www.ijecs.in
International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume 4 Issue 4 April 2015, Page No. 11401-11406

Fashion Accessories using Virtual Mirror

Sonal Kachare[1], Shrisha Vanga[2], Ekta Gupta[3], Jay Borade[4]

[1]Fr. Conceicao Rodrigues College of Engineering, Father Agnel Ashram, Bandstand, Bandra(W), Mumbai, Maharashtra, India. Pincode-400 050.
sonalkachare29@gmail.com

[2] Fr. Conceicao Rodrigues College of Engineering, Father Agnel Ashram, Bandstand, Bandra(W), Mumbai, Maharashtra, India. Pincode-400 050.
vangashrisha@yahoo.com

[3] Fr. Conceicao Rodrigues College of Engineering, Father Agnel Ashram, Bandstand, Bandra(W), Mumbai, Maharashtra, India. Pincode-400 050.
ektagupta3110@gmail.com

[4]Fr. Conceicao Rodrigues College of Engineering, Father Agnel Ashram, Bandstand, Bandra(W), Mumbai, Maharashtra, India. Pincode-400 050.
jaayb8@gmail.com

Abstract: ***In this system, the customer has the benefit to shop online in a smart way by trying on different accessories like sunglasses, hat, necklaces, etc using webcam. In order to place the clicked image on the face or other body part automatically, face detection algorithm like Viola-Jones is used. Thus the presence of this unique feature enhances the system and stands out as completely different website amongst other existing websites.***

Keywords: e-commerce website, face detection, fashion accessories, virtual mirror.

1. Introduction

Virtual mirror is a computerized generated mirror that acts like a real mirror which allows a person to see himself/herself for various applications. The application "Fashion Accessories Using Virtual Mirror" is an online shopping e-commerce website which we will be implementing as our system. Our system is restricted to face and neck related fashion accessories like eyeglasses, necklaces, caps/hats etc.

Thus the system will be the visualization of fashion accessories for the face and neck that a person can try and watch in front of a mirror although they do not exist in reality. The Virtual mirror will be created by using a computer/laptop display and a sensory device like camera.

The system will work in the following way: When a user enters the zone of the camera, the camera will starts tracing the movements of the user with the detection algorithm working in the background. In the moment of tracing the user, in case the user selects any particular item for trial, then that item directly gets fitted onto that particular body part. [1]

2. Algorithms

There are many techniques to detect a face. Here is a list of the most common approaches in face detection:

2.1 Finding faces in images with controlled background:

This is the easy way out. The method uses images with a plain monocolor background, or uses them with a predefined static background i.e. removing the background will always give the face boundaries. And the rest is easy going.

2.2 Finding faces by color:

Incase there is an access to color images, one might use the typical skin color to find face segments. The disadvantage with this method is that it doesn't work with all kind of skin colors, and is not very robust under varying lighting conditions. [2]

Face Detection in color images:

The system relies on a two step process which first detects regions which are likely to contain human skin in the color image and then it extracts information from these regions which might indicate the location of a face in the image. The skin detection is performed using a skin filter which relies on color and texture information. The face detection is performed on a grayscale image containing only the detected skin areas. A combination of thresholding and mathematical morphology are used to extract object features that would indicate the presence of a face. The face detection process works predictably and fairly reliably. [3]

Face Detection in color images using PCA:

It includes color information into a face detection approach based on principal components analysis (PCA). A skin color probability image is generated by doing a color analysis and the PCA is performed on this new image instead of the luminance image. [4]

Skin color detection under changing lighting conditions:

Skin color detection is an often used cue in human motion tracking especially in face tracking. Skin color detection is orientation invariant and fast to process. As of one way, skin color can be modeled based on the reflectance model of the skin knowledge about the camera parameters and the spectrum of the light source. In particular, the location of the skin color area is chromatically plane is estimated for the different light sources given known camera characteristics. [5]

2.3 Finding faces by motion:

If one is able to use real-time video, one can use the fact that a face is almost always moving in reality. So one needs to just calculate the moving area, and the further process is easy. The problem occurs if there are other objects moving in the background. [2]

Explanation of basic motion detection for face finding:

