

## **The Conceptual Design of "Smart Closet" Fashion Consultant Expert System**

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### **Abstract**

*The article put forward a conceptual design about a "smart closet" fashion consultant expert system. The smart closet is a newly mobile interactive platform that includes many functions such as clothing management, clothing fitting, dress collocation and so on. This platform can offer help about dress collocation and image design for ordinary user, and also can offer service about brand design and marketing for enterprise. The system is design with friendly interface, clearly process, easily operation and which will become important tool for the development of fashion field in the near future.*

**Keywords:** smart closet; interactive platform; conceptual design; fashion

### **1. Design Background**

The smart mobile is a life necessity for majority people, almost all of the activities and deals can finish by mobile phone. And portable, easy to carry make it become the more popular electronic products than the computer.

More and more people choose to use mobile phones to browse and buy clothes, but the electronic commerce is always faced with the question as "can't try on, high rate of return". For this case, the research of virtual fitting technology has been in the works, whether it is based on physical fitting room, or the fitting based on the online system, or the fitting software based on mobile terminal has a certain development. The development of the virtual fitting system, especially the 3D virtual fitting system, not only can bring convenience for the consumer, also eliminated the scruple of worry about the dress doesn't fit and can't rest assured to buy, at the same time also can reduce business losses caused by return.

The development of economy and the improvement of living standards lead to more and more busy of people, and there are more clothes for people to dress up themselves. Almost every day, people will be upset for what to wear today, even know what to wear, the closet of multifarious also makes it is very difficult to find a piece of clothing. While a "smart closet" system which can classified management clothing and see the fitting effect directly can solve all the problems.

"Smart closet" concept has begun to enter people's sight and has caused the attention of technology. The Apple Inc had applied for a patent about virtual closet in 2010, but the Apple hasn't yet launched this service up to this moment. The consumer brand uniqlo also had launched a network service of virtual wardrobe which can recommend the right goods for online shoppers according to their gender, dress occasion, style and weather. The user can put clothes which they like into the wardrobe and looking for suitable clothes for match in wardrobe.

### **2. Design Objectives**

"Smart closet", a software integration platform which is developed based on Android system. It can implement functions such as log in and registration, clothing classification, clothing upload, virtual fitting, brand focus, recommended of collocation, virtual shopping and so on. It can satisfy customers' diversified needs. At the same time, it's design with friendly interface, easily operation, pretty and fashion appearance.

For ordinary users, the "smart closet" fashion consultant expert system is a handheld device for them to matching clothing, designing image and shopping. It can improve user's fashion sense and fashion acuity, and also provides a platform to save time, loosen body and mind for busy office workers.

For high-end users, the "smart closet" fashion consultant expert system provide some services apart from as same as ordinary users, and also provide some personality services such as provide different image design for different occasions. For high-end brand which users concerned, the system can offer customized services, and users can enjoy some treatment such as try on new products in advance, customized garments and so on.

For enterprises, the "smart closet" fashion consultant expert system can provide active service for brands' production and marketing. While designers design a series of products, they can put products to the platform to matched and virtual display, and for consumers to try it on, then the enterprise can determine the combination of new products through the consumer feedback, and so on. After product shelf, the enterprise can recommended collocation and virtual display through the "smart closet", improve brand awareness and product sales. Both save time and reduce the cost for enterprise.

### 3. Technical Analysis

#### 3.1 Android Platform

Android is a open source mobile operating system developed based on Linux platform by Google. It is divided into application layer, application framework, the Android native libraries and operation environment and the Linux kernel layer four parts from an architectural point of view. Android SDK provides the necessary development tools, API function library and the emulator, enable developers using the Java development and debugging applications based on the Android platform . Android mainly include four major components:

- (1) Activity: The main part of Android applications. As an application interface framework, the activity responsible for the dynamic load of various user interface view, realize the underlying message transmission and so on.
- (2) Service: A component that runs in the background of Android application, there are two most basic functions of the service, one is executive the time-consuming operation which is running longtime, such as music broadcast, Internet downloads, and so on. Another feature is the interaction between components.
- (3) Broadcast Receiver: It is used to receive and process the broadcast news, whether system messages or custom message.
- (4) Content Provider: It is mainly used to provide data for other applications, the data can be stored in the file system.

Android platform has many advantages because of its openness , many vendors will launch various and functional characteristics products. The differences and characteristics on the function, will not affect the data synchronization, and even the software compatibility. And android is developed by Google which has past 10 years history on the Internet, from the search giant to comprehensive Internet penetration, Google services such as maps, mail, search has become an important bond connected users and the Internet, and the mobile phone based on the android system will combine the excellent Google services seamlessly.

#### 3.2 3D Virtual Fitting

virtual clothing technology means that it can realize the design and performance of clothing by simulating fabric with virtual technology, graphics technology and simulation technology. Ascension of technology makes the study of the , the fitting software and the online fitting have a further development.



