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(54) **DRY SENSOR EEG/EMG AND MOTION SENSING SYSTEM FOR SEIZURE DETECTION AND MONITORING**

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(52) **U.S. Cl.**

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See application file for complete search history.

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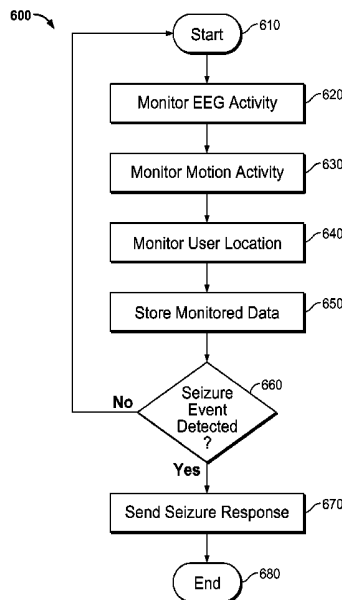
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(57) **ABSTRACT**

A dry sensor EEG/EMG and motion sensing system for seizure detection and monitoring is disclosed. In some embodiments, a system for seizure detection/monitoring is provided that can measure a user's EEG/EMG and motor activity, automatically detect an epileptic seizure and perform actions, such as triggering an alarm and/or turning off the provoking stimulation. In some embodiments, a system for seizure detection/monitoring is provided that can be used to continuously monitor and store a user's EEG/EMG and motor activity for doctor evaluation. In some embodiments, a system for seizure detection/monitoring is provided that can be mounted directly on a user's head using active dry EEG sensors. In some embodiments, a system for seizure detection/monitoring is provided that can be mounted into/onto a pair of glasses (e.g., 3D glasses), and the user's eyes can be automatically covered by the glasses if a seizure is detected.