To detect and analyze movement in a video sequence, we perform to following four steps: 1.Frame differencing 2.Thresholding 3.Noise removal 4.Add up pixels on each line in the motion image. Initially we find the difference between the current frame in the video sequence and the previous. If the difference between the pixel values are greater than (color used)/10, the movement has been significant and the pixel is set to black. If the change is less than this threshold, the pixel is set to white. This image now indicates if something has moved and where the movement is located. In the thresholded image, there may be noise present. To remove the noise, we need to scan the image with a 3*3 window and remove all black pixels which are isolated in a white area. If the center pixel of the 3*3 frame is black and less than three of the pixels in the frame are black, we remove the black center pixel because it is probably noise. Otherwise the pixel remains black. This way detection occurs to only large moving objects. [6]

Blink detection:

As each image is acquired, the previous image is subtracted. The resulting difference image generally contains a small boundary region around the outside of the head. If the eyes happened to be closed in one of the two images, there are also two small roundish regions over the eyes where the difference is significant.

The difference image is thresholded, and a connected components algorithm is run on the thresholded image. A bounding box is computed for each connected components. A candidate for an eye must have a bounding box within a particular horizontal and vertical size. Two such candidates must be detected with a horizontal separation of a certain range of sizes, and little vertical difference in the vertical separation. When this configuration of two small bounding boxes is detected, a pair of blinking eyes is hypothesized. The position in the image is determined from the center of the line between the bounding boxes. The distance to the face is measured from the separation. This permit is to determine the size of a window which is used to extract the face from the image. [7]

2.4 Using mixture of the above:

Combining several good approaches normally yields an even better result. Here are some works on that: [2]

A mixture of color and 3D:

In this approach, real-time person is tracked in crowded and/or unknown environments using multi-modal integration. Then we combine stereo, color, and face detection modules into a single robust system, and show an initial application in an interactive, face-responsive display. Dense, real-time stereo processing is used to isolate users from other objects and people in the background. Skin-hue classification identifies and tracks likely body parts within the silhouette of a user. Face pattern detection discriminates and localizes the face within the identified body parts. Faces and bodies of users are tracked over several temporal scales: short-term (user stays within the field of view), medium-term (user exits/reenters within minutes), and long term (user returns after hours or days). Short-term tracking is performed using simple region position and size correspondences, while medium and long-term tracking are based on statistics of user appearance. [8]

A mixture of color and background removal:

Much effort has is put in order to implement real-time video-based methods for detection and tracking of the user's head (or more precisely, of the 3D locations of both eyes). The tracking algorithm developed had to overcome difficulties such as variable orientations, sizes and partial occlusions of the face in the camera image, as well as noise and poor camera resolution (a special high-resolution video camera was not foreseen in our system). The two essential steps in the tracking process are face detection and eye localization. [9]

2.5 Finding faces in unconstrained scenes:

The most complicated algorithm as compared to above all be face detection in unconstrained scenes. Given a black and white still image, where is the face? Humans can do it, so where's the perfect algorithm that can do it, too? Here is some work on it:

1. Model-based face tracking:

There seems to be a revival of edge-based methods, using geometric models. [2]

Real-time face detection using edge-orientation matching:

This method is on real-time face detection in grey level images using edge orientation information. In this system the edge orientation is a powerful local image feature to model objects like faces for detection purposes. There would be a simple and efficient method for template matching and object modeling based solely on edge orientation information. One can also show how to obtain an optimal face model in the edge orientation domain from a set of training images. Unlike many approaches that model the grey level appearance of the face this approach is computationally very fast. It takes less than 0.08 seconds on a Pentium II 500MHz for a 320x240 image to be processed using a multi-resolution search with six resolution levels. [10]

Robust face detection using the Hausdorff distance:

A model-based approach that works on grayscale still images. It is based on the Hausdorff distance is used as a similarity measure between a general face model and possible instances of the object within the image. This distance has been used for other visual recognition tasks. The method performs robust and accurate face detection and its efficiency makes it suitable for real-time applications. [11]

Genetic model optimization for Hausdorff distance-based face localization:

A model-based approach to perform robust, high-speed face localization based on the Hausdorff distance. A crucial step during the design of the system is the choice of an appropriate edge model that fits for a wide range of different human faces. There includes an optimization approach that creates and successively improves such a model by means of genetic algorithms. To speed up the process and to prevent early saturation we use a special bootstrapping method on the sample set. [12]

