



The Application of Visualization of Internet of Things in Online Teaching of Mobile Interactive Interface Optimization

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Abstract. The existing interactive interface of online teaching mobile terminal is not well used in the process of user experience. To optimize it, this paper puts forward the application of the visualization of the Internet of Things in the optimization of the interactive interface of online teaching mobile terminal. Utilizing the visualization technology advantages of the Internet of Things, we can improve the user's sense of use by optimizing the mobile interactive interface vision and human interaction design with the use module. Design simulation experiment compares the number of user choices before and after optimization to verify the validity of the design.

Keywords: Internet of Things · Online teaching · Mobile terminal · Interactive interface

1 Introduction

The innovation and development of mobile equipment and social network technology has caused great changes in the way people communicate, learn and play [1]. The use of mobile devices and social media enables everyone to maintain communication and communication with other members of society at anytime, anywhere, flexibly and conveniently [2]. The Internet of Things (IOT) is considered as the third typical application developed by the explosion of information after human beings entered the Internet era: the first typical application is the application of information, that is, search engine; the second typical application is the application of interpersonal relationships, that is, social networking sites; and the third is the application of things, that is, the Internet of Things. The Internet of Things (IOT) technology is designed to achieve a worldwide physical network for object awareness and interchange, enabling wider interconnection. With the rise of the Internet of Things, the development prospects of related industries are very promising [2]. At present, there are few studies on the experimental teaching of the Internet of Things. Most of the papers are about some technology and development of the Internet of Things itself. There are few studies on specific teaching tools and teaching methods. Although many colleges and universities in China have set up the related specialties of Internet of Things, they have not changed the teaching according to the characteristics of their disciplines. In the experimental teaching, the existing software and hardware are mostly used directly, and the actual teaching effect is not taken into account.

In addition, through the investigation of the experimental teaching platforms used by domestic colleges and universities that have set up the specialty of Internet of Things, the drawbacks are also obvious: most of these experimental platforms provide very simple basic verification experiments, which are far from the actual application. The cost is relatively high, and the parts in the test box are highly customized, which damages one or more parts, so the whole test platform cannot be used anymore, and the daily maintenance of the equipment is very troublesome [4]. Existing systems have problems such as inconvenience in operation and maintenance, and do not use cloud technology. Therefore, it puts forward the application of the Internet of Things visualization in the optimization of the interactive interface of the mobile side of online teaching, setting up the instant interaction function between teachers and students, highlighting the guiding role of education teachers and the main role of students, supporting the upload of continuation points such as video and audio, so as to make the learning forms of students more diverse. The function of tripartite evaluation of students, teachers and business managers is set up to make the evaluation of students more comprehensive. The user experience of interface is smooth, easy to maintain and update, and it is suitable for school application. The experimental results show that the interface optimized by the proposed method is more popular with testers, and the selection rate is as high as 94.29%. And in the experimental process, the program runs well and the interface runs smoothly.

2 Optimize the Interactive Interface of Mobile Teaching on the Visualization of the Internet of Things

2.1 Design Optimization of Mobile Interactive Interface Based on Visualization

Interfaces are a very important part of human-machine interaction. From the point of view of design psychology, it can be divided into two main dimensions, affection and sensation, among which sensation includes touch and vision and hearing [5]. The design of interactive interface is a fusion of different disciplines, including cognitive psychology, design and language. The interactive interface is the most direct part of user contact. Design includes icons, background and overall interface effects, which affect the style of the entire interface design.

The development of graphical interface on mobile side has led to a new direction in the design of human-computer interaction. The development of interactive design and GUI design has evolved from a single functional requirement to a bridge to coordinate users and satisfy their emotional needs. Emphasizing the user's feeling and satisfying the user's emotional experience is the general trend of interactive design.

