Proceedings of the 3rd International Conference on Computing Innovation and Applied Physics
DOI: 10.54254/2753-8818/34/20241175

Dynamic switching of psychological test questions and design of scalable database: A study of web page data visualization and front-end interaction

Xinyu Hu

School of International Education, Guangdong Neusoft University, 528000, China

huxinyu21@s.nuit.edu.cn

Abstract. As the need for efficient and user-friendly web applications in the field of psychological assessment continues to grow, traditional web development approaches are challenged to provide a dynamic and adaptive user experience. This study focuses on addressing these challenges through a comprehensive study that provides insight into the current state of psychological assessment web development, highlighting the shortcomings of traditional approaches, including the static limitations of Hyper Text Markup Language (HTML) and limited client-side scripting. The result is a user experience that lacks the responsiveness and flexibility that modern users expect. To tackle these problems, the intended solution suggested in this work combines a strong and scalable database design with a dynamic switching mechanism for psychological exam questions. Features-rich, aesthetically pleasing, and functioning client-server Web applications are created using technologies such as Servlets and Java Server Pages (JSP). The research contains practical case studies that demonstrate how Java-based user interface design can be successfully applied in real-world scenarios. The advantages of modularity, code reusability, and maintainability are demonstrated in these case studies. The study examines how selected technologies affect the performance, security, and accessibility of web UI, while also addressing load times, data integrity, and user inclusion issues. To summarize, this investigation underscores the crucial role of dynamic and scalable databases and Java-based technologies in enhancing the design of psychological assessment Web UIs.Developers can create web applications that exceed user expectations and provide superior user experience in the evolving digital landscape by using the proposed framework's comprehensive toolkit.

Keywords: Web UI design, Scalable database design, Data visualization, Front-end interaction

1. Introduction

As mental health becomes a growing concern [1], the need for dynamic and user-friendly web applications continues to grow [2-3]. These apps not only need to provide accurate psychological assessments but also ensure ease of use and interactivity, helping users better understand and participate in their health management [4]. Traditional web development methods are faced with many challenges in meeting these needs. Especially in terms of flexibility and personalization, traditional methods are usually limited to static HTML pages and limited client-side scripts, which limits the responsiveness of the application and the adaptability of the user experience [5]. As digital technology continues to develop, it has become crucial to create web applications that can adjust to user requirements and technological

DOI: 10.54254/2753-8818/34/20241175

developments. It is now a critical task in the field to explore ways to overcome these limitations and create psychological assessment tools that are both efficient and easy to use.

This study adopts an interdisciplinary approach, integrating elements from computer science, user experience design, and data science. Our objective is to create an innovative web application that not only offers accurate and personalized psychological assessments but also prioritizes user-friendliness and high interactivity in its design. Such an approach aims to overcome the limitations of traditional web development in terms of flexibility and personalization, thereby adapting better to the needs of modern users and the rapidly changing technological landscape.

2. Implementation

In the mental health assessment tool project, after considering the user groups that the project may face in the future, the environment has been configured as shown in Figure 1. Hyper Text Transfer Protocol (HTTP) requests are used by the front-end to communicate with the back-end. When a user performs operations, such as logging in, registering, or submitting test answers, the front-end sends corresponding requests to the back-end server. These requests contain necessary user input data, such as login credentials or answer choices. The back-end server receives the front-end request and executes the corresponding business logic. For example, for login requests, the backend verifies the validity of user credentials; for test answer submissions, the backend stores and processes the answers. The interaction between the backend and the database is achieved through SQL queries or the API of the database management system. The backend queries, updates, or stores data as needed. For example, the user's personal information and test results are stored in the database, and the backend retrieves or updates this information from the database based on the frontend request. After the backend completes processing, the relevant data is sent back to the frontend. For example, data visualization of test results requires the backend to query the database for test data and then send this data back to the frontend in the appropriate format for display. This tight connection between the front-end, back-end, and database ensures that the application runs efficiently, making the user interface responsive, while the back-end can process and store data securely and accurately.

