Virtual fitting room technology in fashion design

D Werdayani* and I Widiaty
Universitas Pendidikan Indonesia, Jln Setiabudhi no 229, Bandung, Indonesia

*dewiwerdidayani16@gmail.com

Abstract. The presence of technology is inevitable in several fields, including in fashion design. This paper identifies technology-based virtual fitting rooms. All types of technology-based virtual rooms were identified; offline, online, web-based, mobile-based. It has been found that some of the most commonly used virtual rooms in fashion design involve technologies such as 2D fashion design, 3D fashion design, digital communication, e-commerce, internet-based, ICT-based, e-magazines, and e-books. It has also been inferred that virtual fitting rooms are starting to change conventional ones.

1. Introduction
The use of technology in the field of fashion design is currently growing rapidly. The development of technology has become something interesting in technological progress. Of course, also in the world of fashion. Fashion is a popular term for clothing. Fitting room or fitting room in a clothing store is a room for customers who want to try on a garment. Fitting rooms or fitting rooms can only be found in offline stores, unlike in an online shop that only displays product photos in its catalog. Customers or potential buyers sometimes want to try clothes that are in an online store but the store does not have an offline store so customers or potential buyers cannot try on the clothes they want. This paper will discuss the Virtual Fitting Room. The scope of technology used in the field of fashion design is related to software and tools.

Virtual fitting room, which means the application built is a web-based application that applies the concept of augmented reality to display clothing objects in 2D [1]. Augmented reality itself is a technology that combines two-dimensional and/or three-dimensional virtual objects into a real environment [1]. Also mentioned Augmented reality (AR) is an interactive experience of the real world environment where objects that are in the real world are enhanced by computer-generated perception information, sometimes crossing various sensory modalities, including visual, auditory, haptic, somatosensory, and olfactory [2]. Virtual Reality (VR), the user's perception of reality is entirely based on virtual information [3]. In Augmented Reality (AR) users are given additional information generated by the computer which increases their perception of reality [4].

The purpose of writing this paper is to analyze some of the views of Virtual Fitting Room in the field of fashion design.

2. Methods
The review literature contains reviews, summaries and thoughts of the author about virtual fitting rooms from several library sources such as articles, related journals (Google Scholar, Taylor Frances, Springer, Elsevier) books, information and the internet. The keywords that I use are Virtual Fitting Room, Virtual Dressing Room, and Augmented Reality.
Virtual fitting room (VFR) technology, consumers can browse wider fashion collections and try to inventory in online channels. [5] The use of Virtual Fitting Room (VTR) presents a huge opportunity for the fashion industry by allowing consumers to try products virtually [6]. VFR is a technology that provides a virtual product trial experience through virtual model simulation based on consumer body measurements [7]. Using a webcam to visualize fitting rooms or fitting rooms, the application built is a web-based application that applies the concept of augmented reality to display clothing objects in 2D, and 3D where augmented reality is a technology that combines two-dimensional and or three-dimensional virtual objects into an environment three-dimensional reality then project these virtual objects in real-time, with the final result of this application can be used to try out clothing and to change the size of clothes virtually [8]. Virtual Dressing Room application, the user interacts with the system to try and find an appropriate clothing size. Virtual Dressing Room utilizes a webcam, Kinect camera technology to take measurements on the user's body and determine the size of clothing that is close to body size.

3. Results and discussion

Based on the results of data collection by authors sourced from journals, related articles and e-books, the following will describe the findings regarding the Virtual Fitting Room.

Virtual fitting room provides movement-based interaction for users and suggests a variety of clothing [8,9]. The main screen is divided into three parts (top, middle and bottom). The top section presents the logo of each store as well as menu options, such as language, gender, and clothing categories. The middle section is the actual AR area of the system, displaying real-time videos of users standing in front of the system wearing virtual clothes that are selected categories superimposed on their bodies. The bottom part consists of a Buy and View Photos button. "Passport" is the code used as a unique identifier that gives access to an online html page that contains all of the user's preferred product.

**Figure 1.** 3D virtual fitting mirror Fx gear.

**Figure 2.** Applications for virtual reality and augmented reality in retail by Alexander Pinker.
Barde et al., in their article titled Virtual Fitting Room using Webcam, exposes innovative Virtual shopping that allows customers to visualize themselves wearing clothes present in traditional shops, as well as online [10]. This application is based on software that helps in representing the output of the framework, extracted from the picture (taken from the camera). If someone stands in front of the camera, that person will be able to choose the desired clothes. The choice of clothing is then superimposed on the image recorded by the camera. A system uses one Kinect sensor and one High Definition Camera (HD). These sensors are built by Microsoft and are very expensive. An HD camera to replace the default role of the Kinect RGB camera is included for HD recording. This requires a calibration process between an HD camera and an in-depth Kinect camera to map 3D clothing seamlessly to the customer's HD video recording. The virtual test system consists of a vertical TV screen. Microsoft Kinect sensor, HD camera and desktop computer.

