Digital Body Measurements and AI: Transforming Fashion and Apparel Production and Retail in Africa

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Abstract

The fashion and apparel industry in Africa is yet to fully benefit from the recent transformations in the global fashion scene driven by the integration of digital body measurement technologies and artificial intelligence (AI). This paper explores the potential impact of these innovations on apparel production and retail within the region, highlighting how they will enhance efficiency, accuracy, and customization. Leveraging 3D body scanning and AI-powered data analytics, African garment manufacturers and designers can offer tailored solutions that meet diverse global consumer needs, meet orders, improve fit and reduce waste and production costs. This paper will further examine the case study of how Design Shark International will leverage machine learning and computer vision technology for mobile 3D body scanning with the introduction of Mezer™ its AI powered digital body measurement solution to address quality standards and scalability challenges in its local fashion industry. It discusses the challenges of adoption, provides strategic recommendations for stakeholders, and addresses how our solution is being applied for the development and adoption of a standardized African clothing size chart. Our results suggest that embracing digital body measurements and AI not only improves competitive advantage but also fosters sustainable growth in Africa's growing fashion industry.

The integration of digital body measurements and artificial intelligence (AI) is revolutionizing the fashion and apparel industry globally. This paper explores a case study of a pioneering company in Africa that leverages machine learning and computer vision technology for mobile 3D body scanning, providing an AI-powered digital body measurement solution. The study examines the technological framework, implementation challenges, and the transformative impact on production efficiency and retail experiences.

1. Introduction

The fashion and apparel industry in Africa is poised for a technological revolution driven by advancements in digital body measurements and AI. Traditional methods of garment fitting and production are being upended by innovative solutions that promise greater accuracy, efficiency, and customer satisfaction. This paper investigates the transformative potential of these technologies through the case study of Mezer™ by Design Shark, an African leader in mobile 3D body scanning and AI-driven measurement solutions.

1.1. Recent Transformations in the Global Fashion Scene

*1.1.1. Application of AI Technology in Generative Design***:** assists designers in expediting the design process by generating multiple innovative options based on specified parameters. Autodesk's Generative Design technology is an example of AI software that facilitates this process.

*1.1.2. Product Development***:** In the realm of product development for the apparel industry, there are AI software solutions designed for tasks such as trying out samples, ensuring proper fit, and visualizing the overall appearance. Many tools and platforms showcase advanced capabilities in this domain, with 3DLOOK standing out as a notable example.

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1.2. Case Study: Mezer ™ by Design Shark International

Mezer™ (pronounced as 'Measure' and derived from the English phonetic spelling of the word) is Design Shark's flagship AI solution that utilizes AI and computer vision technologies to provide precise and accurate body measurements still in its developmental stages. These types of technologies will allow; our designers and sample makers to virtually try on garments to see how they fit and look, with eventual integration into online platforms for a seamless virtual try-on experience to allow customers visualize how a garment will look and fit before making a physical sample, reducing product development lead time. The platform will also generate valuable data on customer body measurements, which can inform inventory planning and design decisions.

1.2.1. Company Overview

Design Shark International is at the forefront of integrating digital body measurements and AI in Africa. The company has developed a mobile application that uses machine learning and computer vision to make accurate digital body measurements and personalized fashion recommendations **available**, **accessible** and **affordable** for the African market.

2. Methodology

2.1. Technological Framework

2.1.1. Machine Learning and Computer Vision: Machine learning algorithms and computer vision techniques form the core of digital body measurement solutions. By training on extensive datasets of body scans, these algorithms can accurately interpret and measure various body dimensions.

2.1.2. Mobile 3D Body Scanning: Mobile 3D body scanning technology utilizes smartphone cameras to capture detailed body measurements. This accessibility democratizes the technology, making it available to a wide audience without the need for specialized equipment.

2.1.3.AI-Powered Measurement Solutions: AI algorithms process the 3D scans to extract precise body measurements. These measurements are then used to recommend appropriate clothing sizes and styles, enhancing the fit and comfort of apparel.