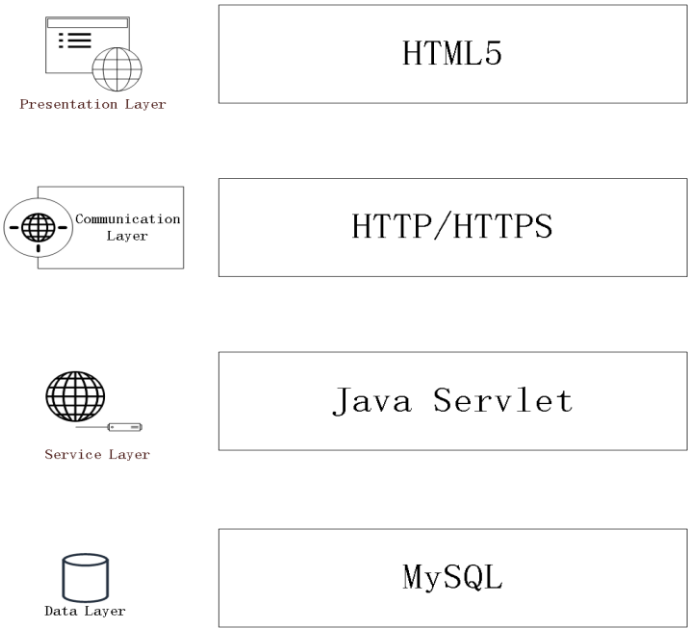

Figure 1. Web development architecture diagram.

Compared with static page design, dynamic pages are more suitable for collecting information. When designing a dynamic mental health questionnaire website, the user registration and login process is crucial, because a user-friendly web design is also one of the goals explored in this study. A good layout

DOI: 10.54254/2753-8818/34/20241175

design is shown in Figure 2. The MySQL database was used in this study to securely store user credentials. When users register, their information (including username, password, and other personal details) is encrypted and stored in the database. During login, user credentials are verified against stored data to ensure authenticity. The importance of this process is to maintain the integrity and confidentiality of the data, which is crucial in a field as sensitive as mental health. Implementing advanced encryption and secure connections (such as SSL/TLS) further enhances data protection, ensuring user privacy and system reliability.