23 Claims, 5 Drawing Sheets



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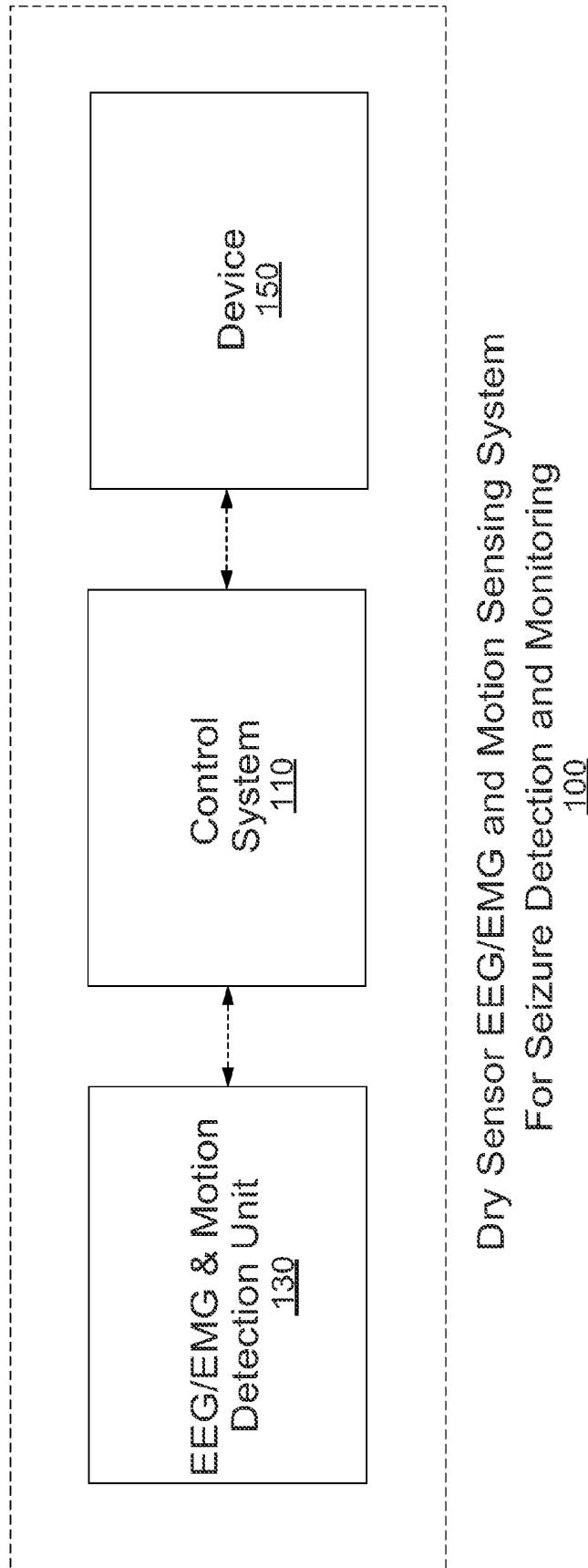
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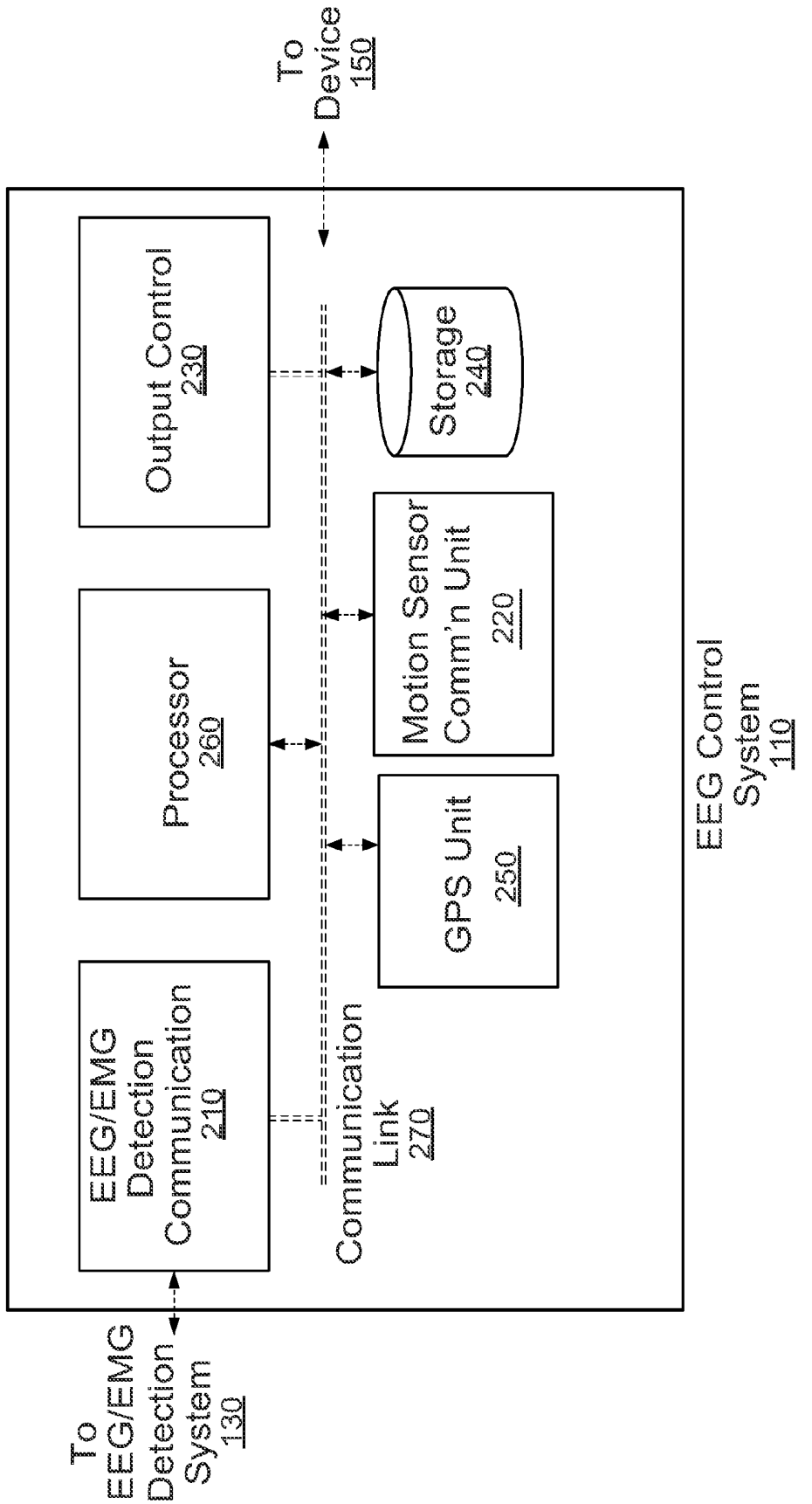
