

zenSleep Business plan

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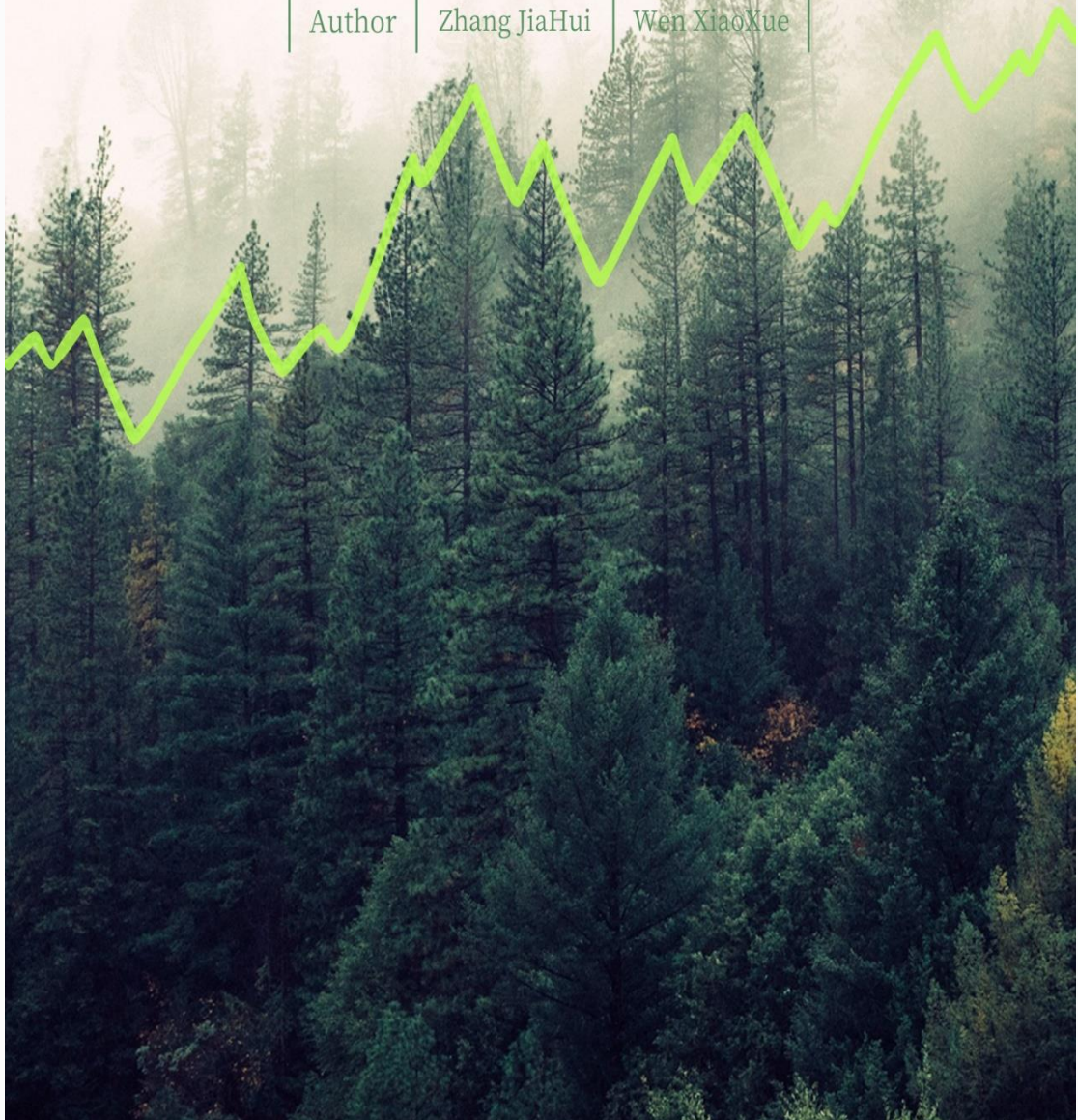


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ZenSleep



1. Project Overview

1.1. Project Background

Depression is a common mental disorder with significant and persistent low mood as the main clinical feature. It is the main type of mood disorder. Depression patients will have symptoms such as memory loss, lack of interest, decreased sleep quality, and persistent sadness, which will damage the patient's physical and mental health. The occurrence of depression is affected by many factors. First, the fast-paced life and high-pressure working environment in modern society make people more prone to anxiety and stress, increasing the risk of depression. Secondly, psychosocial factors such as interpersonal relationship problems, family conflicts, and economic pressure are also important causes of the development of depression. In addition, genetic factors, biological factors, and individual psychological quality and coping ability also play a role in the development of depression.

According to the data of the "2022 National Depression Blue Book" released by the People's Daily, the number of people suffering from depression in China exceeds 95 million, 30% of whom are young people under the age of 18, and 50% of whom are students. According to the "2023 China Mental Health" blue book, under the pressure of society and life, the mental health problems of the people are prominent. The detection rate of depression risk among adults in my country is 10.6%, and the detection rate of anxiety risk is 15.8%. Only 36% of the people believe that they are in good mental health. Among those who self-assess as "poor", the detection rate of depression risk exceeds 45%. Globally, the situation of depression is also not optimistic. The report "The Lancet-World Psychiatric Association Major Report on Depression: It's Time to Take Joint Action on Depression" pointed out that 5% of adults in the world suffer from depression every year, and most people with depression are not diagnosed and treated.

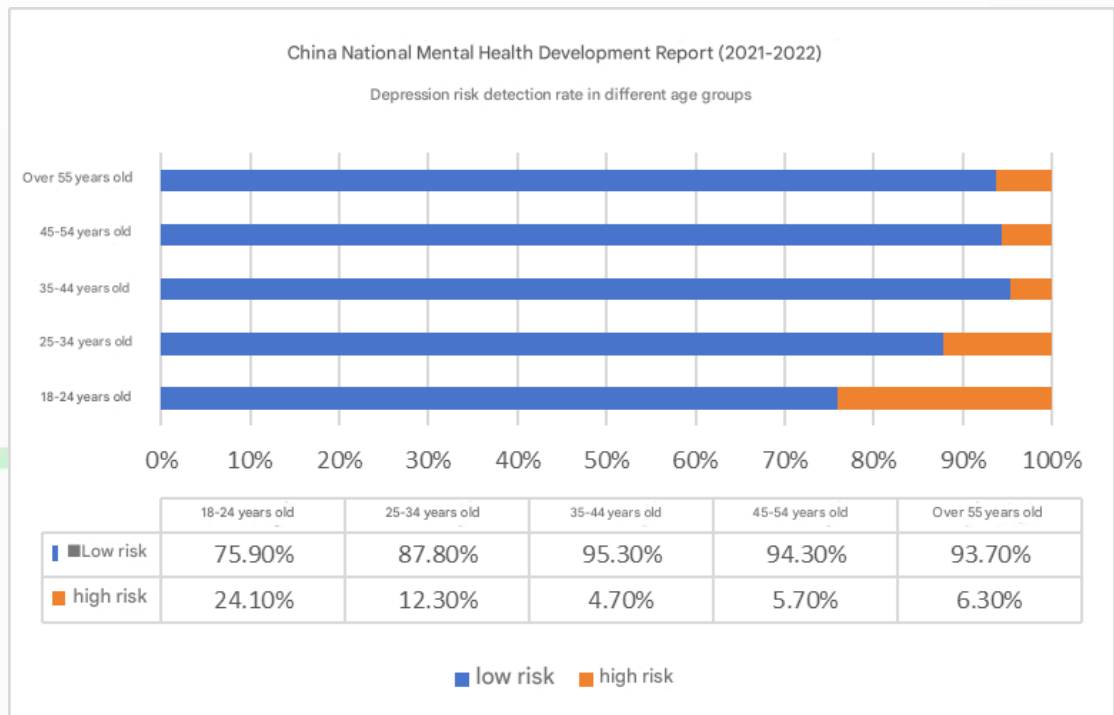


Figure 1 Depression risk detection rate in different age groups

Data from the 2023 China Mental Health Blue Book

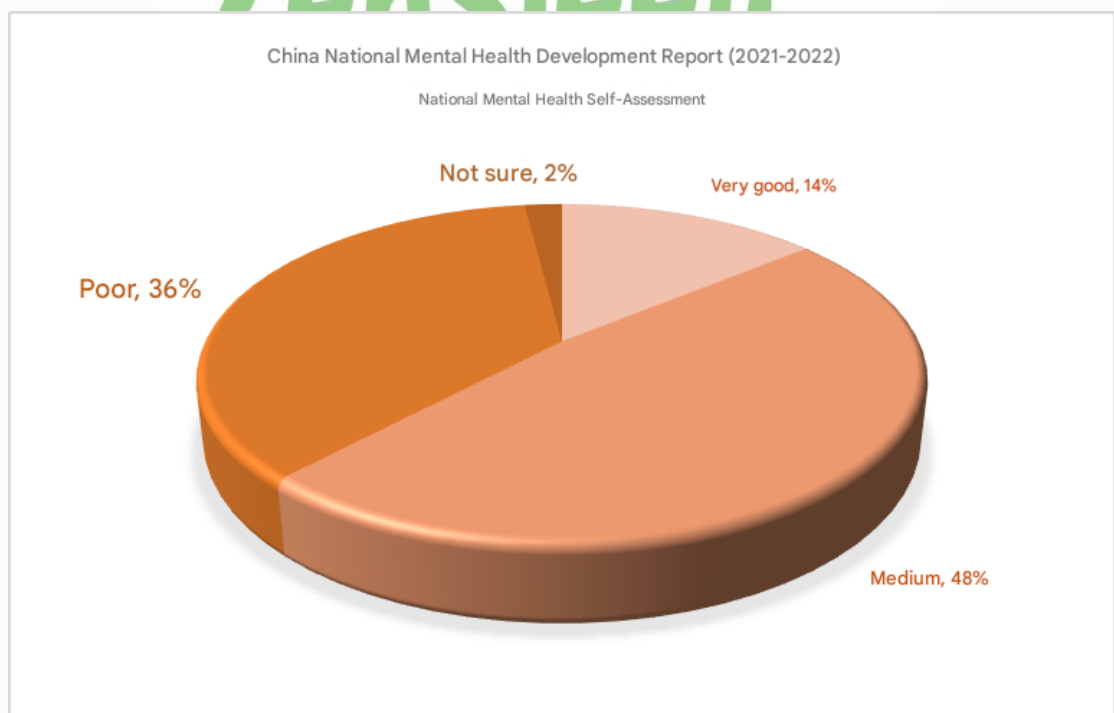


Figure 2 National mental health self-assessment

Data from the 2023 China Mental Health Blue Book

According to the latest epidemiological survey data, depression has become a common mental health disorder worldwide. The prevalence varies in different regions

and populations, but it is generally on the rise. The age of onset of depression is getting younger. More and more adolescents and young people are experiencing symptoms of depression. In today's society, where mental health issues are becoming increasingly prominent, the prevention and treatment of depression is urgent. With the continuous development of psychology and medicine, the treatment of depression is also constantly enriching and improving. The comprehensive use of multiple treatment methods, including drug therapy, psychotherapy, cognitive behavioral therapy, etc., has become the main model for the treatment of depression. At the same time, more and more attention has been paid to mental health education and psychological rehabilitation to improve the public's cognition and coping ability of depression.

1.2. Project Opportunities

In recent years, depressive disorder has become the second-highest burden disease in my country and ranks first among all types of mental and psychological diseases. By 2030, depressive disorder will become the highest burden disease in China [1]. As a highly disabling disease, depressive disorder has become a major public health problem in my country. According to the 2022 National Depression Blue Book, more than 95 million people in China suffer from depression. The Lancet and the World Psychiatric Association released a joint report stating that 5% of adults worldwide suffer from depression each year, and most people with depression are not diagnosed or treated.

At present, the diagnosis of depression is mainly based on clinical interviews with patients and psychiatric questionnaires. This diagnostic method is affected by the doctor's clinical experience and the authenticity of the patient's self-description and is highly subjective. Sleep disorders are one of the common symptoms of depression. Studies have found that the sleep EEG characteristics of depression have obvious changes and can be used to identify depression. Previously, depression identification based on sleep EEG signals mostly used traditional machine learning methods, which required experienced experts to train the model by performing sleep staging on the signals. At present, there is still a problem that the accuracy of theoretical tests is high

but the accuracy is unstable during actual tests. Most of the existing methods for treating depression, such as drug therapy and psychotherapy, rely on long-term treatment and continuous intervention, which causes a large time and financial burden on patients.

The system uses advanced brain wave monitoring technology to identify possible signs of depression by analyzing the EEG signals of the subjects during sleep. This non-invasive diagnostic method is more convenient and accurate than traditional diagnostic methods, and is expected to provide patients with more timely and effective help. In addition, the project also involves the regulation of depression. By monitoring and analyzing brain waves, the system can detect changes in the patient's emotions in real time and take corresponding intervention measures, such as music therapy, cognitive behavioral therapy, etc., to help patients relieve depression symptoms and improve their quality of life.

As people pay more attention to mental health, the demand for diagnosis and treatment of depression continues to increase. The diagnosis and regulation system based on sleep brain waves is innovative and forward-looking, and is expected to fill the gaps in existing diagnosis and treatment methods and provide better services and support for patients with depression. At the same time, the project is also expected to promote research and application in the fields of brain science and neuropsychology, and promote the development and progress of related technologies.

1.3. Project Concept

At present, depression has become a common mental health problem worldwide, which has a serious negative impact on individuals and society. According to the World Health Organization, depression is one of the main causes of global disease burden and occurs in people of different ages.

However, in the diagnosis and treatment of depression, traditional methods have certain limitations. Clinical diagnosis relies on the doctor's experience and the patient's self-report, which is easily affected by subjective factors; and although drug treatment can relieve symptoms, it has side effects and dependence. Therefore, finding more

objective and effective diagnosis and treatment methods has become an important direction of current depression research.

In order to meet the challenges of depression patients around the world, this project is aimed at the challenges of current depression diagnosis and treatment, combined with the latest progress in sleep brain wave research, and strives to provide a more objective, accurate diagnosis and personalized treatment plan. By real-time monitoring of patients' sleep brain waves, the system can quickly and accurately identify the characteristics of depression, provide scientific basis for doctors, provide patients with personalized treatment plans, and monitor and improve patients' sleep quality in real time. It has the characteristics of high precision, high efficiency and high user-friendliness, and is expected to bring new breakthroughs and progress in the diagnosis and treatment of depression.

1.4. Product Overview

Based on the characteristics of sleep EEG signals being non-invasive, easy to obtain, and having high temporal resolution, this project will use an attention-based multi-channel EEG signal sleep staging method (AMCSleepNet) to fully utilize the spatial and frequency domain characteristics of sleep signals to improve the accuracy of sleep staging. At the same time, a depression screening method is developed based on the deep residual network (PC-DRN) model architecture with pyramid convolution layers. The model can extract multi-scale and multi-band feature information through its unique pyramid convolution structure, thereby enhancing the accuracy of depression screening. Compared with traditional machine learning methods, this combination can more accurately perform sleep staging and depression screening.

In addition, based on the scale-free characteristics of the amplitude of EEG signals and the distribution of pitch in music, this project proposes a scale-free brainwave music generation method based on single-channel EEG data, using actual EEG signals for music generation. This method not only faithfully reflects the detailed information of the waveform, but also retains the original scale-free nature of the signal. Based on

this, this project develops a corresponding real-time brainwave music system to provide users with real-time feedback and relieve depression symptoms through music therapy.

Finally, this project was tested with various public data sets to verify its generalization performance in different populations, and parameters were adjusted and optimized continuously, and the front-end and back-end codes were integrated to improve the accuracy and reliability of the system. Finally, we connected the EEG acquisition equipment to the computer to build an integrated depression diagnosis system that integrates signal acquisition, processing and classification, result output, and music regulation.

1.5. Marketing Overview

Based on the current status of the industry, we divide target users into three types: C-end users, H -end users and B -end users . B -end users are professional medical device manufacturers and are also the main target users of this product. C -end users , as direct users and the main beneficiary group, are patients and potential patients who have been diagnosed with depression. H -end users are professional medical institutions, mainly hospitals. Marketing is mainly carried out through the following methods:

a. Subscription Fees

In order to meet the needs of different target groups, we adopt a flexible monthly subscription fee model to provide customers with continuous value and service. We will provide two subscription methods: basic version and advanced version, and different groups can choose according to their needs. The basic version subscription includes general diagnostic and analysis functions, such as system access, standard data analysis and regular updates. The advanced version subscription is more personalized, providing advanced functions such as customized analysis and priority customer support.

b. Sales share

Cooperate with professional medical device manufacturers to bundle this system with professional medical devices for sale. Users pay a certain percentage of distribution commission and marketing expenses based on the number of subscriptions.

We will establish a flexible profit-sharing mechanism and regularly adjust the profit-sharing ratio based on market dynamics and sales performance. At the same time, ensure good communication with partners and jointly develop market strategies to achieve long-term win-win results for both parties.

c. Advertising Revenue

We will increase profitability by introducing advertisers and providing healthcare and other related advertising services. The system attracts a large number of healthcare professionals and patient groups related to depression, creating a targeted and highly focused advertising market for related medical companies, pharmaceutical companies and health service providers. We will adopt a non-intrusive advertising strategy to ensure that the advertising content is highly relevant to user needs and interests while maintaining the user experience.

d. Research report income

We regularly publish industry reports and market research reports to reveal the trends and patterns of depression and mental health problems, and provide perspectives and experience for clinical medicine, psychology, and medicine. At the same time, we establish partnerships with academic institutions and non-profit organizations, share anonymized data, support their research in the field of mental health, obtain potential research funding and project cooperation opportunities, and achieve a win-win situation.

2. Product Introduction

2.1. Product Introduction

According to the 2022 National Depression Blue Book, more than 95 million people in China suffer from depression. The Lancet and the World Psychiatric Association released a joint report stating that 5% of adults worldwide suffer from depression each year, and most patients with depression are not diagnosed or treated. In order to meet the challenges of depression patients around the world, this project

plans to design a depression screening and regulation system based on sleep EEG signal analysis and brainwave music generation, aiming to improve the diagnostic accuracy of depression and accelerate the patient's recovery process. The system can not only identify depressive symptoms, but also monitor and improve the patient's sleep quality in real time, with the characteristics of high precision, high efficiency and high user-friendliness.

