Interactive Mirror System based on Personal Purchase Information

Donghyun Kim¹, Younsam Chae², Jonghun Shin², Uyeol Baek² and Seoksoo Kim³

¹,³Dept of Multimedia Engineering, Hannam University, Daejeon, Korea
²KPD Co., Ltd, 10F Daegu Gyeongbuk Design Center, 701-824 Daegu, Korea
kimdh1986@hnu.kr, kpd7542007@gmail.com, sskim0123@naver.com

Abstract

Virtual fitting system is the system that coordinates the clothes that the customers want on their virtual avatars and it can be the representative interactive digital signage, and the virtual fitting systems that adopt the augmented reality method are researched currently. That the information on the products of the brands that adopt the system can be checked only, the coordination with other brands or other clothing products cannot be carried out and it has the problem that the personalized coordination information cannot be acquired because the coordination between the existing clothing products and newly-purchased clothing products cannot be performed. In order to coordinate the clothing product using the existing system, basic coordination knowledge or the information like recent fashion trends should be secured, however it is difficult to perform the proper coordination now that most of users do not possess appropriate coordination knowledge in general. Therefore in this paper, virtual reality-based interactive mirror system that provides the personalized coordination information was suggested to solve the problem of existing interactive mirror system that performs virtual coordination work.

Keywords: Digital Signage, Augmented Reality, Virtual Fitting

1. Introduction

Digital media has much developed in functional and technical aspect due to rapid development of digital technology and it has caused the change of expressive and accommodative forms and sociocultural change in various fields such as politics, economy and culture, etc., due to development of digital media.

OOH (Out of Home) media has brought numerous changes as it is highlighted again in advertisement marketing field and especially digital signage [1] that transfers digital media that expresses various information and advertisement, etc. under central control through display panel in public places and commercial space is rising as main media [2].

Due to such paradigm, fashion field is commercializing the system that the customers can receive the information about the wanted goods easily any time anywhere through digital signage that is the interactive media produced in type of POP (Point of Purchase) advertisement [3].

Virtual fitting system [4] is the system that coordinates the clothes that the customers want on their virtual avatars and it can be the representative interactive digital signage.

³ Corresponding Author
and the virtual fitting systems that adopt the augmented reality method [5] are researched currently [6].

However, such systems enable the customers to purchase the products that go well with them by enabling them to coordinate the clothing products they want in person; however now that the information on the products of the brands that adopt the system can be checked only, the coordination with other brands or other clothing products cannot be carried out and it has the problem that the personalized coordination information cannot be acquired because the coordination between the existing clothing products and newly-purchased clothing products cannot be performed.

Also, in order to coordinate the clothing product using the existing system, basic coordination knowledge or the information like recent fashion trends should be secured, however it is difficult to perform the proper coordination now that most of users do not possess appropriate coordination knowledge in general.

Therefore, in this paper, augmented reality-based interactive mirror system that is capable of coordinating the clothing products in person the customers want through non-marker-based augmented reality that uses the characteristics like dot, line, edge and texture, etc., generated naturally from the input image is suggested. And, regarding that the users perform the coordination through the augmented clothing products, it provides the information about the information about personalized clothing production and basic coordination about the selected products using the purchasing information about the existing clothing products and clothing product trend information of the users.

2. Real Related Works

Virtual fitting system [4] is the system that checks the fitting of the products by enabling 2D model image or virtual 3D avatar to perform the coordination works on the fashion clothing products that the users want.

D. Protopsaltou [7] studied web-based virtual fitting system that judges the suitability of coordination products by performing coordination work attaching 3D clothing product model on virtual avatar and carrying out animation work that moves virtual avatar.

![Figure 1. 3D object based virtual fitting room](image_url)
N. Magnenat-Thalmann [8] researched the system that performs coordination work by creating 3D model that is similar to actual customer with front, rear, left and right images of the user and mapping the face of actual customer with clothing item that the customer selects.

However, now that systems like the above performs coordination work through virtual 3D avatar, they have the problem that it is difficult to distinguish the coordination product is suitable for the actual customer or not.

In order to solve such problems of existing systems, C.G. Martin [6] researched the system that the users perform fitting work by augmenting clothing items on the output image of the image input through web cam using the marker-based augmented reality system.

Figure 2. Marker based virtual fitting room system

However it has the problem that it is hard for the users to perform fitting work holding the marker because it augments the virtual object through the marker and has the problem that the personalized coordination information cannot be acquired because it cannot perform coordination work on the existing clothing product the users possess with the clothing product that the users will purchase newly.

3. Interactive Mirror System based on Personal Purchase Information

Figure 3 shows a diagram of interactive mirror system based on personal purchase information.
In this paper, we can configure an interactive mirror system based on personal purchase information using a total of three modules as shown in Figure 1, and for each module are described as follows.

3.1. User Awareness Module

The system that this paper suggests produces the virtual coordination information of the users who connect in the order of the following figure to provide the personalized coordination information using the personal information of the users.

![Diagram of interactive mirror system based on personal purchase information](image)

**Figure 3. Diagram of interactive mirror system based on personal purchase information**

![Flowchart of user awareness](image)

**Figure 4. Flowchart of user awareness**
The users who connect to the system perform the user’s registration through the subscription service prepared in web server, input the personal profile information and physical information and the registered users connect to the system through Digital View in shopping mall.

If the user connects to the system for correct matching between the user and the augmented object in output image, it produces the warping data with the augmented object for coordination working area through the physical information of the registered user.

