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(71) Name of Applicant(s):

**Vels Institute Of Science, Technology & Advanced
Studies (vistas),**

(72) Name of Inventor(s):

- 1. Dr. S.vijayaraj**
- 2. Dr. E. Padma**
- 3. Dr. K. Ashok Kumar**
- 4. Dr.r.parameswari**
- 5. Dr.a.akila**
- 6. Dr.r.padma**
- 7. Dr.m.chandrasekaran**
- 8. Dr.m.komala**
- 9. Dr.venkatesh Alagarsamy**
- 10. Dr.r.sridhar**
- 11. Dr. Vivek Pazhamalai**

(57) Abstract:

ABSTRACT AI BASED RESPIRATORY SENSING AND DISEASE PREDICTION DEVICE The present invention discloses an AI based respiratory sensing and disease prediction device. The said device comprises at least one respiratory sensing module (110) configured to acquire physiological respiratory signals from a subject. The signal conditioning and preprocessing unit (120) configured to filter, normalize, and segment the acquired respiratory signals. The artificial intelligence processing unit (130) operatively coupled to the signal conditioning and preprocessing unit (120). The memory unit (140) configured to store the respiratory signals, extracted features, trained model parameters, and predicted disease outcomes. The output interface (150) configured to provide disease prediction results and respiratory health indicators to a user. The artificial intelligence processing unit (130) continuously or periodically analyzes the respiratory signals in real time or near real time to generate an early disease prediction and severity score for one or more respiratory disorders. Fig 1

FORM 2

The Patents Act 1970

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(39 of 1970)

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The Patent Rules, 2003

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COMPLETE SPECIFICATION

(Section 10 and Rule 13)

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**Title: AI BASED RESPIRATORY SENSING AND DISEASE
PREDICTION DEVICE**

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Applicant:

Vels Institute of Science, Technology & Advanced Studies (VISTAS)

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whose address is

***The Registrar, Vels Institute of Science, Technology & Advanced Studies
(VISTAS), Pallavaram, Chennai-600117, Tamil Nadu, India***

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The following specification particularly describes the invention and the manner in
21 which it is to be performed.

AI BASED RESPIRATORY SENSING AND DISEASE

PREDICTION DEVICE

3 TECHNICAL FIELD OF THE INVENTION

The present invention relates to the field of biomedical instrumentation and intelligent healthcare monitoring systems. More particularly, the invention pertains to an artificial intelligence–based respiratory sensing and disease prediction device configured to acquire physiological respiratory signals from a subject, process the acquired signals using machine learning techniques, and predict respiratory diseases and associated severity levels in real time or near real time. The invention finds application in preventive healthcare, remote patient monitoring, clinical diagnostics, and home-based respiratory health assessment.

BACKGROUND OF THE INVENTION

The respiratory diseases such as asthma, chronic obstructive pulmonary disease (COPD), pneumonia, sleep apnea, pulmonary fibrosis, and respiratory infections contribute significantly to global morbidity and mortality. Early detection and continuous monitoring of respiratory abnormalities are essential for timely diagnosis, effective treatment, and prevention of disease progression. Conventional respiratory diagnostic techniques, including spirometry tests, imaging methods, and

laboratory-based investigations, are typically episodic, resource-intensive, and dependent on clinical infrastructure and skilled medical
3 professionals.

The existing respiratory monitoring devices often rely on single-parameter sensing or threshold-based analysis, which limits their ability
6 to capture complex respiratory patterns and early pathological changes. Such systems generally lack predictive capability and fail to adapt to inter-patient variability or long-term physiological changes. Although
9 advances in sensor technology enable continuous acquisition of respiratory signals, the absence of intelligent data interpretation restricts their clinical usefulness.

12 The artificial intelligence and machine learning techniques have demonstrated the ability to analyze complex physiological data and identify subtle patterns indicative of disease. However, currently
15 available AI-based respiratory systems are fragmented, lack integrated multi-sensor fusion, do not provide disease-specific prediction with severity assessment, or depend heavily on cloud-based processing,
18 thereby introducing latency and privacy concerns. Hence, there exists a need for an integrated, intelligent, and adaptive respiratory sensing

device capable of continuous monitoring and accurate disease prediction using artificial intelligence.

