pasolini teaches “dominant axis logic . . . to assign a dominant axis.” Consistent with the analysis at [1.2], Pasolini renders obvious the identification and use of the main vertical axis (i.e., the dominant axis) to count a user’s steps. *Id.*

Thus, Pasolini renders obvious “dominant axis logic . . . to assign a dominant axis” as recited in the claim. *Id.*

Fourth, Pasolini teaches “dominant axis logic . . . to update the dominant axis as the orientation of the device changes.” Consistent with the analysis at [1.3], Pasolini’s pedometer equipped with the three-axis accelerometer regularly (i.e., at each acquisition of a new acceleration sample) updates the main vertical axis (i.e., the dominant axis) to account for various device orientations. *Id.* Thus, Pasolini renders obvious “dominant axis logic . . . to update the dominant axis as the orientation of the device changes” as recited in the claim. Ex. 1003, pp. 44-45.

The above analysis is applicable even if the Patent Owner overcomes the presumption against construction under 35 U.S.C. § 112, sixth paragraph. To the extent that the term “dominant axis logic” is interpreted to include the example described in block 812 of the ’508 Patent for “assigning the dominant axis based on the rolling averages of acceleration” (Ex. 1001, 12:40-44), Pasolini teaches that the hardware of Pasolini calculates the rolling averages by using “the mean value” of the acceleration samples to determine a main vertical axis. Ex. 1003, p. 45.

Thus, Pasolini’s processing unit that identifies the dominant axis at each acceleration sample to account for variations in the orientation of the pedometer renders obvious “a dominant axis logic to continuously determine an orientation of

a device, to assign a dominant axis, and to update the dominant axis as the orientation of the device changes.” Ex. 1003, pp. 45-46.

[11.2] a counting logic to count periodic human motions by monitoring accelerations relative to the dominant axis.

The combination of Pasolini’s embodiments renders this limitation obvious. Ex. 1003, p. 45. First, as described above at [11.1.1], Pasolini teaches hardware and software for performing the disclosed functions (i.e., logic). *Id.* Second, consistent with the analysis at [1.4], Pasolini teaches counting steps (i.e., periodic human motions) based on acceleration signal A (i.e., accelerations) taken along the main vertical axis (i.e., the dominant axis). *Id.* Thus, Pasolini teaches “a counting logic to count periodic human motions by monitoring accelerations relative to the dominant axis” as recited in the claim. *Id.*

The above analysis is applicable even if the Patent Owner overcomes the presumption against construction under 35 U.S.C. § 112, sixth paragraph. To the extent that the term “a counting logic” is interpreted to include the following example described in the ’508 Patent: “measurement data is checked to determine whether an additional step is recognized (block 615). If an additional step is recognized, then it is added to the final or actual step count (block 620)” (Ex. 1001, 11:21-24); Fabio discloses this example. Ex. 1003, pp. 45-46. In particular, Pasolini teaches that the “processing unit 3 compares the value of the 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.” Ex. 1005, 3:34-41. A POSITA would have thus recognized that detecting peaks in the acceleration signal A is “measuring” the acceleration data in the signal. Ex. 1003, pp. 45-46.

Thus, Pasolini’s processing unit that counts steps by detecting accelerations along a main vertical axis showing a positive peak followed by a negative peak teaches “a counting logic to count periodic human motions by monitoring accelerations relative to the dominant axis” as recited in the claim. *Id.*, p. 46.

4. Claim 12

[12.0-12.1] The device of claim 11, wherein: The counting logic uses acceleration measurements along only the dominant axis to count steps.

Pasolini renders this limitation obvious. First, as described above at [11.1.1], Pasolini teaches a “counting logic.” *Id.* Second, consistent with the analysis at [2.1], Pasolini teaches that “the counting logic uses acceleration measurements along only the dominant axis to count steps” as recited in the claim. *Id.*

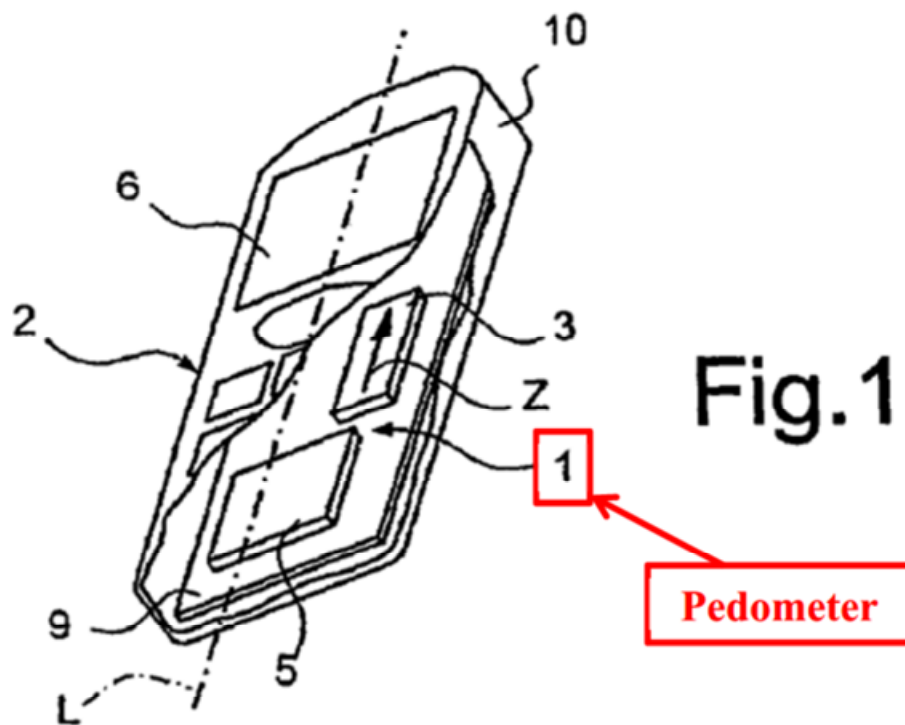
E. Challenge #2: Claims 6-8, 15-16, and 19 are obvious under 35 U.S.C. § 103(a) over Fabio.

The following analysis describes how Fabio renders obvious each and every element of at least claims 6-8, 15-16, and 19 of the ’508 patent. A corresponding claim chart is contained in Dr. Paradiso’s expert declaration. *See* Ex. 1003, pp. 47-79.

1. *Claim 6*

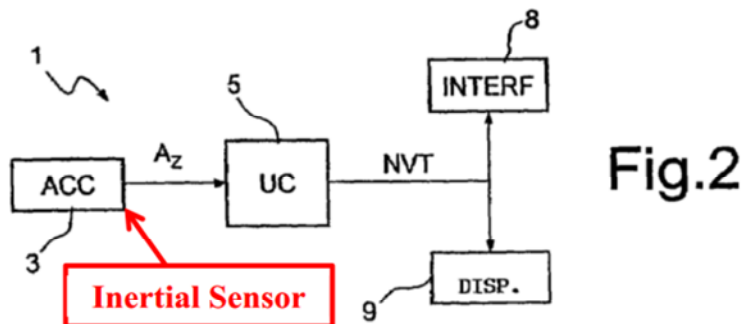
[6.0] *A method of monitoring human activity using an inertial sensor, comprising:*

To the extent that the preamble is limiting, Fabio discloses it. *Id.*, p. 47. First, Fabio teaches “**a method** for controlling a pedometer” that includes “generating a signal correlated to movements of a user of the pedometer” and “**detecting steps of the user** based on the signal.” Ex. 1006, 1:62-2:3. A POSITA would understand that a user’s steps are a form of “human activity.” Ex. 1003, p. 47. Fabio’s pedometer is shown in Figure 1 (below):



Ex. 1006, FIG. 1 (annotated); Ex. 1003, p. 48.

Second, Fabio teaches that its “pedometer 1 comprises **an inertial sensor 3,**” such as an “accelerometer.” *Id.*, 2:34-52. Fabio’s “inertial sensor 3” of the “pedometer 1” is shown in Figure 1 (above) and also in Figure 2 (below):



Id., FIG. 2 (annotated); Ex. 1003, p. 49.

