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(71)**Name of Applicant :**
1)Dr.D.Subbarao
Address of Applicant :Professor and Vice-Principal, Department of ECE, Siddhartha Institute of Engineering and Technology, Ibrahimpatnam, Hyderabad, Telangana, India. Pin Code:501506 Telangana India
2)Mr.G.Suresh Kumar
3)Mr.G.Nagarajan
4)Mr.Raghu Kumar Lingamallu
5)Mr.Venkata Rao Yanamadni
6)Dr.Kandunuri Ramakrishna
7)Dr.A.V.Sudhakara Reddy
8)Dr.Sushma Jaiswal
9)Mr.Tarun Jaiswal
10)Mr.K.Uma Shankar
(72)**Name of Inventor :**
1)Dr.D.Subbarao
2)Mr.G.Suresh Kumar
3)Mr.G.Nagarajan
4)Mr.Raghu Kumar Lingamallu
5)Mr.Venkata Rao Yanamadni
6)Dr.Kandunuri Ramakrishna
7)Dr.A.V.Sudhakara Reddy
8)Dr.Sushma Jaiswal
9)Mr.Tarun Jaiswal
10)Mr.K.Uma Shankar

(57) Abstract :
ABSTRACT A WEARABLE ARTICLE WITH SENSORS AND ML & AI MODULES FOR ANALYSING BEHAVIOUR OF USER [032] The present invention discloses a wearable article with sensors and ML & AI modules for analysing behaviour of a user. The wearable article includes, but not limited to, a plurality of sensors to receive varied body vitals of the user; a processing unit to receive the input from the sensors in conjunction with an artificial intelligence interface and a machine learning interface. The artificial intelligence interface and the machine learning interface are configured with an updated database repository on as server to learn and trained the input data for a desired output to analyse the human behaviour. Further, the processing unit is configured to provide a plurality of inferences by comparing a confidence level of the generated inference to a first predetermined threshold. Accompanied Drawing [FIG. 1]

No. of Pages : 19 No. of Claims : 10

FORM 2

THE PATENTS ACT, 1970

(39 of 1970)

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The Patent Rules, 2003

COMPLETE SPECIFICATION

(See section 10 and rule 13)

TITLE OF THE INVENTION

"A WEARABLE ARTICLE WITH SENSORS AND ML & AI MODULES FOR ANALYSING BEHAVIOUR OF USER"

We, Applicant(s)

NAME	NATIONALITY	ADDRESS
1. Dr.D.Subbarao	Indian	Professor and Vice-Principal, Department of ECE, Siddhartha Institute of Engineering and Technology, Ibrahimpatnam, Hyderabad, Telangana, India. Pin Code:501506
2. Mr.G.Suresh Kumar	Indian	Assistant Professor, Department of Electronics and Communication Engineering, Vinayaka Mission's Kirupananda Variyar Engineering College (A Constituent College of Vinayaka Mission's Research Foundation Deemed to be University), NH-47, Sankari Main Road, Periya Seeragapadi(PO), Salem, Tamil Nadu, India. Pin Code:636308