Augmented Reality (2D, 3D) is a technology that expands our physical world by adding layers of digital information into it [12]. Unlike VR (Virtual Reality), AR does not create an entire artificial environment to replace the original with the virtual. 3D fitting space uses computer-generated 3D images to create experiences similar to those seen in virtual world computer games. The 3D version itself uses information taken from a scanning device, by measuring it yourself, or by providing other biometric information. 3D models can also be changed to change the shape of the body. Clothing is then displayed on a 3D avatar, which customers can personalize by uploading their own face images.
Displaying body size is one of the important items in the Virtual Dressing System [14], which is intended to provide an assessment of the size of clothing that matches the user's body size without having to change clothes and use clothes that are appropriate to their body size. The size used is the size of Indonesian national standard clothing, yaiyu adult clothing sizes S, M, L and XL. One of the hardware used in building body measurements in a Virtual Makeup Room is the Kinect Xbox 360. Microsoft has released the SDK (Software Development Tool) as an API that can be used by Kinect application developers. It is used to write software on hardware. One of the output streams on the Kinect SDK that is widely used in this study is the skeleton stream. Skeleton stream also has Clipped Edge information. This information can be used by the application to lend users to move towards the center of the frame to get a better moved frame. VFR is sufficiently high to boost sales but also minimize returns due to improper fit [13].

| Tabel 1 Ukuran pakaian pria dewasa |
|-------------------------------------|
| Size  | S     | M     | L     | XL    |
| Lingkar leher | 35.5 cm | 38 cm | 40.5 cm | 43 cm |
| Lingkar dada | 96 cm | 104 cm | 112 cm | 120 cm |
| Lebar punggung | 40 cm | 42 cm | 44 cm | 46 cm |

| Tabel 2 Ukuran pakaian wanita dewasa |
|-------------------------------------|
| Size  | S    | M    | L    | XL   |
| Lebar punggung | 36 cm | 38 cm | 40 cm | 42 cm |
| Lebar badan | 96 cm | 100 cm | 104 cm | 108 cm |
| Waist | 82 cm | 86 cm | 90 cm | 94 cm |
| Hip   | 100 cm | 104 cm | 108 cm | 112 cm |

4. Conclusion
This Virtual Fitting application can be developed from various sides. Starting from the development of learning media about fashion to the application in terms of business both in online stores, department stores, fashion houses, etc. Appearance in the Virtual Fitting Room can be in the form of 2-dimensional images, 3D dimensions, the use of a webcam, various fashion models of various sizes, all of which aim to make it easier for consumers to search for clothes. This is not without obstacles. Constraints related to the performance of the self/users in the virtual dressing room such as lack of understanding of the work flow, the compatibility between the mirror/monitor with the body and clothes that were tried, also about the terms of textile, size and color. These constraints pose challenges to further development systems.
References
[1] Telkom University 2020 Virtual Fitting Room [Online] Retrieved from: https://openlibrary.telkomuniversity.ac.id
[2] Wikipedia 2020 Augmented reality [Online] Retrieved from: https://en.wikipedia.org/wiki/augmented_reality
[3] Mann S, Feiner S, Harner S, Ali M A, Janzen R, Hansen J and Baldassi S 2015 Wearable computing, 3d aug* reality, photographic/videographic gesture sensing, and veilance Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction 497-500
[4] Carmigniani J, Furht B, Anisetti M, Ceravolo P, Damiani E and Ivkovic M 2011 Augmented reality technologies, systems and applications Multimedia tools and applications 51(1) 341-377
[5] Rodriguez C A B 2016 Virtual Fitting Rooms (Madrid, Španija)
[6] Lee H and Xu Y 2020 Classification of virtual fitting room technologies in the fashion industry: from the perspective of consumer experience International Journal of Fashion Design, Technology and Education 13(1) 1-10
[7] Blázquez M 2014 Fashion shopping in multichannel retail: The role of technology in enhancing the customer experience International Journal of Electronic Commerce 18(4) 97-116
[8] Kencana I K B A W 2015 Web Based Virtual Fitting Room Application Webcam (Bandung: Telkom University Bandung)
[9] Patel B 2016 Design and implementation of virtual fitting room based on image blending Int J Adv Eng Res Dev 3(4) 452-458
[10] Barde C, Nadkarni S, Joshi N and Joshi S 2015 Virtual Fitting Room using Webcam. International Journal of Engineering and Technical Research (IJETR) ISSN 2321-0869
[11] Boonbrahm S, Kaewrat C, Sewata L, Kateilerprasert P and Boonbrahm P 2015 3D Real Time Virtual Fitting Room for Women. In International Conference of Design, User Experience, and Usability 162-171 Springer, Cham
[12] Bonetti F, Warnaby G and Quinn L 2018 Augmented reality and virtual reality in physical and online retailing: A review, synthesis and research agenda Augmented reality and virtual reality 119-132 Springer, Cham
[13] Pachoulakis I and Kapetanakis K 2012 Augmented reality platforms for virtual fitting rooms The International Journal of Multimedia & Its Applications 4(4) 35
[14] Dewi I A 2020 Analisis dan Desain Body Measurement pada Virtual Dressing Room (Bandung: Teknik Informatika, Institut Teknologi Nasional)