**Fig.1 Virtual Fitting Mirror**

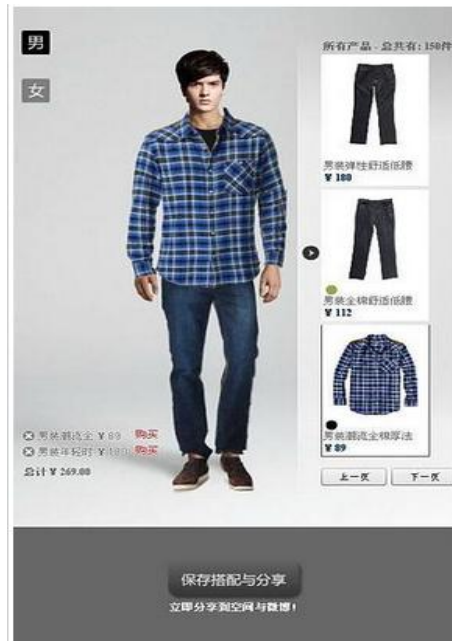


Fig.2 Virtual Fitting Based on the Mobile

The existing virtual fitting system generally consists of 3D human body measurement technology, the establishment of digital fitting body model, the interactive stitching of cut pieces and virtual simulation technology<sup>[4]</sup>.

3.2.1 3D Human Body Measurement

3D human body measurement technology has developed more mature at present: moire fringe method, laser measuring method, three-dimensional camera measurement method, Cyberware whole body scanning system, digital imaging fitting process and so on<sup>[5]</sup>. Methods above are all non-contact measurement and needs to have the corresponding hardware equipment, among them, the most convenient and the most suitable for online fitting is the digital imaging fitting process, and its requirement for equipment especially low, just need an ordinary camera or webcam. However, the human body data this method obtained is not enough or accurate.

3.2.2 The Establishment of 3D Human Body Model

There are many ways to establish a digital surface model of the human body such as comprehensive OpenGL and 3DS technique to attain the human body model, the Modelling method based on the B-spline curved surface piece, the geometrical method based on the construction entity, method of Matlab and polyhedron modeling and so on<sup>[6]</sup>.

3.2.3 Interactive Stitching of Cut Pieces<sup>[7]</sup>

The main steps of 3D virtual stitching process are as follows:

(1) Set the initial position of sewing the pieces by match the key point information of the pieces with the body's key point information, it show as the fig.3.

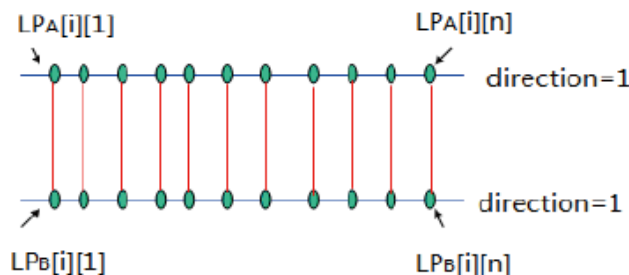


Fig. 3 Set the Suture Point

- (2) According to the suture information which is produced by interactive suture, the system will exert press on the edge of the corresponding stitching pieces, and each vertex based on Newton's second law will moving together,so the corresponding stitching pieces will gradually moving together under the internal force of the pieces.
- (3) 2D pieces are under the static state at the beginning of the suture, and the sewing process from two-dimensional pieces to 3D garment is a dynamic system over time. The grid point in the process of movement under the press of internal forces and external forces, then the 2D pieces will be gradually out of shape, and whereabouts with the natural gravity, finally achieve the result.

### 3.2.4 Virtual Simulation Technology

The includes fabric simulation and try on effect simulation. Fabric simulation, including geometric method, physical method and integrated modeling method. Among them, the integrated modeling method is the synthesis of geometrical method and physical method and the simulation results is perfect<sup>[8]</sup>; Try on effect simulation including finite element analysis method, particle system, mass-spring system and so on. The different methods and system has different contribution to result of try on simulation<sup>[9]</sup>. The virtual simulation technology is a Research hot spot of 3D virtual fitting technology.

## 4. Functional Design

All functions of the "smart closet" fashion consultant expert system are shown in fig.4<sup>[1]</sup>.

