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Research and Implementation of Mental Health Consultation Service Platform Based on Multi-sensor Information Fusion

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Abstract: *In the course of social development and progress, the mental health of contemporary people has never been taken as the focus and received enough attention and attention. After mental health problems, most people often choose not to choose psychological counseling, and even fear it. In order to solve the contemporary people's fear of psychological counseling and the uneven level and single form of mental health counseling services, this paper designs a mental health counseling service platform based on multi-sensor information fusion. The platform uses multi-sensor information fusion technology to process a large amount of user characteristic data, analyzes the user's mental health status, and matches psychological counselors who are highly adaptable to the user's needs. It provides more personalized mental health services. Finally, through the functional comparison test, the user's sense of use test and the overall system test, it compares the function usage data of the mental health consulting service platform under the traditional mode and the mental health consulting service platform based on multi-sensor information fusion. The test results show that in the psychological test function part, the overall mean value of the test questions professionalism and user matching under the multi-sensor information fusion is 11.15% higher than that of the traditional model. In the expert consultation function, the multi-sensor fusion positioning speed is 1.03 times faster than the traditional mode. This shows that multi-sensor information fusion technology can process user data more quickly and accurately, can meet the actual needs of users, and can solve the user's mental health problems to a certain extent, and has strong practicability.*

Keywords: *Multi-sensor Information Fusion, Mental Health, Psychological Counseling, Mental Health Service Platform*

1. Introduction

With the renewal and progress of the times, the pace of life of contemporary people is constantly accelerating. The competition for academic qualifications and workplace competition in the society is becoming more and more fierce, and the interpersonal communication in the society is becoming more and more complicated. The rapid development of productivity and science and technology has forced people to accept higher barriers to competition, and the burden and pressure have become heavier. By providing psychological counseling, researching and implementing a mental health counseling service platform, there are ways and methods to alleviate or eliminate the mental health problems of contemporary people. The continuous emergence of new sensors and the rapid development of computer technology, whether it is from hardware technology or software technology, have greatly enhanced the power of the machine to simulate human information fusion, making the true fusion of information possible. The multi-sensor signal fusion system can comprehensively process the provided signals. It makes more reliable judgments and decisions than traditional single sensors. It can not only greatly improve the accuracy of the guidance system, but also increase the amount of information extracted and enhance the anti-interference ability of the guidance system.

The integration of multi-sensor technology into production can greatly increase the labor productivity of the industry and promote economic development. Because of its wide application prospects, it has attracted countless scholars to study it. Liu BJ introduced on the basis of Bernhardt's BP neural network and DS proof tale a new method for fusing multi-sensor information to diagnose faults. He diagnoses fault data employing two concurrent BP nets and then uses proof theory to

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integrate the local diagnostic results to obtain an accurate analysis of inaccurate data. The approach is employed in the fault diagnosis of a specific model of rocket launcher hydraulic drive solenoid scheme (HDSS) to achieve fault location and diagnosis of the main elements of the diesel fuel system, effectively reducing the dependability of the facility [1]. LuY presents a study based on many sensory intelligence merging and computer study to identify user movements.He detects the onset and shift of the mobile sector by the sample entropy of the SEMG and the standard deviation of the acceleration signal. The experiments showed that the identification accuracies of SEMG and IMU were 91.76% and 97.68% on average, respectively. When the combination of SEMG, IMU and foot switch signals was used, the average accuracy was 98.70%, which was higher than that of the mixture of SEMG and IMU (97.97%, $p<0.01$), proving that the study is valid [2]. Zhu X further proposes a new and innovative VAV control method that is embedded in the synoptic emulation stage based on the combined Emulation stage discussed above, by merging the data from a variety of transducers, and presents a simulation of the new approach in conjunction with the existing VAV control scheme. It was shown that the integration of many sensors gives a higher degree of thermal stability. The air dispersion property indicator (ADPI) of the proposed method was above 80% for most of the typical test days, while the air dispersion property indicator (ADPI) of the conventional control method was between 60% and 80%, demonstrating that the VAV construction solution has the capability to guarantee greater indoor thermodynamic well-being thanks to the fusion of many sensor data [3]. Xiangyu introduced a kind of parton ulation technique used to improve the precision and stability of filtering by incorporating smart mobile terminals with indoor positioning and filtering the positioning results with a particle filter. The test results indicate that，compared with Wi-Fi-based positioning algorithms, multi-sensor-based positioning algorithms improve positioning accuracy and robustness [4]. There are already common uses of multi-sensor data systems for identification, intelligent robotics, crime detection, industrial monitoring, remote sensing technology and more.