3. Mr.G.Nagarajan	Indian	Assistant Professor, Department of Information Technology, KSR College of Engineering, Tiruchengode, Tamil Nadu, India. Pin Code:637215
4. Mr.Raghu Kumar Lingamallu	Indian	Assistant Professor, Department of Computer Science and Engineering, KG Reddy College of Engineering and Technology, Hyderabad, Telangana, India. Pin Code: 501504
5. Mr.Venkata Rao Yanamadni	Indian	Assistant Professor, Department of Computer Science and Engineering, KG Reddy College of Engineering & Technology, Hyderabad, Telangana, India. Pin Code:501504
6. Dr.Kandunuri Ramakrishna	Indian	Assistant Professor, Department of Computer science & Engineering, J.B Institute of Engineering & Technology, Moinabad, Hyderabad, Telangana, India. Pin Code:500075
7. Dr.A.V.Sudhakara Reddy	Indian	Associate Professor, Department of EEE, Malla Reddy Engineering College, Secunderabad, Telangana, India. Pin Code:500100
8. Dr.Sushma Jaiswal	Indian	Assistant Professor, Department of Computer Science & Information Technology (CSIT), Guru Ghasidas Vishwavidyalaya (A Central University), Koni, Bilaspur, Chhattisgarh, India. Pin Code: 495009
9. Mr.Tarun Jaiswal	Indian	Research Scholar, Department of Computer Application, National Institute of Technology (NITRR), Raipur, Chhattisgarh, India. Pin Code:492010
10. Mr.K.Uma Shankar	Indian	Assistant Professor, Department of Computer Science & Engineering, KG Reddy College of Engineering and Technology, Moinabad, Hyderabad, Telangana, India. Pin Code:501504

The following specification particularly describes the nature of the invention and the manner in which it is performed:

FIELD OF THE INVENTION

[001] The present invention relates to a wearable device to analyse human behavioural data which includes his confidence level, his state of mind, by analysing his physiological, psychological and biochemical. The invention more particularly relates to a wearable article with sensors and ML & AI modules for analysing behaviour of a user.

BACKGROUND OF THE INVENTION

[002] The present invention is directed towards a method and electronics arrangement for a wearable article, and in particular towards performing human behaviour analyse by machine learning and artificial intelligence operations on the wearable article on a cloud network connected data associated with the wearable article.

[003] In the present invention, wearable articles includes sensors to measure properties such as the physiological, psychological, biochemical, environmental and behavioural traits of a user wearing the wearable device. The whole data sensed by the wearable articles are used to be modelled by machine-learning applications and in particular to learn and train models for recognizing properties of the user and/or the activities the user is undertaking. To test and validate machine-learned models from data sensed by a number of wearable articles, it is conventionally required that the wearable articles all transmit data to a central server or a computing device present in a computer network. The implemented computational server has the computational resources to further train machine-learned data models using large data sets received from the wearable articles.

[004] One drawback of the conventional approach is that it requires concentrate on and excavate online daily record, but these daily records were not sufficient to sight when describing user's behavioural without considering his/her physical body vitals; Secondly, large-scale website generally has huge online discrete dat, and real-time behavior and the contextual information amount of generation are huge,.

[005] Thus, a need exists for a method and apparatus that can sense and monitor, provide feedback about, and ultimately assist in controlling and assessing human behaviour that substantially eliminates the problems associated with the prior art.

[006] Accordingly, there is therefore a need for a wearable article with sensors and ML & AI modules for analysing behaviour of a user. The proposed system overcomes the effects by replacing the general wired arrangement into a normal wearable non-wired and a machine learning modelled processing unit. Therefore, it would be useful and desirable to have a smart wearable device, assembly and interface to meet the above-mentioned needs.

SUMMARY OF THE PRESENT INVENTION

[007] In view of the foregoing disadvantages inherent in the known types of conventional set up for analysing human behaviour and his state of mind, are now present in the prior art, the present invention provides and wearable article with sensors and ML & AI modules for analysing behaviour of a user and its working methods thereof. The system is designed with, but not limited to, at least two housings, in which the first housing is implemented with a wearable article having the fixed assembly such as but not limited to, plurality

of sensors, which is communicatively coupled with the second units such as, but not limited to, a computing device having a processing unit connected with further one or more other computing devices, which has all the advantages of the prior art and none of the disadvantages.

[008] The main aspect of the present invention is to provide a system for evaluating the user behavioural data which includes his confidence level, his state of mind, by analysing his physiological, psychological and biochemical changes in his body, which is further monitored under the ML & AI model using deep learning on the computing device. The system further helps in forensic science to analyse the persons different different body effects, stimulation, observations and reactions on listening and viewing for a particular event by the user.

