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Digital Fashion Show: Metaverse Unveiling Designer Expression Through Digital Runways

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Abstract

Technology use was contested in 2013, but after the pandemic struck in early 2020, Malaysia began to realize how important technology was. In the absence of the pandemic, individuals would need to embrace technology due to the demands of civilization and advanced technology. The field of fashion in virtual runway appeared after the COVID-19 pandemic where all physical activities were changed to digital and virtual. The application advancements in technology fashion designers rethink new methods not just photos or pre-recorded videos but together with online audiences and 3D imagery which brings them closer than ever. Other than that, attendees of the virtual reality fashion show experienced the sensation of being in an exquisitely adorned space, with stunning models gracefully presenting before them. The advancement of technology with AI, VR, and AR makes fashion shows easy to access and more convenient. This study aims to investigate the future era of fashion shows on the virtual runway. This study uses qualitative research with applied one-to-one interviews with eight Malaysian fashion designers in Malaysia. The data can be analysed using thematic analysis that forms three major elements of a show performance or fashion show that include clothing, model, and scene. By using these elements, it covers 1) Virtual clothing production, 2) Virtual runway show, and 3) Design and production of virtual models. The study's findings showed the designers could launch a digital clothing item in the metaverse with a variety of color variations, using sales data to determine which colors to incorporate into the physical version. Digital fashion trends have culminated in the establishment of virtual runways that attract fashion fans internationally. The virtual runways don't need to mirror real-life conditions, particularly concerning accessibility. The usage of AI and 3D avatar models, design, and rig-wearing digitally created clothing reflects the diversity and inclusivity of the target audience. The underscore the necessity for designers to stay abreast of emerging trends to maintain competitiveness in the industry. With technology's pervasive reach enabling access to information anytime and anywhere, virtual fashion emerges as a crucial technique for the future. Moving forward, the insights gleaned from this study prove invaluable in aiding Malaysian fashion students and designers in adopting digital fashion shows and virtual runways as part of their repertoire. In conclusion, the integration of AI and virtual runways is in its early stages, yet the possibilities are immense. The designers are able to develop and exhibit their collections without being bound by financial or geographical barriers.

Keywords: *Virtual runway, digital fashion show, advancement of technology, and fashion designers.*

I. INTRODUCTION

Technology use was contested in 2013, but after the pandemic struck in early 2020. The fashion industry is undergoing a rapid digital evolution following the epidemic. Brands and designers have notably embraced digital transformation in 2020 and 2021, with initiatives such as cross-border gaming, 3D fashion, virtual models, and online fashion weeks gaining prominence [1]. Malaysia began to realize how important technology was. In the absence of the pandemic, individuals would need to embrace technology due to the demands of civilization and advanced technology. Since then, a new normal has emerged while we have survived the fear of a pandemic. Technological advancements have a pervasive impact on all facets of human existence. Presently, digital or virtual runways have replaced

