AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court WESTERN DISTRICT OF TEXAS, WACO DIVISION on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
6:20-CV-1112	12/7/2020	WESTERN DISTRICT OF TEXAS, WACO DIVISION

PLAINTIFF	DEFENDANT
AliveCor, Inc.	Apple Inc.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	10,595,731	3/24/2020	AliveCor, Inc.
2	10,638,941	5/5/2020	AliveCor, Inc.
3	9,572,499	2/21/2017	AliveCor, Inc.
4			
5			

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

APPLE 1002

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/588,201	03/24/2020	10595731	A102992 1170US.C4	3448

151512 7590 03/04/2020

WOMBLE BOND DICKINSON (US) LLP/AliveCor
Attn: IP DOCKETING
P.O. BOX 7037
ATLANTA, GA 30357-0037

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Ravi GOPALAKRISHNAN, San Francisco, CA;
AliveCor, Inc., Mountain View, CA;
Lev KORZINOV, San Francisco, CA;
Fei WANG, San Francisco, CA;
Euan THOMSON, Los Gatos, CA;
Nupur SRIVASTAVA, San Francisco, CA;
Omar DAWOOD, San Francisco, CA;
Iman ABUZEID, San Francisco, CA;
David E. Albert, Oklahoma City, OK;

IR103 (Rev. 10/09)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/588,201	09/30/2019	Ravi GOPALAKRISHNAN	A102992 1170US.C4

CONFIRMATION NO. 3448

151512
WOMBLE BOND DICKINSON (US) LLP/AliveCor
Attn: IP DOCKETING
P.O. BOX 7037
ATLANTA, GA 30357-0037

POA ACCEPTANCE LETTER

OC000000114653625

Date Mailed: 02/12/2020

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/10/2020.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/yteferra/

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	**16/588,201**
Inventors	:	**Ravi GOPALAKRISHNAN et al.**
Filed	:	**September 30, 2019**
Title	:	**METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING**
Confirmation No	:	**3448**
Examiner	:	**Johnson, Nicole F.**
Docket No.	:	**A102992 1170US.C4**
Customer No.	:	**151512**

RESPONSE TO INFORMATIONAL NOTICE TO APPLICANT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Informational Notice to Applicant mailed October 18, 2019 and Notice Requiring Inventor's Oath or Declaration mailed February 3, 2020, Applicant submits herewith the following:

(X) Declarations from Ravi GOPALAKRISHNAN, Lev KORZINOV, Fei WANG, Euan THOMSON, Nupar SRIVASTAVA, Omar DAWOOD, Iman ABUZEID, and David E. ALBERT

No fees are believed to be required. If any fees are deemed to be required, the Commissioner is hereby authorized to charge such additional fees or credit any overpayment to Deposit Account No. 09-0528.

Date: February 10, 2020

Respectfully submitted,

/Daniel Ovanezian/
Daniel E. Ovanezian
Reg. No. 41,236
Attorney for Applicant

Womble Bond Dickinson (US) LLP
1841 Page Mill Road, Suite 200
Palo Alto, CA 94304
408-341-3040 (Telephone)

DECLARATION (37 CFR 1.63) AND ASSIGNMENT FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

This declaration and assignment is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 16/588,201 filed on September 30, 2019 .

DECLARATION

As a below named inventor, I hereby declare that:

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

ASSIGNMENT

For good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, I, the undersigned, hereby sell, assign, and transfer to AliveCor, Inc.

a corporation of Delaware ,

(Type of Assignee: e.g., corporation, company, partnership, university, etc.),

having a principal place of business at 444 Castro St., Ste 600, Mountain View, CA 94041,

("Assignee"), and its successors, assigns, and legal representatives, the entire right, title, and interest for the United States and all foreign countries, in and to any and all inventions or improvements that are disclosed in the above identified application and in and to said application (provisional or non-provisional) and all provisional applications, non-provisional applications, utility applications, design applications, divisional applications, continuation applications, continued prosecution applications, continuation-in-part applications, substitute applications, renewal applications, reissue applications, reexaminations, extensions, and all other patent applications that have been or shall be filed in the United States

and all foreign countries on any of said inventions or improvements; and in and to all original patents, reissued patents, reexamination certificates, and extensions, that have been or shall be issued in the United States and all foreign countries on said inventions or improvements; and in and to all rights of priority resulting from the filing of said application;

agree that said Assignee may apply for and receive a patent or patents for said inventions or improvements in its own name; and that, when requested, without charge to, but at the expense of, said Assignee, its successors, assigns, and legal representatives, to carry out in good faith the intent and purpose of this Assignment, the undersigned will execute all provisional applications, non-provisional applications, utility applications, design applications, divisional applications, continuation applications, continued prosecution applications, continuation-in-part applications, substitute applications, renewal applications, reissue applications, reexaminations, extensions, and all other patent applications on any and all said inventions or improvements; execute all rightful oaths, assignments, powers of attorney, and other papers; communicate to said Assignee, its successors, assigns, and representatives all facts known to the undersigned relating to said inventions or improvements and the history thereof; and generally assist said Assignee, its successors, assigns, or representatives in securing and maintaining proper patent protection for said inventions or improvements and for vesting title to said inventions or improvements, and all applications for patents and all patents on said inventions or improvements, in said Assignee, its successors, assigns, and legal representatives; and

covenant with said Assignee, its successors, assigns, and legal representatives that no assignment, grant, mortgage, license, or other agreement affecting the rights and property herein conveyed has been made to others by the undersigned, and that full right to convey the same as herein expressed is possessed by the undersigned.

LEGAL NAME OF INVENTOR

Inventor: Omar Dawood Date: February 7, 2020

Signature: 

PTO/AIA/01 (06-12)
Approved for use through 01/31/2013. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

As the below named inventor, I hereby declare that:

This declaration is directed to:
- ☐ The attached application, or
- ☒ United States application or PCT international application number 14/569,513 filed on December 12, 2014

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Ravi GOPALAKRISHNAN Date (Optional): _____

Signature: _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

PTO/AIA/01 (06-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

As the below named inventor, I hereby declare that:

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☐ The attached application, or

☒ United States application or PCT international application number 14/569,513 filed on December 12, 2014

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LEGAL NAME OF INVENTOR

Inventor: Lev KORZINOV Date (Optional): 12/31/2015

Signature:

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

PTO/AIA/01 (06-12)
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

As the below named inventor, I hereby declare that:

This declaration is directed to:

- ☐ The attached application, or
- ☒ United States application or PCT international application number 14/589,513 filed on December 12, 2014.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

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LEGAL NAME OF INVENTOR

Inventor: Fei WANG Date (Optional):

Signature:

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

PTO/AIA/01 (06-12)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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Title of Invention	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

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LEGAL NAME OF INVENTOR

Inventor: Evan THOMSON Date (Optional): _____

Signature: _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

PTO/AIA/01 (05-13)
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LEGAL NAME OF INVENTOR

Inventor: Nupur SRIVASTAVA Date (Optional): _____

Signature: _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

PTO/AIA/01 (06-12)
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

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LEGAL NAME OF INVENTOR

Inventor: Iman ABUZEID Date (Optional): August 11, 2015

Signature: [signature]

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

PTO/SB/01 (08-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

As the below named inventor, I hereby declare that:

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☒ United States application or PCT international application number 14/569,513 filed on December 12, 2014

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

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LEGAL NAME OF INVENTOR:

Inventor: David E. ALBERT Date (Optional): 6/8/2015

Signature: David Albert

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/SB/01 form for each additional inventor.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: ALIVECOR, INC.

Application No./Patent No.: 16/588,201 Filed/Issue Date: September 30, 2019

Titled: METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

ALIVECOR, INC., a corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 041444, Frame 0863, or for which a copy thereof is attached.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Daniel Ovanezian/	February 10, 2020
Signature	Date
Daniel E. Ovanezian	41,236
Printed or Typed Name	Title or Registration Number

[Page 2 of 2]

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PTO/AIA/80 (07-17)
Approved for use through 01/31/2018. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

[X] Practitioners associated with Customer Number: 151512

OR

[ ] Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number

Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

[X] The address associated with Customer Number: 151512

OR

[ ]

Firm or individual name		
Address		
City	State	Zip
Country		
Telephone	Email	

Assignee name and address: AliveCor, Inc.
444 Castro Street, Suite 600
Mountain View, CA 94041

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee.

Signature Brian Clarke	Date 10/18/2017
Name Brian Clarke	Telephone
Title General Counsel	

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 18 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

151512 7590 02/03/2020
WOMBLE BOND DICKINSON (US) LLP/AliveCor
Attn: IP DOCKETING
P.O. BOX 7037
ATLANTA, GA 30357-0037

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/588,201	09/30/2019	Ravi GOPALAKRISHNAN	A102992 1170US.C4	3448

TITLE OF INVENTION: METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	05/04/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
JOHNSON, NICOLE F	3792	600-483000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Womble Bond Dickinson (US) LLP
2 Daniel E. Ovanezian
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE	(B) RESIDENCE: (CITY and STATE OR COUNTRY)
AliveCor, Inc.	Mountain View, CA

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 090528

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Daniel Ovanezian/ Date February 10, 2020

Typed or printed name Daniel E. Ovanezian Registration No. 41,236

Electronic Patent Application Fee Transmittal

Application Number:	16588201
Filing Date:	30-Sep-2019
Title of Invention:	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING
First Named Inventor/Applicant Name:	Ravi GOPALAKRISHNAN
Filer:	Daniel E. Ovanezian/Aaron Dunn
Attorney Docket Number:	A102992 1170US.C4

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1000	1000

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1000**

Electronic Acknowledgement Receipt	
EFS ID:	38538254
Application Number:	16588201
International Application Number:	
Confirmation Number:	3448
Title of Invention:	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING
First Named Inventor/Applicant Name:	Ravi GOPALAKRISHNAN
Customer Number:	151512
Filer:	Daniel E. Ovanezian/Aaron Dunn
Filer Authorized By:	Daniel E. Ovanezian
Attorney Docket Number:	A102992 1170US.C4
Receipt Date:	10-FEB-2020
Filing Date:	30-SEP-2019
Time Stamp:	13:59:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1000
RAM confirmation Number	E202020E00076951
Deposit Account	090528
Authorized User	Aaron Dunn
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Response to Pre-Exam Formalities Notice	A102992_1170USC4_Resp_Inf_Notice.pdf	98585 6184570941add57f7d4051d18e051b3bcb2efde8	no	1
Warnings:					
Information:					
2	Oath or Declaration filed	A102992_1170USC4_Dec_Dawood.pdf	129273 7c787ee57046a500e59a74dfc4ba64e906e29eb1	no	2
Warnings:					
Information:					
3	Oath or Declaration filed	A102992_1170USC4_Decs.pdf	1781688 f4777af391862f324b021a1faa034ea98abea7e6	no	7
Warnings:					
Information:					
4	Assignee showing of ownership per 37 CFR 3.73	A102992_1170USC4_373_Statement.pdf	129842 bfd3ad9ef4476bb8d8491d8d4802abb02f250dfd	no	3
Warnings:					
Information:					
5	Power of Attorney	Alive_POA.pdf	162218 7d6406dca0fe26f38cd96de77969e2ae320349b3	no	2
Warnings:					
Information:					
6	Issue Fee Payment (PTO-85B)	A102992_1170USC4_Issue_Fee.pdf	210515 b9705ff88dc4bcd4fff46005ce73376257c6e57d	no	1
Warnings:					
Information:					

7	Fee Worksheet (SB06)	fee-info.pdf	30321 6a3653ba5b76f7d1919a022bac5418383549554a	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	2542442	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

151512 7590 02/03/2020

WOMBLE BOND DICKINSON (US) LLP/AliveCor
Attn: IP DOCKETING
P.O. BOX 7037
ATLANTA, GA 30357-0037

EXAMINER	
JOHNSON, NICOLE F	
ART UNIT	PAPER NUMBER
3792	

DATE MAILED: 02/03/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/588,201	09/30/2019	Ravi GOPALAKRISHNAN	A102992 1170US.C4	3448

TITLE OF INVENTION: METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	05/04/2020

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

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Commissioner for Patents
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CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

151512 7590 02/03/2020
WOMBLE BOND DICKINSON (US) LLP/AliveCor
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ATLANTA, GA 30357-0037

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Certificate of Mailing or Transmission

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(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/588,201	09/30/2019	Ravi GOPALAKRISHNAN	A102992 1170US.C4	3448

TITLE OF INVENTION: METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	05/04/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
JOHNSON, NICOLE F	3792	600-483000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required) ❑Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/588,201	09/30/2019	Ravi GOPALAKRISHNAN	A102992 1170US.C4	3448

151512 7590 02/03/2020

WOMBLE BOND DICKINSON (US) LLP/AliveCor
Attn: IP DOCKETING
P.O. BOX 7037
ATLANTA, GA 30357-0037

EXAMINER	
JOHNSON, NICOLE F	
ART UNIT	**PAPER NUMBER**
3792	

DATE MAILED: 02/03/2020

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Notice Requiring Inventor's Oath or Declaration	Application No. 16/588,201	Applicant(s) Ravi GOPALAKRISHNAN	
	Examiner JOHNSON, NICOLE F	Art Unit 3792	

This notice is an attachment to the Notice of Allowability (PTOL-37), or the Notice of Allowability For A Design Application (PTOL-37D).

An inventor's oath or declaration in compliance with 37 CFR 1.63 or 1.64 executed by or with respect to each inventor has not yet been submitted.

An oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each inventor (for any inventor for which a compliant oath, declaration, or substitute statement has not yet been submitted) MUST be filed no later than the date on which the issue fee is paid. See 35 U.S.C. 115(f). Failure to timely comply will result in ABANDONMENT of this application.

A properly executed inventor's oath to declaration has not been received for the following inventor(s):

If applicant previously filed one or more oaths, declarations, or substitute statements, applicant may have received an informational notice regarding deficiencies therein.

The following deficiencies are noted:

INFORMAL ACTION PROBLEMS

- A properly executed inventor's oath or declaration has not been received for the following inventor(s): **Ravi GOPALAKRISHNAN**, **Lev KORZINOV**, **Fei WANG**, **Euan THOMSON**, **Nupur SRIVASTAVA**, **Omar DAWOOD**, **Iman ABUZEID**, and **David E. Albert**.
  Applicant may submit the inventor's oath or declaration at any time before the Notice of Allowance and Fee(s) Due, PTOL-85, is mailed.

Questions relating to this Notice should be directed to the Application Assistance Unit at 571-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/588,201	Applicant(s) GOPALAKRISHNAN et al.	
	Examiner NICOLE F JOHNSON	Art Unit 3792	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to the arguments submitted on January 8, 2012.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-30 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/NICOLE F LAVERT/
Primary Examiner, Art Unit 3792

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

THE EXAMINER'S STATEMENT OF REASONS FOR ALLOWABILITY

The following is a statement of reasons for the indication of allowable subject matter: The closest prior art, Levitan (as cited by 14/730122), fails to disclose, suggest and/or teach the claimed invention having a smart watch and a method of determining a presence of an arrhythmia of a first comprising a means of sensing an activity level of said first user with a motion sensor and comparing a heart rate variability of said first user to said activity level, in combination with the other claimed elements.

Allowable Subject Matter

Claims 1-30 are allowed.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NICOLE F JOHNSON whose telephone number is (571)270-5040. The examiner can normally be reached on **Mon-Thu 7:30am-4:30 pm**.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Christopher Koharski** can be reached on **571-272-7230**. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see https://ppair-my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NICOLE F LAVERT/
Primary Examiner, Art Unit 3792

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/588,201	GOPALAKRISHNAN et al.
	Examiner	Art Unit
	NICOLE F JOHNSON	3792

CPC - Searched*		
Symbol	**Date**	**Examiner**

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**
A61B5/00405	11/21/2019	NFJ
ABOVE UPDATED	01/19/2020	NFJ

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**
600	508-509	11/21/2019	NFJ
ABOVE	UPDATED	01/19/2020	NFJ

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
Inventor Search (PE2E)		
EAST Search (see attachment)		
Consulted Search notes from 16/153446		

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/588,201	GOPALAKRISHNAN et al.
	Examiner	Art Unit
	NICOLE F JOHNSON	3792

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
Searched all classes and subclasses from the Searched notes	Searched the USPAT, USOCR, USPGPUB, EPO, DERWENT, etc databases	01/19/2020	NFJ

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/588,201	GOPALAKRISHNAN et al.
	Examiner	Art Unit
	NICOLE F JOHNSON	3792

CPC						
Symbol					Type	Version
A61B	/	5	/	02055	F	2013-01-01
A61B	/	5	/	02405	I	2013-01-01
A61B	/	5	/	0245	I	2013-01-01
A61B	/	5	/	02416	I	2013-01-01
A61B	/	5	/	046	I	2013-01-01
A61B	/	5	/	7264	I	2013-01-01
A61B	/	5	/	681	I	2013-01-01
A61B	/	5	/	0022	I	2013-01-01
A61B	/	5	/	7275	I	2013-01-01
A61B	/	5	/	746	I	2013-01-01
A61B	/	5	/	6898	I	2013-01-01
G16H	/	20	/	40	I	2018-01-01
G16H	/	40	/	67	I	2018-01-01
G16H	/	40	/	63	A	2018-01-01
G16H	/	15	/	00	A	2018-01-01
G16H	/	10	/	60	A	2018-01-01
A61B	/	5	/	021	A	2013-01-01
A61B	/	5	/	02438	A	2013-01-01
A61B	/	5	/	0452	A	2013-01-01
A61B	/	5	/	1118	A	2013-01-01
G16H	/	50	/	30	A	2018-01-01

CPC Combination Sets							
Symbol					Type	Set	Ranking	Version
	/		/					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	30	
/NICOLE F LAVERT/ Primary Examiner, Art Unit 3792	19 January 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office — Part of Paper No.: 20200117

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/588,201	GOPALAKRISHNAN et al.
	Examiner	**Art Unit**
	NICOLE F JOHNSON	3792

INTERNATIONAL CLASSIFICATION				
CLAIMED				
A61B	/	5	/	024

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**
600	508

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					
600	509					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	30	
/NICOLE F LAVERT/ Primary Examiner, Art Unit 3792	19 January 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office — Part of Paper No.: 20200117

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/588,201	GOPALAKRISHNAN et al.
	Examiner	**Art Unit**
	NICOLE F JOHNSON	3792

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	10	10	19	19	28	28								
2	2	11	11	20	20	29	29								
3	3	12	12	21	21	30	30								
4	4	13	13	22	22										
5	5	14	14	23	23										
6	6	15	15	24	24										
7	7	16	16	25	25										
8	8	17	17	26	26										
9	9	18	18	27	27										

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	30	
/NICOLE F LAVERT/ Primary Examiner, Art Unit 3792	19 January 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16588201
Filing Date	2019-09-30
First Named Inventor	Ravi Gopalakrishnan
Art Unit	3792
Examiner Name	JOHNSON, NICOLE F
Attorney Docket Number	A102992 1170US.C4

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	9839363	B2	2017-12-12	Albert	
	2	7846106	B2	2010-12-07	Andrews et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20150305684	A1	2015-10-29	GROSS	
	2	20150122018	A1	2015-05-07	Yuen	
	3	20150057512	A1	2015-02-26	Kapoor	
	4	20140276154	A1	2014-09-18	Katra et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.F.L/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16588201
	Filing Date	2019-09-30
	First Named Inventor	Ravi Gopalakrishnan
	Art Unit	3792
	Examiner Name	JOHNSON, NICOLE F
	Attorney Docket Number	A102992 1170US.C4

	5	20140163393	A1	2014-06-12	McCombie et al.	
	6	20120289790	A1	2012-11-15	Jain et al.	
	7	20120109675	A1	2012-05-03	Ziegler et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/NICOLE F LAVERT/	Date Considered	01/17/2020

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.F.L/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16588201
	Filing Date	2019-09-30
	First Named Inventor	Ravi Gopalakrishnan
	Art Unit	3792
	Examiner Name	JOHNSON, NICOLE F
	Attorney Docket Number	A102992 1170US.C4

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16588201
	Filing Date	2019-09-30
	First Named Inventor	Ravi Gopalakrishnan
	Art Unit	3792
	Examiner Name	JOHNSON, NICOLE F
	Attorney Docket Number	A102992 1170US.C4

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Bill Jacobs/	Date (YYYY-MM-DD)	2020-01-08
Name/Print	William D. Jacobs, Jr.	Registration Number	74758

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	2755	600/508.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/09/30 02:05
S2	4833	600/509.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/09/30 02:07
S3	2551	(heart same "HRV")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/09/30 02:14
S4	620	S3 and ((score or value) same 'HRV')	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/09/30 02:14
S5	269	S4 and arrhythmia	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/09/30 02:14
S6	3396	a61b5/02405.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/09/30 02:16
S7	161	S5 and @py<="2012"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/09/30 02:16
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S9	2	"20120197148" and (display and algorithm)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/09/30 10:11
S10	2	"20120197148" and screen	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/09/30 10:13
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S15	5031	600/509.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/06/07 21:12
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S44	9	S40 and @py<="2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/12/03 09:59
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S46	3313	600/508.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/04/29 09:25
S47	5731	600/509.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/04/29 09:25
S48	7503	a61b5/02405.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/04/29 09:25
S53	3313	600/508.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/04/29 13:00
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S56	1873	600/483.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/04/29 13:00
S61	3360	600/508.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/21 08:57
S62	5815	600/509.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/21 08:57
S63	7670	a61b5/02405.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/21 08:57
S64	1895	600/483.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/01/17 18:18
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S67	8497	a61b5/02405.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	OFF	2020/01/17 18:20

			IBM_TDB				

1/ 19/ 2020 10:34:28 AM
C:\ Users\ nlavert\ Documents\ EAST\ Workspaces\ 16588201.wsp

Bibliographic Data

Application No: 16/588,201

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /NICOLE F LAVERT/ (Examiner's Signature) NFJ (Initials)

Title: METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
09/30/2019	600	3792	A102992 1170US.C4
RULE			

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CONTINUING DATA

This application is a CON of 16153446 10/05/2018 PAT 10426359

16153446 is a CON of 15393077 12/28/2016 PAT 10159415

15393077 is a CON of 14730122 06/03/2015 PAT 9572499

14730122 is a CON of 14569513 12/12/2014 PAT 9420956

14569513 has PRO of 62014516 06/19/2014

14569513 has PRO of 61970551 03/26/2014

14569513 has PRO of 61969019 03/21/2014

14569513 has PRO of 61953616 03/14/2014

14569513 has PRO of 61915113 12/12/2013

FOREIGN APPLICATIONS

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UNITED STATES

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/588,201	09/30/2019	Ravi GOPALAKRISHNAN	A102992 1170US.C4

CONFIRMATION NO. 3448

151512
WOMBLE BOND DICKINSON (US) LLP/AliveCor
Attn: IP DOCKETING
P.O. BOX 7037
ATLANTA, GA 30357-0037

PUBLICATION NOTICE

Title:METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

Publication No.US-2020-0022594-A1
Publication Date:01/23/2020

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

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Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
* 16/588,201 *	16/588,201	GOPALAKRISHNAN et al.	
	Examiner	**Art Unit**	
	JOHNSON, NICOLE F	3792	

Document Code - DISQ	**Internal Document - DO NOT MAIL**

TERMINAL DISCLAIMER	☐ APPROVED	☑ DISAPPROVED
Date Filed: **08 January 2020**	**This patent is subject to a Terminal Disclaimer**	

Approved/Disapproved by:

Td disapproved.
The person who signed the Td does not have POA, nor appointed or listed in the OATH.
Also resubmit Td, NO Fee required. /LAWANA R HIXON/

Technology Center: OPLC

Telephone: (571)272-6074

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of	)	
	)	Examiner: Johnson, Nicole F.
Ravi GOPALAKRISHNAN et al.	)	
	)	Art Unit: 3792
Application No: 16/588,201	)	
	)	Atty. Docket No: A102992 1170US.C4
Filed: September 30, 2019	)	
	)	Conf. No. 3448
For: METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING	)	

RESPONSE TO OFFICE ACTION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir/Madam:

In response to the Office action dated November 25, 2019, please consider the following remarks. Please note that a Terminal Disclaimer and an Information Disclosure Statement have been filed herewith.