[009] Another object of the present invention is to replace the conventional device having the problem such as discreet data values that cannot evaluate undesirable behaviors, which is solved by the present invention by incorporating orientation and/or gesture recognition into a single device worn as a wearable article.

[010] It is an important aspect of the present invention to provide sensors, which includes an optical sensor, force sensor, electrical sensor temperature sensor and, acoustic sensor. The optical sensor may further comprise a photoplethysmography, PPG, sensor. The force sensor may further comprise an accelerometer, a magnetometer and a gyroscope. The electrical sensor may further comprise at least one of an electropotential potential sensor and an electroimpedance sensor. In addition, the electropotential sensor comprises electrocardiaography, ECG, sensor and/or an electromyography,

EMG, sensor, based on the electrioimpedance sensor comprised of a skin conductance sensor.

[011] Another object of the present invention is to provide the machine learning interface, which is capable to calibrate and handle the whole process precisely according to the desired level by receiving the first data and generating varied inferences from the electronics arrangement for the wearable article and further, updating the data values of the machine-learned model using the first data obtained from the wearable article and the generated inferences by various comparisons and modelling using deep learning algorithm.

[012] In this respect, before explaining at least one object of the invention in detail, it is to be understood that the invention is not limited in its application to the details of set of rules and to the arrangements of the various models set forth in the following description or illustrated in the drawings. The invention is capable of other objects and of being practiced and carried out in various ways, according to the need of that industry. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of description and should not be regarded as limiting.

[013] These together with other objects of the invention, along with the various features of novelty which characterize the invention, are pointed out with particularity in the disclosure. For a better understanding of the invention, its operating advantages and the specific objects attained by its uses, reference should be made to the accompanying drawings and descriptive matter in which there are illustrated preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[014] The invention will be better understood and objects other than those set forth above will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

[015] FIG. 1 illustrates a schematic diagram of a wearable article with sensors and ML & AI modules for analysing behaviour of a user, in accordance with an embodiment of the present invention; and

[016] FIG. 2 illustrates a block diagram having the Machine Learning interface and AI based learning and testing for the wearable article with sensors and ML & AI modules for analysing behaviour of a user, in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[017] While the present invention is described herein by way of example using embodiments and illustrative drawings, those skilled in the art will recognize that the invention is not limited to the embodiments of drawing or drawings described and are not intended to represent the scale of the various components. Further, some components that may form a part of the invention may not be illustrated in certain figures, for ease of illustration, and such omissions do not limit the embodiments outlined in any way. It should be understood that the drawings and detailed description thereto are not intended to limit the invention to the particular form disclosed, but on the contrary, the invention is to cover all modifications, equivalents, and alternatives falling within the scope of the present invention as defined by the appended claims. As used throughout this description, the word "may" is used in a permissive

sense (i.e. meaning having the potential to), rather than the mandatory sense, (i.e. meaning must). Further, the words "a" or "an" mean "at least one" and the word "plurality" means "one or more" unless otherwise mentioned. Furthermore, the terminology and phraseology used herein is solely used for descriptive purposes and should not be construed as limiting in scope. Language such as "including," "comprising," "having," "containing," or "involving," and variations thereof, is intended to be broad and encompass the subject matter listed thereafter, equivalents, and additional subject matter not recited, and is not intended to exclude other additives, components, integers or steps. Likewise, the term "comprising" is considered synonymous with the terms "including" or "containing" for applicable legal purposes. Any discussion of documents, acts, materials, devices, articles and the like is included in the specification solely for the purpose of providing a context for the present invention. It is not suggested or represented that any or all of these matters form part of the prior art base or were common general knowledge in the field relevant to the present invention.

[018] In this disclosure, whenever a composition or an element or a group of elements is preceded with the transitional phrase "comprising", it is understood that we also contemplate the same composition, element or group of elements with transitional phrases "consisting of", "consisting", "selected from the group of consisting of, "including", or "is" preceding the recitation of the composition, element or group of elements and vice versa.