2. Weak classifier cascades:

One of the face detection methods is Viola & Jones. Using a cascade of "weak-classifiers" and using simple Haar features, it yields impressive results. This approach is now the most commonly used algorithm for face detection. A basic

implementation is included in OpenCV. [2]

Robust Real-time face detection:

A face detection framework that is capable of processing images extremely rapidly while achieving high detection rates. There are three key contributions. The first is the introduction of a new image representation called the "Integral Image" which allows the features used by the detector to be computed very quickly. The second is a simple and efficient classifier which is built using the AdaBoost learning to select a small number of critical visual features from a very large set of potential features. The third contribution is a method for combining classifiers in a "cascade" which allows background regions of the image to be quickly discarded while spending more computation on promising face-like regions. A set of experiments in the domain of face detection is presented. The system yields face detection performance. Implemented on a conventional desktop, face detection proceeds at 15 frames per second. [13]

By comparing all the above methods for face detection, Viola-Jones face detection method is apt for our system as it satisfies our requirements which involve robust, real-time face detection, etc.

3. DATABASE

A database is basically a collection of tables of information, such as a list of customers and their orders. A typical database for an e-commerce website has tables for customers, products, categories, orders and order items (for the contents of shopping baskets).Databases have many other uses — such as for content management, customer relations, accounts and invoicing, and events. The most complicated type of database relationship is a many-to-many relationship. One relationship is at the core of all e-commerce databases: an order can contain many products, and a single product can be added to many different orders. This is where the "order items" table comes in: it sits between the products and the orders, and it records every time a product is added to an order. This will be relevant later on in the article, when we look at why some database queries are slow. [14]

Websites tend to present information in a static state: all of the information is locked together and presented the same way every time it's accessed. These traditional websites are limited in how they present their message, market their product, or develop their company or organization's image. Users and customers are limited by what information they can obtain from these sites by not being able to select individual parts, or regroup and compare the displayed information. A database driven website application can dynamically present, organize, and update information for not only the users, but also for website owners. A website can become a tool that the designer, their clients, and the people they work with can use to be more productive. With a database driven site, anybody can:

-Find information, products, or services that are designed for specific search criteria.

-Generate collections of information.

-Change how the information is presented to them.

-Owners can instantly create, edit, save or delete information from anywhere in the world. [15]

A brand new empty website will run very fast, but as it grows and ages, one may notice some sluggishness on certain pages, particularly pages with complicated bits of functionality. Suppose the web designer wanted to show "Customers who bought this product also bought…" at the bottom of a page of products. To extract this information from the database, the designer would need to do the following:

-Start with the current product,

-See how many times the product has recently been added to anyone's shopping basket (the "order items" table from above),

-Look at the orders related to those shopping baskets (for completed orders only),

-Find the customers who made those orders,

-Look at other orders made by those customers,

-Look at the contents of those orders' baskets (the "order items" again),

-Look up the details of those products,

-Identify the products that appear the most often and display them.

One could, in fact, do all of that in one massive database query, or could split it up over several different queries. Either way, it might run very quickly when the database has 30 products, 10 customers, 15 orders and 50 order items (i.e. items in shopping baskets). But if the queries are not written and programmed efficiently, then it will be a lot slower with many products, customers and order in the range of hundreds and thousands. Thus an efficient choice of database is required to maintain information efficiently and overcome these problems. [14]

Popular database software includes Microsoft Access 2010, Microsoft SQL Server, MySQL, PostgreSQL and Oracle Database 11g. Access is the popular Microsoft database that some people may have installed on their computers. The advantage of access is that it's very easy to deploy & to use. The downside is that if one expecting a lot of visitors to a shopping cart (thousands a day) it might not handle it so well. A good database for small to medium size sites. Example is Magic Way Shopping Cart uses access. SQL Server is the Microsoft's high end database, used to power some of the busiest websites in the world. There's no doubt this can handle the traffic, and its feature set is excellent. SQL Server can be pricey so web hosts offering SQL Server will often charge a premium of $10 - $20 a month or more, although some good deals can be had. It's a good choice for heavy duty web sites. Example can be ShopDotNet uses SQL Server. Companies use Oracle for application development requiring the capabilities that MySQL does not offer. For example, Oracle, but not MySQL, includes a procedural language to develop stored procedures, triggers, and functions; views and inline views; subqueries; hierarchical queries, advanced replication; dynamic role-based security, bitmap and reverse key indexes; and native Internet-based computing support. MySQL, on the other hand, is the most popular. It's a fast fairly powerful database with excellent integration with PHP. Being open source probably helps its popularity! It's a good all round choice. osCommerce is an example of a popular shopping cart that uses MySQL. [16]

A few of the perks it offers:

-MySQL provides access to most other major online databases.