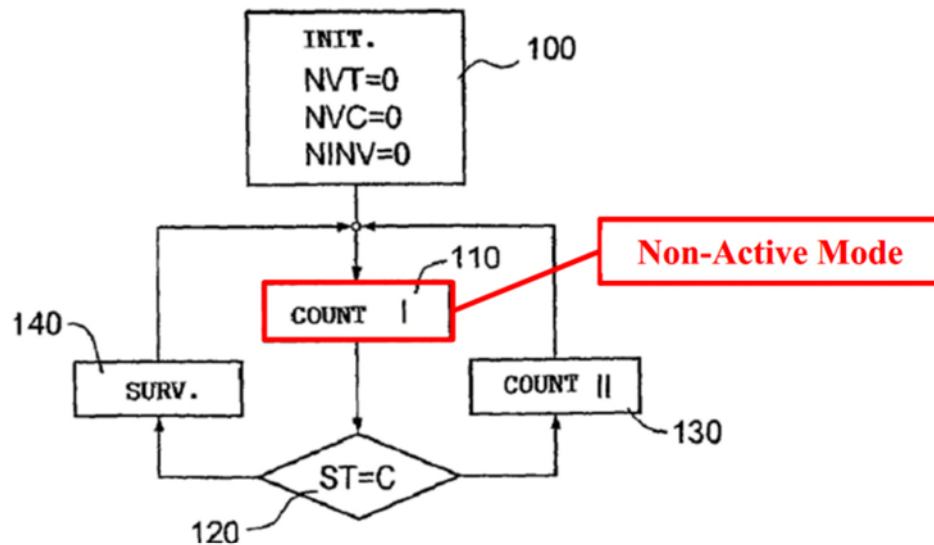
In Fabio, the accelerometer 3 monitors the user’s steps in that “inertial sensor 3 supplies at output an acceleration signal A_z ” that the pedometer’s “control unit 5 receives and processes . . . for identifying and counting a total number of valid steps N_{VT} made by a user wearing or carrying the pedometer 1.” Ex. 1006, 2:49-64. A POSITA would have thus recognized that Fabio’s device “monitor[s] human activity” because it uses the acceleration signal from the accelerometer to detect the steps taken by a user. Ex. 1003, p. 49.

Thus, Fabio’s method of detecting a user’s steps using an inertial sensor-based pedometer device teaches “[a] method of monitoring human activity using an inertial sensor,” as recited in the claim. *Id.*

[6.1] running a device that includes the inertial sensor in a non-active mode, in which periodic human motions are buffered;

First, as described at [6.0], Fabio describes a pedometer 1 (device) that includes an inertial sensor 3.

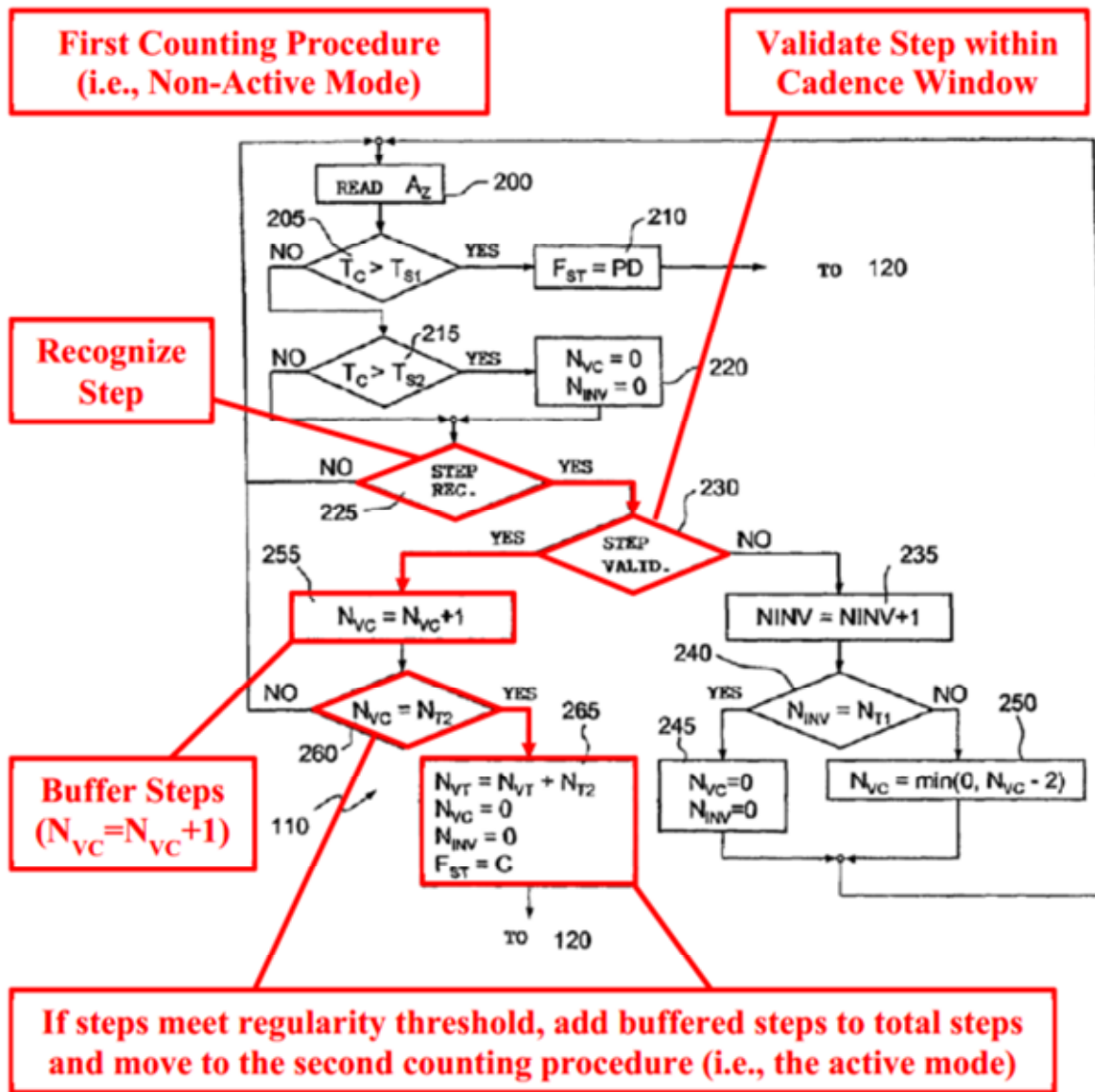
Second, Fabio discloses that the device runs in a non-active mode.² Fabio teaches a counting procedure 110 wherein motion is detected but the steps are buffered but not counted. Ex. 1003, pp. 49-50. Fabio's method, including the first counting procedure 110 (i.e., the non-active mode), is shown below in Fig. 3:



Ex. 1006, Fig. 3 (annotated); Ex. 1003, p. 50.

² The specification of the '508 Patent makes clear that it is the *device* rather than the *inertial sensor* that is in the non-active mode: "The exact behavior of the step count buffer 165 depends on which operating mode the electronic device 100 is in . . . operating modes include a non-active mode, in which periodic human motions are buffered." Ex. 1001, 7:21-28. Ex. 1003, p. 50.

During the counting procedure 110, “**the number of valid control steps N_{VC} is incremented by one** (block 255), and then the control unit 5 executes a first test on regularity of the sequence of steps recognized (block 260).” Ex. 1006, 5:10-13. The control steps recorded in N_{VC} are buffered steps because they are maintained in the N_{VC} variable but not added to the total step count: “the control unit 5 acquires once again a new sample of the acceleration signal A_Z (block 200), **without the total number of valid steps N_{VT} being incremented.**” *Id.*, 5:27-29. After the number of control steps reaches a threshold, control steps are counted by adding them to the total step count: “when the first regularity test (block 260) is passed, **the total number of valid steps N_{VT} is immediately updated so as to take into account the valid steps** (equal to N_{T2}) that make up the sequence considered as being regular.” *Id.*, 5:52-56. Fabio’s Fig. 4, reproduced below, shows the first counting procedure in more detail:



Ex. 1006, Fig. 4 (annotated); Ex. 1003, p. 55.