2.2. Implementation Strategy

2.2.1. Data Collection

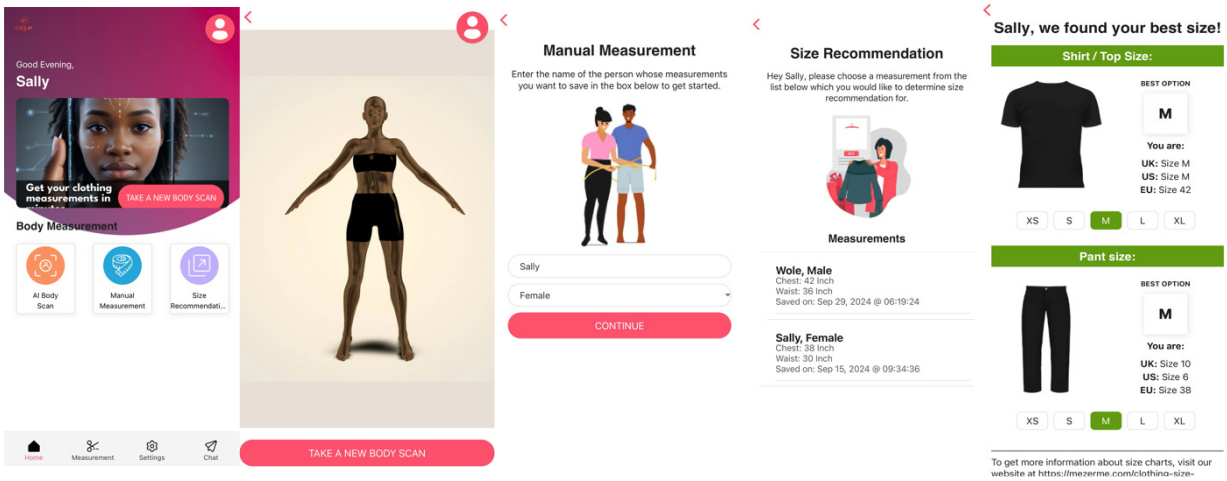
Lack of existing anthropometric data on African body types means we are generating this data ourselves, starting in Nigeria. At the first instance, we collected a diverse dataset of 5,812 manual measurements which we then went ahead to verify via body scans to train our algorithms. Initial results revealed a 25% margin of error in body scans, therefore further development work is ongoing to improve accuracy of our algorithms. Future plans include data collection across West Africa and the rest of the African continent.

2.2.2. Algorithm Development

Using machine learning models, we developed algorithms capable of detecting body parts, interpreting 3D scans and extracting key body measurements. Furthermore, our model has native support for body segmentation which we needed to enable the AI body scanning feature work effectively. We are also continually investing in research and development to improve our algorithms. Nevertheless, we are prioritizing manual measurements for enhancing algorithm accuracy for anomalous measurements.

2.2.3. Mobile Application

A user-friendly mobile application that is lightweight, fast and works on a broad range of devices has been created to facilitate the scanning process, ensuring ease of use and broad accessibility which is key to the objectives of the company. While training of our AI model is still ongoing, users are able to use the size recommendation feature which works in tandem with the manual measurement input feature that allows you to get personalized size recommendations on demand and save multiple measurements for future recall. This feature allows users to compare measurements over a time period or save multiple measurements of individuals in their households or for business use and share with third parties.



2.2.4. Customer Discovery

We spoke to 20 prospective customers and partners to hear first-hand about their needs and frustrations and validate their jobs to be done. These Interviews were ideal for quickly gaining initial qualitative insights into validating the problem we imagined for our customer segments and that the value proposition we've designed resonates with them. It also helped us define and prioritise our top personas—specific groups of ideal, fictional, and archetypal customers.

These are the list of questions presented to both groups.

Fashion business -
- Tell us a bit about what you do.
- How involved are you in sizing and fitting in your fashion business?
- Tell us about any challenges you have faced asking a client to send you their measurements.
- What would make getting clients' body measurements easier for you?
- Our AI Body Scanner captures body measurements and gives personalized size recommendations for added convenience. You can save your clients' measurements on the app for quick access. Would you like to try this?

Fashion consumer -
- How often do you shop for clothing items?
- How important is getting the right size and fit when you shop for clothing items?
- Tell us about when you had to get your exact body measurements for a clothing item.
- Our AI-powered Body Scanner records your measurements and suggests the best sizes, making the shopping experience more convenient. You can easily access your measurements on the app. What do you think about this?
- Would you like to try our app to capture your body measurements, get size recommendations, store this information, and share it with your favorite fashion vendors?

How we worked:
- We conducted the Interview in pairs to ensure one person listens and asks follow-up questions while the other takes notes.
- After each interview, we did a quick debrief to see what worked and what did not. The debrief was an excellent opportunity to refine the interview questions and style to improve our subsequent interviews.
- We never ask people what they want. It's not their job to tell you what they want; they may not know what is possible. Instead, we ask open-ended and nonspecific questions and let the customer lead the conversation.

After conducting these interviews to identify patterns and form affinity groups and extracting insights from the interviews, we came up with some key messaging to test as we built our list of early adopters. We outlined all the steps in their decision-making journey from beginning to end. These maps helped us identify the most significant jobs to be done and earmark potential solutions for each.

2.2.5 Build a List of Early Adopters

We did this by driving four unscalable channels, The objective was to acquire an initial 1,000 fashion consumers and 100 fashion businesses who use Mezer so we can leverage this audience to adapt our product and positioning so we can pursue market fit.

2.2.6. Collaboration with University of Lagos Business School

DSI is very excited that the University of Lagos Business School (one of the highest rated business schools in Africa) is now using our app development process as case study work for its graduate level students with the following markers;

Brief: Design a program to assist Design Shark International in validating the desirability of its proposition, positioning their brand for relevance and establishing a viable business model with minimal risk.