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traditional runways. Runway displays, often known as "Fashion Shows" or "Catwalk Shows," typically entail physically presenting clothing on the runway [2]. According to [3] fashion shows are a communication and marketing tool to gain the fashion brands, brand image, values, culture, and personality to marketing strategies and commercial goals. In a new era of technology, the virtual runway appeared after the COVID-19 pandemic where all physical activities were changed to digital and virtual. The application advances in technology and fashion designers rethink new methods not just photos or pre-recorded videos but together with online audiences and 3D imagery which brings them closer than ever [4]. The attendees of the virtual reality (VR) fashion show experienced the sensation of being in an exquisitely adorned space, with stunning models gracefully presenting before them. VR involves the utilization of computer-generated simulations allowing users to interact within a virtual, three-dimensional visual setting via digital representation. Typically, users immerse themselves in this digital environment using a Head-Mounted Display (HMD), though physically, they remain separate from the objects or environments reconstructed in VR [4]. According to [6] they agree that the advancement of technology with AI, VR, and AR makes fashion shows easy to access and more convenient. VR impacts fashion shows, which serve as platforms for presenting fashion and facilitating communication between fashion brands and audiences. However, spatial aspects have not received comparable attention to clothing in the context of fashion shows [7]. The traditional fashion shows served as a primary avenue for advertising and promoting fashion brands, maintaining loyalty among current customers, and attracting new ones by evoking consumer emotions through conveying information [8]. Digital fashion shows incorporating interactive elements and VR environments prove beneficial for assessing apparel, promoting fashion events, and facilitating apparel purchases [9]. According to [4], the digital fashion show represents a novel approach to showcasing fashion, integrating digital imagery and advanced technology instead of traditional analog methods. Digitally, the user interface must be tailored to accommodate the visual, auditory, and tactile sensations of the user, encompassing sensory experiences. Additionally, the UX interaction module should incorporate data transformation elements including virtual stage, lighting, music, effects, and animation, pertinent to the digital fashion show [4]. A digital fashion show involves virtual models showcasing 3D-rendered digital attire on the runway. Collaborations between fashion brands and tech companies are bringing forth these innovative displays, presenting digital garments within tailored virtual environments [10].

In Malaysia, several events related to digital fashion like KL Fashion Week (KLFW) in 2021 have 12 virtual shows (featuring Andy Bandy, Celeste, Cassey Gan and more) [11]. In addition, TryitOn successfully launched their 3D Virtual Fitting Room that digitizes any fashion garment into high-quality 3D Virtual Assets and allows fashion e-commerce businesses to incorporate this technology seamlessly with just a plug-in [12]. So, this study aims to investigate the future era of fashion shows on the virtual runway.

A. Metaverse Runway Show

The metaverse denotes an expansive virtual realm existing alongside reality, where individuals interact via digital representations known as avatars. This virtual space is characterized by its three-dimensional (3D) environment, facilitating seamless interaction and exchange between real-world entities and users [13]. The potential for a Malaysian Metaverse Runway Show to usher in a new era of accessible, creative, and technologically advanced fashion shows is immense [14]. In order to conceptualize the event, organizers would work with designers, technologists, and VR specialists. Their focus would be on finding ways to combine digital and physical components in a seamless manner.

The researcher outlined in Figure 1 stated that the primary technological components of the metaverse are the outer ring of the organizing framework. It contributes to establishing the fundamental structure of the metaverse. The interface devices in the central concentric ring

symbolize users' access and interaction with the metaverse world. In the framework, the metaverse environment where users can interact is represented by the innermost concentric ring.

Figure 1 Operating Metaverse framework by [15]

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The user experience in the metaverse environment depends on its level of immersiveness, environmental fidelity, and sociability [15]. Based on the concept by [15], the "Metaverse Runway Show" brings together aspects of virtual reality, fashion, and digital innovation in a single concept. Individuals are able to engage in real-time interaction with one another and with digital items within the metaverse, which is effectively a communal virtual shared area [16].

Another scholar [17] said a Metaverse Runway Show is a virtual event where designers exhibit their latest creations through avatars or digital representations. Guests could join globally via virtual reality goggles or their personal computers or smartphones.

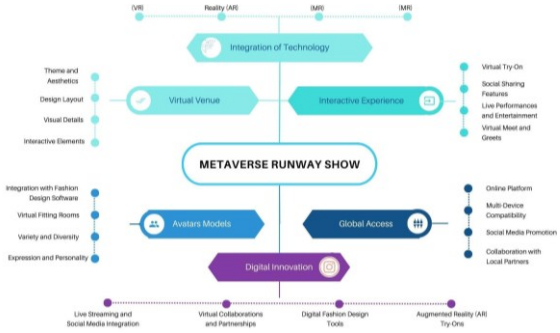

Figure 2 Metaverse Conceptual theory by [15]

Hence, in Malaysia especially, technology use was contested in 2013, but after the pandemic struck in early 2020, Malaysia began to realize how important technology was. In the absence of the pandemic, individuals would need to embrace technology due to the demands of civilization and advanced technology. Since then, a new normal has emerged while we have survived the fear of a pandemic. Technological advancements have a pervasive impact on all facets of human existence.