Amendments to the specification begin on page 2 of this response.

A listing of the claims begins on page 3 of this response.

Remarks begin on page 8 of this response.

PTO/AIA/26 (04-14)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT	Docket Number (Optional) A102992 1170US.C4

In re Application of: Ravi GOPALAKRISHNAN et al.

Application No.: 16/588,201

Filed: September 30, 2019

For: METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

The applicant, ALIVECOR, INC., owner of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of **prior patent** No. 10,426,359 as the term of said **prior patent** is presently shortened by any terminal disclaimer. The applicant hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the **prior patent** are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the applicant does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the **prior patent**, "as the term of said **prior patent** is presently shortened by any terminal disclaimer," in the event that said **prior patent** later:

expires for failure to pay a maintenance fee;
is held unenforceable;
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has all claims canceled by a reexamination certificate;
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is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

Check either box 1 or 2 below, if appropriate.

1. ☐ The undersigned is the applicant. If the applicant is an assignee, the undersigned is authorized to act on behalf of the assignee.

I hereby acknowledge that any willful false statements made are punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

2. ☑ The undersigned is an attorney or agent of record. Reg. No. 74,758

/Bill Jacobs/ — Signature
January 8, 2020 — Date

William D. Jacobs, Jr. — Typed or printed name

Attorney of Record — Title
(408) 341-3091 — Telephone Number

☑ Terminal disclaimer fee under 37 CFR 1.20(d) included.

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The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16588201
Filing Date	2019-09-30
First Named Inventor	Ravi Gopalakrishnan
Art Unit	3792
Examiner Name	JOHNSON, NICOLE F
Attorney Docket Number	A102992 1170US.C4

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	9839363	B2	2017-12-12	Albert	
	2	7846106	B2	2010-12-07	Andrews et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20150305684	A1	2015-10-29	GROSS	
	2	20150122018	A1	2015-05-07	Yuen	
	3	20150057512	A1	2015-02-26	Kapoor	
	4	20140276154	A1	2014-09-18	Katra et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16588201
	Filing Date	2019-09-30
	First Named Inventor	Ravi Gopalakrishnan
	Art Unit	3792
	Examiner Name	JOHNSON, NICOLE F
	Attorney Docket Number	A102992 1170US.C4

	5	20140163393	A1	2014-06-12	McCombie et al.	
	6	20120289790	A1	2012-11-15	Jain et al.	
	7	20120109675	A1	2012-05-03	Ziegler et al.	

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16588201
	Filing Date	2019-09-30
	First Named Inventor	Ravi Gopalakrishnan
	Art Unit	3792
	Examiner Name	JOHNSON, NICOLE F
	Attorney Docket Number	A102992 1170US.C4

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16588201
	Filing Date	2019-09-30
	First Named Inventor	Ravi Gopalakrishnan
	Art Unit	3792
	Examiner Name	JOHNSON, NICOLE F
	Attorney Docket Number	A102992 1170US.C4

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Bill Jacobs/	Date (YYYY-MM-DD)	2020-01-08
Name/Print	William D. Jacobs, Jr.	Registration Number	74758

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal	
Application Number:	16588201
Filing Date:	30-Sep-2019
Title of Invention:	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING
First Named Inventor/Applicant Name:	Ravi GOPALAKRISHNAN
Filer:	William D Jacobs Jr/Aaron Dunn
Attorney Docket Number:	A102992 1170US.C4
Filed as Large Entity	
Filing Fees for Utility under 35 USC 111(a)	

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
STATUTORY OR TERMINAL DISCLAIMER	1814	1	160	160
		Total in USD ($)		**400**

Electronic Acknowledgement Receipt	
EFS ID:	38242863
Application Number:	16588201
International Application Number:	
Confirmation Number:	3448
Title of Invention:	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING
First Named Inventor/Applicant Name:	Ravi GOPALAKRISHNAN
Customer Number:	151512
Filer:	William D Jacobs Jr/Aaron Dunn
Filer Authorized By:	William D Jacobs Jr
Attorney Docket Number:	A102992 1170US.C4
Receipt Date:	08-JAN-2020
Filing Date:	30-SEP-2019
Time Stamp:	18:12:47
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$400
RAM confirmation Number	E202018I13281530
Deposit Account	090528
Authorized User	Aaron Dunn
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		A102992_1170USC4_Amendment.pdf	111388 8a90060f0509b57b6721728b0441dbb2d9fd0d34	yes	10

Multipart Description/PDF files in .zip description

Document Description	Start	End
Applicant Arguments/Remarks Made in an Amendment	8	10
Claims	3	7
Specification	2	2
Amendment/Req. Reconsideration-After Non-Final Reject	1	1

Warnings:

Information:

2	Terminal Disclaimer Filed	A102992_1170USC4_TD.pdf	156680 fc000a87b4073eda6726a9b864f39d0ca1643f96	no	2

Warnings:

Information:

3	Information Disclosure Statement (IDS) Form (SB08)	A102992_1170USC4_IDS.pdf	1034545 a27310f749d5b74a6f33c9c596672eab7644edee	no	5

Warnings:

Information:

4	Fee Worksheet (SB06)	fee-info.pdf	32353 64b26219b0ca5e628f456b84779c3a091ebb9bba	no	2

Warnings:

Information:

Total Files Size (in bytes):	1334966

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

REMARKS

Applicants request reconsideration of this application in view of the Terminal Disclaimer and Information Disclosure Statement filed herewith.

Status of the Claims

No claims were amended by the current response. No claims were cancelled or added. No new matter has been added. Thus, claims 1-30 are pending.

Office Action Summary

Claims 1, 17, and 25 have been rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1, 5, and 11 of U.S. Patent No. 10,426,359.

Response to Office Action Rejections

Double Patenting Claim Rejection

CLAIMS 1, 17, and 25

Claims 1, 17, and 25 have been rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1, 5, and 11 of U.S. Patent No. 10,426,359. Please note that a Terminal Disclaimer (and an Information Disclosure Statement) has been filed herewith. As such, Applicant respectfully requests that a Notice of Allowance be issued.

Reservation of Rights

Applicant believes that every assertion made in the Office action has been addressed; however, in the interest of clarity and brevity, Applicant may not have asserted every available

argument for each assertion made in the Office action. Applicant's silence regarding any such assertion does not constitute any admission or acquiescence. Applicant reserves all rights not exercised in connection with the response, such as the right to challenge or rebut any tacit or explicit characterization of any reference or of any of the present claims, the right to challenge or rebut any asserted factual or legal basis of any of the rejections, or the right to assert co-ownership of any cited reference. Applicant does not admit that any of the cited references or any other references of record are relevant to the present claims, or that they constitute prior art. To the extent that any rejection or assertion is based upon the Examiner's personal knowledge, rather than any objective evidence of record as manifested by a cited prior art reference, Applicant timely objects to such reliance on Official Notice, and reserves all rights to request that the Examiner provides a reference or affidavit in support of such assertion, as required by MPEP § 2144.03. Applicant reserves all rights to pursue any canceled claims in a subsequent patent application claiming the benefit of priority of the present patent Application, and to request rejoinder of any withdrawn claim, as required by MPEP § 821.04.

CONCLUSION

In view of the foregoing, Applicants respectfully submit that all of the pending claims are in condition for allowance. A notice of allowance is respectfully requested. In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at (408) 341-3091. If any fees are due in connection with the filing of this paper, then the Commissioner is authorized to charge such fees to Deposit Account No. 09-0528

Should the Examiner have any questions concerning this matter, please contact the undersigned.

Respectfully submitted,

WOMBLE BOND DICKINSON (US) LLP

Date: January 8, 2020

/Bill Jacobs/
William D. Jacobs, Jr.
Reg. No. 74,758

Customer No. 151512
1841 Page Mill Road
Suite 200
Palo Alto, CA 94304
(408) 341-3091

LISTING OF THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Original) A smart watch to detect the presence of an arrhythmia of a user, comprising:

a processing device;

a photoplethysmography ("PPG") sensor operatively coupled to the processing device;

an ECG sensor, comprising two or more ECG electrodes, the ECG sensor operatively coupled to the processing device;

a display operatively coupled to the processing device; and

a memory, operatively coupled to the processing device, the memory having instructions stored thereon that, when executed by the processing device, cause the processing device to:

receive PPG data from the PPG sensor;

detect, based on the PPG data, the presence of an arrhythmia;

receive ECG data from the ECG sensor; and

confirm the presence of the arrhythmia based on the ECG data.

2. (Original) The smart watch of claim 1, further comprising a motion sensor operatively coupled to the processing device, wherein to detect the presence of the arrhythmia, the processing device is configured to:

receive motion sensor data from the motion sensor; and

determine, from motion sensor data, that the user is at rest.

3. (Original) The smart watch of claim 2, wherein to detect the presence of the arrhythmia, the processing device is configured to input the PPG data into a machine learning algorithm trained to detect arrhythmias.

4. (Original) The smart watch of claim 2, wherein to detect the presence of the arrhythmia, the processing device is configured to:

determine heartrate variability ("HRV") data from the PPG data; and

detect, based on the HRV data, the presence of the arrhythmia.

5. (Original) The smart watch of claim 4, wherein to detect the presence of the arrhythmia, the processing device is configured to input the HRV data into a machine learning algorithm trained to detect arrhythmias.

6. (Original) The smart watch of claim 5, wherein to detect the presence of the arrhythmia, the processing device is further configured to input the motion sensor data with the HRV data into the machine learning algorithm trained to detect arrhythmias.

7. (Original) The smart watch of claim 1, wherein the processing device is further configured to:

extract one or more features from the PPG data; and

detect, based on the one or more features, the presence of the arrhythmia.

8. (Original) The smart watch of claim 7, wherein the one or more features correspond to an HRV signal analyzed in a time domain.

9. (Original) The smart watch of claim 7, wherein the one or more features comprise a nonlinear transform of R-R ratio or R-R ratio statistics with an adaptive weighting factor.

10. (Original) The smart watch of claim 7, wherein the one or more features are features of an HRV signal analyzed geometrically.

11. (Original) The smart watch of claim 7, wherein the one or more features are features of an HRV signal analyzed in the frequency domain.

12. (Original) The smart watch of claim 1, wherein the processing device is further configured to generate a notification of the detected arrhythmia.

13. (Original) The smart watch of claim 1, further comprising a biometric data sensor, wherein the processing device is further configured to:

receive biometric data of the user from the biometric data sensor; and

detect, based on the biometric data, the presence of the arrhythmia.

14. (Original) The smart watch of claim 13, wherein the biometric data comprises at least one of: a temperature, a blood pressure, or an inertial data of the user.

15. (Original) The smart watch of claim 1, the processing device further configured to display an ECG rhythm strip from the ECG data.

16. (Original) The smart watch of claim 1, the processing device further to receive the ECG data from the ECG sensor in response to receiving an indication of a user action.

17. (Original) A method to detect the presence of an arrhythmia of a user on a smart watch, comprising:

receiving PPG data from a PPG sensor of the smartwatch;

detecting by a processing device, based on the PPG data, the presence of an arrhythmia;

receiving ECG data from an ECG sensor of the smartwatch; and

confirming the presence of the arrhythmia based on the ECG data.

18. (Original) The method of claim 17, wherein detecting the presence of the arrhythmia comprises:

receiving motion sensor data from a motion sensor of the smartwatch; and

determine, from motion sensor data, that the user is at rest.

19. (Original) The method of claim 18, wherein detecting the presence of the arrhythmia comprises inputting the PPG data into a machine learning algorithm trained to detect arrhythmias.

20. (Original) The method of claim 18, wherein detecting the presence of the arrhythmia comprises:

determining heartrate variability ("HRV") data from the PPG data; and

detecting, based on the HRV data, the presence of the arrhythmia.

21. (Original) The method of claim 20, wherein detecting the presence of the arrhythmia comprises inputting the HRV data into a machine learning algorithm trained to detect arrhythmias.

22. (Original) The method of claim 21, wherein detecting the presence of the arrhythmia comprises inputting the motion sensor data with the HRV data into the machine learning algorithm trained to detect arrhythmias.

23. (Original) The method of claim 17, further comprising generating a notification of the detected arrhythmia.

24. (Original) The method of claim 17, further comprising receiving the ECG data from the ECG sensor in response to receiving an indication of a user action.

25. (Original) A non-transitory computer-readable storage medium including instructions that, when executed by a processing device, cause the processing device to:

receive PPG data from a PPG sensor of the smartwatch;

detect by the processing device, based on the PPG data, the presence of an arrhythmia;

receive ECG data from an ECG sensor of the smartwatch; and

confirm the presence of the arrhythmia based on the ECG data.

26. (Original) The non-transitory computer-readable storage medium of claim 25, wherein the processing device is further configured to:

extract one or more features from the PPG data; and

detect, based on the one or more features, the presence of the arrhythmia.

27. (Original) The non-transitory computer-readable storage medium of claim 26, wherein the one or more features correspond to an HRV signal analyzed in a time domain.

28. (Original) The non-transitory computer-readable storage medium of claim 26, wherein the one or more features comprise a nonlinear transform of R-R ratio or R-R ratio statistics with an adaptive weighting factor.

29. (Original) The non-transitory computer-readable storage medium of claim 26, wherein the one or more features are features of an HRV signal analyzed geometrically or in the frequency domain.

30. (Original) The non-transitory computer-readable storage medium of claim 25, the processing device further to receive the ECG data from the ECG sensor in response to receiving an indication of a user action.

AMENDMENT TO THE SPECIFCATION

Please amendment paragraph 0001 of the specification as follows:

[0001] This application is a continuation of U.S. Application Serial No. 16/153,446, filed October 5, 2018, now U.S. Patent No. 10,426,359, issued October 1, 2019, which is a continuation of U.S. Application Serial No. 15/393,077, filed December 28, 2016, now U.S. Patent No. 10,159,415, issued December 25, 2018, which is a continuation of U.S. Application Serial No. 14/730,122, filed June 3, 2015, now U.S. Patent No. 9,572,499, issued February 21, 2017, which is a continuation of U.S. Application Serial No. 14/569,513 filed December 12, 2014, now U.S. Patent No. 9,420,956, issued August 23, 2016, which claims the benefit of U.S. Provisional Application No. 61/915,113, filed December 12, 2013, which application is incorporated herein by reference, U.S. Provisional Application No. 61/953,616 filed March 14, 2014, U.S. Provisional Application No. 61/969,019, filed March 21, 2014, U.S. Provisional Application No. 61/970,551 filed March 26, 2014 which application is incorporated herein by reference, and U.S. Provisional Application No. 62/014,516, filed June 19, 2014, which application is incorporated herein by reference.

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/588,201	09/30/2019	Ravi GOPALAKRISHNAN	A102992 1170US.C4	3448

151512 7590 11/25/2019

WOMBLE BOND DICKINSON (US) LLP/AliveCor
Attn: IP DOCKETING
P.O. BOX 7037
ATLANTA, GA 30357-0037

EXAMINER	
JOHNSON, NICOLE F	

ART UNIT	PAPER NUMBER
3792	

NOTIFICATION DATE	DELIVERY MODE
11/25/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

IPDocketing@wbd-us.com

Office Action Summary	Application No. 16/588,201	Applicant(s) GOPALAKRISHNAN et al.	
	Examiner NICOLE F JOHNSON	Art Unit 3792	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 9/30/19.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-30 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1,17 and 25 is/are rejected.

8) ☑ Claim(s) 2-16,18-24 and 26-30 is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☑ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Specification

The disclosure is objected to because of the following informalities: The current status of all pending U.S. applications and/or publications must be updated prior to issuing an allowance. Please update any and all applications and/or publications listed in the written disclosure, i.e. paragraph [e.g., 0001].

Appropriate correction is required.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application,

or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP §§ 706.02(l)(1) - 706.02(l)(3) for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

Claims 1, 17 & 25 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1, 5 & 11 of U.S. Patent No. 10,426,359. Although the claims at issue are not identical, they are not patentably distinct from each other because both claimed sets are directed towards a smart watch, method and a non-transitory computer readable medium comprising a PPG and ECG sensor, and based on the data obtained by said PPG sensor determining the presence of an arrhythmia and confirming said presence via the ECG sensor.

Allowable Subject Matter

1. Claims 2-16, 18-24 & 26-30 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The closest prior art, Levitan (as cited by 14/730122), fails to disclose, suggest and/or teach the claimed invention having a smart watch and a method of determining a presence of an arrhythmia of a first comprising a means of sensing an activity level of said first user with a motion sensor and comparing a heart rate variability of said first user to said activity level, in combination with the other claimed elements.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NICOLE F JOHNSON whose telephone number is (571)270-5040. The examiner can normally be reached on **Mon-Thu 7:30am-4:30 pm**.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Christopher Koharski** can be reached on **571-272-7230**. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see https://ppair-my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NICOLE F LAVERT/
Primary Examiner, Art Unit 3792

Notice of References Cited	Application/Control No. 16/588,201	Applicant(s)/Patent Under Reexamination GOPALAKRISHNAN et al.	
	Examiner NICOLE F JOHNSON	Art Unit 3792	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20120197148-A1	08-2012	LEVITAN; JACOB	A61B5/02405	600/515
*	B	US-20140125619-A1	05-2014	Panther; Heiko Gernot Albert	G06F3/04883	345/173
*	C	US-20070213624-A1	09-2007	Reisfeld; Daniel	A61B5/0402	600/504
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/588,201	GOPALAKRISHNAN et al.
	Examiner	Art Unit
	NICOLE F JOHNSON	3792

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner
A61B5/00405	11/21/2019	NFJ

US Classification - Searched*			
Class	Subclass	Date	Examiner
600	508-509	11/21/2019	NFJ

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Inventor Search (PE2E)		
EAST Search (see attachment)		
Consulted Search notes from 16/153446		

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

Bibliographic Data

Application No: 16/588,201

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /NICOLE F LAVERT/ (Examiner's Signature) NFJ (Initials)

Title: METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
09/30/2019	600	3792	A102992 1170US.C4
RULE			

APPLICANTS

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CONTINUING DATA

This application is a CON of 16153446 10/05/2018 PAT 10426359

16153446 is a CON of 15393077 12/28/2016 PAT 10159415

15393077 is a CON of 14730122 06/03/2015 PAT 9572499

14730122 is a CON of 14569513 12/12/2014 PAT 9420956

14569513 has PRO of 62014516 06/19/2014

14569513 has PRO of 61970551 03/26/2014

14569513 has PRO of 61969019 03/21/2014

14569513 has PRO of 61953616 03/14/2014

14569513 has PRO of 61915113 12/12/2013

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

10/16/2019

STATE OR COUNTRY

UNITED STATES

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WOMBLE BOND DICKINSON (US) LLP/AliveCor
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P.O. BOX 7037
ATLANTA, GA 30357-0037
UNITED STATES

FILING FEE RECEIVED

$6,860

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	3360	600/508.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/21 08:57
L2	5815	600/509.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/11/21 08:57
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S4	620	S3 and ((score or value) same 'HRV')	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/09/30 02:14
S5	269	S4 and arrhythmia	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/09/30 02:14
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S7	161	S5 and @py<="2012"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/09/30 02:16
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S13	2	S12 and motion	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	OFF	2016/02/18 17:17

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S16	4046	a61b5/02405.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/06/07 21:12
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S36	151	(arrhythmia same photoplethysmography)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/12/03 08:29
S37	114	S36 and (motion same sensor)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	OFF	2018/12/03 08:29

			IBM_TDB			
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S41	98	S40 and watch	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/12/03 09:50
S42	0	S41 and @py<="2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/12/03 09:52
S43	19177	"l12" and @py<="2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/12/03 09:53
S44	9	S40 and @py<="2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/12/03 09:59
S45	1873	600/483.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/04/29 09:24
S46	3313	600/508.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/04/29 09:25
S47	5731	600/509.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/04/29 09:25
S48	7503	a61b5/02405.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/04/29 09:25
S53	3313	600/508.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/04/29 13:00
S54	5731	600/509.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/04/29 13:00
S55	7503	a61b5/02405.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/04/29 13:00
S56	1873	600/483.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/04/29 13:00

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/588,201	09/30/2019	Ravi GOPALAKRISHNAN	A102992 1170US.C4	3448

151512 7590 10/23/2019

WOMBLE BOND DICKINSON (US) LLP/AliveCor
Attn: IP DOCKETING
P.O. BOX 7037
ATLANTA, GA 30357-0037

EXAMINER	

ART UNIT	PAPER NUMBER
3792	

NOTIFICATION DATE	DELIVERY MODE
10/23/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

IPDocketing@wbd-us.com

Decision Granting Request for Prioritized Examination (Track I)	**Application No.** 16/588,201	**Applicant(s)** GOPALAKRISHNAN et al.	
	Examiner BRIAN W BROWN	**Art Unit** OPET	**AIA (FITF) Status** Yes

1. THE REQUEST FILED 30 September 2019 IS **GRANTED** .

The above-identified application has met the requirements for prioritized examination

A. ☑ for an original nonprovisional application (Track I).
B. ☐ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination**. The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

A. filing a **petition for extension of time** to extend the time period for filing a reply;

B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims** , or a multiple dependent claim;

C. filing a **request for continued examination** ;

D. filing a notice of appeal;

E. filing a request for suspension of action;

F. mailing of a notice of allowance;

G. mailing of a final Office action;

H. completion of examination as defined in 37 CFR 41.102; or

I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to BRIAN BROWN at (571)272-5338.

