

SMART FASHION RECOMMENDER APPLICATION

A PROJECT REPORT

Submitted by

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1.ABSTRACT

In recent years, the textile and fashion industries have witnessed an enormous amount of growth in fast fashion. On e-commerce platforms, where numerous choices are available, an efficient recommendation system is required to sort, order, and efficiently convey relevant product content or information to users. Image-based fashion recommendation systems (FRSs) have attracted a huge amount of attention from fast fashion retailers as they provide a personalized shopping experience to consumers. With the technological advancements, this branch of artificial intelligence exhibits a tremendous amount of potential in image processing, parsing, classification, and segmentation. Despite its huge potential, the number of academic articles on this topic is limited. The available studies do not provide a rigorous review of fashion recommendation systems and the corresponding filtering techniques.

2.INTRODUCTION

clothing is a kind of symbol that represents people's internal perceptions through their outer appearance. It conveys information about their choices, faith, personality, profession, social status, and attitude towards life. Therefore, clothing is believed to be a nonverbal way of communicating and a major part of people's outer appearance [1]. Recent technological advancements have enabled consumers to track current fashion trends around the globe, which influence their choices. Additionally, consumers' clothing choices and product preference data have become available on the Internet in the form of text or opinions and images or pictures. Since these images contain information about people from all around the world, both online and offline fashion retailers are using these platforms to reach billions of users who are active on the Internet. Therefore, e-commerce has become the predominant channel for shopping in recent years. The ability of recommendation systems to provide personalized recommendations and respond quickly to the consumer's choices has contributed significantly to the expansion of e-commerce sales. According to different studies, e-commerce retailers, such as Amazon, eBay, and Shopstyle, and social networking sites, such as Pinterest, Snapchat, Instagram, Facebook, Chictopia, and Lookbook, are now regarded as the most popular media for fashion advice and

recommendations. Therefore, the purpose of this paper is to present an integrative review of the research related to fashion recommendation systems. Moreover, Guan et al. cited research published until 2015. Therefore, the first objective of this paper is to review the most recent research published on this

topic from 2010 to 2020. The previous study did not provide an in-depth analysis of the computational methods or algorithms corresponding to the fashion recommendation systems. This review study aims to fulfill this research gap and rigorously study the principles underlying, the methods used by, and the performance of the state-of-the-art fashion recommendation systems. To the best of our knowledge, this in-depth study is first of its kind. It includes research articles related to image parsing, clothing and body shape identification, and fashion attribute recognition, which are critical parts of fashion recommendation systems (FRSs). This review paper also provides a guideline for a research methodology to be used by future researchers in this field. The first section of this review discusses the history and background of FRSs. This review paper has identified state-of-the art algorithms and filtering techniques that have high potential to become more popular in the future. The sections of this paper are arranged in the order of the important FRS components, so that the reader can gain a substantial understanding of components such as algorithmic models before moving to other important components such as filtering techniques.

3. History and Overview of Recommendation System

The era of recommendation systems originally started in the 1990s based on the widespread research progress in Collective Intelligence. During this period, recommendations were generally provided to consumers based on their rating structure. The first consumer-focused recommendation system was developed and commercialized by Goldberg, Nichols, Oki and Terry in 1992. Tapestry, an electronic messaging system was developed to allow users only to rate messages as either a good or bad product and service. However, now there are plenty of methods to obtain information about the consumer's liking for a product through the Internet. These data can be retrieved in the forms of voting, tagging, reviewing and the number of likes or dislikes the user provides. It may also include reviews written in blogs, videos uploaded on YouTube or messages about a product.

4. RECOMMENDATION SYSTEM

The selection of an effective and accurate filtering technique is crucial for developing a successful recommendation system. Therefore, an elaborate understanding of these techniques is required before implementing them in a commercial platform.

a. Content-Based Filtering Technique:

The content-based filtering (CBF) technique examines the features of a recommended item by classifying users and products profile data based on the products features. The use of domain- dependent algorithms emphasizes the analysis of the products features, which are utilized to generate predictions. Although the applications of content-based filtering techniques have been more successful in recommending web pages, publications and news articles, researchers have implemented this technique to develop fashion recommendation system as well. In this technique, user profiles are matched with the features extracted from the product content, which provides the recommendation where the user has evaluated a specific product in the past. The products that have the highest relation

with the positively scored or rated items are generally recommended to users. The content-based technique uses different kinds of models to explore the similarity between items to generate a meaningful recommendation, which is the main distinctive feature between content-based and collaborative filtering techniques.

b. Collaborative Filtering (CF) Technique

The collaborative filtering (CF) algorithm is one of the most successful techniques among all of the filtering techniques available for the recommendation system. CF is a domain-independent prediction technique for analyzing hard-to-describe content by observing metadata. This filtering technique is formed by using a dataset of the preferences of a group of users to make a recommendation to another group of users who show similar types of behavior. The fundamental assumption of CF is based on the similarities of users, which build a neighborhood group. Therefore, this technique is called user-based collaborative filtering. In collaborative filtering, automatic predictions are made based on the reviews given by other people. Therefore, the major assumption is that if two people have similar interests in a common dataset then their interests would be similar for the rest as well. Although the CF technique is critical and has some issues, such as data sparseness and the cold-start problem, recommendation systems based on CF techniques have successfully worked for many renowned business stores and services. Yu et al. proposed a collaborative clothing recommendation system that overcomes the problem of capturing the aesthetic preferences of users by using a novel tensor factorization model [159]. They used the Amazon dataset and the Aesthetic Visual Analysis (AVA) dataset to train the recommendation models and the aesthetic network, respectively. The Amazon dataset contains records of 39,371 users and 23,022 items. The AVA dataset contains over 250,000 images with aesthetic ratings from 1 to 10 and 14 photographic styles representing complementary colors, duotones, light on white, long exposure, high dynamic range, motion blur, negative image, silhouettes, soft focus, vanishing point and image grain. They proposed a dynamic collaborative

filtering model using both aesthetic features and CNN features (DCFA) and compared it with baseline models such as the matrix factorization (MF) method, state-of-the-art visual-based recommendation method (VBPR) and state-of-the-art context-aware recommendation method (CMTF).