3 **OBJECTS OF THE INVENTION**

The primary object of the present invention is to provide an AI-based respiratory sensing and disease prediction device that overcomes the
6 limitations of existing respiratory monitoring systems.

Another object of the invention is to provide a device capable of acquiring multiple respiratory physiological parameters in a continuous
9 and non-invasive manner.

Yet another object is to enable intelligent analysis of respiratory signals using trained machine learning models for accurate disease prediction.

12 A further object of the invention is to generate early warning indicators and severity scores for respiratory diseases.

An additional object is to facilitate real-time or near real-time
15 respiratory health assessment in home, clinical, and remote healthcare environments. Another object is to provide secure storage and communication of respiratory data.

18 A further object is to enable adaptive learning and improvement of prediction accuracy over time based on newly acquired data.

SUMMARY OF THE INVENTION

The present invention discloses an AI-based respiratory sensing and
3 disease prediction device comprising a respiratory sensing module
configured to acquire physiological respiratory signals from a subject.

The acquired signals are processed by a signal conditioning and
6 preprocessing unit to remove noise, normalize the signals, and segment
the data into meaningful respiratory cycles. An artificial intelligence
processing unit receives the preprocessed signals and applies one or
9 more trained machine learning models to extract respiratory features
and predict one or more respiratory diseases along with associated
severity scores.

12 The device further comprises a memory unit for storing respiratory data,
extracted features, and model parameters, and an output interface for
presenting disease prediction results and respiratory health indicators to
15 a user. In one embodiment, a communication module enables secure
transmission of data and predictions to external systems or healthcare
providers. The artificial intelligence processing unit may be configured
18 to update or retrain the machine learning model based on newly
acquired data, thereby improving predictive accuracy over time. The

invention enables continuous, intelligent, and predictive respiratory health monitoring.

3 **BRIEF DESCRIPTION OF THE INVENTION**

The invention will now be described with reference to illustrative embodiments and accompanying drawings, which are intended to explain the working of the device and not to limit the scope of the invention. The AI-based respiratory sensing and disease prediction device integrates multi-parameter respiratory sensing, signal preprocessing, artificial intelligence-based analysis, data storage, and output presentation within a single system. The device may be implemented in wearable, handheld, or stationary form factors and may operate independently or in conjunction with remote healthcare infrastructure.

DETAILED DESCRIPTION OF THE INVENTION

15 The present invention relates to an AI-based respiratory sensing and disease prediction device designed to continuously monitor respiratory physiological parameters and intelligently predict respiratory diseases.

18 The device comprises a respiratory sensing module configured to acquire one or more respiratory signals including airflow, breathing rate, lung sounds, oxygen saturation, chest movement, and respiratory

pressure from a subject. The respiratory sensing module may employ one or more sensors such as microphones, airflow sensors, pressure
3 sensors, accelerometers, piezoelectric sensors, pulse oximeters, or thermal sensors depending on the application.

The acquired respiratory signals are provided to a signal conditioning
6 and preprocessing unit that performs noise filtering, artifact removal, normalization, segmentation, and feature scaling to ensure data quality and consistency. The preprocessed signals are then supplied to an
9 artificial intelligence processing unit comprising one or more trained machine learning models. The artificial intelligence processing unit extracts meaningful respiratory features such as temporal patterns,
12 frequency characteristics, and abnormal signal signatures, and predicts one or more respiratory diseases based on the extracted features. The prediction may further include a disease severity score or risk index.