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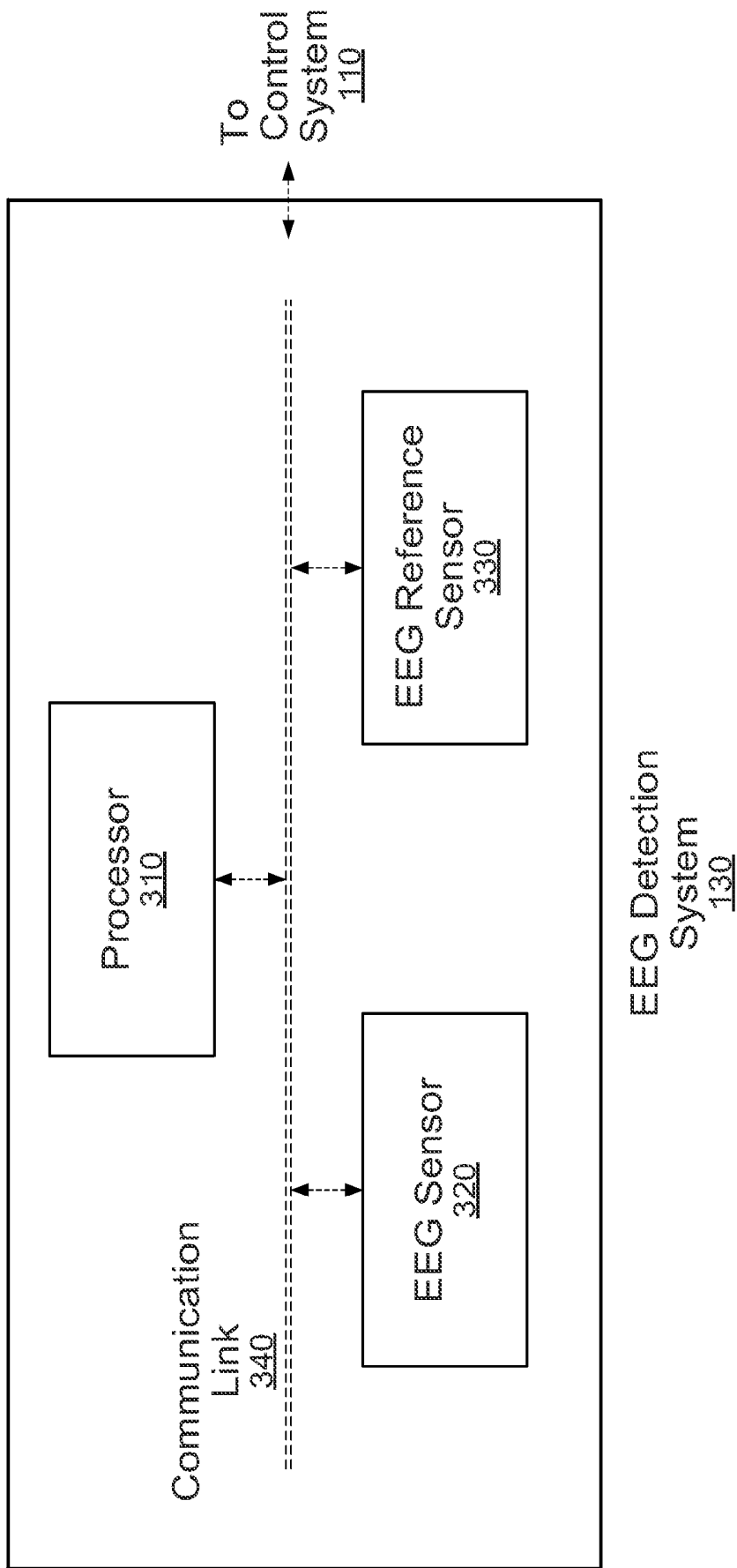
Dry Sensor EEG/EMG and Motion Sensing System
For Seizure Detection and Monitoring
100