c. Hybrid Filtering Technique

The hybrid filtering (HF) technique combines multiple recommendation techniques to achieve better system optimization and avoid different limitations and challenges of a basic recommendation system. The concept behind implementing the hybrid technique is that the combination of algorithms would provide more appropriate and effective recommendations to users than a single algorithm. Hence, this is the disadvantage of using one algorithm-based recommendation system. This construction is beneficial when the dataset lacks user preferences; information about such preferences builds the foundation of collaborative recommendations. Their recommendation system has two properties. Firstly, it is knowledge-based, which helps it learn a pairwise preference or occurrence matrix based on the knowledge learnt from examples such as images uploaded to fashion blogs. Secondly, it has features of content-based filtering as it uses a deep learning network for learning the feature representation. They used 10,000 street-style images for image segmentation, 45,645 street-style images for product localization and 14,000 online fashion images for texture classification. Their proposed DeepLab-MSc-LargeFOV + CRF for image segmentation outperformed other baseline models such as fully convolutional networks (FCN), combination of convolutional networks (FCN) and the conditional random field (CRF)

network model. The proposed model achieved 73.99% mean intersection over union (IoU), which was higher than the other baseline models.

d. Hyperpersonalization Filtering Technique

Personalization is a system that uses the profiling of customers to make certain assumptions about the users. These assumptions are based on certain specific features and traits gathered from the profiling. For example, suggesting ads to buyers since they have ordered or searched for a similar product online is a very common strategy used these days. This technique of personalization can bring a huge boom in sales for companies according to their sales reports. Hyperpersonalization uses the same strategy and works more on it. Hyperpersonalization is an advanced technique built over the concept of personalization, in which the model not only investigates the item or product that was bought, but also looks into other details such as location of purchase, mode of purchase, cost of purchase, keywords inserted during purchase, demographics of the person who purchased, etc

e. Strengths and Weakness of Filtering Techniques

The successful outcome of the recommendation system depends on the relevance of the filtering technique and its compatibility with the proposed model. Therefore, researchers should consider the strengths and weaknesses of the corresponding filtering techniques while conducting research on fashion recommendation systems. It presents the strengths and weakness of the each of the recommendation filtering techniques discussed above.

f. Prospects, Challenges and Recommendations for Future Research

There has been significant progress recently in fashion recommendation system research, which will benefit both consumers and retailers soon. The use of product and user images, textual content, demographic history, and cultural information is crucial in developing recommendation frameworks. Product

attributes and clothing style matching are common features of collaborative and content-based filtering techniques. Researchers can develop more sophisticated hyperpersonalized filtering techniques considering the correlation between consumers clothing styles and personalities. The use of virtual sales advisers in an online shopping portal would provide consumers with a real time offline shopping experience. Retailers can collect the data on users purchase history and product reviews from the recommendation system and subsequently use them in style prediction for the upcoming seasons. The integration of different domain information strengthens the deep learning paradigm by enabling the detection of design component variation, which improves the performance of the recommendation system in the long run.

5.LITERATURE REVIEW

To put this survey in context, we identified and present related review and survey articles to explain in which ways our article differs from and extends earlier work. In a recent work, a survey of fashion recommender application, i.e., visual, audio, and/or textual features. The domains studied in this survey include various ones such as media streaming for audio and video recommendation, e-commerce for recommending different products including fashion items, news, and information recommendation, social media, and so forth. While fashion RS were also discussed, the authors only included a small portion of the topics and papers in this domain. Here, we discuss and present a comprehensive survey of significant tasks, challenges, and types of content used in the fashion RS field. We have also identified surveys [29, 170] where the authors present a literature review of techniques at the intersection of fashion and computer vision (CV) and/or natural language processing (NLP). While we find these works relevant to this article, they remain largely different from the review presented here as those systems are not focused on RS but on other aspects of the fashion domain, such as text generation from images or pose estimation. Moreover, as another point of difference, we also provide recent techniques dealing with item visual and textual content representation exploited by RS approaches. Perhaps the most relevant work to our current survey is a recent book chapter by Jaradat et al. [75] on fashion RS. This chapter focuses on discussing the state of the art of fashion recommendation systems; in particular, the authors affirm that deep learning represented a turning point with respect to the canonical approaches and therefore the authors examined four different tasks that use this new approach. Additionally they provided examples and possible problems and their evaluation. In particular,

the authors focused their review on tasks related to social media and the size recommendation problem (see Section 2.1.3, where we introduce this task in detail). In our survey, in addition to analyzing the state of the art of the most commonly used algorithms in a wide range of tasks, we went in depth to

understand which are the main features used by the more modern fashion recommender systems. In fact, an extensive discussion is held on how both the user and the items, with their characteristics, can be a source for the definition of models with accurate recommendations.

6.METHODLOGY

Learning Phase

A learning algorithm is applied in this phase to filter and exploit the users' features based on the feedback collected in the information collection phase. The learning algorithms used in this phase are helpful for drawing out the appropriate patterns relevant for application during the recommendation stage [57,62,63].

Recommendation Phase

The recommendation phase recommends the types of items that a user or consumer may prefer. Recommendations can be provided either directly based on the dataset collected during the information collection phase (which might be memory- or model-based) or through the browsing history of users observed by the system [57,62,63]. Recommendations can also be provided by combining the learned information with the rating matrix to recommend learning resources [67]. Researchers reported improved recommendation accuracy using hybrid models in comparison with product content-based or other user-preference-based collaborative models [68].