The development team integrates this multi-sensor information into the construction of a mental health consulting service platform. The platform uses the advantages of multi-sensor mutual cooperation to combine psychological information data at multiple levels and aspects, and comprehensively processes the information source data. It can not only extract effective information to make accurate judgments, but also improve the intelligence of the entire mental health information platform.

2. Multi-sensor Information Fusion Technology

Multi-sensor information fusion is abbreviated as information fusion, which originally came from the imitation of the combined functions of human organs. Scholars at home and abroad define it as an information processing process, which is the use of computer technology in accordance with specific standards. It automatically analyzes and synthesizes the observations of multiple sensors acquired in the time series to perform the necessary functions for making determinations and assessments [5].

In a multi-sensor system, the realization of multi-sensor signal fusion depends on various specific fusion algorithms. Various fusion calculations require comprehensive processing of signals from various sensors to produce a unified conclusion. At present, there is no information fusion algorithm that can realize the fusion management of multiple sensors. Generally speaking, the appropriate information fusion algorithm must be selected for the specific use scenario [6].

D-S evidence theory uses confidence interval and definite interval to characterize sensor information. In the case of multi-sensor information fusion, the information collected by each sensor is used as evidence. Setting appropriate basic credibility in a set of decision-making goals, and using merging rules to combine different information into a unified information representation under the same decision-making framework. For a decision problem, all possible recognition results are expressed by a finite set Θ called a recognition frame. This limited set Θ is set as a recognition frame. Function $M:2^{\Theta} \mapsto [0,1]$ is the basic probability assignment function on frame Θ, then [7]:

$$\mathrm{Bel}(A) = \sum B \subseteq A \, m(B) \quad \forall A \subset \Theta \tag{1}$$

The defined function $\mathrm{Bel}:2^{\Theta} \mapsto [0,1]$ is the reliability function on the frame Θ. The function $M:2^{\Theta} \mapsto [0,1]$ indicates that the basic probability assignment function M maps each subset of the

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recognition framework to a value between 0 and 1.

The plausibility function Pl(A) also means that the reliability of A cannot be denied. It is the sum of all the basic probability assignments that intersect with A, namely [8-9]:

$$Pl(A) = \sum A \cap B \neq \emptyset \, m(B) \tag{2}$$

Give an example to help understand the concepts.

Identification framework:

$$\Theta = \{x, y, z\} \tag{3}$$

Then identify the power set of the frame [10]:

$$2^{\Theta} = \left\{ \{x\}, \{y\}, \{z\}, \{xy\}, \{xz\}, \{yz\}, \Phi, \Theta \right\} \tag{4}$$

Table 1 is an example of the definition of evidence.

Table 1: An example showing the definition of an evidence system

Event A	Basic probability assignmentm(A)	Confidence	Likelihood
Φ	0	0	0
{x}	m_x	m_x	$1-m_y-m_z-m_{yz}$
{y}	m_y	m_y	$1-m_x-m_z-m_{xz}$
{z}	m_z	m_z	$1-m_x-m_y-m_{xy}$
{xy}	m_{xy}	$m_x+m_y+m_{xy}$	$1-m_z$
{xz}	m_{xz}	$m_x+m_z+m_{xz}$	$1-m_y$
{yz}	m_{yz}	$m_y+m_z+m_{yz}$	$1-m_x$
Θ	1- The sum of all other probability assignments	1	1

3. Mental Health Consulting Service Platform Design

3.1. Mental Health Consultation Service Consultation Function Design

The specific function of mental health consultation service consists of two parts: psychological test and expert consultation.

The psychological test function provides powerful and complete psychological tests with a wide range of types. Users can choose the psychological test that suits them according to their preferences, and judge the severity of their psychological problems based on the test results. If it is necessary, it can consult a psychologist.

The expert consultation function, as the name suggests, is to provide expert consultation services across the country, including consultation centers and psychological clinics. These experts can solve anxiety, obsessive-compulsive disorder, depression, hypochondria, and schizophrenia from mild to severe professional consultation and advice. In order to facilitate users to seek medical treatment nearby, it also provides a positioning function to locate nearby psychological counselors. The platform provides credibility classification based on user satisfaction with psychological counselors and offers qualification rankings according to the professional level of the counselors.