Figure 1



EEG Control System 110

Figure 2



EEG Detection System 130

Figure 3

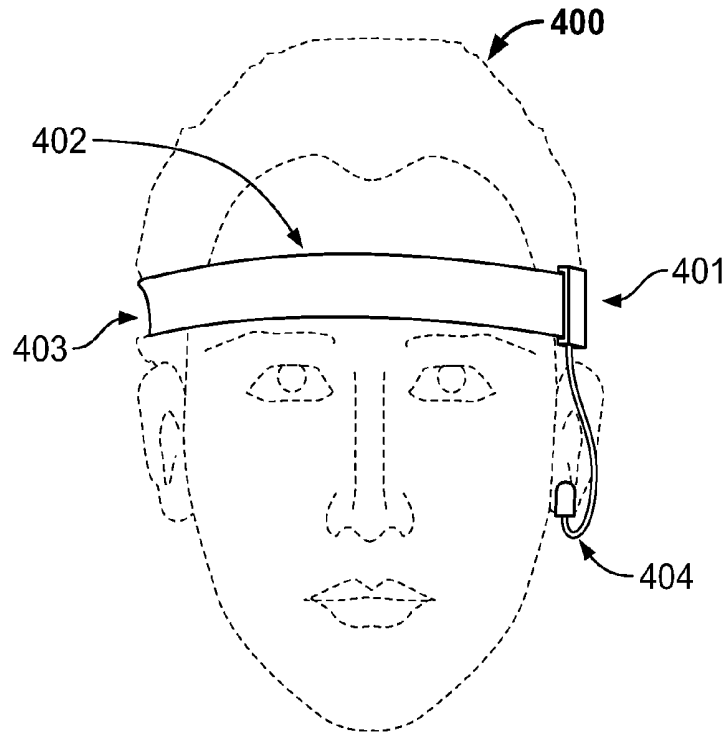


Figure 4

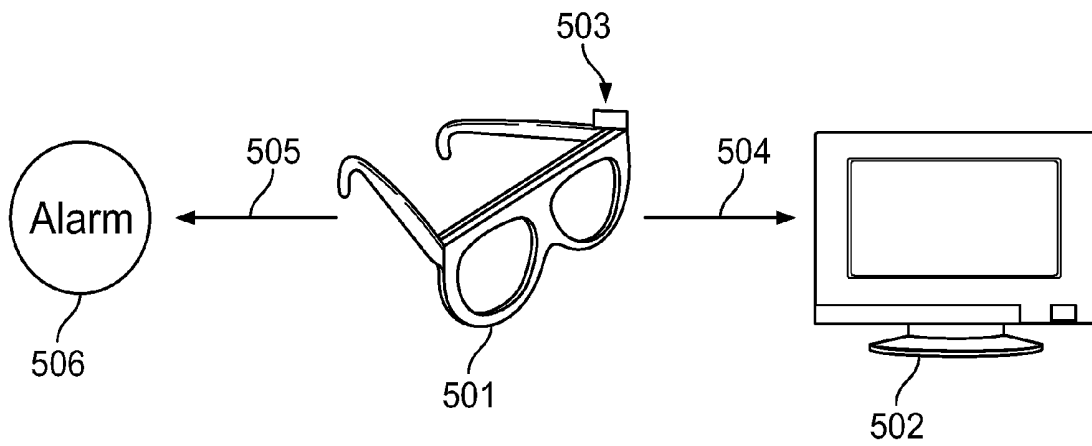


Figure 5

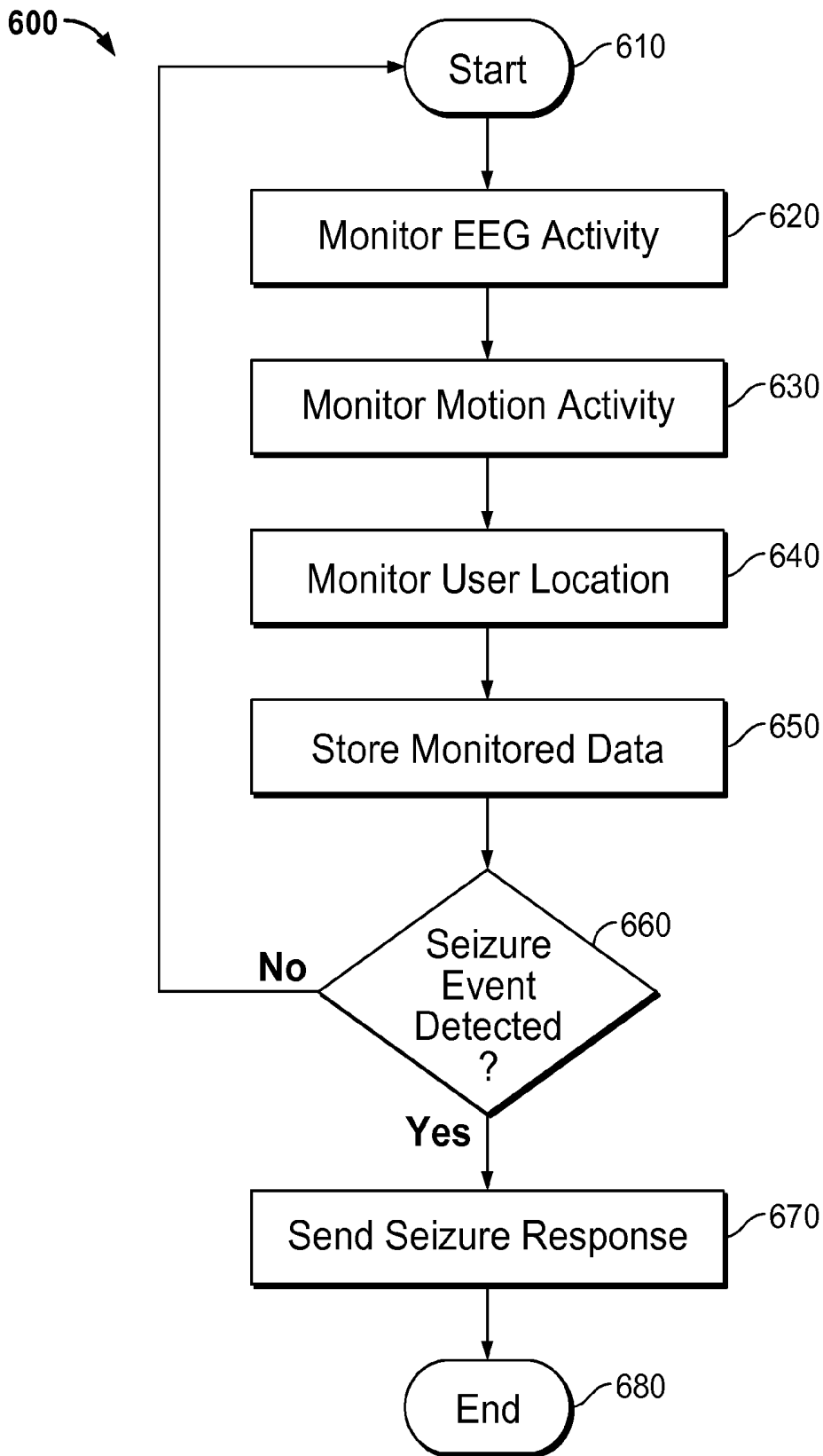


Figure 6

DRY SENSOR EEG/EMG AND MOTION SENSING SYSTEM FOR SEIZURE DETECTION AND MONITORING

CROSS REFERENCE TO OTHER APPLICATIONS

This application claims priority to U.S. Provisional Patent Application No. 61/437,403, entitled DRY SENSOR EEG/EMG AND MOTION SENSING SYSTEM FOR SEIZURE DETECTION AND MONITORING, filed Jan. 28, 2011, which is incorporated herein by reference for all purposes.

BACKGROUND OF THE INVENTION

It is estimated that 50 million people have epilepsy worldwide. Among them, it is further estimated that over 30% do not have an effective seizure control even with the best available medications. A seizure can generally happen anytime, anywhere, and very often without predictive signs, which can be especially dangerous when the patient is alone.

BRIEF DESCRIPTION OF THE DRAWINGS

Various embodiments of the invention are disclosed in the following detailed description and the accompanying drawings.

FIG. 1 is a block diagram illustrating a dry sensor EEG/EMG and motion sensing system for seizure detection and monitoring in accordance with some embodiments.

FIG. 2 is a functional diagram illustrating a control system for seizure detection and monitoring in accordance with some embodiments.

FIG. 3 is a functional diagram illustrating an EEG/EMG detection system in accordance with some embodiments.

FIG. 4 is a functional diagram illustrating a seizure detection unit mounted on a headband in accordance with some embodiments.

FIG. 5 is a functional diagram illustrating a seizure detection unit mounted on a pair of 3D glasses in accordance with some embodiments.

FIG. 6 is a flow diagram for techniques seizure detection and monitoring techniques in accordance with some embodiments.

DETAILED DESCRIPTION

The invention can be implemented in numerous ways, including as a process; an apparatus; a system; a composition of matter; a computer program product embodied on a computer readable storage medium; and/or a processor, such as a processor configured to execute instructions stored on and/or provided by a memory coupled to the processor. In this specification, these implementations, or any other form that the invention may take, may be referred to as techniques. In general, the order of the steps of disclosed processes may be altered within the scope of the invention. Unless stated otherwise, a component such as a processor or a memory described as being configured to perform a task may be implemented as a general component that is temporarily configured to perform the task at a given time or a specific component that is manufactured to perform the task. As used herein, the term 'processor' refers to one or more devices, circuits (e.g., PCBs, ASICs, and/or FPGAs), and/or processing cores configured to process data, such as computer program instructions.

A detailed description of one or more embodiments of the invention is provided below along with accompanying figures that illustrate the principles of the invention. The invention is described in connection with such embodiments, but the invention is not limited to any embodiment. The scope of the invention is limited only by the claims and the invention encompasses numerous alternatives, modifications and equivalents. Numerous specific details are set forth in the following description in order to provide a thorough understanding of the invention. These details are provided for the purpose of example and the invention may be practiced according to the claims without some or all of these specific details. For the purpose of clarity, technical material that is known in the technical fields related to the invention has not been described in detail so that the invention is not unnecessarily obscured.

It is estimated that 50 million people have epilepsy worldwide. Among them, it is further estimated that over 30% do not have an effective seizure control even with the best available medications. A seizure can generally happen anytime, anywhere, and very often without predictive signs, which can be especially dangerous when the patient is alone.