Based on the characteristics of sleep EEG signals being non-invasive, easy to obtain and having high temporal resolution, this project will use an attention-based multi-channel EEG signal sleep staging method (AMCSleepNet) to make full use of the spatial and frequency domain characteristics of sleep signals to improve the accuracy of sleep staging. At the same time, a depression screening method is developed based on the deep residual network (PC-DRN) model architecture with pyramid convolution layers. This model can extract multi-scale and multi-band feature information through its unique pyramid convolution structure, thereby enhancing the accuracy of depression screening. Compared with traditional machine learning methods, this combination can more accurately perform sleep staging and depression screening. In addition, based on the scale-free characteristics of the amplitude of EEG signals and the distribution of pitch in music, this project proposes a scale-free brainwave music generation method based on single-channel EEG data, and uses actual EEG signals for music generation. This method not only faithfully reflects the detailed information of the waveform, but also retains the original scale-free nature of the signal. Based on this, this project develops a corresponding real-time brainwave music system to provide users with real-time feedback and relieve depression symptoms through music therapy.

Finally, this project was tested with various public data sets to verify its generalization performance in different populations, and parameters were adjusted and optimized continuously, and the front-end and back-end codes were integrated to improve the accuracy and reliability of the system. Finally, we connected the EEG acquisition equipment to the computer to build an integrated depression diagnosis system that integrates signal acquisition, processing and classification, result output,

and music regulation.

In summary, this project is not only expected to improve the diagnosis and treatment of depression, but also has the potential to promote technological innovation and social development in the field of mental health. At present, this project has established a cooperative relationship with Guangdong Provincial People's Hospital to jointly promote the research of scientific and technological automated diagnosis and treatment of depression. We hope that with the promotion and application of the project, it can create greater value for medical institutions and the depression group.

2.2.Core Technology

The overall technical route of this project is as follows: First, obtain the sleep EEG signals of normal people and insomnia patients for a whole night from the public data set and perform data preprocessing; then perform sleep staging and classify according to the sleep staging results; then diagnose depression based on the sleep staging results; finally, collect EEG through EEG equipment, connect the front and back ends, and build a depression diagnosis system. See Figure 3 for an overview of the technical route:

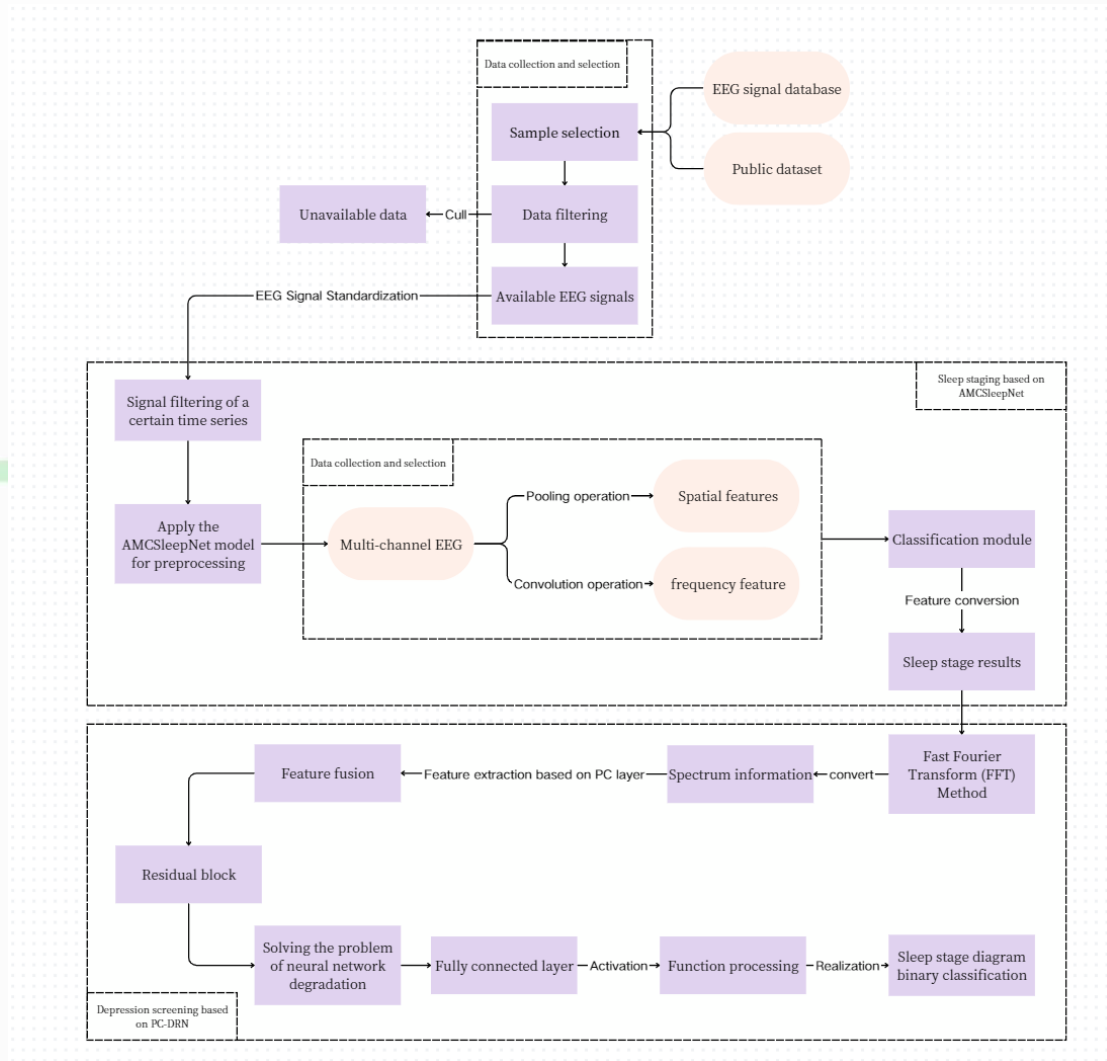


Figure 3 Overview of technical routes

AMCSleepNet sleep staging module based on multi-channel

For the bedtime staging task, it can generally be processed in the following three steps: data preprocessing, feature extraction and classification recognition, as shown in Figure 4.



Figure 4 Sleep staging task steps

Data preprocessing: In this step, the raw sleep signal data needs to be preprocessed. This may include operations such as removing noise, standardizing data, filtering or downsampling to provide better data quality and operability for subsequent processing.

Feature extraction: Extracting appropriate features is the key to effectively

classifying sleep signals. In this step, various signal processing techniques and feature engineering methods can be used to extract useful features from the preprocessed signals .

Classification: In this step, deep learning methods are used to associate the extracted features with known sleep stage labels.

(1) Data preprocessing

①Sample segmentation

This project refers to the research of Rechtschaffen and Kales on human sleep stages and AESCHBACH's method of processing sleep EEG data. First, data segmentation is performed. The original sleep EEG signal is segmented into a time series of 30 seconds each using a sliding time window, and the data is cut at intervals of 30 seconds (the last data less than 30 seconds is deleted). The cut data is an independent sample, assigned a label, and brought into the data model for processing. The specific method of time window cutting sleep EEG data is shown in Figure 5.

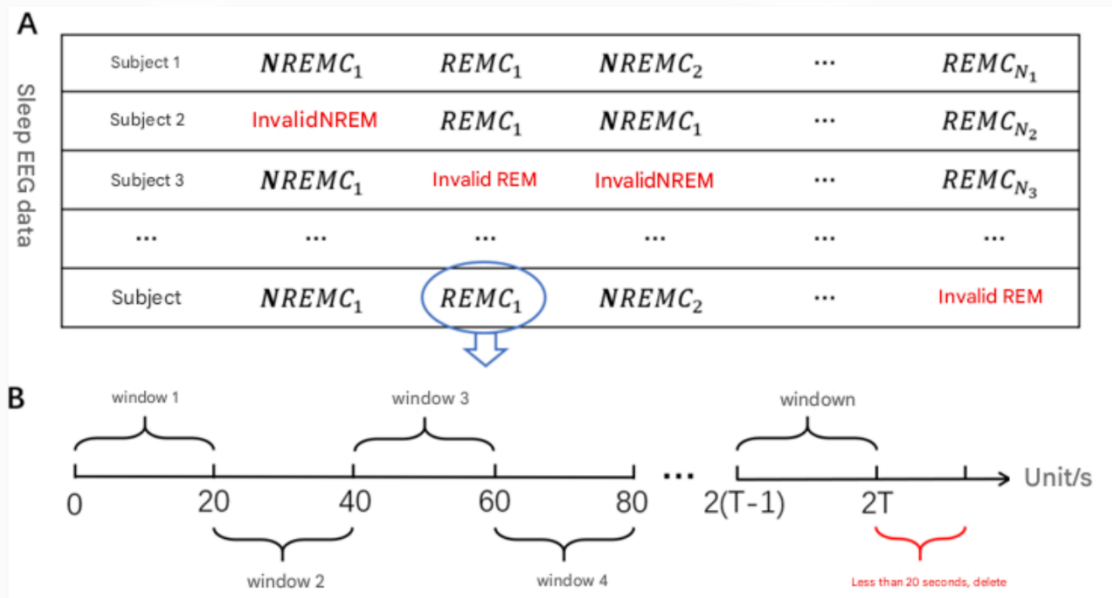


Figure 5 Schematic diagram of sliding time window cutting sleep EEG data

After such sample segmentation, this project can not only ensure data stability, but also increase the number of samples, improve model effectiveness and the accuracy of sleep staging results, and is more conducive to the study of depressive

symptoms after sleep staging.

②Wavelet Transform

According to the characteristics of sleep data, this project selects one of the modern filters, wavelet transform, to denoise and remove artifacts from the original sleep EEG signal. The wavelet threshold filtering process is as follows: after selecting the wavelet basis function and determining the number of decomposition layers, the original sleep EEG signal is decomposed by wavelet to obtain the wavelet coefficients corresponding to different frequency bands; then, according to the frequency band range of the noise, the corresponding wavelet coefficients are thresholded and finally inverse wavelet transform is performed to obtain the filtered sleep EEG signal. The specific denoising process is shown in Figure 6:



Figure 6 Schematic diagram of sleep signal denoising

(2) Sleep data feature extraction module

AMCSleepNet (Attention Based Multi-Channel EEG Sleep Net) is a neural network model for sleep staging. It performs well when processing multi-channel EEG (electroencephalogram) data. AMCSleepNet was originally designed as a single-channel model to process data from a single EEG channel. In the single-channel model, AMCSleepNet performs sleep staging by learning sleep features and patterns on each channel.

However, on the multi-channel dataset, AMCSleepNet was modified to a model capable of processing multiple EEG channels. By setting the number of channels to 1 and training the model on each channel independently, the sleep staging accuracy of different channels can be obtained. From the experimental results, AMCSleepNet has improvements in all channels compared to AttnSleepNet , especially in the F4-M1 channel. The overall architecture of AMCSleepNet is shown in Figure 7, which is mainly divided into three parts: feature extraction, feature fusion, and Transformer

encoder.

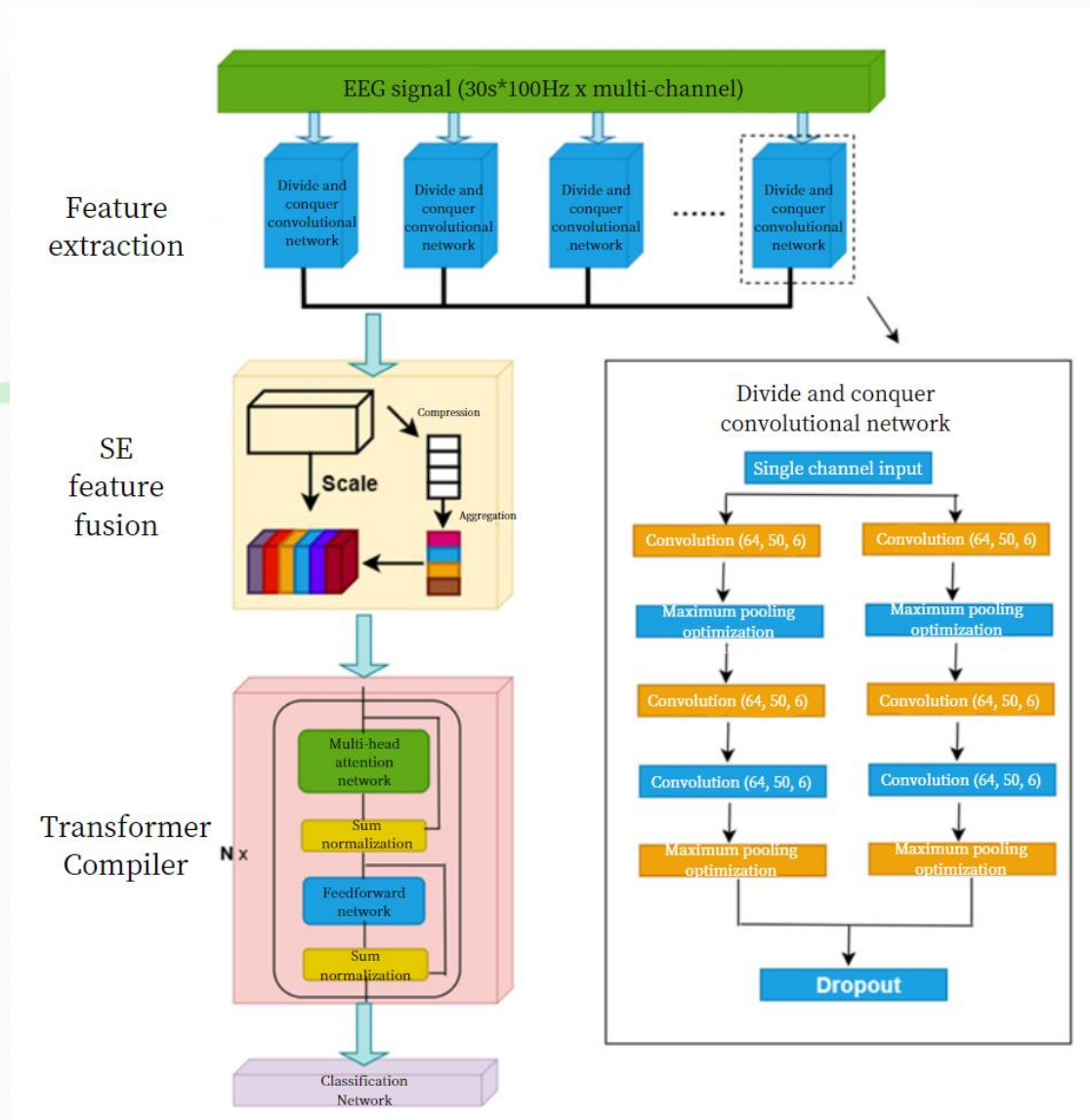


Figure 7 The overall framework of AMCSleepNet

① Time-frequency feature extraction

By analyzing EEG signals collected at different sleep stages, it is found that their energy is concentrated in different frequency ranges. Studies have shown that small-scale convolution kernels in convolutional neural networks are mainly used to capture time domain features, while large-scale convolution kernels are more suitable for capturing frequency domain features. In addition, the size of the convolution kernel is related to the corresponding characteristic frequency. Larger convolution kernels correspond to lower characteristic frequencies, while smaller convolution kernels

correspond to higher characteristic frequencies.

AMCSleepNet uses a multi-branch convolutional neural network (MB-CNN) to extract time-frequency features from EEG signals. As shown in Figure 8, the EEG signal of each channel passes through two branches of convolutional layers, and each branch has three convolutional layers. These convolutional layers have different scales. Small-scale convolutional kernels can capture time domain features, and large-scale convolutional kernels can capture frequency domain features. Larger convolutional kernels correspond to lower feature frequencies, and smaller convolutional kernels correspond to higher feature frequencies. **Through the multi-branch design of the convolutional layer, AMCSleepNet can extract the features of EEG signals in different frequency ranges.**

In addition to the convolutional layers, Dropout layers and maximum pooling layers are used to prevent overfitting. Each convolutional layer is batch normalized after calculation, and Gaussian Error Linear Units (GELU) activation function is used for nonlinear operations .

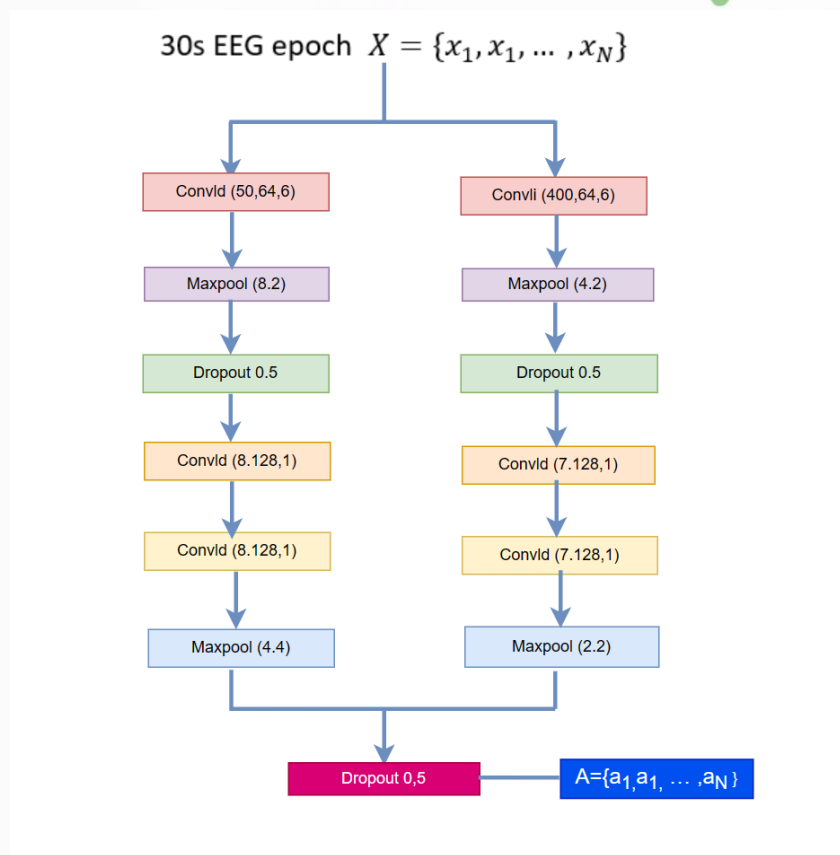


Figure 8 Schematic diagram of multi-branch convolutional neural network extracting EEG signals

② Feature fusion network

The feature fusion network is part of the AMCSleepNet model, which is used to solve the fusion problem of EEG time-frequency features from different channels. **It mainly includes three steps: compression, aggregation and reconstruction.** Its structure is shown in Figure 8.

First, the input multi-channel feature matrix is compressed into a one-dimensional vector by using convolution and global average pooling . This vector represents the importance of each channel feature in the overall feature, denoted as vector $s = \{s_1, s_2, \dots, s_N\}$.