Objectives
- Outline their Value Proposition
- Conduct interviews and surveys to identify patterns and develop key messaging to deploy in building a list of early adopters.
- Build a List of Early Adopters
- Design and implement program that onboards 10,000 fashion consumers (average regular men and women) and 500 fashion businesses (to include regular tailors) who use Mezer.
- Design program to leverage this audience to adapt product positioning to pursue market fit and build trust.
- Design and implement program that positions the app as a reliable, accurate, and easy-to-use tool for body measurement.

Suggested Target Audience
- Fashion Shoppers: Consumers who frequently shop online and need accurate measurements for better fitting clothes.
- Tailors and Fashion Designers: Professionals who require precise measurements for custom clothing.

This is another way Design Shark International would constantly generate consumer feedback and build a robust list of early adopters.

3. Results

3.1. Challenges

3.1.1. Input Data

Collection of manual measurements across Nigeria was expensive, time consuming and logistically challenging as ensuring the dataset accurately represented the diverse body types in Nigeria was crucial. The verification process via body scan was additionally challenging as selecting individuals with smart phones who were willing to install a trial application on their devices to provide us with body scan images via our algorithm was limiting.

3.1.2. Lighting

In overcoming the limitations of smartphone cameras in different lighting conditions and environments, we optimized the code as best we could and included audio prompts (voice assistant) to modify users pose when parts of their body could not be detected due to poor lighting.

3.1.3. Inference

To address the challenge of speed and ease of use, we tried out several AI Models eventually settling on one on account of its fast-loading time and ease of detection. The other models while good at detection had long loading times and since speed of inference was one of the factors we were looking at, this influenced our decision on our final model.

3.1.4. Accuracy

While one of our objectives is to keep cost low and results high, the limited measurement points provided by the Model presented a huge challenge with getting accurate measurements for garment production. We compensated for this by implementing human body ratios which we discovered from

anthropometric research journals as well as requesting user data input (the user's height) in order to improve the accuracy of the results.

3.2. Pros

3.2.1. Mobile App

With good lighting the app is able to give accurate measurements of up to 75% for the AI body scanning functionality. Speed of inference is 0.8 seconds, with the automated scanning process being completed in less than 1 minute. The other features such as the size recommendation and manual measurements capture features are fully functional. Our Size recommendation tool is able predict user clothing sizes based on UK, US and EU Size charts, matching measurements via AI Body scanning or Manual Measurements input, to include our standardized African Size chart in future updates.

3.2.2. User Adoption

Early users are excited to use the app as a store of measurement record and the ability to share saved measurements in real time.

3.2.3. Development of standardized African size chart

With data collection ongoing, our goal is to collect 1 million sets of anonymized measurement data across Africa, that will allow us begin the modulation of an African size chart specifically for the use of the African fashion industry, and by world wide retailers who have interest in selling specifically in the African market place.

3.3. Transformative Impact on Fashion and Apparel Industry in Africa

3.3.1. Production

- The technology promises to streamline the production process and improve efficiency by
- Reducing the need for multiple fittings and adjustments.
- Reducing material waste through precise cutting and fitting.
- Increasing production speed and reducing costs.

3.3.2. Retail

In the retail sector, the technology will:

- Enable virtual measurement, enhancing the online shopping experience.
- Reduce return rates and associated costs.
- Allow retailers to offer customized fashion recommendations with virtual try-on

3.3.3. Economic and Social Benefits

- Ease of access: Democratizing access to advanced technology empowers local designers and manufacturers.
- Economic Growth: By increasing efficiency and customer satisfaction, the technology has the potential to boost the fashion and apparel industry's contribution to the economy.
- Simplicity of app: A user friendly and easy to use application can be used by both beginner level and experts in fashion.
- Standardization between users
- Provides business solutions for bespoke tailoring as it enables data storage and recall
- Access to new markets: Remote digital measurement empowers businesses to accept orders from anywhere in the world.
- Ability to share in real time and across platforms
- Enable direct to production
- Business understanding of size applications on production values

5. Conclusion

The case study of Mezer™ demonstrates the profound impact that digital body measurements and AI can have on the fashion and apparel industry in Africa. By leveraging mobile 3D body scanning and AI-powered solutions, the company hopes to improve production efficiency, transform retail experiences, and contribute to economic growth on the African continent as well as create access to international markets. As our technology continues to evolve, it holds promise for further innovations and advancements in the industry.

6. Future Work

Future research will focus on expanding the dataset to include more diverse body types across Africa for establishment of a standardized African size chart, improving algorithm accuracy under various conditions, and exploring additional applications of the technology in other regions and industries.

The application will further be improved to include development of 3D avatars to enable Virtual try-on for 3D design, production and retail purposes.

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