Complete the interface design based on feeling and emotion. Emotion is a user's subjective perception of the interface. Interface is the only channel for user perception, which is divided into sensory, emotional and cultural levels [6]. Traditional interactive design pays more attention to practical usability, ignoring emotional penetration will directly affect the friendly performance and usage evaluation of the interface. This requires us to pay more attention to the importance of emotion and sensory invocation

in interface interaction design. Starting with pictures and graphic elements, we will use the tensive and expressive interface design to stimulate user's emotional feedback, which will increase the fun and pleasure, thus encouraging users to use it. The core part is always to focus on and understand the mindset of the target user. User-centered interface design needs to grasp user's psychology, immerse emotions in the design, adjust interface zoning and classification, and help users complete operation and decision-making in pleasure and novelty.

Applied visual design includes: font, color combination, icon, spacing, style uniformity, visual continuity. The readability and recognizability of text include readability, size, contrast between text color and background, and no interference from surrounding design elements. Consider the age group of a particular population, such as the elderly, and have tips to adjust the font size. Instead of using low-resolution pictures, use vector graphics for design rather than bitmaps. Follow the high resolution display design and scale down. Screen resolution is getting higher and higher, requiring scaling down from high resolution devices. Design drawings can be imported into mobile phone test corrections after design. The final result graph of the final design implementation on mobile devices must also undergo continuous iteration and upgrade.

Experience ease of use: Streamline the main information and operations, prioritization, the most important core functions and content to be reflected in the layout, so that there are obvious functional options in the operation; try to avoid introducing animation. The application loading process transitions from picture display to animation, which requires excessive natural panning. The first time a user opens an app, introducing animations is fun and lengthens the user's exposure to the app. It's worth waiting unless you can guarantee a short period of time and a fine and attractive design.

The button click design of the operation interface should have implication effect, dynamic conversion, concave and convex effect, and shadow effect, and ensure that the button design can ensure the click range to avoid mis-operation of keys. Use theme style, size, and color resources together to avoid redundancy.

Responsive design, also known as adaptive design, requires a unified visual effect across platforms and the unified visual effect of different mobile terminal screen sizes. By choosing the appropriate layout composition type, the visual display effect that mobile WEB needs to consider will be extended, the display of horizontal and vertical interfaces will also make APP design more difficult, and the corresponding screen size category will be expanded [7].

Mobile application interface design should avoid panning other systems causing obtrusiveness due to differences in application operating system versions and aesthetics and interaction. The design panels described in this section include application startup pages, size specifications for interface design, icon design and color design. This section describes the differences between different devices, especially the classification of screen size and density. The Android interface size is usually $480 * 800, 720 * 1280, 1080 * 1920$. After multi-machine testing, $720 * 1280$ is suitable for display, $1080 * 1920$ is clear, and the size of the picture file after cutting is appropriate to reduce memory consumption. The basic Android interface is divided into navigation and status bars, as well as the main menu content area. Usually the base size chosen is $720 * 1280$. Take the Android system as an example, and the basic composition of the interface diagram is shown in Fig. 1:



Fig. 1. Interface diagram of android application basic composition

Droid sans fallback is Google’s default font on Android. The acceptable range of text resolution and comfort values can be analyzed from the survey of Baidu user experience in the following table, as shown in Table 1:

Table 1. Acceptance of font resolution for users

		Minimum value	Acceptability	Comfort value
High resolution	Long text	21px	24px	27px
	Short text	21px	24px	27px
	Notes	18px	18px	21px
Low resolution	Long text	14px	16px	18px–20px
	Short text	14px	14px	18px
	Notes	12px	12px	14px–16px

The screen density benchmark for the device is medium. As a result, adding benchmark icons increases generation to create a high-density version, and vice versa. Put the icon in the application’s specific density resource directory. For example: (run under the default res/drawable/directory). Avoid filling in too much information or UI components on high-density pixel screens. When designing a UI for a high PPI (pixel per inch) screen, because more pixels are available, placing more information on the interface or UI components can lead to a preview of the design results, the interface clutter can affect the display of key functions on the interface. Screen density standard version size, as shown in Table 2:

Table 2. Screen density standard version size

Classification	Low density screen	Medium density screen	High density screen
Menu	36 × 36px	48 × 48px	72 × 72px
Status bar	24 × 24px	32 × 32px	48 × 48px
Label	24 × 24px	32 × 32px	48 × 48px
Dialogue	24 × 24px	32 × 32px	48 × 48px
List view	24 × 24px	32 × 32px	48 × 48px

The value of interface color is hexadecimal. Because there are 10 million different colors that can be distinguished by the naked eye, users pay much attention to color during the process of interface interaction. Color also has implications on users' psychology and culture. For example, red usually means warning, green means calm and healthy, etc. To reduce the complex memory of user interface information and actual operation, color information needs to be used efficiently to distinguish content classification from level [8]. This requires choosing appropriate colors for different interface scenarios, such as managing cool tone anomalies in the interface. Secondly, avoid more than three colors in the same interface in terms of matching style to avoid visual confusion. Finally, the contrast of colors should be emphasized clearly, such as using dark text on a light background, or using special colors to emphasize important information tips that users need to be aware of.

2.2 Human Computer Interaction Design Optimization

In the process of learning the boutique course, the learner will encounter difficult problems. The learner can go to the FAQ module to find solutions. If the FAQ module has no questions that the learner encounters or the learner is not satisfied with the presented answers, it is necessary to seek help from the teachers or other learners through the interpersonal communication tools provided to the learners through the elaborate course platform. Interpersonal interaction can be divided into synchronous interaction and asynchronous interaction according to the time of interactive feedback. Synchronous interaction is a real-time interaction in which the learner can get feedback immediately while asking a question [9]. Asynchronous interaction is a non-real-time interaction in which the learner takes some time to get feedback after asking a question. At present, the interaction provided by the boutique courses is mainly asynchronous, which means that the learner's questions need to wait for some time to get feedback. If the time interval is long, it will frustrate the motivation of the learner. Therefore, synchronous interaction should be combined with asynchronous interaction. Based on this, the structure of interpersonal interaction system is designed, as shown in Fig. 2:

Asynchronous interaction design: Because the learner is separated from the tutor and other learners in time and space when learning the boutique courses, it determines that the communication between people in the boutique courses must be mainly asynchronous interaction. At present, the asynchronous interactive tools provided by the boutique courses are relatively single, different learners are accustomed to using different interactive tools, and each interactive tool has its own unique functions.

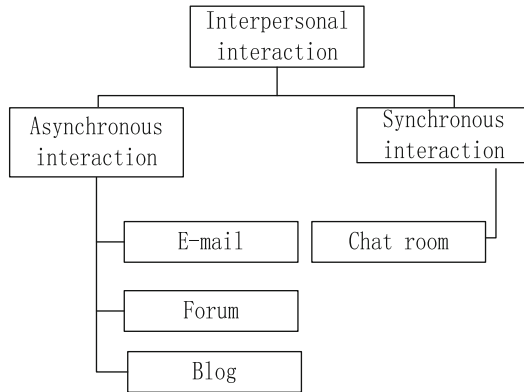


Fig. 2. Diagram of interpersonal interaction design

Therefore, boutique courses should provide a variety of interactive tools to enhance the communication between learners and teachers, and between learners and learners. Based on this, design three interactive ways: e-mail, forum and blog.

E-mail: E-mail is a kind of interaction often provided in the boutique courses. Its advantages are fast communication, convenience, low cost, and one-to-one non-real-time communication. Through e-mail, learners can send their homework or difficult questions to teachers for guidance and answers. Teachers can understand the learning situation of learners and give them guidance and encouragement. At the same time, e-mail reduces the barriers to traditional face-to-face communication and makes it easier for teachers to maintain contact with learners [10].