In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.

/BRIAN W BROWN/ Petitions Examiner, OPET	

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UNITED STATES DEPARTMENT OF COMMERCE
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Alexandria, Virginia 22313-1450
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/588,201	09/30/2019	3792	2880	A102992 1170US.C4	30	3

CONFIRMATION NO. 3448

151512
WOMBLE BOND DICKINSON (US) LLP/AliveCor
Attn: IP DOCKETING
P.O. BOX 7037
ATLANTA, GA 30357-0037

FILING RECEIPT

OC000000111964071

Date Mailed: 10/18/2019

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Ravi GOPALAKRISHNAN, San Francisco, CA;
Lev KORZINOV, San Francisco, CA;
Fei WANG, San Francisco, CA;
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Omar DAWOOD, San Francisco, CA;
Iman ABUZEID, San Francisco, CA;
David E. Albert, Oklahoma City, OK;

Applicant(s)

AliveCor, Inc., Mountain View, CA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 16/153,446 10/05/2018 PAT 10426359
which is a CON of 15/393,077 12/28/2016 PAT 10159415
which is a CON of 14/730,122 06/03/2015 PAT 9572499
which is a CON of 14/569,513 12/12/2014 PAT 9420956
which claims benefit of 62/014,516 06/19/2014
and claims benefit of 61/970,551 03/26/2014
and claims benefit of 61/969,019 03/21/2014
and claims benefit of 61/953,616 03/14/2014
and claims benefit of 61/915,113 12/12/2013

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 10/16/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/588,201**

Projected Publication Date: 01/23/2020

Non-Publication Request: No

Early Publication Request: No
Title

METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

Preliminary Class

607

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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Title 35, United States Code, Section 184

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The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/588,201

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	30 minus 20 =	* 10			OR	x 100 =	1000
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 460 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	2720

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/588,201	09/30/2019	Ravi GOPALAKRISHNAN	A102992 1170US.C4

CONFIRMATION NO. 3448

151512
WOMBLE BOND DICKINSON (US) LLP/AliveCor
Attn: IP DOCKETING
P.O. BOX 7037
ATLANTA, GA 30357-0037

INFORMAL NOTICE

OC000000111964072

Date Mailed: 10/18/2019

INFORMATIONAL NOTICE TO APPLICANT

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
  Ravi GOPALAKRISHNAN
  Lev KORZINOV
  Fei WANG
  Euan THOMSON
  Nupur SRIVASTAVA
  Omar DAWOOD
  Iman ABUZEID
  David E. Albert

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/fasrat/

United States Patent and Trademark Office

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Sale Accounting Date:10/16/2019

Sale Item Reference Number	Effective Date
16588201	09/30/2019

Document Number	Fee Code	Fee Code Description	Amount Paid	Payment Method
I20190FG00556560	1051	LATE FILING FEE FOR OATH OR DECLARATION	$160.00	Deposit Account

Doc Code: TRACK1.REQ
Document Description: TrackOne Request

PTO/AIA/424 (04-14)

CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION UNDER 37 CFR 1.102(e) (Page 1 of 1)

First Named Inventor:	Ravi GOPALAKRISHNAN	Nonprovisional Application Number (if known):	
Title of Invention:	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING		

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently $0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.

2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.

3. The applicable box is checked below:

I. ☑ Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)

i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.

---OR---

(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.

ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, **or** the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

II. ☐ Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)

i. A request for continued examination has been filed with, or prior to, this form.
ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature /Bill Jacobs/	Date September 30, 2019
Name (Print/Typed) William D. Jacobs, Jr.	Practitioner Registration Number 74,758

Note: *This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.**

☑ *Total of 1 forms are submitted.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

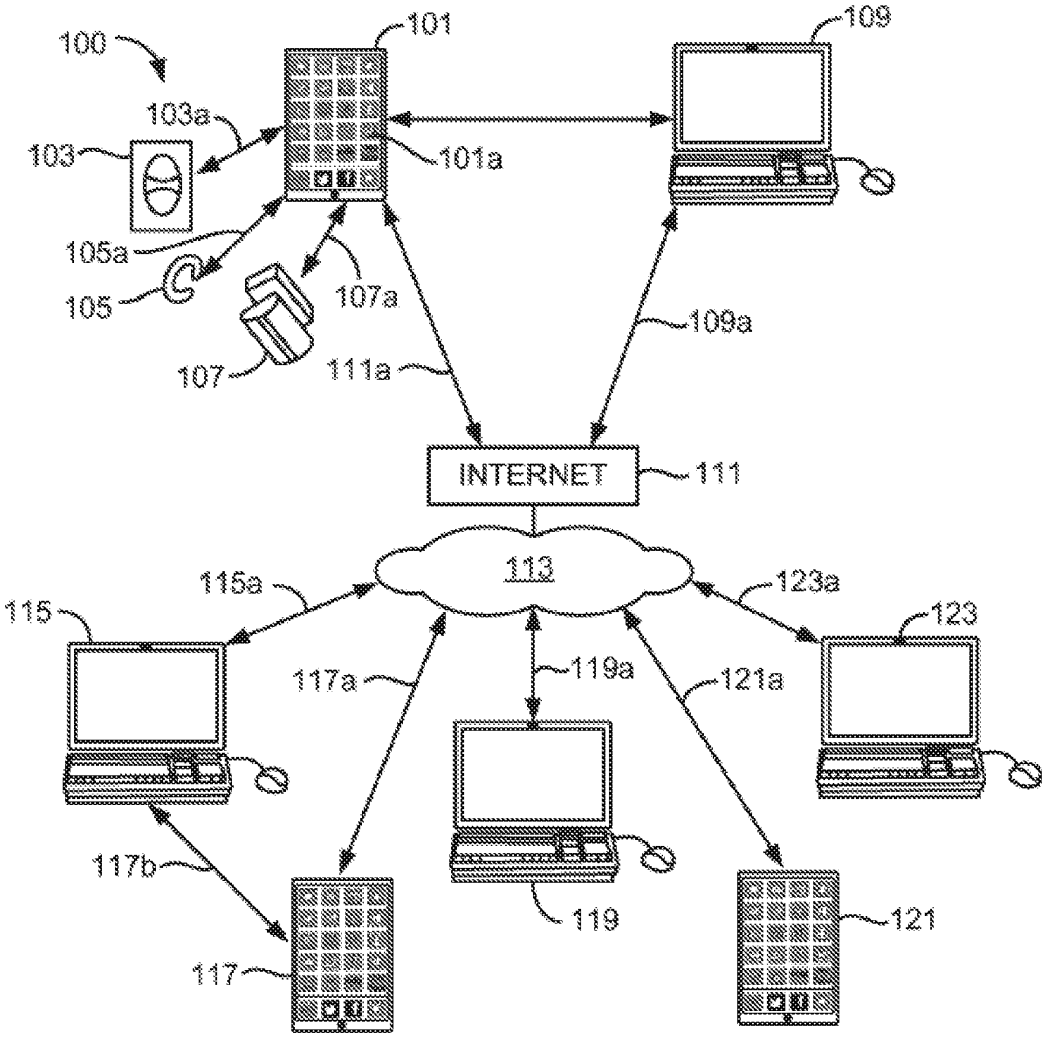
100
101
109
103a
103
101a
105a
105
107a
107
109a
111a
INTERNET
111
113
115a
123a
115
123
117a
119a
121a
117b
119
121
117

FIG. 1

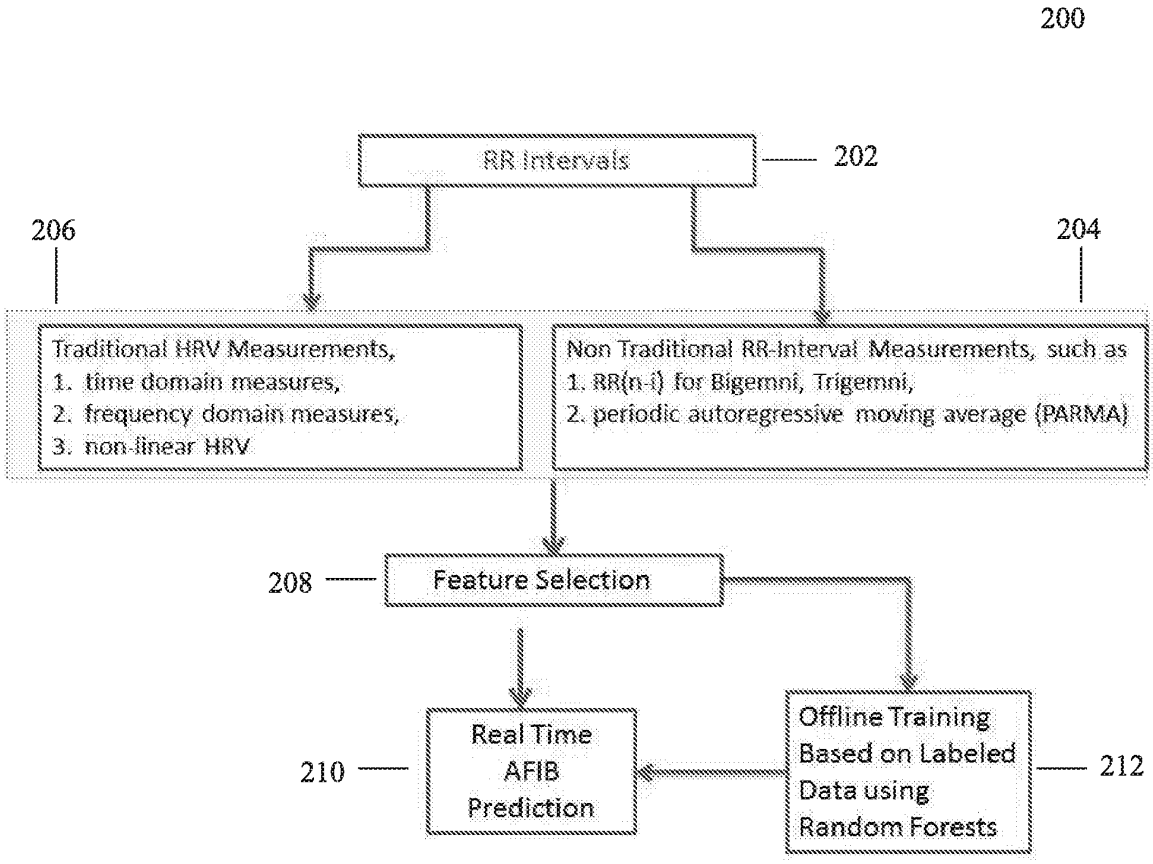
200
RR Intervals
202
206
204
Traditional HRV Measurements,
1. time domain measures,
2. frequency domain measures,
3. non-linear HRV
Non Traditional RR-Interval Measurements, such as
1. RR(n-i) for Bigemni, Trigemni,
2. periodic autoregressive moving average (PARMA)
208
Feature Selection
210
Real Time AFIB Prediction
Offline Training Based on Labeled Data using Random Forests
212

FIG. 2

300

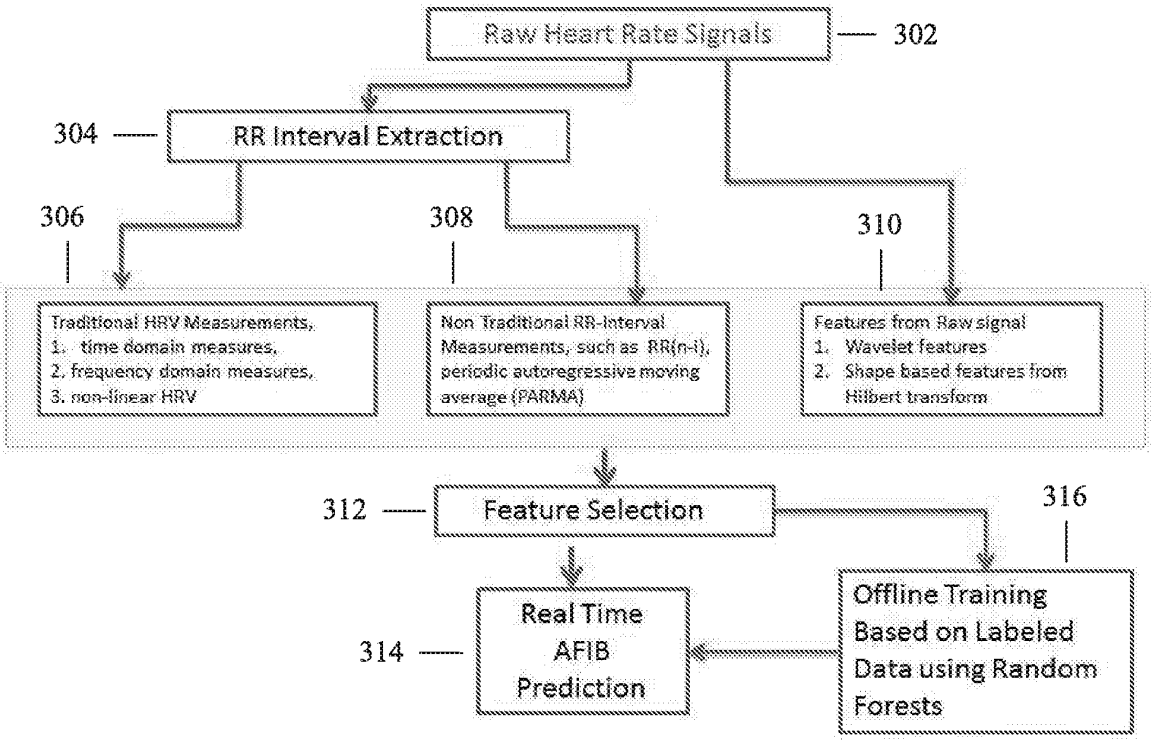
Raw Heart Rate Signals
302
304
RR Interval Extraction
306
308
310
Traditional HRV Measurements,
1. time domain measures,
2. frequency domain measures,
3. non-linear HRV
Non Traditional RR-Interval Measurements, such as RR(n-i), periodic autoregressive moving average (PARMA)
Features from Raw signal
1. Wavelet features
2. Shape based features from Hilbert transform
312
Feature Selection
316
314
Real Time AFIB Prediction
Offline Training Based on Labeled Data using Random Forests

FIG. 3

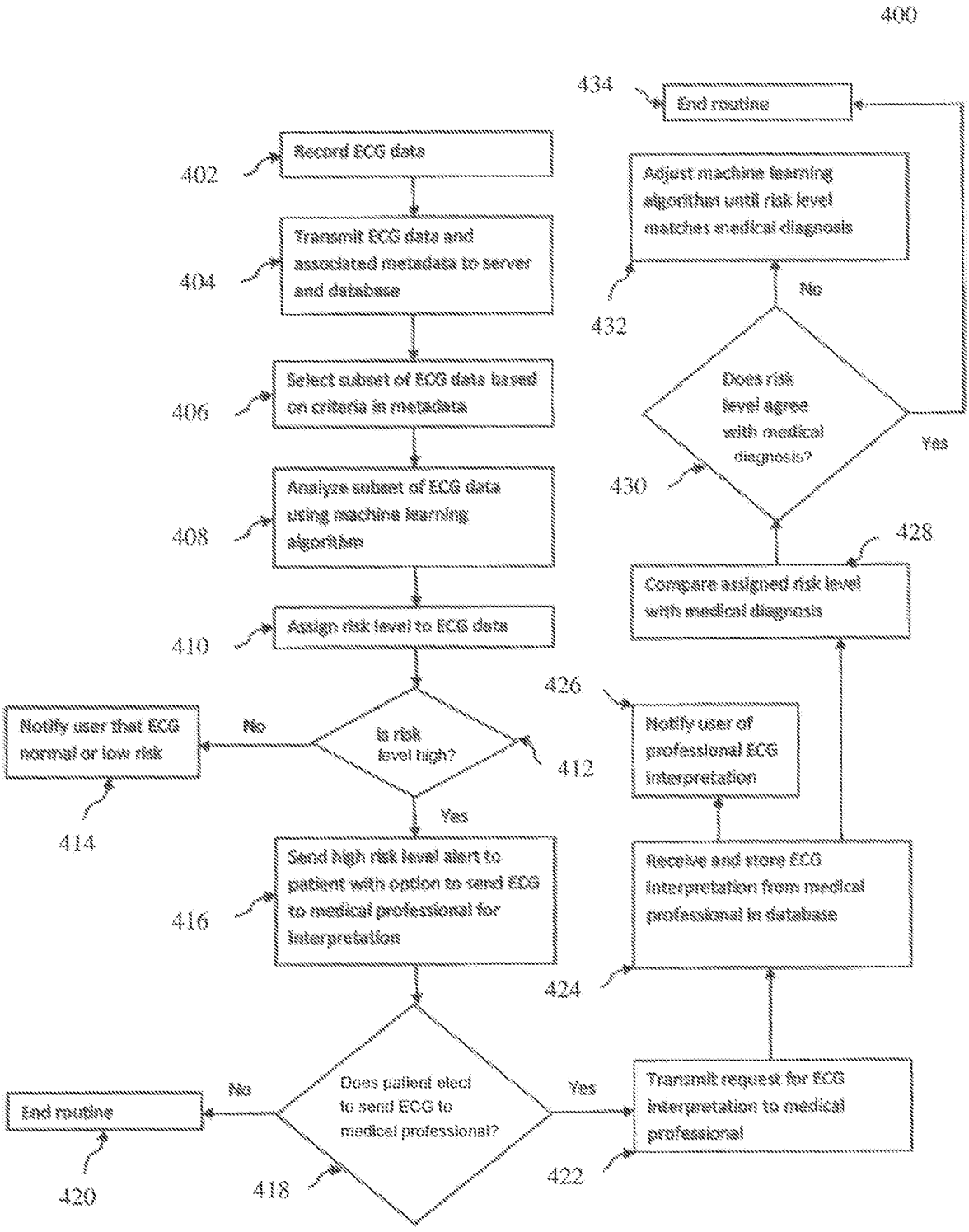
400
434
End routine
Record ECG data
402
Adjust machine learning algorithm until risk level matches medical diagnosis
Transmit ECG data and associated metadata to server and database
404
No
432
Select subset of ECG data based on criteria in metadata
406
Does risk level agree with medical diagnosis?
Yes
Analyze subset of ECG data using machine learning algorithm
408
430
428
Compare assigned risk level with medical diagnosis
Assign risk level to ECG data
410
426
Notify user that ECG normal or low risk
No
Is risk level high?
412
Notify user of professional ECG interpretation
414
Yes
Send high risk level alert to patient with option to send ECG to medical professional for interpretation
Receive and store ECG interpretation from medical professional in database
416
424
No
Does patient elect to send ECG to medical professional?
Yes
Transmit request for ECG interpretation to medical professional
End routine
420
418
422

FIG. 4

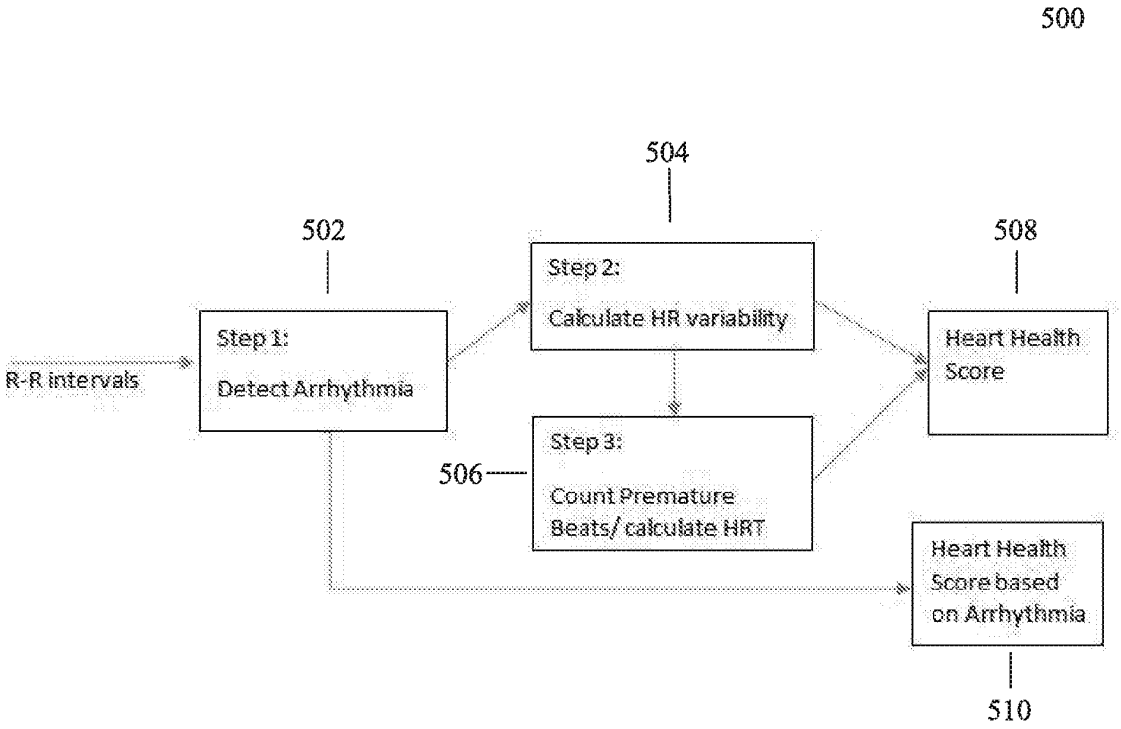
500
504
502
508
Step 2:
Calculate HR variability
Step 1:
Detect Arrhythmia
R-R intervals
Heart Health
Score
Step 3:
Count Premature
Beats/ calculate HRT
506
Heart Health
Score based
on Arrhythmia
510