Early detection of seizures can avoid further injuries and prevent long term damages to the patient's brain. Electroencephalography (EEG) monitoring is a primary tool to diagnose and evaluate epilepsy. Traditionally, EEG is recorded using medical grade EEG devices in epilepsy clinics. Before recording, a number of electrodes are typically glued to the patient's head using conductive gel. However, the application of conductive gel can require both a significant amount of time to apply to the patient's head (e.g., depending on the number of electrodes) and make the hair difficult to clean afterwards. Also, a brief recording of EEG at an epilepsy clinic will not capture the epileptic form EEG if the patient is not having a seizure at the moment or when he/she is not in seizure vulnerable period.

Specifically, when a patient is having a seizure or in a seizure vulnerable period, their EEG generally shows abnormal, excessive, or synchronous neuronal activity. If motor symptoms are present during a seizure, abnormal activity can also be detected by electromyography (EMG) or motion sensors. Automatic seizure detection systems exist that include one or more EEG and EMG sensors. However, conductive gel is needed for these EEG and EMG sensors. There are also approaches that use implantable seizure detection devices embedded underneath a patient's scalp, but these approaches are invasive and can often require a surgery to implant such seizure detection devices. Both the medical grade EEG sensors and the implantable EEG sensors are generally expensive and require assistance from professionals, and thus are difficult and/or impractical to use at home and/or on an everyday basis. Other automatic seizure detection systems employ motion, sound, and/or image sensors to monitor a patient's motor activity and transmit an alarm if seizures are detected.

In accordance with some embodiments, it is desirable to provide an automatic seizure detection system that is user friendly and economical (e.g., low cost). In accordance with some embodiments, it is also desirable to combine EEG/EMG sensing with motion sensing to provide for enhanced and more reliable seizure detection, and to store such time sensitive information for use and help in medical diagnosis and/or medical treatment.

More specifically, for patients with photosensitive epilepsy (PSE), seizures can be triggered by visual stimuli that form patterns in time or space, such as flashing lights, regular still or moving patterns. Television has traditionally been the most common source of seizures in PSE patients, for example,

especially when the television is out of adjustment or is showing a rapidly flickering image. A common practice to stop or alleviate the seizure is to cover one or both patient's eyes. The advent of three dimensional (3D) movies and 3D televisions (e.g., which typically involves the use of special glasses for view such 3D content, referred to herein as 3D glasses) is also creating concerns regarding the effect of 3D viewing in triggering seizures.

In accordance with some embodiments, it is also desirable to embed an automatic seizure detection unit into/onto a pair of glasses, including, for example, 3D glasses. In some embodiments, a system for seizure detection/monitoring is provided that can measure a user's EEG/EMG and motor activity, automatically detect an epileptic seizure and perform actions, such as triggering an alarm and/or turning off the provoking stimulation. In some embodiments, a system for seizure detection/monitoring is provided that can be used to continuously monitor and store a user's EEG/EMG and motor activity for doctor evaluation. In some embodiments, a system for seizure detection/monitoring is provided that can be mounted directly on a user's head using active dry EEG sensors. In some embodiments, a system for seizure detection/monitoring is provided that can be mounted into/onto a pair of glasses (e.g., 3D glasses), and the user's eyes can be automatically covered by the glasses if a seizure is detected.

In some embodiments, a dry sensor EEG/EMG and motion sensing system for seizure detection and monitoring includes one or more dry EEG or EMG sensors mounted on a wearable object, a detection unit configured to determine a seizure event based on data received from the EEG or EMG sensor, and a transmission unit configured to send a seizure response. In some embodiments, a dry sensor EEG/EMG and motion sensing system for seizure detection and monitoring further includes any of a motion sensor, where the detection unit is configured to determine a seizure event based on data received from the EEG or EMG sensor and the motion sensor; a storage unit, where the storage unit is capable of recording seizure event data and non-seizure event data from the detection unit; and a location tracking unit. In some embodiments, the detection unit determines occurrence of a seizure based on a linear discrimination analysis, an artificial neural network, a decision tree, or a Bayesian method. In some embodiments, the wearable object is any of a headband, a pair of glasses, and a pair of active-lens 3D glasses. In some embodiments, a seizure response includes any of a trigger alarm communicated to a user or third party, commanding a device producing visual stimulus to modify its behavior, and administering treatment to a user.

FIG. 1 is a block diagram illustrating a dry sensor EEG/EMG and motion sensing system for seizure detection and monitoring in accordance with some embodiments. In some embodiments, for a dry sensor EEG/EMG and motion sensing system **100** for seizure detection and monitoring includes a control system **110**, an EEG/EMG and motion detection unit **130**, and a device **150**. In some embodiments, the EEG/EMG and motion detection unit **130** includes one or more active dry EEG sensors and/or EMG sensors that can be placed on the forehead, scalp, and/or other areas of a patient/user. In some embodiments, the EEG/EMG and motion detection unit **130** includes a motion sensor (e.g., an accelerometer and/or other types of motion sensors). In some embodiments, a control system **110** for seizure detection/monitoring includes a motion sensing unit **120** that monitors a user's motor activity.

In some embodiments, the device **150** is included with or integrated with the dry sensor EEG/EMG and motion sensing system for seizure detection and monitoring **100**, as shown,

and communicates with the device **150** using a serial or other communication channel. In some embodiments, the device **150** is separate from the dry sensor EEG/EMG and motion sensing system for seizure detection and monitoring **100** and is in communication with the control system **110** using a wired line or wireless communication. In some embodiments, the control system **110** communicates with the EEG/EMG and motion detection unit **130** using a serial or other communication channel (e.g., wired or wireless).

In some embodiments, the EEG/EMG and motion detection unit **130** detects EEG and/or EMG signals of a user, and the control system **110** includes a processor configured to perform a seizure detection and monitoring algorithm for EEG and/or EMG signals detected by the EEG/EMG and motion detection unit **130** using various techniques as described herein.