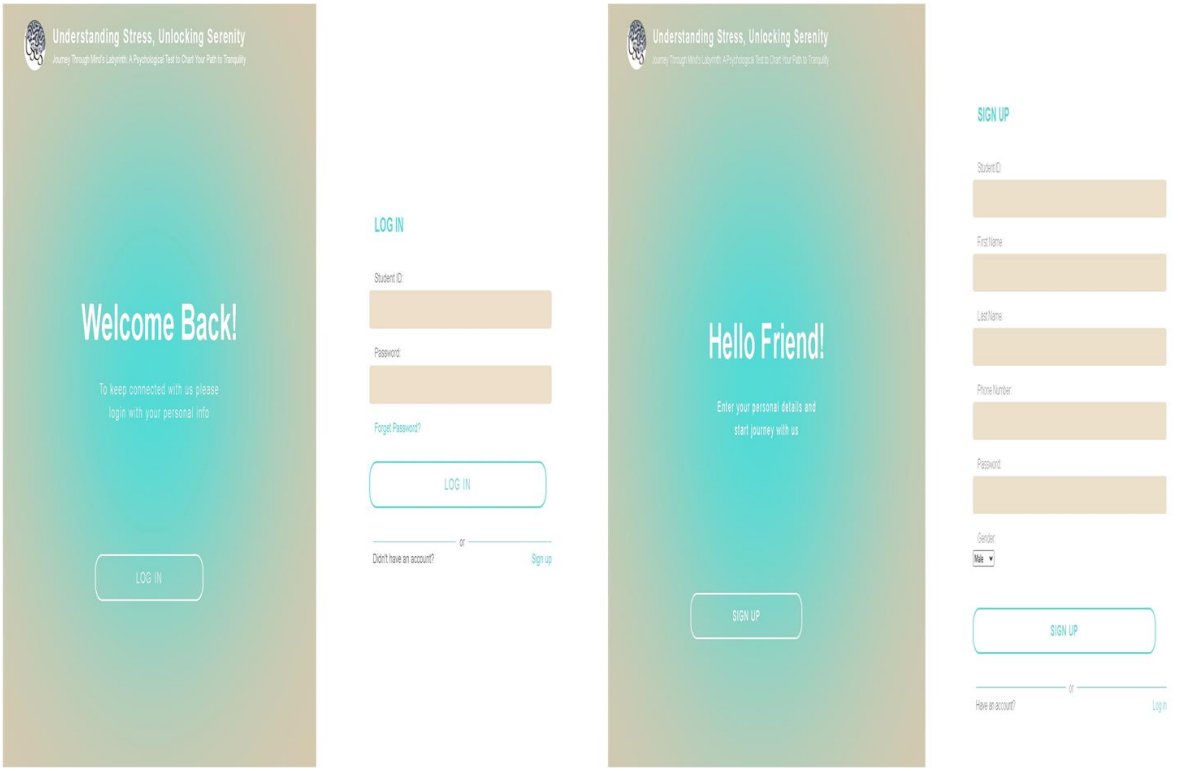

Figure 2. The login registration webpage display page.

The essence of a dynamic questionnaire is its ability to adapt to different user responses. Each question is stored in the database with a unique identifier as shown in Table 1, allowing the system to dynamically retrieve and display questions based on user interaction. This approach ensures a personalized experience for each user and adjusts the questionnaire process based on their responses or switches between different questionnaires for different user groups. The display of the questionnaire on the web page is shown in Figure 3. This study uses Java to handle business logic and JSP to integrate Java code and connect to the database to dynamically render content. The switching of questionnaires in this study is different from traditional back-end development. Instead, the purpose of switching questionnaires is achieved by directly switching the unique identifier of each questionnaire. This also provides an idea for the back-end development of dynamic question switching.