Next, two fully connected layers and sigmoid functions are used to convert the vector s into a weight matrix $e \in \mathbb{R}^{N \times d}$, whose size is $N \times d$, where N and d are the number and length of the output features of each branch convolutional network, respectively. This weight matrix represents the contribution of each channel feature in the reconstruction process, that is, it determines the proportion of each channel feature in the reconstructed feature matrix.

performing a dot product operation on the weight matrix e and the original feature matrix F , a multi-channel feature matrix F' is reconstructed, and its size is also $N \times d$. This feature matrix F' can be regarded as a feature representation after considering the channel weights, as the input of the next module.

The feature fusion network fuses features from different channels through three steps of compression, aggregation and reconstruction, and reweights the features according to the contribution of each channel to the final feature to generate better feature representation, thereby improving the accuracy and performance of sleep staging.

③ Transformer and its encoder

Transformer is a new architecture proposed based on the paper "Attention is All You Need" to solve sequence-to-sequence tasks and can easily handle long-term

dependency problems. Compared with traditional recurrent neural networks (RNNs), Transformer is better able to learn long-range relationships in the input. Although the LSTM model can also learn temporal relationships in the input, it has some limitations. First, the temporal structure of the LSTM model makes it difficult to perform parallel calculations efficiently, because the calculation of the current state depends not only on the current input, but also on the output of the previous state. Secondly, the entire LSTM model (and other RNN models) is more like a Markov decision process as a whole, and it is difficult to extract overall information.

In contrast, Transformer uses a self-attention mechanism, can process all vector inputs at the same time, has the ability to train in parallel, thus improving efficiency and being able to better extract global information. Therefore, Transformer has become the preferred model for processing sequence tasks, replacing the method of combining RNN and CNN.

In the encoder, the multi-head attention network is the first unit. Assume that the input feature is $X = \{x_1, x_2, \dots, x_N\} \in \mathbb{R}^{N \times d}$, X is divided into h subspaces in the d dimension, corresponding to h heads. According to formula (1), for each subspace X_i , multiply W^Q , W^K and W^V respectively to obtain Q_i , K_i and V_i in Figure 2. \sqrt{d} The attention matrix is converted into a standard normal distribution, and softmax () is used to calculate the weight of V_i . The attention of each subspace is spliced to obtain the multi-head attention MA, as shown in formulas (1)(2).

$$ATT(X_i) = \text{softmax}\left(\frac{X_i W^Q, X_i W^K}{\sqrt{d}}\right) X_i W^V \quad (1)$$

$$MA = \text{Concat}(ATT(X_i), \dots, ATT(X_H)) \quad (2)$$

Transformer uses a summation and normalization layer with residual connections to add the network input to the output of the multi-head attention network to avoid the gradient disappearance of the deep network. In the feedforward network, Transformer uses two layers of linear full connection and linear rectification function (ReLU) to further deepen the complexity of the model. **These layers can extract higher-order features through nonlinear transformations, thereby enhancing the representation**

ability of the model.

(3) Classification module

In the classification module, fully connected networks and Softmax layers are often used to convert features into probability vectors to obtain the final sleep staging results. A fully connected network usually refers to a series of fully connected layers (also called dense layers or linear layers), in which each neuron is connected to all neurons in the previous layer. These fully connected layers can establish a mapping relationship between input features and output results by learning connection weights. Fully connected networks can perform nonlinear transformations and combinations on high-dimensional features to extract richer feature expressions.

In the last layer of the fully connected network, a softmax layer is usually used. This layer converts the output of the fully connected layer into a probability vector, where each element represents the probability of the corresponding category. The Softmax function normalizes the output of the fully connected layer so that the sum of the probabilities of all categories is equal to 1. In this way, the model can determine whether the input belongs to different sleep stages based on probability. Through the fully connected network and the Softmax layer, the extracted features can be converted into a probability vector, and the sleep staging result of the input can be determined based on the maximum probability. **This method can achieve feature-based classification and prediction, thereby completing the sleep staging task.**

2.2.2. Depression screening section

After implementing sleep staging, the project can learn and classify these different sleep stages. The project will use the results of sleep staging to screen the alpha, theta, and delta bands of the REM period for signal conversion, obtain spectrum information, and implement depression screening and classification based on the PC-DRN network. There are two types of convolutional layers: one is the PC layer. The first convolutional layer adopts the PC layer architecture, which enables the neural network to **extract the**

features of the sleep staging map more comprehensively ; the other is the conventional convolutional layer in the residual block, and each residual block contains two conventional convolutional layers. **This enables the neural network to effectively learn the features of the sleep staging map and improve classification accuracy .** The process of diagnosing depression using the PC-DRN architecture is shown in Figure 9:

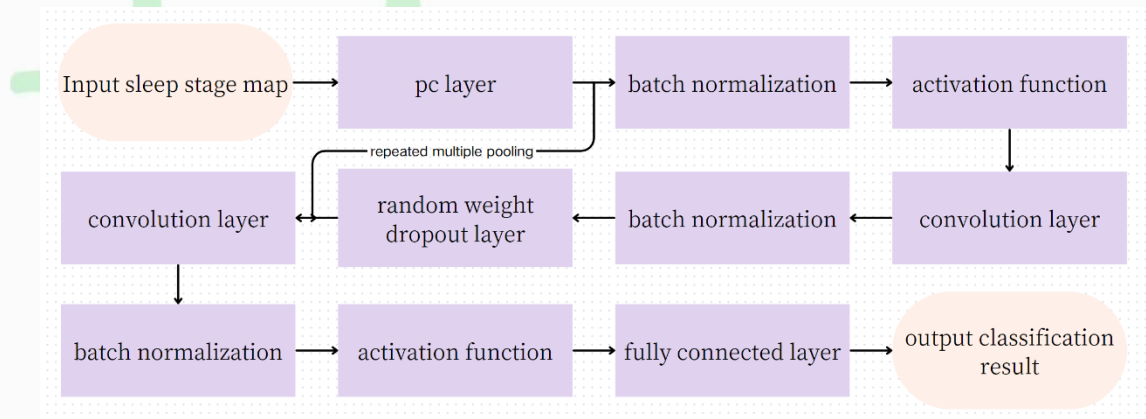


Figure 9 Overview of the PC-DRN-based depression screening technology architecture

(1) Filter sleep data after sleep stage classification

Most studies have shown that compared with normal people, patients with depression have more frequent and fragmented rapid eye movement (REM) sleep during the entire night's sleep, and there are obvious differences in sleep microstructure (i.e., alpha, theta, and delta bands). Therefore, this project first screened out REM sleep EEG data based on the results of sleep staging for subsequent analysis.

(2) Convert data to signals

This project uses the fast Fourier transform (FFT) method to process the sleep staging results, as shown in formula (3). Through FFT, this project can convert EEG signals from the time domain to the frequency domain to obtain spectrum information. This can help this project analyze the changes of different frequency components in different time periods, reveal the time-frequency characteristics of EEG signals, and help to study the changes in sleep stages more carefully. **In this way, the differences in sleep physiological signals between depression patients and normal people can**

be better highlighted, and the accuracy of classification can be improved.

$$\begin{cases} X(k) = \sum_{n=0}^{N-1} x(n) * \exp(-j * 2\pi * k * \frac{n}{N}) \\ x(n) = \left(\frac{1}{N}\right) * \sum_{k=0}^{N-1} X(k) * \exp(j * 2\pi * k * \frac{n}{N}) \end{cases} \quad (3)$$

(3) Perform feature extraction

CNN, which was designed based on the concept of "receptive field" in the field of biological neuroscience, is a special deep feedforward neural network. In the convolution layer of CNN, each receptive field is repeatedly acted on by the convolution kernel to form a feature map. However, the feature information contained in a single feature map is limited. In order to increase the amount of information expressed by the features, this study uses a pyramid convolution layer (PC) to obtain fused features, as shown in Figure 10. The PC layer consists of multiple different convolution branches, and the features extracted by each branch are concatenated to obtain cascade features. Then, the cascade features pass through a convolution kernel of size 1×1 to generate the final fused features. **This design can further improve and enhance the comprehensiveness and accuracy of the neural network's feature extraction of sleep staging results.** The PC layer algorithm is shown in formula (4):

$$\begin{cases} X = \text{Conv}(x) \\ Y = \text{Concat}(X_1, X_2, \dots, X_n) \\ R = \text{Conv}(Y) \end{cases} \quad (4)$$

Where x represents the ECG signal input to the convolution branch, $\text{Conv}(\cdot)$ represents the convolution operation, x represents the feature map obtained by a convolution branch, x_n represents the feature map obtained by the n th convolution branch, $\text{Concat}(x)$ represents the cascade operation, Y represents the cascaded features after the feature maps of n convolution branches are concatenated, and R represents the fused features obtained after the cascaded features pass through the convolution kernel of size 1×1 .

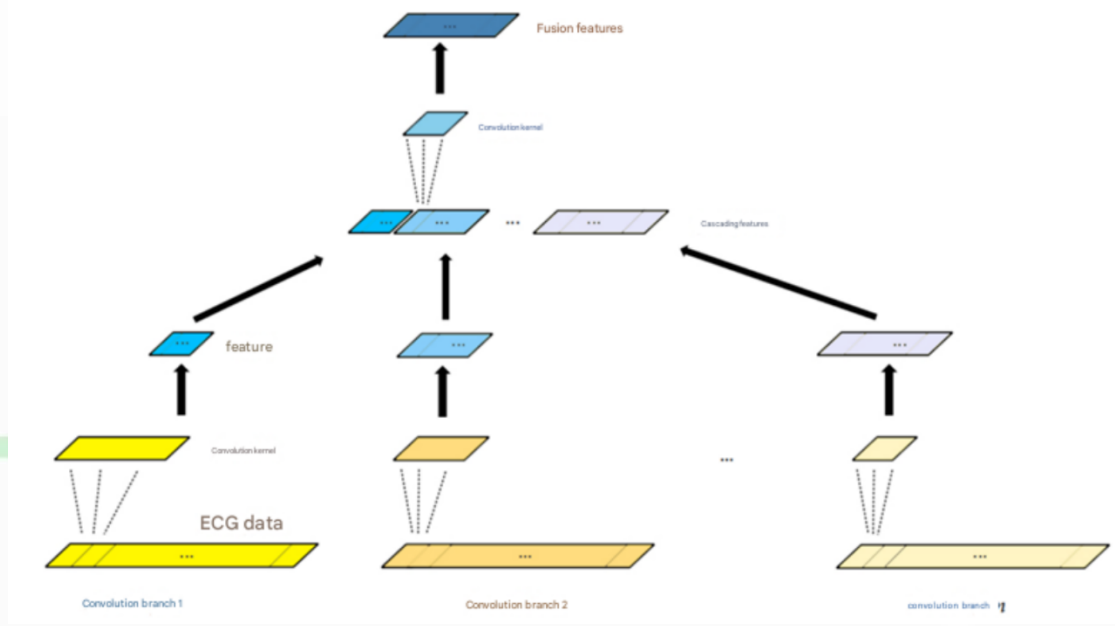


Figure 10 Feature extraction and fusion based on PC layer

The PC layer is a structure containing multiple different convolution branches, each of which has 32 different convolution kernels. The sizes of these convolution kernels are selected in descending order to obtain features at different scales. After the ECG signal is input, these convolution branches can simultaneously extract information of different bands in the signal and obtain feature maps of multiple scales. **The obtained feature maps describe different levels of information of the ECG signal, so that each band in the ECG signal can be effectively extracted.** The expression of the convolution operation is shown in formula (5):

$$\begin{cases} O_h^a = f(I_h^a) \\ I_h^a = \sum_{i \in M^a} x_{h-1}^i * k_h^{ia} + bias \end{cases} \quad (5)$$

Among them, I_h^a represents the a th channel input of the h th convolutional layer, represents the corresponding output, $f()$ is the activation function, x is the ECG signal, M^a represents the $h-1$ th layer feature map, i represents each feature unit, x_{h-1}^i represents the output of the i -th feature unit in the $h-1$ th regular convolutional layer, k_h^{ia} represents the convolution kernel matrix, $bias$ is the bias term, and “*” represents the convolution operator.

(4) Connecting Deep CNNs in a Residual Way

The PC-DRN model contains multiple residual blocks built with identity

connections. Each residual block calculates the residual based on each layer of the input to make it easier to optimize the network parameters. As shown in Figure 11, the network structure contains multiple residual blocks. Inside the residual block, two convolutional layers are used to fit the residual between the input data and the mapped output data **to help the network solve the degradation problem**.

In order to improve network performance, the residual block contains batch normalization (BN), activation function and random weight drop layer, as shown in Figure 10. Batch normalization speeds up network training by reducing the mean square error and helps gradient propagation. This project chooses the rectified linear unit (ReLU) as the activation function, as shown in formula (6). **It helps to update parameters during back propagation and solve the problem of gradient disappearance.**

$$h(x) = \begin{cases} x & (x > 0) \\ 0 & (x \leq 0) \end{cases} \quad (6)$$

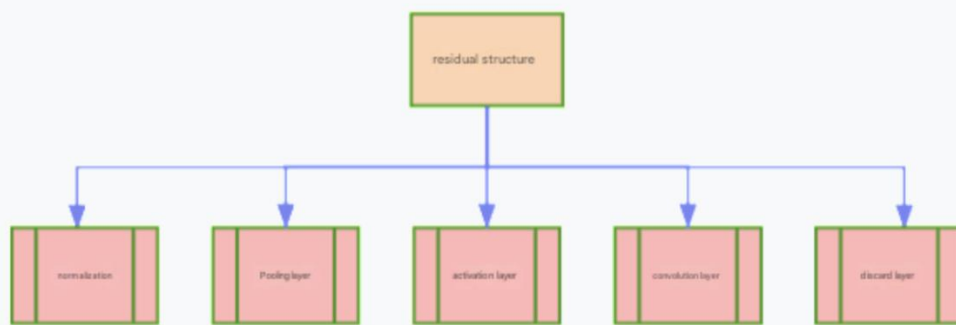


Figure 11 Residual block structure

(5) Output classification results

After multiple residual blocks are processed, batch normalization is performed again, and then the activation function (Logistic Sigmoid) is used to process the data, and the output of the model is converted into a probability value to better achieve binary classification, as shown in formula (7). After the fully connected layer, **the binary classification of the sleep stage diagram of patients with depression and the sleep stage diagram of normal people is finally achieved.**

$$h(x) = \frac{1}{1 + \exp(-x)} \quad (7)$$

2.2.3. System construction based on project algorithm

After implementing the deep learning method based on sleep staging, the project will rely on the implementation of the algorithm to further develop an automatic screening and regulation system for depression. The system will consist of five parts: application layer, network layer, business layer, data layer, and operating environment, as shown in Figure 12.

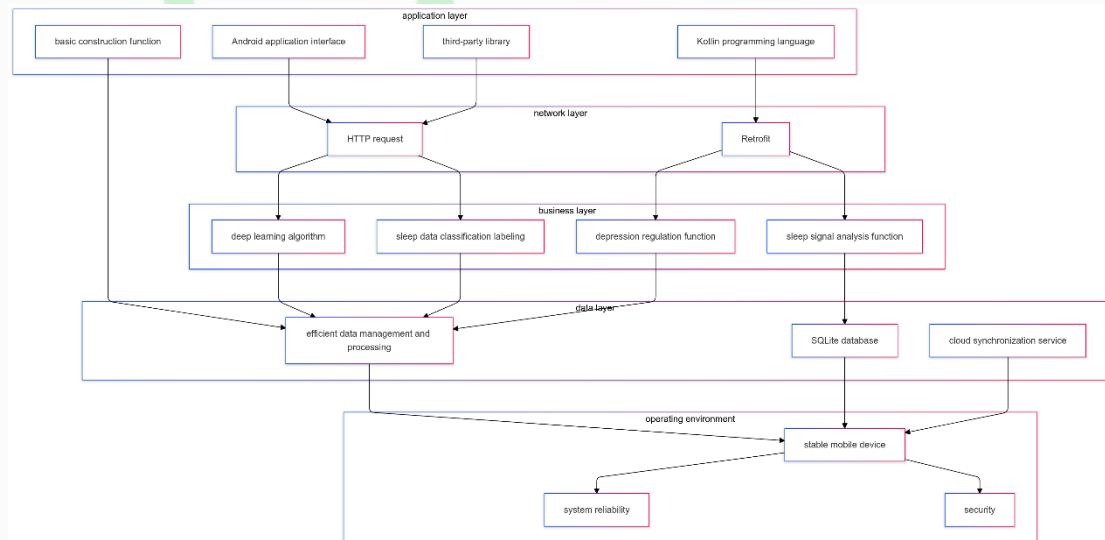


Figure 12 System framework overview

For the application layer, the main goal of the project is to meet the user's operational needs through algorithms and mobile application development. The application layer will focus on the following functions: recording sleep signals, analyzing sleep status in real time, and providing an intuitive user interface so that users can better understand sleep data and analysis results. These functions will be implemented through the Android application interface, Kotlin programming language and third-party libraries , and use HTTP requests for data interaction.

The network layer will use the Retrofit library to process network requests to ensure the reliability and security of data transmission. At the business layer, this project will use deep learning algorithms to analyze sleep signals and classify and label sleep data to provide support for subsequent sleep quality assessment and depression risk assessment. At the same time, depression regulation functions such as relaxation guidance or sleep suggestions can be added to provide more health management methods.

In terms of the data layer, efficient data management and processing technology is used to quickly process and analyze data. The system uses the SQLite database to store and manage local data, and remotely backs up and synchronizes data through cloud synchronization services. Finally, in terms of the operating environment, the system needs to run on stable mobile devices to ensure the reliability and security of the system. By optimizing the performance and security of mobile devices, the user experience is improved.

2.3. System Implementation

2.3.1. System architecture design

This project adopts a modular architecture design to adapt to the development needs of the Android platform. The system is mainly divided into the following levels:

1. Application Layer:
 - Basic Construction Function: Provides basic functional modules for applications.
 - Android Application Interface: defines the interface for interacting with the Android system.
 - Third-party Library: Integrate external libraries to enhance application functionality.
2. Network Layer:
 - HTTP Request: handles data exchange between the application and the server.
 - Retrofit: A library for network requests that simplifies the creation and use of HTTP clients.
3. Business Layer:
 - Deep Learning Algorithm: implements the core algorithm logic of the application.
 - Sleep Data Classification Labeling: Classify and label sleep data.

- Sleep Signal Analysis Function: Analyzes sleep signals to provide user insights.
- Depression Regulation Function: Provides regulation and suggestions for depressive emotions.