3.1.1. Database Design

This paper designs a mental health consulting service system based on combination of different signals and technologies merging. Relying on the computing power of combination of different signals and technologies merging computing, the service system uses a database. The database is MySQL database, and the character encoding is UTF-8. The database mainly builds tables around the service system, and the logical structure design of the database is shown in Table 2 to Table 4.

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Table 2: User Table

Column name	Type of data	Length	Field description
User_phonenum	Varchar	11	User Phone Number
User_pwd	Varchar	255	User Password
User_nickname	Varchar	255	User PhoneNickname
User_sex	Varchar	6	User Gender
User_city	Varchar	255	User Target City
User_email	Varchar	255	User Email
User_headimg	Varchar	255	Profile Picture
User_regist_date	Datetime	4	Registration Date
User_type	Tinyint	1	User Type

Table 3: Psychological Counselor List

Column name	Type of data	Length	Field description
ExpertId	Bigint	20	Counselor Id, Primary Key
ExpertPhoneNum	Varchar	11	Phone Number
ExpertPwd	Varchar	36	Password
RealName	Varchar	50	Actual Name
Gender	Tinyint	4	Gender
Qualification	Int	20	Certification
QualificationPic	Varchar	255	Qualification image
InstitutionName	Varchar	50	Organization name
ShowInstitutionName	Varchar	50	Display organization name
QQ Number	Varchar	15	QQ number
Email	Varchar	50	E-mail
ZoneId	Bigint	20	ZoneId, Primary Key, Representing Different City Id
Province	Varchar	50	Province
City	Varchar	50	City

Table 4: Psychological information sheet

Column name	Type of data	Length	Field description
Id	Varchar	32	Id, Primary Key, Self-growth,Represents Information Id
Publisher	Varchar	50	News Publisher
Title	Varchar	100	Title
Content	Varchar	3000	Content
CommentNum	Bigint	20	Number of comments
ShareNum	Bigint	20	Number of shares
ViewNum	Bigint	20	View quantity
ShowTime	Date	4	Show time
Id	Varchar	32	Id, Primary Key, Self-Growth, Represents TheTagid
Keyword	Varchar	20	Label Content

3.1.2. Technical Architecture

Mental health consulting services provide users with more professional consulting services. The location of the functional modules is shown in Figure 1.

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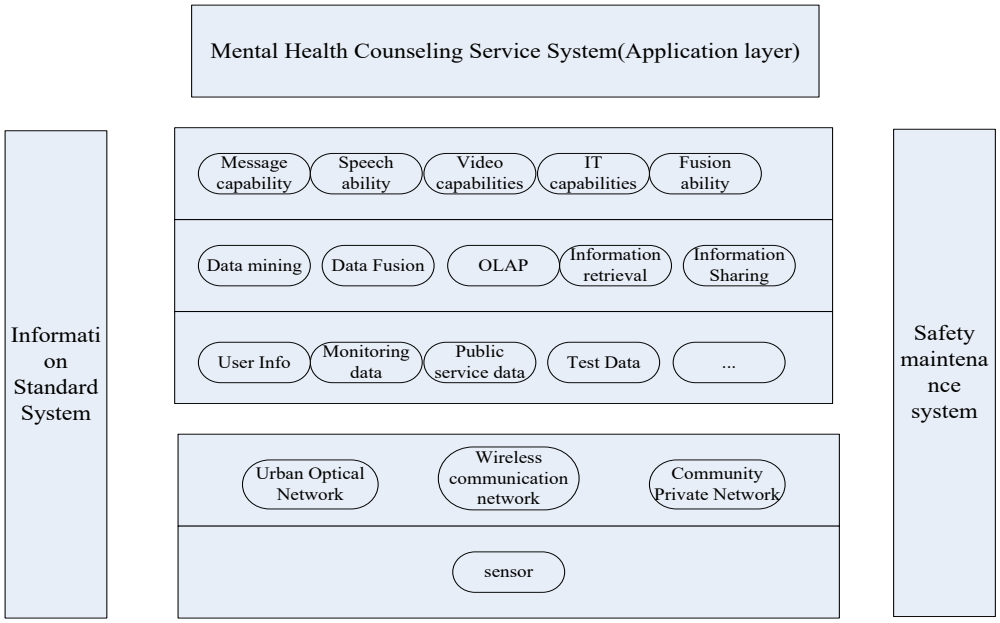

Figure 1: Location of Mental Health Counseling Service Function Module

3.1.3. Psychological Test Function

The psychological test function is composed of a series of psychological test questions. These test questions are viewed by a professional system administrator or psychological counselor, the types of psychological tests in the system and the psychological test itself are edited, and they are stored in the psychological test part of thecombination of different signals and technologies merging center. After the server has processed the data in the background, it is sent to the corresponding front end. After the front end is rendered and displayed, it is embedded in the client, and the user can complete the psychological test on the mobile phone.

