

1. An AI-based self-service vision testing device capable of reading human movements, characterized in that it comprises a motion capture module, an eye-tracking module, an adaptive testing module, a feedback and recommendation module, an intelligent diagnosis module, and a user interaction interface module;

the motion capture module captures and analyzes human body movements in real time by using a camera or sensor;

the eye-tracking module detects the user's visual responses by analyzing the movement trajectory of the eyeball in real time; using a high-precision camera or infrared sensor, the module monitors the subject's eye movements in real time. By analyzing subtle eye movements, it detects whether the user is focusing and tracking letters, numbers, or graphic objects displayed on the screen;

the eye tracking module not only monitors eye movements in real time but also uses AI analysis algorithms to calculate the duration of eye fixation on specific characters, focus stability, and eye movement speed;

the adaptive testing module automatically adjusts the difficulty of the test content based on the user's eye movement data;

the feedback and recommendation module automatically determines the user's visual acuity level and provides corresponding feedback based on the analysis results of the user's reaction time and eye focusing accuracy data;

the intelligent diagnosis module, via the user AI system and according to a series of preset visual testing schemes, comprehensively analyzes the user's test results and provides a diagnostic result;

the user interaction interface module allows the user to interact with the device via touchscreen, voice, or gesture commands to complete vision testing tasks;

furthermore, to comprehensively and quantitatively assess the user's vision status, the following fusion scoring formula is used:

$$V = \frac{\alpha \cdot E + \beta \cdot F + \gamma \cdot D}{1 + \theta \cdot \left(\frac{M}{U + A}\right)}$$

where:

V represents the final vision assessment score;

E represents the eye tracking performance score, including metrics such as fixation duration and tracking accuracy;

F represents the user's focus and response feedback score;

D represents the score output by the intelligent diagnosis module, based on a comprehensive AI analysis of the visual test results;

M represents the motion interference factor obtained by the motion capture module;

U represents the user interaction efficiency score;

A represents the adaptive test adjustment range, reflecting the user's ability to cope with varying vision difficulties;

α , β , γ , and θ represent weights and adjustment coefficients set internally by the system or optimized through machine learning;

using this fusion formula, the system can quantitatively analyze and dynamically assess the user's vision status based on multi-dimensional input.

2. The AI-based self-service vision testing device capable of reading human movements according to claim 1, characterized in that the motion capture module is configured with a red light below each character on the vision chart, and the subject responds by waving according to the direction of the character;

the camera captures the gesture signal and determines correctness, records the result as appropriate, and provides a prompt for the next character to be tested.

3. The AI-based self-service vision testing device capable of reading human movements according to claim 2, characterized in that the gesture data captured by the camera is analyzed using image recognition technology to determine whether it conforms to the preset response method, and provides real-time feedback based on the accuracy of gesture recognition; if the subject responds correctly, the system displays the next character for testing;

if the response is incorrect, the system prompts for a retry and records the result; each response result is recorded, and the system adjusts the prompt method for the next character to be tested based on the user's performance.

4. The AI-based self-service vision testing device capable of reading human movements according to claim 1, characterized in that the eye-tracking module uses a high-precision camera or infrared sensor to monitor the subject's eye movement trajectory in real time; by analyzing subtle eye movements, it detects whether the user makes appropriate focusing and tracking responses to letters, numbers, or graphic targets displayed on the screen;

the accuracy and stability of eye tracking enable the system to quickly determine the user's visual capabilities; in addition, eye-tracking data can provide key evidence for personalized vision assessment.

5. The AI-based self-service vision testing device capable of reading human movements according to claim 1, characterized in that the eye-tracking module adjusts the subsequent visual test plan according to real-time eye movement data.

6. The AI-based self-service vision testing device capable of reading human movements according to claim 1, characterized in that the intelligent diagnosis module, through the AI system and in combination with preset visual testing schemes, comprehensively analyzes the user's test data; the AI system can assess the accuracy of each test result, establish correlations across tests, and identify potential visual problems.

7. The AI-based self-service vision testing device capable of reading human movements according to claim 6, characterized in that after completing a series of vision tests, the intelligent diagnosis module automatically generates a personalized diagnostic report; the report not only includes the specific results of each test, but also provides further visual health management recommendations to the user through data analysis.

8. The AI-based self-service vision testing device capable of reading human movements according to claim 1, characterized in that the feedback and recommendation module uses the user's reaction time and eye focusing accuracy data to analyze in real time and automatically determine the user's visual acuity level, and provides personalized feedback and recommendations based on the analysis results;

based on this feedback, the system will prompt the user about specific issues and provide targeted solutions.

9. The AI-based self-service vision testing device capable of reading human movements according to claim 1, characterized in that the user interaction interface module provides users with multiple interaction methods; the touchscreen function allows users to intuitively select vision testing content, adjust test settings, or view test results by tapping or swiping;

the voice command function, utilizing voice recognition technology, enables users to operate the device without touching the screen by issuing simple voice commands; users can respond to characters or make selections by waving or using gestures.

10. The AI-based self-service vision testing device capable of reading human movements according to claim 1, characterized in that the self-service vision testing device further comprises one of a vision testing device or a projection device, selected according to the on-site requirements.