4. Data Layer:

- Efficient Data Management and Processing: Ensure efficient storage and processing of data.
- SQLite Database: used for local data storage.
- Cloud Synchronization Service: Enables cloud-based data synchronization.

5. Operating Environment :

- Stable Mobile Device: Ensure the stable operation of the application on mobile devices.
- System Reliability: Ensure the stability and reliability of the application.
- Security: Protect user data and privacy.

The development language uses Kotlin, a modern, concise programming language designed specifically for Android development to improve development efficiency and code maintainability. Through this architectural design, we are able to build an Android application that is feature-rich, user-friendly, and stable in performance.



Figure 13 Overall architecture design

2.3.2. Technology selection

(1) Development environment

- Android Studio: As the main integrated development environment (IDE) for

Android application development, it provides functions such as code editing, debugging, and performance tools.

(2) Programming language

- Kotlin: As the main programming language, Kotlin provides simplicity, security, and strong interoperability, making it suitable for Android application development.

(3) Application layer technology

- Android SDK: Provides the APIs and tools needed to build Android applications.
- Third-party libraries: Integrate libraries such as Retrofit to enhance network requests, image loading and other functions.

(4) Network layer technology

- Retrofit : Used to handle HTTP network requests and simplify communication with backend services.
- OkHttp : As the underlying HTTP client of Retrofit, it provides efficient network request processing.

(5) Business layer technology

- Deep Learning Algorithms: Integrate machine learning libraries such as TensorFlow Lite to run deep learning models on mobile devices.
- Data Analysis: Use Kotlin to write business logic to handle functions such as sleep data classification, signal analysis, and depression regulation.

(6) Data layer technology

- SQLite: As a local database, used to store application data.
- Room: As an abstraction layer for SQLite, it simplifies database operations, provides compile-time checking and a simpler API.

(7) Cloud Services

- Firebase: Provides cloud synchronization services to achieve cloud storage and synchronization of data.
- Google Cloud Platform: Potentially used to scale cloud services such as compute, storage, and machine learning services.

(8) User Interface

- XML/ ConstraintLayout : Used to design responsive user interfaces.
- Material Design: Follow the Material Design guidelines to provide a beautiful and consistent user interface.

(9) Performance and safety

- ProGuard : Used for code obfuscation and optimization to improve application security and performance.
- Android Security: Follow the security best practices of the Android platform to protect user data.

Through these technical selections, this product will be able to provide rich functions, excellent user experience, and good performance and security.

2.3.3. Module division and implementation

(1) Registration Page

The user enters his name, email address and password on this page to register an account, clicks Register to complete the account registration, and then the page jumps to the login page.

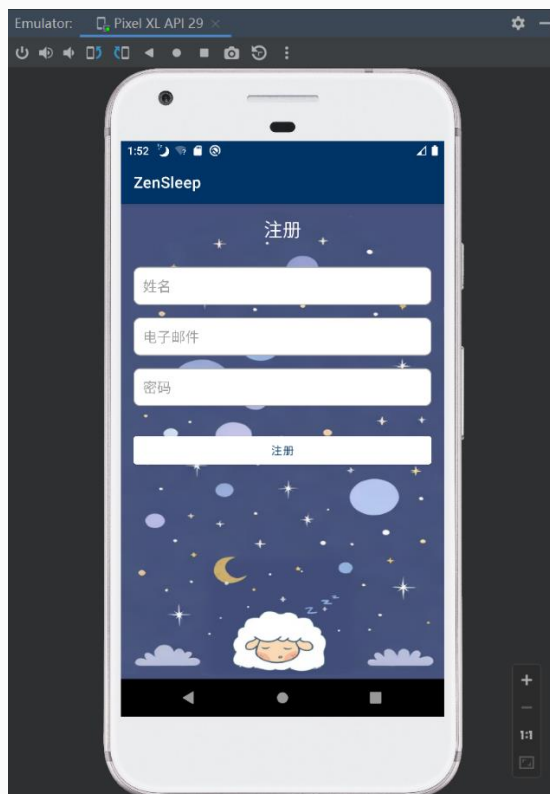


Figure 14 Registration page

(2) Login Page

Enter the username, email address and password of the registered account on this page, click Login to enter the APP. If you want to register an account, click Register to jump to the registration page.

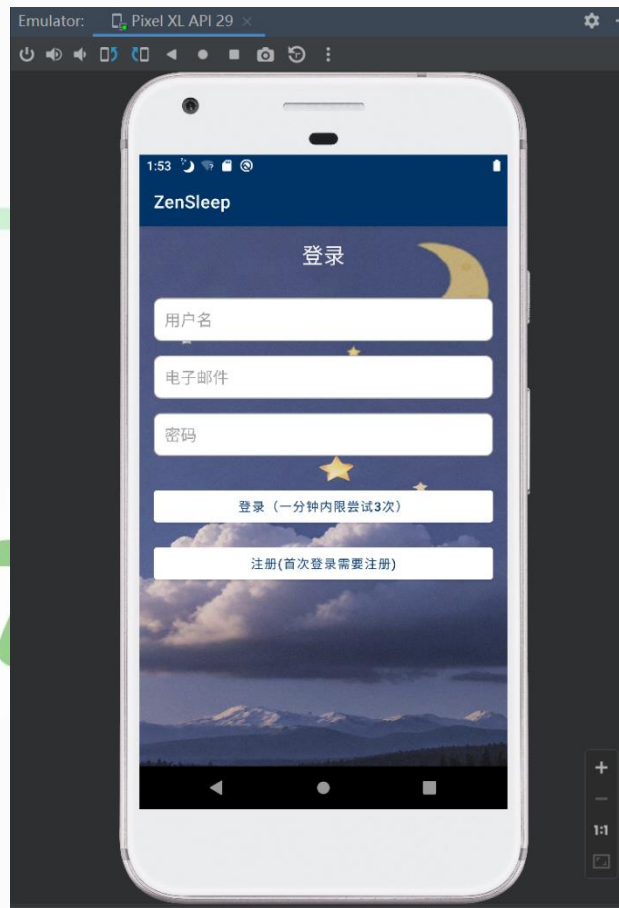


Figure 15 Login Page

(3) User Page

Click the My icon in the bottom navigation bar to enter the user page, which displays the logged-in user's avatar, registered email address, and user name. The following list also displays the user's use of the APP information;

Click "Logout" to log out of the account and return to the login page; click "Switch User" to enter the login page and the user can log in to the new account.

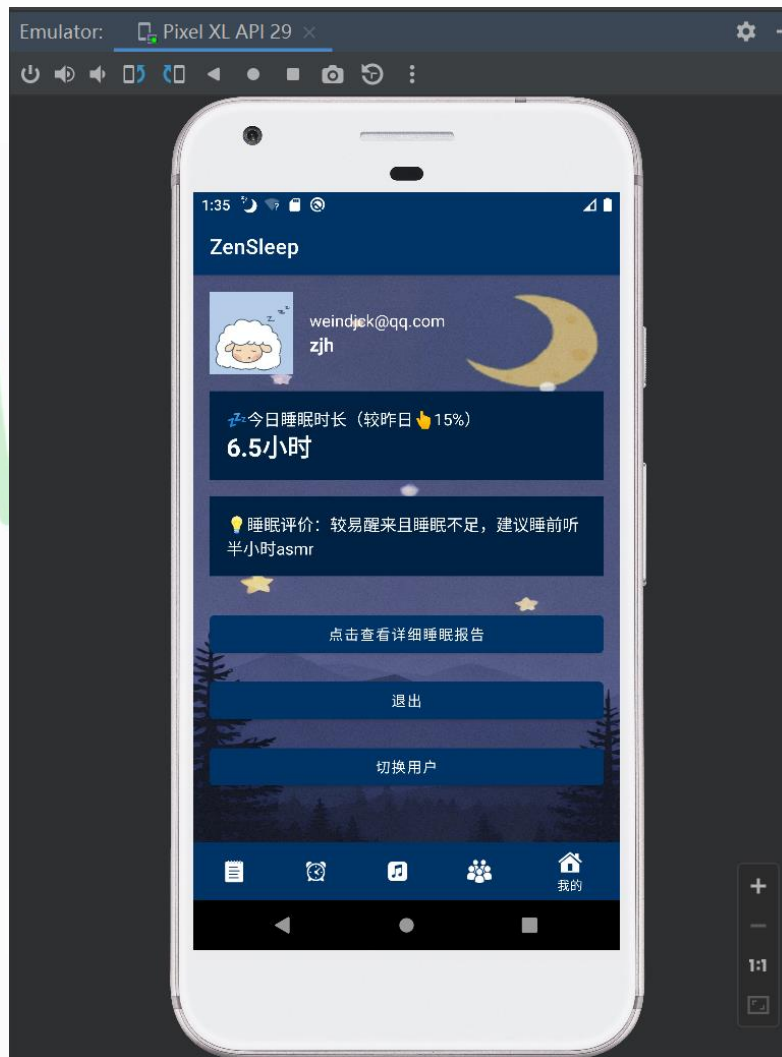


Figure 16 User Page

(4) Sleep aid module

After logging into the APP, the first page displayed is the music list page, which shows all the sleep-aiding songs in the background. When users click on the song they want to listen to , they will jump to the listening page of the song;

On the listening page, the song title and author name of the selected song are displayed. Users can click on the previous song, next song or pause, or drag the song progress bar and click the page back to return to the song list page.

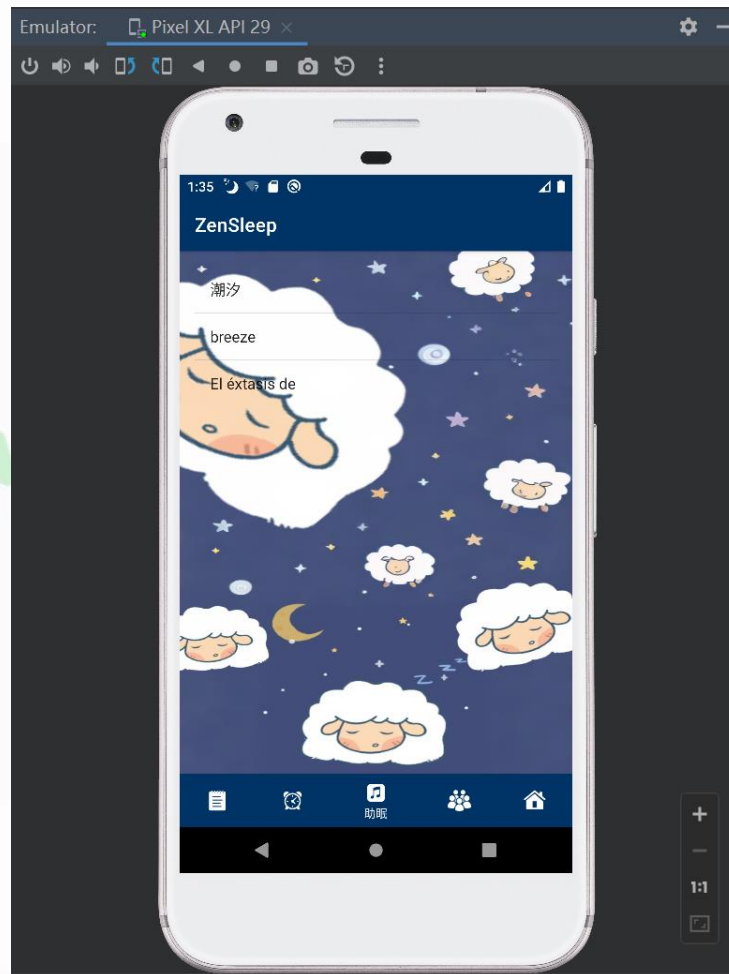


Figure 17 Sleep aid page

(5) Alarm clock module

Click the timing icon in the bottom navigation bar to enter the nap timing page. Users can scroll the digital axis to select the time to be counted. After selection, there will be text at the bottom showing the corresponding ringing time. Users click "Start Timing" and the APP will enter the countdown interface. At the same time, there will be a prompt to inform the user to start timing. Click "Cancel Timing" to stop timing. After the countdown is over, the phone will ring and vibrate to remind the user that the countdown is over and it is time to end the nap.

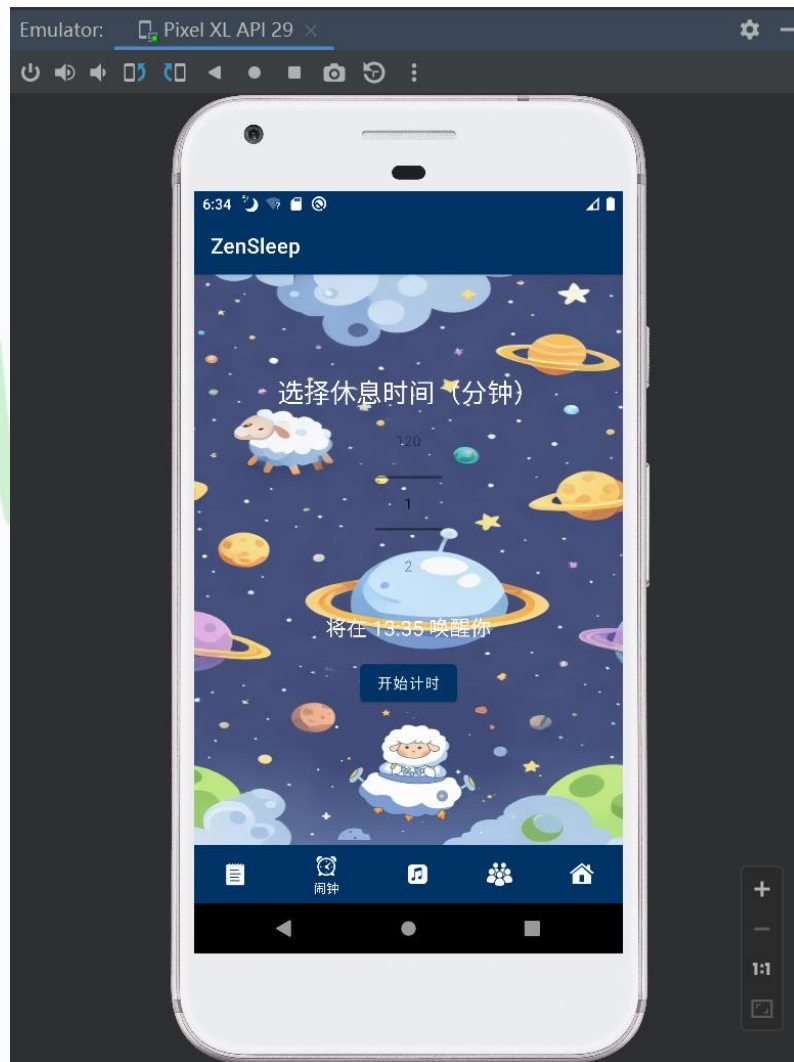


Figure 18 Alarm Page

(6) Recording Module

Click the note icon in the bottom navigation bar to enter the note page. The list on this page displays the user's note records. Each note shows the content of the note and the date and time when the note was edited. Click the note to delete the record.

Click "Add" below to enter the note editing page, where you can edit the content. Click "Done" to save the note. Click "Cancel" to exit the editing page and the note content will not be saved.

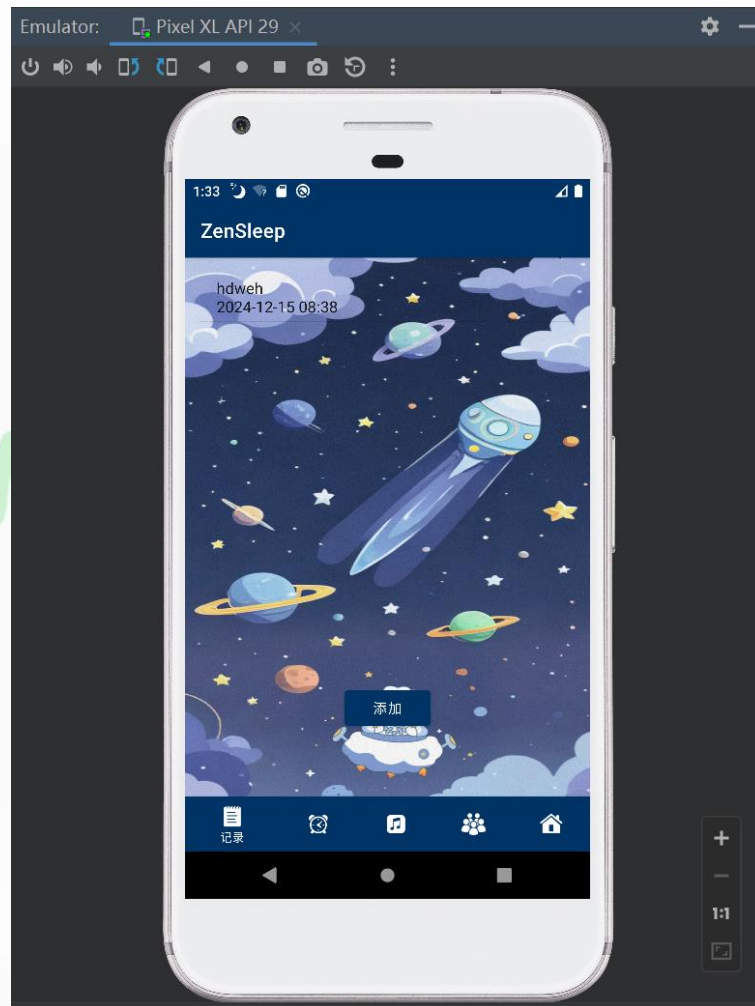


Figure 19 Notes Page

(7) Community Module

Click the community icon in the bottom navigation bar to enter the community page. The list on this page displays various shared information of users in the community. Each information bar displays the content of the information bar and the name of the user who edited the information bar. Users can click the star icon to like it, or click the pencil icon to comment.

Click the "+" in the lower right corner to enter the page for posting and editing information strips. You can edit the content on this page. You can click "Select Picture" to select photos from the phone memory, or click "Take Photo" to take photos in real time. Click "Publish" to publish the information strip and return to the community page.