DOI: 10.54254/2753-8818/34/20241175

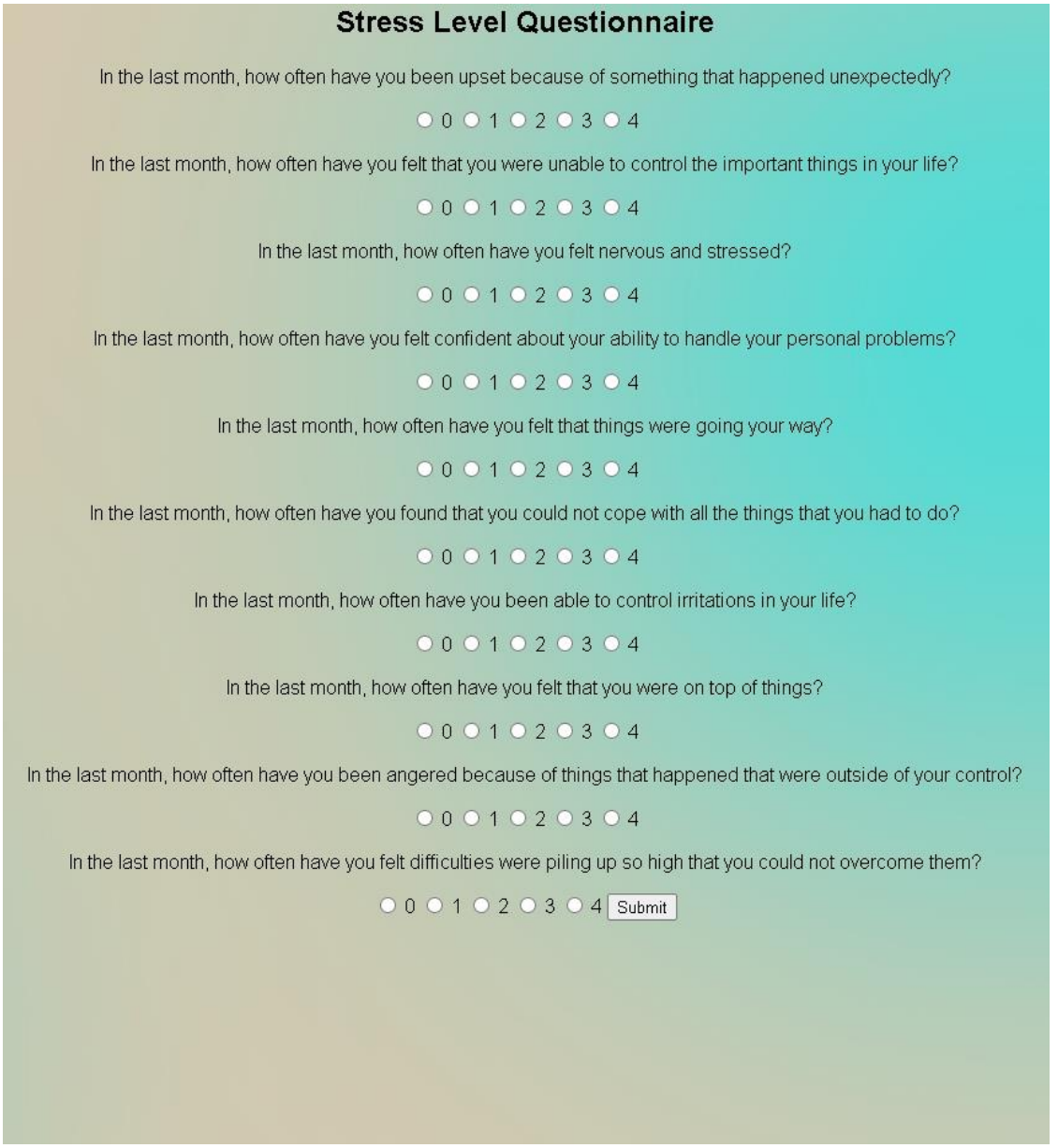

Figure 3. Questionnaire page display.

Table 1. Database display.

ID	Questionnaire
Q1	In the last month, how often have you been upset because of something that happened unexpectedly?
Q2	In the last month, how often have you felt that you were unable to control the important things in your life?
Q3	In the last month, how often have you felt nervous and stressed?
Q4	In the last month, how often have you felt confident about your ability to handle your personal problems?
Q5	In the last month, how often have you felt things were going your way?

DOI: 10.54254/2753-8818/34/20241175

3. Results and Discussion

Visual representations of data are powerful tools for enhancing user understanding and engagement. In this project, psychological assessment results are displayed using interactive charts (e.g., line charts) that are dynamically generated based on user responses. This research uses the Canvas element in HTML5 to display data visualization on web pages. Of course, there are many ways to render visualizations in web pages, such as D3.js or Chart.js. However, implementing data visualization on a mental health test website not only makes the user's interpretation of the results more intuitive but also adds interactive elements to the website, enriching the user experience. The choice of line chart is particularly effective at showing changes and trends over time, which is crucial for monitoring mental health progress as shown in Figure 4.