Accordingly, Fabio teaches that the valid control steps N_{VC} —that are tracked during the counting procedure 110—are buffered because they are not added to the total step count until they meet a threshold of regularity. Fabio also discloses that while in non-active mode, “the user is considered at rest.” Ex. 1006, 3:19-27; Ex. 1003, pp. 55-56.

Thus, Fabio's first counting procedure that buffers steps without updating the total step count until a condition of regularity has been met teaches "running a device that includes the inertial sensor in a non-active mode, in which periodic human motions are buffered" as recited in the claim. Ex. 1003, p. 56.

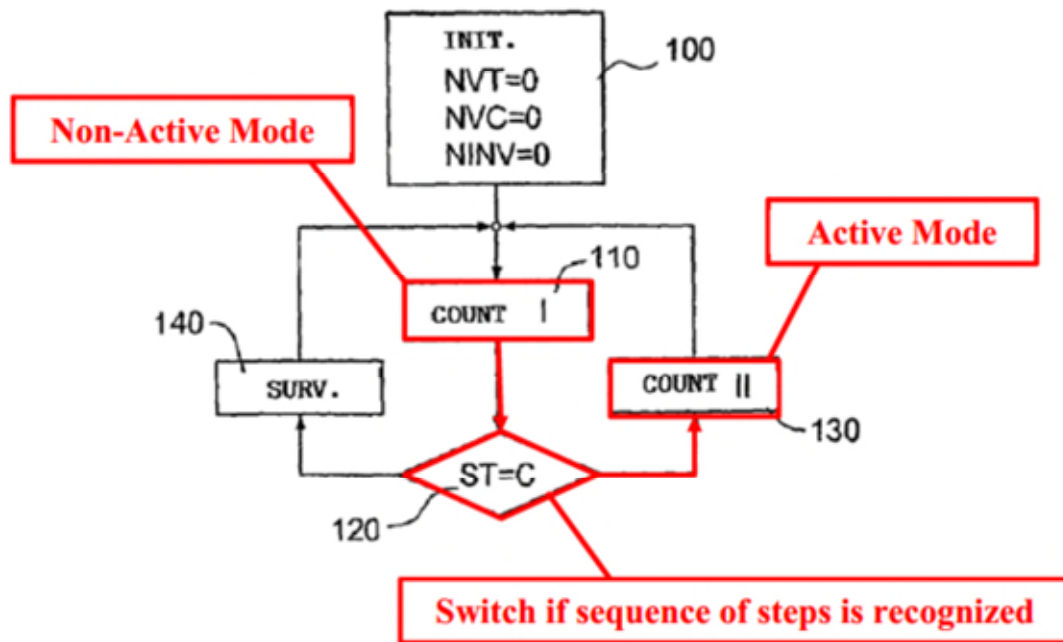
[6.2] switching the device from the non-active mode to an active mode, after identifying a number of periodic human motions within appropriate cadence windows

Fabio discloses this limitation because it teaches switching the pedometer from the first counting procedure 110 (e.g., a non-active mode) to a second counting procedure 130 (e.g., an active mode) after a condition of stepping regularity has been met. *Id.* The condition of regularity is determined based on the detected steps falling within a validation interval TV (i.e., a cadence window). *Id.*

More specifically, Pasolini first teaches that its pedometer device switches from the first counting procedure 110 (e.g., the non-active mode as discussed in [6.1]) to the second counting procedure 130 (e.g., the active mode) after identifying a recognized sequence of steps: "[a]t the end of the first counting procedure, the control unit 5 checks whether the state flag FST has been set at the first value C (block 120), i.e., whether a sequence of steps has been recognized. **If so (output YES from block 120), a second counting procedure is executed (block 130).**"

Ex. 1006, 3:37-49. The switching between the first counting procedure and the

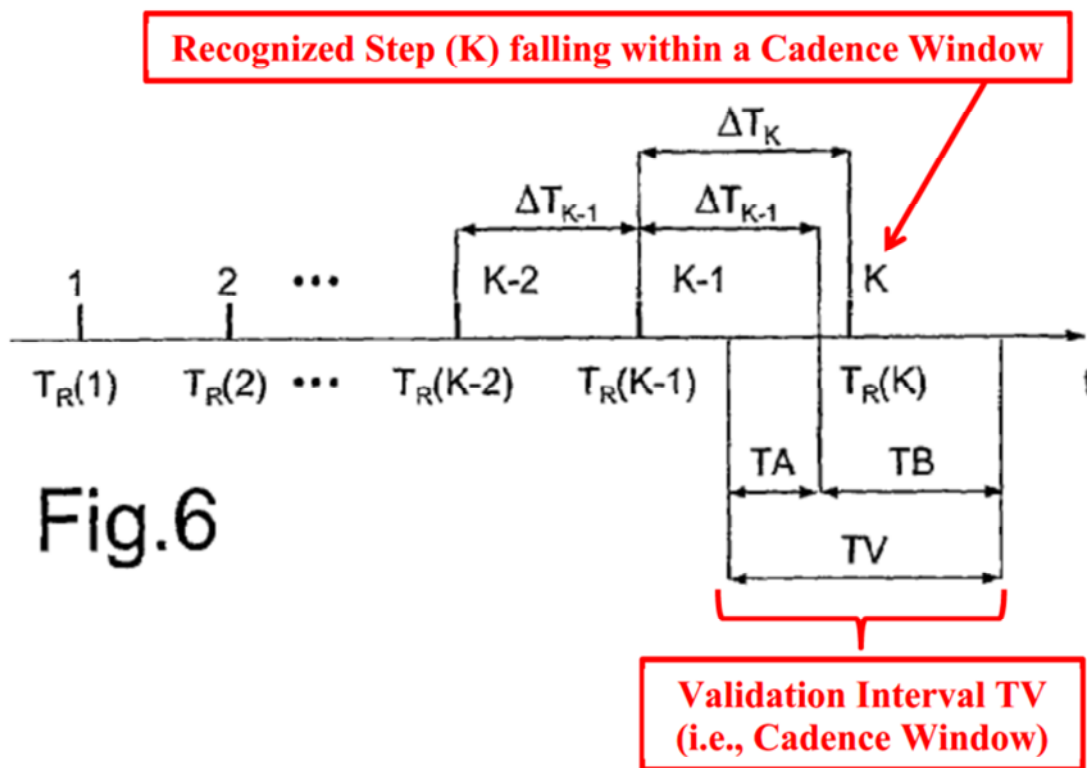
second counting procedure based on a valid sequence of steps is shown below in reference to Fig. 3:



Ex. 1006, Fig. 3 (annotated); Ex. 1003, p. 57.

Fabio's second counting procedure 130 is an "active mode" because, unlike the non-active mode that buffers steps, each step recognized and validated in this mode is counted (i.e., added to the total step count N_{VT}). Ex. 1006, 3:37-49 ("a second counting procedure is executed (block 130). The user is considered to be moving, and a first counter, hereinafter referred to as total number of valid steps N_{VT} , is incremented whenever an event corresponding to a step is recognized."). A POSITA would thus understand that second counting procedure to be an "active mode."

Second, Fabio teaches switching between the non-active mode and the active mode after a sequence of steps is recognized within a validation interval (i.e., a cadence window). Ex. 1003, p. 58. More specifically, to validate steps, Fabio determines whether “the instant of recognition of the current step $T_R(K)$ falls **within a validation interval TV.**” Ex. 1006, 4:35-37; 6:40-44 (“control unit 5 updates the total number of **valid steps** N_{VT} . . . incrementing them by one.”). In Figure 6 (below), Fabio shows a time-based representation of how its system validates whether a step occurred within a validation interval TV (i.e., a cadence window):



Ex. 1006, FIG. 6 (annotated); Ex. 1003, p. 61.