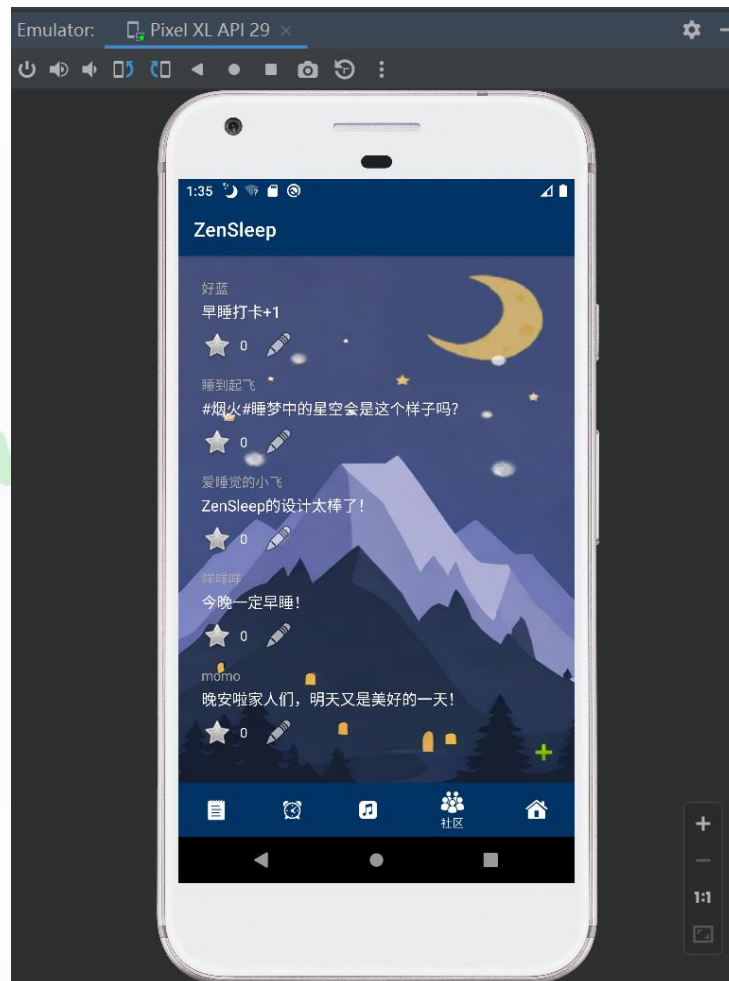


Figure 20 Community Pages

(8) Detailed sleep report module

A date selector is displayed at the top of the page, and the currently selected date is December 20, 2024. Users can select a different date to view sleep data by clicking the date selector.

There is a circular chart in the middle of the page, which shows the user's sleep score, which is currently 76 points. The chart is divided into three parts, with different colors representing different sleep stages: light sleep, snoring, and deep sleep. The size of each part represents the proportion of the sleep stage in the total sleep time.

Below the sleep score graph, there is a pie chart showing the user's depression level. Most of the area in the chart is green, labeled "No Depression", and has a value of 1,048, which represents the depression index derived by the algorithm.



Figure 21 Sleep Report Page

2.4. Features and innovations of the work

2.4.2 An Effective Sleep Staging Framework

This project uses the attention-based multi-channel EEG signal sleep staging method AMCSleepNet . This framework has three technical highlights: First, high accuracy and robustness: AMCSleepNet has an accuracy of over 96% and is highly robust to noise in biological signals; second, automatic labeling: automatic labeling of data through this system can greatly help analyze experimental results.

2.4.3 Accurate depression screening algorithm

This project uses a deep residual network (PC-DRN) based on a pyramid convolutional layer to achieve automatic classification of sleep stage images. The technical features of this framework are: constructing a pyramid convolutional layer for multi-scale feature extraction, and then performing feature fusion to achieve comprehensive feature extraction; connecting deep CNN in a residual manner can help overcome network degradation problems.

2.4.4 Scientific real-time brainwave music system

This project will use a real-time brainwave music system to regulate depression. Compared with traditional depression screening or treatment methods, this system can not only monitor and analyze the subject's brainwave data in real time, but also generate personalized music based on this data to alleviate depression symptoms. The system uses advanced eight-channel brain-computer equipment and wireless transmission technology to ensure the accuracy and real-time nature of data collection. Through complex mathematical models and formulas, the system can accurately map parameters such as brainwave amplitude, events, and energy to factors such as pitch, length, and intensity of music.

2.4.5 The value of interdisciplinary research

This project integrates knowledge and technologies from multiple fields such as computer science, artificial intelligence, medicine, and music. It introduces data science into the field of mental health and integrates music therapy into the auxiliary treatment of depression. Through interdisciplinary perspectives, the project provides a new direction for understanding the pathological mechanisms of depression and provides a comprehensive and innovative solution for the diagnosis and treatment of depression.

3. Market Analysis

3.1 Market Pain Points

In the field of mental health care, the diagnosis and treatment of depression has

always been an important topic. In today's society, mental health issues have become one of the most concerned topics. Among them, depression, as a common mental disorder, has always been the focus of medical and social attention in terms of diagnosis and treatment. However, despite long-term research and efforts, we still face a series of problems and pain points that limit the ways for patients with depression to get effective help.

3.1.1. Subjectivity of diagnosis

Traditional methods of diagnosing depression rely mainly on the doctor's clinical experience and the patient's self-described symptoms. This method is highly subjective, and the accuracy of the diagnosis depends largely on the doctor's professional level and experience, as well as the patient's self-cognition and expression ability. Different doctors may make different diagnoses based on their personal experience and preferences, and the patient's subjective feelings and descriptions may also be misleading or inaccurate, further affecting the accuracy and reliability of the diagnosis. Due to the uncertainty of these factors, the diagnostic results may vary from person to person, affecting the accuracy of the diagnosis.

3.1.2. Economic and time costs of treatment

At present, drug therapy and psychotherapy are the main treatments for depression. However, these methods usually require patients to take medication for a long time or receive regular psychological counseling, which not only brings a heavy financial burden to patients, but also takes up a lot of their time. Drug therapy may require long-term medication, while psychotherapy usually requires regular professional counseling and treatment. For many patients, these treatment processes may affect their daily life and work, and even cause them to be unable to maintain a normal rhythm of life. For many patients, the long-term treatment process may have a serious impact on their daily life and work, and even cause them to be unable to maintain a normal rhythm of life.

3.1.3. Limitations of EEG signal recognition

In recent years, research on depression recognition based on EEG signals has made some progress. However, most studies still use traditional machine learning methods for model training, which requires experienced experts to perform detailed sleep staging processing on EEG signals. This method not only relies on the subjective judgment of experts, but also the accuracy of actual tests is not stable. In addition, due to the complexity and individual differences of EEG signals, the widespread application and promotion of this method faces many difficulties.

3.1.4. Lack of personalized treatment options

The symptoms and causes of depression may be different for each patient, so a personalized treatment plan is needed. A personalized treatment plan can better take into account the patient's living environment and social support system. Some patients may live in a high-pressure work environment, while others may face family problems or social isolation. In response to these different living environments, corresponding treatment plans need to be developed to help patients cope with life stress and provide necessary social and psychological support. Personalized treatment plans can also better take into account the patient's cause and disease development trajectory. For some patients, depression may be closely related to genetic factors or life events, while for others, depression may be related to substance abuse or other psychological problems. In response to these different causes, corresponding treatment strategies are needed to address the patient's underlying problems and prevent the disease from worsening.

However, current treatment methods often adopt a "one-size-fits-all" approach, lacking consideration for individual differences among patients. This may lead to poor treatment effects and even induce resistance and adverse reactions in patients. Therefore, it is urgent to promote personalized treatment plans in the field of depression treatment, and to tailor the most appropriate treatment plan for each patient by fully understanding the individual characteristics and disease conditions of the patient, so as to improve the

treatment effect and the patient's quality of life.

3.1.5. Insufficient social awareness of depression

Although the incidence of depression has been increasing year by year, society still lacks awareness of depression. Many people have misunderstandings and prejudices about depression, believing that it is just an emotional problem or a personality defect, rather than a disease that requires professional treatment. Society's understanding of depression is also affected by some wrong prejudices. Some people attribute depression to individual personality or willpower problems, believing that patients simply lack strong willpower or positive personality. The deep-rooted concept leads to accusations and misunderstandings against patients, making it more difficult for them to accept their condition and seek help from others. Many people's understanding of depression is also affected by the media and social culture. The media often reports depression in an exaggerated or inaccurate way, emphasizing the extreme cases in individual cases and ignoring the complexity and diversity of depression. The concept of happiness first in social culture also makes people more reluctant to accept depression, a seemingly negative emotional state, and thus neglects support and understanding for patients. This lack of cognition has led to many patients being unable to receive timely and effective diagnosis and treatment, further exacerbating the impact of depression on patients and society.

Table 1 Market pain point analysis

Pain point number	Pain point description	Influencing factors	Potential Solutions
1	Advantages of diagnosis	Rely on doctor's experience and patient's description	Develop more diagnostic techniques for monitoring, For example, AI-assisted diagnostic tools
2	Financial and time costs of	Long-term	Researching more cost-

	treatment	treatment needs	effective treatments
3	Limitations of EEG signal recognition	Rely on expert judgment	Introducing more accurate machine learning algorithms
4	Personalized treatment plan	Universalization of treatment plans	Developing a customized treatment planning system
5	Society lacks awareness of depression	Social prejudice and misunderstanding	Strengthen public education and awareness-raising activities

In summary, there are many pain points in the diagnosis and treatment market of depression that need to be addressed urgently. To address these issues, we need to continue to explore and innovate, and seek more accurate and personalized diagnosis and treatment solutions to reduce the pain of patients and the social burden.

3.2 In-depth analysis of industry, consumers and competition

3.2.1. Current status and development of the global mental health industry

With the increasing pressure of modern life and people's increasing attention to mental health, mental health issues have become a prominent challenge worldwide. Depression, as the most common and influential mental disorder, has attracted widespread attention from the medical community and the public. Against this background, related fields of the mental health industry have ushered in a series of changes and innovations.

More and more research institutions, medical institutions and technology companies are beginning to pay attention to mental health issues and invest more resources in related research and development. From traditional psychotherapy to personalized treatment plans based on artificial intelligence and big data, various innovative technologies and methods continue to emerge, bringing new hope and

opportunities to the mental health industry.

The public's awareness of mental health issues continues to improve, prompting governments, social organizations and enterprises to increase their investment and support for mental health issues. More and more countries and regions have begun to introduce relevant policies and regulations, establish mental health service systems, and provide more support and help to meet the challenges of mental health issues.

With the advancement of science and technology and the popularization of medical services, the forms and channels of mental health services are also constantly enriching and expanding. From traditional outpatient treatment to online psychological counseling, from mental health apps to virtual reality treatment, patients can more conveniently obtain various forms of mental health services, which improves the accessibility and convenience of treatment.

Although the mental health industry has made some progress, it still faces many challenges. Among them, the diagnosis and treatment of depression are particularly prominent. The subjectivity of diagnosis, the economic and time costs of treatment, and the lack of personalized treatment plans have all restricted the development of the mental health industry. Therefore, it is necessary to further strengthen interdisciplinary cooperation, integrate resources, explore more effective diagnosis and treatment methods, and provide better mental health services for patients.

3.2.2. In-depth exploration of consumer needs

Pursuit of accuracy and timeliness: For depression patients and their families, the most important thing is whether they can get an accurate and timely diagnosis, which is directly related to the formulation of treatment plans and the prognosis of the disease.

Minimize the impact on life: The treatment method should minimize the impact on the patient's daily life, which is also an important goal pursued by modern medicine. Patients do not want to disrupt their original rhythm of life due to treatment, and they do not want to bear excessive financial and time burdens.

Preference for non-invasive and side-effect-free methods: With the advancement

of medical technology and the improvement of consumers' health awareness, more and more people tend to choose non-invasive and side-effect-free diagnostic and treatment methods. This is not only out of consideration for physical health, but also for the pursuit of quality of life.

3.2.3. Analysis of market competition situation

Technology-driven competition: In the field of diagnosis and treatment of depression, the application of advanced technologies such as deep learning is changing the traditional competition landscape. Early screening and diagnosis using technologies such as EEG signals and neuroimaging has become a new competitive point.

Commercialization potential and challenges: Although most of the related products on the market are still in the R&D and testing stage, this field undoubtedly contains huge commercialization potential. Whoever can first break through the technical bottleneck and realize the large-scale application of products will have the opportunity to gain an advantage in future market competition.

Cooperation and competition coexist: In this field, not only competition, but cooperation is also an important keyword. Many research institutions and companies are seeking cooperation with other institutions to jointly promote the research and development and application of related technologies. This situation of coexistence of cooperation and competition also makes this market full of more possibilities and opportunities.

3.2.4. Industry trends and future prospects

Integration of technology and humanity: The future mental health industry will pay more attention to the integration of technology and humanity. Technology can help us diagnose and treat diseases more accurately, but humanistic care is equally important. How to maintain care and understanding for patients while using advanced technology will be an important issue that the industry needs to face in the future.

Trend of personalized treatment: With the application of big data and artificial

intelligence technology, the treatment of depression will be more personalized in the future. Each patient will receive a treatment plan tailored to their specific situation, which will greatly improve the effect of treatment and the quality of life of patients.

Global cooperation and resource sharing: In the context of globalization, the future mental health industry will also pay more attention to global cooperation and resource sharing. Through cross-border and cross-industry cooperation, we can promote the research and development and application of related technologies more quickly and provide better medical services for depression patients around the world.

From the analysis of the current status of the industry, consumer demand and market competition, we can see that the field of depression diagnosis and treatment is at a crossroads of change. Technological advances, changes in consumer demand and fierce market competition have made this field full of opportunities and challenges. However, no matter how it changes, the core principle of people-oriented and caring for patients remains unchanged. Only by truly thinking about and solving problems from the perspective of patients can we go further and more steadily in this field.

3.3. SWOT in-depth analysis

3.3.1. Strengths of technological leadership

Application of deep learning technology: Our project is at the forefront of the industry in terms of technology, using deep learning technology. This technology can provide more accurate and reliable depression diagnosis services, thereby laying the foundation for providing patients with better treatment options and accurately extracting key information from complex sleep EEG signals, which greatly improves the diagnostic accuracy of depression. The powerful learning ability and adaptability of the deep learning model enable our diagnostic system to continuously learn and optimize, thereby maintaining technological leadership.

Innovative real-time brainwave music system: In addition to diagnostic technology, we have also developed a real-time brainwave music system. This system not only

provides patients with real-time music therapy feedback, but also dynamically adjusts the music according to the patient's brainwave state to achieve the best treatment effect. This personalized treatment method is expected to open up a new path in the field of depression treatment.

3.3.2. Challenges and weaknesses

High technical threshold: The application of high-tech technologies such as deep learning has brought technical advantages, but it also puts higher requirements on the technical level of the R&D team. This means that we need to continue to invest in talent training and technology updates to maintain technological leadership.

R&D and clinical trial costs: R&D and clinical trials of high-tech products often require a lot of money and time. From product prototype design to clinical trials and then to final market promotion, every link requires meticulous management and continuous investment.

Complex approval process: The particularity of the medical industry determines that the product approval and listing process is relatively complex and lengthy. This requires us to have strong regulatory compliance and government relations management capabilities to ensure that the product can be successfully listed and serve the majority of patients.

3.3.3. Market Opportunities

Mental health issues are becoming increasingly prominent: With the acceleration of the pace of modern life and the increase of social pressure, mental health issues, especially depression, are receiving more and more attention from society. This provides a broad market space and development opportunities for this project.

Unmet market needs: There is an urgent need for more accurate and convenient diagnosis and treatment of depression in the market. Our project is born out of this need and is expected to occupy an important position in the future market.

Promotion opportunities brought by technological progress: With the continuous

advancement of technology and the reduction of costs, our projects are expected to be more widely used and promoted in the future. Whether in cities or rural areas, whether in large hospitals or community clinics, our products and services are expected to reach more patients.

3.3.4. Potential Threats

Fierce market competition: Although our project has technical advantages, competitors may also be developing similar technologies and products. The project needs to continuously innovate and enhance its core competitiveness to seize market opportunities and maintain its market leadership. If their R&D progress is faster or their marketing is more effective, it may pose a threat to us.

Policy changes and regulatory requirements: Policy changes and regulatory requirements in the medical industry may have an impact on the development of the project. The regulations, policies and approval processes in the medical industry are relatively cumbersome, and the project team needs to invest a lot of time and energy to deal with them. It is necessary to ensure that the project's technology and services comply with relevant regulatory requirements to avoid risks due to illegal operations. We need to pay close attention to policy trends and ensure that products and services always comply with relevant regulatory requirements.

Acceptance of new technologies: Although our technologies and products are innovative, patients' acceptance and trust in new technologies is still a potential challenge. We need to improve patients' awareness and acceptance of new technologies through continuous market education and patient communication.

Table 2 Compensation and consumer demand analysis

category	describe	Chance	threaten
Industry status	Change and innovation in the mental health industry	Technological advances offer new treatments	High R&D cost and complexity

Consumer demand	Accurate needs and timely treatment	Increased demand for highly effective treatments	High expectations can make it difficult to achieve goals
Competitive Advantage	Technology-driven market competition	Advanced technology can gain market advantages	Fierce competition and rapid technological change

In summary, this project faces certain opportunities and challenges in the market. However, as long as we give full play to our technological advantages and clinical cooperation resources and continuously optimize our products and services, we believe that this project is expected to achieve breakthrough progress in the field of depression diagnosis and treatment.

4. Business Model

ZenSleep System Business Model Canvas



Figure 22 ZenSleep System Business Model Canvas

4.1. Target Users

Based on an in-depth analysis of the current market pain points and the medical

industry, we divide the target users of the ZenSleep depression diagnosis system into the following categories:

4.1.1.C-end users

As the direct users and main beneficiaries of the ZenSleep system, C -end users can be divided into two categories: one is potential patients who have recently experienced significant mood swings and decreased sleep quality, and they hope to use the ZenSleep system for preliminary screening to assess the possibility of depression. The other is patients who have been diagnosed with depression, and they use the ZenSleep system to monitor the progression or improvement of the disease and assist in evaluating the efficacy of medical intervention.

For the first type of users, the ZenSleep system aims to solve the obstacles to medical treatment caused by the uneven distribution of medical resources and limited accessibility, and to improve patients' enthusiasm for medical treatment and treatment compliance. In addition, the system can also make up for the shortcomings of the traditional medical model, such as patients' difficulty in talking about their illness, low willingness to seek medical treatment, and poor medical experience. On the one hand, patients can receive medical treatment at home, reducing the need to travel; on the other hand, the privacy of patients with psychological and mental problems is protected, and the sense of stigma is reduced , which improves the medical experience and treatment rate. For the second type of users, the ZenSleep system provides telemedicine consultation functions, allowing patients to receive medical treatment services at home. Through the system, patients can securely transmit their personal health data to medical professionals, who can analyze the data and provide feedback in a timely manner to assist patients in formulating or adjusting treatment plans. This not only saves patients the time cost of going to the hospital for medical treatment, but also the economic cost of online consultation is lower than that of hospital outpatient clinics, which improves the overall medical efficiency and patient satisfaction. With the improvement of patient compliance and accessibility, the emphasis on daily disease management can also

effectively reduce the overall cost of the disease.