3.1.4. Expert Consultation Function

The expert consultation function is actually used by a psychologist to help users solve their psychological problems. For different psychological consultants across the country, the cloud platform is used to store the personal information of psychological consultants across the country in the database server, and then the combination of different signals and technologies merging is used to accurately find the psychological consultants that meet the user's requirements on the platform. The specific classification is as follows: classify from the positioning and call the positioning function; after the user is positioned, the system will classify the information of nearby psychological counselors according to the user's location for the user to choose. Users can also change their location address, or find a non-local counselor. According to user feedback, the credibility of psychological counselors is divided into high and low. According to different qualifications, psychological counselors are classified in the order of national second-level and national third-level. Users get what they need and get the most professional psychological consultation.

3.2. Function Test

This functional test uses two sets of data for comparison. One group is the functional data of the mental health consultation service platform under the traditional model, and the other group is the functional data of the mental health consultation service platform based on combination of different signals and technologies merging.

3.2.1. Realization of Psychological Test Function

Selecting 4 users to log in to the mental health consulting service platform client under the traditional mode and the mental health consulting service platform client based on combination of different signals and technologies merging, enter the platform homepage, and clicking on the psychological test. The client will assign psychological test questions based on the user's personal information and the database configured by the system. The professionalism of the test questions and the matching degree of the user are shown in Figure 2:

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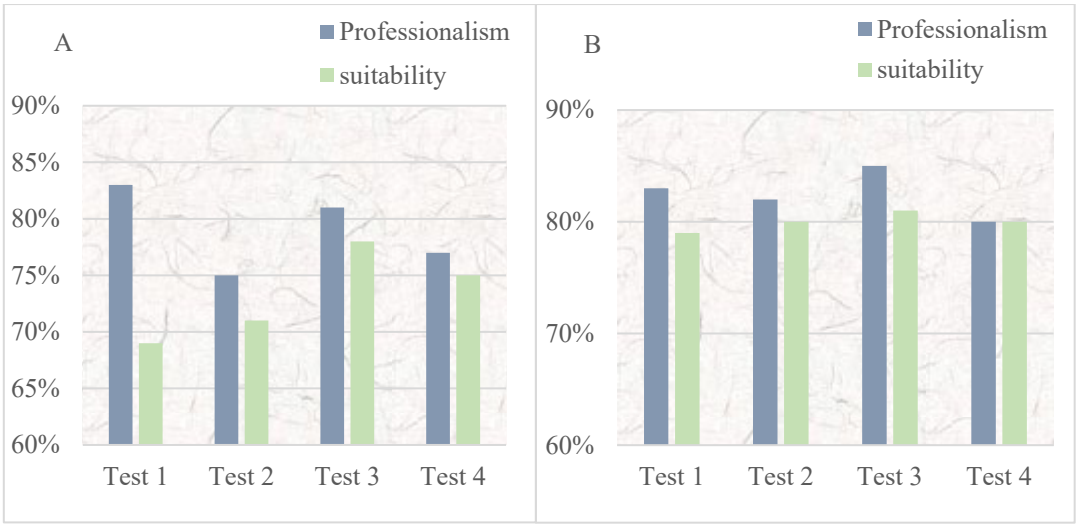

Figure 2: Test questions professional degree and user matching degree

Figure 2A shows the matching degree between the professionalism of the test questions and the user in the traditional mode

Figure 2B shows the degree of professionalism and user matching of test questions under multi-sensor information fusion

The average professional degree of traditional mode test questions is 79%, the average user matching degree is 73.25%, the average professional degree of test questions under multi-sensor information fusion is 82.5%, and the average user matching degree is 80%.