Fabio explains that each step is validated based on that step's appropriate cadence window in that the validation interval TV for each step is "defined with respect to the instant recognition of the immediately preceding step $T_R(K-1)$." Ex. 1006, 4:37-39. In other words, in Fabio, a step is validated "**when the duration ΔT_K of a current step K is substantially homogenous with respect to the duration of ΔT_{K-1} of an immediately preceding step $K-1$.**" *Id.*, 4:28-31. Thus, Fabio teaches identifying whether each step falls within an appropriate cadence window since the appropriate cadence window for each step (K) is defined as a window of time based on the immediately preceding step ($K-1$).

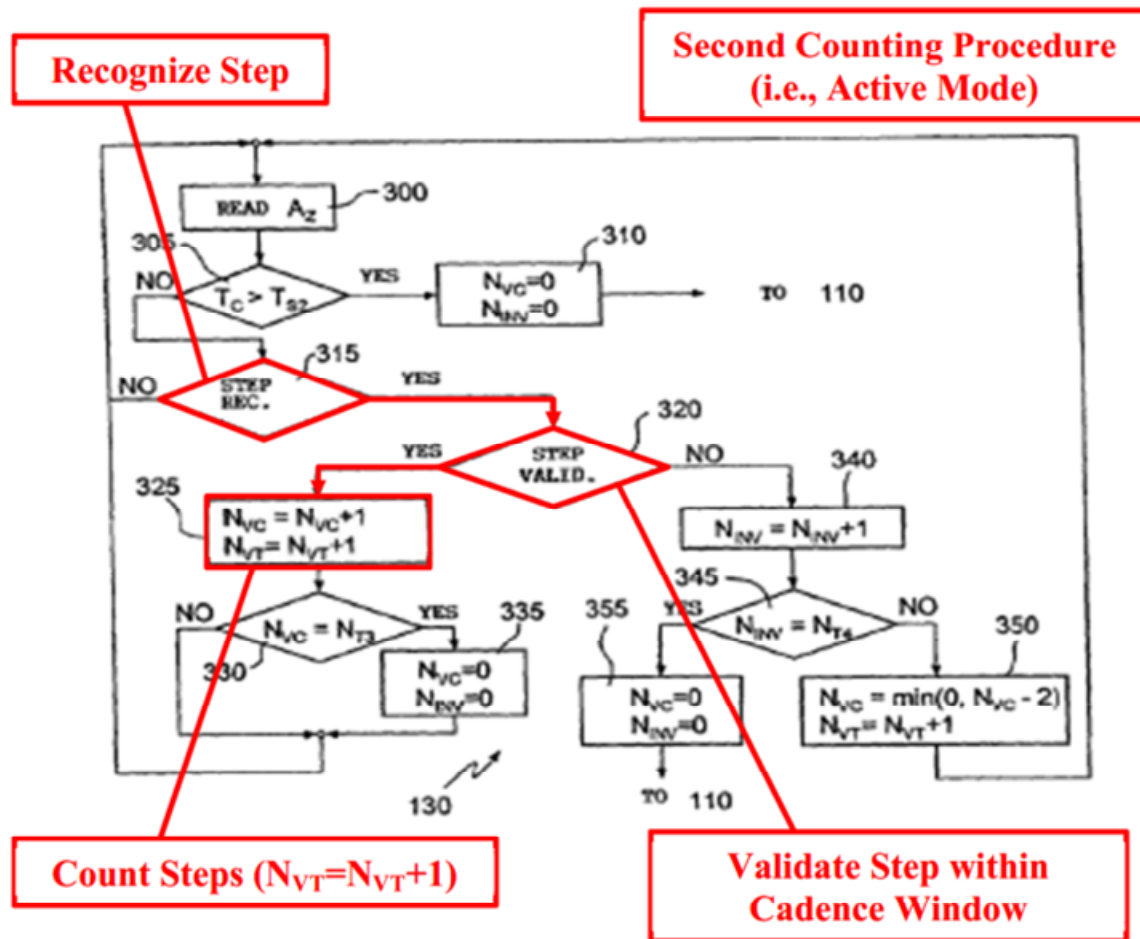
Fabio's teachings regarding its validation window are consistent with the '508 patent's descriptions of its cadence window. For example, the '508 patent describes that "[a] cadence window is a window of time since a last step was counted that is looked at to detect a new step." Ex. 1001, 3:67-4:3. Similarly, A POSITA would thus recognize that the '508 patent's "cadence window" and Fabio's "validation interval" are both defined with respect to the time that an immediately preceding step was recognized. Ex. 1003, pp. 61-62. Thus, a POSITA would understand that the "validation interval" in Fabio discloses the recited "cadence window." *Id.*, p. 62. Accordingly, Fabio's teaching of recognizing each step with its particular validation interval teaches "identifying a number of periodic human motions within appropriate cadence windows."

Thus, Fabio's switching from the first counting procedure 110 to the second counting procedure 130 after detecting a sequence of steps within validation intervals teaches "switching the device from the non-active mode to an active mode, after identifying a number of periodic human motions within appropriate cadence windows" as recited in the claim. *Id.*

[6.3] during the active mode, counting each of the periodic human motions to enable the monitoring of human activity.

Fabio discloses this limitation. *Id.* First, as described in section [6.2], the second counting procedure 130 in Fabio is an active mode where each step is counted as it is validated.

Second, Fabio teaches that while operating in the second counting procedure, each validated step (i.e., in a cadence window) is counted (i.e., added to the total step count). Specifically, Fabio teaches that "a first counter, hereinafter referred to **as total number of valid steps N_{VT} , is incremented whenever an event corresponding to a step is recognized.**" Ex. 1006, 3:37-49. In other words, "the control unit 5 **updates the total number of valid steps N_{VT}** " while in its active mode. *Id.*, 6:27-53. A flowchart in "FIG. 7 illustrates in detail the second counting procedure," and shows that each step is counted. Ex. 1005, 6:12-13.



Ex. 1006, Fig. 7 (annotated); Ex. 1003, p. 64.

Because the second counting procedure counts the valid steps (the periodic human motions), the second counting procedure monitors human activity when, for example, the user is running or walking. Ex. 1003, p. 65. In fact, Fabio teaches: “As is known, a pedometer is a device that can be carried by a user and has the function of counting the number of steps during various walking or running activities for estimating accordingly the distance traveled.” Ex. 1006, 1:14-21. Because walking and running are periodic human motions, detecting steps while

running and walking is monitoring periodic human motions. Ex. 1003, p. 65. Accordingly, a POSITA would have understood that when Pasolini's pedometer counts steps, it is monitoring human activity. *Id.*

Third, Fabio's device enables the monitoring of human activity because "**the function of counting the number of steps during various walking or running activities**" is, for example, "**for estimating accordingly the distance traveled.**" Ex. 1006, 1:14-17.

Thus, Fabio's pedometer that counts steps while in the second counting procedure teaches "during the active mode, counting each of the periodic human motions to enable the monitoring of human activity" as recited in the claim. Ex. 1003, p. 62.

2. Claim 7

[7.0-7.1] The method of claim 6, further comprising: switching the device from the active mode to the non-active mode when a number of expected periodic human motions are not identified in the appropriate cadence windows.

Fabio discloses this limitation because it teaches switching from the second counting procedure (i.e. an active mode) to the first counting procedure (i.e., a non-active mode) when an interruption in locomotion occurs. Ex. 1003, pp. 65-66.

As discussed, Fabio teaches an "active mode" in that its pedometer implements "a second counting procedure [that] is executed" when "the user is considered to be moving." Fabio, 3:37-44. Fabio also discloses a "non-active mode"

in that its pedometer “executes a first counting procedure” when “the user is considered at rest.” Ex. 1006, 3:19-27.

In Fabio, the device switches from the second counting procedure (i.e., the active mode) to the first counting procedure (i.e., the non-active mode) when an interrupt occurs: “[W]hen an **interruption in the locomotion is detected, the second counting procedure is terminated, and execution of the first counting procedure resumes** (block 110).” Ex. 1006, 3:37-49.

The interrupt in locomotion is determined when a certain number of steps (N_{INV}) are not identified within validation intervals. Specifically, if “the second validation test of block 320 is negative, **the number of invalid steps N_{INV} is incremented by one** (block 340).” *Id.*, 6:54-56. **“If the number of invalid steps N_{INV} has reached the fourth threshold number N_{T4} (output YES from block 345) . . . the second counting procedure is terminated.”** *Id.*, 7:1-6.