15 The memory unit is provided to store raw respiratory signals, processed data, extracted features, trained model parameters, and historical prediction results. An output interface presents respiratory health
18 indicators and disease prediction results to a user through a display, mobile application, web-based dashboard, or alert system. In one embodiment, the device further includes a communication module for

transmitting respiratory data and prediction results to remote servers or
healthcare providers using secure communication protocols. The
3 artificial intelligence processing unit may be configured to adaptively
update or retrain the machine learning models based on newly acquired
data or feedback, thereby enhancing prediction accuracy and
6 personalization over time.

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CLAIMS

We claim,

- 3 1. An AI-based respiratory sensing and disease prediction device
(100), comprising:
at least one respiratory sensing module (110) configured to
6 acquire physiological respiratory signals from a subject, the
physiological respiratory signals comprising at least one of
airflow pattern, breathing rate, lung sound, oxygen saturation,
9 chest movement, and respiratory pressure;
a signal conditioning and preprocessing unit (120) configured to
filter, normalize, and segment the acquired respiratory signals;
12 an artificial intelligence processing unit (130) operatively
coupled to the signal conditioning and preprocessing unit (120),
the artificial intelligence processing unit (130) comprising at
15 least one trained machine learning model configured to extract
respiratory features and predict one or more respiratory diseases
based on the extracted features;
18 a memory unit (140) configured to store the respiratory signals,
extracted features, trained model parameters, and predicted
disease outcomes; and,

an output interface (150) configured to provide disease prediction results and respiratory health indicators to a user,

3 characterized in that the artificial intelligence processing unit (130) continuously or periodically analyzes the respiratory signals in real time or near real time to generate an early disease
6 prediction and severity score for one or more respiratory disorders.

2. The device as claimed in claim 1, wherein the respiratory sensing
9 module (110) comprises one or more sensors selected from a microphone, spirometer, pressure sensor, accelerometer, piezoelectric sensor, pulse oximeter, thermal sensor, or airflow
12 sensor.

3. The device as claimed in claim 1, wherein the artificial
intelligence processing unit (130) employs one or more machine
15 learning models selected from convolutional neural networks, recurrent neural networks, long short-term memory networks, transformer-based models, or ensemble learning models.

18 4. The device as claimed in claim 1, wherein the predicted respiratory diseases include at least one of asthma, chronic

obstructive pulmonary disease (COPD), pneumonia, bronchitis, sleep apnea, pulmonary fibrosis, or respiratory infection.

- 3 5. The device as claimed in claim 1, wherein the signal conditioning and preprocessing unit (120) is further configured to perform noise reduction, feature scaling, signal segmentation, and artifact
6 removal prior to AI-based analysis.
6. The device as claimed in claim 1, wherein the output interface (150) comprises at least one of a display unit, mobile application
9 interface, web-based dashboard, or audible alert system for presenting disease prediction results.
7. The device as claimed in claim 1, further comprising a
12 communication module (160) configured to transmit respiratory data and disease prediction results to a remote server, cloud platform, or healthcare provider through wired or wireless
15 communication.
8. The device as claimed in claim 7, wherein the communication module (160) supports secure data transmission using encryption
18 and authentication protocols to ensure patient data privacy.
9. The device as claimed in claim 1, wherein the artificial intelligence processing unit (130) is configured to update or

retrain the machine learning model based on newly acquired respiratory data to improve prediction accuracy over time.

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ABSTRACT

AI BASED RESPIRATORY SENSING AND DISEASE

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PREDICTION DEVICE

The present invention discloses an AI based respiratory sensing and disease prediction device. The said device comprises at least one respiratory sensing module (110) configured to acquire physiological respiratory signals from a subject. The signal conditioning and preprocessing unit (120) configured to filter, normalize, and segment the acquired respiratory signals. The artificial intelligence processing unit (130) operatively coupled to the signal conditioning and preprocessing unit (120). The memory unit (140) configured to store the respiratory signals, extracted features, trained model parameters, and predicted disease outcomes. The output interface (150) configured to provide disease prediction results and respiratory health indicators to a user. The artificial intelligence processing unit (130) continuously or periodically analyzes the respiratory signals in real time or near real time to generate an early disease prediction and severity score for one or more respiratory disorders.

Fig 1