FIG. 5

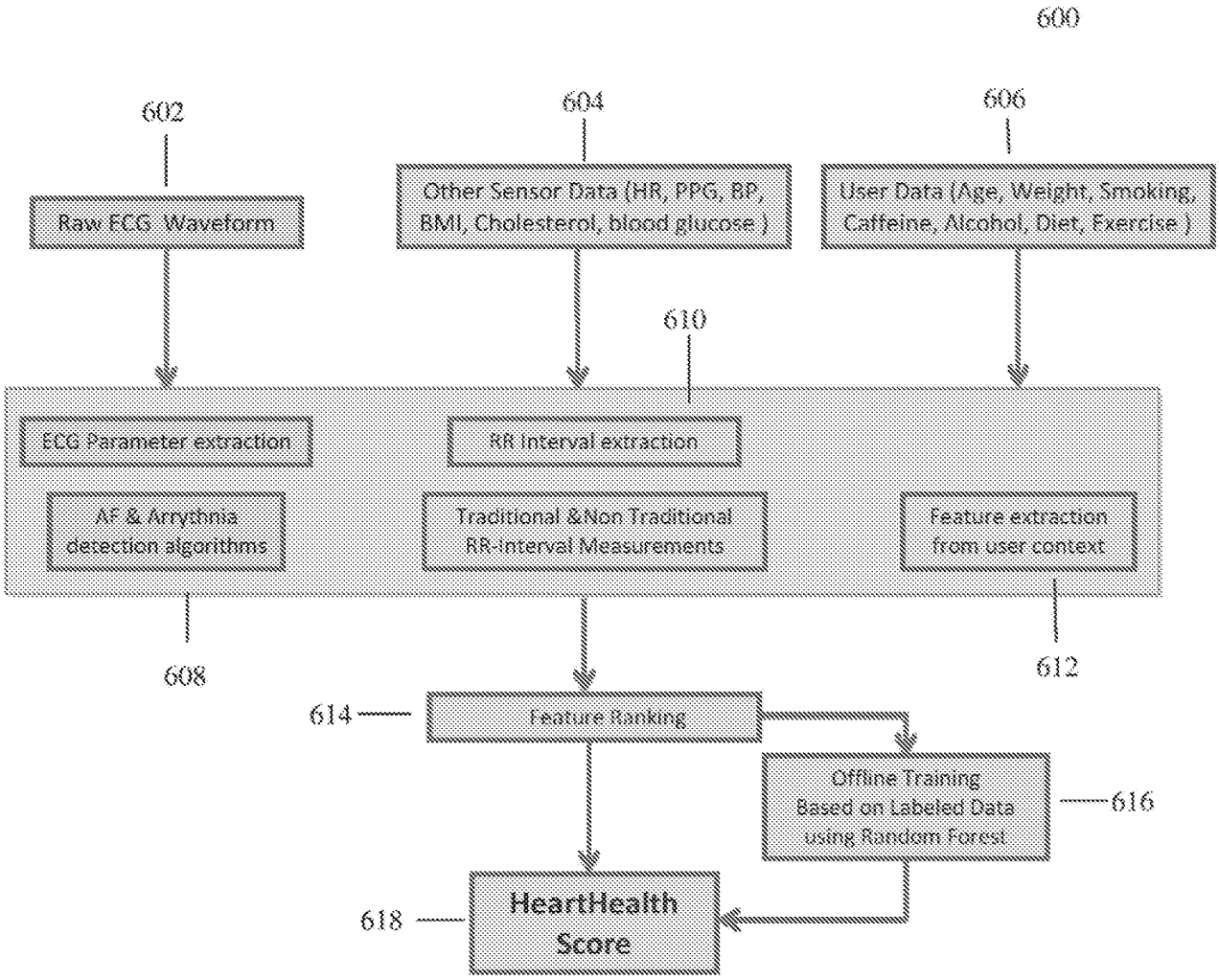
600
602
604
606
Raw ECG Waveform
Other Sensor Data (HR, PPG, BP, BMI, Cholesterol, blood glucose)
User Data (Age, Weight, Smoking, Caffeine, Alcohol, Diet, Exercise)
610
ECG Parameter extraction
RR Interval extraction
AF & Arrythmia detection algorithms
Traditional &Non Traditional RR-Interval Measurements
Feature extraction from user context
608
612
614
Feature Ranking
Offline Training Based on Labeled Data using Random Forest
616
618
HeartHealth Score

FIG. 6

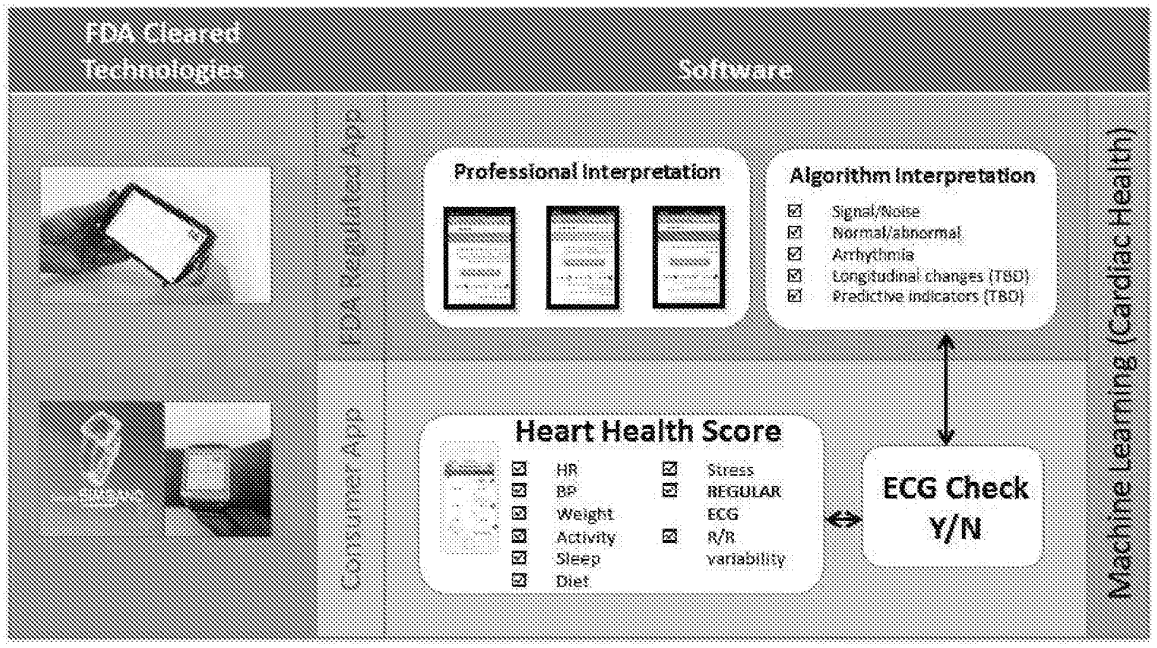
FDA Cleared Technologies
Software
Professional Interpretation
Algorithm Interpretation
Signal/Noise
Normal/abnormal
Arrhythmia
Longitudinal changes (TBD)
Predictive indicators (TBD)
Heart Health Score
HR
BP
Weight
Activity
Sleep
Diet
Stress
REGULAR ECG
R/R variability
ECG Check Y/N
Consumer App
Machine Learning (Cardiac Health)

FIG. 7

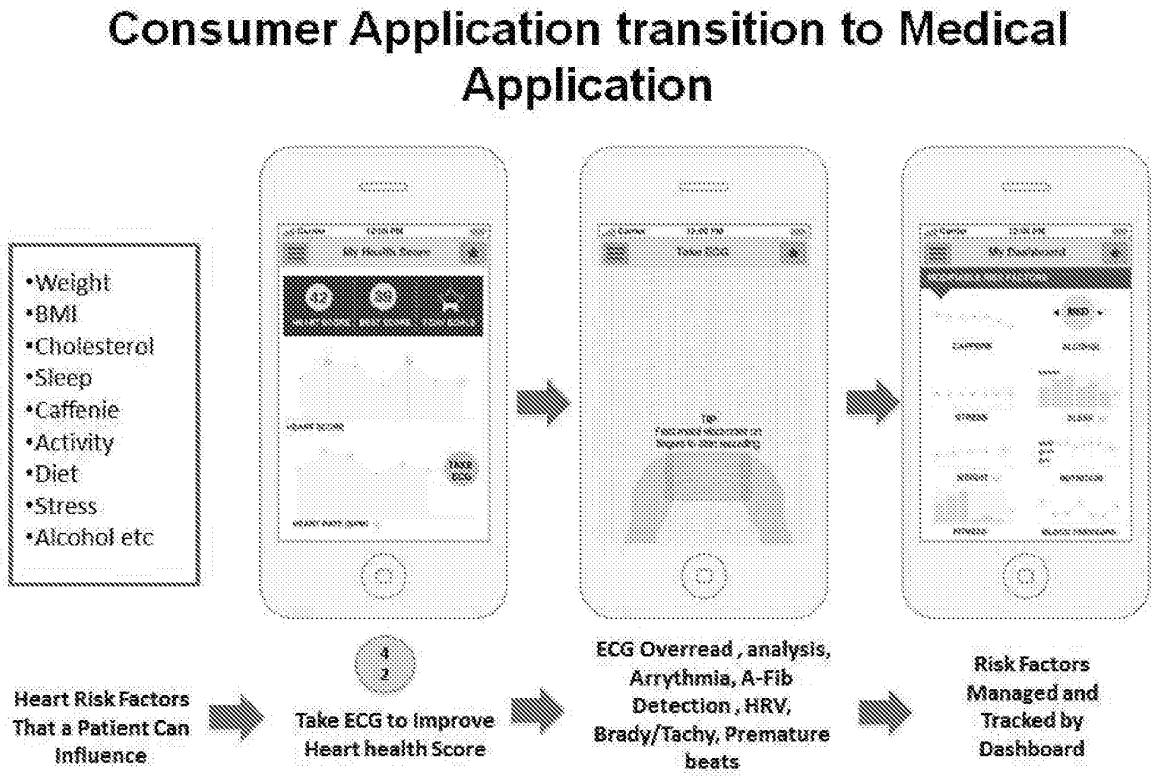
Consumer Application transition to Medical Application
•Weight
•BMI
•Cholesterol
•Sleep
•Caffenie
•Activity
•Diet
•Stress
•Alcohol etc
Heart Risk Factors That a Patient Can Influence
Take ECG to Improve Heart health Score
ECG Overread , analysis, Arrythmia, A-Fib Detection , HRV, Brady/Tachy, Premature beats
Risk Factors Managed and Tracked by Dashboard

FIG. 8

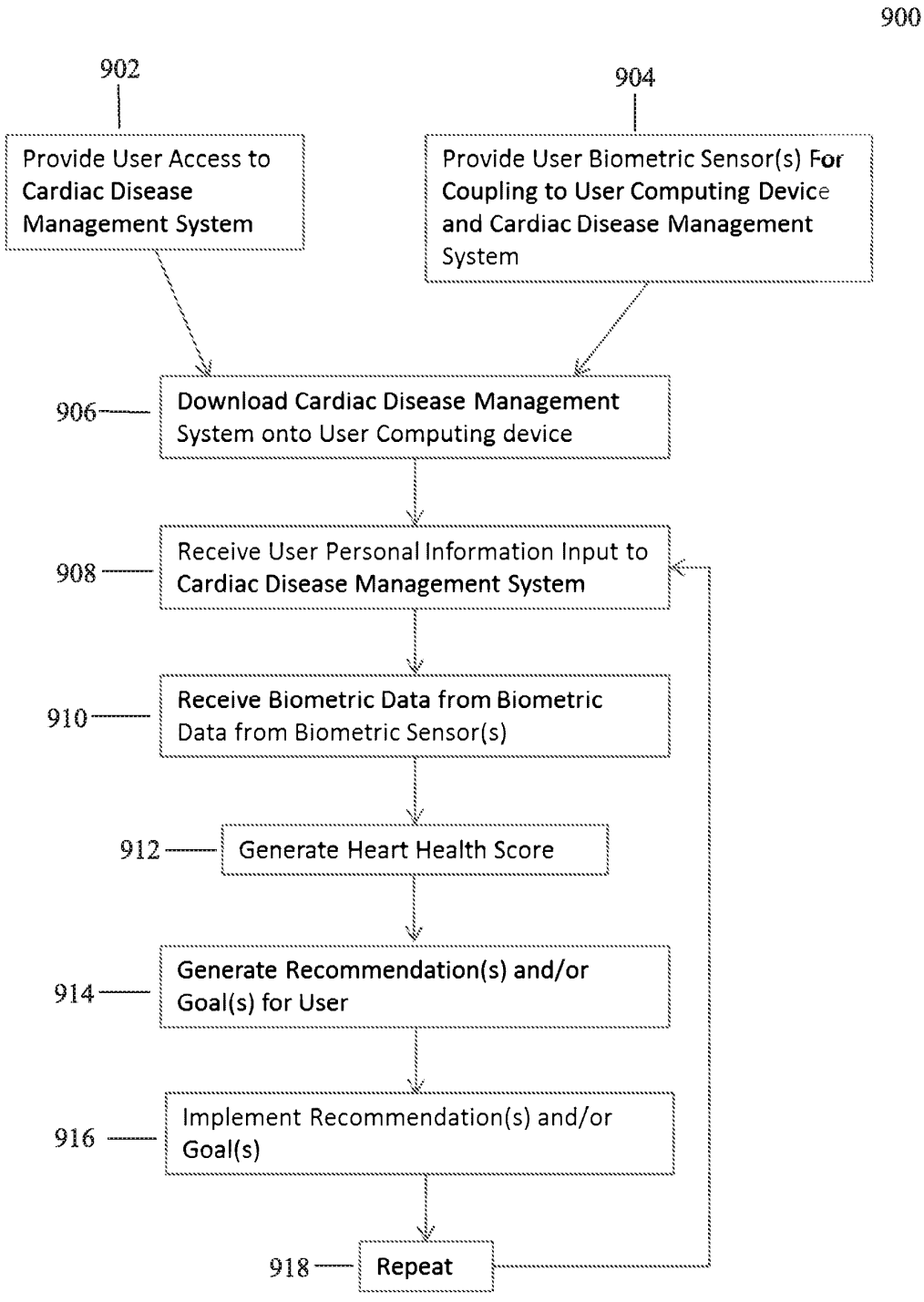
900
902
Provide User Access to Cardiac Disease Management System
904
Provide User Biometric Sensor(s) For Coupling to User Computing Device and Cardiac Disease Management System
906
Download Cardiac Disease Management System onto User Computing device
908
Receive User Personal Information Input to Cardiac Disease Management System
910
Receive Biometric Data from Biometric Data from Biometric Sensor(s)
912
Generate Heart Health Score
914
Generate Recommendation(s) and/or Goal(s) for User
916
Implement Recommendation(s) and/or Goal(s)
918
Repeat

FIG. 9

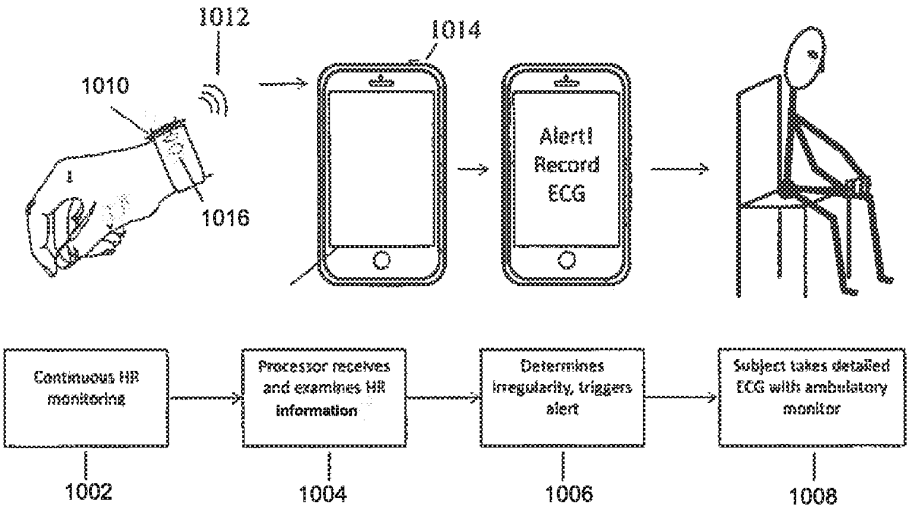
1012
1014
1010
1016
Alert!
Record
ECG
Continuous HR monitoring
Processor receives and examines HR information
Determines irregularity, triggers alert
Subject takes detailed ECG with ambulatory monitor
1002
1004
1006
1008

FIG. 10

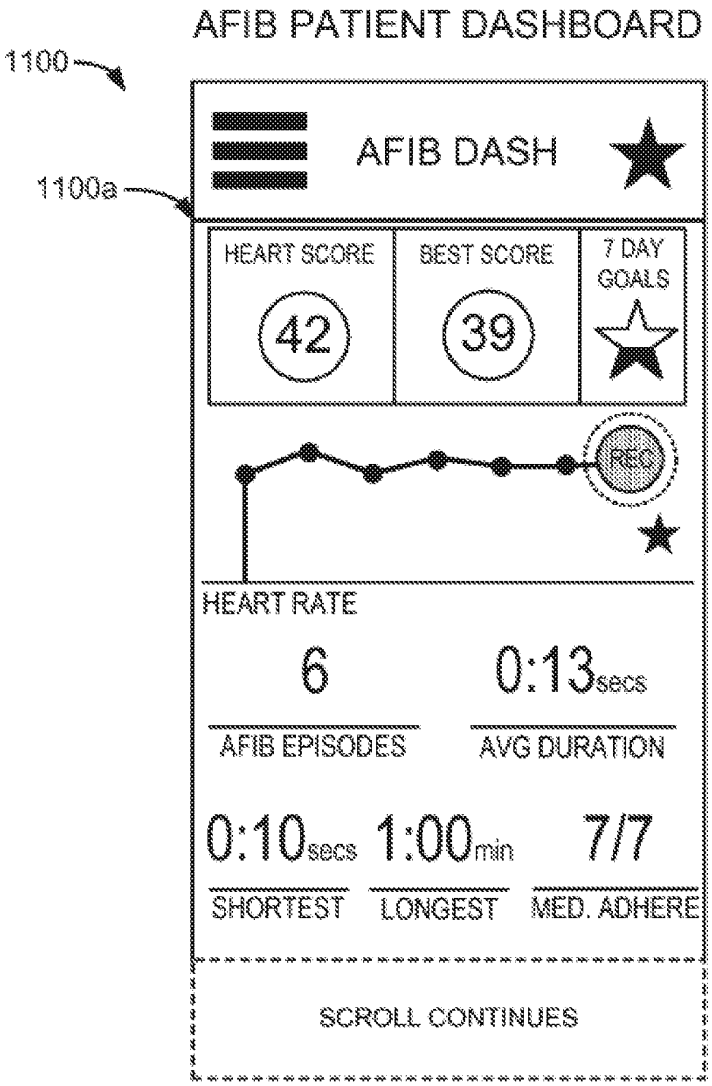
AFIB PATIENT DASHBOARD
1100
1100a
AFIB DASH
HEART SCORE
42
BEST SCORE
39
7 DAY GOALS
HEART RATE
6
AFIB EPISODES
0:13secs
AVG DURATION
0:10secs
SHORTEST
1:00min
LONGEST
7/7
MED. ADHERE
SCROLL CONTINUES

FIG. 11

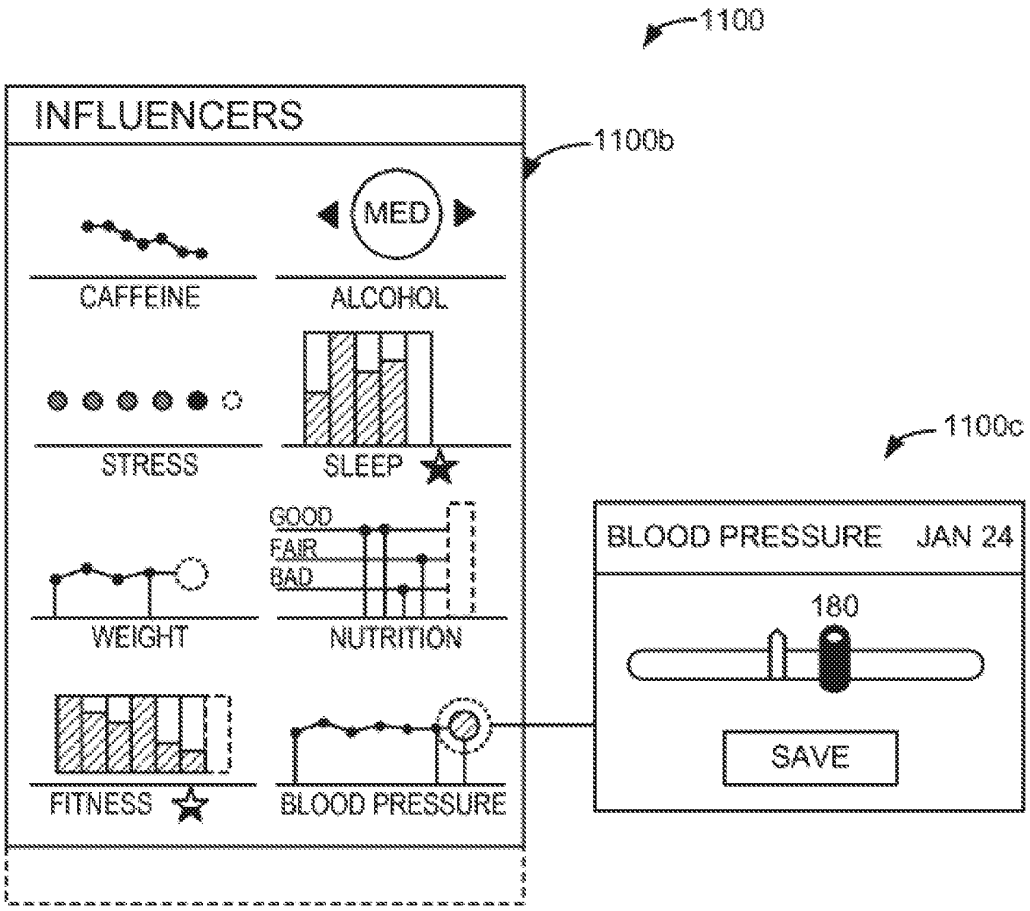
1100
INFLUENCERS
1100b
MED
CAFFEINE
ALCOHOL
STRESS
SLEEP
1100c
GOOD
FAIR
BAD
WEIGHT
NUTRITION
BLOOD PRESSURE JAN 24
180
SAVE
FITNESS
BLOOD PRESSURE