As a result, Fabio discloses switching from the active mode to the non-active mode because the second counting procedure (active mode) is terminated and execution of the first counting procedure (non-active mode) resumes. Ex. 1003, p. 69. This switch happens when steps are not detecting within validation intervals (cadence windows). *Id.*

Thus, Fabio’s switching the pedometer from the second counting mode to the first counting mode when a number of steps are not identified in the appropriate

validation intervals TV teaches “switching the device from the active mode to the non-active mode when a number of expected periodic human motions are not identified in the appropriate cadence windows.” *Id.*

3. Claim 8

[8.0-8.1] The method of claim 6, further comprising: switching from a sleep mode to the non-active mode of operation when an acceleration is detected.

Fabio discloses this limitation because it teaches a surveying procedure (i.e., a sleep mode) in which the pedometer is placed in a low-power state that includes a lower sampling rate. Ex. 1003, p. 70. More specifically, Fabio’s teaches that its surveying procedure is “**a low-consumption wait state (‘power down’ state).**” Ex. 1006, 3:51-52. In addition to the “wait state,” Fabio’s surveying procedure includes intermittently reactivating the pedometer at a reduced rate (e.g., every 10 seconds) to check for accelerations: “**A waiting cycle is then carried out (block 420), for example of the duration of 10 s,** after which all the functions of the pedometer 1 are re-activated (“power on”, block 430).” *Id.*, 7:43-45.

The ’508 patent similarly describes its sleep mode as executing “a low sampling rate” in order to “reduces power consumption and prolongs battery life.” Ex. 1001, 8:66-67. In the ’508 patent’s sleep mode, “the sampling function may be executed every ten seconds” *Id.*, 9:12-13. Thus, a POSITA would recognize that the surveying procedure in Fabio is a “sleep mode” because it similarly sample at a reduced rate.

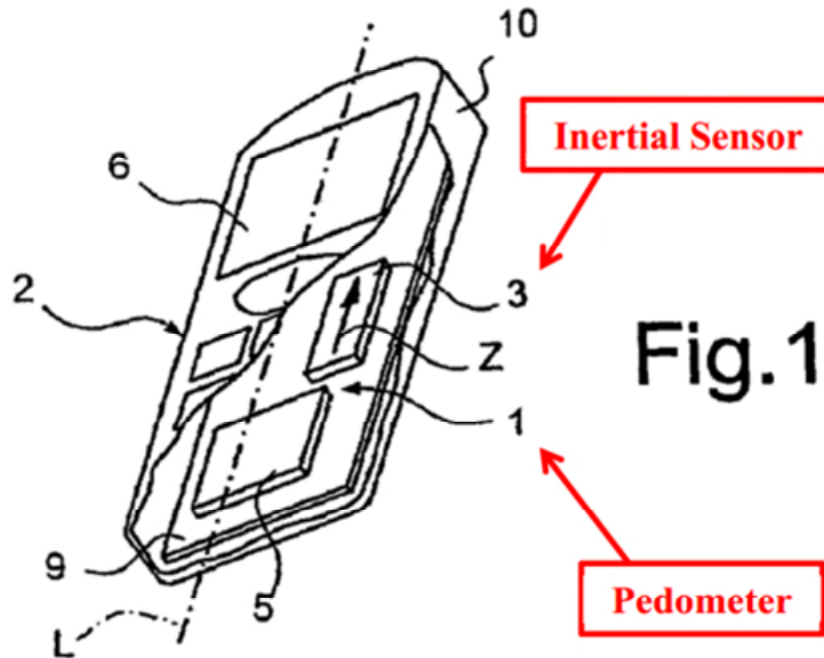
In Fabio, “[t]he **surveying procedure terminates** when a variation of the d.c. component of the acceleration signal A_Z is detected, i.e., when the cell phone 2 that includes the pedometer 1 is moved. **The control unit 5 then returns to execution of the first calculation procedure (block 110).**” Ex. 1006, 3:50-57. Accordingly, the surveying procedure (i.e., the sleep mode) terminates and then starts execution of the first counting procedure (i.e., the non-active mode) when a variation in acceleration (e.g., a variation in the d.c. component) is detected. Ex. 1003, p. 71-72.

Thus, Fabio’s terminating the surveying procedure and entering the first counting procedure when acceleration is detected teaches “switching from a sleep mode to the non-active mode of operation when an acceleration is detected.” *Id.*, p. 72.

4. *Claim 15*

[15.0] A device including an inertial sensor, comprising:

To the extent that the preamble is limiting, Fabio discloses it. *Id.* Fabio teaches a pedometer device that “generat[es] a signal correlated to movements of a user of the pedometer” and “**detect[s] steps of the user** based on the signal.” Ex. 1006, 1:62-2:3. To generate the signal, Fabio’s device includes “**an inertial sensor 3,**” such as an “accelerometer.” *Id.*, 2:34-52. Fabio’s pedometer, including an inertial sensor, is shown in Figure 1 (below):



Ex. 1006, FIG. 1 (annotated); Ex. 1003, p. 73.

Thus, Fabio’s pedometer with an inertial sensor teaches “[a] device including an inertial sensor” as recited in the claim. Ex. 1003, p. 73.

[15.1] a counting logic, to identify and count periodic human motions.

As discussed above in [6.1] and [6.2], Fabio discloses identifying and counting steps (i.e., periodic human motions) in both a non-active mode (where steps are buffered) and an active mode (where steps are added to the total step count). *Id.* In particular, as previously discussed, Fabio teaches “a pedometer device for detecting and counting steps of a user on foot,” where “an accelerometer sensor detects a vertical acceleration generated during the step.” Ex. 1006, Abstract.

As also discussed above in [6.1] and [6.2], Fabio teaches that the identifying and counting of steps is performed by a control unit (i.e., logic): “The control unit

5 receives and processes the acceleration signal A_Z as explained in detail hereinafter for **identifying and counting a total number of valid steps N_{VT} made by a user wearing or carrying the pedometer 1.**” Ex. 1006, 2:60-3:2.

Accordingly, a POSITA would have understood Fabio’s control unit 5 to execute machine readable instructions to perform various functions, such as detecting and counting steps. Ex. 1003, p. 74. Such hardware (control unit 5) and software (instructions that are executed by the control unit 5) would have been considered “logic” as used in the claim. *Id.*

The above analysis is applicable even if the Patent Owner overcomes the presumption against construction under 35 U.S.C. § 112, sixth paragraph. To the extent that the term “a counting logic” is interpreted to include the following example described in the ’508 patent: “measurement data is checked to determine whether an additional step is recognized (block 615). If an additional step is recognized, then it is added to the final or actual step count (block 620)” (Ex. 1001, 11:25-28); Fabio discloses this example. Ex. 1003, p. 74. In particular, Fabio teaches that its control unit performs step recognition in step 315 “based upon the detection of a positive peak of the acceleration signal A_Z followed by a negative peak” and that “the control unit 5 updates the total number of valid steps N_{VT} and the number of valid control steps N_{VC} , incrementing them by one.” *See* Ex. 1006, 6:23-26, 6:40-43. A POSITA would have thus recognized that detecting peaks in

the acceleration signal A_z is “measuring” the acceleration data in the signal. Ex. 1003, p. 74.

Thus, Fabio’s control unit that identifies and counts steps by detecting accelerations along a vertical axis showing a positive peak followed by a negative peak within a validation interval teaches “a counting logic, to identify and count periodic human motions” as recited in the claim. *Id.*

[15.2] a mode logic, to switch the device from a non-active mode to an active mode after a number of periodic human motions are detected within appropriate cadence windows by the counting logic; and

Fabio discloses this limitation. *Id.* First, as discussed in [6.2], Fabio teaches the pedometer switching from a non-active mode to an active mode after identifying a number of periodic human motions with appropriate cadence windows. Ex. 1003, pp. 74-75.