Channels of Scholarly Dissemination Related to Fashion Recommendation System (FRS)

Articles published from January 2010 to June 2020 have been considered for the review purpose of this article. Various online literature resources or databases

such as Scopus, Web of Science, Science Direct, and Design and Applied Arts Index (DAAI) have been used to find the literature. Boolean operator techniques i.e., “AND” or “OR” strategies were used to search articles from these sources.

Keywords grouped in three categories as listed below were used to conduct the final search.

Group 1: Fashion OR Style OR Apparel OR Clothing

Group 2: Recommend*

Group 3: Filtering Technique OR Algorithm OR Model OR fuzzy Techniques OR Model

OR Image Processing OR Image Retrieval OR Image Feature extraction.

Final Search = Group 1 AND Group 2, Group 1 AND Group 2 AND Group 3
Overall, 230 scholarly articles and 9 web sources have been reviewed. Among

these, 214 scholarly articles were found containing the required keywords when using the search strategy mentioned above. Among these, 132 articles are indexed in Scopus, 26 in Web of Science, 3 in Science Direct and 1 in the Design and Applied Arts Index (DAAI) database. In addition, 50 articles and 2 patents were found in Google Scholar, published in different peer-reviewed journals and conferences.

7. PROJECT PHASE

PHASE 1

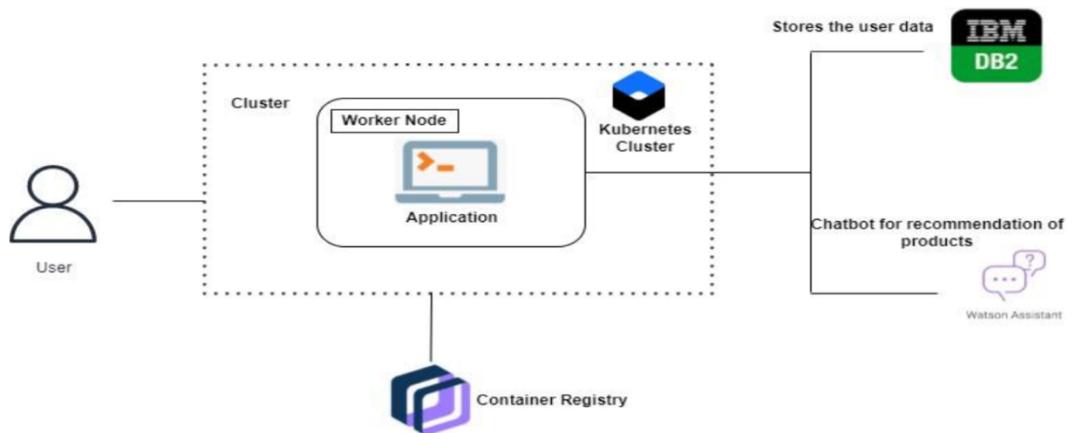
PROBLEM SOLUTION

<p>Define CS, fit into CC</p>	<p>1. CUSTOMER SEGMENT(S) Who is your customer? i.e. working parents of 0-5 y.o. kids</p> <p>CS</p> <p>Our customers are children and adults.</p>	<p>6. CUSTOMER CONSTRAINTS What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.</p> <p>CC</p> <p>As much as service providers make the needs of their customers, it is just as important for them to satisfy their customers.</p>	<p>5. AVAILABLE SOLUTIONS Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking.</p> <p>AS</p> <p>Online shopping gives new collections. The pros are easy to use. The cons are customer confused when have lost of collections.</p> <p>Explore AS, differentiate</p>
<p>Focus on J&P, tap into BE, understand RC</p>	<p>2. JOBS-TO-BE-DONE / PROBLEMS What jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.</p> <p>J&P</p> <p>From the customer can easily to choose a bestout fitting product. And to even manage time in effective wav.</p>	<p>9. PROBLEM ROOT CAUSE What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations.</p> <p>RC</p> <p>Customers need to be withnew fashions for current trends. Lot of time is wasted and an best product of his/her outfit not selected.</p>	<p>7. BEHAVIOUR What does your customer do to address the problem and get the job done directly related: find the right solar panel installer, calculate usage and benefits indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)</p> <p>BE</p> <p>Customer experience, content performance, and perfection in the product review, spend time to find new clothes.</p> <p>Focus on J&P, tap into BE, understand RC</p>
<p>Identify strong TR & EM</p>	<p>3. TRIGGERS What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.</p> <p>TR</p> <p>This software like as a merchant. It can access the customer location and give the related identification.</p>	<p>10. YOUR SOLUTION If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.</p> <p>SL</p>	<p>8. CHANNELS OF BEHAVIOUR</p> <p>8.1 ONLINE What kind of actions do customers take online? Extract online channels from #7</p> <p>8.2 OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.</p> <p>CH</p>
<p>Identify strong TR & EM</p>	<p>4. EMOTIONS: BEFORE / AFTER How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure > confident, in control - use it in your communication strategy & design.</p> <p>EM</p> <p>Feeling sad and frustration > Self-confident</p>	<p>Make the Chatbot Assistant for shopping with customers and send notifications when new collections arrived.</p>	<p>ONLINE: This application depends upon the internet connectivity, because we use the API and data connection through internet.</p> <p>OFFLINE: This is not applicable in online mode.</p> <p>Identify strong TR & EM</p>