FIG. 11A

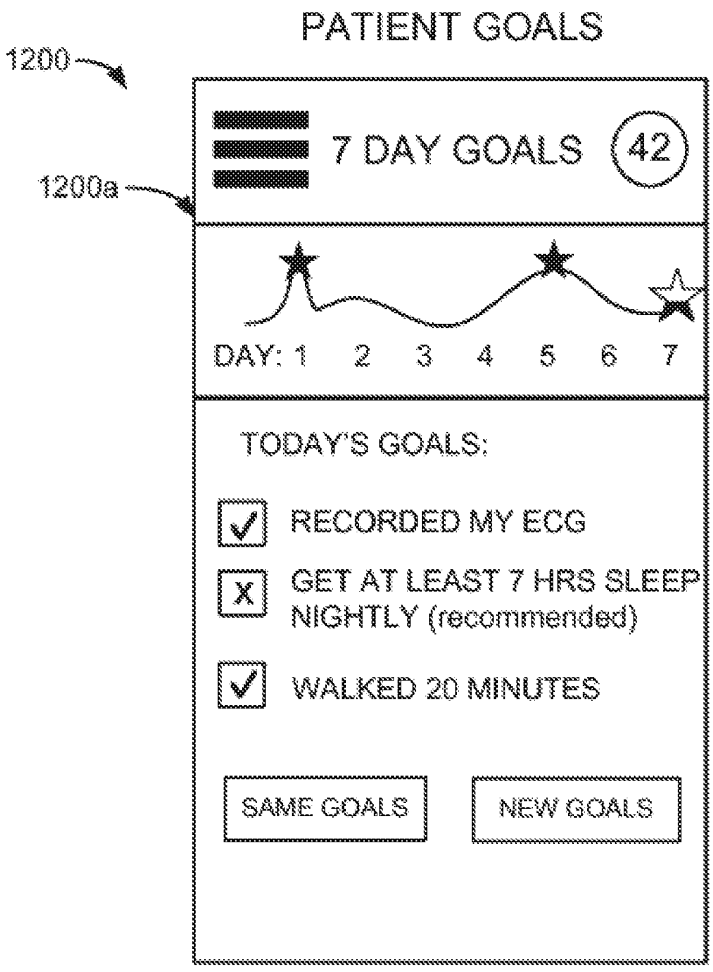
PATIENT GOALS
1200
1200a
7 DAY GOALS
42
DAY: 1 2 3 4 5 6 7
TODAY'S GOALS:
RECORDED MY ECG
GET AT LEAST 7 HRS SLEEP NIGHTLY (recommended)
WALKED 20 MINUTES
SAME GOALS
NEW GOALS

FIG. 12

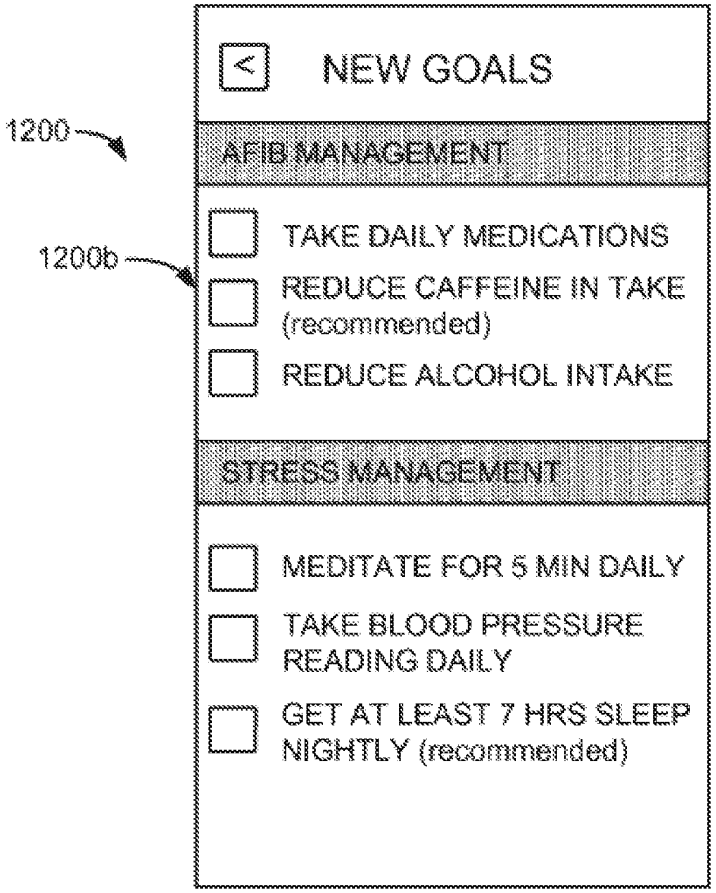
NEW GOALS
1200
AFIB MANAGEMENT
1200b
TAKE DAILY MEDICATIONS
REDUCE CAFFEINE IN TAKE (recommended)
REDUCE ALCOHOL INTAKE
STRESS MANAGEMENT
MEDITATE FOR 5 MIN DAILY
TAKE BLOOD PRESSURE READING DAILY
GET AT LEAST 7 HRS SLEEP NIGHTLY (recommended)

FIG. 12A

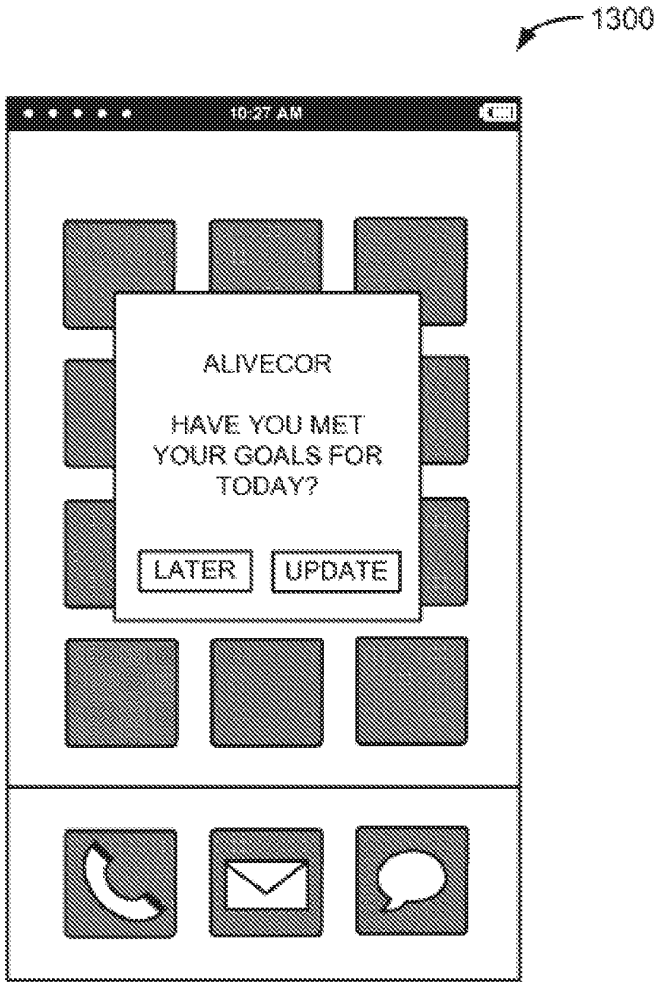
1300
10:27 AM
ALIVECOR
HAVE YOU MET YOUR GOALS FOR TODAY?
LATER
UPDATE

FIG. 13

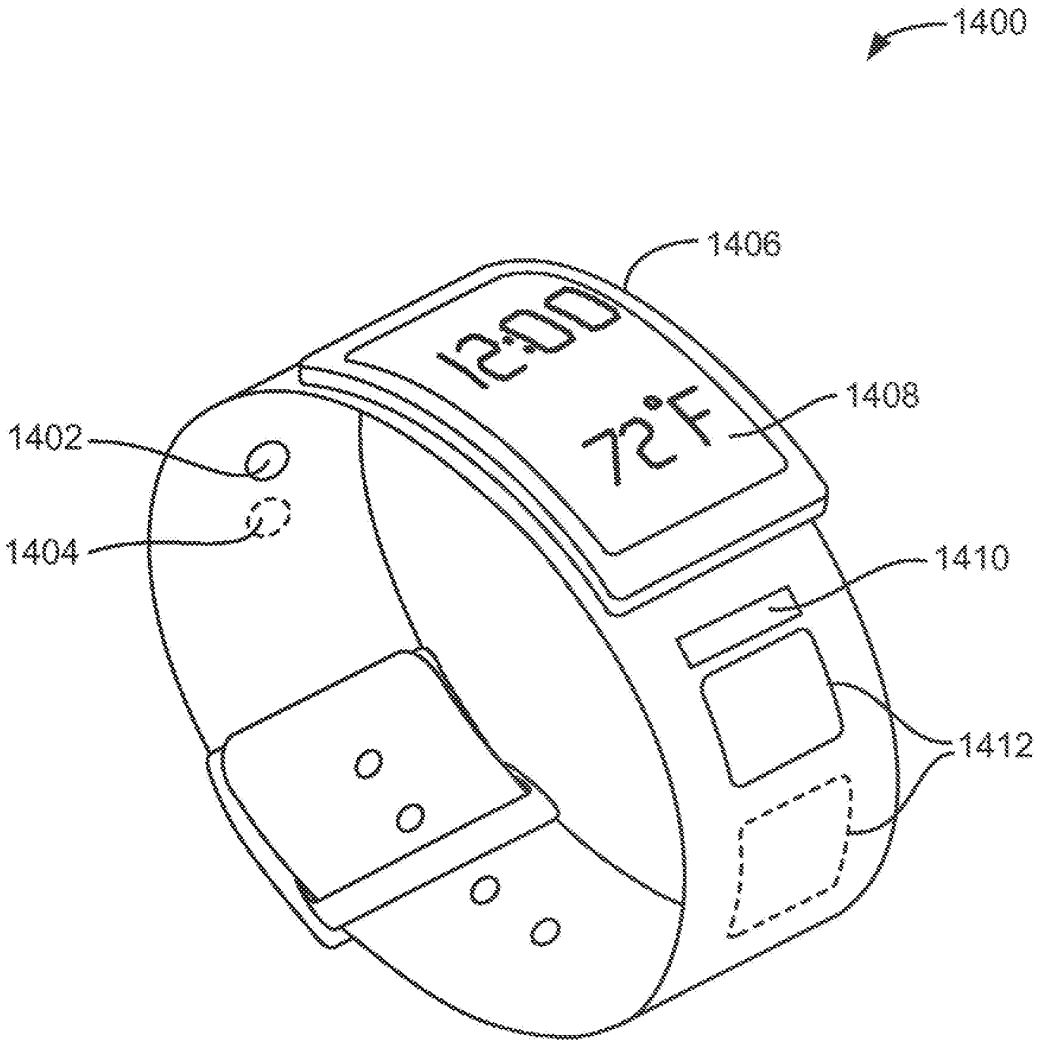

FIG. 14

METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Application Serial No. 16/153,446, filed October 5, 2018, which is a continuation of U.S. Application Serial No. 14/730,122, filed June 3, 2015, now U.S. Patent No. 9,572,499, issued February 21, 2017, which is a continuation of U.S. Application Serial No. 14/569,513 filed December 12, 2014, now U.S. Patent No. 9,420,956, issued August 23, 2016, which claims the benefit of U.S. Provisional Application No. 61/915,113, filed December 12, 2013, which application is incorporated herein by reference, U.S. Provisional Application No. 61/953,616 filed March 14, 2014, U.S. Provisional Application No. 61/969,019, filed March 21, 2014, U.S. Provisional Application No. 61/970,551 filed March 26, 2014 which application is incorporated herein by reference, and U.S. Provisional Application No. 62/014,516, filed June 19, 2014, which application is incorporated herein by reference

BACKGROUND

[0002] The present disclosure relates to medical devices, systems, and methods. In particular, the present disclosure relates to methods and systems for managing health and disease such as cardiac diseases including arrhythmia and atrial fibrillation.

[0003] Cardiovascular diseases are the leading cause of death in the world. In 2008, 30% of all global death can be attributed to cardiovascular diseases. It is also estimated that by 2030, over 23 million people will die from cardiovascular diseases annually. Cardiovascular diseases are prevalent in the populations of high-income and low-income countries alike.

[0004] Arrhythmia is a cardiac condition in which the electrical activity of the heart is irregular or is faster (tachycardia) or slower (bradycardia) than normal. Although many arrhythmias are not life-threatening, some can cause cardiac arrest and even sudden cardiac death. Atrial fibrillation is the most common cardiac arrhythmia. In atrial fibrillation, electrical conduction through the ventricles of heart is irregular and disorganized. While atrial fibrillation may cause no symptoms, it is often associated with palpitations, shortness of breath, fainting, chest, pain or congestive heart failure. Atrial fibrillation is also associated with atrial clot formation, which is associated with clot migration and stroke.

[0005] Atrial fibrillation is typically diagnosed by taking an electrocardiogram (ECG) of a subject, which shows a characteristic atrial fibrillation waveform

[0006] To treat atrial fibrillation, a patient may take medications to slow heart rate or modify the rhythm of the heart. Patients may also take anticoagulants to prevent atrial clot formation and stroke. Patients may even undergo surgical intervention including cardiac ablation to treat atrial fibrillation.

[0007] Often, a patient with arrhythmia or atrial fibrillation is monitored for extended periods of time to manage the disease. For example, a patient may be provided with a Holter monitor or other ambulatory electrocardiography device to continuously monitor a patient's heart rate and rhythm for at least 24 hours.

[0008] Current ambulatory electrocardiography devices such as Holter monitors, however, are typically bulky and difficult for subjects to administer without the aid of a medical professional. For example, the use of Holter monitors requires a patient to wear a bulky device on their chest and precisely place a plurality of electrode leads on precise locations on their chest. These requirements can impede the activities of the subject, including their natural movement, bathing, and showering. Once an ECG is generated, the ECG is sent to the patient's physician who may analyze the ECG and provide a diagnosis and other recommendations. Currently, this process often must be performed through hospital administrators and health management organizations and many patients do not receive feedback in an expedient manner.

SUMMARY

[0009] Disclosed herein are devices, systems, and methods for managing health and disease such as cardiac diseases, including arrhythmia and atrial fibrillation. In particular, a cardiac disease and/or rhythm management system, according to aspects of the present disclosure, allows a user to conveniently document their electrocardiograms (ECG) and other biometric data and receive recommendation(s) and/or goal(s) generated by the system or by a physician in response to the documented data. The cardiac disease and/or rhythm management system can be loaded onto a local computing device of the user, where biometric data can be conveniently entered onto the system while the user may continue to use the local computing device for other purposes. A local computing device may comprise, for example, a computing device worn on the body (e.g. a head-worn computing device such as a Google Glass, a wrist-worn computing device such as a Samsung Galaxy Gear Smart Watch, etc.), a tablet computer (e.g. an Apple iPad, an Apple iPod, a Google Nexus tablet, a Samsung Galaxy Tab, a Microsoft Surface, etc.), a smartphone (e.g. an Apple iPhone, a Google Nexus phone, a Samsung Galaxy phone, etc.)

[0010] A portable computing device or an accessory thereof may be configured to continuously measure one or more physiological signals of a user. The heart rate of the user may be continuously measured. The continuously measurement may be made with a wrist or arm band or a patch in communication with the portable computing device. The portable computing device may have loaded onto (e.g. onto a non-transitory computer readable medium of the computing device) and executing thereon (e.g. by a processor of the computing device) an application for one or more of receiving the continuously measured physiological signal(s), analyzing the physiological signal(s), sending the physiological signal(s) to a remote computer for further analysis and storage, and displaying to the user analysis of the physiological signal(s). The heart rate may be measured by one or more electrodes provided on the computing device or accessory, a motion sensor provided on the computing device or accessory, or by imaging and lighting sources provided on the computing device or accessory. In response to the continuous measurement and recordation of the heart rate of the user, parameters such as heart rate (HR), heart rate variability (R-R variability or HRV), and heart rate turbulence (HRT) may be determined. These parameters and further parameters may be analyzed to detect and/or predict one or more of atrial fibrillation, tachycardia, bradycardia, bigeminy, trigeminy, or other cardiac conditions. A quantitative heart health score may also be generated from the determined parameters. One or more of the heart health score, detected heart conditions, or recommended user action items based on the heart health score may be displayed to the user through a display of the portable computing device.

[0011] The biometric data may be uploaded onto a remote server where one or more cardiac technicians or cardiac specialists may analyze the biometric data and provide ECG interpretations, diagnoses, recommendations such as lifestyle recommendations, and/or goals such as lifestyle goals for subject. These interpretations, diagnoses, recommendations, and/or goals may be provided to the subject through the cardiac disease and/or rhythm management system on their local computing device. The cardiac disease and/or rhythm management system may also include tools for the subject to track their biometric data and the associated interpretations, diagnoses, recommendations, and/or goals from the cardiac technicians or specialists.

[0012] An aspect of the present disclosure includes a dashboard centered around arrhythmia or atrial fibrillation tracking. The dashboard includes a heart score that can be calculated in response to data from the user such as their ECG and other personal information such as age, gender, height, weight, body fat, disease risks, etc. The main driver of this heart score will often be the incidence of the user's atrial fibrillation. Other drivers and influencing factors include the aforementioned personal

information. The heart score will be frequently related to output from a machine learning algorithm that combines and weights many if not all of influencing factors.

[0013] The dashboard will often display and track many if not all of the influencing factors. Some of these influencing factors may be entered directly by the user or may be input by the use of other mobile health monitoring or sensor devices. The user may also use the dashboard as an atrial fibrillation or arrhythmia management tool to set goals to improve their heart score.

[0014] The dashboard may also be accessed by the user's physician (e.g. the physician prescribing the system to the user, another regular physician, or other physician) to allow the physician to view the ECG and biometric data of the user, view the influencing factors of the user, and/or provide additional ECG interpretations, diagnoses, recommendations, and/or goals.

[0015] Another aspect of the present disclosure provides a method for managing cardiac health. Biometric data of a user may be received. A cardiac health score may be generated in response to the received biometric data. One or more recommendations or goals for improving the generated cardiac health score may be displayed to the user. The biometric data may comprise one or more of an electrocardiogram (ECG), dietary information, stress level, activity level, gender, height, weight, age, body fat percentage, blood pressure, results from imaging scans, blood chemistry values, or genotype data. The recommendations or goals may be updated in response to the user meeting the displayed recommendations or goals. The user may be alerted if one or more recommendations or goals have not been completed by the user, for example if the user has not completed one or more recommendations or goals for the day.

[0016] The analysis applied may be through one or more of the generation of a heart health score or the application of one or more machine learning algorithms. The machine learning algorithms may be trained using population data of heart rate. The population data may be collected from a plurality of the heart rate monitoring enabled portable computing devices or accessories provided to a plurality of users. The training population of users may have been previously identified as either having atrial fibrillation or not having atrial fibrillation prior to the generation of data for continuously measured heart rate. The data may be used to train the machine learning algorithm to extract one or more features from any continuously measured heart rate data and identify atrial fibrillation or other conditions therefrom. After the machine learning algorithm has been trained, the machine learning algorithm may recognize atrial fibrillation from the continuously measured heart rate data of a new user who has not yet been identified as having atrial fibrillation or other heart conditions. One or more of training population data or the trained machine learning algorithm may be provided on a central computing device (e.g. be stored on a non-transitory computer readable

medium of a server) which is in communication with the local computing devices of the users and the application executed thereon (e.g. through an Internet or an intranet connection.)

[0017] A set of instructions for managing cardiac health may be downloaded from the Internet. These set of instructions may be configured to automatically generate the cardiac health score. The cardiac health score may be generated using a machine learning algorithm. The machine learning algorithm may generate the cardiac health score of the user and/or the recommendations and/or goals in response to biometric data from a plurality of users. The set of instructions may be configured to allow a medical professional to access the received biometric data. The cardiac health score and/or the recommendations and/or goals may be generated by the medical professional.

[0018] The set of instructions may be stored on a non-transitory computer readable storage medium of one or more of a body-worn computer, a tablet computer, a smartphone, or other computing device. These set of instructions may be capable of being executed by the computing device. When executed, the set of instructions may cause the computing device to perform any of the methods described herein, including the method for managing cardiac health described above.

[0019] Another aspect of the present disclosure provides a system for managing cardiac health. The system may comprise a sensor for recording biometric data of a user and a local computing device receiving the biometric data from the sensor. The local computing device may be configured to display a cardiac health score and one or more recommendations or goals for the user to improve the cardiac health score in response to the received biometric data.

[0020] The system may further comprise a remote server receiving the biometric data from the local computing device. One or more of the local computing device or the remote server may comprise a machine learning algorithm which generates one or more of the cardiac health score or the one or more recommendations or goals for the user. The remote server may be configured for access by a medical professional. Alternatively, or in combination, one or more of the cardiac health score or one or more recommendations or goals may be generated by the medical professional and provided to the local computing device through the remote server.

[0021] The sensor may comprise one or more of a hand-held electrocardiogram (ECG) sensor, a wrist-worn activity sensor, a blood pressure monitor, a personal weighing scale, a body fat percentage sensor, a personal thermometer, a pulse oximeter sensor, or any mobile health monitor or sensor. Often, the sensor is configured to be in wireless communication with the local computing device. The local computing device comprises one or more of a personal computer, a laptop computer, a palmtop computer, a tablet computer, a smartphone, a body-worn computer, or the like.

The biometric data may comprise one or more of an electrocardiogram (ECG), dietary information, stress level, activity level, gender, height, weight, age, body fat percentage, or blood pressure.

[0022] Other physiological signals or parameters such as physical activity, heart sounds, blood pressure, blood oxygenation, blood glucose, temperature, activity, breath composition, weight, hydration levels, an electroencephalograph (EEG), an electromyography (EMG), a mechanomyogram (MMG), an electrooculogram (EOG), etc. may also be monitored. The user may also input user-related health data such as age, height, weight, body mass index (BMI), diet, sleep levels, rest levels, or stress levels. One or more of these physiological signals and/or parameters may be combined with the heart rate data to detect atrial fibrillation or other conditions. The machine learning algorithm may be configured to identify atrial fibrillation or other conditions in response to heart rate data in combination with one or more of the other physiological signals and/or parameters for instance. Triggers or alerts may be provided to the user in response to the measured physiological signals and/or parameters. Such triggers or alerts may notify the user to take corrective steps to improve their health or monitor other vital signs or physiological parameters. The application loaded onto and executed on the portable computing device may provide a health dash board integrating and displaying heart rate information, heart health parameters determined in response to the heart rate information, other physiological parameters and trends thereof, and recommended user action items or steps to improve health.