Second, Fabio teaches that its various functions are performed by a control unit 5. A POSITA would have understood that Fabio’s control unit would execute machine readable instructions to perform various functions, such as detecting and counting steps. *Id.*, p. 75. Such hardware (control unit 5) and software (instructions that are executed by the control unit 5) would have been considered “logic” as used in the claim. *Id.*

Thus, Fabio’s control unit 5 that switches from the first counting procedure 110 to the second counting procedure 130 after detecting a number of steps within

validation intervals teaches “a mode logic, to switch the device from a non-active mode to an active mode after a number of periodic human motions are detected within appropriate cadence windows by the counting logic” as recited in the claim.

Id.

The above analysis is applicable even if the Patent Owner overcomes the presumption against construction under 35 U.S.C. § 112, sixth paragraph. To the extent that the term “a mode logic” is interpreted to include the following example described in the ’508 patent: “When the number of steps in the buffered step count reaches N, the buffered steps are added to an actual or final step count, and a stepping mode is entered into (block 584)” (Ex. 1001, 10:67-11:3); Fabio discloses this example. Ex. 1003, p. 75. In particular, Fabio teaches that its control unit performs switches from the first to the second counting procedure after “a sequence of steps is recognized that satisfies the first condition of regularity” by incrementing “the total number of valid steps N . . . by a value equal to the second threshold number N (block 265)” and executing “the second counting procedure.” Ex. 1006, 5:32-39.

Thus, Fabio’s control unit that switches from a first counting procedure to a second counting procedure based on steps detecting within their appropriate cadence windows teaches “a mode logic, to switch the device from a non-active mode to an active mode after a number of periodic human motions are detected within

appropriate cadence windows by the counting logic” as recited in the claim. Ex. 1003, pp. 75-76.

[15.3] a buffer, to buffer periodic human motions when the device is in the non-active mode.

First, as discussed in [6.1], Fabio teaches running a pedometer in a non-active mode that buffers counted steps in an N_{VC} value until a threshold is reached, whereby the steps are then added to a total step count value N_{VT} . *Id.*, p. 76. Second, a POSITA would find it obvious that the N_{VC} value is a buffer since it is used to store a count of these detected motions while in a non-active mode. *Id.*

Accordingly, Fabio’s N_{VC} value that counts steps during a non-active mode but does not add them to the total step count until a threshold is reached teaches “a buffer, to buffer periodic human motions when the device is in the non-active mode” as recited in the claim. *Id.*

5. Claim 16

[16.0-16.1] The device of claim 15, wherein: the mode logic to switch the device from the active mode to the non-active mode when a number of expected periodic human motions are not identified in the appropriate cadence windows.

Fabio discloses this limitation. *Id.* First, as discussed in [7.1], Fabio teaches that its pedometer terminates a second counting procedure (i.e., an active mode) and returns to a first counting procedure (a non-active mode) when a number of recognized steps (i.e., periodic human motions) are not identified in the appropriate cadence windows. *Id.*

Second, Fabio teaches that the various functions of its pedometer are performed by a control unit 5. *See, e.g.*, Ex. 1006, 3:37-49. A POSITA would have understood that Fabio's control unit would execute machine readable instructions to perform various functions, such as detecting and counting steps. Ex. 1003, p. 76. Such hardware (control unit 5) and software (instructions that are executed by the control unit 5) would have been considered "logic" as used in the claim. *Id.*, pp. 76-77.

Thus, Fabio's control unit that terminates the second counting procedure (active mode) and returns to the first counting procedure (active mode) after not detecting steps within validation intervals teaches "the mode logic to switch the device from the active mode to the non-active mode when a number of expected periodic human motions are not identified in the appropriate cadence windows" as recited in the claim. *Id.*, p. 77.

The above analysis is applicable even if the Patent Owner overcomes the presumption against construction under 35 U.S.C. § 112, sixth paragraph. To the extent that the term "the mode logic" in this claim includes the following example described in the '508 patent: "If the cadence window has elapsed, then an expected step was not counted, and an exit mode is initiated (block 630)." (Ex. 1001, 10:67-11:3); Fabio discloses this example. Ex. 1003, p. 77. In particular, Fabio teaches that its control unit determines whether a "number of invalid steps N_{INV} has reached"

a threshold and terminates “the second counting procedure” to then return to the first counting procedure. Ex. 1006, 7:1-6, Fig. 3.

Thus, Fabio’s control unit that switches from a second counting procedure to a first counting procedure based on detecting a number of invalid steps (i.e., motions not within appropriate cadence windows) teaches “the mode logic to switch the device from the active mode to the non-active mode when a number of expected periodic human motions are not identified in the appropriate cadence windows” as recited in the claim. Ex. 1003, p. 77.

6. Claim 19

[19.0-19.1] The device of claim 15, further comprising: a cadence logic, to set the appropriate cadence windows.

Fabio discloses this limitation. *Id.*, p. 78. First, as discussed in [6.2], Fabio teaches determining appropriate cadence windows for each step because the validation interval TV (i.e., the cadence window) is “defined with respect to the instant recognition of the immediately preceding step $T_R(K-1)$.” Ex. 1006, 4:37-39. Second, Fabio discloses that the of setting the validation interval at each step is performed by its control unit (i.e., a cadence logic): “the control unit 5 executes a first validation test” that is performed as described in [6.2]. Ex. 1003, p. 78; *see also* Ex. 1006, 4:22-40. A POSITA would have understood that the hardware (control unit) and software (instructions executed by the control unit) are “logic” as used in the claim. Ex. 1003, p. 78.

The above analysis is applicable even if the Patent Owner overcomes the presumption against construction under 35 U.S.C. § 112, sixth paragraph. To the extent that the term “a cadence logic” is interpreted to include the following example described in the ’508 Patent: “a new cadence window is set (block 574) based on a stepping cadence of the M steps measured.” (Ex. 1001, 10:57-58); Fabio discloses this example. Ex. 1003, p. 78. In particular, Fabio describes that its formula for defining the validation interval (i.e., the cadence window) is based on both the “duration ΔT_{K-1} of an immediately preceding step K-1” as well as “the instant of recognition of the immediately preceding step $T_R(K-1)$.” Ex. 1006, 4:28-41. A POSITA reading this formula would have thus understood that Fabio’s validation interval (i.e., that cadence window) is similarly based on the cadence of measured steps. Ex. 1003, p. 78.

Thus, Fabio’s control unit 5 that defines the validation interval TV for each step based on timing and duration of previous steps teaches “a cadence logic, to set the appropriate cadence windows.” *Id.*

F. Challenge #3: Claims 3-4, 13-14, and 20 are unpatentable under 35 U.S.C. § 103 over Pasolini in view of Fabio.

1. Reasons to Combine Pasolini and Fabio

As described above, Pasolini discloses a pedometer device with various features. Specifically, Pasolini’s pedometer regularly determines which axis is most

aligned with gravity as the device rotates. Pasolini's pedometer uses that axis to count steps. Pasolini's pedometer further has adapting thresholds for step detection.

Also, as described above, Fabio describes a pedometer device with various features. Specifically, Fabio's pedometer uses different counting modes to more accurately detect and count steps. Fabio's pedometer has other features that are similar to those of Pasolini. For example, Fabio's device also detects which axis of three axes is most aligned with gravity and uses that axis for step detection. *See* Ex. 1006, 8:21-34.

It would have been obvious for a POSITA to combine Pasolini and Fabio because, as described below, the combination is merely a use of a known technique to improve a similar device, method, or product in the same way. Ex. 1003, p. 79.