4.1.2.H-end users

H -end users are professional medical institutions, mainly hospitals. By cooperating with professional medical institutions, we can increase the use of the ZenSleep system in these institutions. At the same time, we can combine the diagnostic methods commonly used by professional medical institutions at this stage to improve the accuracy of depression diagnosis, assist in disease diagnosis and drug prescription decisions.

ZenSleep system assists in determining whether a patient suffers from depression, and determines the patient's depression level in a more objective manner, thereby providing a more accurate treatment plan. After determining the patient's depression level, the ZenSleep system can be recommended by a doctor, and the patient can purchase professional medical equipment that can measure brain waves, such as an EEG ring, install the system, and receive further treatment through online home consultations. This method allows patients to enjoy medical services that are coordinated by humans and software, and the system is endorsed by the hospital, making it easier to gain the trust of patients.

4.1.3. B-side users

Our B -end target users are manufacturers of professional medical devices that can detect brain waves, such as brain wave rings, EEG meters, etc. Since the ZenSleep system needs to be used in conjunction with professional medical devices, B- end users will be the main target users of this product.

Professional medical device manufacturers are a key link in the ZenSleep depression diagnosis system ecosystem. Through direct cooperation with manufacturers, the system is applied to medical devices to create an integrated solution to enhance the market competitiveness and user convenience of the product. In terms of product integration, the manufacturer's brain wave detection equipment will be

seamlessly integrated with our diagnostic system to provide a smoother user experience. In terms of technical collaboration, the technical teams of both parties can work together to optimize the compatibility of hardware and software and improve the performance of the overall system. In terms of market expansion, the manufacturer's existing market channels can help our products quickly enter the target market and reduce initial marketing costs.

Through close cooperation with medical device manufacturers, our depression diagnosis system will be deeply integrated with EEG measurement equipment to provide an efficient and collaborative medical solution for C-end or H- end customers . This integration can greatly improve the accuracy and convenience of diagnosis. Direct cooperation with B -end users will enable us to leverage the manufacturer's existing customer base and distribution network to directly reach target user groups such as medical institutions, clinics, individual medical practitioners and patients.

Based on the analysis of the above three types of target users, we take B -end users as the main target users, and H-end and C -end users as secondary target users.

4.2. Profit model

4.2.1. Sources of income

(1) Subscription Fees

To meet the needs of different target customers, our ZenSleep depression diagnosis system will adopt a flexible monthly subscription fee model to provide customers with continuous value and services.

For C-end users: We will provide two subscription options: Basic and Premium. Basic subscription includes regular diagnostic and analysis functions, such as system access, standard data analysis and regular updates. For consumers seeking more personalized services, Premium subscription will provide customized analysis, priority customer support and advanced features, such as personal health trend analysis.

For H-end users: Professional medical institutions such as hospitals require more

advanced services and customized systems to better diagnose depression and manage patient information. Therefore, we provide enterprise version subscriptions for H- end customers , including but not limited to the following aspects:

Customized system interface and workflow to suit user's specific needs.

Batch account management, convenient for multiple users within medical institutions.

Advanced reporting tools to support medical research and clinical decision making.

(2) Sales share

For B-end users: Cooperate with professional medical device manufacturers to bundle the ZenSleep system with professional medical devices, promote the ZenSleep system through their sales channels, and pay a certain percentage of distribution commissions and marketing fees based on the number of subscriptions from C-end or H -end users .

In the early stage of ZenSleep system promotion, the focus was to establish market presence and verify product concepts, and to establish the product tone. Therefore, we initially provided partners with a relatively generous share ratio, namely 30% of sales, to encourage them to actively promote our products and compensate for their investment in marketing and user education.

In the middle stage of ZenSleep system promotion, as the product gradually gains market recognition and sales channels become more stable, we will appropriately adjust the profit sharing ratio to 20% of sales, and share the marketing expenses with our partners to form a more balanced cost-sharing mechanism, while focusing on brand building.

In the later stage of ZenSleep system promotion, as the product has become mature and established a solid position in the market, the share ratio will be further adjusted to 15% of sales to ensure long-term profitability and sustainability . At the same time, partners are encouraged to increase revenue by providing value-added services, such as customized solutions or advanced user training.

We hope to establish a flexible profit-sharing mechanism and regularly adjust the profit-sharing ratio based on market dynamics and sales performance. At the same time, we will ensure good communication with our partners and jointly develop market strategies to achieve long-term win-win results for both parties.

(3) Advertising Revenue

The ZenSleep system will enhance profitability by introducing advertisers, integrating and providing accurate medical and health-related advertising services. The system attracts a large number of healthcare professionals and patient groups related to depression, creating a targeted and highly focused advertising market for related medical companies, pharmaceutical companies and health service providers. We will adopt a non-intrusive advertising strategy to ensure that the advertising content is highly relevant to user needs and interests while maintaining the user experience. Advertising revenue comes from the following aspects:

Banner ads: Set up banner ad slots in the user interface to provide brand exposure.

Educational content sponsorship: Partner with medical education institutions to provide sponsored content to educate users about depression and mental health.

Product Demonstrations: Provide opportunities to showcase new medical devices or related health products, especially those that complement our diagnostic systems.

ZenSleep system provides advertisers with a high-value promotion platform while bringing a stable advertising revenue stream to itself. We promise that the advertising content will strictly comply with medical advertising regulations and ensure that it will not interfere with the user's main experience.

(4) Research report income

The ZenSleep system will accumulate a large amount of anonymized patient data, and after strict privacy processing and statistical analysis, it will reveal the trends and patterns of depression mental health problems, regularly publish industry reports and market research reports, and provide valuable insights for the pharmaceutical industry. At the same time, we will establish partnerships with academic institutions and non-

profit organizations to share anonymized data, support their research in the field of mental health, obtain potential research funding and project cooperation opportunities, achieve win-win results, and enhance ZenSleep 's brand influence.

4.2.2. Cost structure

(1) R&D costs

R&D costs are one of the core expenses in the ZenSleep depression diagnosis system project . It covers all aspects from initial concept design, algorithm development, software programming to subsequent system testing and optimization. In addition, it is necessary to consider the compatibility cost of integration with EEG measurement equipment and compliance testing to ensure that the system meets medical device safety and performance standards . With the continuous iteration and upgrading of technology, continuous R&D investment is crucial to maintaining product competitiveness and market leadership.

(2) Data management costs

Data management costs include all kinds of expenses required to maintain the security, privacy and integrity of patient data. When handling sensitive medical data, strict laws and regulations must be followed, requiring projects to invest in high-standard data encryption technology, cloud storage services, and data backup and recovery solutions. At the same time, funds are also needed to support the development of data analysis tools to extract valuable medical insights from the large amount of data collected.

(3) Partner and channel building costs

Partner and channel building are important strategies for expanding the market and increasing product coverage. In order to establish cooperative relationships with excellent B-end users, namely professional medical equipment manufacturers, and H-end users, namely professional medical structures such as hospitals, it is necessary to

invest time and resources to identify and screen suitable partners, including market research, credit assessment, and negotiation costs. In order to motivate distributors and partners, price discounts, sales rebates or other incentives need to be provided. In addition, maintaining channel relationships is also an ongoing expense, such as regular product updates and preferential policies. In order to monitor channel performance and continuously improve cooperation strategies, it is also necessary to invest in channel management and analysis tools. As the market develops, the channel structure also needs to be adjusted, such as adding partners and changing partnerships, which may incur additional costs.

(4) Marketing and advertising costs

In order to make the ZenSleep depression diagnosis system stand out in the highly competitive market, marketing and advertising costs are indispensable, including developing and implementing marketing strategies, creating promotional materials, managing social media advertising, participating in industry conferences and exhibitions, and other promotional activities. In addition, a budget is needed to conduct market research to better understand the needs and preferences of the target market, so as to design more attractive marketing information.

(5) Human resource costs

Human resource costs involve the salaries and benefits paid to project team members, including R&D engineers, data scientists, marketing experts, sales staff, customer support staff, and management. In the field of medical technology, professional talent is particularly valuable, so attracting and retaining highly skilled employees often requires offering competitive salaries and benefits. In addition, as the scale of projects increases, it is necessary to invest in employee training and career development programs to ensure that the team's skills keep pace with project needs.

5. Marketing strategy

5.1. Pricing and promotion strategies

Regarding the subscription fees mentioned in the previous business model as the source of revenue for the ZenSleep system, we have made the following pricing standards:

- a. Basic version: 39 yuan per month, designed to provide an affordable option for a wide range of individual users.
- b. Premium version: 49 yuan per month, providing more value in addition to basic services for individual users who need advanced services.
- c. Enterprise Edition: 59 yuan per month, providing multiple services for users of professional medical institutions such as doctors.

In addition, we have set up the following flexible preferential policies to meet the different budgets and needs of different customers:

- a. Free trial: A 7-day free trial is provided, during which users can experience the ZenSleep system for free without incurring any cost, helping users understand the specific functions and benefits of the product, eliminating users' concerns about unknown products, and increasing their recognition and satisfaction with the product.
- b. First month discount: We offer an attractive first month discount price, with the basic version costing only 9 yuan, the advanced version costing 19 yuan, and the enterprise version costing 29 yuan. The ultra-low trial cost can effectively attract users to experience the service and lower the threshold for new users. The positive experience in the first month can help users build trust and satisfaction, and promote their conversion from free or trial users to paying customers.
- c. Annual subscription discount: In order to attract long-term subscription customers, we will provide annual subscription discounts. Compared with monthly payment, annual paying customers will enjoy a 20% price discount.
- d. Discounts are available for nonprofits and low-income groups, as well as

volume purchase discounts for high-usage customers.

Through a tiered subscription model and preferential policies, we can meet a wide range of needs from individual users to large medical institutions, while ensuring the sustainability of the profit model, supporting us to continuously provide innovative and high-quality services.

5.2. Promotion strategy

5.2.1. Brand building

Brand building is one of the core components of ZenSleep's marketing strategy. We will design a recognizable brand image, publish press releases online, publish professional articles in professional medical journals, showcase the latest research results and patents of the ZenSleep system, enhance the brand's authority and customer trust; participate in industry interviews and exhibitions offline, showcase the latest functions and application cases of the ZenSleep system, enhance brand awareness, keep abreast of the latest developments and development trends in the industry, and communicate with potential customers and partners. At the same time, we will use brand storytelling and visual content creation to strengthen emotional connections with target audiences and establish brand authority and trust.

5.2.2. Channel cooperation

Channel cooperation is another core component of ZenSleep's marketing strategy. Through cooperation with B -end users , ZenSleep system is sold together with medical devices such as brain wave rings and electroencephalograms of professional medical device manufacturers, and the ZenSleep system is promoted through B -end users , which significantly improves the core competitiveness of the product. Through cooperation, ZenSleep system can be directly integrated into the manufacturer's existing sales and service network, using its brand influence and market share to rapidly expand ZenSleep 's market coverage, while also reducing the high market development

costs in the early stage of product promotion.

5.2.3. Social media and online advertising

Social media and online advertising are ZenSleep 's main channels for online promotion, which enable the product to reach C-end users directly.

By leveraging the advanced targeting capabilities of social media platforms and personalized ad creatives, the ZenSleep system can push ads to specific user groups, such as diagnosed depression patients, undiagnosed but potential patients with mental health problems, mental health professionals, decision makers at medical institutions and medical device manufacturers, or ordinary users interested in mental health. Through precise targeting, we can ensure that advertising content reaches the most interested users and improve advertising conversion rates.

Implement search engine optimization (SEO) and search engine marketing (SEM) strategies to improve the ZenSleep system's ranking in search results and attract more interested visitors.

Establish social network accounts, build brand IP, and regularly publish educational content on the diagnosis, treatment, and prevention of depression, including articles, videos, charts, and infographics, to provide information to potential users and demonstrate the professionalism and depth of the ZenSleep system. At the same time, through continuous interaction and communication with users, build brand trust and loyalty, form a stable customer base, enhance brand influence, attract and retain users, and achieve sustainable market growth.

Work with opinion leaders (KOLs) or influencers in your industry and use their influence to promote the ZenSleep system. These KOLs can be psychologists, mental health bloggers , or well-known people in the medical and health field. Their recommendations can greatly enhance the credibility of the product and dispel the doubts of potential consumers.

5.3. Customer Service

In addition to pricing and product promotion strategies, good customer service is also indispensable. It can establish lasting customer relationships, provide excellent user experience, improve consumer satisfaction and loyalty, encourage them to become repeat purchasers, and establish a good brand reputation and enhance the market competitiveness of products.

5.3.1. Customer Relationship Management (CRM)

Use the CRM system to track customer interactions and collect user feedback on the ZenSleep system, so as to better understand customer needs, improve product quality, improve system deficiencies, and develop more high-quality and effective functions.

5.3.2. Customer service function

on the ZenSleep system to provide quick responses to user inquiries and questions, reduce customer waiting time, and improve service efficiency. Design a customer care plan, regularly ask customers about their health and usage experience, provide holiday greetings, birthday discounts, etc., to enhance customer loyalty and satisfaction. In the process of product development and service improvement, actively invite customer participation, ask users for their current product usage feedback and expected features to be developed, optimize products, improve services, and promote continuous development and innovation of the system.

5.3.3. Community and Forum

on the ZenSleep system encourages users to exchange and communicate about their experiences and feelings. It also serves as a platform for R&D personnel to collect customer opinions, provide valuable market information, discover and solve operational problems, and improve operational efficiency.

6. Financial Analysis

6.1. Funding sources and structure

The company was established in 2024 with a registered capital of RMB 1.5 million. The main sources of funds include the founding team's own funds, government subsidies and initial financing activities. In order to expand the scale of business and meet the growing business needs, the company obtained a long-term loan from the bank with a total amount of RMB 300,000 per year from 2024 to 2026. In view of the company's positive development trend and market performance in recent years, the founding team decided to invest in the research and development of new products and plan to further expand the scale of business.

To achieve this strategic goal, the company plans to introduce two venture capital institutions in 2027 to jointly invest 600,000 yuan. In addition, it is expected that three venture capital institutions will participate in 2028 and jointly invest 1.2 million yuan in the company. These funds will be mainly used for product research and development, market expansion, infrastructure construction and strengthening of operating capital.

The distribution of the company's funding sources and structure from 2024 to 2028 is detailed in Table 3 and Figure 21. These data reflect the company's capital structure adjustment from relying on internal funds and debt financing to gradually transitioning to introducing external equity investment. This move not only optimizes the capital structure and reduces financial risks, but also introduces new business partners and technical support, injecting new impetus into the company's long-term development.

Table 3 Sources of company funds from 2024 to 2028

Unit: Ten thousand yuan

years	Founding team investment	Finan cing	Governme nt subsidies	Venture Capital	Bank Loans	total
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2024	80	30	10.78		30	150.78
2025	80	70	1.98		30	181.98
2026	110	90	1.98		30	231.98
2027	120	100	0.9	60		280.9
2028	100	120		120		340

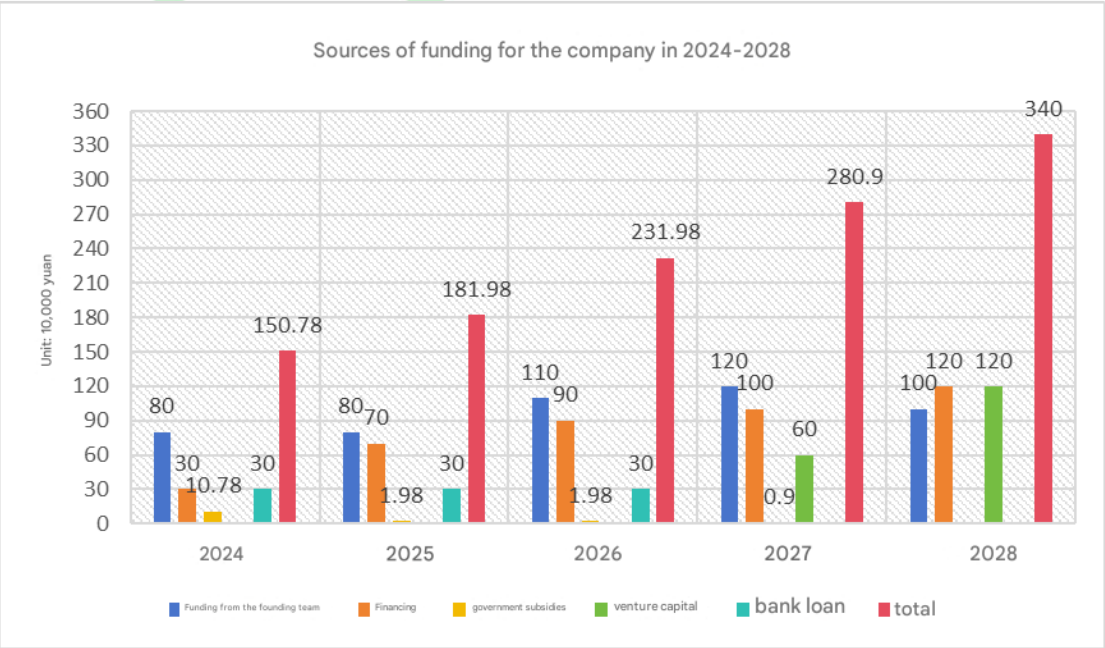


Figure 23 Source of funds

6.2. Share capital structure

The company's registered capital is RMB 1.12 million. The share capital structure and scale are shown in Table 3:

Table 4 Company share structure and size in 2024

Source of equity Equity size	Initial team	Technology investment	Capital investment
Amount	900,000	200,000	100,000
Proportion	75.00%	16.67%	8.33%

6.2.1. Equity Ratio Agreement

The Company expects to sign an equity investment agreement with a venture capital institution in the fourth year of operation. After the efforts in the initial stage, the Company has successfully shaped its own brand, and its market share and competitive strength have gradually increased. It has successfully crossed the most difficult and critical stage of entrepreneurship. Therefore, the Company plans to reach the following agreement with the venture capital institution: the venture capital institution will obtain no more than 25% of the company's equity, but will not constitute a controlling stake, to ensure that the founding team still maintains actual control over the company; the venture capital institution has the right to send representatives to supervise the company's business activities and participate in the formulation of major decisions. At the same time, after the company is converted to a joint-stock system, the venture capital institution will obtain a certain number of board seats to participate in the joint management of the company. Such an arrangement is intended to ensure the stable development of the company, while introducing external capital and expertise to promote the company's further development and expansion.