[019] The present invention is described hereinafter by various embodiments with reference to the accompanying drawings, wherein reference numerals used in the accompanying drawing correspond to the like elements throughout

the description. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiment set forth herein. Rather, the embodiment is provided so that this disclosure will be thorough and complete and will fully convey the scope of the invention to those skilled in the art. In the following detailed description, numeric values and ranges are provided for various aspects of the implementations described. These values and ranges are to be treated as examples only and are not intended to limit the scope of the claims. In addition, a number of materials are identified as suitable for various facets of the implementations. These materials are to be treated as exemplary and are not intended to limit the scope of the invention.

[020] Referring now to the drawings, these are illustrated in **FIGS. 1 & 2**, the present invention discloses a wearable article with sensors and ML & AI modules for analysing behaviour of a user. The wearable article and device are comprised of, but not limited to, a plurality of sensors to receive varied body vitals of the user, a processing unit to receive the input from the sensors in conjunction with an artificial intelligence interface and a machine learning interface. The artificial intelligence interface and the machine learning interface are configured with an updated database repository on as server to learn and trained the input data for a desired output to analyse the human behaviour. Further, the processing unit is configured to provide a plurality of inferences by comparing a confidence level of the generated inference to a first predetermined threshold.

[021] In accordance with another embodiment of the present invention, the sensors are configured to detect physiological, psychological and biochemical

changes in user body. The sensors includes, but not limited to, a temperature sensor such as a skin temperature sensor. A skin temperature sensor is a thermopile arranged to capture infrared energy and transform it into an electrical signal that represents the temperature. The sensor includes, but not limited to, a humidity sensor such as to measure skin surface wetness. The sensor includes, but not limited to, an acoustic sensor. The acoustic sensor includes, but not limited to, a microphone. The acoustic sensor can be arranged to measure the user's voice. The acoustic sensor is arranged to measure other (typically low power) sounds emitted from the user, such as the user's heart. The wearable article is having other sensors for measuring other signals these sensors can be biosensors for measuring biosignals of the user. "Biosignals" is defined as any signal obtained from a living being that can be measured and monitored.

[022] In accordance with another embodiment of the present invention, the plurality of inferences is generated by the data modelling using a backwards propagation error approach, a weight imprinting behavioural approach, transfer learning approach and the like. Further, the generated plurality of inferences is further classified into varied activities of the user for making the final inference about user, by a classifier module based on the deep learning data modelling.

[023] In accordance with another embodiment of the present invention, the processing unit is further configured with a display unit to show the varied effects of the human behavior in the form graphical representation and data values thresholds. Further, the processing unit is connected with other processing units in a cloud network or a computer network to analyse a big

data through the artificial intelligence interface and the machine learning interface.

[024] In accordance with another embodiment of the present invention, all the analysed behaviour and output data is further stored in the online updated database repository to create a big-data analytics.

[025] In accordance with another embodiment of the present invention, the wearable article is provided with a wired or wireless communication module to connect the wearable article with the processing unit and a battery is further provided with the wearable article for maintaining the power consumption of all stored electronic components in the wearable article. The communication module is configured to provide communication with the wearable articles and one or more processing units over one or more networks.

[026] In accordance with another embodiment of the present invention, the machine learning interface is deployed so as to perform computationally efficient precise calculation by previous learning and training using a hardware. This implementation enables on-device machine-learning to perform despite size, power and other constraints of the wearable article.

[027] In accordance with another embodiment of the present invention, the processing unit determines to update the whole data using machine-learned model with deep learning, then the processing unit updates the machine-learned model. In these implementations. The online updated database repository is provided to enable the wearable article to receive an initial data values for comparison of the machine-learned model and communicate updated machine-learned model data to the computation server.