A POSITA would have recognized that Pasolini and Fabio describe similar pedometer devices. *Id.* For example, the pedometers described in Pasolini and Fabio are both implemented in portable electronic devices, such as mobile phones, and include similar components for step detection, such as accelerometers with multiple axes of detection. *Id.*, pp. 76-77. Pasolini and Fabio are in the same field of endeavor as both patents describe the problem that errors in step recognition cause for step counting, and are directed to solving this problem. *Id.*, p. 77. Both Pasolini and Fabio teach addressing the problem, at least in part, by selecting the acceleration signal from the vertical detection axis (the axis that is most influenced by gravity)

and sampling the acceleration signal to recognize steps by identifying positive and negative acceleration peaks. *Id.*

A POSITA would have recognized that as Pasolini's device is counting steps, it only counts those acceleration peaks that exceed a threshold, not all detected accelerations. For example, as the user stops moving and then later continues moving, or makes other non-periodic motions, the accelerometer will detect peaks that do not correspond to steps taken by the user. *Id.* A POSITA would have understood that in order to identify acceleration peaks as steps, a pattern of regularity should be determined. *Id.*

Fabio explicitly addresses this problem by describing a first counting procedure that "enables the pedometer 1 to remain waiting for a sequence of events corresponding to a sequence of steps that satisfies the first condition of regularity." *Id.*; Ex. 1006, 5:40-44. A POSITA would have recognized that by implementing the techniques associated with Fabio's regularity test, "[i]solated events and sequence of steps that are in any case too short are thus advantageously ignored, whereas counting of the steps promptly resumes also in the case of isolated irregularities (for example, due to a non-homogeneous acceleration or to a loss of balance at the start of locomotion)." Ex. 1003, p. 79; Ex. 1006, 5:56-61.

Combining Fabio's technique for using a regularity test to validate steps into Pasolini's pedometer would have been a relatively simple and obvious solution to

enhance Pasolini's pedometer so that it does not count all acceleration peaks as steps. Ex. 1003, p. 81. A POSITA would have applied Fabio's technique to Pasolini with the predictable result being that Pasolini's device would more accurately count steps. *Id.* This advantage would have been readily recognized by a POSITA. *Id.* Moreover, Fabio states that "the control procedure described can be used to advantage in a stand-alone pedometer or in any case one integrated in a further portable device." Ex. 1006, 8:7-9.

The combination of Pasolini and Fabio would therefore provide improvements to Pasolini's pedometer by providing improved step recognition, which would result in a more accurate step count. Ex. 1003, p. 81. Thus, it would have been obvious to combine Pasolini and Fabio as the combination is merely the use of Fabio's known step counting technique to improve Pasolini's similar device in the same way. *Id.*

The following analysis describes how Pasolini in view of Fabio renders obvious each and every element of at least claims 3-4, 13-14, and 20 of the '508 patent. A corresponding claim chart is contained in Dr. Paradiso's expert declaration. *See Id.*, pp. 82-95.

2. *Claim 3*

[3.0-3.1] The method of claim 1, further comprising: maintaining a cadence window, wherein the cadence window is continuously updated as an actual cadence changes;

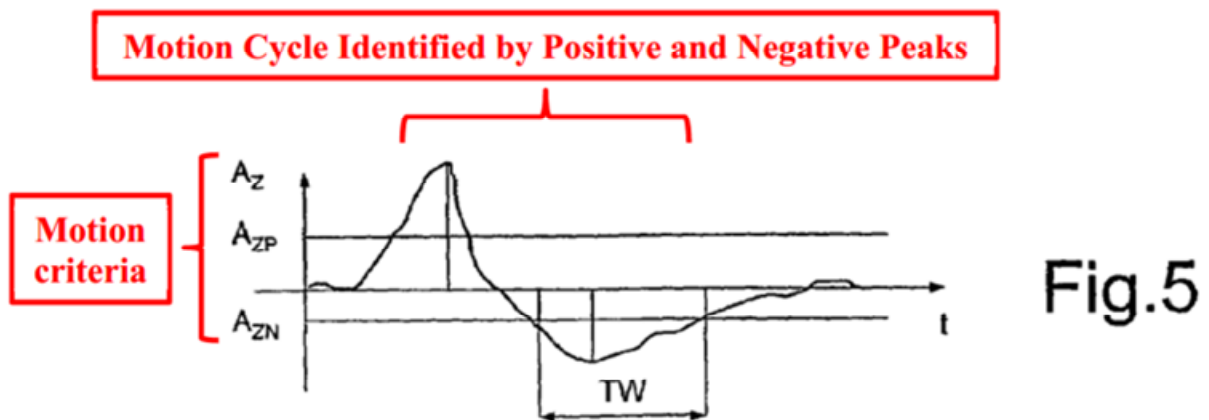
Fabio discloses this limitation. As discussed above in [6.2], Fabio teaches that its validation interval TV is an appropriate cadence window because it is continuously updated for each step as a user's actual cadence changes. Ex. 1003, p. 82. More specifically, Fabio teaches that "the last step recognized is validated if the instant of recognition of the current step $T_R(K)$ falls within **a validation interval TV.**" Ex. 1006, 4:24-37. The validation interval TV is "**defined with respect to the instant of recognition of the immediately preceding step $T_R(K-1)$.**" *Id.*, 4:37-39. Because the validation interval TV is based on the immediately preceding step, the validation interval TV is updates continuously as the user's actual cadence changes. Ex. 1003, p. 83. Second, because Fabio's validation interval TV is updated at each step, a POSITA would have understood that the validation interval is maintained at each step. *Id.*

As described above, a POSITA would have been motivated to combine the teachings of Fabio with those of Pasolini to improve Pasolini's pedometer with the step validating procedures of Fabio's similar pedometer in order to improve step counting accuracy. *Id.* Thus, Pasolini's device as modified to include Fabio's validation interval for a particular step, which is based in part on the validation

interval for preceding steps, teaches “maintaining a cadence window, wherein the cadence window is continuously updated as an actual cadence changes” as recited in the claim. *Id.*, pp. 83-84.

[3.2] counting a periodic human motion when an acceleration measurement that meets motion criteria is within the cadence window.

Fabio discloses this limitation. In particular, Fabio teaches that its device recognizes and counts a step (i.e., a periodic human motion) “if the acceleration signal A_Z shows a positive peak, higher than a positive acceleration threshold A_{ZP} , followed by a negative peak, smaller than a negative acceleration threshold A_{ZN} .” Ex. 1006, 4:12-21. A POSITA would have recognized that detecting positive and negative peaks in the acceleration signal A_Z is “measuring” whether the accelerations meet a motion criteria. Ex. 1003, p. 85. This is shown below in Fabio’s Figure 5:



Ex. 1006, FIG. 5 (annotated); Ex. 1003, p. 85.

A POSITA would have understood that the above acceleration measurement “is taken within the cadence window” because Fabio describes that “the last step is validated if the instant of recognition of the current step $T_R(K)$ falls within a validation interval TV .” Ex. 1006, 4:35-37. A POSITA would have understood that “the instant of recognition” that “falls within a validation interval TV ” refers to performing the measurements on peak accelerations taken within the validation interval. Ex. 1003, pp. 85-86.

Thus, Fabio’s device that recognizes and counts steps when an acceleration measurement showing a positive peak followed by a negative peak is taken within the validation interval teaches “counting a periodic human motion when an acceleration measurement that meets motion criteria is within the cadence window.” *Id.*, p. 87.

3. *Claim 4*

[4.0-4.1] The method of claim 3, wherein at least one of the motion criteria is a dynamic motion criterion, the dynamic motion criterion being continuously updated to reflect current conditions.

The combination of Fabio and Pasolini renders this limitation obvious. *Id.* First, as described above in [3.2], Fabio teaches using a “motion criteria” for step recognition in that “a step is recognized if the acceleration signal A_Z shows a positive peak, higher than a positive acceleration threshold A_{ZP} , followed by a negative

peak, **smaller than a negative acceleration threshold A_{ZN} .**” Ex. 1006, 4:16-21, 6:21-26.

Pasolini teaches a similar method to recognize a step by “compar[ing] the value of the acceleration signal A (with the d.c. component filtered out) 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.” Ex. 1005, 3:36-41.