-MySQL can carry out procedures faster than can a programming language alone, and it puts much less of a load on servers.

-Almost alone among RDBMSs, it can run on almost all operating systems.

-MySQL is commercial grade, but like PHP it's open source and free.

-It works particularly well with PHP, one of the most common and effective programming languages on the internet.
-Some highly successful websites that use MySQL: Facebook, Flickr, Wikipedia, WordPress, and YouTube. [17]
As our project which doesn't need highly technical functionality, loads of customers' information dealing, etc came to a conclusion of using MySql as the backend database. As we are dealing with images, not few but loads of images, thus we also need to pay attention to the storage of images to the database and the type of storage used along with the image format. There are ways to store images in the database, some are:
1) Create binary column in table and store image in binary format in table itself. 2) Create column with file name/path reference only and store actual file in some folder.
MySQL has a blob data type which can used to store binary data. A blob is a collection of binary data stored as a single entity in a database management system. Blobs are typically images, audio or other multimedia blob objects. MySQL has four BLOB types: TINYBLOB, BLOB, MEDIUMBLOB and LONGBLOB. All these types differ only in their sizes. Consider the following example: create a test table named test_image in MySQL having 3 columns show below-:
Id (INT) -Act as primary key for table.
Name (VARCHAR) - Used to store image name.
Image (BLOB) - Used to store actual image data.
MySQL query-:
Create table test_image (
id int(10) not null AUTO_INCREMENT PRIMARY KEY,
name varchar(25) not null default '',
image blob not null); [18]
For most of the web applications, there remains a common design question "whether the images should be stored in the database or in a file system?" In the web based apps like shopping cart, the site has to deal with a number of product images and the best choice is to store the images in the database together with the meta data. However, having said that, there are pros and cons for both the approaches. While designing any data store applications, System Architect should take the right decision on this by taking into account the behavior of the proposed systems in a broader perspective.
As everyone knows, the IO operation is a bit faster and hence the file retrieval is when we use the file servers for storage whereas the database as the document or file store will deliver a central repository of data for the organizations and hence data management is more efficient and hence more under control. A database may follow good entity modeling and have a logical design, but if the application and users cannot access and manipulate the BLOB data stored in it efficiently, the database is not effective.
BLOBs require database designers to understand how the application will access and use the BLOBs in practice. How the designer lays out the large objects within the database affects both the response time and throughput of the application.
Advantages and Disadvantages:
BLOB Storage as the Best Solution:
-For better scalability. Although file systems are designed to handle a large number of objects of varying sizes, say files and folders, actually they are not optimized for a huge number (tens of millions) of small files. Database systems are optimized for such scenarios.
-For better availability. Database servers have availability features that extend beyond those provided by the file system. Database replication is a set of solutions that allow you to copy, distribute, and potentially modify data in a distributed environment whereas Log shipping provides a way of keeping a stand-by copy of a database in case the primary system fails.
-For central repository of data with controlled growth. DBA has the privilege to control and monitor the growth of database and split the database as and when needed.
-For full-text index and search operations. You can index and search certain types of data stored in BLOB columns. When a database designer decides that a table will contain a BLOB column and the column will participate in a full-text index, the designer must create, in the same table, a separate character-based data column that will hold the file extension of the file in the corresponding BLOB field. During the full-text indexing operation, the full-text service looks at the extensions listed in the character-based column (.txt, .doc, .xls, etc.), applies the corresponding filter to interpret the binary data, and extracts the textual information needed for indexing and querying. [19]
-Images are suddenly sortable, indexable, and easily retrievable using SQL commands. Usually one can access images via a simple row identifier, but is not convenient always. Also, it keeps the scripts and templates separate from the data.
- It makes your database bigger. Quite a lot bigger, actually. Response time is probably a little slower.
Other problems include processing overhead, etc that can affect the regular performance of the system. [20]
File System Storage as the Best Solution:
-For the application in which the images will be used requires streaming performance, such as real-time video playback.
-For applications such as Microsoft PhotoDraw® or Adobe PhotoShop, which only know how to access files.
-If you want to use some specific feature in the NTFS file system such as Remote Storage. [19]
As our system is dealing with real - time virtual mirror where the image will merge with original image i.e. the image of the customer in real-time, thus we find file system storage approach is a better way for image storage and management into the database.