In some embodiments, based on the seizure detection and monitoring determination(s), the control system **110** sends corresponding control signal(s) to the device **150** (e.g., for sending a communication or other notification to the patient/user, friends or family of the patient, medical or other professional support for the patient/user using various techniques described herein). In some embodiments, the EEG/EMG and motion detection unit **130** sends raw EEG/EMG signal data, or in some embodiments, processed EEG/EMG signal data (e.g., to filter out noise), to the control system **110** for further processing and/or analysis using various techniques described herein.

FIG. 2 is a block diagram illustrating a control system **110** for seizure detection and monitoring in accordance with some embodiments. In some embodiments, the control system **110** for seizure detection and monitoring includes, as shown, a dry sensor EEG/EMG communication unit **210**, a motion sensor communication unit **220** for communicating with the EEG/EMG and motion detection system **130**, an output control **230** for communicating with the device **150**, a GPS unit **250** for determining location information, a processor **260** for performing a seizure detection determination algorithm based on EEG/EMG signals and motion sensor data detected by EEG/EMG and motion detection system **130**, and a communication link **270**. In some embodiments, a data storage unit **240**, such as flash memory or other form of data storage component, is also provided as shown such (e.g., for storing received EEG/EMG sensor signal data and motion sensor data, such that when abnormal EEG/EMG or motor activity is detected and determined to be associated with a seizure or potential seizure event, such data can be maintained and recorded continuously for further evaluation, such as by medical or other professionals for further analysis). In some embodiments, patients/users can voluntarily and continuously record EEG/EMG and motor activity (e.g., stored on such the storage unit **240**). Internal communication between components of control system **110** can be accomplished through communication link **270**. In some embodiments, these functions shown and described with respect to FIG. 2 are implemented in a various other configurations, including as an integrated unit, module, or component, or as multiple distinct units, modules, or components.

In some embodiments, the output control **230** (e.g., a wireless transmission unit) transmits control signals, such as to trigger alarm or to call or notify care giver and/or doctor, and/or send various other commands. For example, if a seizure is triggered by a TV show or a movie, the output control **230** and/or the device **150** can send out a wireless signal to turn off the TV or inform the movie theater management. Once a seizure is detected, the alarm can be transmitted to allow the patient to take appropriate actions (e.g., to sit down)

before they are themselves aware that a seizure has begun. In some embodiments, treatments, such as electrical stimulation or drug injection, can also be administered to stop the evolution of the seizure. As another example, for seizures where few clinical signs are observable, tests and diagnosis can be performed more accurately if the seizure is detected earlier. In some embodiments, a programmed computer is in communication with the control system **110**, and the control system **110** also includes an EEG/EMG and motion data to computer component for sending detected EEG/EMG signal samples and motion data to the computer. In this example, the computer includes a processor configured to perform a seizure detection determination algorithm based on EEG/EMG signals and motion sensor data detected by EEG/EMG and motion sensing detection system **130**, and the computer can then provide the results of the analysis to the control system **110** for controlling the device **150** (e.g., based on seizure determination and/or location information). In some embodiments, the computer includes a processor configured to perform a seizure detection determination algorithm based on EEG/EMG signals and motion sensor data detected by EEG/EMG and motion detection system **130**, and the computer sends corresponding control signal(s) to the device **150** based on the results of the analysis of the EEG/EMG signal samples, motion data, and/or location information (e.g., GPS data). In some embodiments, all or just a portion of the analysis of the EEG/EMG signal samples, motion data, and/or GPS data is performed by the programmed computer. In some embodiments, all or just a portion of the analysis of the EEG/EMG signal samples is performed in an EEG/EMG detection system (e.g., an ASIC integrated with or in communication with EEG/EMG sensors).

FIG. 3 is a functional diagram illustrating an EEG/EMG detection system in accordance with some embodiments. As shown, the EEG detection system **130** includes a processor **310** (e.g., an FPGA or ASIC), active EEG sensor **320**, a reference EEG sensor **330**, and a communication link **340**. The measured EEG signals are provided to the EEG control system **110**. In some embodiments, a continuous measure of EEG signal samples are detected and provided to the control system **110**.

FIG. 4 is a functional diagram illustrating an automatic seizure detection system **400** in accordance with some embodiments. As shown, a seizure detection unit **401** is mounted on a headband **403**. A dry EEG sensor **402** and a reference sensor **404** are respectively mounted inside and near headband **403**. In some embodiments, seizure detection system **400** includes more than one EEG sensor **402**. In some embodiments, EEG sensor **402** is located in different locations based on each user's needs and/or preferences. In some embodiments, the seizure detection unit **401** is mounted on a headset, audio headset, an automobile seat headrest, and/or any other form of apparatus or module that can be used by the user to securely locate the EEG sensor(s) **402**, and the reference EEG sensor **404** is mounted/provided on appropriate locations of the user's head for EEG signal detection. In some embodiments, the seizure detection system **400** includes a grounded ear clip **406** to reduce the amount of noise. In some embodiments, the seizure detection unit includes a printed circuit board (PCB) with analog front-end circuitry that amplifies the EEG signal and filters out noise. In some embodiments, the circuitry for the EEG sensor **402** is integrated into an application specific integrated circuit (ASIC). In some embodiments, a motion sensing unit **220** is included in the detection unit **401** to measure the user's movement (e.g., in real-time). In some embodiments, the detection unit **401** includes a microprocessor **260** to sample the EEG and/or

motion data at predefined sampling rates and to determine if the user/patient is having a seizure. In some embodiments, the detection unit **401** also includes a memory **240** to store data. In some embodiments, the detection unit **401** also includes a wireless transmission unit **230** to communicate/wirelessly transmit and/or receive information (e.g., data, alerts, and commands and/or other information). In some embodiments, the detection unit **401** also includes a GPS sensor **250** to record/store location information of the user/patient when a seizure event is determined and/or to communicate location information of the user/patient when a seizure event is determined, such as by the wireless transmission unit **230**.