6.2.2. Sources of debt funds

In 2024, the current assets will be 200,000 yuan, which will be used as cash to cope with various emergencies. The later working capital will be mainly obtained through financing and venture capital, and the loan interest rate is 5% per annum.

6.3. Use of startup funds

According to the company's initial development strategy, the priority is "R&D > Promotion", so our initial start-up funds are mainly aimed at strengthening the research and development of core technologies. This move is to ensure technological leadership and market competitiveness, and to promote the company's core value and market expansion through innovation. Secondly, the funds will also be used for marketing and

promotion activities. The use of this part of the funds will be committed to enhancing brand awareness and market share, and attracting and retaining customer bases through effective market penetration strategies. In addition, the funds will also support the company's daily operations, including but not limited to human resources, management, infrastructure maintenance and other expenses, to ensure the stability and sustainability of the company's operations.

6.4. Cost structure

The following is the specific cost structure of our project. We divide various operating expenses into three categories of costs (R&D costs, marketing and promotion costs, and daily operating costs).

6.4.1. R&D costs

R&D staff salaries: salaries of the R&D team, including engineers, product managers, quality control, etc.

Equipment purchase and maintenance: purchase and maintenance costs of equipment required for research and development.

Material costs: Purchase of materials required for experiments and prototype development.

Software Licenses: Licensing fees for software development tools and systems.

Intellectual property costs: the costs of patent application and maintenance.

6.4.2. Marketing and promotion costs

Advertising costs: Costs for online and offline advertising.

Market research: Expenses for market research and consumer surveys.

Public relations activities: expenses for press conferences, partnership building, and other public relations activities.

Sales Compensation: Salaries and commissions for the sales team.

Promotional activities: costs for production of promotional materials and organization

of activities.

6.4.3. Daily operating costs

Rental costs: rental of office space.

Equipment depreciation: Depreciation of office and production equipment.

Operating materials: the purchase cost of daily materials such as office supplies.

Staff salaries: salaries for management, administration, customer service and other departments.

Utility fees: water, electricity, internet and other utility fees.

Insurance premiums: Costs of business property insurance and employee health insurance.

Legal and Compliance : Fees for legal advice and compliance reviews.

Technical Support and Services: Costs of outsourced technical support and customer services.

The specific cost structure amount allocation and forecast are shown in Table 5 :

Table 5 Cost structure amount allocation and forecast

Unit: Yuan

years	R&D cost (yuan)	Marketing promotion costs	Daily operating costs
2024	275450.67	365608.29	529403.1476
2025	338804.3241	464322.5283	689748.8844
2026	484490.1835	589689.6109	995898.2116
2027	92820.9624	748905.8059	1379589.537
2028	990733.9762	951110.3735	2237021.027

6.5. Cost analysis and forecasting

Table 6 Specific cost amount and forecast

Unit: Yuan

Cost Structure	2024	2025	2026	2027	2028
R&D Design	275,450.67	338,804.32	484,490.18	692,820.96	990,733.98
Marketing Promotion	365,608.29	464,322.53	589,689.61	748,905.81	951,110.37
Office Space and Equipment	175,061.39	241,584.72	333,386.91	460,073.94	311,056.11
Staff compensation and benefits	158,953.52	247,967.49	386,829.29	603,453.69	881,042.38
Technical Support and Services	205,450.67	281,467.42	385,610.36	528,286.20	723,752.09
Administrative expenses	94,946.92	149,066.66	234,034.66	367,434.42	613,615.48
Legal and compliance costs	56,040.56	80,138.00	114,597.34	163,874.20	234,340.10
Risk management fees	0	0	0	239,273.93	318,234.33
Other expenses	17,372.57	24,842.78	35,525.18	50,801.00	96,079.44
Total cost	1,348,884.59	1,828,193.93	2,564,163.53	3,854,924.14	5,119,964.29

6.5.1. Specific project analysis

(1) R&D design cost analysis

During the forecast period, R&D design costs will increase from RMB 275,450.67 in 2024 to RMB 990,733.98 in 2028, with a slight fluctuation in the proportion of total

operating expenses, from 20.42% to 19.35%. This trend reflects the company's continued commitment to innovation, and the intensity of investment keeps pace with business growth. Maintaining a relatively stable proportion of R&D expenditure ensures the continued competitiveness of products and services, while demonstrating the company's strategic investment in future growth.

(1) Marketing promotion cost analysis

Marketing and promotion costs increased from RMB 365,608.29 to RMB 951,110.37 during the forecast period, but its share in total operating expenses decreased year by year, from 27.09% to 18.58%. This change indicates that the company's market penetration strategy is gradually maturing, and brand building and customer loyalty have led to improved marketing efficiency. In addition, the decline in the proportion of marketing costs may also mean that the company is gradually turning to more accurate and cost-effective marketing channels.

(2) Office space and equipment cost analysis

The proportion of office space and equipment costs remains relatively stable between 2024 and 2027, accounting for about 12% of total expenses, but drops to 6.08% in 2028, reflecting that the company may have effectively controlled related costs through measures such as leasing optimization, improving space utilization efficiency or depreciation of equipment investment.

(3) Personnel salary and benefits cost analysis

The cost of personnel compensation and benefits increases significantly, from RMB 158,953.52 in 2024 to RMB 881,042.38 in 2028, and its proportion in total operating expenses increases from 11.78% to 17.21%. This upward trend highlights the company's increased investment in human resources, aimed at attracting and retaining key talents to support the company's expansion and business development needs.

(4) Administrative Cost Analysis

Administrative expenses will increase from RMB 94,946.92 in 2024 to RMB 613,615.48 in 2028, and the proportion will increase from 7.04% to 11.98%. This increase indicates that as the company grows in size, the complexity of management and operating costs have increased. In addition, this may also reflect the company's increased investment in ensuring compliance , improving internal controls, and strengthening management systems.

(5) Comprehensive analysis

Overall, the company's cost structure demonstrates investment in long-term growth and sustainability . Steady investments in R&D and human resources, as well as optimization of marketing, together form the cornerstone of the company's future development. Although the growth in administrative expenses indicates the challenges that come with expansion, this is also a natural result of the company's growth in size. Risk management is introduced from 2027, showing the company's attention to potential risks and forward-looking management. Overall, the cost structure and capital allocation during the forecast period indicate that the company is on a positive development trajectory and is ready to meet future challenges and opportunities.

6.6. Revenue analysis and forecast

Table 7 Main business income and forecast

Unit: Yuan

years	2024	2025	2026	2027	2028
Product Sales	651238.4	1352465	2654931	5159862	8409723
Service Fees	98234.21	198465.2	396930.4	793860.8	1587722
Data analysis	48391.74	97432.89	194865.8	389731.6	779463.1

Collaborative research	49234.56	98469.12	196938.2	393876.5	787753
Training Services	29349.89	58632.89	117265.8	234531.6	469063.1
Advertising and sponsorship	15875.12	29765.21	59530.42	119060.8	238121.7
Intellectual Property Licensing	14989.99	29956.79	59913.58	119827.2	239654.3
Cloud Services	49409.04	98701.01	197402	394804	789608.1
Total income	907723.9	1878989	3701607	7181118	11705223



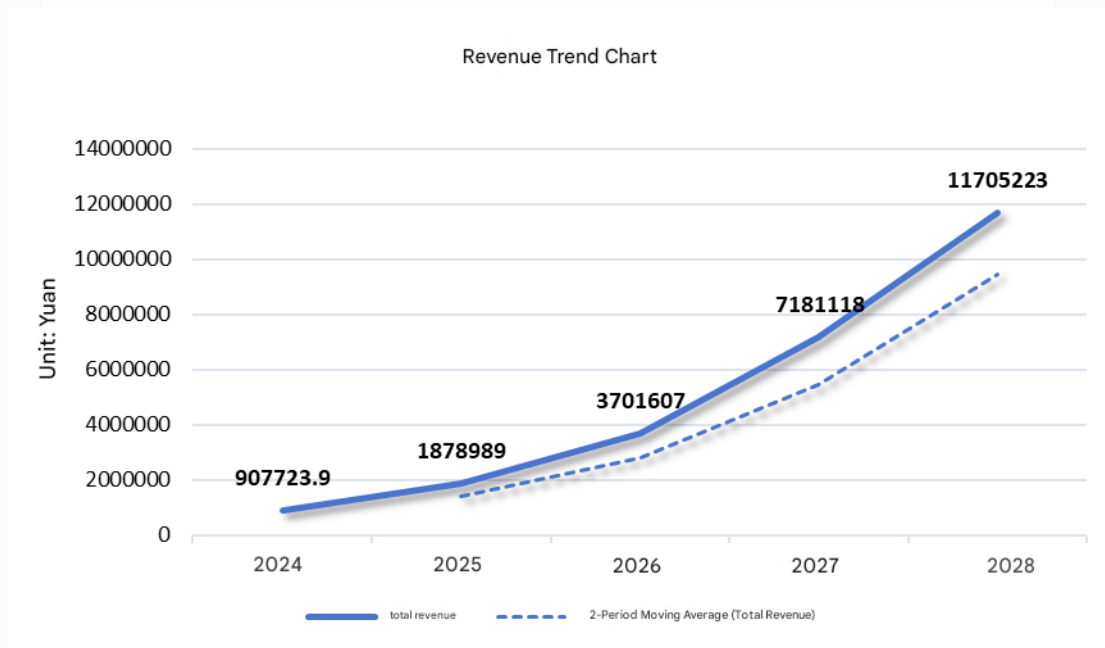


Figure 24 Income Trend Chart

6.6.1. Revenue analysis

The company's total revenue for the next five years shows a significant growth trend. It will grow from approximately RMB 907,700 in 2024 to approximately RMB 11,705,200 in 2028, with a compound annual growth rate of 65%. This growth is mainly due to the substantial increase in product sales and service revenue, especially product sales, whose revenue is expected to reach RMB 8,409,700 in 2028, accounting for 72% of total revenue. The revenue structure shows that product sales are the main source of revenue, followed by service fees and cloud services. Over time, although the absolute amount of data analysis, collaborative research, training services and other fields has increased, their proportion in total revenue has decreased year by year. This shows that the company has obvious competitive advantages and market demand in its core products and services.

Overall, the company has demonstrated strong growth momentum and profitability. By continuing to strengthen the core competitiveness of its products and services while effectively managing costs and risks, the company is expected to achieve long-term sustainable development in the project field.

6.6.2. Key financial assumptions

- a. The company is the accounting entity; continuous operation is the premise; the accounting year is determined by 360 days in a year (30 days per month); the accounting is recorded in RMB, and the unit is Yuan; all expenses paid in cash shall be paid in the current period in which the expenses are incurred.
- b. The amount of statutory surplus reserve to be withdrawn each year is 10% of the net profit for that year, and the amount of discretionary surplus reserve to be withdrawn each year is 5% of the net profit for that year.
- c. Regarding profit distribution, the company's shareholders' meeting unanimously resolved that in view of the fact that the company is expected to be in a rapid expansion phase in the first three years of its start-up period, it will face greater capital demand and reinvestment pressure, so it decided to postpone the distribution of shareholder dividends to retain more working capital to support business growth and market expansion. Entering the fourth and fifth years, the company is expected to enter a mature business period and its market position will gradually consolidate. At that time, the company will distribute annual dividends to shareholders at a rate of 20% based on the net profit achieved in that year.
- d. Regarding the discount rate and bank loan interest rate, based on comprehensive consideration of factors such as market interest rates, inflation rates and investment risks of the project, we have determined the discount rate for this project to be 8.5 % and the annual interest rate for long-term bank loans to be 5%.
- e. The "sales commission", "overtime pay" and "bonus" paid by the enterprise to employees are still part of the employees' wages and salaries and constitute the total salary of the enterprise.
- f. Since cash flow is expected to stabilize after 5 years, the company's financial forecast and financial analysis will only be conducted for the next 5 years.
- g. As a small and profitable start-up enterprise established by college graduates in Shenzhen, our company enjoys a series of local policy subsidies and tax incentives:

- In the initial stage of establishment, starting from the profit-making year, the part of the annual taxable income of the enterprise that does not exceed 1 million yuan will be reduced by 25% and included in the taxable income, and corporate income tax will be paid at a rate of 20%; the part exceeding 1 million yuan but not exceeding 3 million yuan will be reduced by 25% and included in the taxable income, and corporate income tax will be paid at a rate of 20%.
- Taxable sales revenue subject to a 3% VAT rate will be reduced to a 1% rate.
- The urban maintenance and construction tax is subject to a 7% levy rate, the education surcharge is subject to a 3% levy rate, and the local education surcharge is subject to a 2% levy rate. If the taxable income exceeds RMB 3 million, the full amount shall be subject to corporate income tax at a rate of 25%.
- Regarding the employment promotion subsidy, if employing 3 people or less (including 3 people), a subsidy of 2,000 yuan per person will be given; if employing 4 people or more (including 4 people), a subsidy of 3,000 yuan will be given for each net additional person, with the maximum total amount not exceeding 30,000 yuan.
- Regarding subsidies for start-up enterprises, for enterprises established by partnership, a subsidy of RMB 10,000 can be given to each partner based on the number of commercially registered partners at the time of the start-up enterprise's first application, with a total amount not exceeding RMB 100,000.
- Regarding rental subsidies, start-up enterprises established by college graduates within five years of starting a business in recognized carriers or by renting business premises outside recognized carriers will be given a rental subsidy of no more than RMB 650 per month (no more than RMB 7,800 per year) for a maximum of three years.

6.7. Financial statement forecasts

(1) Income Statement Forecast

Unit: Yuan

Financial income statement	2024	2025	2026	2027	2028
operating income					
sales revenue	916,522.53	1,897,201.64	3,737,487.23	7,250,725.22	11,818,682.10
Less: discount	8,798.62	18,213.14	35,879.88	69,606.96	113,459.35
net income	907,723.91	1,878,988.50	3,701,607.35	7,181,118.25	11,705,222.75
cost of goods sold	119,147.93	126,296.80	159,133.97	187,778.09	236,600.39
gross profit	788,575.98	1,752,691.70	3,542,473.37	6,993,340.17	11,468,622.36
operating expenses					
R&D design	275,450.67	338,804.32	484,490.18	692,820.96	990,733.98
Marketing promotion	365,608.29	464,322.53	589,689.61	748,905.81	951,110.37
Office space and equipment	175,061.39	241,584.72	333,386.91	460,073.94	311,056.11
Staff compensation and benefits	158,953.52	247,967.49	386,829.29	603,453.69	881,042.38
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administrative expenses	94,946.92	149,066.66	234,034.66	367,434.42	613,615.48
Legal and Compliance Fees	56,040.56	80,138.00	114,597.34	163,874.20	234,340.10
risk management fees	0.00	0.00	0.00	239,273.93	318,234.33
Other expenses	17,372.57	24,842.78	35,525.18	50,801.00	96,079.44
total cost	1,348,884.59	1,828,193.93	2,564,163.53	3,854,924.14	5,119,964.29
operating profit	-560,308.61	-75,502.23	978,309.84	3,138,416.02	6,348,658.07
non-operating income and expenses	107,800.00	19,800.00	16,800.00	9,000.00	0.00
profit before tax	-452,508.61	-55,702.23	995,109.84	3,147,416.02	6,348,658.07
Tax	43,792.20	103,489.85	963,012.44	1,891,524.14	3,083,184.35
net profit	-496,300.81	-159,192.08	32,097.40	1,255,891.88	3,265,473.72

Figure 25 Profit forecast for the next five years

The company's operating income has continued to grow over the past five years, showing a steady growth trend, which reflects the company's continued improvement in market performance and the vitality of business growth, and has strong development potential. However, it should be noted that while sales revenue is growing, discount expenses are also increasing year by year, which may be affected by intensified market competition or adjustments to pricing strategies, and requires special attention and further investigation.

In terms of cost, the cost of goods sold is relatively stable throughout the period. Although it is increasing, the increase is relatively small, from 119,100 yuan in 2024 to

236,600 yuan in 2028, and the proportion of sales revenue remains at about 2% throughout the period. This shows the effectiveness of the company in cost control , and under the condition of scale expansion, the cost of unit products has not increased significantly, and the gross profit has maintained a steady growth, indicating that the company's profitability is constantly increasing and the business model is gradually maturing.

In terms of operating expenses, all expenses have shown a trend of increasing year by year, from 1.3489 million yuan in 2024 to 5.1199 million yuan in 2028, with an annual compound growth rate of approximately 40.32%. This is mainly due to expenditures on R&D design, marketing promotion, and personnel salaries and benefits. This shows that the company is continuing to work hard to increase investment to support business development and market expansion, but it also needs to prudently control cost growth to avoid excessive pressure on profits.

Despite losses in the first two years, the company has achieved profitability since 2026 and has made substantial net profits in subsequent years. This reflects the gradual improvement in the company's operating conditions and the continued growth of its business. At the same time, due to the company's increased profitability, the amount of tax to be paid has increased. The company needs to further optimize its tax strategy to reduce its tax burden.

Overall, the company will face challenges in the future, such as intensified market competition, cost control, and business expansion, but it also has good growth potential and profitability. While maintaining its current development momentum, the company should further optimize its cost structure, strengthen marketing and brand building, and achieve long-term sustainable development.

(2) Balance Sheet Forecast

Unit: 10,000 yuan

balance sheet						
years	Asset Class	2024	2025	2026	2027	2028
current assets	Monetary funds	150.78	181.98	231.98	280.90	340.00
	accounts receivable	29.17	38.97	45.41	72.51	118.19
	stock	11.91	12.63	18.91	25.28	23.66
	Other current assets	25.78	37.23	26.50	15.75	36.00
non-current assets	fixed assets	83.70	113.00	141.24	190.68	276.48
	intangible assets	66.75	83.44	104.30	130.37	189.04
	long term investment	20.00	25.00	40.25	50.31	62.89
total assets		388.09	492.24	608.59	765.80	1046.26
current liabilities	short term borrowing	30.00	30.00	30.00	0.00	0.00
	accounts payable	91.65	133.73	153.79	207.62	280.28
	Advance payments	62.43	81.79	102.24	117.57	135.21
	Other payables	53.23	66.74	90.10	55.75	56.48
long-term liabilities	long term borrowing	0.00	0.00	0.00	60.00	120.00
Owner's equity	Equity	150.78	181.98	231.98	280.90	340.00
	Surplus reserve	0.00	0.00	0.48	18.84	48.98
	Dividends	0.00	0.00	0.00	25.12	65.31
Total liabilities and equity		388.09	494.24	608.59	765.80	1046.26

Figure 26 Asset and liability forecast for the next five years

According to the balance sheet data, the project shows a significant growth trend in the next five years. Total assets will increase from 3.8809 million yuan in 2024 to 10.4626 million yuan in 2028, with an average annual growth rate of 27.8%. This growth mainly benefits from the company's strategic investment in fixed assets and intangible assets. The continued growth of intangible assets reflects the company's unremitting investment in intellectual property, technology research and development, and brand building, laying a solid foundation for the company to maintain its

competitive advantage in the market.