[028] The above-mentioned device, system, method and wearable article provides the user behavioural data which includes his confidence level, his state of mind, by analysing his physiological, psychological and biochemical changes in his body, which is further monitored under the ML & AI model using deep learning on the computing device. The system can be used in forensic science to analyse the persons varied body vitals, stimulation, observations and reactions on listening and viewing for a particular event by the user.

[029] It is to be understood that the above description is intended to be illustrative, and not restrictive. For example, the above-discussed embodiments may be used in combination with each other. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description.

[030] The benefits and advantages which may be provided by the present invention have been described above with regard to specific embodiments. These benefits and advantages, and any elements or limitations that may cause them to occur or to become more pronounced are not to be construed as critical, required, or essential features of any or all of the embodiments.

[031] While the present invention has been described with reference to particular embodiments, it should be understood that the embodiments are illustrative and that the scope of the invention is not limited to these embodiments. Many variations, modifications, additions and improvements to the embodiments described above are possible. It is contemplated that these variations, modifications, additions and improvements fall within the scope of the invention.

We Claim:

1. A wearable article and device with sensors for analysing behaviour of a user, comprising:

a plurality of sensors to receive varied body vitals of the user;

a processing unit to receive the input from the sensors in conjunction with an artificial intelligence interface and a machine learning interface;

wherein the artificial intelligence interface and the machine learning interface are configured with an updated database repository on as server to learn and trained the input data for a desired output to analyse the human behavior; and

wherein the processing unit is configured to provide a plurality of inferences by comparing a confidence level of the generated inference to a first predetermined threshold.

2. The device as claimed in claim **1**, wherein the sensors are configured to detect physiological, psychological and biochemical changes in user body.

3. The device as claimed in claim **1**, wherein the plurality of inferences is generated by the data modelling using a backwards propagation error approach, a weight imprinting behavioral approach, transfer learning approach and the like.

4. The device as claimed in claim **1**, wherein the generated plurality of inferences is further classified into varied activities of the user for making the final inference about user, by a classifier module based on the deep learning data modelling.

5. The device as claimed in claim **1**, wherein the processing unit is further configured with a display unit to show the varied effects of the human behaviour in the form graphical representation and data values thresholds.

6. The device as claimed in claim **1**, wherein the processing unit is connected with other processing units in a cloud network or a computer network to analyse a big data through the artificial intelligence interface and the machine learning interface.

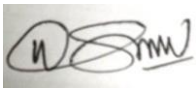
7. The device as claimed in claim **1**, wherein all the analysed behaviour and output data is further stored in the online updated database repository to create a big-data analytics.

8. The device as claimed in claim **1**, wherein the sensors is used in the wearable article such as, but not limited to, an optical sensor, a force sensor, an electrical sensor, temperature sensor, an acoustic sensor, and the like.

9. The device as claimed in claim **1**, wherein the wearable article is provided with a wired or wireless communication module to connect the wearable article with the processing unit.

10. The device as claimed in claim **1**, wherein a battery is further provided with the wearable article for maintaining the power consumption of all stored electronic components in the wearable article.

Dated this 30th day of May, 2021

Signature: 

Applicant(s)

Dr.D.Subbarao et. al.

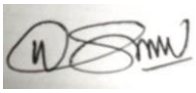
ABSTRACT

A WEARABLE ARTICLE WITH SENSORS AND ML & AI MODULES FOR ANALYSING BEHAVIOUR OF USER

[032] The present invention discloses a wearable article with sensors and ML & AI modules for analysing behaviour of a user. The wearable article includes, but not limited to, a plurality of sensors to receive varied body vitals of the user; a processing unit to receive the input from the sensors in conjunction with an artificial intelligence interface and a machine learning interface. The artificial intelligence interface and the machine learning interface are configured with an updated database repository on as server to learn and trained the input data for a desired output to analyse the human behaviour. Further, the processing unit is configured to provide a plurality of inferences by comparing a confidence level of the generated inference to a first predetermined threshold.