INCORPORATION BY REFERENCE

[0023] All publications, patents, and patent applications mentioned in this specification are herein incorporated by reference to the same extent as if each individual publication, patent, or patent application was specifically and individually indicated to be incorporated by reference.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The novel features of the subject matter disclosed herein are set forth with particularity in the appended claims. A better understanding of the features and advantages of the present disclosure will be obtained by reference to the following detailed description that sets forth illustrative embodiments, in which the principles of the disclosure are utilized, and the accompanying drawings of which:

[0025] FIG. 1 shows a system for cardiac disease and rhythm management;

[0026] FIG. 2 shows a flow chart of a method 200 for predicting and/or detecting atrial fibrillation from R-R interval measurements;

[0027] FIG. 3 shows a flow chart of a method for predicting and/or detecting atrial fibrillation from R-R interval measurements and for predicting and/or detecting atrial fibrillation from raw heart rate signals;

[0028] FIG. 4 shows an embodiment of the system and method of the ECG monitoring described herein;

[0029] FIG. 5 shows a flow chart of an exemplary method to generate a heart health score in accordance with many embodiments;

[0030] FIG. 6 shows an exemplary method of generating a heart score;

[0031] FIG. 7 shows a schematic diagram of the executed application described herein;

[0032] FIG. 8 shows exemplary screenshots of the executed application;

[0033] FIG. 9 shows an exemplary method for cardiac disease and rhythm management;

[0034] FIG. 10 shows an exemplary method for monitoring a subject to determine when to record an electrocardiogram (ECG);

[0035] FIG. 11 shows an exemplary screenshot of a first aspect of a dashboard application;

[0036] FIG. 11A shows an exemplary screenshot of a second aspect of a dashboard application;

[0037] FIG. 12 shows an exemplary screenshot of a first aspect of a goals and recommendations page of the cardiac disease and rhythm management system interface or mobile app;

[0038] FIG. 12A shows an exemplary screenshot of a second aspect of a goals and recommendations page of the cardiac disease and rhythm management system interface or mobile app;

[0039] FIG. 13 shows an exemplary screenshot of a user's local computing device notifying the user with a pop-up notice to meet their daily recommendations and goals; and

[0040] FIG. 14 shows an embodiment comprising a smart watch which includes at least one heart rate monitor and at least one activity monitor.

DETAILED DESCRIPTION

[0041] Devices, systems, and methods for managing health and disease such as cardiac diseases, including arrhythmia and atrial fibrillation, are disclosed. In particular, a cardiac disease and/or rhythm management system, according to aspects of the present disclosure, allows a user to conveniently document their electrocardiograms (ECG) and other biometric data and receive recommendation(s) and/or goal(s) generated by the system or by a physician in response to the documented data.

[0042] The term "atrial fibrillation," denoting a type of cardiac arrhythmia, may also be abbreviated in either the figures or description herein as "AFIB."

[0043] FIG. 1 shows a system 100 for cardiac disease and rhythm management. The system 100 may be prescribed for use by a user or subject such as being prescribed by the user or subject's regular or other physician or doctor. The system 100 may comprise a local computing device 101 of the user or subject. The local computing device 101 may be loaded with a user interface, dashboard, or other sub-system of the cardiac disease and rhythm management system 100. For example, the local computing device 101 may be loaded with a mobile software application ("mobile app") 101a for interfacing with the system 100. The local computing device may comprise a computing device worn on the body (e.g. a head-worn computing device such as a Google Glass, a wrist-worn computing device such as a Samsung Galaxy Gear Smart Watch, etc.), a tablet computer (e.g. an Apple iPad, an Apple iPod, a Google Nexus tablet, a Samsung Galaxy Tab, a Microsoft Surface, etc.), a smartphone (e.g. an Apple iPhone, a Google Nexus phone, a Samsung Galaxy phone, etc.).

[0044] The local computing device 101 may be coupled to one or more biometric sensors. For example, the local computing device 101 may be coupled to a handheld ECG monitor 103. The handheld ECG monitor 103 may be in the form of a smartphone case as described in co-owned U.S. Patent Applications Nos. 12/796,188 (now U.S. Patent No. 8,509,882), 13/107,738, 13/420,520 (now U.S. Patent No. 8,301,232), 13/752,048, 13/964,490, 13/969,446, 14/015,303, and 14/076,076, the contents of which are incorporated herein by reference.

[0045] In some embodiments, the handheld ECG monitor 103 may be a handheld sensor coupled to the local computing device 101 with an intermediate protective case/adapter as described in U.S. Provisional Application No. 61/874,806, filed Sep. 6, 2013, the contents of which are incorporated herein by reference. The handheld ECG monitor 103 may be used by the user to take an ECG measurement which the handheld ECG monitor 103 may send to the local computing device by connection 103a. The connection 103a may comprise a wired or wireless connection (e.g. a Wi-Fi

connection, a Bluetooth connection, a NFC connection, an ultrasound signal transmission connection, etc.). The mobile software application 101a may be configured to interface with the one or more biometric sensors including the handheld ECG monitor 103.

[0046] The local computing device 101 may be coupled to a wrist-worn biometric sensor 105 through a wired or wireless connection 105a (e.g. a Wi-Fi connection, a Bluetooth connection, a NFC connection, an ultrasound signal transmission connection, etc.). The wrist-worn biometric sensor 105 may comprise an activity monitor such as those available from Fitbit Inc. of San Francisco, CA or a Nike FuelBand available from Nike, Inc. of Oregon. The wrist-worn biometric sensor 105 may also comprise an ECG sensor such as that described in co-owned U.S. Provisional Application No. 61/872,555, the contents of which is incorporated herein by reference.

[0047] The local computing device 101 may be coupled to other biometric devices as well such as a personal scale or a blood pressure monitor 107. The blood pressure monitor 107 may communicate with the local device 101 through a wired or wireless connection 107a (e.g. a Wi-Fi connection, a Bluetooth connection, a NFC connection, an ultrasound signal transmission connection, etc.).

[0048] The local computing device 101 may directly communicate with a remote server or cloud-based service 113 through the Internet 111 via a wired or wireless connection 111a (e.g. a Wi-Fi connection, a cellular network connection, a DSL Internet connection, a cable Internet connection, a fiber optic Internet connection, a T1 Internet connection, a T3 Internet connection, etc.). Alternatively, or in combination, the local computing device 101 may first couple with another local computing device 109 of the user, such as a personal computer of the user, which then communicates with the remote server or cloud-based service 113 via a wired or wireless connection 109a (e.g. a Wi-Fi connection, a cellular network connection, a DSL Internet connection, a cable Internet connection, a fiber optic Internet connection, a T1 Internet connection, a T3 Internet connection, etc.) The local computing device 109 may comprise software or other interface for managing biometric data collected by the local computing device 101 or the biometric data dashboard loaded on the local computing device 101.

[0049] Other users may access the patient data through the remote server or cloud-based service 113. These other users may include the user's regular physician, the user's prescribing physician who prescribed the system 100 for use by the user, other cardiac technicians, other cardiac specialists, and system administrators and managers. For example, a first non-subject user may access the remote server or cloud-based service 113 with a personal computer or other computing device 115 through an Internet connection 115a (e.g. a Wi-Fi connection, a cellular network connection, a DSL Internet connection, a cable Internet connection, a fiber optic Internet connection,

a T1 Internet connection, a T3 Internet connection, etc.). Alternatively, or in combination, the first non-subject user may access the remote server or cloud-based service 113 with a local computing device such as a tablet computer or smartphone 117 through an Internet connection 117a. The tablet computer or smartphone 117 of the first non-subject user may interface with the personal computer 115 through a wired or wireless connection 117b (e.g. a Wi-Fi connection, a Bluetooth connection, a NFC connection, an ultrasound signal transmission connection, etc.). Further, a second non-subject user may access the remote server or cloud-based service 113 with a personal computer or other computing device 119 through an Internet connection 119a (e.g. a Wi-Fi connection, a cellular network connection, a DSL Internet connection, a cable Internet connection, a fiber optic Internet connection, a T1 Internet connection, a T3 Internet connection, etc.). Further, a third non-subject user may access the remote server or cloud-based service 113 with a tablet computer or smartphone 121 through an Internet connection 121a (e.g. a Wi-Fi connection, a cellular network connection, a DSL Internet connection, a cable Internet connection, a fiber optic Internet connection, a T1 Internet connection, a T3 Internet connection, etc.). Further, a fourth non-subject user may access the remote server or cloud-based service 113 with a personal computer or other computing device 123 through an Internet connection 123a (e.g. a Wi-Fi connection, a cellular network connection, a DSL Internet connection, a cable Internet connection, a fiber optic Internet connection, a T1 Internet connection, a T3 Internet connection, etc.). The first non-subject user may comprise an administrator or manager of the system 100. The second non-subject user may comprise a cardiac technician. The third non-subject user may comprise a regular or prescribing physician of the user or subject. And, the fourth non-subject user may comprise a cardiac specialist who is not the user or subject's regular or prescribing physician. Generally, many if not all of the communication between various devices, computers, servers, and cloud-based services will be secure and HIPAA-compliant.

[0050] Aspects of the present disclosure provide systems and methods for detecting and/or predicting atrial fibrillation or other arrhythmias of a user by applying one or more machine learning-based algorithms. A portable computing device (or an accessory usable with the portable computing device) may provide R-R intervals and/or raw heart rate signals as input to an application loaded and executed on the portable computing device. The raw heart rate signals may be provided using an electrocardiogram (ECG) in communication with the portable computing device or accessory such as described in U.S. Ser. Nos. 13/964,490 filed August 12, 2013, 13/420,520 filed March 14, 2013, 13/108,738 filed May 16, 2011, and 12/796,188 filed June 8, 2010. Alternatively, or in combination, the raw heart rate signals may be provided using an on-board heart rate sensor of the portable computing device or by using photoplethysmography implemented by an imaging

source and a light source of the portable computing device. Alternatively, or in combination, the raw heart rate signals may be from an accessory device worn by the user or attached to the user (e.g. a patch) and which is in communication with the portable computing device. Such wearable accessory devices may include Garmin's Vivofit Fitness Band, Fitbit, Polar Heart Rate Monitors, New Balance's Balance Watch, Basis B1 Band, MIO Alpha, Withings Pulse, LifeCORE Heart Rate Monitor strap, and the like.

[0051] R-R intervals may be extracted from the raw heart rate signals. The R-R intervals may be used to calculate heart rate variability (HRV) which may be analyzed in many ways such as using time-domain methods, geometric methods, frequency-domain methods, non-linear methods, long term correlations, or the like as known in the art. Alternatively, or in combination, the R-R intervals may be used for non-traditional measurements such as (i) determining the interval between every other or every three R-waves to evaluate for bigeminy or trigeminy or (ii) the generation of a periodic autoregressive moving average (PARMA).

[0052] The machine learning based algorithm(s) may allow software application(s) to identify patterns and/or features of the R-R interval data and/or the raw heart rate signals or data to predict and/or detect atrial fibrillation or other arrhythmias. These extracted and labelled features may be features of HRV as analyzed in the time domain such as SDNN (the standard deviation of NN intervals calculated over a 24 hour period), SDANN (the standard deviation of the average NN intervals calculated over short periods), RMSSD (the square root of the mean of the sum of the squares of the successive differences between adjacent NNs), SDSD (the standard deviation of the successive differences between adjacent NNs), NN50 (the number of pairs of successive NNs that differ by more than 50 ms), pNN50 (the proportion of NN50 divided by total number of NNs), NN20 (the number of pairs of successive NNs that differ by more than 20 ms), pNN20 (the proportion of NN20 divided by the total number of NNs), EBC (estimated breath cycle), NNx (the number of pairs of successive NNs that differ by more than x ms), pNNx (the proportion of NNx divided by the number of NNs), or other features known in the art. Alternatively, or in combination, the extracted and labelled features may comprise a nonlinear transform of R-R ratio or R-R ratio statistics with an adaptive weighting factor. Alternatively, or in combination, the extracted and labelled features may be features of HRV as analyzed geometrically such as the sample density distribution of NN interval durations, the sample density distribution of differences between adjacent NN intervals, a Lorenz plot of NN or RR intervals, degree of skew of the density distribution, kurtosis of the density distribution, or other features known in the art. Alternatively, or in combination, the extracted and labelled features may be features of HRV in the frequency domain

such as the power spectral density of different frequency bands including a high frequency band (HF, from 0.15 to 0.4 Hz), low frequency band (LF, from 0.04 to 0.15 Hz), and the very low frequency band (VLF, from 0.0033 to 0.04 Hz), or other frequency domain features as known in the art. Alternatively, or in combination, the extracted and labelled features may be non-linear features such as the geometric shapes of a Poincaré plot, the correlation dimension, the nonlinear predictability, the pointwise correlation dimension, the approximate entropy, and other features as known in the art. Other features from the raw heart rate signals and data may also be analyzed. These features include for example a generated autoregressive (AR) model, a ratio of consecutive RR intervals, a normalized ratio of consecutive RR intervals, a standard deviation of every 2, 3, or 4 RR intervals, or a recurrence plot of the raw HR signals, among others.

[0053] The features of the analysis and/or measurement may be selected, extracted, and labelled to predict atrial fibrillation or other arrhythmias in real time, e.g. by performing one or more machine learning operation. Such operations can be selected from among an operation of ranking the feature(s), classifying the feature(s), labelling the feature(s), predicting the feature(s), and clustering the feature(s). Alternatively, or in combination, the extracted features may be labelled and saved for offline training of a machine learning algorithm or set of machine learning operations. For example, the operations may be selected from any of those above. Any number of machine learning algorithms or methods may be trained to identify atrial fibrillation or other conditions such as arrhythmias. These may include the use of decision tree learning such as with a random forest, association rule learning, artificial neural network, inductive logic programming, support vector machines, clustering, Bayesian networks, reinforcement learning, representation learning, similarity and metric learning, sparse dictionary learning, or the like.

[0054] The systems and methods for detecting and/or predicting atrial fibrillation or other conditions such as arrhythmias described herein may be implemented as software provided as a set of instructions on a non-transitory computer readable medium. A processor of a computing device (e.g. a tablet computer, a smartphone, a smart watch, a smart band, a wearable computing device, or the like) may execute this set of instructions to receive the input data and detect and/or predict atrial fibrillation therefrom. The software may be downloaded from an online application distribution platform such as the Apple iTunes or App Store, Google Play, Amazon App Store, and the like. A display of the computing device may notify the user whether atrial fibrillation or other arrhythmias has been detected and/or if further measurements are required (e.g. to perform a more accurate analysis). The software may be loaded on and executed by the portable computing device of the user such as with the processor of the computing device.

[0055] The machine learning-based algorithms or operations for predicting and/or detecting atrial fibrillation or other arrhythmias may be provided as a service from a remote server which may interact or communicate with a client program provided on the computing device of the user, e.g. as a mobile app. The interaction or communication may be through an Application Program Interface (API). The API may provide access to machine learning operations for ranking, clustering, classifying, and predicting from the R-R interval and/or raw heart rate data, for example.

[0056] The machine learning-based algorithms or operations, provided through a remote server and/or on a local application on a local computing device, may operate on, learn from, and make analytical predictions from R-R interval data or raw heart rate data, e.g. from a population of users. The R-R interval or raw heart rate data may be provided by the local computing device itself or an associated accessory, such as described in U.S. Ser. Nos. 13/964,490 filed August 12, 2013, 13/420,520 filed March 14, 2013, 13/108,738 filed May 16, 2011, and 12/796,188 filed June 8, 2010. Thus, atrial fibrillation and other arrhythmias or other heart conditions can be in a convenient, user-accessible way.

[0057] FIG. 2 shows a flow chart of a method 200 for predicting and/or detecting atrial fibrillation from R-R interval measurements. In a step 202, an R-R interval of a user is obtained. In a step 204, the obtained R-R interval is analyzed using one or more traditional heart rate variability measurements such as, for example, time domain measures, frequency domain measures, and non-linear heart rate variability. In a step 206, the obtained R-R interval is analyzed using one or more non-traditional heart rate variability measurements such as, for example, RR (n-i) for Bigeminy and Trigeminy detection, and the generation of a periodic autoregressive moving average (PARMA). In a step 208, a feature selection occurs. In a step 210, a real time prediction or detection of atrial fibrillation, and/or in a step 212, the heart rate variability measurements may be labelled and saved for offline training of a machine learning algorithm or set of machine learning operations, and then may be subsequently used to make a real time prediction and/or detection of atrial fibrillation.

[0058] FIG. 3 shows a flow chart of a method 300 for predicting and/or detecting atrial fibrillation from R-R interval measurements and for predicting and/or detecting atrial fibrillation from raw heart rate signals. In a step 302, raw heart rate signals are obtained from, for example, an ECG of a user. In a step 304, R-R intervals are obtained from the obtained raw hearth signals. In a step 306, the obtained R-R interval is analyzed using one or more traditional heart rate variability measurements such as, for example, time domain measures, frequency domain measures, and non-linear heart rate variability. In a step 308, the obtained R-R interval is analyzed using one or more non-traditional heart rate variability measurements such as, for example, RR (n-i) for bigeminy and trigeminy

detection, and the generation of a periodic autoregressive moving average (PARMA). In a step 310, features from the obtained heart rate features are analyzed using one or more of wavelet features and shape based features from a Hilbert transform. In a step 312, a feature selection occurs. In a step 314, a real time prediction or detection of atrial fibrillation, and/or in a step 316, the heart rate variability measurements may be labelled and saved for offline training of a machine learning algorithm or set of machine learning operations, and then may be subsequently used to make a real time prediction and/or detection of atrial fibrillation.

[0059] Although the above steps show methods 200 and 300 in accordance with many embodiments, a person of ordinary skill in the art will recognize many variations based on the teaching described herein. The steps may be completed in a different order. Steps may be added or deleted. Some of the steps may comprise sub-steps. Many of the steps may be repeated as often as beneficial to the user or subject.

[0060] One or more of the steps of method 200 and 300 may be performed with circuitry, for example, one or more of a processor or a logic circuitry such as a programmable array logic for a field programmable gate array. The circuitry may be programmed to provide one or more of the steps of methods 200 and 300, and the program may comprise program instructions stored on a non-transitory computer readable medium or memory or programmed steps of the logic circuitry such as the programmable array logic or the field programmable gate array, for example.

[0061] Aspects of the present disclosure provide systems and methods for monitoring one or more physiological parameters and providing a trigger message to the user if the one or more physiological parameter meets a pre-determined or learned threshold(s). Two or more of the physiological parameters may be combined to provide a trigger message. That is, a particular trigger message may be provided to the user if two or more pre-determined threshold(s) for the physiological parameter(s) are met.

[0062] Table 1 below shows an exemplary table of physiological parameters that may be measured (left column), features of interest to be measured or threshold types to be met (middle column), and exemplary trigger messages (right column).

TABLE 1

Physiological Parameter	Measurements/Threshold	Sample Trigger Messages
Heart Rate	Heart Rate Variability (HRV), Non-linear Transformation of RR Intervals	Measure ECG; See Your Doctor
Heart Sound	Sound Features	Abnormal Heart Sound; Measure ECG; See Your Doctor
Blood Pressure	Upper and Lower Thresholds	High/Low Blood Pressure; Take BP Medication; Exercise; See Your Doctor
Blood Oxygenation	O2 Saturation, O2 Saturation Variability	High Risk of Hypoventilation; High Risk of Sleep Disorder such as Apnea; See Your Doctor
Blood Glucose	Upper and Lower Thresholds	High Risk of Hypoglycemia; See Your Doctor
Temperature	Temperature, Temperature Changes	Fever; Take OTC Fever Medication; See Your Doctor
Physical Activity (accelerometer data)	Gait, Chest Compressions, Speed, Distance	Monitor Senior or Infant Posture, e.g. if senior/infant has fallen
Electrocardiogram (ECG)	ECG Features (E.g. QT, QRS, PR intervals, HRV ,etc.	High Risk of Certain Cardiac Diseases; Sleep apnea; See Your Doctor
Breath Content (Breathalyzer data)	Percentage of the Certain Chemicals	High Risk of Certain Dental Disease, Diabetes, etc.; See Your Doctor

[0063] The machine learning based algorithms or operations as described herein may be used to determine the appropriate trigger thresholds in response to the raw physiological data input and/or user-input physiological parameters (e.g. age, height, weight, gender, etc.). Features of the raw physiological data input may be selected, extracted, labelled, clustered, and/or analyzed. These processed features may then be analyzed using one or more machine learning operation such as ranking the feature(s), classifying the feature(s), predicting the feature(s), and clustering the feature(s). The various machine learning algorithms described herein may be used to analyze the features to detect and predict health conditions and generate recommendations or user action items to improve the health of the user. For instance, the machine learning algorithms may be trained to identify atrial fibrillation or other conditions in response to the non-heart rate physiological parameter(s) such as age, gender, body mass index (BMI), activity level, diet, and others in combination with the raw heart rate data and HRV that can be extracted therefrom.

[0064] The systems and methods for monitoring one or more physiological parameters and providing a trigger message to the user if the one or more physiological parameter meets a pre-determined threshold(s) described herein may be implemented as software provided as a set of instructions on a non-transitory computer readable medium. A processor of a computing device (e.g. a tablet computer, a smartphone, a smart watch, a smart band, a wearable computing device, or the

like) may execute this set of instructions to receive the input data and detect and/or predict atrial fibrillation therefrom. The software may be downloaded from an online application distribution platform such as the Apple iTunes or App Store, Google Play, Amazon App Store, and the like. The software may be loaded on and executed by the portable computing device of the user such as with the processor of the computing device. The software may also provide both the triggering application described herein and the heart rate monitoring and analysis for detecting atrial fibrillation or other heart conditions described herein.

[0065] In an embodiment, a method and system for longitudinal monitoring of a patient's or any consumer's (after referred to as "patient") health using various ECG monitoring devices is described herein. The ECG monitoring devices generate ECG signal data which can be stored in a database for further analysis. The ECG data, which can be stored in a database along with other patient information, can be analyzed by a processing device, such as a computer or server, using various algorithms.

[0066] Various ECG monitoring or recording devices, hereinafter referred to as ECG monitoring devices, can be used to record the ECG data. For example, the ECG monitoring device can be a handheld, portable, or wearable smartphone based device, as described in U.S. Patent No. 8,301,232, which is herein incorporated by reference in its entirety for all purposes. A smartphone based device, or a device having wireless or cellular telecommunication capabilities, can transmit the ECG data to a database or server directly through the internet. These types of ECG monitoring devices as well as other ECG monitoring devices include portable devices, wearable recording devices, event recorders, and Holter monitors. Clinical or hospital based ECG recording devices can also be used and integrated into the system. Such devices may be able to transmit stored ECG data through a phone line or wirelessly through the internet or cellular network, or may need to be sent to a data collection center for data collection and processing. The ECG data can be tagged with the type of ECG monitoring device used to record the data by, for example, including it in metadata for indexing and searching purposes.