FIG. 5 is a functional diagram illustrating a seizure detection unit mounted on a pair of 3D glasses **501** in accordance with some embodiments. As shown, the seizure detection unit **503** is mounted on 3D glasses **501**. In some embodiments, the seizure detection unit includes a microprocessor **260** that processes the EEG/EMG and/or motor activity and determines if the user/patient is having a seizure. For example, if a seizure is detected, one or both eyes can be covered by the glasses **501** (e.g., automatically darkening one or more of the lenses of the glasses). In some embodiments, a wireless transmission unit **230** is provided such that a signal **504** is sent to the display **502** (e.g., a computer with an integrated or connected display device/element, television, a mobile entertainment device, PDA/smartphone device, and/or another display device) from the seizure detection unit **503** to stop the visual stimulation. In some embodiments, a wireless signal **505** is sent to the alarm **506** by the seizure detection unit **503**. In some embodiments, a headband (e.g., or headset) and glasses can be combined together to mount a seizure detection unit.

In some embodiments, the seizure detection control device **110** includes a motion sensing device **220**. If abnormal activities are detected (e.g., a potential seizure or seizure event are determined), one or both eyes of glasses **501** can be covered to eliminate or reduce the visual stimulation to the patient. In some 3D glasses (e.g., active shutter glasses), glasses **501** are controlled by a transmitter that sends a timing signal **404** that allows the glasses to alternately darken over one eye, and then the other, in synchronization with the refresh rate of screen **502**. In some embodiments, if a seizure is detected, the transmitter controls one or both eyes' glasses to be dark continuously. In some embodiments, an alarm signal **506** can be transmitted, and/or the device that triggered the seizure can be disabled or powered off.

FIG. 6 is a flow diagram for seizure detection and monitoring techniques in accordance with some embodiments. It is understood that not all steps of process **600** as shown in FIG. 6 are required in order to realize seizure detection and response. It is also understood that the steps of the process **600** may be arranged in any order and in any repetition. As shown, the process begins at **610**. In some embodiments, the occurrence of seizures can be detected if excessive or synchronous EEG/EMG activity is detected at **620**. Various EEG/EMG patterns, such as sustained rhythmic activity, increase in amplitude, or EEG flattening can indicate the happening seizures. For example, a detection algorithm can be based on one or more features computed from spectral or wavelet decomposition, amplitude or power change in relative to background activity, and/or a template method. These features can be combined in a classifier such as a linear discrimination analysis, an artificial neural network, a decision tree, or a Bayesian method to determine the occurrence of seizures.

In some embodiments, the occurrence of seizures can also be detected by abnormal motor activity recorded from motion sensing unit **220** at **630**. For example, the motion of an object can be detected by measuring change in speed or direction of

that object in relative to its environment. An accelerometer is one type of motion sensor that measures the proper acceleration of the device. In some embodiments, piezoelectric, piezoresistive and/or capacitive accelerometers can be used to measure the motor activity of users.

Examples of motor symptoms of seizures include muscle jerking and stiffening. Involuntary but coordinated movements, such as smacking, chewing, fidgeting and walking can also happen during seizures. Some patients lose consciousness and fall during seizure, so abrupt body movements also occur. Various movement patterns, such as sustained rhythmic activity and sudden change in velocity, can indicate the occurrence of seizures. In some embodiments, a seizure detection algorithm is based on one or more features computed from spectral or wavelet decomposition, amplitude or power change in relative to background velocity, and/or a template method. For example, these features can be combined in a classifier, such as a linear discrimination analysis, an artificial neural network, a decision tree, or a Bayesian method to determine the occurrence of seizures.

In some embodiments, a GPS sensor or other locating system may, at step 640, record/store location information of the user/patient when a seizure event is determined and/or to communicate location information of the user/patient at step 670 when a seizure event is determined (e.g., using the wireless transmission unit 230).

At 650, monitored EEG/EMG sensor data, motion data, and location data are stored. At 660, based on the monitored EEG/EMG sensor data and motion data, whether a seizure event has been detected is determined. If a seizure response is determined to have been detected, then a seizure response can be performed at 670. Otherwise, the process returns to 610 as shown. In some embodiments, the process ends at 680.

In some embodiments, a detection algorithm is embedded in the recording unit and makes decisions in real-time at step 660. In some embodiments, the EEG/EMG and motion data are transmitted wirelessly to another device 150 or functional element (e.g., a computer or another computing or processing device) where the decision is made at step 660 and proper actions are taken at step 670.

In some embodiments, the occurrence of seizures is detected at step 660 by combining information recorded from EEG/EMG and motion sensing units, such as using the various techniques described herein and/or other similar or related techniques as would now be apparent to one of ordinary skill in the art. For example, features from EEG/EMG and motor activities can be combined in a classifier, such as a linear discrimination analysis, an artificial neural network, a decision tree, or a Bayesian method to determine the occurrence of seizures.

Although the foregoing embodiments have been described in some detail for purposes of clarity of understanding, the invention is not limited to the details provided. There are many alternative ways of implementing the invention. The disclosed embodiments are illustrative and not restrictive.

What is claimed is:

1. An apparatus for detecting and monitoring a seizure, the apparatus comprising:

one or more dry electroencephalography (EEG) sensors or electromyography (EMG) sensors mounted on a wearable object;

a motion sensor mounted on the wearable object;

a detection unit configured to determine occurrence of a seizure event based on data received from the EEG or EMG sensor and the motion sensor, wherein the determining of the occurrence of the seizure event comprises:

receive a first data from the EEG or EMG sensor and receive a second data from the motion sensor; and

determine the occurrence of the seizure event based on an analysis of one or more features from the first data and the second data using a classifier, wherein the classifier comprises a linear discrimination analysis, an artificial neural network, a decision tree, or a Bayesian method; and

a transmission unit configured to send a seizure response, wherein the seizure response comprises administering treatment to a user of the apparatus.