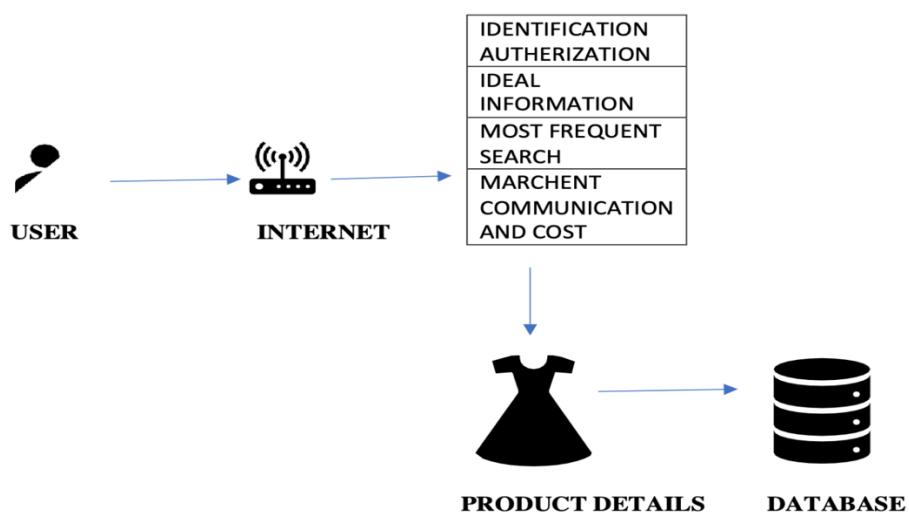
PROPOSED SOLUTION:

S.No	Parameter	Description
1.	Problem Statement (Problem to be solved)	Customers feels difficult when they search many websites to find any fashion clothes and accessories.
2.	Idea / Solution description	Customers directly make online shopping based on customer choice without any search.
3.	Novelty / Uniqueness	The customer will talk to Chat Bot regarding products. Perfection of the image presentation.
4.	Social Impact / Customer Satisfaction	User friendly interface, Assistants should form the chat bot finding dress which makes the customer satisfied. It should be customer modification.
5.	Business Model (Revenue Model)	Safe and secure identity to the user which modify the confidence to the customer. Customers buy our products and generate revenue.
6.	Scalability of the Solution	We can easily scalable our applications by increases the items and products, so we can satisfy all the customer's vision.

SOLUTION ARCHITECTURE:

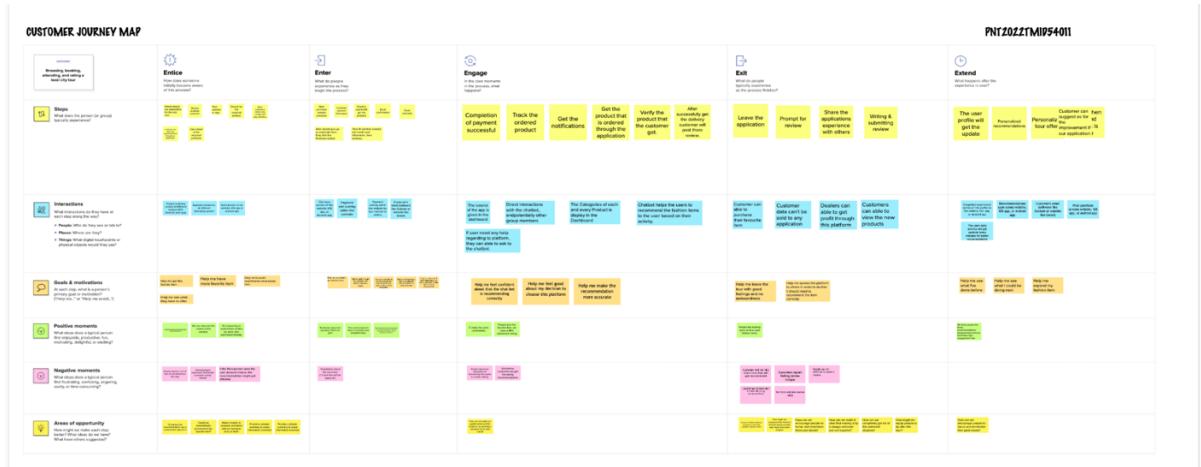


Example - Solution Architecture Diagram:



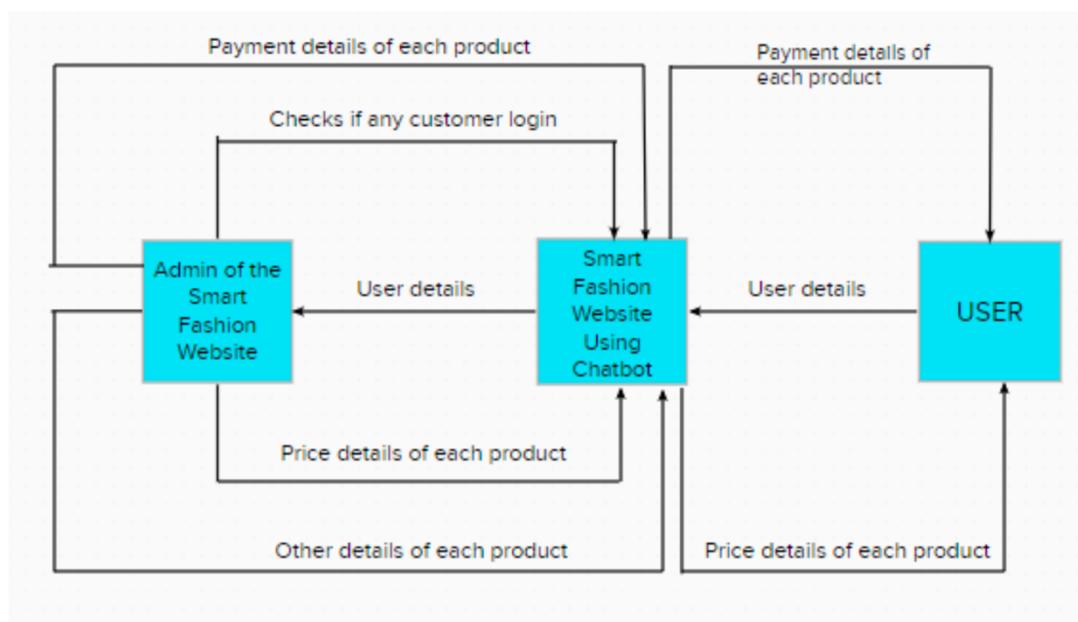
PHASE 2 :