Forum: In the boutique course website, the course builder can establish a BBS site, or connect a BBS site, which is a commonly used interactive way to achieve one-to-one, one-to-many interaction [11]. In the forum, you can set up a variety of learning topics related to the content of the course, or you can set up a theme dedicated to emotional communication. The learner can choose the theme module of interest to learn [12]. If the learner has any questions or puzzles, you can post a post in the forum to ask for help, and the teacher or other learners can reply through the forum. At this time, as long as the online learners can see the reply information, which not only avoids repeated questions of the same problem, but also reduces the time for teachers to reply. By participating in the discussion in the forum and observing the learners' statements and comments, teachers can know what the learners care about and want to know, communicate with the learners in time, and stimulate the learners' enthusiasm for learning more easily [13]. Due to the variety of topics in the forum, you need to set up a search bar in the forum to help learners quickly find the topic or problem they need. At the same time, in each theme module of the forum, upload and download functions are provided to enable resource sharing among learners.

Blog: Blog, also known as web log, is a space for publishing personal thoughts, opinions, emotions and other content in the form of a journal. Its advantages are easy to create, easy to operate, instant updates, personalization, sharing and interaction, etc. Each student can have his or her own blog, as long as he or she logs in to relevant

websites (such as Sina, NetEase) to register [14]. Moreover, blogs between learners can be shared with each other, and even with the authorization of the blogger, they can comment on a topic. In addition, in the blog, the learner can set up a blog circle according to their own interests and hobbies, that is, a virtual learning group. The learner can study and explore a certain problem or topic. This not only reduces the loneliness of the learner learning in the network, but also increases the emotional communication between the learners.

Synchronous interaction design should follow the principle of “asynchronous interaction as the main factor and synchronous interaction as the supplement” when designing the interpersonal interaction mode of the boutique course. Therefore, synchronous interaction design is also an indispensable part of the boutique course [15]. Synchronized interaction requires that teachers and learners in different areas be online simultaneously in order to communicate smoothly. Due to the limited time and energy of the teachers, it is impossible to be online frequently. This requires the teachers to inform the learners of the specific online time through the bulletin board, so that the learners can grasp the opportunity of “face-to-face” communication with the teachers. Provide online chat rooms for learners when designing synchronized interactions for boutique courses. Chat room is a real-time communication tool, which can achieve one-to-one, one-to-many interaction. Its advantage is the timeliness of interaction. In the chat room, the learner can consult the teacher and get feedback from the teacher immediately. The learner can also collaborate with other learners online to encourage each other, overcome learning difficulties and accomplish the construction of the meaning of knowledge together. When students communicate with teachers and other learners, they can use text, images, videos, audio, which makes the communication between them more vivid and interesting.

3 Simulation Experiments

3.1 Experimental Preparation

Design simulation experiment to analyze the application performance of the interactive interface optimization of online teaching mobile end in the visualization of the Internet of Things. By comparing the number of users using online teaching mobile end before and after optimization, the difference between before and after optimization is proved.

The test uses the method of static test to test the software function and user interface layout one by one. The test environment is an Android system 4.0 and above. The test case design takes into account the complexity of the Android mobile phone brand, and has been tested with different models and system versions to ensure that the software can be compatible with the mainstream mobile phone types in the market, so as to ensure the use of different models and maximize the user group. Therefore, different brands and resolutions of mobile phones are used for testing, and the model configuration is as follows (Table 3):

Table 3. Test model configuration

Brand and model	Operating system	Resolution	PPI
Galaxy S3 (I9300)	Android OS4.0	2930 * 720	306
ZTE U930	Android OS4.0	960 * 540	256
Huawei Ascend P7	Android OS4.4	1920 * 1080	441
HTC One	Android OS4.1	1920 * 1082	469

1 Install test. The software download prompts the user that the current network environment is a WIFI or mobile network and asks if they want to install it. Software installation can choose its own path and be installed on a mobile phone or SD card. The new version installation can overwrite the old version, and the software application will not be abnormal, while the software can be uninstalled normally.

2 Performance test. Software usage means that there will be no Carton situation in the system, software application function is normal, each module works normally, and there is no unexpected exit. In the unstable network environment, the software application is normal, the network can still be used normally after disconnection, downloads such as courses will prompt the network disconnection information.

3 Interface test. The user interface is simple and generous, coordinated as a whole, consistent with the design prototype, and there is no interface scale imbalance. During the operation, pictures and text can be displayed normally without picture or text errors.