Accompanied Drawing **[FIG. 1]**

Dated this 30th day of May, 2021

Signature: 

Applicant(s)

Dr.D.Subbarao et. al.

FORM- 5
THE PATENTS ACT, 1970
(39 of 1970)
&
The Patents Rules, 2003
DECLARATION AS TO INVENTORSHIP
[See Section 10(6) and Rule 13(6)]

1. NAME OF THE APPLICANT(S)

~~I~~/We, Dr.D.Subbarao et. al., all are citizen of India, Address of first Applicant: Professor and Vice-Principal, Department of ECE, Siddhartha Institute of Engineering and Technology, Ibrahimpatnam, Hyderabad, Telangana, India. Pin Code:501506

hereby declare that the true and first inventor(s) of the invention disclosed in the complete specification filed in pursuance of ~~my~~ / our application numbered _____ dated 30-05-21 ~~is~~/are

2. INVENTOR(S)

(a) NAME	**(b) NATIONALITY**	**(c) ADDRESS**
1. Dr.D.Subbarao	Indian	Professor and Vice-Principal, Department of ECE, Siddhartha Institute of Engineering and Technology, Ibrahimpatnam, Hyderabad, Telangana, India. Pin Code:501506
2. Mr.G.Suresh Kumar	Indian	Assistant Professor, Department of Electronics and Communication Engineering, Vinayaka Mission's Kirupananda Variyar Engineering College (A Constituent College of Vinayaka Mission's Research Foundation Deemed to be University), NH-47, Sankari Main Road, Periya Seeragapadi(PO), Salem, Tamil Nadu, India. Pin Code:636308
3. Mr.G.Nagarajan	Indian	Assistant Professor, Department of Information Technology, KSR College of Engineering, Tiruchengode, Tamil Nadu, India. Pin Code:637215
4. Mr.Raghu Kumar Lingamallu	Indian	Assistant Professor, Department of Computer Science and Engineering, KG Reddy College of Engineering and Technology, Hyderabad, Telangana, India. Pin

		Code: 501504
5. Mr.Venkata Rao Yanamadni	Indian	Assistant Professor, Department of Computer Science and Engineering, KG Reddy College of Engineering & Technology, Hyderabad, Telangana, India. Pin Code:501504
6. Dr.Kandunuri Ramakrishna	Indian	Assistant Professor, Department of Computer science & Engineering, J.B Institute of Engineering & Technology, Moinabad, Hyderabad, Telangana, India. Pin Code:500075
7. Dr.A.V.Sudhakara Reddy	Indian	Associate Professor, Department of EEE, Malla Reddy Engineering College, Secunderabad, Telangana, India. Pin Code:500100
8. Dr.Sushma Jaiswal	Indian	Assistant Professor, Department of Computer Science & Information Technology (CSIT), Guru Ghasidas Vishwavidyalaya (A Central University), Koni, Bilaspur, Chhattisgarh, India. Pin Code: 495009
9. Mr.Tarun Jaiswal	Indian	Research Scholar, Department of Computer Application, National Institute of Technology (NITRR), Raipur, Chhattisgarh, India. Pin Code:492010
10. Mr.K.Uma Shankar	Indian	Assistant Professor, Department of Computer Science & Engineering, KG Reddy College of Engineering and Technology, Moinabad, Hyderabad, Telangana, India. Pin Code:501504

~~3. DECLARATION TO BE GIVEN WHEN THE APPLICATION IN INDIA IS FILED BY THE APPLICANT(S) IN THE CONVENTION COUNTRY: -~~

N.A.

~~We the applicant(s) in the convention country hereby declare that our right to apply for a patent in India is by way of assignment from the true and first inventor(s).~~

Dated this 30th day of May, 2021

Dr.D.Subbarao et. al.
Applicant(s)

To,
The Controller of Patents
The Patent Office, Chennai