CUSTOMER JOURNEY

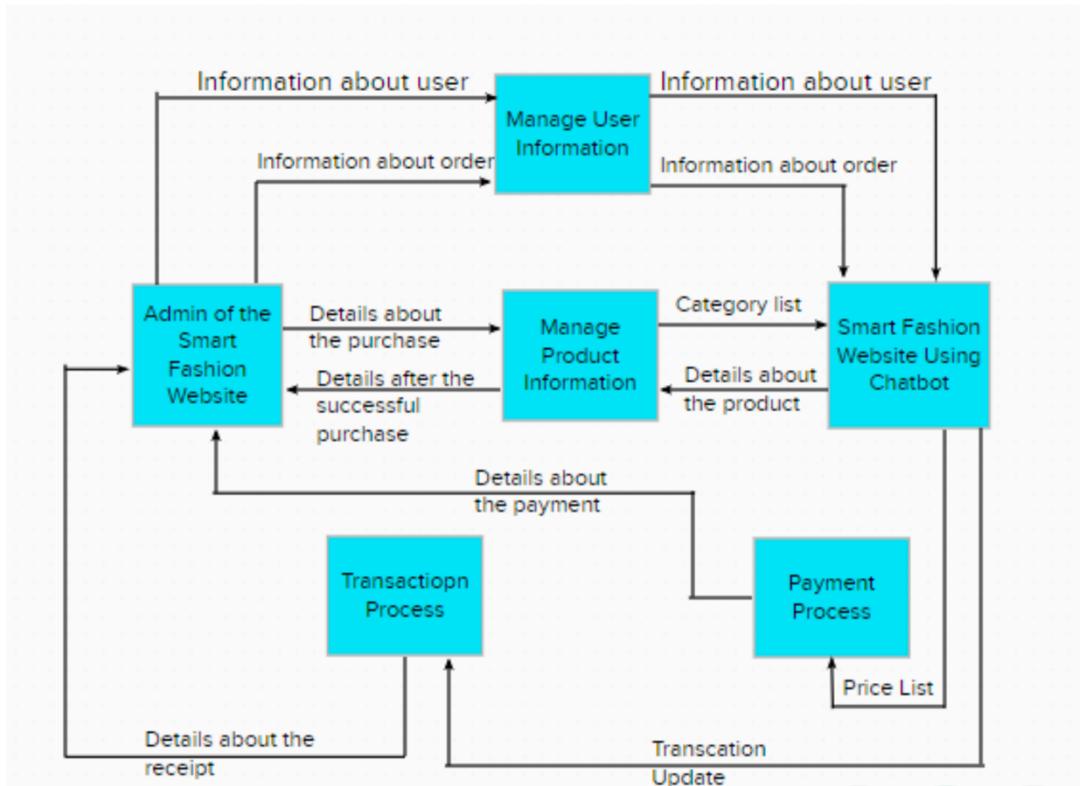


Data Flow Diagram & User Stories

DFD LEVEL 0:



DFD LEVEL 1:



User Flow:



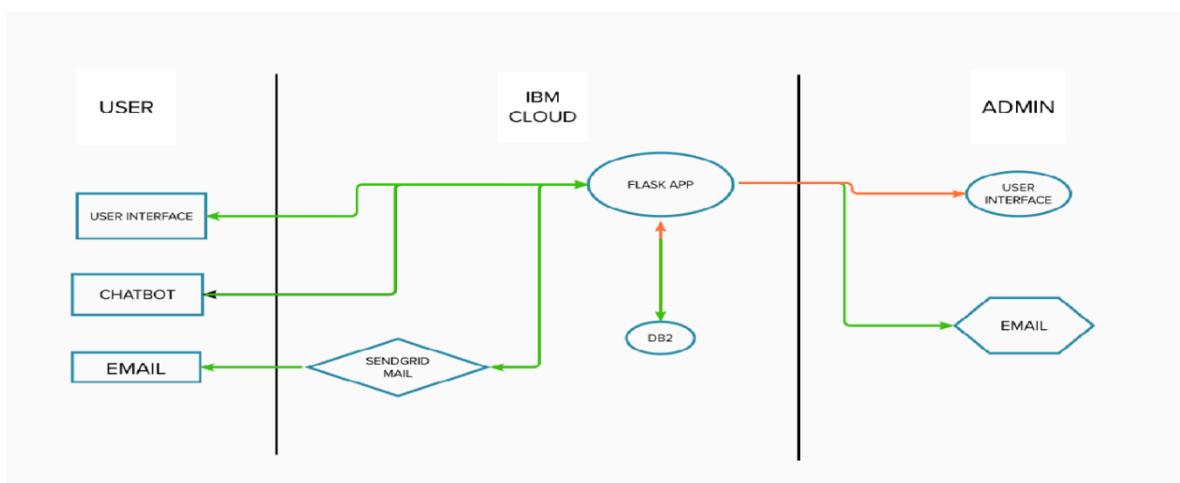
Work Flow:



SOLUTION REQUIRMENT :