3.2.2. Realization of Expert Consultation Function

After completing the psychological test questions, the user can choose whether to conduct expert consultation according to the level of the system evaluation. Expert consultation is divided into two parts: the selection of psychological consultants and the details of psychological consultants. The user can select the positioning of different cities in the upper right corner. After the positioning is successful, the system will recommend a counselor suitable for the user's needs. After completing the test questions, 4 users completed the matching between the positioning and the counselor in the two modes of the client. Figure 3 shows the city positioning speed of the service platform in the two modes. After the test, the 4 users rated the applicability of the two service platforms' user needs, user satisfaction, and scores, as shown in Figure 4:

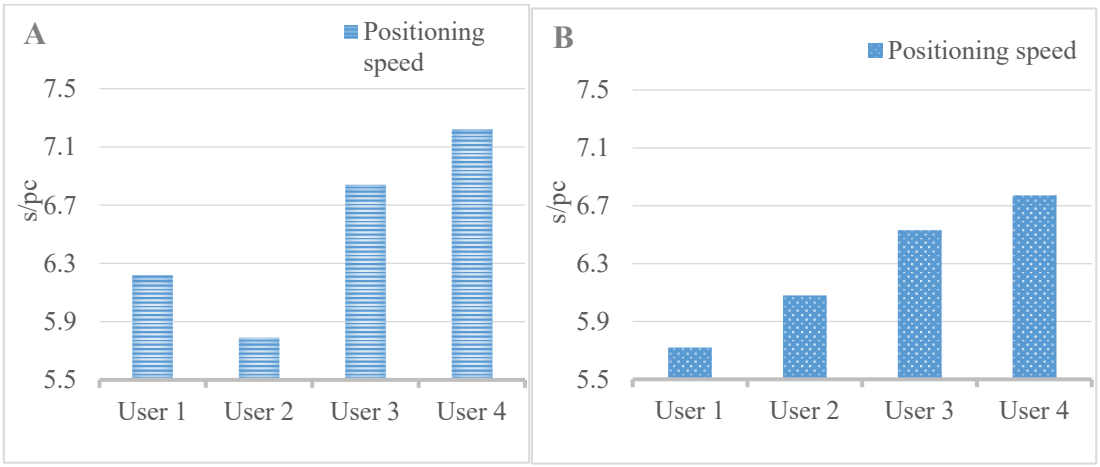

Figure 3: City positioning speed

Figure 3A shows the city positioning speed in traditional mode

Figure 3B shows the urban positioning speed under multi-sensor information fusion

The average urban positioning speed under the traditional mode is 6.5175s/pc, and the average

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urban positioning speed under the multi-sensor information fusion is 6.275s/pc.

3.3. User Sense Test

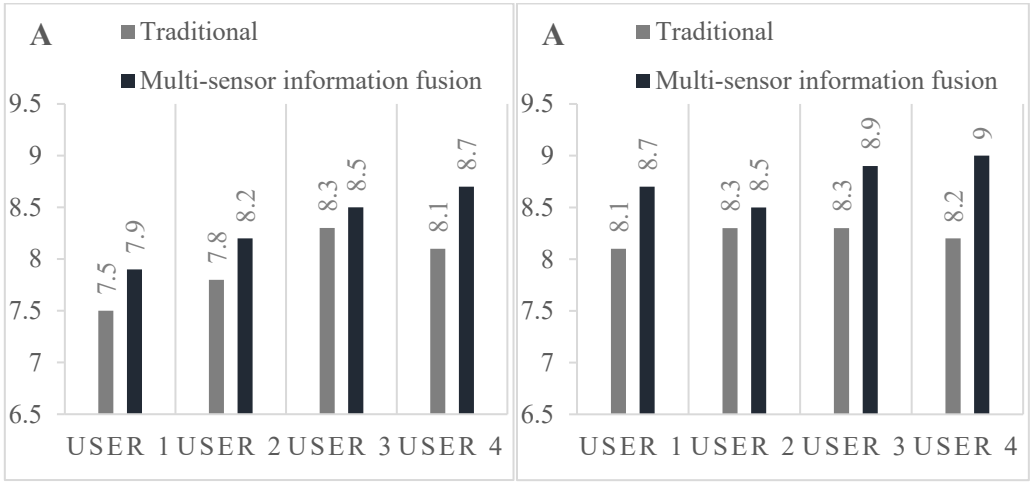

Figure 4: User needs applicability and satisfaction

Figure 4A scores the applicability of user needs

Figure 4B scores user satisfaction

In the traditional mode, the average user needs applicability score is 7.925 points, and the average user needs applicability score under multi-sensor information fusion is 8.325 points. The average user satisfaction score under the traditional model is 8.225 points, and the average user satisfaction score under the multi-sensor information fusion is 8.775 points.