Presently, digital or virtual runways have replaced traditional runways. Runway displays, often known as "Fashion Shows" or "Catwalk Shows," typically entail physically presenting clothing on the runway [2]. In addition, [18] defines fashion shows as platforms for sharing new qualitative insights, which I term 'enclothed knowledge.' This knowledge is experiential and cannot be fully conveyed through static or verbal descriptions alone. Additionally, fashion shows empower participants to influence the circulation of knowledge and provide researchers with opportunities to engage with diverse audiences. The fashion show provides designers and couture brands with the opportunity to influence the meaning associated with particular clothing items and the identities they represent [19].

II. LITERATURE REVIEW

In the study conducted by [20], an interactive virtual runway show system was implemented utilizing Unity3D and MySQL. The research encompassed scientific analysis as well as the design of the virtual runway's functionality and database structure. Furthermore, the company incorporated the runway function and standardized the model production process. In addition, they demonstrate a technique for integrating models with dynamic apparel models in order to improve the simulation of a wide range of fabrics, thereby providing more extensive reference materials for professional designers.

According to [2] in their research about digital fashion shows, there are four main elements which designers can use in order to make a unique and wonderful show like model, theme, location, and finale. In addition, the Spectacle effect with other implicit elements such as music and lighting. Other than that, the brand also presented its digital show across various social channels. The landscape of emerging technologies intertwines with the fashion world, evident even behind the scenes of the show, amplifying its impact and, importantly, heightening anticipation for the collection.

The study evaluated how different interactive features affect the user experience (UX) of a digital fashion show in a virtual reality (VR) environment. An IVR fashion show concept and prototype were created to enhance user experience. User testing revealed that interactive experiences had a greater positive influence on key aspects of UX, such as curiosity, enjoyment, immersion, and usability, compared to passive experiences. To conduct a study on VR fashion show production and user evaluations for UX analysis, a carefully prepared design that matches certain research objectives is required throughout the production phase. The design and implementation methodology detailed in this study are expected to provide a guiding framework for planners and developers during the planning, production, and testing phases of future VR fashion show preparations [4].

Additionally, [21] discovered that all physical live fashion presentations were canceled amidst the COVID-19 pandemic, which not only disappointed but also perplexed the global community. Virtual events were the only choice for

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designers in this scenario. Organizers quickly worked with experienced event planners to create the best virtual event platform. Social media platforms like Instagram and Facebook have become easily accessible from any location. Virtual fashion shows and events allow fashion companies and designers to interact with clients without being physically present at the event or on the catwalk.

Furthermore, [7] revealed that the VR fashion industry could be divided into three categories, each of which produced a distinct VR experience in the areas of cognitive presence, sensory immersion, emotional immersion, and aesthetic interaction. Different VR experiences may be correlated with differences in VR spatial characteristics. Based on the research, three key conclusions can be drawn: first, the experiential aspect of virtual space is influenced by predefined elements like sociocultural contexts and personal backgrounds; second, VR fashion shows create a psychologically engaging environment for brands and consumers; and third, immersive fashion spaces that depart from the original source can greatly encourage user creativity and exploratory engagement.

B. Elements of Fashion Show Performance

In this research, researchers used three major elements of show performance or fashion show that include clothing, model, and scene. By using these elements, it covers 1) Virtual clothing production, 2) Virtual runway show, and 3) Design and production of virtual models [20].