Second, Pasolini teaches that the positive and negative reference thresholds that make up the motion criteria are dynamic because they are calculated on-the-fly to be self-adaptive for the user. *Id.*, 3:30-54 (“**[T]he values of the positive and negative reference thresholds S^+ , S^- are not fixed and equal to a given pre-set value, but are calculated in a self-adaptive way** (i.e., in a way that adapts without any external intervention from a user).”). The reference thresholds are also updated as each step occurs:

[T]he values of the **positive and negative reference thresholds S^+ , S^- are modified at each acquisition of a new sample of the acceleration signal A**, as a function of the value of a positive and negative amplitude envelope of the acceleration signal, in such a manner that the reference thresholds vary with time approximately following said envelopes. The pedometer device 1 thus **adapts to variations in the detection conditions** (and, in particular, to different profiles of the acceleration

signal, in terms of amplitude and duration), due, for example, to a different type of terrain, or to an increase in the speed of the gait.

Id., 3:48-59. Since the positive and negative reference *thresholds* for recognizing a step are modified as each step occurs, the motion criteria defined by the positive and negative thresholds is a dynamic motion criteria. Ex. 1003, p. 89.

Third, the dynamic motion criterion are updated so that “pedometer device 1 thus **adapts to variations in the detection conditions** (and, in particular, to different profiles of the acceleration signal, in terms of amplitude and duration), due, for example, to a different type of terrain, or to an increase in the speed of the gait.” Ex. 1005, 3:54-59.

Thus, Fabio and Pasolini’s positive and negative peak reference thresholds that update as each step occurs to adapt to variations in the terrain or speed of the gait renders obvious “wherein at least one of the motion criteria is a dynamic motion criterion, the dynamic motion criterion updated to reflect current conditions.” Ex. 1003, p. 91.

4. *Claim 13*

[13.0-13.1] The device of claim 11, further comprising: a cadence logic to continuously update a dynamic cadence window; and

The combination of Pasolini and Fabio renders this limitation obvious. *Id.* Fabio teaches this limitation because (1) as discussed in [19.0-19.1], Fabio teaches a cadence logic that sets the appropriate cadence window for each step based on the

previous step; and (2) as discussed in [3.1], the validation interval TV (i.e., the cadence window) for each new step is continuously updated based on the timing and duration of the immediately preceding step. *Id.* Because the validation interval for each step is updated based on the timing and duration of the immediately preceding step, a POSITA would have understood that the validation interval (i.e., the cadence window) is continuously updated upon each step, and is therefore dynamic. *Id.*, p. 92.

Thus, the combination of Pasolini's cadence logic implementing Fabio's validation interval that updated continuously upon each new step teaches "a cadence logic to continuously update a dynamic cadence window" as recited in the claim. *Id.* ***[13.2] the counting logic to count a periodic human motion when an acceleration measurement that meets motion criteria is taken within the cadence window.***

Fabio discloses this limitation. *Id.* First, as described in [11.2], Fabio teaches "a counting logic." Second, as discussed in [3.2], Fabio teaches counting steps (i.e., periodic human motions) when acceleration measurements meet motion criteria (i.e., positive and negative peak thresholds) that fall within a validation interval (i.e., a cadence window).

Thus, Fabio's control unit that counts steps when an acceleration measurement showing a positive peak followed by a negative peak is taken within the validation interval teaches "the counting logic to count a periodic human motion

when an acceleration measurement that meets motion criteria is taken within the cadence window” as recited in the claim.

5. *Claim 14*

[14.0- 14.1] The device of claim 11, further comprising: a comparator, to compare measurements of acceleration to dynamic motion criteria, the dynamic motion criteria updated to reflect current conditions; and

The combination of Fabio and Pasolini renders this limitation obvious. *Id.*, p. 92-94. First, Pasolini teaches comparing the acceleration signal (i.e., measurements of acceleration) to motion criteria consisting of positive and negative peak thresholds: “**the processing unit 3 compares the value of the acceleration signal A** (with the d.c. component filtered out) **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.” Ex. 1005, 3:36-41. This is similarly disclosed in Fabio as discussed above in [3.2].

As also discussed above in [4.1] Pasolini discloses that its positive and negative reference thresholds that make up a motion cycle are dynamic because they “**are modified at each acquisition of a new sample of the acceleration signal A.**” *Id.*, 3:48-51. Based on these disclosures, a POSITA would thus recognize that to detect a step, Pasolini teaches comparing the acceleration signal to motion criteria that dynamically updates as each new step is detected. Ex. 1003, p. 93. Because the

motion criteria is dynamically updated for each step, it is updated to reflect current conditions. *Id.*

Second, a POSITA would have understood that Pasolini's "processing unit 3" for performing the above comparison is "a comparator" because it performs comparisons. *Id.* A POSITA would have understood that Pasolini's comparator would execute machine readable instructions to compare the measurements. *Id.* Such hardware (processing unit 3) and software (instructions that are executed by the processing unit 3) would have been considered "a comparator" as used in the claim. *Id.*, pp. 93-94.

Thus, Fabio and Pasolini's positive and negative reference thresholds, in view of Pasolini's processing unit that compares measurements of acceleration to the reference thresholds that are updated for each step, renders obvious "a comparator, to compare measurements of acceleration to dynamic motion criteria, the dynamic motion criteria updated to reflect current conditions." *Id.*, p. 94.

[14.2] the counting logic to count a periodic human motion when the measurements of acceleration satisfy the dynamic motion criteria.

Fabio in view of Pasolini renders this limitation because (1) Fabio teaches "the counting logic to count a periodic human motion when an acceleration measurement that meets motion criteria is taken" as discussed in [13.2]; and (2) Pasolini teaches for the acceleration measurements to satisfy "dynamic motion criteria" as discussed in section [14.1]. *Id.*

Thus, Fabio's control unit that counts steps when an acceleration measurement showing a positive peak followed by a negative peak is taken, in view of Pasolini's identifying the peaks using adaptive reference thresholds, renders obvious "the counting logic to count a periodic human motion when the measurements of acceleration satisfy the dynamic motion criteria." *Id.*

6. Claim 20

[20.0-20.1] The device of claim 19, wherein the cadence logic adjusts the cadence windows based on a measured cadence associated with the periodic human motion.

The combination of Pasolini and Fabio renders this limitation obvious. *Id.*, p. 94. Fabio teaches this limitation because (1) as discussed in [19.0-19.1], Fabio teaches a cadence logic that sets the appropriate cadence window for each step based on the previous step; and (2) as discussed in [3.1], the validation interval TV (i.e., the cadence window) for each new step is continuously updated based on the timing and duration of the immediately preceding step. *Id.*, pp. 94-95. Because the validation interval for each step is updated based on the timing and duration of the immediately preceding step, a POSITA would have understood that the validation interval (i.e., the cadence window) is adjusted based on a measured cadence associated with the periodic human motion. *Id.*, p. 95.

Thus, the combination of Pasolini's cadence logic implementing Fabio's validation interval that updated continuously upon each new step teaches a "cadence

logic adjust[ing] the cadence windows based on a measured cadence associated with the periodic human motion” as recited in the claim. *Id.*

X. CONCLUSION

For the reasons set forth above, Petitioner has established a reasonable likelihood that claims 1-4, 6-8, 11-16, 19, and 20 of the '508 patent are unpatentable. Petitioner thus requests institution of an *inter partes* review and cancellation of claims 1-4, 6-8, 11-16, 19, and 20.

Respectfully submitted,

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CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. §42.24(d), Petitioner hereby certifies, in accordance with and reliance on the word count provided by the word-processing system used to prepare this petition, that the number of words in this paper is 13,760. Pursuant to 37 C.F.R. §42.24(d), this word count excludes the table of contents, table of authorities, mandatory notices under §42.8, certificate of service, certificate of word count, appendix of exhibits, and any claim listing.

Dated: August 23, 2018

/Todd E. Landis/

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Lead Counsel for Petitioner
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CERTIFICATE OF SERVICE

The undersigned certifies that, in accordance with 37 C.F.R. § 42.6(e) and 37 C.F.R. § 42.105, Petition for *Inter Partes* Review of U.S. Patent No. 7,653,508; Exhibits 1001 through 1006; and Petitioner's, HTC Corporation and HTC America, Inc., Power of Attorney are being served via overnight mail on the 23rd day of August 2018, the same day as the filing of the above-identified documents in the United States Patent and Trademark Office/Patent Trial and Appeal Board, upon the Patent Owner by serving the correspondence address of record with the USPTO as follows:

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