[0067] The ECG monitoring devices can be single lead devices or multiple lead devices, where each lead generally terminates with an electrode. Some embodiments may even be leadless and have electrodes that are integrated with the body or housing of the device, and therefore have a predetermined relationship with each other, such as a fixed spacing apart from each other. The orientation and positioning of the single lead in a single lead device or of each lead of the multiple lead device or of the electrodes of the leadless device can be transmitted with the ECG data. The lead and/or electrode placement may be predetermined and specified to the patient in instructions for

using the device. For example, the patient may be instructed to position the leads and/or electrodes with references to one or more anatomical landmarks on the patient's torso. Any deviation from the predetermined lead and/or electrode placement can be notated by the patient or user when transmitting the ECG data. The lead and electrode placement may be imaged using a digital camera, which may be integrated with a smart phone, and transmitted with the ECG data and stored in the database. The lead and electrode placement may be marked on the patient's skin for imaging and for assisting subsequent placement of the leads and electrodes. The electrodes can be attached to the skin using conventional methods which may include adhesives and conducting gels, or the electrodes may simply be pressed into contact with the patient's skin. The lead and electrode placement may be changed after taking one recording or after recording for a predetermined or variable amount of time. The ECG data can be tagged with the numbers of leads and/or electrodes and the lead and/or electrode placement, including whether adhesives and/or conducting gels were used. Again, this information can be including in metadata for indexing and searching purposes.

[0068] The ECG signal data can be continuously recorded over a predetermined or variable length of time. Continuous ECG recording devices can record for up to 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, or 14 days. Alternatively, or additionally, the ECG data can be recorded on demand by the patient at various discrete times, such as when the patient feels chest pains or experiences other unusual or abnormal feelings. The on demand ECG recorder can have a memory buffer that can record a predetermined amount of ECG data on a rolling basis, and when activated by the patient to record a potential event, a predetermined amount of ECG data can be saved and/or transmitted. The predetermined amount of ECG data can include a predetermined amount of ECG data before activation and a predetermined amount of ECG data after activation such that a window of ECG data is captured that encompasses the potential event. The time period between ECG recordings may be regular or irregular. For example, the time period may be once a day, once a week, once a month, or at some other predetermined interval. The ECG recordings may be taken at the same or different times of days, under similar or different circumstances, as described herein. One or more baseline ECGs can be recorded while the patient is free of symptoms. The baseline ECGs can be periodically recorded and predetermined intervals and/or on-demand. The same ECG recording device or different ECG recording devices may be used to record the various ECG of a particular patient. All this information may be tagged to or associated with the ECG data by, for example, including it in the metadata for indexing and searching purposes.

[0069] The ECG data can be time stamped and can be annotated by the patient or health care provider to describe the circumstances during which the ECG was recorded, preceding the ECG

recording, and/or following the ECG recording. For example, the system and device can have a user interface for data entry that allows the patient to enter in notes regarding the conditions and circumstances surrounding the ECG recording. This additional data can be also included as metadata for indexing and searching purposes. For example, location, food, drink, medication and/or drug consumption, exercise, rest, sleep, feelings of stress, anxiety, pain or other unusual or abnormal feelings, or any other circumstance that may affect the patient's ECG signal can all be inputted into the device, smart phone, computer or other computing device to be transmitted to the server or database along with the ECG data. The annotated data can also include the patient's identity or unique identifier as well as various patient characteristics including age, sex, race, ethnicity, and relevant medical history. The annotated data can also be time stamped or tagged so that the ECG data can be matched or correlated with the activity or circumstance of interest. This also allows comparison of the ECG before, after and during the activity or circumstance so that the effect on the ECG can be determined.

[0070] The ECG data and the associated metadata can be transmitted from the device to a server and database for storage and analysis. The transmission can be real-time, at regular intervals such as hourly, daily, weekly and any interval in between, or can be on demand. The metadata facilitates the searching, organizing, analyzing and retrieving of ECG data. Comparison and analysis of a single patient's ECG data can be performed, and/or comparison of ECG data between patients can be performed. For example, the metadata can be used to identify and select a subset of ECG data where an activity or circumstance, such as the taking of medication, occurred within a predetermined amount of time to the ECG data. The components of the ECG signal data, such as the P wave, T wave, and QRS complex and the like, the amplitudes of the components, the ratios between the components, the width of the components, and the delay or time separation between the components, can be extracted, compared, analyzed, and stored as ECG features. For example, the P wave and heart rate can be extracted and analyzed to identify atrial fibrillation, where the absence of P waves and/or an irregular heart rate may indicate atrial fibrillation. The extracted ECG features can also be included in the metadata for indexing and searching.

[0071] The changes in the ECG signal over time in view of the activities and circumstances can be compared with changes over time and circumstances observed within a database of ECG's. Comparisons may include any comparison of data derived from any other ECG signal or any database of ECG's or any subset of ECG data, or with data derived from any database of ECG's. Changes in any feature of the ECG signal over time may be used for a relative comparison with similar changes in any ECG database or with data derived from an ECG database. The ECG data

from the baseline ECG and the ECG data from a potential adverse event can be compared to determine the changes or deviations from baseline values. In addition, both the baseline ECG and the ECG data recorded from the patient can be compared to one or more predetermined template ECGs which can represent a normal healthy condition as well as various diseased conditions, such as myocardial infarction and arrhythmias.

[0072] The comparisons and analysis described herein can be used to draw conclusions and insights into the patient's health status, which includes potential health issues that the patient may be experiencing at the time of measurement or at future times. Conclusions and determinations may be predictive of future health conditions or diagnostic of conditions that the patient already has. The conclusions and determinations may also include insights into the effectiveness or risks associated with drugs or medications that the patient may be taking, have taken or may be contemplating taking in the future. In addition, the comparisons and analysis can be used to determine behaviors and activities that may reduce or increase risk of an adverse event. Based on the comparisons and analysis described herein, the ECG data can be classified according to a level of risk of being an adverse event. For example, the ECG data can be classified as normal, low risk, moderate risk, high risk, and/or abnormal. The normal and abnormal designation may require health care professional evaluation, diagnosis, and/or confirmation.

[0073] Diagnosis and determination of an abnormality, an adverse event, or a disease state by physicians and other health care professionals can be transmitted to the servers and database to be tagged with and associated with the corresponding ECG data. The diagnosis and determination may be based on analysis of ECG data or may be determined using other tests or examination procedures. Professional diagnosis and determinations can be extracted from the patient's electronic health records, can be entered into the system by the patient, or can be entered into the system by the medical professional. The conclusions and determinations of the system can be compared with actual diagnosis and determinations from medical professions to validate and/or refine the machine learning algorithms used by the system. The time of occurrence and duration of the abnormality, adverse event or disease state can also be included in the database, such that the ECG data corresponding with the occurrence and/or the ECG data preceding and/or following the abnormality, adverse event or disease state can be associated together and analyzed. The length of time preceding or following the abnormality may be predetermined and be up to 1 to 30 days, or greater than 1 to 12 months. Analysis of the time before the abnormality, adverse event or disease state may allow the system to identify patterns or correlations of various ECG features that precede the occurrence of the abnormality, adverse event or disease state, thereby providing advance detection or warning of the

abnormality, adverse event or disease state. Analysis of the time following the abnormality, adverse event or disease state can provide information regarding the efficacy of treatments and/or provide the patient or physician information regarding disease progression, such as whether the patient's condition in improving, worsening or staying the same. The diagnosis and determination can also be used for indexing by, for example, including it in the metadata associated with the corresponding ECG data.

[0074] As described herein, various parameters may be included in the database along with the ECG data. These may include the patient's age, gender, weight, blood pressure, medications, behaviors, habits, activities, food consumption, drink consumption, drugs, medical history and other factors that may influence a patient's ECG signal. The additional parameters may or may not be used in the comparison of the changes in ECG signal over time and circumstances.

[0075] The conclusions, determinations, and/or insights into the patient's health generated by the system may be communicated to the patient directly or via the patient's caregiver (doctor or other healthcare professional). For example, the patient can be sent an email or text message that is automatically generated by the system. The email or text message can be a notification which directs the patient to log onto a secure site to retrieve the full conclusion, determination or insight, or the email or text message can include the conclusion, determination or insight. Alternatively, or additionally, the email or text message can be sent to the patient's caregiver. The notification may also be provided via an application on a smartphone, tablet, laptop, desktop or other computing device.

[0076] As described herein, the system can identify behaviors, habits, activities, foods, drinks, medications, drugs, and the like which are associated with the patient's abnormal ECG readings. In addition to informing the patient of these associations, the system can provide instructions or recommendations to the patient to avoid these behaviors, habits, activities, foods, drinks, medications, drugs, and the like which are associated with the patient's abnormal ECG readings. Similarly, the system can identify behaviors, habits, activities, foods, drinks, medications, drugs, and the like which are associated with normal or improving ECG readings, and can instruct or recommend that the patient perform these behaviors, habits, and activities and/or consume these foods, drinks, medications, and drugs. The patient may avoid a future healthcare issue, as instructed or recommended by the system, by modifying their behavior, habits or by taking any course of action, including but not limited to taking a medication, drug or adhering to a diet or exercise program, which may be a predetermined course of action recommended by the system independent of any analysis of the ECG data, and/or may also result from insights learned through this system

and method as described herein. In addition, the insights of the system may relate to general fitness and or mental wellbeing.

[0077] The ECG data and the associated metadata and other related data as described herein can be stored in a central database, a cloud database, or a combination of the two. The data can be indexed, searched, and/or sorted according to any of the features, parameters, or criteria described herein. The system can analyze the ECG data of a single patient, and it can also analyze the ECG data of a group of patients, which can be selected according to any of the features, parameters or criteria described herein. When analyzing data from a single patient, it may be desirable to reduce and/or correct for the intra-individual variability of the ECG data, so that comparison of one set of ECG data taken at one particular time with another set of ECG data taken at another time reveals differences resulting from changes in health status and not from changes in the type of ECG recording device used, changes in lead and electrode placement, changes in the condition of the skin (i.e. dry, sweaty, conductive gel applied or not applied), and the like. As described above, consistent lead and electrode placement can help reduce variability in the ECG readings. The system can also retrieve the patient's ECG data that were taken under similar circumstances and can analyze this subset of ECG data.

[0078] FIG. 4 illustrates an embodiment of the system and method 400 of ECG monitoring described herein. The system can be implemented on a server or computer having a processor for executing the instructions described herein, which can be stored in memory. In step 402, ECG data can be recorded using any of the devices described herein for one or more patients. In step 404, the ECG data is transmitted along with associated metadata to a server and database that stores the ECG data. In step 406, a subset of the ECG data can be selected based on criteria in the metadata, such as user identity, time, device used to record the ECG data, and the like. In step 408, the subset of ECG data can be analyzed using a machine learning algorithm, which can assign a risk level to the ECG data in step 410. The system can then determine whether the risk level is high, as shown in step 412. If the risk level is low, the user can be notified that the ECG is normal or low risk, as shown in step 414. If the risk level is high, a high risk level alert can be sent to the patient with the option of sending the ECG to the medical professional for interpretation, as shown in step 416. The system then waits for the user's response to determine whether the patient elects to send the ECG to the medical professional for interpretation, as shown in step 418. If the patient does not wish to send the ECG to the medical professional for interpretation, the system can end the routine at this point, as shown in 420. If the patient does elect to send the ECG to the medical professional for interpretation, the request can be transmitted to the medical professional in step 422. The request to

the medical professional can be sent to a workflow auction system as described in U.S. Provisional Application No. 61/800,879, filed March 15, 2013, which is herein incorporated by reference in its entirety for all purposes. Once the medical professional has interpreted the ECG, the system can receive and store the ECG interpretation from the medical professional in the database, as shown in step 424. The system can then notify the user of the professional ECG interpretation, which can be sent to or accessed by the user, as shown in step 426. Additionally, the system can compare the assigned risk level with the medical diagnosis in step 428 and can determine whether the risk level determined by the system agrees with the medical diagnosis in step 430. If the risk level does not agree with the medical diagnosis, the machine learning algorithm can be adjusted until the risk level matches the medical diagnosis, as shown in step 432. If the risk level does agree with the medical diagnosis, the routine can be ended as shown in step 434.

[0079] Although the above steps show a method 400 in accordance with many embodiments, a person of ordinary skill in the art will recognize many variations based on the teaching described herein. The steps may be completed in a different order. Steps may be added or deleted. Some of the steps may comprise sub-steps. Many of the steps may be repeated as often as beneficial to the user or subject.

[0080] One or more of the steps of a method 400 may be performed with circuitry, for example, one or more of a processor or a logic circuitry such as a programmable array logic for a field programmable gate array. The circuitry may be programmed to provide one or more of the steps of a method 400, and the program may comprise program instructions stored on a non-transitory computer readable medium or memory or programmed steps of the logic circuitry such as the programmable array logic or the field programmable gate array, for example.

[0081] Aspects of the present disclosure provide systems and methods for generating a heart health score in response to continuously measured or monitored physiological parameter(s). The score may be given a quantitative value such as be graded from A to F or 0 to 100 for example (e.g. a great score may be an A or 100, a good score may be a B or 75, a moderate score may be a C or 50, a poor score may be a D or 25, and a failing score may be an F or 0.) If an arrhythmia is detected, the score may be below 50 for example. Other scoring ranges such as A to Z, 1 to 5, 1 to 10, 1 to 1000, etc. may also be used. Arrhythmia may be detecting using the machine learning based operations or algorithms described herein.

[0082] FIG. 5 shows a flow chart of an exemplary method 500 to generate a heart health score in accordance with many embodiments.

[0083] In a step 502, an arrhythmia is detected. If an arrhythmia is detected (e.g. using the methods and/or algorithms disclosed herein), then the heart health score generated will be below 50. Depending on the severity of the arrhythmia detected, the heart score may be calculated or assigned within the ranges according to the table below in Table 2.

TABLE 2

Arrhythmia	Heart Health score
ATRIAL FIBRILLATION, HR below 100	30-45
ATRIAL FIBRILLATION, HR above 100	15-30
Sinus Tachycardia	20-40
Supraventricular Tachycardia	20-40
Bradycardia	20-40
Bigeminy, Trigeminy	30-50
Short runs of High Heart Rate (VTACH suspect)	10-30

[0084] In a step 504 a Heart Rate Variability (HRV) is calculated. HRV can be an indicator of heart health. The value for HRV value for a healthy heart is typically higher than HRV for an unhealthy heart. Also, HRV typically declines with age and may be affected by other factors, like stress, lack of physical activity, etc. HRV may be measured and analyzed using the methods described above. HRV may be calculated in the absence of arrhythmia, which may improve the accuracy of the HRV measurement. HRV may be determined and further analyzed as described above.

[0085] In a step 506, premature beats are counted and Heart Rate Turbulence (HRT) is calculated. Premature beats in the sequence of R-R intervals may be detected. Also, R-R intervals typically tend to recover at a certain pace after a premature beat. Using these two parameters (prematurity and pace of R-R recovery), HRT parameters may be calculated. There may be known deviations of HRT parameters associated with patients with risk of Congestive Heart Failure (CHF). These deviations, however, may be used to estimate an inverse measure. The number of premature beats per day (or per hour) may also be used as a measure of heart health. A low number of premature beats may indicate better heart health. In summary, the heart health score may be generated by combining at least heart rate variability (HRV), the number of premature beats, and heart rate turbulence (HRT). This combination (in the absence of arrhythmia) may provide an accurate estimate of how healthy the heart of the user is.

[0086] In a step 508, a heart health score is generated, and in a step 510, a hearth health score is generated based on an arrhythmia. To initially generate the score, a few hours (e.g. 2-5 hours) of

measured R-R intervals may be required. A more accurate score may be generated after a week of continuous R-R interval measurements. Longer data sets may be required to detect significant arrhythmias as they may usually be detected within the first 7-8 days of monitoring.

[0087] Although the above steps show a method 500 in accordance with many embodiments, a person of ordinary skill in the art will recognize many variations based on the teaching described herein. The steps may be completed in a different order. Steps may be added or deleted. Some of the steps may comprise sub-steps. Many of the steps may be repeated as often as beneficial to the user or subject.

[0088] One or more of the steps of a method 500 may be performed with circuitry, for example, one or more of a processor or a logic circuitry such as a programmable array logic for a field programmable gate array. The circuitry may be programmed to provide one or more of the steps of a method 500, and the program may comprise program instructions stored on a non-transitory computer readable medium or memory or programmed steps of the logic circuitry such as the programmable array logic or the field programmable gate array, for example.

[0089] FIG. 6 shows a further method 600 of generating a heart score. In addition to the parameters which may be derived from the heart rate data described above, the heart health score may also be generated in response to further physiological parameters as shown in FIG. 6.

[0090] In a step 602, a raw ECG waveform is obtained. In a step 608, ECG parameters are extracted from the raw ECG waveform data and arrhythmia prediction and/or detection algorithms are run to analyze the obtained raw ECG waveform data.

[0091] In a step 604, physiological parameters may be measured using a sensor of the user's local computing device or an accessory thereof. Such measured physiological parameters may include blood pressure, user activity and exercise level, blood oxygenation levels, blood sugar levels, an electrocardiogram, skin hydration or the like of the user. These physiological parameters may be measured over time such as over substantially the same time scale or length as the measurement of heart rate. In a step 610, an R-R interval is extracted and both traditional and non-traditional heart rate measures are used to analyze the measured heart rate and physiological parameters.

[0092] In a step 606, additional physiological parameters for determining the heart health score may be input by the user. These parameters may include the age, the gender, the weight, the height, the body type, the body mass index (BMI), the personal medical history, the family medical history, the exercise and activity level, the diet, the hydration level, the amount of sleep, the cholesterol level, the alcohol intake level, the caffeine intake level, the smoking status, and the like of the user. For example, the heart health score may be weighted by age and/or gender to provide the user an

accurate assessment of his or her heart health in response to the heart rate data. In a step 612, feature extraction is used to analyze the inputted physiological parameters.

[0093] In a step 614 feature ranking and/or feature selection occurs. In a step 618, a real time prediction or detection of atrial fibrillation, and/or in a step 616, the heart rate variability measurements may be labelled and saved for offline training of a machine learning algorithm or set of machine learning operations, and then may be subsequently used to make a real time prediction and/or detection of atrial fibrillation. A plurality of heart health scores may be generated by a plurality of users to generate a set of population data. This population data may be used to train the machine learning algorithms described herein such that the trained algorithm may be able to detect and predict atrial fibrillation or other health conditions from user data.

[0094] Although the above steps show a method 600 in accordance with many embodiments, a person of ordinary skill in the art will recognize many variations based on the teaching described herein. The steps may be completed in a different order. Steps may be added or deleted. Some of the steps may comprise sub-steps. Many of the steps may be repeated as often as beneficial to the user or subject.

[0095] One or more of the steps of a method 600 may be performed with circuitry, for example, one or more of a processor or a logic circuitry such as a programmable array logic for a field programmable gate array. The circuitry may be programmed to provide one or more of the steps of a method 600, and the program may comprise program instructions stored on a non-transitory computer readable medium or memory or programmed steps of the logic circuitry such as the programmable array logic or the field programmable gate array, for example.

[0096] The systems and methods for generating a heart health score in response to continuously measured or monitored physiological parameter(s) may comprise a processor of a computing device and software. A processor of a computing device (e.g. a tablet computer, a smartphone, a smart watch, a smart band, a wearable computing device, or the like) may execute this set of instructions to receive the input data and detect and/or predict atrial fibrillation therefrom. The software may be downloaded from an online application distribution platform such as the Apple iTunes or App Store, Google Play, Amazon App Store, and the like. A display of the computing device may notify the user of the calculated heart health score and/or if further measurements are required (e.g. to perform a more accurate analysis).

[0097] FIG. 7 shows a schematic diagram of the executed application described herein. The heart health score may be provided on a software application such as a mobile app downloaded from an application distribution platform and executed on a local computing device of the user as described

above. This executed application may instruct the user to take active steps in response to a poor or moderate heart health score. For example, the instructions to the user may be to make a corrective measure such as to modify his or her diet, exercise pattern, sleep pattern, or the like. Alternatively, or in combination, the instructions to the user may be to take a further step such as to take an electrocardiogram (e.g. to verify the presence of an arrhythmia), enroll in an electrocardiogram over-read service, or schedule an appointment with a physician or other medical specialist. If the heart health score is below a desired threshold for good heart health, the executed application may link the user to a second execute application with further application features. Alternatively, or in combination, these further features may be unlocked on the first executed application if the heart health score is below the threshold. In at least some cases, a prescription or verification from a medical professional may also be required to unlock the further application features.

[0098] FIG. 8 shows screenshots of the executed application. The further features unlocked may include the ability to read electrocardiogram (ECG) data from a sensor coupled to the local computing device and display the electrocardiogram (ECG) in real-time and/or detect and alert for atrial fibrillation based on the electrocardiogram (ECG) in real-time (e.g. as described in U.S. Appln. Nos. 12/796,188, 13/108,738, 13/420,540, and 13/964,490). As shown in FIG. 8, these further features may include an electrocardiogram (ECG) over-read service such as that described in U.S. Appln. No. 14/217,032. The first executed application may comprise a consumer software application and the second executed application may comprise a medical professional or regulated software application or set of features of the first executed application. As described herein and shown in FIG. 8, the executed application may provide a dash board to track the heart health of the user and show risk factors which may be monitored and tracked by the user. The dash board may be provided with further features such as that described in U.S. Ser. No. 61/915,113 (filed 12/12/2013).

[0099] FIG. 9 shows a method 900 for cardiac disease and rhythm management, which may, for example, be implemented with the system 100 described herein. In a step 902, a user or subject is provided access to a cardiac disease and/or rhythm management system such as system 100. Step 902 may comprise prescribing the use of the system 100 for the user or subject. In a step 904, the user or subject is provided one or more biometric sensors. These biometric sensor(s) may couple to a computing device of the user or subject, e.g. a personal desktop computer, a laptop computer, a tablet computer, a smartphone, etc., and associated software loaded thereon.

[00100] In a step 906, the user or subject downloads the cardiac disease and/or rhythm management system software onto their computing device. For example, the system software may comprise a mobile software application ("mobile app") downloaded from the Apple App Store,

Google Play, Amazon Appstore, BlackBerry World, Nokia Store, Windows Store, Windows Phone Store, Samsung Apps Store, and the like. The downloaded system software, e.g. mobile app 101a, may be configured to interface with the biometric sensors provided to the user or subject in the step 154.