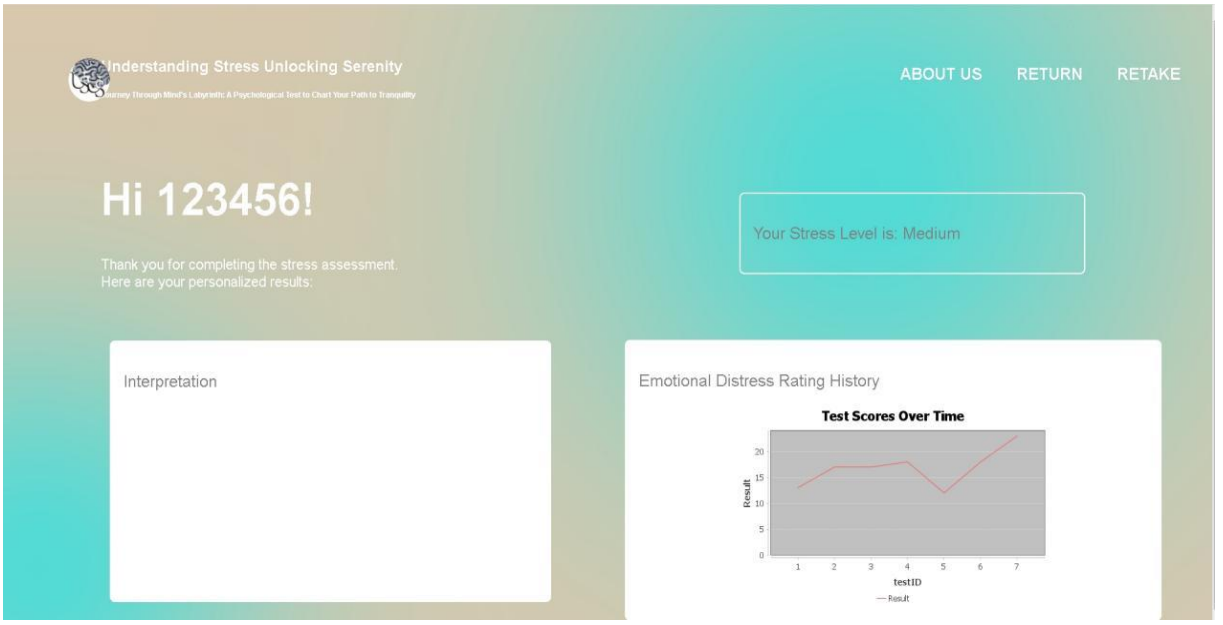

Figure 4. Data visualization display.

The efficiency of the user registration and login process in this project was evaluated in detail and shown to be efficient. On average, users take less than two minutes to complete the sign-up process, while the login process typically completes within 24 milliseconds. From a user perspective, this process is considered simple and user-friendly, which also reflects the importance of user experience for a website. In addition, through the survey, more than 50% of the testers believe that this is a convenient new way to conduct psychological tests. Compared with traditional paper questionnaires, it is more convenient to register as a user of the website and conduct the test, and the overall test time is relatively short. is shorter than that, further confirming the success of the system design. Although the back-end language JSP used may not be as fast as Node.js in terms of response speed, it has shown superiority in adapting to different environments and needs, ensuring the flexibility and stability of the system [6], which is suitable for psychological testing websites. Said it is particularly important.

In terms of the smoothness of test topic switching, the dynamic switching mechanism of test topics shows a high degree of fluency for users. The average question switching response time in the system is within 1 second to switch the questionnaire topic, you only need to create a new topic test question data table in the database and change the unique identifier of the data table in the JSP file to complete the switch, which is crucial to providing a smooth user experience. In addition, the accuracy has also been highly praised by users, with almost no incorrect switching. For website developers, the switching of test questions does not require complicated logic. Test questions can be switched by changing the logic of the unique identifier of the test question, which greatly improves the efficiency of development and the convenience of maintenance personnel. These results show that back-end systems developed

DOI: 10.54254/2753-8818/34/20241175

using technologies such as Java and JSP can effectively process logic and quickly respond to front-end requests.

Regarding how data visualization can improve the user experience [7], user feedback shows that tools such as line charts are both clear and easy to understand when presenting complex data. Users can easily track their test results through the visual tool, and most users report being able to intuitively understand their health trends. Additionally, the interactivity of these visualization tools enhances user engagement, allowing them to explore and understand their data more deeply [8]. This feedback demonstrates the importance of implementing high-quality data visualization in mental health assessment tools. Regarding feedback from testers, this study summarized the following factors that may cause the test results to meet expectations:

The efficiency of the user registration and login process is not only due to the optimization of the database, but also the concise and intuitive interface design, which makes the interface intuitive and easy to understand, and the simple operation lowers the user's threshold for use. It also considers different user groups and reduces the user's Wait times improving the overall experience. The key to successful data visualization is to design the web page from the user's perspective, and through user behavior research, select the chart type and color scheme that best suits the user's psychology and usage habits.