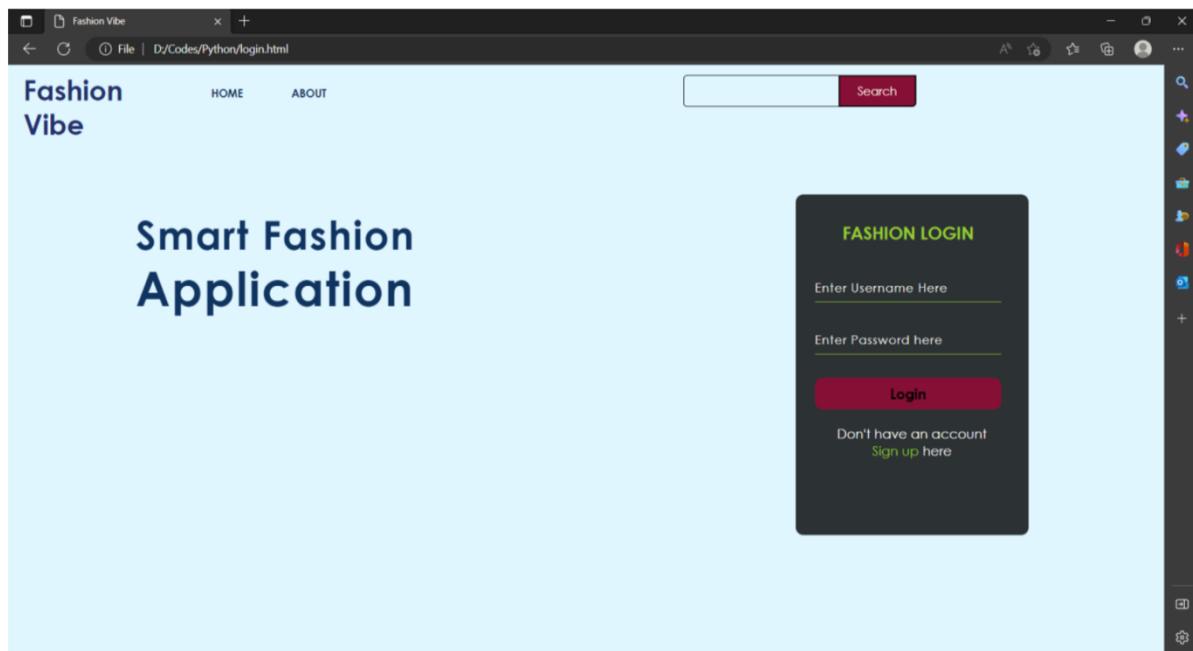
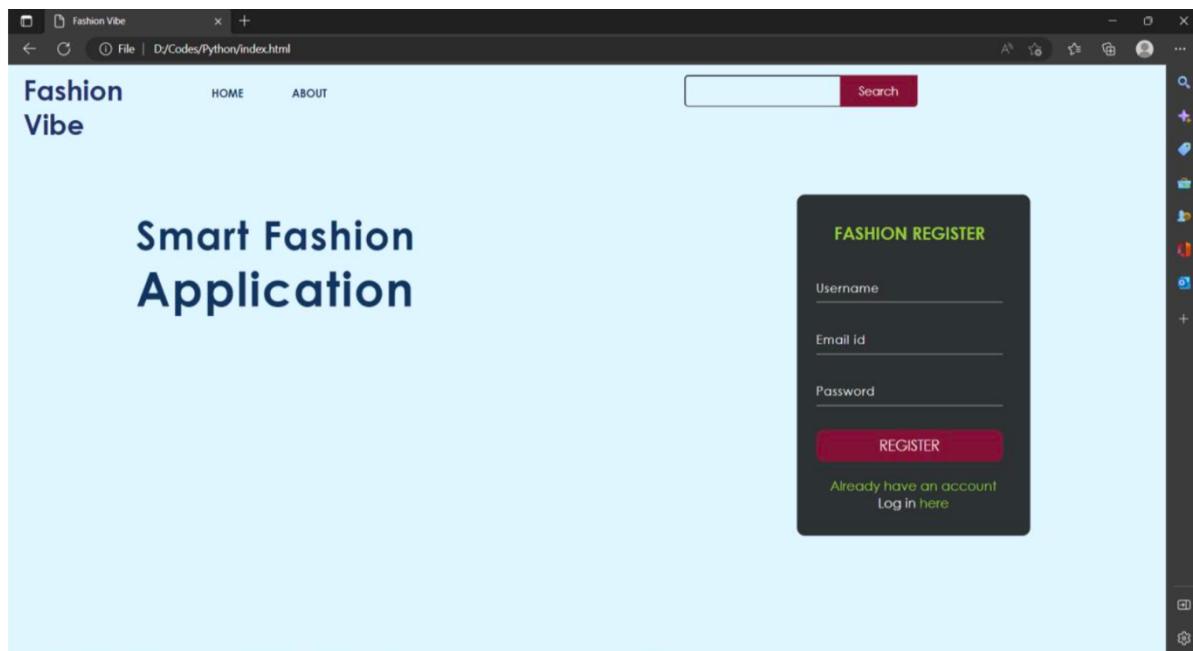
FR.NO	FUNCTIONAL REQUIREMENTS(EPIC)	SUB REQUIREMENTS(STORY/SUB-TASK)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through Mobile number Registration through LinkedIn.
FR-2	User confirmation	Confirmation via Email Confirmation via OTP.
FR-3	Advanced Search Capabilities	Sorting and filtering options.
FR-4	Checking item availability	Item availability in specific locations.
FR-5	Shopping cart	My cart button Add-to-cart button Remove-from-cart button.
FR-6	Super-fast checkout	Online transfer Credit card payment Paying with mobile wallets.
FR-7	Checking the shipping status	Option to easily check the shipping status of items ordered in the store.