4. Related Content

There are various companies that use virtual mirror for their websites. These websites differ from each other in terms of technology used for building virtual mirror , the front end structure, database used for storing information, etc. Following are examples where virtual mirror is used in some the other way.
Ray-Ban:
Ray-Ban is using augmented reality to demo their products with the Ray-Ban Virtual Mirror. The technology behind the Virtual Mirror, called FIT3D Live, is made by a company called FittingBox, and according to them, they want to be "the driving force behind this digital revolution which will dramatically change the optical industry". They've also found a way to track your face without the need for an augmented reality tracking marker, so existing reference points (eyes, nose, and ears) are apparently enough to place and move the sunglasses in real time. The end result is a rather fluid experience that accurately replicates the experience of trying on a pair of sunglasses. The benefits are that it existing technology, and doesn't require any special tracking marker. It also allows a user to quickly try on any pair of sunglasses that Ray-Ban makes, eliminating the chance that the desired product is out of stock. The drawbacks are that it needs to be

downloaded as an application, rather than just running within a web browser. And it only works on Windows, and requires a newer computer. As it is located on a Flash website, so the specific program can't be bookmarked, shared or linked to. First the user needs to visit the website and then go to the section of virtual mirror. A dialog box appears in the front as shown in the fig 1. The user has to choose "I Accept" and after that the second dialog box appears. After accepting "Allow", the webcam gets initialised and the user can start trying out different eyeglasses and place an order by clicking on "Buy this style". [21]

fig(a)

fig(b)


fig(c)

Fig.(a), (b) and (c) are the screenshots of the above system.

BoutiqueAccessories:

BoutiqueAccessories.com.au are preoccupied with style and quality. Their boutique supports and showscases Australian designer accessories to enable the style conscious to easily support their home grown fashion industry. Their fantastic range includes hanbags, clutches, purses, necklaces, bracelets and earrings, designed by their very ownAustralian fashion designers. Each item is personally selected for it's individual style and quality and they thrive on finding new Austalian fashion labels and sharing them with the customers. BoutiqueAccessories is proud to launch the first virtual mirror in Australia. This application has been created to provide an online shopping experience for their customers that is closer to a real shopping experience. First the customer needs to visits the website and click on the "Virtual Mirror". Later the customer needs to go through the following procedure shown in the figure and place an order for the accessory they liked. [22]

Above figure is the screenshot of the system.

EzFace:

The virtual mirror kiosks are designed to be easy to use. The EzFace Virtual Mirror In-Store Kiosk is a breakthrough solution for the customers sampling cosmetics in store. A person stands in front of the screen and the internal camera takes a picture. Then the person scans the barcodes of various cosmetics-such as mascara, foundation, eye shadow, blush and lip gloss-and each automatically appears on the appropriate part of the face. A list on the right side of the screen reminds the person what products she is virtually testing. The user can print out image, send it by email, or post it on Facebook. The new technology could help consumers overcome their hesitation in splurging on another tube of lipstick or daring a new hair color.[23]

Above figure is the screenshot of the system.

5. References

[1] S. Kachre, S. Vanga, E. Gupta and J. Borade, "Fashion Accessories Using Virtual Mirror," *International Journal of Science and Technology*, submitted for publication. (Pending publication)

[2] R. W. Frischholz, "Face Detection" http://facedetection.com/facedetection/techniques.htm, February, 15th, 1999.

[3] Jay P. Kapur , "Face Detection in Color Images", EE499 Capstone Design Project Spring, University of Washington Department of Electrical Engineering, http://web.archive.org/web/20090723024922/http:/geocities.com/jaykapur/face.html. 1997.