If warping data is produced, it produces the appropriate coordination data for the user by checking shopping mall or the existing fashion item data that the user purchased and produces the augmented object for the existing fashion item.

3.2. Human Detection Module

In order to detect the man, the moving object should be extracted with priority.
Therefore in this paper, like of Figure 5, if coordination information is acquired through User Awareness Module, we identify the gaussian distribution each frame using the following equations.

\[
p(\bar{x} | X_T, BG + FG) = \sum_{m=1}^{M} \hat{\pi}_m N(\bar{x}; \hat{\mu}_m, \hat{\sigma}_m^2)\tag{1}
\]

\[
\hat{\pi}_m \leftarrow \hat{\pi}_m + \alpha (\sigma^{(t)}_m - \hat{\sigma}_m)\tag{2}
\]

\[
\hat{\mu}_m \leftarrow \hat{\mu}_m + (\alpha / \hat{\sigma}_m) \delta_m\tag{3}
\]

\[
\hat{\sigma}_m^2 \leftarrow \hat{\sigma}_m^2 + \sigma^{(t)}_m (\alpha / \hat{\sigma}_m) (\delta_m^T \delta_m - \hat{\sigma}_m^2)\tag{4}
\]

After that the candidate region of human would be extracted set as ROI (Region of Interest) by using Gaussian Mixture Model [9] that extracts the moving object using the difference between the foreground of image and Gaussian distribution of background area.

It performs Histogram equalization on distributional direction of brightness against local area of ROI set by using HOG (Histogram of Oriented Gradient) [10] and produces the feature vector for that and extracts a man by combining HOG feature vectors using Adaboost Classifiers [11] shunt.

3.3. Augmented Reality Module

If the man is detected at Human Detection Module, it produces the virtual fitting model by augmenting fashion items in the order as following figure.

![Figure 6. Flowchart of augmented reality module](image)

The outline of the man is extracted by rotating the image with the mask that differentiates two Gaussian masks using DoG (Difference of Gaussian) operator [12] in the area of the detected man. The pole that can become feature point in scale space is detected using SIFT (Scale Invariant Feature Transform) algorithm [13] from the extracted out-
line and the coordination area where the object will be augmented is set by recognizing standard physical features (head, upper and lower body, hands) of the man based on that.

If coordination area is set, the user designates the fashion item to be augmented from fashion item list.

If the augmented object is selected, the detected feature point is regularized into the coordinates system in virtual space by estimating the distance between the coordination area and camera and change of pose through calibration method [14] that initializes the size of article existed in specific distance from camera. The article in virtual space is produced in screen and object is augmented by performing projection transform on the regularized coordinates system in screen coordinates system finally.

If augments the object, it provides the recommended coordination data for the selected fashion item by checking coordination data acquired from User Awareness Module and it enables to check if the existing fashion item that the user purchases can be matched with the selected item after implementing the additional augmentation [15].

4. Conclusion

In this paper, virtual reality-based interactive mirror system that provides the personalized coordination information was suggested to solve the problem of existing interactive mirror system that performs virtual coordination work. The users can carry out the virtual coordination work in person on the clothing product that they want through non-marker-based augmented reality. And it provides the basic coordination information about the personalized clothing product information and the selected product using purchasing information on the existing clothing product of the users and cloth trend information of the users.

However, in case of the suggested system, it is capable of performing fitting work by augmenting fashion item, however there is a problem it cannot be checked if the result of performing virtual coordination work goes well with other environment or not.

Therefore, the method that can check if the result of coordination goes well with virtual background space by setting virtual background through image synthesis method is willing to be studied later.

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References


Authors

Donghyun Kim received his B.S degree in Department of Multimedia Engineering from Hannam University, Daejeon, Korea in 2012, and currently, he is working on the M.S. degree in Department of Multimedia from Hannam University. His research interests include Image Processing, Augmented reality, and Network Security.

Younsam Chae conferred academic degree on 2006 from Daegu University, with Degree of Ph.D. Conferred academic degree on 2001 from Daegu University, with degree of M.A. graduated on 1995 from College of Arts(Department of Crafts), Daegu University, with Degree of Bachelor of Fine Art. He is CEO & designer of KPD.co. Ltd. His research interests include Technique of Casting and Holistic Arts Healing. He is a member of The Korea Society of Art&Design, MMC and KODFA.
Jonghun Shin received a B.S degree in Department of Industrial Design from Daegu University. He has been working as a Chief designer at KPD Company from 2010 to present. His research interests include Industrial Design and Digital Sinage.

Uyeol Baek received a B.S. degree in Department of Industrial Design from Keimyung University. He has been working as a product designer at KPD Company from 2006 to present. His research interests include Industrial Design and Digital Signage.

Seoksoo Kim received a B.S. degree in Computer Engineering from Kyungnam University, Korea, 1989 and M.S. degree in Information Engineering from Sungkyun-kwan University, Korea, 1991 and Ph.D. degree in Information Engineering from Sungkyun-kwan University, Korea, 2002. In 2003, he joined the faculty of Hannam University, Korea, where he is currently a professor in the Department of Multimedia Engineering. His research interests include multimedia communication systems, distance learning, multimedia authoring, telemedicine, multimedia programming, computer networking, and information security. He is a member of KCA, KICS, KIMICS, KIPS, KMS, and DCS. He is editor-in-chief of IJMUE.