Claims

1. an acute ischemic stroke monitoring system based on wearable devices, which is characterized by comprising the following units:

The multimodal sign sensing unit (1) comprises at least three bioelectrical sensors, two optical sensors and one motion acceleration sensor, and each sensor is integrated in the temporal artery patch with a flexible circuit for collecting the original signal;

The embedded data processing unit (2) uses the Wavelet Transform Kalman filter composite algorithm to preprocess the original signal and obtain the user's sign data;

The dynamic baseline generation unit (3) has a built-in time series prediction model based on the long-term and short-term memory network, and generates a personalized dynamic baseline curve by continuously learning the user's physical signs data in the past 72 hours, combined with the ambient temperature and altitude parameters. The baseline update cycle does not exceed 15 minutes. The physical signs data include but are not limited to cerebral blood flow velocity, oxygen metabolism rate and heart rate variability;

The stroke risk assessment unit (4) uses the improved weighted dynamic time warping algorithm to calculate the deviation degree between the current sign data and the dynamic baseline curve in real time. When the collaborative deviation degree of multiple parameters exceeds the preset threshold, an alarm is triggered. The preset threshold is that systolic blood pressure decreases ≥ 25mmhg and cerebral oxygen saturation decreases ≥ 15% for 5 minutes.

2. the acute ischemic stroke monitoring system based on wearable devices according to claim 1, which is characterized in that the steps for the multimodal sign sensing unit (1) to collect the original signal are as follows:

The bioelectrical sensors, optical sensors and motion acceleration sensors are initialized and calibrated. According to the set sampling frequency, the bioelectrical sensors collect EEG and ECG signals, the optical sensors collect

optical signals related to cerebral blood flow and blood oxygen, and the motion acceleration sensors collect head motion acceleration signals. The collected original signals are preliminarily integrated and time stamped.

3. the acute ischemic stroke monitoring system based on wearable devices according to claim 1, which is characterized in that the embedded data processing unit (2) uses the Wavelet Transform Kalman filter composite algorithm to preprocess the original signal as follows:

The wavelet transform algorithm is used to decompose the original signal and separate the signals with different frequency components. For the separated signals with different frequency components, the Kalman filter algorithm is used for de-noising and data smoothing, and the processed signals with different frequency components are reconstructed to obtain the preprocessed sign data.

4. the acute ischemic stroke monitoring system based on wearable devices according to claim 1, which is characterized in that the training steps of the time series prediction model based on the long-term and short-term memory network in the dynamic baseline generation unit (3) are as follows:

Collect the physical signs data, ambient temperature and altitude data of different users in a variety of environments, build a training data set, and normalize the data in the training data set;

The processed data is divided into training set and verification set according to a certain proportion. The training set is used to train the long-term and short-term memory network model. During the training process, the model parameters are adjusted according to the evaluation results of the verification set until the model converges.

5. the acute ischemic stroke monitoring system based on wearable device according to claim 1, which is characterized in that the steps of generating personalized dynamic

baseline curve by the dynamic baseline generation unit (3) are as follows:

Real time access to the user's current signs data, ambient temperature and altitude parameters, input the signs data and current environmental parameters in the past 72 hours into the trained long-term and short-term memory network model, and draw personalized dynamic baseline curves according to the model output results and combined with the preset curve generation rules.

6. the acute ischemic stroke monitoring system based on wearable devices according to claim 1, which is characterized in that the dynamic baseline generation unit (3) also performs the following steps after generating a personalized dynamic baseline curve:

Conduct trend analysis on the generated personalized dynamic baseline curve to judge whether the fluctuation of the curve is abnormal. If the fluctuation of the curve is abnormal, automatically re collect the physical signs data of the past 72 hours, the current ambient temperature and altitude parameters, and re input the re collected data into the long-term and short-term memory network model to re generate the personalized dynamic baseline curve.

7. the acute ischemic stroke monitoring system based on wearable devices according to claim 1, which is characterized in that the stroke risk assessment unit (4) uses an improved weighted dynamic time warping algorithm to calculate the deviation degree as follows:

The current sign data and the dynamic baseline curve were aligned in time series. According to the impact of different sign parameters on the risk of acute ischemic stroke, the weight of each sign parameter was assigned. Based on the assigned weight, the deviation between the current sign data and the dynamic baseline curve was calculated by using the improved weighted dynamic time warping algorithm.

8. the acute ischemic stroke monitoring system based on wearable devices according to

claim 3, which is characterized in that the specific steps of triggering early warning by the stroke risk assessment unit (4) are as follows:

The multi parameter collaborative deviation calculated by real-time monitoring, when the systolic blood pressure decreased ≥ 25mmhg and cerebral oxygen saturation decreased ≥ 15% for 5 minutes, it is determined that the multi parameter collaborative deviation exceeds the preset threshold. Once it is determined that it exceeds the threshold, it is immediately triggered by the audible and visual module of the wearable device.

9. the acute ischemic stroke monitoring system based on wearable devices according to claim 1, which is characterized in that the stroke risk assessment unit (4) also performs the following steps during system operation:

Self evaluate the weighted dynamic time warping algorithm regularly, and compare the deviation calculated from the same sign data in different time periods with the actual clinical case data;

According to the evaluation results, if it is found that the deviation between the deviation calculated by the algorithm and the actual situation exceeds the preset range, the algorithm optimization process is automatically started, and the weight distribution of each sign parameter in the algorithm is readjusted by using the historical accumulated sign data and the corresponding clinical diagnosis results;

After retraining and optimization, the algorithm is evaluated again until the deviation calculated by the algorithm is within the normal range from the actual situation.

10. the acute ischemic stroke monitoring system based on wearable devices according to claim 1, which is characterized in that the stroke risk assessment unit (4) also performs the following steps after triggering the early warning:

Start the emergency data recording mode, set a sampling frequency to collect and store the current physical signs data, automatically call the preset emergency

contact information, send a distress signal containing the user location, the current physical signs data summary and early warning information to the emergency contact through the communication module of the wearable device, and store the detailed physical signs data change records before and after the early warning locally for subsequent medical analysis.