[4] B. Menser and F. Muller, "Face detection in color images using principal components analysis", *Proc. Image Processing and Its Applications, Seventh International Conference,* Conf. Publ. No. 465, vol.2, pp. 620 – 624, 1999.

[5] M. Störring, H. J. Andersen and E. Granum, "Skin colour detection under changing lighting conditions", *Proc. 7th Symposium on Intelligent Robotics Systems*, pp. 187-195, 1999
[6] E. Hjelmås, C. B. Lerøy and H. Johansen, "Detection and Localization of Human Faces in the ICI System: A First Attempt", Department of Electrical Engineering and Science. Gjøvik College, version 2, 1998.
[7] J. L. Crowley and J. Coutaz, "Vision for man machine interaction", *Robotics and Autonomous Systems, Intelligent Robotic Systems SIRS'95*, vol.19, Issues 3–4, pp. 347–358, March 1997.
[8] T. Darrell, G. Gordon, M. Harville and J. Woodfill, "Integrated Person Tracking Using Stereo, Color, and Pattern Detection", *Proc. Computer Vision and Pattern Recognition*, pp. 601 – 608, 1998.
[9] Multimo3D, "Head Tracker", 2003, pp. 1, http://web.archive.org/web/20030404133850/http://atwww.hhi.de/blick/Head_Tracker/head_tracker.html.
[10] B. Fröba and C. Külbeck, "Real-Time Face Detection Using Edge-Orientation Matching," *Proc. Third International Conference*, AVBPA 2001 Halmstad, Sweden, pp 78-83, vol. 2091, 2001.
[11] O. Jesorsky , K. J. Kirchberg and R. W. Frischholz, "Robust Face Detection Using the Hausdorff Distance", *Proc. Third International Conference on Audio- and Video-based Biometric Person Authentication, Springer, Lecture Notes in Computer Science, LNCS-2091*, pp. 90–95, Halmstad, Sweden, 2001.
[12] K. J. Kirchberg, O. Jesorsky, and R. W. Frischholz, "Genetic Model Optimization for Hausdorff Distance-Based Face Localization", *Proc. International ECCV 2002 Workshop on Biometric Authentication, Springer, Lecture Notes in Computer Science, LNCS-2359*, pp. 103–111, Copenhagen, Denmark, June 2002.
[13] P. Viola and M. J. Jones, "Robust Real-Time Face Detection", *International Journal of Computer Vision*, vol. 57, pp. 137-154, 2004.
[14] Paul Tero, "Speeding up your website's database", http://www.smashingmagazine.com/2011/03/23/speeding-up-your-websites-database. 2011.
[15] ShortGrassWebDevelopment, "Web-Based Database Programming", http://www.shortgrass.com/databaseprogramming. 2001.
[16] EcommerceSpot, "What database do I need for my shopping cart software", http://www.ecommercespot.com/articles/database.aspx. 2005.
[17] S. C. Daniero, "Database Development Tools for a Dynamic eCommerce Website", http://cmsadgroup.com/2011/07/4-database-development-tools-for-a-dynamic-ecommerce-website. 2011.
[18] DaniWeb, " How to Store an image in MySQL database", https://www.daniweb.com/web-development/databases/threads/439533/how-to-store-an-image-in-mysql-database. 2013.
[19] Z. Mohammad, "Best Practice in File Storage while Building Applications - Database (Blob Storage) Vs File System", http://www.codeproject.com/Articles/28416/Best-Practice-in-File-Storage-while-Building-Appli. 2008.
[20] "Storing images as blobs - database or cloud? Pros and cons?", http://www.webmasterworld.com/webmaster/4020106.htm. 2009.
[21] C. O'Brien, "Ray-Ban Uses Augmented Reality For Their Virtual Mirror" http://thefutureofads.com/ray-ban-uses-augmented-reality-for-their-virtual-mirror.
[22] BoutiqueAccessories, "About Us", http://www.boutiqueaccessories.com.au/www/701/1001127/displayarticle/1001175.html#.VRBwpfyUdtR.
[23] C. Passariello, "Electronic Mirrors Sell Lipstick and a Makeover", http://www.wsj.com/articles/SB10001424052748703700904575391213196820750. 2010.