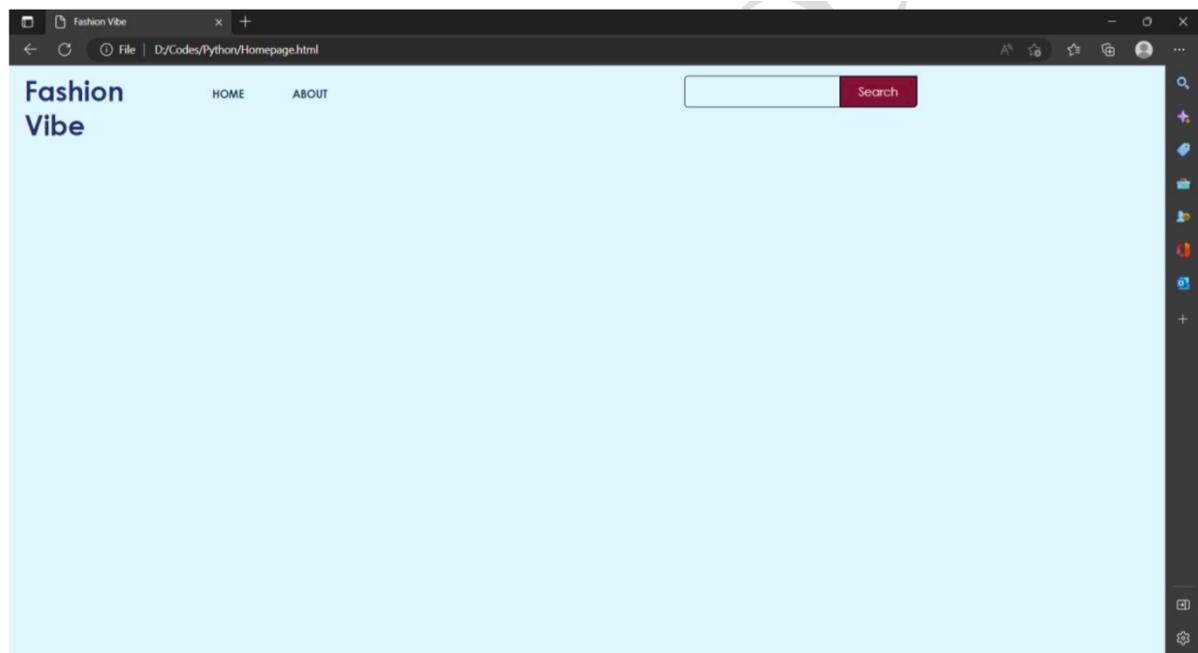
TECHNICAL ARCHITECTURE:



PROJECT DEVELOPMENT PHASE

LOGIN PAGE





HOME PAGE

A stylized screenshot of a modern fashion website. The top navigation bar is teal with white text. It includes the brand name "FASHION VIBE", a search bar with "TYPE TO SEARCH" placeholder text and a "SEARCH" button, and menu items "HOME", "FEATURES", and "ABOUT" in yellow. There's also a user icon. Below the navigation is a large image of a man and a woman posing together; the woman is making a peace sign. To the right of the image is a dark rectangular area with white text: "THE JOY OF DRESSING IS AN ART." and "Let's have a look on it ---->". At the bottom right of this dark area is a blue speech bubble icon. A thin horizontal line at the bottom right points to the text "Activate Windows".

FASHION VIBE

TYPE TO SEARCH SEARCH

HOME FEATURES ABOUT 


MODERN VIBE


FESTIVE MOOD


SKINNY DRESS


MAX GIRLS



FASHION VIBE

TYPE TO SEARCH SEARCH

HOME FEATURES ABOUT 



HANDSOME MEN ATTIRE
Always DRESS well, Keep it SIMPLE but SIGNIFICANT....