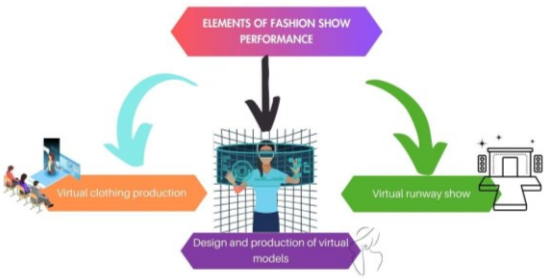

Figure 3: Elements of Fashion Show Performance by [20]

C. Virtual Clothing Production

The process of creating clothing designs completely digitally utilizing computer software and 3D modelling techniques, without the need for actual materials, is known as virtual clothing production, often referred to as digital fashion design or virtual fashion. Other scholars such as [22], also agree that this novel method of garment design provides various advantages, such as sustainability, cost-efficiency, and the opportunity to explore endless creative options. Here is a summary of the virtual apparel making process. The process begins with conceptualizing the design of the virtual apparel. This involves determining the style, silhouette, colors, and materials. Designers either sketch the apparel on paper or use digital design software such as Adobe Illustrator or CorelDRAW to create detailed digital designs. Once the design is finalized, 3D artists create a virtual 3D model of the apparel using specialized software like Blender or Marvelous Designer. This step involves shaping the garment in three dimensions, considering factors like fit, drape, and texture. Texturing involves applying digital textures to the 3D model to give it realistic colors, patterns, and surface details. Shading is used to simulate how light interacts with the fabric, creating effects like highlights and shadows. Virtual fitting sessions may be conducted to ensure that the apparel fits properly on the virtual model. Adjustments such as resizing, repositioning, or tweaking the design may be made based on feedback. Simulation software can be used to visualize how the apparel will behave in different conditions, such as when the wearer moves or when different types of fabrics are used. This helps ensure that the virtual apparel looks realistic and functions as intended. The final step involves rendering high-quality images or videos of the virtual apparel. Rendering software is used to generate photorealistic visuals that showcase the design from different angles and perspectives. The virtual apparel may be integrated into virtual platforms or environments; such as virtual fashion shows or e-commerce websites. This could involve optimizing the apparel for real-time rendering and ensuring compatibility with the platform's technical requirements.

D. Virtual Runway Show

Fashion labels and designers can digitally present their collections in an innovative manner with a virtual runway show, which enables viewers to experience the intricacy and innovation of a traditional fashion show from the convenience of their personal residences. According to [20], the virtual runway show is broadcast live or made available on digital platforms like fashion websites, social media channels, or specialized virtual event platforms. Global viewers can watch the show live or access it on-demand at a later time. As stated by [23], these occasions employ technological

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advancements such as live streaming, virtual reality (VR), augmented reality (AR), and 3D rendering in order to provide attendees with engaging and immersive experiences.

E. Design and production of virtual models

Begin by conceptualizing the virtual fashion model. This entails identifying its physical attributes, temperament, and traits. The purpose of the model (e.g., runway show, virtual assistant, gaming character) and the intended audience are factors that impact this stage. The designer utilizes specialized tools like Blender, Maya, or ZBrush to sculpt and mold the virtual object in three dimensions [24]. They design the model's anatomy, clothing, accessories, and any further aspects completely from the beginning.

The primary requirement for female models in the worldwide fashion industry is a height of 178cm, with a tolerance of plus or minus 2 cm. Therefore, female models with heights that range from 176-180 cm meet these criteria. The term "three dimensions" pertains to the measurements of a model's bust, waist, and hip circumference. Typically, for Eastern female models, the bust circumference ranges from 83-90cm, waist circumference from 60-62cm, and hip circumference from 88-90cm [20].

III. RESEARCH METHODOLOGY

This study used qualitative research with applied one-to-one interviews with eight Malaysian fashion designers in Malaysia. This interview was conducted face to face with the designers at their boutique or their shops and it took around 1 hour to 1 hour and 30 minutes. This research used purposive sampling based on the criteria: 1) Attended any virtual fashion show, 2) Established Fashion designer brand, and 3) The designer must have any digital media accounts. There are six semi-structured questions that were formed as a guide for the interview and two additional questions during the interview. The data can be analyzed using thematic analysis that forms three main themes parallel to the objective.