[00101] In a step 908, personal information input to the cardiac disease management system is received. For example, the user or subject may enter his or her gender, height, weight, diet, disease risk factors, etc. into the mobile app 101a. Alternatively, or in combination, this personal information may be input on behalf of the user or subject, for example, by a physician of the user or subject.

[00102] In a step 910, biometric data is received from the biometric sensors provided to the user or subject. For example, the system 100 and the mobile app 101a may receive ECG data and heart rate from handheld sensor 103, activity data from wrist-worn activity sensor 105, blood pressure and heart rate data from mobile blood pressure monitor 107a, and other data such as weight and body fat percentage data from a "smart" scale in communication with the local computing device 101.

[00103] In a step 912, a cardiac health score is generated. The cardiac health score can be generated by considering and weighing one or more influencing factors including the incidence of atrial fibrillation or arrhythmia as detected by the handheld ECG monitor, the heart rate of the user or subject, the activity of the user or subject, hours of sleep and rest of the user or subject, blood pressure of the user or subject, etc. Often, the incidence of atrial fibrillation or arrhythmia will be weighed the most. The cardiac health score may be generated by a physician or a machine learning algorithm provided by the remote server or cloud-based service 113, for example. A plurality of users and subject may concurrently use the cardiac health and/or rhythm management system 100 and the machine learning algorithm may, for example, consider population data and trends to generate an individual user or subject's cardiac health score.

[00104] In a step 914, one or more recommendations or goals is generated for the user or subject based on or in response to the generated cardiac health score. These recommendation(s) and/or goal(s) may be generated automatically based on or in response to the biometric and personal information of the user or subject. For example, the machine learning algorithm may generate these recommendation(s)/goal(s). Alternatively, or in combination, a physician or other medical specialist may generate the recommendation(s) and/or goal(s), for example, based on or in response to the biometric and personal information of the user or subject. The physician or other medical professional may access the patient data through the Internet as described above.

[00105] In a step 916, the patient implements many if not all of the recommendation(s) and/or goal(s) provided to him or her. And in a step 916, steps 908 to 916 may be repeated such that the user or subject may iteratively improve their cardiac health score and their overall health.

[00106] Although the above steps show method 900 of managing cardiac disease and/or rhythm in accordance with many embodiments, a person of ordinary skill in the art will recognize many variations based on the teaching described herein. The steps may be completed in a different order. Steps may be added or deleted. Some of the steps may comprise sub-steps. Many of the steps may be repeated as often as beneficial to the user or subject.

[00107] One or more of the steps of the method 900 may be performed with circuitry, for example, one or more of a processor or a logic circuitry such as a programmable array logic for a field programmable gate array. The circuitry may be programmed to provide one or more of the steps of the method 900, and the program may comprise program instructions stored on a non-transitory computer readable medium or memory or programmed steps of the logic circuitry such as the programmable array logic or the field programmable gate array, for example.

[00108] In some embodiments, the heart rate information (or an extracted portion of HR information) may be used to compare to a database of similar information that has been correlated with cardiac events. For example, heart rate information may be compared to a database of HR information extracted for ECG recordings of patients known to be experiencing cardiac problems. Thus, patterns of heart rate information taken from a subject may be compared to patterns of cardiac information in a database. If there is a match (or a match within a reasonable closeness of fit), the patient may be instructed to record an ECG, e.g. using an ambulatory ECG monitor. This may then provide a more detailed view of the heart. This method may be particularly useful, as it may allow recording and/or transmission and/or analysis of detailed electrical information about the heart at or near the time (or shortly thereafter) when a clinically significant cardiac event is occurring. Thus, the continuous monitoring may allow a subject to be alerted immediately upon an indication of the potential problem (e.g. an increase in HRV suggestive of a cardiac dysfunction). This may allow the coupling of continuous HR monitoring with ECG recording and analysis for disease diagnosis and disease management.

[00109] FIG. 10 illustrates one variation of a method for monitoring a subject to determine when to record an electrocardiogram (ECG). In FIG. 10, a subject is wearing a continuous heart rate monitor (configured as a watch 1010, including electrodes 1016), shown in step 1002. The heart rate monitor transmits (wirelessly 1012) heart rate information that is received by the smartphone 1018, as shown in step 1004. The smartphone includes a processor that may analyze the heart rate

information 1004, and when an irregularity is determined, may indicate 1006 to the subject that an ECG should be recorded. In FIG. 10, an ambulatory ECG monitor 1014 is attached (as a case having electrodes) to the phone 1018. The user may apply the ECG monitor as to their body (e.g. chest, between arms, etc.) 1008 to record ECGs that can then be saved and/or transmitted for analysis.

[00110] FIGS. 11 and 11A show screenshots of an atrial fibrillation dashboard 1100 of a user interface for the cardiac disease and/or rhythm management system 100. FIG. 11 shows a top portion 1100a of the atrial fibrillation dashboard 1100 while FIG. 10A shows a bottom portion 1100b of the atrial fibrillation dashboard 1100.

[00111] The top portion 1100a of the atrial fibrillation dashboard 1100 as shown in FIG. 10 may display the current cardiac health score of the user or subject, a recent best cardiac health score of the user or subject, and a completion percentage of recommendation(s) and/or goal(s) for the user or subject. The user or subject may tap any one of the cardiac health score displays or the recommendation(s) and/or goal(s) displays to access more detailed information regarding the calculated health score(s) or recommendation(s) and/or goal(s), respectively. The top portion 1100a may also show an ECG of the user or subject and a button which may be tapped to record the ECG of the user or subject for the day. As discussed with reference to FIG. 1, the ECG may be recorded with a handheld sensor 103 in communication with the local computing device 100. The top portion 1000a may also show the number of atrial fibrillation episodes and the average duration of these atrial fibrillation episodes. This number and duration may be generated automatically by software or logic of the mobile app 101a based on or in response to the ECG measurements taken by the user or subject. Alternatively, or in combination, a physician may access the atrial fibrillation dashboard 1100 of an individual user or subject, evaluate his or her ECGs, and provide the number of atrial fibrillation episodes and their duration to the mobile app 101a or other software loaded on the local computing device 101 of the user or subject. The shortest and longest durations of the atrial fibrillation episodes may also be shown by the top portion 1100a as well as the user or subject's daily adherence to a medication regime.

[00112] The bottom portion 1100b of the atrial fibrillation dashboard 1100 as shown in FIG. 10A may display one or more influencers which influence how the cardiac health score is generated. These influencers may include, for example, caffeine intake, alcohol intake, stress levels, sleep levels, weight, nutrition, fitness and activity levels, and blood pressure. Data for these influencers may be input automatically by one or more biometric sensors coupled to the local computing device 101 and/or the mobile app 101a. Alternatively, or in combination, the data for these influencers may

be input manually by the user or subject by tapping on the respective influencer display. For example, tapping on the blood pressure display area may cause a slider input 1100c for blood pressure to pop up. The user or subject may use the slider to enter and save his or her blood pressure for the day. Similar pop-ups or user-selected inputs may be provided for the other influencers. For example, the user or subject may enter his or her daily caffeine or alcohol intake, stress and sleep levels, nutrition levels, or activity and fitness levels (e.g. low/bad, medium/so-so, or high/good based on the user's age, gender, height, weight, etc. as can be indicated by an instruction page of the mobile app 101a). The influencer displays may also show the goal progression of the user or subject.

[00113] FIGS. 12 and 12A show screenshots of a goals and recommendations page 1200 of the cardiac disease and rhythm management system interface or mobile app 101a. A top portion 1200a of the goals and recommendations page 1100 may comprise a listing of 7-day goals for the user or subject. The top portion 1200a may further comprise everyday goals for the user or subject which often cannot be removed or changed. The user or subject can check off these goals or recommendations as he or she meets them. The top portion 1200a may track goal completion percentage over a 7-day period. The user or subject can set the same goals for the next day and/or set new goals.

[00114] A bottom portion 1200b of the goals and recommendations page 1200 may comprise a listing of new goals which the user or subject may add. The new goals may be categorized into goals or recommendations for atrial fibrillation management, stress management, and/or other categories. For example, goals for atrial fibrillation management may include taking daily medications, reducing caffeine intake, and reducing alcohol intake. And, goals for stress management may include meditate for 5 minutes daily, take blood pressure reading daily, and getting at least 7 hours of sleep nightly. Using the goals and recommendations page 1200, the user or subject can set their goals for the week. One or more of these goals may be automatically recommended to the user or subject or be recommended by a physician having access to the dashboard 1100. For example, goals may be recommended based on last week's progress. The completion of recommended goals can result in the user or subject earning more "points," in effect gamifying health and cardiac rhythm management for the user or subject. Alternatively, or in combination, the goals may be set by a physician having access to the dashboard 1100.

[00115] FIG. 13 shows a screenshot of a user's local computing device notifying the user with a pop-up notice 1300 to meet their daily recommendations and goals. By tapping on the pop-up

notice, 1300, the user or subject can be taken to the atrial fibrillation dashboard where the user or subject can update or otherwise manage their cardiac health.

[00116] FIG. 14 shows an embodiment comprising a smart watch 1400 which includes at least one heart rate monitor 1402 and at least one activity monitor 1404. One or more processors are coupled to one or more non-transitory memories of the smart watch and configured to communicate with the heart rate monitor 1402 and the activity monitor 1404. The one or more processors are further coupled to an output device 1408. Processor executable code is stored on the one or more memories and when executed by the one or more processors causes the one or more processors to determine if heart rate and activity measurements represent an advisory condition for recording an ECG, and generate and send notification signals through the output device 1408 when an advisory condition for recording an ECG is determined.

[00117] For example, presently available smart watches include motion sensors such as pedometers. Pedometers can be based on an accelerometer or electromechanical mechanism such as a pendulum, magnetic reed proximity switch, and a spring suspended lever arm with metal-on-metal contact. Modern accelerometers are often small micro electro-mechanical systems and are well known by those skilled in the art. Heart rate monitors are readily available with smart phones as well as smart watches. One type uses an optical sensor to detect the fluctuation of blood flow. The signal can be amplified further using, for example, a microcontroller to count the rate of fluctuation, which is actually the heart rate.

[00118] An advisory condition for recording an ECG may occur due to, for example, large continuing fluctuations in heart rate. An advisory condition for recording an ECG can also occur when a measured heart rate increases rapidly without a corresponding increase in activity monitored by, for example, an accelerometer. By comparing measured heart rate changes with measured activity changes, the presently disclosed software or "app" minimizes false alarms are minimized. ECG devices are described in U.S. Ser. No 12/796,188, filed June 8, 2010, now U.S. Patent No. 8,509,882, hereby expressly incorporated herein by reference in its entirety. The ECG device can be present in a smart watch band or a smart phone. In one embodiment, the ECG device includes an electrode assembly configured to sense heart-related signals upon contact with a user's skin, and to convert the sensed heart-related signals to an ECG electric signal. The ECG device transmits an ultrasonic frequency modulated ECG signal to a computing device such as, for example, a smartphone. Software running on the computing device or smartphone digitizes and processes the audio in real-time, where the frequency modulated ECG signal is demodulated. The ECG can be further processed using algorithms to calculate heart rate and identify arrhythmias. The ECG, heart

rate, and rhythm information can be displayed on the computer or smartphone, stored locally for later retrieval, and/or transmitted in real-time to a web server via a 2G/3G/4G, Wi-Fi or other Internet connection. In addition to the display and local processing of the ECG data, the computer or smartphone can transmit, in real-time, the ECG, heart rate and rhythm data via a secure web connection for viewing, storage and further analysis via a web browser interface.

[00119] In another embodiment, the converter assembly of an ECG device is integrated with, and electrically connected to the electrode assembly and is configured to convert the electric ECG signal generated by electrode assembly to a frequency modulated ECG ultrasonic signal having a carrier frequency in the range of from about 18 kHz to about 24 kHz. It is sometimes desirable to utilize a carrier frequency in the 20 kHz to 24 kHz range. The ultrasonic range creates both a lower noise and a silent communication between the acquisition electronics and the computing device such as the smartphone, notebook, smart watch and the like.

[00120] A kit can include downloadable software such as an "app" for detecting an advisory condition for recording an ECG and an ECG device. The ECG device can be present on a watch band for replacing a specific band on a smart watch. The ECG device can also be provided on a smart phone back plate for replacing an existing removable smartphone back. In another configuration, the ECG device is usable as a smartphone protective case.

[00121] Software on the smartphone or smart watch can also combine data and signals from other sensors built into the smartphone or smart watch such as a GPS.

[00122] While preferred embodiments of the present disclosure have been shown and described herein, it will be obvious to those skilled in the art that such embodiments are provided by way of example only. Numerous variations, changes, and substitutions will now occur to those skilled in the art without departing from the subject matter described herein. It should be understood that various alternatives to the embodiments of the subject matter described herein may be employed in practicing the subject matter described herein. It is intended that the following claims define the scope of the disclosure and that methods and structures within the scope of these claims and their equivalents be covered thereby.

CLAIMS

WHAT IS CLAIMED IS:

1. A smart watch to detect the presence of an arrhythmia of a user, comprising:

a processing device;

a photoplethysmography ("PPG") sensor operatively coupled to the processing device;

an ECG sensor, comprising two or more ECG electrodes, the ECG sensor operatively coupled to the processing device;

a display operatively coupled to the processing device; and

a memory, operatively coupled to the processing device, the memory having instructions stored thereon that, when executed by the processing device, cause the processing device to:

receive PPG data from the PPG sensor;

detect, based on the PPG data, the presence of an arrhythmia;

receive ECG data from the ECG sensor; and

confirm the presence of the arrhythmia based on the ECG data.

2. The smart watch of claim 1, further comprising a motion sensor operatively coupled to the processing device, wherein to detect the presence of the arrhythmia, the processing device is configured to:

receive motion sensor data from the motion sensor; and

determine, from motion sensor data, that the user is at rest.

3. The smart watch of claim 2, wherein to detect the presence of the arrhythmia, the processing device is configured to input the PPG data into a machine learning algorithm trained to detect arrhythmias.

4. The smart watch of claim 2, wherein to detect the presence of the arrhythmia, the processing device is configured to:

determine heartrate variability ("HRV") data from the PPG data; and

detect, based on the HRV data, the presence of the arrhythmia.

5. The smart watch of claim 4, wherein to detect the presence of the arrhythmia, the processing device is configured to input the HRV data into a machine learning algorithm trained to detect arrhythmias.

6. The smart watch of claim 5, wherein to detect the presence of the arrhythmia, the processing device is further configured to input the motion sensor data with the HRV data into the machine learning algorithm trained to detect arrhythmias.

7. The smart watch of claim 1, wherein the processing device is further configured to:

extract one or more features from the PPG data; and

detect, based on the one or more features, the presence of the arrhythmia.

8. The smart watch of claim 7, wherein the one or more features correspond to an HRV signal analyzed in a time domain.

9. The smart watch of claim 7, wherein the one or more features comprise a nonlinear transform of R-R ratio or R-R ratio statistics with an adaptive weighting factor.

10. The smart watch of claim 7, wherein the one or more features are features of an HRV signal analyzed geometrically.

11. The smart watch of claim 7, wherein the one or more features are features of an HRV signal analyzed in the frequency domain.

12. The smart watch of claim 1, wherein the processing device is further configured to generate a notification of the detected arrhythmia.

13. The smart watch of claim 1, further comprising a biometric data sensor, wherein the processing device is further configured to:

receive biometric data of the user from the biometric data sensor; and

detect, based on the biometric data, the presence of the arrhythmia.

14. The smart watch of claim 13, wherein the biometric data comprises at least one of: a temperature, a blood pressure, or an inertial data of the user.

15. The smart watch of claim 1, the processing device further configured to display an ECG rhythm strip from the ECG data.

16. The smart watch of claim 1, the processing device further to receive the ECG data from the ECG sensor in response to receiving an indication of a user action.

17. A method to detect the presence of an arrhythmia of a user on a smart watch, comprising:
receiving PPG data from a PPG sensor of the smartwatch;
detecting by a processing device, based on the PPG data, the presence of an arrhythmia;
receiving ECG data from an ECG sensor of the smartwatch; and
confirming the presence of the arrhythmia based on the ECG data.

18. The method of claim 17, wherein detecting the presence of the arrhythmia comprises:
receiving motion sensor data from a motion sensor of the smartwatch; and
determine, from motion sensor data, that the user is at rest.

19. The method of claim 18, wherein detecting the presence of the arrhythmia comprises inputting the PPG data into a machine learning algorithm trained to detect arrhythmias.

20. The method of claim 18, wherein detecting the presence of the arrhythmia comprises:
determining heartrate variability ("HRV") data from the PPG data; and
detecting, based on the HRV data, the presence of the arrhythmia.

21. The method of claim 20, wherein detecting the presence of the arrhythmia comprises inputting the HRV data into a machine learning algorithm trained to detect arrhythmias.

22. The method of claim 21, wherein detecting the presence of the arrhythmia comprises inputting the motion sensor data with the HRV data into the machine learning algorithm trained to detect arrhythmias.

23. The method of claim 17, further comprising generating a notification of the detected arrhythmia.

24. The method of claim 17, further comprising receiving the ECG data from the ECG sensor in response to receiving an indication of a user action.

25. A non-transitory computer-readable storage medium including instructions that, when executed by a processing device, cause the processing device to:

receive PPG data from a PPG sensor of the smartwatch;

detect by the processing device, based on the PPG data, the presence of an arrhythmia;

receive ECG data from an ECG sensor of the smartwatch; and

confirm the presence of the arrhythmia based on the ECG data.

26. The non-transitory computer-readable storage medium of claim 25, wherein the processing device is further configured to:

extract one or more features from the PPG data; and

detect, based on the one or more features, the presence of the arrhythmia.

27. The non-transitory computer-readable storage medium of claim 26, wherein the one or more features correspond to an HRV signal analyzed in a time domain.

28. The non-transitory computer-readable storage medium of claim 26, wherein the one or more features comprise a nonlinear transform of R-R ratio or R-R ratio statistics with an adaptive weighting factor.

29. The non-transitory computer-readable storage medium of claim 26, wherein the one or more features are features of an HRV signal analyzed geometrically or in the frequency domain.

30. The non-transitory computer-readable storage medium of claim 25, the processing device further to receive the ECG data from the ECG sensor in response to receiving an indication of a user action.

ABSTRACT OF THE DISCLOSURE

A dashboard centered around arrhythmia or atrial fibrillation tracking is provided. The dashboard includes a heart or cardiac health score that can be calculated in response to data from the user such as their ECG and other personal information and cardiac health influencing factors. The dashboard also provides to the user recommendations or goals, such as daily goals, for the user to meet and thereby improve their heart or cardiac health score. These goals and recommendations may be set by the user or a medical professional and routinely updated as his or her heart or cardiac health score improves or otherwise changes. The dashboard is generally displayed from an application provided on a smartphone or tablet computer of the user.

Electronic Patent Application Fee Transmittal	
Application Number:	
Filing Date:	
Title of Invention:	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING
First Named Inventor/Applicant Name:	Ravi GOPALAKRISHNAN
Filer:	William D Jacobs Jr/Aaron Dunn
Attorney Docket Number:	A102992 1170US.C4
Filed as Large Entity	
Filing Fees for **Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a)**	

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
REQUEST FOR PRIORITIZED EXAMINATION	1817	1	4000	4000
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	1202	10	100	1000
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
PROCESSING FEE, EXCEPT PROV. APPLS.	1830	1	140	140
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**6860**

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Title of Invention:	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING
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Filer Authorized By:	William D Jacobs Jr
Attorney Docket Number:	A102992 1170US.C4
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The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	A102992_1170USC4_ADS.pdf	1830103 236057c996a7e57e42ad9991ad1cc7aa39e6ca8c	no	11
Warnings:					
Information:					
2	TrackOne Request	A102992_1170USC4_Track_One.pdf	115050 0bbe6df4078042084e5c953188eaf367a6bc116e	no	2
Warnings:					
Information:					
3	Drawings-other than black and white line drawings	A102992_1170USC4_Drawings.pdf	2269541 5321e164c658a3ae9456998b2aae68cacd552430	no	16
Warnings:					
Information:					
4		A102992_1170USC4_Spec_.pdf	279321 94a885fd49aff5464a4565f7d7f204e4194547d7	yes	37

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	32
Claims	33	36
Abstract	37	37

Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	42143 dcb394c3f363c80308025dc5b9fcfc3c8f6c614a	no	2

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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PTO/AIA/14 (11-15)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	A102992 1170US.C4
	Application Number	
Title of Invention	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

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☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

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PTO/AIA/14 (11-15)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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Title of Invention	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING	

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Postal Code	94041	**Country**	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	151512

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	A102992 1170US.C4
	Application Number	
Title of Invention	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING	

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Application Information:

Title of the Invention	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING		
Attorney Docket Number	A102992 1170US.C4	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	16	**Suggested Figure for Publication (if any)**	

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Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	● Customer Number	US Patent Practitioner	◯ Limited Recognition (37 CFR 11.9)
Customer Number	151512		

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	A102992 1170US.C4
	Application Number	
Title of Invention	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING	

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	16153446	2018-10-05
Prior Application Status	Patented		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
16153446	Continuation of	15393077	2016-12-28	10159415	2018-12-25
Prior Application Status	Patented		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15393077	Continuation of	14730122	2015-06-03	9572499	2017-02-21
Prior Application Status	Patented		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14730122	Continuation of	14569513	2014-12-12	9420956	2016-08-23
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14569513	Claims benefit of provisional	62014516	2014-06-19
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14569513	Claims benefit of provisional	61970551	2014-03-26
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14569513	Claims benefit of provisional	61969019	2014-03-21
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14569513	Claims benefit of provisional	61953616	2014-03-14

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Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14569513	Claims benefit of provisional	61915113	2013-12-12
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.			Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

			Remove
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.			Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	A102992 1170US.C4
	Application Number	
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Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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	Application Number	
Title of Invention	METHODS AND SYSTEMS FOR ARRHYTHMIA TRACKING AND SCORING	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1 Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

● Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.	Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	AliveCor, Inc.		
Mailing Address Information For Applicant:			
Address 1	444 Castro St., Suite 600		
Address 2			
City	Mountain View	**State/Province**	US
Country	US	Postal Code	94041
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

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Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

Signature:

Remove

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Bill Jacobs/			Date (YYYY-MM-DD)	2019-09-30
First Name	William D.	Last Name	Jacobs, Jr.	Registration Number	74758

Additional Signature may be generated within this form by selecting the Add button. Add

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Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent CooperationTreaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

DocCode – SCORE

SCORE Placeholder Sheet for IFW Content

Application Number: 16588201 Document Date: 09/30/2019

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