FASHION VIBE

TYPE TO SEARCH SEARCH

HOME FEATURES ABOUT 


WEDDING SAREES


SALWAR KAMEEZ


CASUAL KURTIS


BRIDAL LEHENGA



Activate Windows

FASHION VIBE

TYPE TO SEARCH SEARCH

HOME FEATURES ABOUT 

LOVABLE KIDS ATTIRE
-----Smiles are always in FASHION-----





FASHION
VIBE

TYPE TO SEARCH

SEARCH

HOME

FEATURES

ABOUT



POLO T-SHIRTS



HOODIES



MEN CASUALS



FORMAL SHIRTS



FASHION
VIBE

TYPE TO SEARCH

SEARCH

HOME

FEATURES

ABOUT

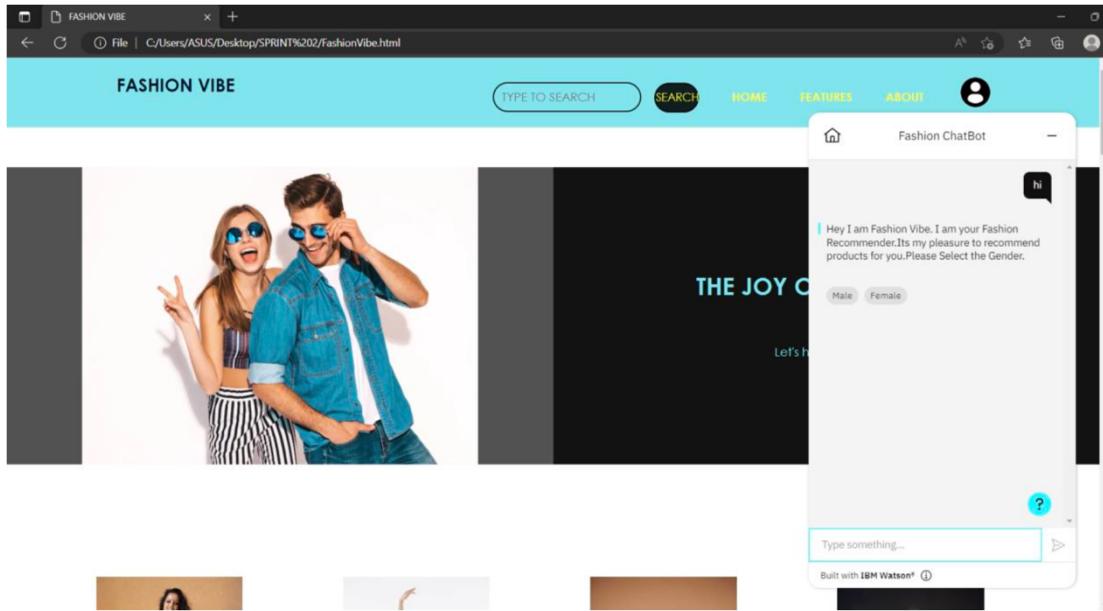


PERSONAL ADORNMENTS

ADORNMENT is never anything except a REFLECTION
of the HEART!!!



CHAT BOT



```
#####
# WARNING!!!!
# This is a sandbox environment. Using personal credentials
# is HIGHLY! discouraged. Any consequences of doing so are
# completely the user's responsibilites.
#
# The PWD team.
#####
[node1] (local) root@192.168.0.28 ~
$ docker pull uifd/ui-for-docker
Using default tag: latest
latest: Pulling from uifd/ui-for-docker
841194d080c8: Pull complete
Digest: sha256:fe371fff5a69549269b24073a5ab1244dd4c0b834cbadf244870572150b1cb749
Status: Downloaded newer image for uifd/ui-for-docker:latest
docker.io/uifd/ui-for-docker:latest
[node1] (local) root@192.168.0.28 ~
$ docker run uifd/ui-for-docker
2022/11/08 09:13:47 Unix socket /var/run/docker.sock does not exist
[node1] (local) root@192.168.0.28 ~
$ docker run -d -p 9000:9000 --privileged -v /var/run/docker.sock:/var/run/docker.sock uifd/ui-for-docker
b8bbdb08bb99652d924c9bccaa47ad1bcd4de7c625d20ca5dbc5e4c70cd2a00
[node1] (local) root@192.168.0.28 ~
$ []
```

The screenshot shows the Docker Container interface. On the left sidebar, there are links for Containers, Images, Volumes, Dev Environments (Beta), Extensions (Beta), and Add Extensions. The main area is titled "Containers" with a "Give feedback" link. It explains that a container packages up code and its dependencies so the application runs quickly and reliably from one computing environment to another. A "Learn more" link is also present. There is a checkbox for "Only show running containers". A search bar and a three-dot menu are at the top right. A table lists the running container "kind_saha" with details: IMAGE app:latest, STATUS Running, PORT(S) 5000:5000, STARTED 7 seconds ago, and ACTIONS (three dots and a trash bin icon).

FEEDBACK

FEEDBACK FORM

FIRST NAME

LAST NAME

MAIL ID

COUNTRY

FEEDBACK

9.DISCSSION :

This scholarly article has provided a comprehensive review of the methods, algorithmic models and filtering techniques used in the recent fashion recommendation-based research papers. However, this review paper has some limitations too. Primarily, the focus of this comprehensive review paper was to explore fashion recommendation-based articles published in last decade that explicitly described their frameworks, algorithms, and filtering techniques. To achieve this goal, the articles were searched using keywords relevant to the topic title instead of using the PRISMA technique. However, it did not affect the article extraction methodology, because the authors included and studied all the research papers relevant to the research focus. However, future researchers could conduct a systematic literature review on the same topic. The initial keyword searching did not include “garment” and “outfit”; however, this did not influence the search results because we also studied the fashion recommendation articles that contained these keywords. The future research can also conduct a review of the datasets that have been used in fashion recommendation-based research articles. Additionally, further reviews of fashion recommendation systems can apply our proposed potential algorithms to any of the available fashion image datasets to evaluate the performance of the recommender systems.

10. CONCLUSION :

Recommendation systems have the potential to explore new opportunities for retailers by enabling them to provide customized recommendations to consumers based on information retrieved from the Internet. They help consumers to instantly find the products and services that closely match with their choices. Moreover, different stat-of-the-art algorithms have been developed to recommend products based on users' interactions with their social groups. Therefore, research on embedding social media images within fashion recommendation systems has gained huge popularity in recent times. This paper presented a review of the fashion recommendation systems, algorithmic models and filtering techniques

based on the academic articles related to this topic. The technical aspects, strengths and weaknesses of the filtering techniques have been discussed elaborately, which will help future researchers gain an in- depth understanding of fashion recommender systems. However, the proposed prototypes should be tested in commercial applications to understand their feasibility and accuracy in the retail market, because inaccurate recommendations can produce a negative impact on a customer. Moreover, future research should concentrate on including time series analysis and accurate categorization of product images based on the variation in color, trend and clothing style in order to develop an effective recommendation system.

12.FUTURE SCOPE :

Online selling and purchasing offer innumerable benefits to both sellers and buyers, and these advantages are also the reasons for the rising scope of eCommerceWell, to put it bluntly, the scope of e-business in the near future looks to be ever-increasing and growing, because the trend has really caught on here. E-commerce giant Amazon is keen to conquer the Indian market and has already invested a great

deal, especially with its 49% stake in the Future Group.

Indian online retail giant Flipkart has already opened a few offline stores and plans more stores in smaller cities. They plan to combine online and offline stores to maximize their selling potential. Google and Tata Trust have launched a joint program ‘Saathi’ to increase internet and mobile penetration among rural women. The Government of India is also making a huge push for Ecommerce by providing numerous sops to startups, cyberparks, and so on through its Digital India program. As of now, there are close to 20,000 E-commerce companies in India, with many more expected to join the bandwagon every month.

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