3.4. Overall System Test

Finally, the two systems were tested for fluency and stability, and the results are shown in Figure 5.

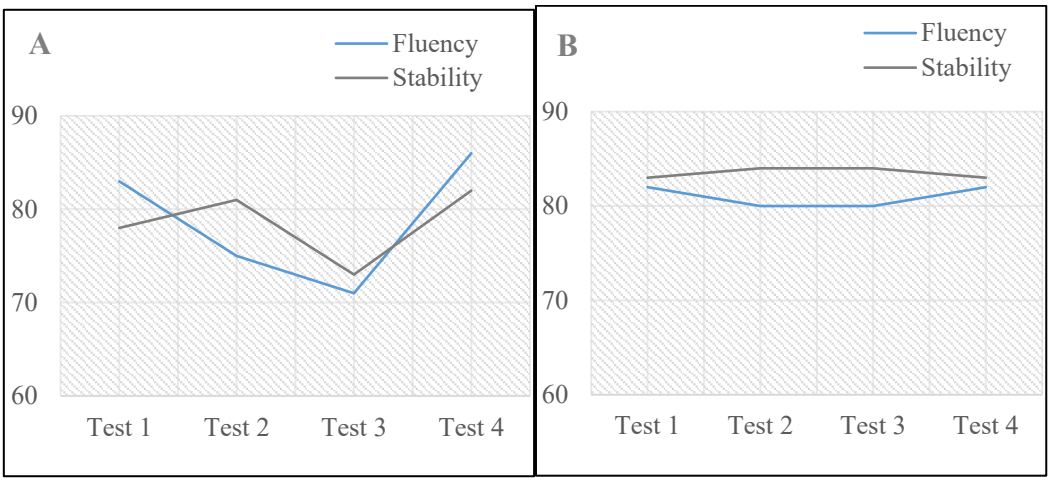

Figure 5: System fluency and stability

Figure 5A shows the fluency and stability of the system in traditional mode

Figure 5B shows the fluency and stability of the system under multi-sensor information fusion

In the traditional mode, the average system fluency is 78.75, the average stability is 78.50. The average fluency of the system under combination of different signals and technologies merging is 81, and the average stability is 83.25.

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4. Discussion

(1) The average professional degree of test questions under the multi-sensor information fusion is 3.5% higher than that under the traditional mode, and the average user matching degree is 6.5% higher.

(2) The average urban positioning speed under the multi-sensor information fusion is 0.2425s/pc faster than the average urban positioning speed under the traditional mode.

(3) The average user demand applicability score under multi-sensor information fusion is 0.4 points higher than the average user demand applicability score under the traditional mode, and the average user satisfaction score is 0.55 points higher.

(4) The average system fluency under the multi-sensor information fusion is 2.25 higher than the average system fluency under the traditional mode, and the average system stability is 4.75 higher.

The whole test results show that the information processing speed and accuracy of the mental health consulting service platform based on multi-sensor information integration designed and implemented in this paper are higher than that of the information service platform under the traditional model. The use of functions is also relatively mature and perfect, which achieves the intended purpose of the design, and has a certain degree of operability and usability.

5. Conclusion

Paying attention to the problems caused by mental health will be an inevitable trend of social development. This article combines combination of different signals merging technology to design a mental health service platform based on combination of different signals and technologies merging. This article first studies and analyzes the basic principles, fusion levels and fusion algorithms of combination of different signals merging technology, then introduces the mental health information service platform, and then completes the overall design of the platform according to the design requirements of the mental health consulting service platform in this paper. The mental health consultation service system is mainly composed of two functional modules, namely psychological testing and expert consultation. The realization of the function is based on multi-sensor information blending technology, collecting data through sensors, smart phones and other devices, and transmitting the data to the cloud platform to use multi-sensing for data blending and analysis. Then providing users with mental health consulting services. Finally, a controlled experiment has proved its effectiveness and practicality. With the rapid development of the information age, a mental health service platform based ontechnology has broad development prospects and markets. It can not only help contemporary people pay attention to and solve mental health problems, but also has a profound impact on social development. It has taken a crucial step for the healthy development of society.

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Research on Psychological Crisis Intervention Mechanisms for Adolescents in Yunnan' s Border Ethnic Minority Regions.

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