2. The apparatus according to claim 1, further comprising a storage unit, wherein the storage unit is capable of recording seizure event data and non-seizure event data from the detection unit.

3. The apparatus according to claim 1, further comprising a location tracking unit.

4. The apparatus according to claim 1, wherein the wearable object is a headband.

5. The apparatus according to claim 1, wherein the wearable object is a pair of glasses or a pair of active-lens 3D glasses.

6. The apparatus according to claim 5, wherein the seizure response further comprises commanding at least one lens of the 3D glasses to modify a timing for darkening.

7. The apparatus according to claim 1, wherein the seizure response further comprises a trigger alarm to the user or a third party.

8. The apparatus according to claim 1, wherein the seizure response further comprises commanding a device producing visual stimulus to modify its behavior.

9. The apparatus according to claim 1, wherein the determining of the occurrence of the seizure event further comprises:

determine whether the first data received from the EEG or EMG sensor includes a sustained rhythmic activity, an increase in amplitude, an EEG flattening, or any combination thereof; and

in the event that the first data received from the EEG or EMG sensor includes the sustained rhythmic activity, the increase in amplitude, the EEG flattening, or any combination thereof, determine the occurrence of the seizure event.

10. The apparatus according to claim 9, wherein the user wearing the wearable object is standing or sitting up.

11. The apparatus according to claim 1, wherein the determining of the occurrence of the seizure event further comprises:

determine whether the second data received from the monitored motor activity relates to a change in speed or a change in direction relative to environment exceeding a predetermined threshold; and

in the event that the change in speed or the change in direction relative to environment exceeds the predetermined threshold, determine the occurrence of the seizure event, the user wearing the wearable object being in an orientation other than lying horizontal.

12. The apparatus according to claim 1, wherein the one or more features are combined in the classifier, and wherein the one or more features are computed from one or more of the following: spectral or wavelet decomposition, amplitude or power change in relative to background activity, and a template method.

13. A method for detecting and monitoring a seizure, the method comprising:
 monitoring electroencephalography (EEG) or electromyography (EMG) activity of a user through a wearable object that includes one or more dry EEG sensors or EMG sensors;
 monitoring motor activity of the user through the wearable object that includes a motion sensor;
 determining occurrence of a seizure event based on data received from the monitored EEG or EMG activity and the monitored motor activity, wherein the determining of the occurrence of the seizure event comprises:
 receiving a first data from the monitored EEG or EMG activity and receiving a second data from the monitored motor activity; and
 determining the occurrence of the seizure event based on an analysis of one or more features from the first data and the second data using a classifier, wherein the classifier comprises a linear discrimination analysis, an artificial neural network, a decision tree, or a Bayesian method; and
 responding automatically to the seizure event, wherein the responding comprises administering treatment to the user.
14. The method according to claim 13, further comprising recording at least one of seizure event data and non-seizure event data.
15. The method according to claim 13, further comprising tracking the user's location.
16. The method according to claim 13, wherein the wearable object is a headband, a pair of glasses, or a pair of active-lens 3D glasses.
17. The method according to claim 16, wherein the responding further comprises commanding at least one lens of the 3D glasses to modify a timing for darkening.
18. The method according to claim 13, wherein the responding further comprises commanding a device producing visual stimulus to modify its behavior.

19. The method according to claim 13, wherein the determining of the occurrence of the seizure event further comprises:
 determining whether the first data received from the EEG or EMG sensor includes a sustained rhythmic activity, an increase in amplitude, an EEG flattening, or any combination thereof; and
 in the event that the first data received from the EEG or EMG sensor includes the sustained rhythmic activity, the increase in amplitude, the EEG flattening, or any combination thereof, determining the occurrence of the seizure event.
20. The method according to claim 19, wherein the user wearing the wearable object is standing or sitting up.
21. The method according to claim 13, wherein the determining of the occurrence of the seizure event further comprises:
 determining whether the second data received from the monitored motor activity relates to a change in speed or a change in direction relative to environment exceeding a predetermined threshold; and
 in the event that the change in speed or the change in direction relative to environment exceeds the predetermined threshold, determining the occurrence of the seizure event, the user wearing the wearable object being in an orientation other than lying horizontal.
22. The method according to claim 13, wherein the one or more features are combined in the classifier, and wherein the one or more features are computed from one or more of the following: spectral or wavelet decomposition, amplitude or power change in relative to background activity, and a template method.
23. The method according to claim 13, wherein the responding further comprises triggering an alarm communicated to the user or a third party.

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专利名称(译)	干式传感器EEG / EMG和运动传感系统，用于检测和监测癫痫发作		
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摘要(译)

公开了一种用于癫痫发作检测和监测的干传感器EEG / EMG和运动传感系统。在一些实施例中，提供了一种用于癫痫发作检测/监测的系统，其可以测量用户的EEG / EMG和运动活动，自动检测癫痫发作并执行动作，例如触发警报和/或关闭激发刺激。在一些实施例中，提供了一种用于癫痫发作检测/监测的系统，其可用于连续监测和存储用户的EEG / EMG和运动活动以用于医生评估。在一些实施例中，提供了一种用于癫痫发作检测/监测的系统，其可以使用主动干式EEG传感器直接安装在用户的头部上。在一些实施例中，提供了一种用于癫痫发作检测/监测的系统，其可以安装到一副眼镜（例如，3D眼镜）中/上，并且如果检测到癫痫发作，则眼镜可以自动覆盖用户的眼睛。