In terms of current assets, the steady growth of monetary funds indicates that the company has maintained sufficient cash flow in a stable operation. However, the increase in accounts receivable indicates the growth of sales, but also implies potential capital recovery risks. Therefore, we need to further optimize customer credit management and collection strategies to ensure the stability of capital liquidity.

In terms of debt management, the company has gradually reduced its reliance on short-term loans and introduced long-term loans to better support the long-term strategic development and investment needs of the project. This move provides financial support for the company to expand its production scale and increase its market share, but it also needs to pay attention to controlling the resulting interest costs and debt repayment pressure to maintain financial stability.

As the company scales up, shareholders' equity has been significantly improved, reflecting the company's steady growth in profitability. The surplus reserve and dividend data show that the company is actively committed to creating value for shareholders and ensuring capital strength to support future development strategies.

Overall, the company has shown strong potential in asset growth, financial stability and shareholder returns. As we continue to optimize accounts receivable management and debt structure, ensure a sound capital chain and reduce financing costs, the company will be able to maintain a flexible financial position and sustainable growth capabilities in future market competition.

(3) Cash flow statement forecast

Unit: Yuan

cash flow statement					
project	2024	2025	2026	2027	2028
1. Cash flows from operating activities					
Cash received from sales of goods and provision of services	916,522.53	1,897,201.64	3,737,487.23	7,250,725.22	11,818,682.10
Other cash received related to operating activities	500,372.15	807,418.42	1,200,826.37	1,732,810.99	2,514,197.13
cash inflow subtotal	1,416,894.68	2,704,620.06	4,938,313.60	8,983,536.21	14,332,879.23
Cash paid for goods or services	119,147.93	126,296.81	159,133.97	187,778.09	236,600.39
Cash payments to employees	1,028,493.83	1,373,880.89	2,015,701.73	3,049,202.64	4,360,309.35
Various taxes paid	42,500.88	105,378.55	965,214.46	1,897,510.88	3,089,995.75
Other cash payments related to operating activities	22,098.35	72,000.00	143,000.00	285,000.00	427,500.00
cash outflow subtotal	1,212,240.99	1,677,556.25	3,283,050.16	5,419,491.61	8,114,405.49
Net cash flow from operating activities	204,653.69	1,027,063.81	1,655,263.44	3,564,044.60	6,218,473.74
2. Cash Flows from Investing Activities					
Net cash received from disposal of fixed assets and intangible assets	0.00	0.00	0.00	54,009.35	115,039.92
Other cash received related to investing activities	23,568.00	18,750.00	15,625.00	12,500.00	10,324.50
cash inflow subtotal	23,568.00	18,750.00	15,625.00	66,509.35	125,364.42
Cash paid for purchasing fixed assets and intangible assets	150,450.00	195,467.50	245,343.75	306,679.69	383,349.61
Other cash paid related to investing activities	18,123.25	25,916.25	37,060.23	52,996.13	75,784.47
cash outflow subtotal	168,573.25	221,383.75	282,403.98	359,675.82	459,134.08
Net cash flows from investing activities	-145,005.25	-202,633.75	-266,778.98	-293,166.47	-333,769.67
3. Cash Flows from Financing Activities					
Obtain cash received from borrowing money	300,000.00	300,000.00	300,000.00	300,000.00	300,000.00
Attract investors to invest the cash received	300,000.00	700,000.00	900,000.00	1,600,000.00	2,400,000.00
Other cash received related to financing activities	232,000.00	185,600.00	306,240.00	500,000.00	825,000.00
cash inflow subtotal	832,000.00	1,185,600.00	1,506,240.00	2,400,000.00	3,525,000.00
Cash paid for dividends, profits and interest payments	29,657.20	45,287.43	60,918.57	275,305.39	665,034.68
Other cash paid related to financing activities	12,345.67	18,947.25	29,367.87	40,254.78	57,812.46
cash outflow subtotal	42,002.87	64,234.68	90,286.44	315,560.17	722,847.14
Net cash flows from financing activities	789,997.13	1,121,365.32	1,415,953.56	2,084,439.83	2,802,152.86
4. Net increase in cash					
	849,645.57	1,945,795.38	2,804,438.02	5,355,317.96	8,686,856.93

Figure 27 Cash flow statement forecast

(4) Project benefit analysis

Based on the previous financial data, the company's predicted net cash flow is as follows:

Table 8 Annual Net Cash Flow Forecast Table 1

Unit: Yuan

Annual net cash flow	2024	2025	2026	2027	2028
	849,645.57	1,945,795.38	2,804,438.02	5,355,317.96	8,686,856.93

Note: Based on professional analysis of the company's actual market conditions, the discount rate is 8.5% (the same below).

Discounting the annual net cash flow at a discount rate of 8.5% yields:

$$2024: \frac{849,645.57}{1.085^1} = 783,083.47 \text{ yuan}$$

$$2025: \frac{1,945,795.38}{1.085^2} = 1,652,866.17 \text{ yuan}$$

$$2026: \frac{2,804,438.02}{1.085^3} = 2,195,617.23 \text{ yuan}$$

$$2027: \frac{5,355,317.96}{1.085^4} = 3,864,259.72 \text{ yuan}$$

$$2028: \frac{8,686,856.93}{1.085^5} = 5,777,154.45 \text{ yuan}$$

Table 9 Annual Net Cash Flow Statement 2

Unit: Yuan

Annual net cash flows discounted at 8.5%				
2024	2025	2026	2027	2028
783083.47	1652866.17	2195617.23	3864259.72	5777154.45

(5) Net Present Value Analysis

The company's initial investment amount is 1.5078 million yuan, and the NPV is calculated as follows:

$$\begin{aligned} \text{NPV} &= -1507800 + 783083.47 + 1652866.17 + 2195617.23 + 3864259.72 \\ &\quad + 5777154.45 = 12765181.05 \text{ (yuan)} > 0 \end{aligned}$$

Since NPV is much greater than 0, the project is worth investing in.

(6) Internal Rate of Return Analysis

Calculate the IRR of a project:

$$\begin{aligned} -1507800 + \frac{849,645.57}{1 + IRR} + \frac{1,945,795.38}{(1 + IRR)^2} + \frac{2,804,438.02}{(1 + IRR)^3} + \frac{5,355,317.96}{(1 + IRR)^4} \\ + \frac{8,686,856.93}{(1 + IRR)^5} = 0 \end{aligned}$$

$$\text{IRR} = 116.64\%$$

The project's internal rate of return of 116.64% is much higher than the company's estimated internal cost rate of 8.5%, indicating that the project has very strong profitability.

(7) Return on investment analysis

① Static rate of return: 51.70%

$$\frac{(-496300.8055 - 159192.0756 + 32097.39551 + 1255891.883 + 3265473.721) \div 5}{1507800} = 51.70\%$$

② Dynamic return rate : 33.30%

$$\left(\frac{-468957.1973}{1.085} + \frac{-170953.8225}{1.085^2} + \frac{172817.7578}{1.085^3} + \frac{1254238.18}{1.085^4} + \frac{3991177.52}{1.085^5} \right) \div 5 \div 1507800 = 33.30\%$$

This analysis shows that the average return on assets of the project is considerable and generous.

(8) Payback period analysis

① Static Payback Period

$$1 + 1,507,800 \div 849,645.57 = 2.77 \text{ years}$$

② Dynamic Payback Period

$$1 + 1507800 \div 783083.47 = 2.93 \text{ years}$$

This analysis shows that the investment in this project can be recovered in a relatively short period of time and the investment risk is low.

7. Risk Assessment and Response

7.1 . Detailed analysis of risk types

7.1.1 . Market risks

It mainly includes market demand, product competitiveness and marketing.

(1) Market demand. The current depression market has huge demand potential , and most existing depression diagnosis services require users to fill out a self-assessment form. This method of depression diagnosis is too subjective. The user's cognitive level

and the doctor's professional ability are both factors that affect inaccurate diagnosis. Our product uses sleep brain waves to diagnose, which to a certain extent avoids the influence of subjectivity. The test results are more accurate, and there is a huge demand in the depression market, so the market prospects are optimistic.

(2) Product competitiveness. The current depression market has huge demand potential and the industry has good development prospects. By investigating the products related to depression in the market, we can find that the main functions of existing products are psychological counseling and confession. There are few products on the market that are specifically designed for depression diagnosis and services. They lack the uniqueness of depression users, which makes users feel inconvenient during use. Our product design is targeted. It diagnoses depression by collecting users' sleep brain waves and plays music according to the needs of depression patients. The product is more comfortable and smooth to use. The current product's brain wave data collection requires certain professional technical capabilities and is complex to operate. It is far less convenient than some depression-related apps and sports bracelets on the market , but sleep brain wave diagnosis has higher accuracy. If the cumbersome data collection is not improved, it will be more difficult to promote the product to ordinary users in the future.

Product	Product Positioning	Advantages
Good Mood	Provide professional central nervous system medical services and neuropsychological digital medical services	Combine online and offline to provide professional medical services
One Psychology	Provide professional psychological counseling platform	Gather new domestic psychologists to export healthy and scientific psychological value
Pine Cone Pour	It connects the talker and	Focus on emotional talk

	the listener together, and and psychological provides a variety of industry information emotional pouring services for the talker
Depression Self-test	Self-monitoring of Self-monitoring in the depression was provided, early stages of Depression and the self-rating depression scale was filled out

Figure 28 Product competitiveness analysis

Marketing: At present, the market prospects for the use of sleep EEG in the field of depression diagnosis and regulation are still unclear, and the construction of industrial scale, marketing promotion, and market development require a lot of human, material, and financial investment.

7.1.2. Technical risks

It mainly includes replicability, platform design, system stability and scalability .

(1) In terms of replicability, in the Internet age, information availability and technology imitability have become higher. The product of this project is a pioneer in the field of depression diagnosis. The product diagnostic results are highly accurate and the market prospects are bright. It is easy for similar products to be replicated in the market.

(2) Platform design requirements. In the information age, users pay more attention to the protection of their own information and privacy. In particular, the patient privacy data of this product is personal and private. When registering new users and other online operations, they will be more vigilant. At the same time, the network platform will also be subject to information theft, website attacks and other behaviors on the Internet.

(3) System stability and scalability . Currently, the product is presented in the form of a web page. As the number of users increases, it will become a challenge to ensure the

stable operation of the system and the real-time performance of data processing. In particular, when the amount of data increases significantly, the system may face the risk of crashing or slow response.

7.1.3 . Legal risks

It mainly includes data privacy and security, commercial contract legal risks, and medical legal risks.

(1) Data privacy and security. Patients' brain wave data involves personal privacy. The collection, storage and processing process needs to be cautious. If there is a data leak, it will cause the leakage of patient privacy, causing users to lose trust and loyalty to the company, which will cause serious damage to the company's brand image and reputation, thereby affecting the company's long-term competitiveness and market position.

(2) Medical legal risks. The products developed by the company involve diagnostic and regulatory properties and need to comply with medical device and medical governance regulations to ensure that the corresponding approvals and qualifications are obtained. At the same time, the company must ensure that the products comply with relevant laws and regulations, including legal requirements for medical device supervision and personal privacy protection, to avoid risks such as legal proceedings and fines.

(3) Legal risks of commercial contracts. When a company signs a cooperation agreement with a partner such as a hospital or scientific research institution, the responsibilities and rights of both parties are unclear in the agreement, which may lead to disputes or controversies in the future, thus bringing negative economic and reputational impacts to both parties.

7.1.4 . Financial risks

The main issues include insufficient funds, unstable cash flow and management problems.

(1) Insufficient funds. College students lack effective financing methods and find it

difficult to raise sufficient start-up funds. They tend to rely on personal savings, family support or venture capital for financing. However, insufficient funds make it impossible to purchase necessary equipment, pay employee wages or respond to emergencies.

(2) Unstable cash flow. Startups often face unstable cash flow problems, especially when they do not have a stable customer base and revenue source in the early stages. Unstable cash flow may lead to the inability to pay bills, rent or debts, or even cause the company to go bankrupt.

(3) Management. Student entrepreneurs usually lack management experience and face challenges in managing teams, organizational operations, and decision-making. Poor management can lead to waste of company resources, inefficiency, and internal conflicts, which in turn affect the company's financial situation.

7.2.Risk response strategy

7.2.1 . Market risks

(1) Based on the market demand for sleep EEG depression detection, the company can continue to improve the diagnostic accuracy of its products so that the products can continue to adapt to the current trend of high prevalence of depression.

(2) In view of the fact that ordinary users lack the ability to collect data, the company currently mainly cooperates with hospitals and scientific research institutions that have the ability to collect sleep brain wave data. In the future, the company will further optimize the data collection method without reducing the accuracy of the test results, lower the user's technical threshold, and provide clear user guides and training to help users use the product correctly and understand the results, so that more ordinary users can also use our products.

(3) In terms of marketing, we will seize the opportunity to conduct research and analysis on audience needs, improve product settings, expand the scale of industrial construction, rationally allocate the company's funds, ensure the steady development and production of products and put them on the market.

7.2.2. Technical risks

(1) Preventing the business model from being copied. The fundamental way to deal with being imitated is to build one's own core capabilities. In the process of platform construction and operation, actively and proactively grasp valuable, scarce, difficult to imitate and irreplaceable resources to cultivate sustainable competitive advantages; focus on the cultivation of core capabilities; pay attention to property rights, apply for patents for products, and effectively protect the company's intellectual achievements, management achievements and business models during the operation process.

(2) Choose a capable software developer, require the platform to be carefully designed and detailed, build security solutions for key issues such as obtaining and processing personal information, and dispel user security concerns; use encryption technology to protect the security of user data during transmission and storage, implement access control and identity authentication mechanisms to ensure that only authorized personnel can access sensitive data; conduct security audits and vulnerability scans regularly, and patch system vulnerabilities in a timely manner.

(3) Optimize the system structure and design a scalable system architecture to adapt to the growing number of users and data; implement load balancing and redundancy mechanisms to improve the stability and fault tolerance of the system.

7.2.3 . Legal risks

(1) When collecting patient brain wave data, it is necessary to ensure compliance with relevant laws and regulations, such as the EU's GDPR and the US's HIPAA, and to legally acquire, store and process data; only necessary user information should be collected, and the collection of sensitive information should be minimized without affecting service functions. For unnecessary personal information, anonymization or desensitization can be used for processing ; when cooperating with hospitals, it is necessary to clarify the data sharing agreement to protect patient privacy and prevent data leakage or abuse.

(2) Most of the company's products and businesses involve privacy and legal issues. It is recommended that a legal advisory department be established or external legal advisory channels be sought to ensure that the products comply with relevant laws and regulations, including legal requirements on medical device supervision and personal privacy protection, to avoid risks such as legal proceedings and fines.

(3) When a company signs a cooperation agreement with partners such as hospitals and scientific research institutions, it needs to clarify terms such as responsibilities, rights, and risk sharing to avoid conflicts and disputes caused by unclear or vague contract terms, which may cause economic losses to both parties and lead to tension and breakdown in the original business cooperation relationship between the two parties.

7.2.4 . Financial risks

(1) Based on the actual situation, actively seek diversified financing channels to ensure that funds are in place. At the same time, use various channels to find well-known companies to guarantee company loans and obtain funds; actively seek support from small technology companies and medical innovation funds. In addition to traditional methods such as bank loans, self-raised funds, and private lending, you can also make full use of financing channels such as venture capital and venture capital funds for financing.

(2) Consider seeking external financial support such as venture capital, angel investment or loans to help ease cash flow pressure; ensure that contracts are signed with customers and payments are collected on time to avoid the risk of default; carefully plan and manage cash flow to ensure a balance between income and expenditure; formulate a budget and financial plan, strictly control expenditures, and avoid unnecessary expenses; establish emergency reserves and maintain sufficient cash reserves to pay necessary expenses such as employee wages, rent, and bills.

(3) The company must establish a complete management system in the early stage of its establishment. This system includes the company's development strategy, business strategy, internal control, performance appraisal, and talent training. Establishing a

complete management system ensures that the company will not develop slowly or encounter serious problems due to imperfect management systems during its development.

7.3 . Exit Mechanism

After an enterprise enters the mature stage, the company founders consider exiting. Generally speaking, there are several exit mechanisms:

a. Stock market listing

When the company develops to a certain scale, we will strive to be listed on the Growth Enterprise Market of the Chinese stock market, and apply for the initial public offering of shares with the help of the capital market . The private equity owned by the founder will be transformed into public equity in the capital market, and then, after being recognized by the market, further transfers will be made to achieve the goal of capital appreciation. At that time, shareholders can recover their investment by selling their shares, and the founder will achieve a successful exit.

b. M&A Exit Methods

Mergers and acquisitions refer to large enterprises or listed companies purchasing part or all of a company's shares or assets to control the company, and the founders recover their funds and exit. Since the company has its own core technological advantages, the various risks faced by the company after it develops to a certain stage are constantly reduced, the market advantages are prominent, the company's development prospects are becoming clearer, and the profit level is constantly rising. This makes the company the focus of similar companies, and companies that want to enter the industry will intervene by acquisition. In the process of mergers and acquisitions, the founders can exit directly after their original shares are diluted. With the increase in demand for depression diagnosis technology and the continuous maturity of the industry, this channel of exit will be adopted more and more.

c. Venture Capital Buyback

When a company has sufficient cash flow or profit, and has a promising future,

the company can use the method of equity repurchase by the management or employees of the venture enterprise, which can not only allow the venture capital to exit smoothly, but also avoid too much impact on the operation of the venture enterprise due to the capital exit. In compliance with the company's articles of association, laws and regulations, and agreements with other shareholders, the founder sells the shares he holds to the company at the determined repurchase price and exits by repurchasing shares. Once the founder successfully exits, the company needs to adjust its internal structure to adapt to the new equity structure, rebalance the corporate governance structure and shareholder interests, and ensure that the company can continue to operate stably.

d. Liquidation Exit

Starting a business is a high-risk profit activity, and generally only 10-30% of projects will succeed. For venture capitalists, once they confirm that a project has lost its development potential or is growing too slowly and cannot provide the expected high returns, and cannot pay when due, they will help investors recover as much residual capital as possible by liquidating bonds and debt relationships.

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