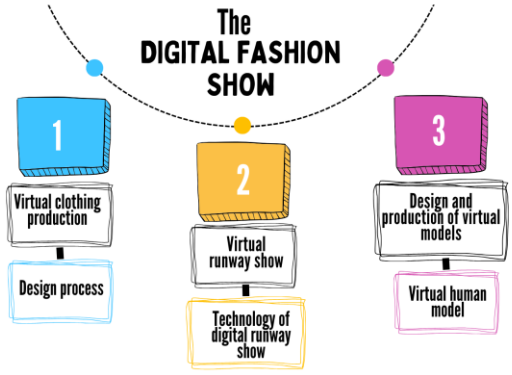

Figure 4: The Digital Fashion Show adaptation from [20]

IV. DATA ANALYSIS

The data can be analysed using thematic analysis that form three main themes adaptation from [20]: 1) Virtual clothing production, 2) Virtual runway show, and 3) Design and production of virtual models (see figure 4). The first theme refers to virtual clothing production and its consist of one sub-theme is design process. The virtual clothing combines traditional fashion with cutting-edge technology with the design process. Most of the designers said the virtual clothing blend of fashion and digital innovation, garments no longer exist physically; rather, they are visually created using 3D software, Auto Computer-aided design (CAD), and augmented reality (AR) technologies. In addition, its influence on the future of fashion suggests it could become the upcoming major trend. The designers could launch a digital clothing item in the metaverse with a variety of color variations, using sales data to determine which colors to incorporate into the physical version. At the same time usage of 3D is a more sustainable approach because designers have no requirement for mass production instead, but the items are created only upon order placement. This essentially adopts an on-demand model, effectively reducing fashion waste. This is also agreed by other designers:

> *"...I've been utilising 3D software to create virtual apparel since the 2021 covid epidemic. Meanwhile, participate in KLFW 2021 to develop a digital clothing named Iridescence. I used 3D software. Using 3D software for such a project probably allowed me to explore textures, colours, and designs in ways that older approaches would not have allowed. Furthermore, presenting my work at a major event like KLFW would have surely brought vital exposure for my ability and innovative approach to fashion design.","" (D4).*

> *"... I think virtual clothing is emerging as a groundbreaking innovation in the realm*

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of fashion. So, the garments no longer exist physically in the future, we can use AR as an illusion that real and digital worlds exist in the same space. I'm now personally using digital clothing in the metaverse adding a variety of colors for customers…" (D6).

"...employing 3D technology is a more sustainable approach compared to traditional fashion methods. By designing prototypes digitally, there is no requirement for mass production, instead the items are created only upon order placement,…" (D7).

"...we started with the design process using technology like auto CAD for fashion sketches as a technical drawing. So, a technical sketch includes the design, construction, and stitch details of my garment,…" (D8).

The second primary information is that virtual runway events encompass a transformational power, offering an alternative to conventional fashion presentations that is more immersive, convenient, and environmentally friendly. The digital runway show is the sub-theme that falls under this overall topic. Consequently, this has led to the development of digital fashion, which is a trend that is characterised by the unique combination of technology and style. This trend has culminated in the establishment of virtual runways that attract fashion fans internationally. It is not necessary for the virtual runways to mirror real-life conditions, particularly with regard to accessibility. It is no longer necessary for the event to have a physical place in order to accommodate guests; rather, numerous accessibility features, such as audio descriptions and subtitles, can be effortlessly integrated into digital shows. In addition, according to [25] VR spaces provide humans with virtual spaces, with social functions that are similar to space in reality. The virtual runway was created using technology like CGI, motion capture, etc. This is in line with the designer's view:

"...through a live stream, my viewers had the opportunity to observe my collection from any of social media platforms because with the emergence of technology and style can create captivating addicts,…" (D1).