At present, the application function of language learning is basically developed, and the core part of application content basically meets the design requirements.

3.2 Comparison of Experimental Results

By comparing the selection of 350 groups of users, the experimental results of the two groups before and after optimization are shown in Fig. 3:

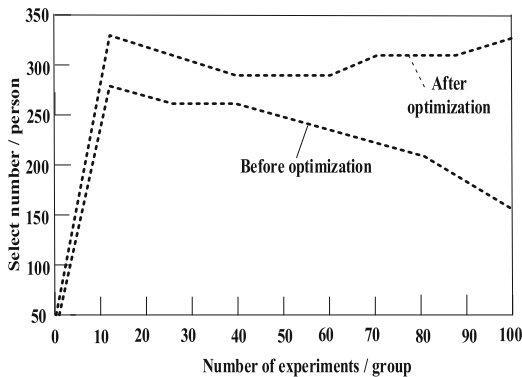


Fig. 3. Comparison of experimental results

According to the experimental results in Fig. 3, the optimized interactive interface of the online mobile terminal is more popular with the testers. The maximum number of users is 330, and the selection rate is 94.29%. The highest number of people who chose the learning interface before optimization was 270, and the selection rate was 77.14%. And in the process of the experiment, the software installation does not appear abnormal, can be unloaded normally. In the process of operation, each function module can run normally and the graphic interface display is normal.

By comparing user selectivity, we can see that most users prefer to choose an optimized interface. The limitations of optimizing the front interface design, the lack of structure and template design have been found in the user experience survey, which makes the overall layout single. The lack of visual and color design, as well as the absence of a GUI, results in a dull and lifeless interface. Although you can choose from Topics, the design section that should be attractive has become a toll file. The lack of practicality and user experience mainly takes the form of listening to pronunciation through a table.

Choose more courses to introduce knowledge as the main knowledge, but charge more, which makes the user experience extremely degraded. Lack of breakthrough and innovation. Compared with the traditional teaching mode, copying the book content to the mobile end of the Internet does not make better use of the enhanced advantages of mobile APP interface interaction. Inconsistent interface design. This is reflected in the picture selection and overall interface effect, as well as the visual color and GUI response. This also violates the user-centered interface design principles, the lack of research on picture selection leads to stale and dull overall interface senses, and the overall style rhythm depression makes learning fun decline.

The optimized interface takes the user as the core, and considers both sensory and emotional aspects. It uses cool tones and three colors to make the interface information and actual operation clearer and reduce the complex visual memory. Includes the use of text Icon backgrounds and contrast to make the interface simple, clear and interesting. Secondly, it is convenient to strengthen learners' autonomous learning and interaction. Interface interaction is guided by the establishment of effective hierarchical learning modules and enhanced autonomy in the form of learning tasks. In particular, a third-party sharing interaction link has been added to enhance the experience. By combining rich audio effects and interesting graphics, users can improve the efficiency of fragmentation learning by downloading interesting Chinese topics and learning stage tests. Finally, the simplicity and clarity of the interface are the main features and advantages of this study. Both the oral listening learning interface and the HSK test interface have clear and concise menu management, and the humanized collection of wrong questions is also the highlight.

4 Conclusion

This paper presents an application of Internet of things visualization technology in the optimization of mobile interaction interface in network teaching. From the beginning of the project to the research requirements analysis to the preparatory work, the prototype design of dual channel Android client interaction and the design of server-side communication and data storage are realized. The main feature of this application interaction is that it can provide a good interface interaction and experience for Chinese learners with different experience backgrounds and learning purposes in the oral listening scene environment and HSK test simulation environment.

Through simulation experiments, the effectiveness of this method is analyzed from three aspects: installation test, performance test and interface test. The experimental results show that the selection rate of the optimized teaching interface and interaction mode is as high as 94.29%. However, due to the limitation of the technical level of myself and the research group, the next research will be carried out in the direction of file transmission optimization and server stability in the future.

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