However, this study also produced test results that did not meet expectations. These test results that did not meet expectations are also worthy of further research. In terms of user login, the tester feedback function is too simple and can only perform simple user login and registration. It should also enrich the functionality of web pages while ensuring a simple and intuitive interface, such as changing personal information. Data visualization may not work properly when changing test questions. This may be due to technical issues in the data binding or dynamic update mechanism. A visualization component may not reflect the latest test results if it doesn't respond effectively to changes in the data source, for instance. To resolve this issue, consider adopting a more flexible data binding framework or enhancing the data synchronization mechanism between the front end and the back end. In addition, regular technical reviews and testing are also key to ensuring that the system maintains stability and reliability after feature updates or changes [9].

When discussing the downsides of data visualization, it's evident that utilizing line charts as the sole visualization tool for psychological testing could be too one-dimensional. Different forms of data visualization may be necessary for different types of psychological tests to convey information with greater accuracy. For example, mood changes may be better represented by a bar chart, while stress levels may be better suited for a pie chart display, which can help users better understand and compare different categories of data. Therefore, to improve the user experience and the effectiveness of data presentation, research should consider introducing more diverse visualization charts according to test types or consider using VR as a data visualization tool [8]. This enhances both the accuracy of data presentation and the website's attractiveness and usefulness. In the design of the page, user experience evaluation can also be considered to increase the attractiveness of the website [10].

4. Conclusion and Outlook

The purpose of this article is to develop research on mental health assessment tools utilizing an interdisciplinary approach, emphasizing the significance of technology in improving the usability and accuracy of these tools. The usability and accuracy of mental health assessment tools have been significantly improved by the technological improvements implemented in this project, which has had a significant impact on the mental health field. By providing dynamic user interfaces, optimized database queries, and intuitive data visualizations, these tools have become indispensable auxiliary tools in the daily lives of users, aiding them in better comprehending and managing their mental health. For example, users can now get a faster and more personalized testing experience through these tools, while also making it easier to understand their health status and progress through intuitive data presentation.

The application of these mental health assessment tools to large populations, such as schools and companies, is a key direction for future development. Using tools, mental health status can be monitored

DOI: 10.54254/2753-8818/34/20241175

and analyzed, and tailored recommendations can be provided to individuals with different levels of needs. Personalized recommendations and medical advice can be generated by the system automatically based on test results for testers with poor psychological conditions. This application will help identify potential mental health issues early and promote mental health education and awareness, especially in educational and workplace settings. Effective solutions will be provided for large groups, such as schools and businesses, through the technological advances in this project. Mental health assessment tools to help with early identification and intervention of psychological problems. The system can provide customized mental health advice based on big data analysis to support individuals with different levels of needs. Also, the psychological assessment content can be improved to provide users with more specific suggestions and intervention plans and can be partnered with medical institutions to give timely guidance and support to individuals who require professional assistance.

References

[1] Vargas T Schiffman J Lam P H Kim A and Mittal V A PLoS ONE 2020 15 e0236157
[2] Jazayeri M Future of Software Engineering (FOSE '07) (Minneapolis: IEEE p 19
[3] Luna E R Garrigós I Rossi G 2010 First International Workshop on the Web and Requirements Engineering (Sydney, NSW, Australia: IEEE) p13
[4] Inal Y Wake J D Guribye F Nordgreen T Journal of Medical Internet Research 2020 22 e15337
[5] Jais B E International Journal of Multidisciplinary Research (IJMR) 2023 p 9
[6] Walczowski L T Waller W A J 6th IEEE International Conference on Electronics, Circuits, and Systems (Paphos, Cyprus: IEEE) p 1717
[7] Wood J Isenberg P Isenberg T Dykes J Boukhelifa N Slingsby A IEEE Trans. Vis. Comput. Graph. 2012 18 TVCG.2012.262
[8] Rajasag D P 2023 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW) (Shanghai, China: IEEE) 2023 p 971
[9] Sharma R Saha A 2018 International Conference on Computing, Power and Communication Technologies (GUCON) (Greater Noida, India: IEEE) p 299
[10] Franco R Y D S Freitas A A D Lima R S D A D Mota M P Santos C G R D and Meiguins B S,2019 23rd International Conference Information Visualisation (IV) (Paris, France:IEEE) p 175