"...for me the good things for virtual runway shows are good things because we no longer need physical space for accommodating attendees for fashion shows events,…"(D3).

"...I think the benefits of the virtual runway shows are a convenient, transformative force, providing an immersive, and environmentally sustainable alternative to traditional fashion shows,…" (D5).

The third main theme is the design and production of virtual models refers to designing and creating virtual models for virtual fashion shows. In addition, most of the designers design a virtual environment that reflects the fashion show's theme and concept, keeping in mind user experience elements like navigation, interaction, and visual appeal. Other than that, the usage of AI and 3D avatar models, design, and rig wearing digitally created clothing that reflect the diversity and inclusivity of the target audience. The designer looks into the details and attention to garment textures to ensure the models are ready for animation to bring a realistic touch to the virtual fashion show. The designers add the virtual scene is composed of geometric surfaces and the more surfaces, the finer the model will be and the more resources will be occupied.. This is also agreed by other designers:

"...I crafted AI-generated ensembles, developed virtual models, and simulated the entire runway atmosphere, including lighting effects and music, at the same time the model to bring a realistic touch to your virtual fashion show." (D2).

"...I think the virtual audiences can engage with fellow avatars, explore immersive 3D environments, and forge connections like never before,..." (D4).

"...we design the movements, pacing, and timing of our models to craft an engaging runway experience. Utilize motion capture or keyframe animation methods to animate our models, ensuring synchronization with music and other audio components for a polished showcase," (D7).

V. DISCUSSION

The study's findings underscore the necessity for designers to stay abreast of emerging trends to maintain competitiveness in the industry. With

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technology's pervasive reach enabling access to information anytime and anywhere, virtual fashion emerges as a crucial technique for the future. Moving forward, the insights gleaned from this study will prove invaluable in aiding Malaysian fashion students and designers in adopting digital fashion shows and virtual runways as part of their repertoire. The virtual clothes have been recognized to be very similar to actual clothes and facilitate creative expressions that are hard to be presented in actual fashion shows. Virtual fashion shows tailored to different body types showcase suitable and unsuitable outfits for each physique. Additionally, developing educational programs or applications tailored to consumers can aid in helping them discover ideal clothing options based on their body types and personal preferences [26]. The adaptation of 3D virtual clothes to the real fashion industry in the future can make new content through the innovation of distribution and industry [20]. AI assumes a crucial role in fashion evolution. It serves as the unseen force behind the creation of virtual models, dressing them in digital attire, and animating the simulated runway ambiance. The AR-enhanced store appears to stimulate brand engagement, increasing consumers' desire to shop at the retailer, which provides managerial opportunities to reinforce brand positioning [27]. The augmented fashion show introduces a novel immersive experience, allowing consumers to generate personalized 3D models of themselves. These models can then be adorned with a range of purchasable clothing options using Augmented Reality technology [28]. The fashion industry is fully embracing digital transformation and experiencing a growing adoption of technology at each point of its value chain as it increasingly recognizes it as a crucial source of value creation in order to compete and thrive in such a complex market [27][29]. The digital revolution has influenced every aspect of the fashion industry. Specifically, in fashion communication and marketing, the adoption of digital tools provides a fertile environment for enhancing business operations and fostering stronger customer relationships [30].

VI. CONCLUSION

The integration of AI and virtual runways is in its early stages, yet the possibilities are immense. Envision a future where fashion presentations transcend geographical limitations, becoming accessible to anyone with an internet connection. The designers are able to develop and exhibit their collections without being bound by financial or geographical barriers. The virtual runway may be a novel experience for some, but its numerous benefits cannot be overlooked. The adaptation of 3D virtual clothes to the real fashion industry in the future can make new contents through the innovation of distribution and industry.

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