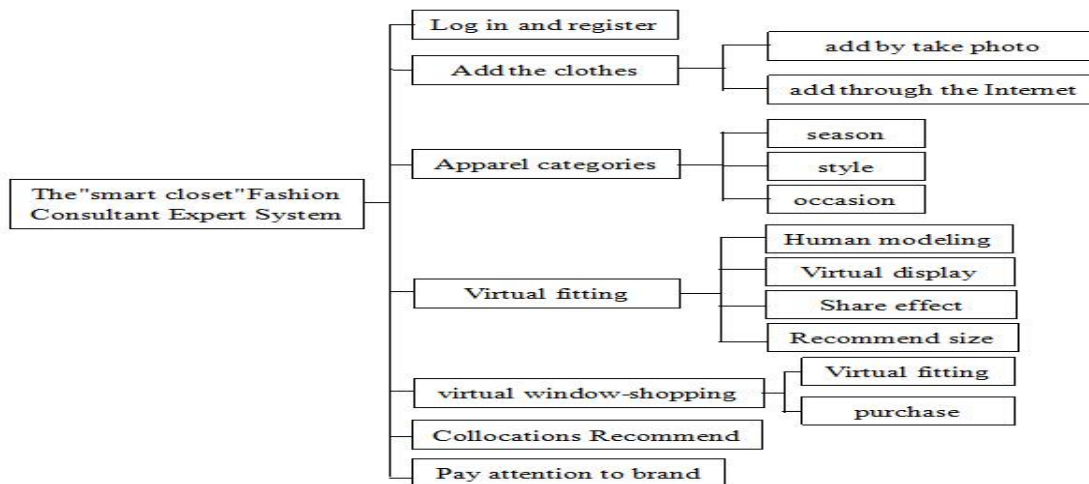


Fig. 4 Function Design

#### (1)Log in and register

Users can register and login through the user name, email, phone number. Then users can take a series of operations and save the data after logging in. And other users can be operated and experienced as tourists without logging in, but the data can't be saved.

#### (2)Add the dress

There are two ways to add the dress, one is take photos for user's own garments or other clothes users saw them when shopping and then upload the photos. The another way is to upload the clothing image which is directly from the Internet. All of the uploaded clothes are kept in "all dress" database, and user's own clothes save repeatedly to "my closet" database. In addition, users also can change, delete uploaded clothes conveniently.

#### (3) apparel categories

The system provide classification management to "All dress"and" my closet "database according to the season, style, wearing occasion and garment categories. Users can choose the required type of clothing, and the system recommend appropriate clothing according to user's selected.

#### (4) Virtual fitting

Firstly, to build user's own 3D human body model quickly, the system provide the male, female and child three original model, and users can adjust the size parameters, such as height, shoulder width, chest circumference, waist circumference, hip circumference and so on build their own personality model. In addition, the model's face and head can be replaced by user's own image, color of skin hair style also can choose to adjust.

The user can select established 3 d garment to try it on after the construction of the 3D human body model, the model can display statically and dynamically after fitting and also can be rotate by 360 degrees manually or automatically, and the model also can zoom in the local to watch wearing effect. At the same time, the system designed with different scenarios and lighting effects, the user can choose the scene and light according to need to show the fitting effect. In addition, the system will recommend the right size according to the fitting effect and stress analysis. Renderings of the fitting can be preserved and shared into QQspace, circle of friends, weibo, renren website and so on.

#### (5) Pay attention to brand

Users can add their interested clothing brands into the system and the system can display the clothing of brand and updated on a regular basis. Users can view apparel products under the brand and try it on at any time, the fitting effects can also be saved and Shared.

#### (6) Collocations Recommend

When users login the system first time every day, the system will recommended collocations according to user's existing clothing. At the same time, the user can also view the recommended collocation choose from the "dress" database and "my closet" database according to different weather and occasions.

#### (7) Virtual window-shopping

The system provide the function of "virtual shopping" which is connected to the Taobao, Jingdong and other online shopping site. Then users can choose favorite dress to try it on, and can undertake collocation with their existing clothing. The system can prompt the user whether the cloth is tightness or looseness through the model fitting and recommend the right size for users. User can direct order the clothing online finally.

### **5. Prospect of System Application**

#### (1) Offering help for users to match clothes and design image

"Smart closet" fashion consultant expert system provide fashion consultancy services which is intelligent and personal. Users can take a virtual try of collocations the network recommend or in the process of buying clothing, so the users will have a reference on dress collocation with the Intuitive fitting effect. At the same time, the users can see the effect of different model wearing the same clothing through change hair, skin color of 3D human body, its convenient for users to design image.

#### (2) Offering service for brand development and marketing of enterprise

In the product planning stage, designers can have a concept design combined with the popular trend, and then through the combination collocation of goods and virtual display in the intelligent wardrobe system to determine the product mix of the new season directly. Its save the time of design and advantageous to the communication between the staff and departments, and both the policymakers will avoid decision-making errors with the effect. In the stage of product promotion, the enterprise can provide some Presentations such as preview of goods collocation, virtual fashion show and so on through the intelligent wardrobe, it makes more easy to convey the goods to the customer and reduce the cost at the same time.

#### (3) Promote the development of the e-commerce industry

Garment enterprises pay more and more attention to e-commerce with the maturity of network technology. But for the clothing products, the restriction of e-commerce which is caused some obstacles is that the customer is unable to see the product visual effect. The "Smart closet" fashion consultant expert system can solve this problem, not only let user can try on the clothes they like directly and have a purchase and its interesting and practicability also will increase the frequency of user to have a virtual shopping, so its promote the development of electronic commerce.

## 6. Conclusions

The "Smart closet" provide a neat, fashion and intuitive wardrobe for users and which can provide intimate service of dress collocation and image design with the function of virtual fitting, recommended collocation. And the "Smart closet" also provides the positive help for enterprise to product and market brand with the function such as pay attention to brand recommended collocations, connected to taobao and so on.

With the development of science and technology and the improve of people's lives concept, "smart closet" fashion consultant expert system will be designed and developed and eventually service in People's Daily life and brand production and marketing of enterprise, which will become the important tool of fashion development.

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